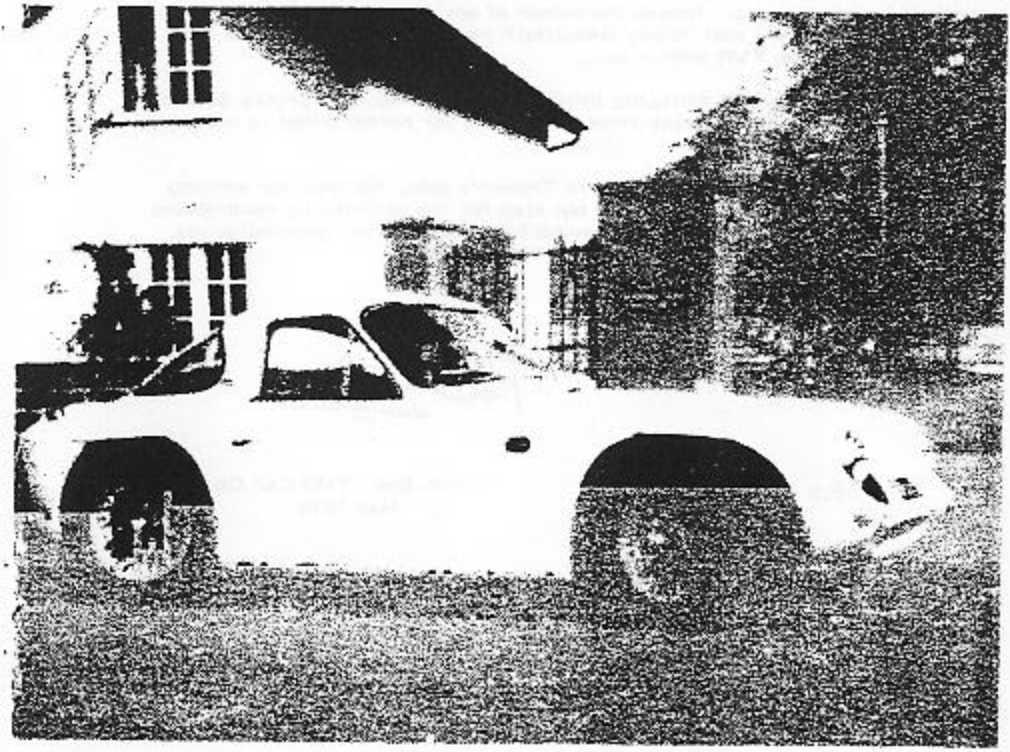
BODY BEAUTIFUL



the rebuilding of a TV1

by TREVOR DAVIE

PREFACE TO THE SECOND EDITION

"Body Beautiful" first appeared as a series of articles in the TVR Car Club's Newsletter in 1969. It was well received and subsequently issued as a separate publication as well as forming a section in early copies of the Mk 1, 2, 2A Workshop Manual. It has been out of print for some time and I am sure this second, litho printed edition will be particularly welcomed by those not fortunate enough to have a copy already.

"Body Beautiful" is compulsory reading for owners and restorers of pre Mk 3 TVRs, being a goldmine of practical advice on improving such items as heating and ventilation, spare wheel and luggage access, suspension, cockpit layout etc., etc. Indeed the owner of any model TVR will find much of interest and I feel that "Body Beautiful" really ought to be on the book-shelf of every true TVR enthusiast.

In these days of galloping inflation, the pre-decimal prices quoted by Trevor will no doubt cause some amusement (or perhaps that is not the right word for it!).

Finally, we are all greatly in Trevor's debt, not only for writing "Body Beautiful" in the first place but also for his painstaking re-drawing of the illustrations (the originals having been lost) and for loaning us his sole surviving photograph of "46 NOE" for our cover.

Peter Wathin

Hon. Sec. TVR Car Club
May 1975

CHAPTER 1 - SETTING THE SCENE

We had changed to a TVR Mk 2A from a Jaguar XK 140 (C Type) in August 1965. The TVR was rough - no, VERY rough - but cheap at approx. £150 below the lowest 'blue book' prices. My wife Eileen didn't like it, it was short and stubby and looked very odd. It was difficult to get in and out of and there was a ghastly smell of mould and rotting upholstery. Myself, I studied the general layout and noticed that it had been lightened to a very high degree and the braking system was dual with an adjustable beam on the foot pedal. I disregarded the rust colour of everything under the bonnet, the puddle of water one inch deep in the footwells and the tyres which showed signs that all four wheels were pointing in different directions.

We returned home in the Jag. and weighed up the possibilities. After a hurried lunch we had convinced each other the TVR was the car for us. So having rumbled (the Jag. was not running too well either) our way back to the dealer's forecourt we placed our BET on the TVR.

Eighteen months later we had suffered just about every failure a TVR owner can know, and most of them seemed to be ganging up on us as we struggled back home from the 1967 Racing Car Show! The car gave its final warning as it gasped to a halt not more than ten miles from home. We did eventually get home and the very next day, 14th. January, the car was taken to a friend's back garden garage and never moved again until 14th. December the same year, when the rebuild was completed.

The garage was about 20' x 8' clear floor area and sported an electric light and power point. The hire charges were agreed upon to be 12/6 per week plus 6d for every working hour to cover the cost of electricity.

And so the work began; engine, gearbox and bonnet removed the car was supported about 2ft. (ground to body) off the ground on brick pillars and soft wood facings. The height of each pillar was carefully adjusted with felt and rubber packing pieces to even out the loads and so minimise the possibility of chassis distortion with uneven stressing. Now everything removeable was taken from the car leaving only a bare fibreglass shell bonded to the tubular chassis. I made notes or marked components that would have to be reassembl in a certain position or direction. A few examples of how components were identified are given overleaf.

Component	Identification Needed
Torsion bar adjusting plates	Front or back and upper or lower. Also mark the 'Stop End'
Brake drums. 11" drum brakes all round on this car.	Front or rear, & off/s or n/s
Hub carriers, swivel pins, rear hubs and front hubs.	off/s or n/s
Torsion bars.	Upper and lower & front or back. Also mark the clamping face.
Trailing arms.	Upper or lower (obvious) & front or back, and off/s or n/s.

No note was made of suspension bushes, dampers or drive shafts (u/j's) because all these components (as with most wearable parts) were well and truly clapped out and to be replaced. Just a quick word here about useful tools (the hands, biceps and shoulders of Cassius Clay, the precise reflexes of Stirling Moss and the patience of Job!) TVRs are made up of so many 'bought in' components that a general assortment of Whitworth, A/F and metric spanners is a must. A hoist of the nylon cord type (900lbs safe load) is quite adequate and cost about £2-17-6d. A torque wrench 0-100 lbs/ft. range costs about £4 and will be necessary to reassemble the engine. A 'nut splitter' may be needed to break loose seized nuts and bolts. However obtaining such a tool will cause problems. Out of five tool shops in Wolverhampton only two knew what a 'nut splitter' was. One prize idiot in the most popular and largest store offered me a pair of 'nut crackers' (the type used at Christmas).

The most stubborn nuts were those holding the fuel tank in position and the most awkward job was that of handling a rather heavy differential at close quarters beneath the car. The trailing arm bushes were worn to paper thickness and were removed quite easily by breaking them up with a screw-driver. All the chassis and underside of the body-shell was cleaned of oil, grease and road filth with a wire brush and grease solvents (Gunk or Jizer) and finally rubbed down smooth with 280 grade emery cloth. This is a most satisfying stage to reach, the point where the nucleus of the car is completely stripped and clean ready to accept repair or modification. It is also a most dangerous stage to reach for the weak willed, as the sight of one's favourite and most expensive piece of machinery spread over the floor in small pieces could be very disheartening.

I will close this chapter here in the hope you will read the next, which will cover all the work done on the body and chassis, including the doors, bonnet and boot lid!

CHAPTER 2 - BODY BEAUTIFUL

Bonnet

The car as bought was bumperless so the holes for the retaining bolts were filled in and rubbed down flush. The position of the indicators and the size of the side lamps are not ideal in the interests of safety, so a new layout was devised as shown in Fig. 1.

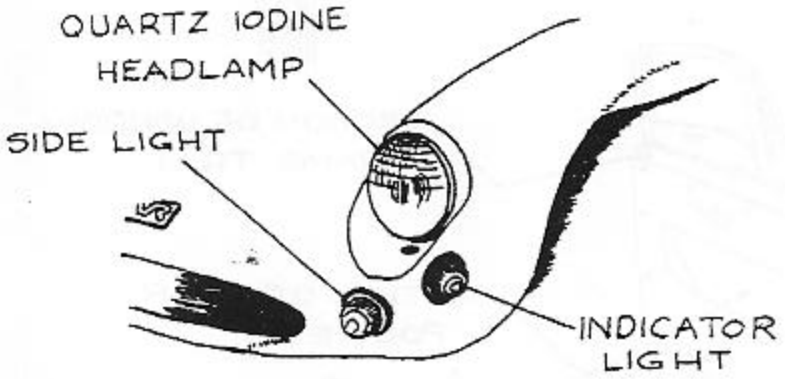


FIG.1. NEW LIGHTING LAYOUT

Two new side lamps matching the indicators (Lucas L594) were positioned forward and directly beneath the headlamp recesses, and the indicators were then positioned slightly higher and on the corner of the bonnet. The side lights are now larger and more obvious, also the indicator can be seen from the front and the side of the car. Modifications were made in the off-side wheel arch by cutting away material and replacing it with a sizeable cowl made in sheet metal to match a similar cowl fitted in the wheel arch of the body. The cowl is to provide clearance for the ram pipes of the Weber carburettors and protect them from road dirt and water thrown inside the wheel arch.

Doors

The doors are lightweight with perspex windows and aluminium frames (no window winding mechanism) and only a new trim panel was needed to replace the old rotting trim. It was made up as Fig. 2 shows with the panel forming one side of a rigid open pocket.

To tidy the upper edge of the door and cover the window frame screws I made a padded roll with the trim material (black vinyl) and a strip of quadrant door seal rubber (see Fig. 2). The glued edges of the vinyl are extended down behind the trim panel for disguise and neatness.

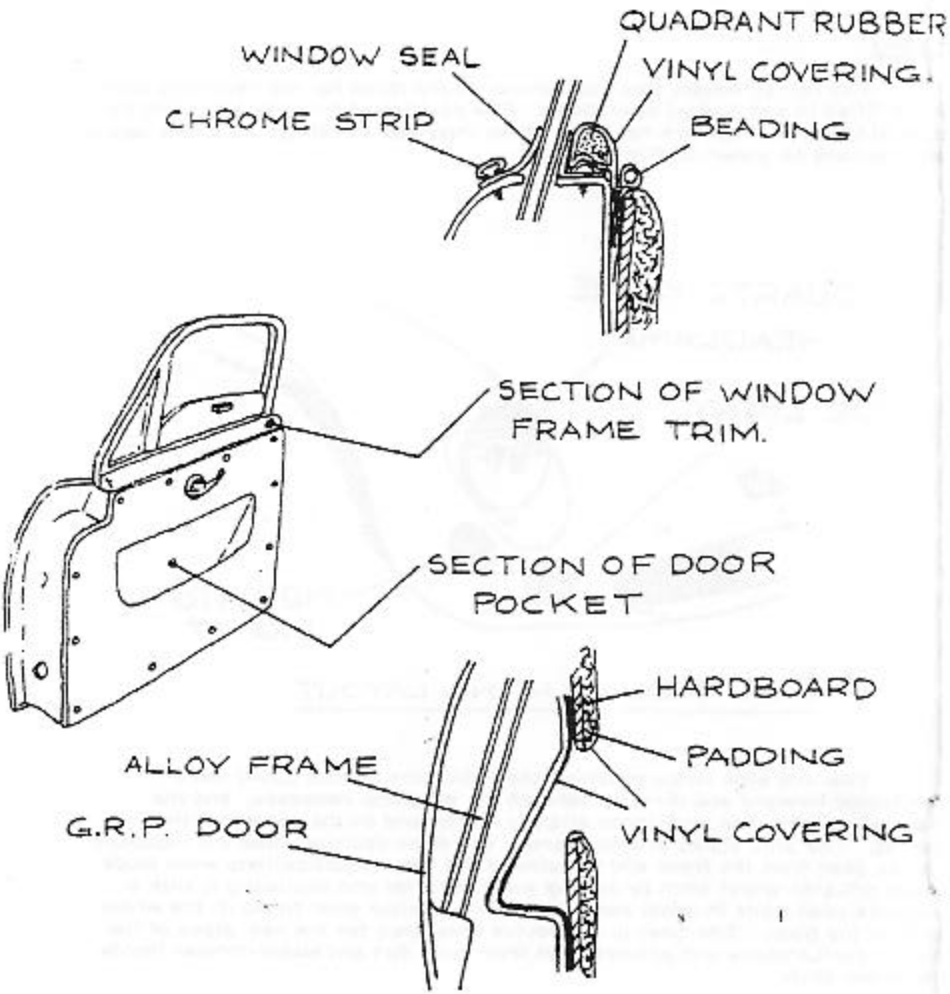


Fig.2. DOOR TRIM.

Body

Considerable modification was needed to the main body to eliminate several problems.

1. The cockpit was poorly ventilated and tended to heat up like a greenhouse in summer.
2. The position of the intake on the heater fan was near perfect for drawing in the carbon monoxide of the vehicle in front.
3. A real TVR screamer! - the spare wheel had to be dragged over a seat and through the narrow door together with any luggage that might be tightly packed into the very tiny space available, each time it was required.
4. Footwells half full of water were a regular feature in wet weather.

Taking the problems in the order above, the roof ventilator was manufactured and fitted as shown in Fig. 3 and Fig. 4.

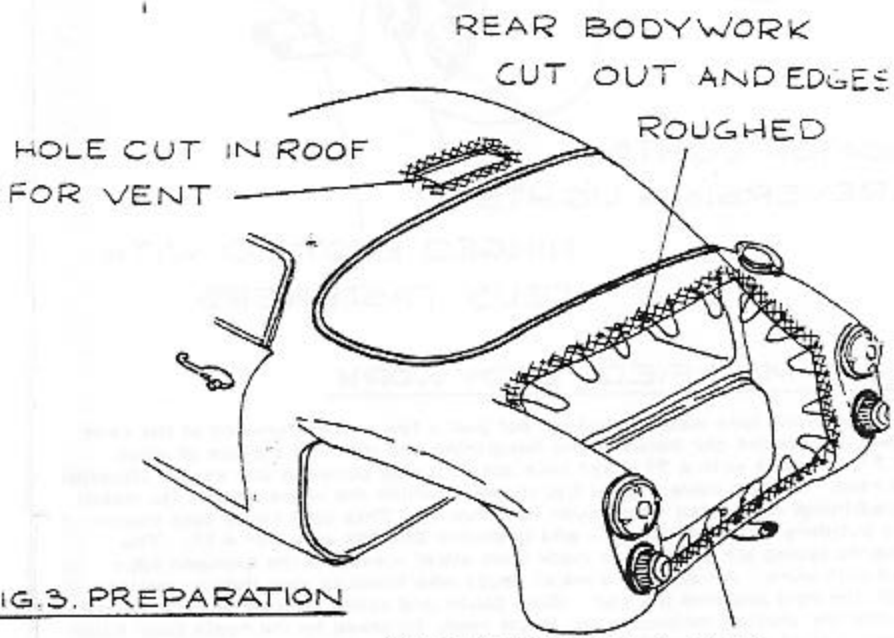


FIG.3. PREPARATION

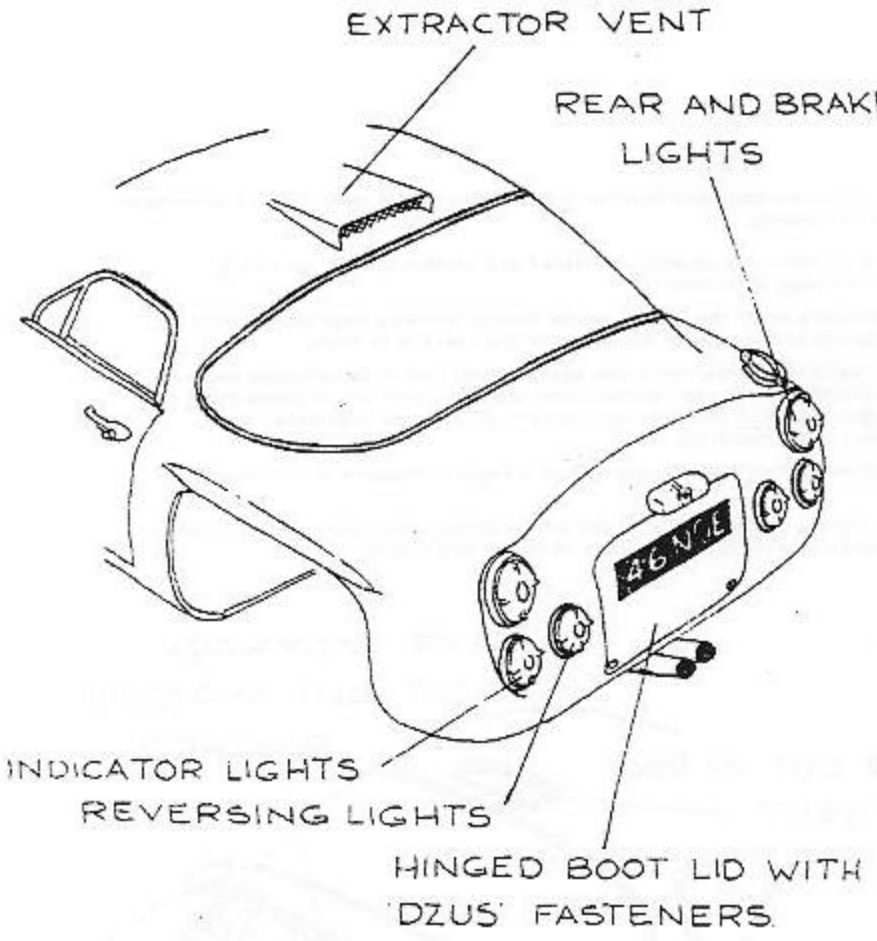


FIG.4. MODIFIED BODYWORK.

An oblong hole was cut in the roof just a few inches forward of the rear window. Inside the car between the headlining and the roof a piece of wood 10" x 7", $\frac{3}{8}$" thick with a 7" x 4$\frac{1}{2}$" hole cut in it was screwed and sealed (Bostik) to the roof. We now have a good flat frame to which the white plastic (to match the headlining) open/shut vent cover is screwed. This vent cover was bought from a builders merchant for 5/- and is double BRICK! size 10" x 7". The backwards facing air scoop was made from sheet steel and the exposed edge beaded with wire. An expanded metal gauze was fitted to stop debris getting through the vent and into the car. Both gauze and scoop flanges were screwed down into the shallow recesses cut in the roof, followed by the resin body filler and then rubbed down smooth to blend in with the original bodywork.

A warning about machining glass fibre; it is rather dangerous and requires a lot of prepara.on. If possible use a set of clothes that can be used solely for this purpose and then be scrapped. Cover up as much of your skin as possible and wear an (inexpensive) industrial face mask for the nose and mouth. If your

skin is easily irritated use plenty of protective cream on the hands, wrists and neck, also keep collar and cuffs well fastened when working. If these precautions aren't taken I can guarantee the results will be at least the loss of a night's sleep - scratching!

Suitably protected as described earlier, I now cut a very large hole in the rear of the body (see Fig. 3) and armed with cardboard, hundreds of newspapers and plenty of paste (Polycell) proceeded to make a support pattern on the glass fibre body. The pattern was made slightly smaller than the required level to allow about 3/16" - 1/4" thickness of glass fibre and body filler. When the pattern was dry and firm it was greased with several thick coats of furniture polish. The area surrounding the pattern (about 3" wide) was roughed with a rotary sander and then perforated with $\frac{1}{8}$" diameter holes. Using soft galvanised steel wire large loops were formed over the pattern by stitching through the holes with the wire (Fig. 3). The glass fibre structure was now built, taking small areas at a time to keep the thickness even and dissipate the heat generated by catalyst action. The curved sharp edge had to be reinforced to ensure it would withstand the weight of any 14 stone CAR SCRUTINEER! and so was strengthened by bonding a strip of 1" x 1" aluminium angle into the structure. Having applied a thick ($\frac{1}{8}$") coat of resin body filler to the rough fibre, I now started the hard graft of smoothing out all the bumps to match the professionally moulded body of TVR's. Having manufactured a flat slab back, it was easy to carve out a boot lid using a keyhole saw. Hinges were made from two large steel gate hinges bolted to the upper edge of the body and cranked (see Fig. 5) to clear the rear number plate lamp. I fastened the lid in the bottom corners with 'DZUS' spring fasteners which I had available amongst my bits and pieces from various Aircraft Companies!

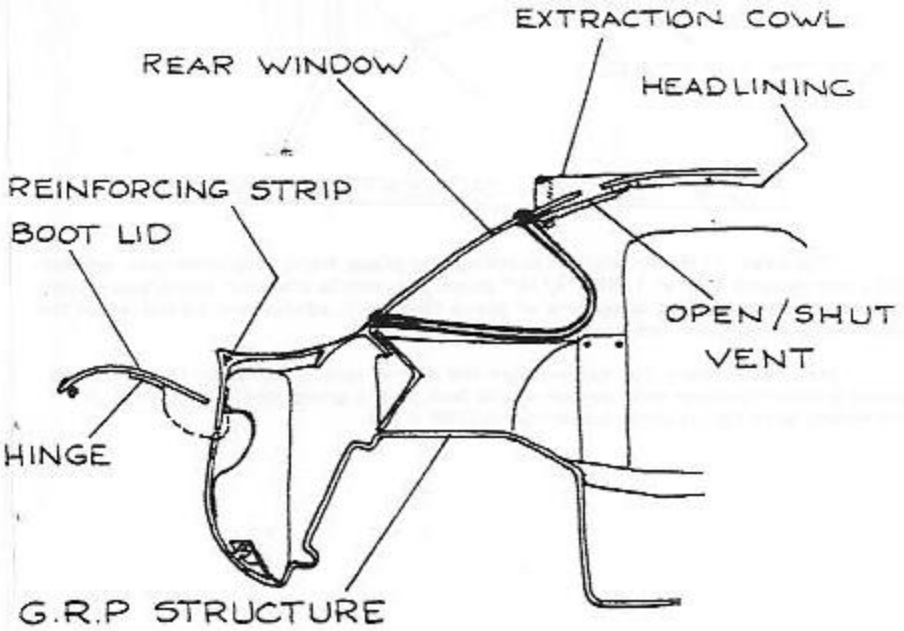


FIG.5. SECTION OF MODIFIED BODYWORK

The nearside engine compartment nostril has been made to serve as an intake for the heater fan by placing a vertical wooden division between the wheel arch and bulkhead, screwed and sealed to the top edge of the footwell and body side. A hole in the division allows (with a close fit) the heater fan to protrude into the cavity and draw cool fresh air through the nostril (Fig. 6). I realise the heater fan now occupies the area where the heater box and battery are normally situated, however these parts are moved to better positions as described in a later chapter.

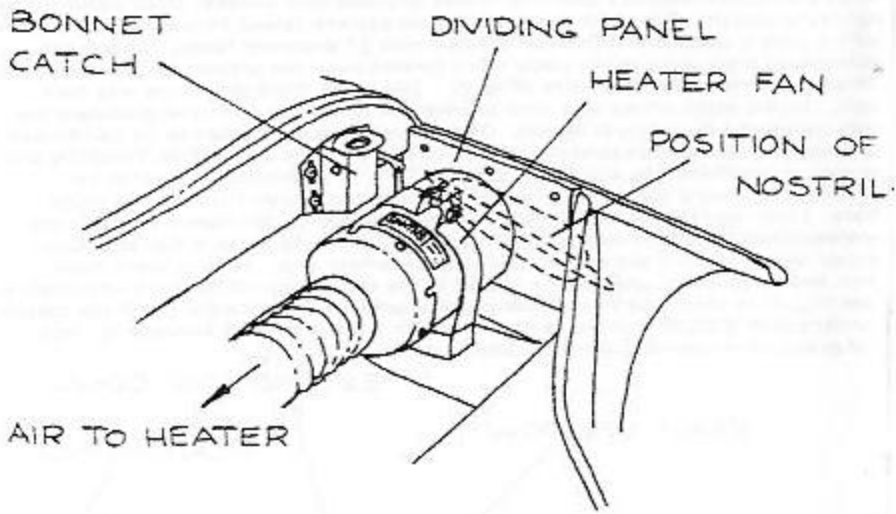


FIG 6. POSITION OF HEATER FAN.

The cost of materials for building the glass fibre bodywork was approx. 12/- per square foot at 1/8" - 3/16" thickness and is cheaper per square foot for larger areas. The suppliers of glass fibre will advise any customer of the quantity of materials required for any type of work.

New holes were cut to re-route the petrol tank filler pipe into the boot space and out through the corner of the body, this gives more clearance in the wheel arch for slightly wider tyres (165 x 15).

The leak into footwells on TVRs seems to come from the poor door sealing arrangement. The worst area is undoubtedly the forward edge of the door, which was easily cured by glueing quadrant section rubber strip into the moulded recess at the edge of the body. Also on the front edge is a strip of rubber seal fixed to the inner flange of the body, which is compressed against the door trim when the door is closed. The seal in the window frame area is very similar to the standard with the exception of having no drain channel and a more flexible seal section (see Fig. 7). The seal strip on the inner flange overlaps and fits inside the upper window frame seal by several inches.

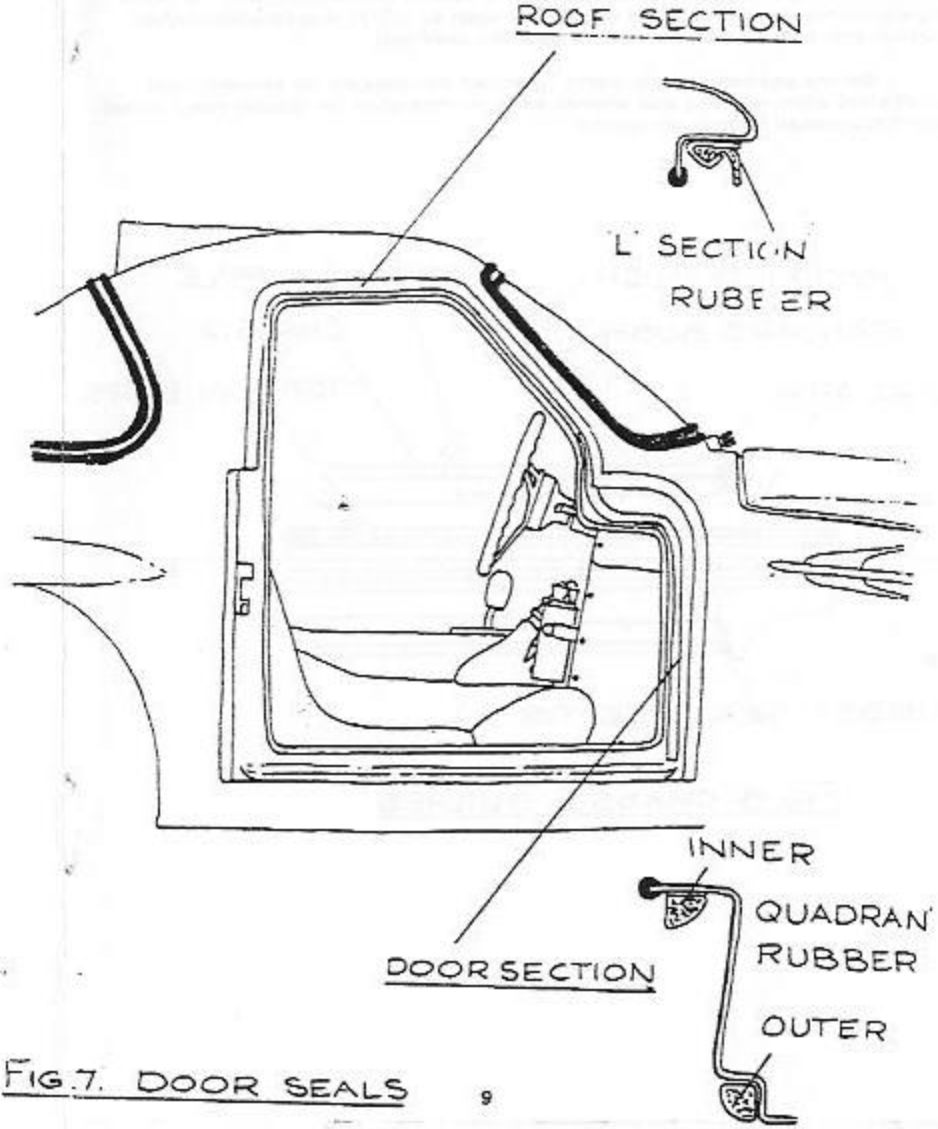


FIG.7. DOOR SEALS

CHAPTER 3

'THINGS THAT GO BUMP IN THE NIGHT' or -

SUSPENSION AND TRANSMISSION

In continuing to build this rather special TVR I decided that the transmission and suspension should be the next areas to complete. A lot of expensive replacements were necessary such as u/j's, suspension bushes, torsion arm bushes and a complete gearbox overhaul.

Before assembling any parts I painted the chassis (to prevent rust corrosion) with red lead and enamel and the underside (to deaden road noise) with 'Boscoseal' rubber compound.

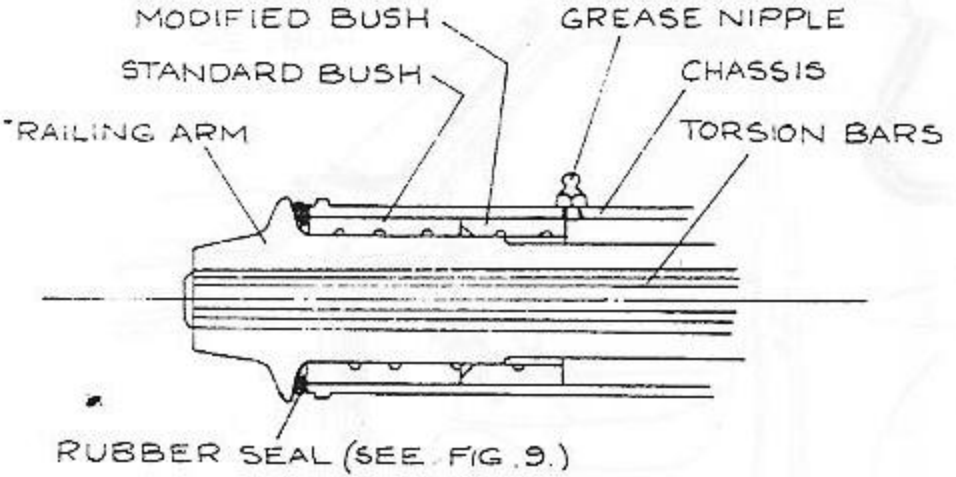


FIG. 8. CHASSIS BUSHES

The main features which required improvement were the infamous trailing arm bushes and rubber suspension bushes. The trailing arm bushes as bought are slightly shorter than the trailing arm bearing surface so I extended the length of bushing by fitting a shortened bush in addition to the standard bush. (see Fig. 8). The mating edges of the bushes were chamfered to ensure a clear path for grease. The second problem with the trailing arm bearings is to stop the water and dirt getting in and the grease running out. In the first instance I used a circular section rubber seal (see Fig. 8) trapped between the trailing arm flange and bush face. This worked fine but unfortunately I had chosen seals made of a rubber which was not compatible with mineral grease and so rotted away in approximately 5,000 miles. The replacement of these seals would mean completely stripping the suspension so I devised another seal arrangement which is inexpensive (about 4d per seal) and can be fitted in situ and lasts a reasonable time (about 5,000 miles).

The seal devised is as shown in Fig. 9 and consists of a gland packing built up of soft oil-soaked string tied tightly in individual loops on the trailing arm. The knots are displaced evenly around the arm to even out the depth of packing. This simple seal arrangement has been most successful as it allows excess grease to clear and stops water and mud entering the bearing, with the advantage of extending the chassis greasing periods.

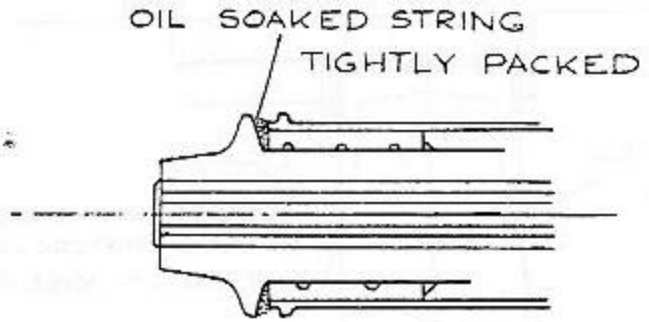


FIG.9. BUSH SEAL

The 'Metalastik' suspension bushes are too long as supplied, so they were cut down in length to suit the hole in the hub casting into which they were fitted. To get the maximum life out of these bushes I have found it is necessary to clear the hole of any sharp edges or protrusions and then tailor the bushes to suit a measured thickness of casting (see Fig. 10).

To the thickness 'A' 0.4" was added and then this total 'B' divided by two gives the length 'C' of each bush for that particular hole.

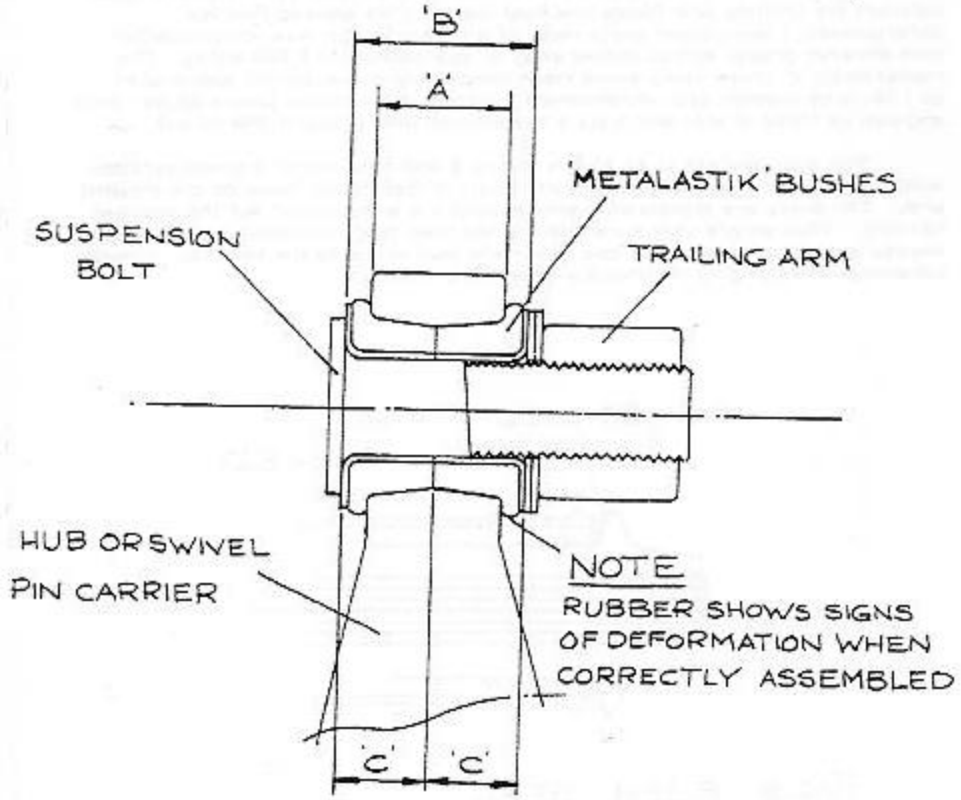


FIG. 10. SUSPENSION BUSHES.

Although the Armstrong dampers were not badly worn I replaced these with 'Koni' dampers which really do give good performance and are adjustable to compensate for wear.

Other changes were of minor importance and include; ABV non-return valves instead of the standard bleed screws in the brake and clutch systems, a 3" length cut off the standard MG gear lever and the handbrake quadrant moved rearwards to clear the central console (I fitted this later), and more recently the 4.3:1 differential has been replaced with a 3.9:1 ratio.

Rebuilding the suspension and transmission was not short of 'HORRORS' such as trying to fit the ABV valves into the slave cylinders via a very small hole in the rubber gaiter. The results of this contortion were a stripped thread and hence another £2/10/- cost towards the rebuild. A further 'HORROR' was the sight of the ground clearance reducing to a mere 2" as the rebuild neared it's finality. I had somehow got the torsion bar adjusters all mixed up (emphasising the need for clear markings) and this necessitated completely stripping down the suspension and rebuilding. PHEW!

-o0o-

STANDARD 1588 cc ENGINE (WITH FAN BLADES)

MODIFIED 1588cc ENGINE:-
L/ALLOY H.R.G. CYLINDER HEAD
TWIN 40 DCOE WEBER CARBURETTERS
10·3/1 COMPRESSION RATIO
MECHANICALLY AND VOLUMETRICALLY BALANCED
ABARTH EXHAUST SYSTEM
COOL AIR INTAKE
NO FAN BLADES FITTED
SPORTS COIL
CONTROLLED OIL TEMPERATURE

FIG. 11. ENGINE PERFORMANCE

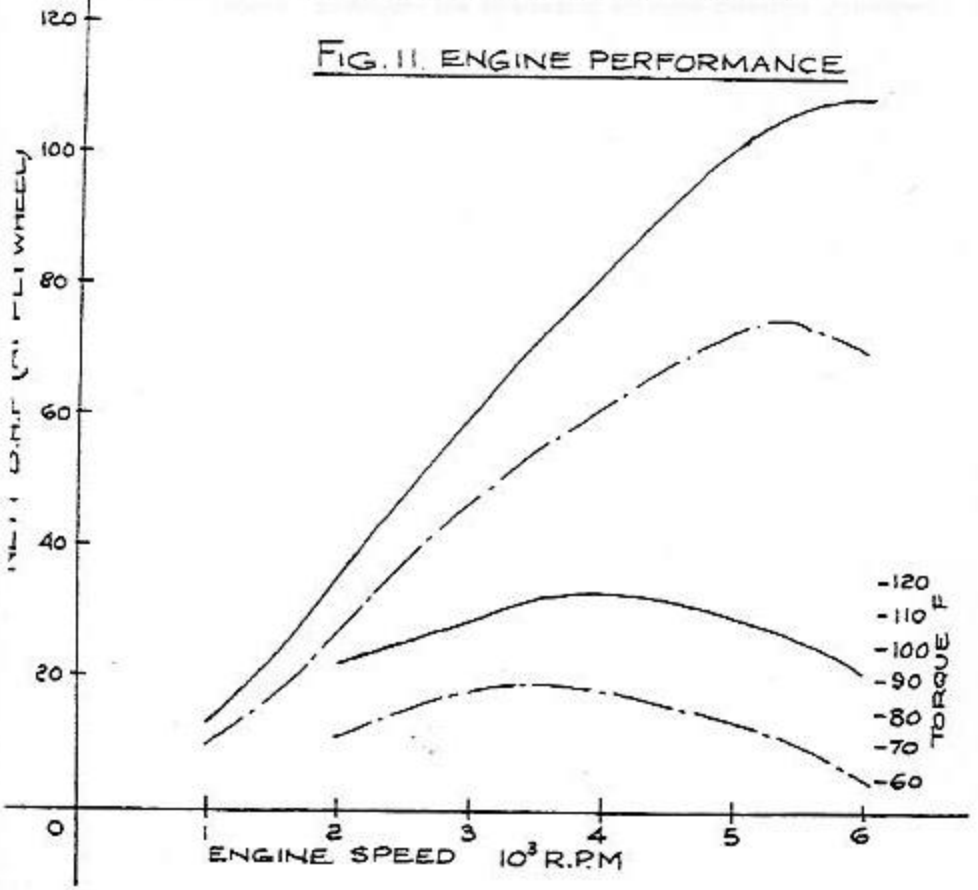
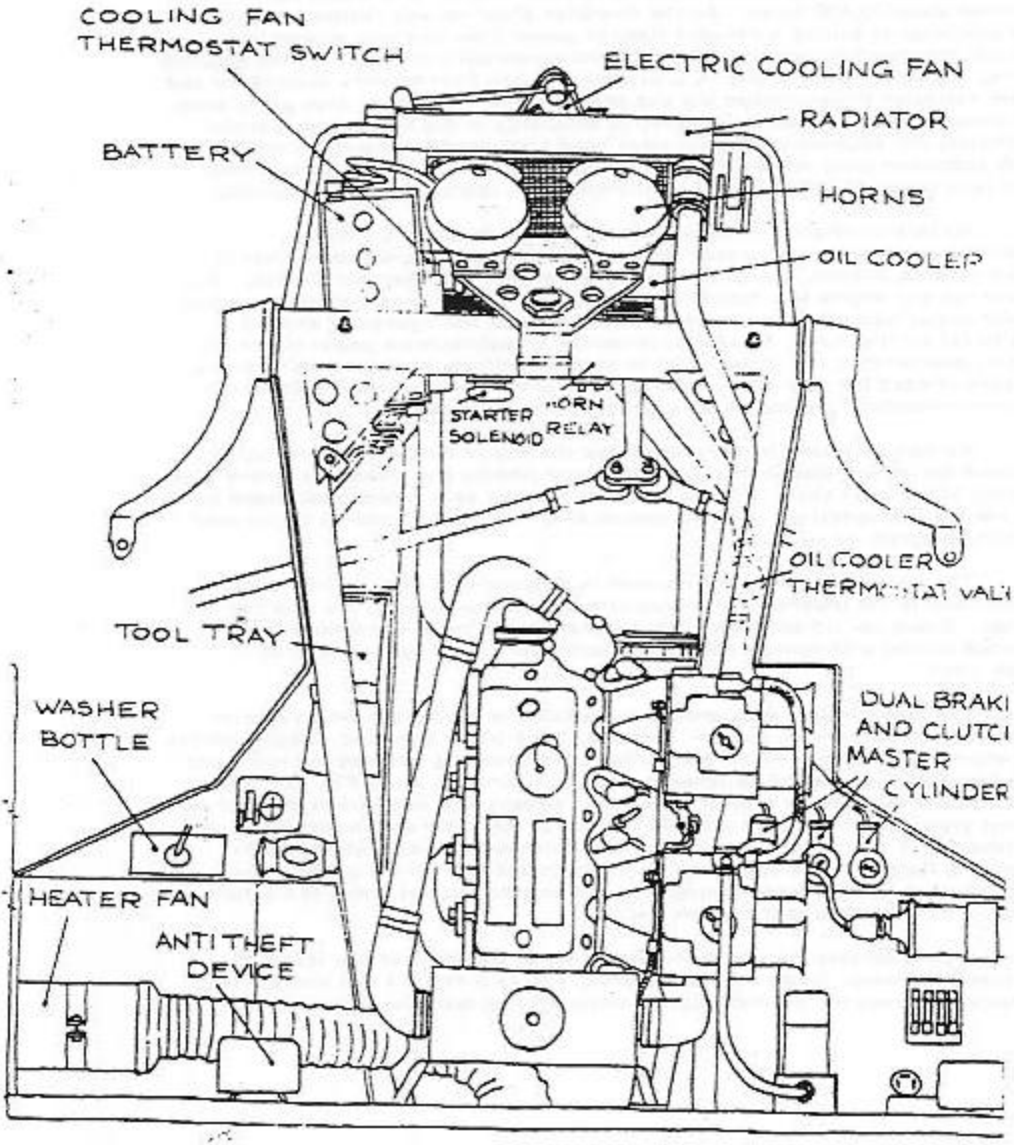


FIG 12. ENGINE COMPARTMENT



CHAPTER 4 - THE POWER AND CONTROL

There are two areas on any enthusiast's car that always get abundant attention, the instrument panel and the engine. My car is no exception and I have discussed these in this chapter.

The existing engine was a standard MGA 1588cc. unit which had covered about 15,000 miles. As the financial situation was limited I accepted the challenge of getting a reliable lump of power from this unit economically. A local engineering company statically and dynamically balanced all the rotating parts, including four flat-top H/C pistons. I used Derrington's experience and fitted reticular tin-aluminium big end and main bearing shells, also while down the bottom end increased the volumetric efficiency of the oil pump by careful machining and assembly. The cylinder head I obtained second-hand was an HRG aluminium alloy 'cross-flow' which had been planed, polished and fitted with twin choke 40 DCOE Weber carburettors on fabricated inlet manifolds.

As this crankshaft is considered to be unsafe above 6,500rpm., I decided to leave the valve gear heavy and deliberately allow valve float at about 6,000-6,200rpm. and so protecting the engine from serious damage. As I have not any engine test facilities peak tuning was not possible and the actual power output was unknown, however using the test bed figures of an MGB engine (of similar tune), I managed to derive an approximate power curve as can be seen on Fig. 11. If you wish to know the effects of these modifications, be sure to read the next and final chapter in which I will attempt to describe the performance of the car as an everyday form of transport.

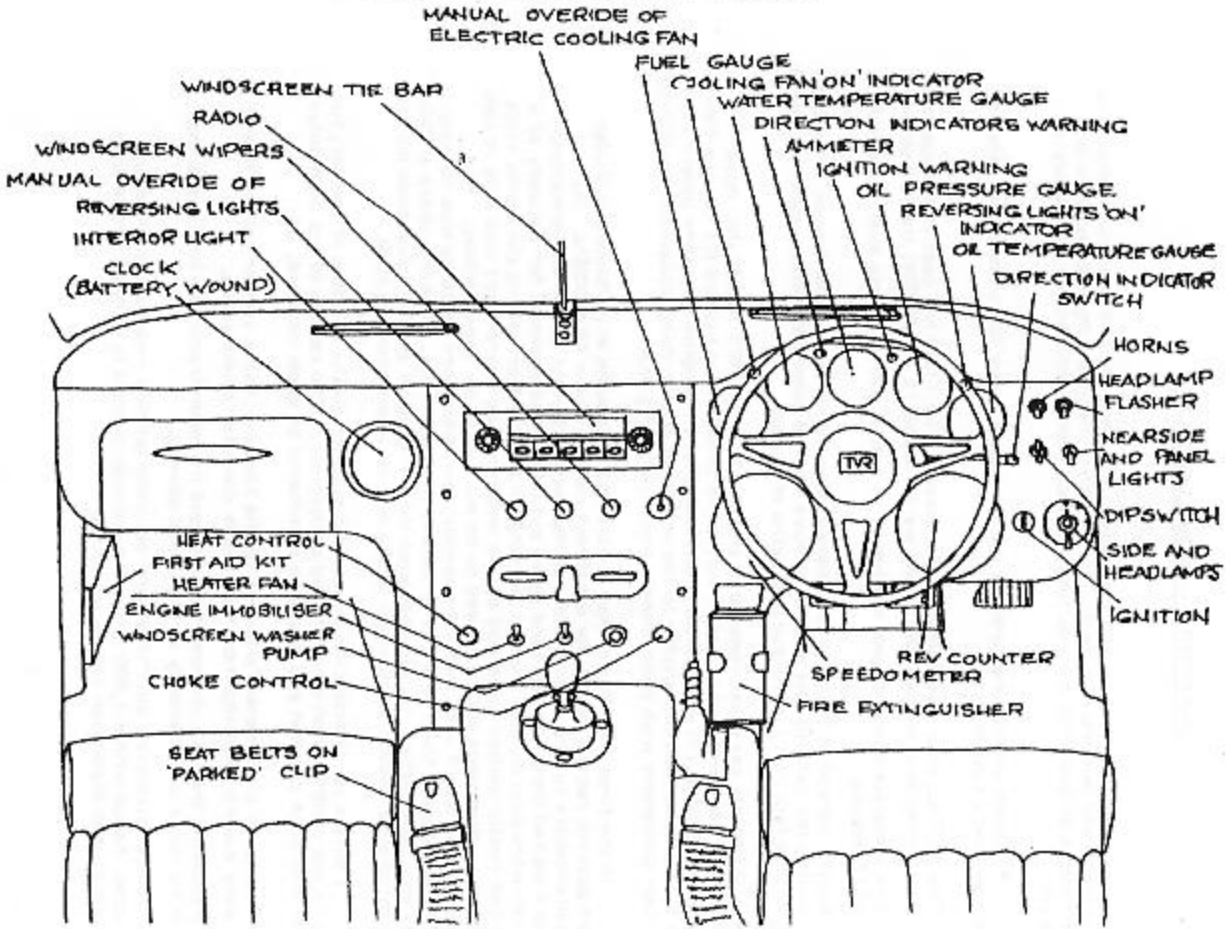
As mentioned earlier I re-arranged the engine compartment mainly to improve the weight distribution over the front wheels and lower the centre of gravity at the same time. Fig. 12. shows the layout as it finally took shape (to get the true perspective, open the bonnet of a TVR Mk 2A, and sit on the roof with the diagram on your lap).

The instrument panel and console is mounted on a very solid wooden frame fixed to the underside of the scuttle and the top sides of the gearbox tunnel. Glove box lid and panel (left hand and right hand) were made from plywood padded with sponge rubber and upholstery wadding and covered in black vinyl.

The frame is just wide enough to contain the heater box which obtains fresh air ducted from the blower through a hole in the bulkhead directly behind the engine into the rear of the box. Above the heater is mounted the radio and between them two rows of switches for various services - see Fig. 13. The switches are mounted on a detachable panel constructed in plywood covered with walnut grain 'Formica' with suitable 'cut-outs' for radio and heater vent. A rectangular (1 gall. size) oil can lined with felt was used as a glove box by producing flanges at the edges and screwing to the rear of the panel. The radio speaker is positioned centrally in the internal access panel to the boot which is now screwed to the bodywork.

A considerable amount of ergonomic study was done on the layout of switches, indicator lamps and instruments, and as a result I can operate the services and read the instrumentation while driving fast with perfect ease.

FIG.13. COCKPIT LAYOUT



CHAPTER 5 - CONCLUSION

For those who have had the patience to read my previous chapters, and those who are owners of elderly, tired TVRs, here are my impressions on the results of spending all that time, sweat, (sometimes blood) and money on the car.

From my written recordings let me supply a few facts about the rebuild you may find - USEFUL?

1. The TOTAL cost was £342.5.11! Deduct £56.13.10 for cost of garage rent, electricity and special tools and we get £285.12.1. (PHEW! that's better!)
2. The complete rebuild took 499 hours of actual working time over a period of 11 months.
3. As the garage is ¾ mile from where I was living at the time I made 150 trips during the rebuild and reckon to have walked some 225 miles, which accounts for the fact that I wore out two pairs of shoes!

When the car was completed and ready to be MOT tested the road conditions were wet and icy so it was some time before I could try out the car's new performance. It soon became obvious that the engine had more power than the 'Cinturatos' could transfer to the wet road and on many occasions rendering the car stationary with rear wheels travelling very fast!

In the first 500 miles I had considerable trouble with 'blown' cylinder head gaskets caused mainly by incorrect setting of the 40 DCOE's. As knowledgeable tuning mechanics are impossible to find in the Wolverhampton area I waited three months (and three cylinder head gaskets) for delivery of a Weber workshop manual from V. Derrington Ltd. After setting the carbs right the car really settled down and as the weather was improving I was able to use the full performance which proved to be well up to my expectations. The acceleration was 0 - 60 in 8 - 9 seconds, but even more amazing was the way it would accelerate from 60 - 100 at almost the same rate. The top speed at this time was never tried, largely because the noise level at high revs made me feel rather unsure about the strength of the engine when near the limit.

I paid a lot of attention to sound insulation in the building of the car, but this is one modification which failed completely. The causes of the high noise level are quite common and could be eliminated at some expense, eg;

1. Having no air cleaner/silencer on the Webers, valve clatter can be heard very clearly emitting from four large diameter choke tubes.
2. Removing the drip channel from around the door frame has increased the wind noise considerably at high road speeds.
3. Exhaust silencers on TVRs burn out very quickly regardless of engine tune, hence within 1,000 miles the exhaust system is nothing better than a pipe and expansion box in its effect.

Although a lot of engine power was available (and generally used) the fuel and oil consumption were good. Oil consumption started off at 350mpp and decreased steadily to 450mpp while fuel consumption started at 22mpg (touring) and decreased to 35mpg (touring) when the carbs were set right. In the summer following the rebuild my wife and myself spent a fortnight touring Ireland with all the necessary camping gear (14' x 7' x 7' steel framed tent, pots, pans, suitcase, stores, 1 gallon water can, 1 gallon fuel can etc.) and covered a mileage of 1,850 miles, during which the average fuel consumption was 38.7mpg and the best consumption was 42mpg! While in Ireland we only suffered two problems with the car other than those terrible Irish roads; first was the fuel gauge ceasing to function and hence the 1 gallon fuel can and some very accurate consumption figures, secondly the 'Taurus' thermostat valve for the oil cooler came unsealed and released many pints of oil at a fast rate onto the roads.

The modifications to the weight distribution are particularly successful, such that rear end steering is only noticeable if one is clumsy with the right foot on the loud pedal. With only the driver aboard and no spare wheel in the boot it is even possible to induce slight understeer, a condition unobtainable on the standard Mk 1, 2, 2A and 3 TVRs?

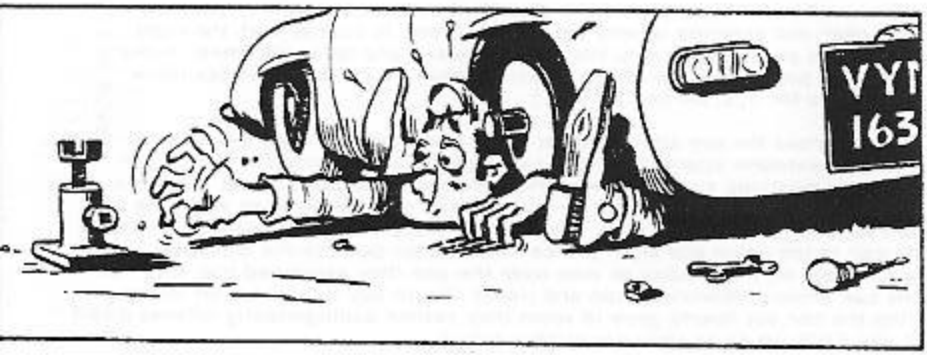
On the road the car attracts a lot more attention now than it used to (sometimes unwelcome attention) and generally will draw a small crowd in car parks at race meetings etc. Friends who previously had no interest in sports cars became enthusiasts and asked for details and to be allowed to sit in the driving seat and 'get the feel' of it. One day a young couple passing by the house saw the car in the drive and after a short discussion came to the bungalow. Having obtained my permission to look over the car they explained that they had seen the car around Wolverhampton and would like to buy it. I was not interested in selling the car but nearly gave in when they rather apologetically offered £660! (need I say £600 would be very acceptable now.)

In 22,000 miles since completing the rebuild I have had to make further changes to combat normal wear and reduce maintainance. The worn out 'Cinturatos' have been replaced by 'fatter' G800's and the 4.3 differential changed to 3.9 ratio to improve fast driving performance. Because of the amount of maintainance necessary the Webers and alloy head have been changed for a highly tuned cast iron head and twin SU carbs with very little reduction in road performance.

Trevor Davies

THE END

Hello, TVR Owner!



For advice, sympathy or just plain friendship -

JOIN THE TVR CAR CLUB

Write now to the address below. - your first year's membership could be free!

The TVR Car Club

4 Ninnings Lane
Rabley Heath
Welwyn, Herts AL6 9TD