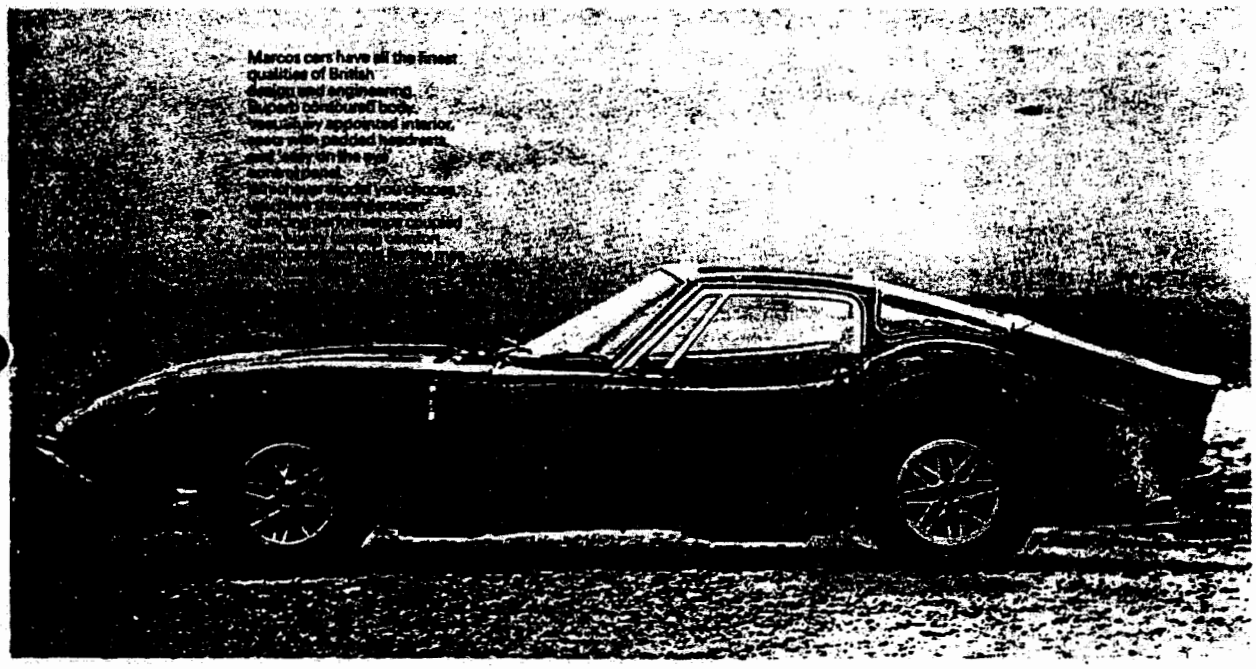
MARCOS CARS OF AMERICA

PRE 1971



MANUAL

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"MARCOS", A LITTLE HISTORY

To anyone who has seen the original "Wooden Wonder" Marcos, it can be difficult to imagine that from such an ungainly vehicle should evolve the sleek and beautiful shape that most people now equate with the name. The story begins in 1959 when Jem Marsh and Frank Costin first met and between them conceived the idea of a car built on a wooden chassis. The result was the strange little car that was raced by a youthful Jackie Stewart in various events, and which interestinly enough still races to this day. In fact the Jackie Stewart car, driven by Jem Marsh himself, has recently won the Historic Group Two Championship, and would seem to be in excellent shape after twenty odd years.

Nevertheless, this car had styling that is best described as unusual, and it had such novelties as a four piece windshield and a great deal of plywood in its construction. By the end of 1960 Frank Costin had left the company, although by this time Dennis and Peter Adams had joined Marsh,Dennis being responsible for styling, and Peter being involved with the intricacies of the wooden chassis that was to become a Marcos hallmark. A move to new premises at Bradford-on-Avon in Wiltshire enabled the company to step up development of the 'Ugly Duckling'; gradually the familiar Marcos shape grew out of this, its shapely fiberglass bodywork being designed by Dennis Adams and based on a wooden monocoque chassis. The car continued in this form until 1969 when the wooden chassis was replaced by a tubular steel unit, and then in 1971 production ceased altogether.

The Marcos is a rewarding car to own and drive, although now I must interject a few words on the motive power units and the model range, which are possibly the most confusing aspects of the car. The very first models, from 1964 to 1966, were fitted with the 1800c.c. Volvo engine, and then from 66 to 67 a FORD engine either 1500 or 1650cc was available. Then from 1967 to 1971 a FORD Cortina 1600 GT crossflow engine was used, although it was at about this time that power was increased quite dramatically with the FORD V engines and so on. In fact, between 68 and 71 the 3-litre Ford V-6 was available on the wooden chassis, from 69 to 70

the car was available with the Ford V-4 (although only 40 examples were made), and from 1969 to 1971 the car was available with the 3 litre straight six engine from the Volvo 164.

Now the famous MARCOS sports car is being built again by its originator Jem Marsh in England and imported to the United States by Marcos Cars of America Ltd. of Roswell, Georgia. The new Marcos is powered by the 2800cc Ford V-6 and is built with the all steel chassis with minor changes and improvements. THAT'S RIGHT!!, Now you have a second chance at owning one of the worlds last true hand-built sports cars. Don'T miss it.....

Bob Boston

This manual is to assist purchasers of Marcos body/chassis units in the completion of their vehicles. We must emphasise that this is only to help you build your vehicle and there are many other parts and ways of fitting the body/chassis units up to road going standards.

Set out below are parts which can be purchased either used and overhauled, or in some cases purchased new through the normal trade channels.

Front suspensions from a Tr Spitfire or GT-6 models. This includes the wishbone uprights, steering arms, brake discs, calipers and hubs. The shock absorbers and springs cannot be used.

Steering column Triumph Spitfire or GT-6. Preferably the later type which has the 3 position light switch. This must be complete with the top mounting brackets and all clamps and fittings, right down to the rack and pinion on the vehicle concerned.

Rack and Pinion these can be taken off of any Spitfire or GT-6. Preferably the later type which has a rubber seal between the brackets and the rack. The earlier models had aluminum brackets and are not so desirable.

Checks to be made on the used parts. Obviously, if you are using used parts you must check every item very carefully and insure that everything is cleaned and oiled,and repacked with grease in the case of the front hubs.

Front Suspension Bottom trunnions are very often worn, due entirely to lack of maintenance. These are shown on figure D. The calipers should be carefully checked for leaks.New rubber seals for these are easily obtained if need be. Wishbone bushings are normally satisfactory but should be checked also.

The brake discs should not be too badly corroded. The vertical link on the front suspension, in conjunction with the trunnion, should also be checked for any undue wear.

Rack and Pinion The rack and pinion shoud be carefully checked for any tight spots. These normally give very little trouble but would be advisable to strip the rack and clean it out and repack with the appropriate grease. The ball joints on the end of the rack should be checked and replaced if necessary.

Rear Axle if using rear axle other than supplied by Marcos, You should check for bearing and oil seal leakage which could leak onto brake shoes. In the rear of this manual is a diagram of the Marcos rear suspension set up. The brackets must be attached correctly and by electric welding other than gas welding which might cause axle shaft heat distoration. You would also have to change rear brake drum bolt pattern to match the front as in figure A.

The front suspension fits right onto the Marcos frame using the nuts and bolts as listed in our nut and bolt sheet in the rear of this manual. The spring and shock should be fitted with the adjusting screw at the bottom, using the correct bolts.

The rack and pinion steering should be bolted on the chassis using the standard Triumph brackets and rubbers.

The rear axle should be fitted with the 4 radius rods. The adjustable radius rod to be fitted last and adjusted to suit the correct length between the axle bracket and the chassis. The panhard rod can then be fitted.(Refer to figure H) Fit it to the chassis first then onto the axle. The panhard rod must be adjusted to insure that the back plates of the axle, on both sides, are the same distance away from the main chassis tubes. The spring/shock units are fitted with the adjusting screw on the bottom.

ensure that the lock nuts on the adjustable radius rod and Panhard rod are done up really tight.

Having fitted the front and rear suspension and modified the axle halfshafts in regard to the bolt pattern for the rear wheels, you can now fit your wheels.

Fit master cylinders,these are Girling 3/4 inch bore with an adjustable rod and vertical reservoirs, to pedal carriage. Fit flexible hoses to suit onto cylinders and to steel brake lines, via a suitable bracket in order to support them, see drawing (B). The brakes can now be bled. It is best to bleed them once then let them set overnight, and then you can bleed them again to ensure there is no air in the lines.

Having already your handbrake (from Cortina),cut a hole in the floor to accept the moving part of the brake and bolt onto the support bracket underneath(as in Marcos chassis drawing). Fit the Marcos handbrake cable to the moving part of the handbrake, using the cable and clevis pin supplied. The other end of the cable fits to the compensating mechanism of the rear axle.

It is very often better to hear the engine you have chosen running before you buy it. If possible drive the car to ensure it has good oil pressure and does not smoke from the oil filler cap. Thouroughly check and clean all engine accessaries (starter,alternator, etc.)to minimize any chance of failure at future dates.

The engine can be installed in the Marcos with all the accessories mounted with the exception of the exhaust manifolds which should be left off until later.

Exhaust manifolds for the 2800cc V-6 Ford engine are special and can be supplied from Marcos. The 1600 cc Cortina and 1500cc Cortina are also special and can be supplied by Marcos. The Triumph TR-6 and the Volvo 6 cylinder engine both use their standard manifolds. The exhaust system can be custom made or supplied by Marcos.

Connect the fuel line to pump using a suitable 3" length of flexible tubing ensuring there is no leakage. Connect the other end to the fuel tank.

To connect up the wiring of the car,thoroughly study the wiring diagram. Take great care with all connections, nothing is more frustrating than an unreliable wiring system.

Next, mount ignition coil in a suitable place on the chassis as near the distributor as possible and connect it up.

Fit a suitable flexible line to the clutch slave cylinder and make sure slave cylinder is mounted firmly via bracket to bellhousing. Then run brake line to pedal carriage to be connected to clutch mastercylinder and bleed air out.

To obviate the cost of a new radiator, the Ford 2800cc V-6 radiator can be used after modifing bottom outlet to clear steering rack. Many other radiators can be used if size permits but should be mounted so top of radiator leans forward. It is recommended that an electric fan be used rather than the stock engine fan. Numerous fans are suitable for this such as the Flex-a-lite fan which bolts directly onto the radiator. Convoluted flexible radiator hose should be used for cooling system.

A suitable driveshaft must be used according to what engine and rear axle you have used and can be made up from parts of the original driveshaft then cut and balanced. Or these driveshafts can be supplied by Marcos if you give us the specifications you require.

The brackets on the top end of the Spitfire steering column concerned can be used and bolted onto one of the three positions on the dashboard to suit driver. An angle bracket is needed to carry out this operation(see drawing F). The bottom fitting of the special Marcos universal joint in the steering must be fitted carefully ensuring that the angles are not too sharp, thus making the steering tight. It is essential that the two pinch bolts holding the Marcos universal joint assembly to rack and pinion are fitted so that they go through the grooves in the rack shaft and the Marcos special assembly correctly.

To fit Fuel Tank use special bracket shown in figure F in this manual.

We recommend fitting, then removing the door and frames before painting the car to minimize damage to paintwork. Fit the quarterwindow and dropglass rubbers into windowframe. Fit quarterwindow into rubbers and secure with small brackets (shown in Figure G). Fit the window regulator channel onto dropglass using an old innertube between the two, ensuring the bracket does not touch the frame when fitted. Slide the dropglass complete with channel into frame and tape into position to facilitate fitting. Fit the frame complete with glasses into the door shell. Trim the door to ensure that the frame fits into the aperature with an even gap all the way around. Drill and fix the front and the back edge of frame to door. Close the door and adjust the top frame edge either in or out by moving the bottom of the frame. When an even gap is obtained, bolt the frame to bottom of door. The frames should now be removed and doors painted . Refit the frames after painting car by same proceedure as above. Fit window motor and regulator, ensuring that the wires are on the motor as these are fairly inaccessible after motor is fitted. Connect all the wires for the window motors and switches. Move the dropglass into the full up position and mark the regulator gear tooth nearest the gearwheel. Repeat the procedure in the down position. Fill the gap between the relevant teeth with weld as shown in figure G2.

Fit door lock as shown in drawing H2. Fit locks and striker plates using bolts listed. These door mechanisms are from MGB or TR-6. Use control rods modified from the same vehicle and the interior handles. Fit the outer door push button and fix brackets as in drawing H2 (MGB trunklatch)

Fit trunk hinges and trunk lid. Fit hinge brackets to rear bulkhead. Attach the hinges to the bracket and adjust to fit. In some cases it may be necessary to bend hinges to suit. Fit the trunk lid stay to the passenger side hinge and to trunk undertray as in drawing G2.

Fit trunk push button lock to back panel. Fit interior lock assembly to back panel and the bracket to the lid. Adjust to fit.

To fit rear windscreen, cut (4) 3" lengths of rear screen rubber supplied and fit onto aperature, 2 forward and 2 rear. Fit the screen into the rear rubbers and mark around the aperature, then grind the screen down to size using a grinding disc on a drill. Periodically check the screen in the aperature until there is an even gap all the way round of approx. 3/8 inch. Then fit the complete rubber into the aperature. Fit the back of the screen first, then the front edge, leaving the sides until last. When screen is fitted, fit the chrome filler strip. The tool used for this is called a Clayton Wright filler strip tool.

Ensure that any holes between the engine compartment and the cabin are effectively sealed. This is as much for noise as for the intrusion of fumes. Before fitting any upholstery, fit ½inch sound deadening felt everywhere except the arm rest area adjacent to the door shut. Also felt glued to the inner side of the door skin will considerably reduce noise. Now is time for upholstery which can be done custom or upholstery kits can be ordered from Marcos Cars of America.

If you are using the headlights supplied with the Stage III kit you will also need front side marker turn signal lamps whichare Morris Minor, Austin Healey 3000 MkIII or can be supplied by Marcos.

A rain gutter should be installed to the top, front , and back edge of the door opening. This is a J shaped aluminum channel and should be pop riveted to the body.

Wheels and tires. Previous production Marcos' were fitted with either 175X13 or 185-70X13 on 5½ inch rims. (Spitfire bolt pattern) We do not recommend any wider than a 6" rim.

After the headlining has been fitted, the interior rear view mirror can be fitted. If you use a screw fitted mirror, you must feel for the wooden block bonded to the roof panel approx.½ to 1 inch back from the windscreen opening in the middle. Make sure the screws are not too long and penetrate the roof.

When the inner mudguards have been fitted and prior to painting, the lower scuttle should be lined up to match the line of the hood. To do this close the hoodand the side catches. Using a piece of wood, prop the lower scuttle panel (this is the F/glass part of the body directly underneath the hood latch)until it is directly in line with the side hood line. Then using F/glass cloth and resin obtainable from any bodyshop supply store,laminate the inner mudguard to the inside of the lower scuttle panel and leave overnight to dry properly.

windshield wipers. The wiper motor is a Lucas 14W model with a sweep of 120 degrees. The wheel boxes too are again Lucas part #72879, and the drive rack is standard Lucas. The wiper tubes to use are made up with the ends flared to the following lengths 20". 10½" with nut 2½". Most of these wiper parts are used on British Leyland sports cars such as TR-6 or MGB or can be supplied to you by Marcos Cars of America.

We strongly advise you use some type hood lock for security and safety reasons.

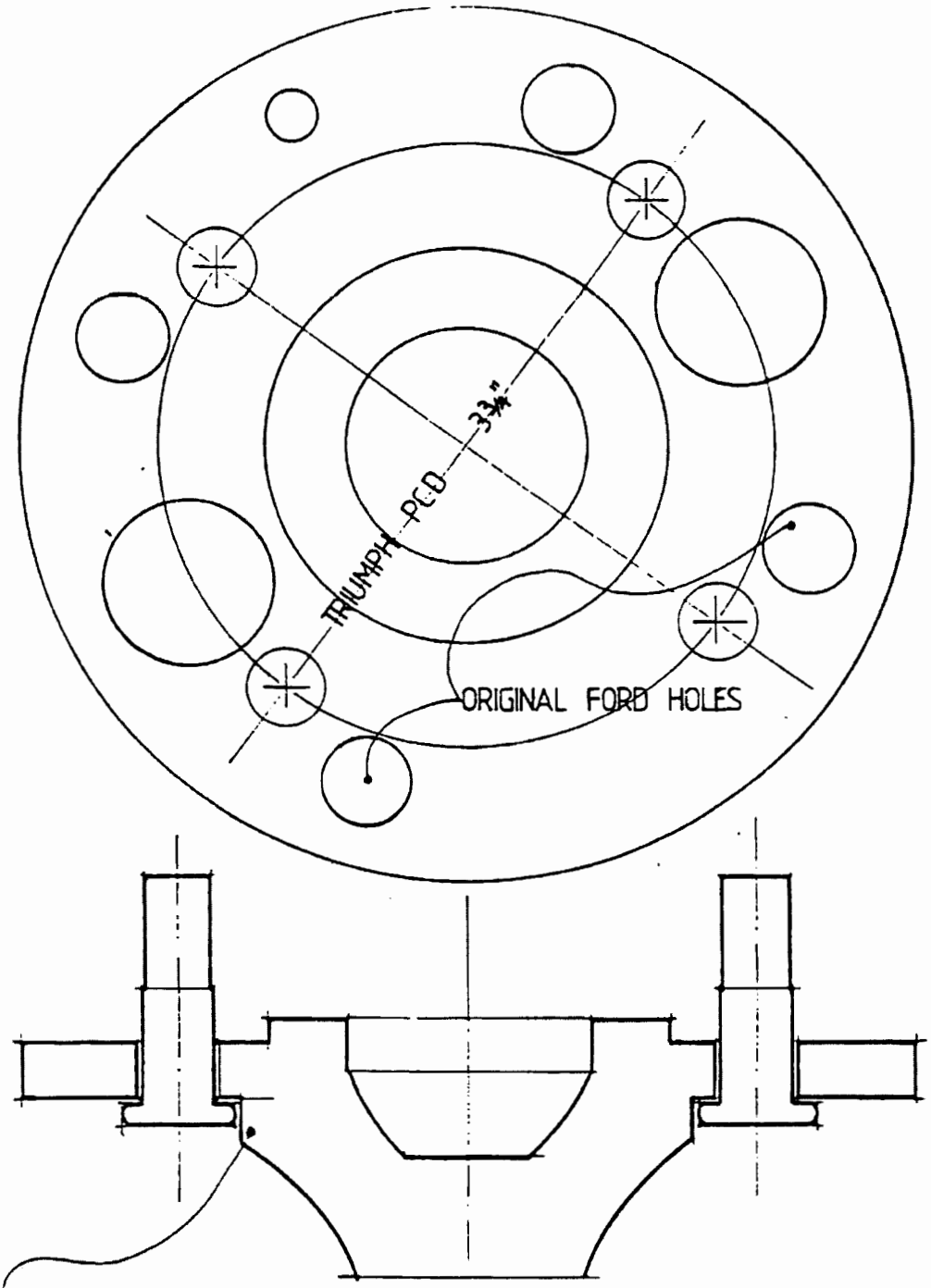
The glove box can be made up to your specs. using pressboard obtainable thru any upholstery shop.

Paintwork. Fiberglass cars are painted in exactly the same way as steel ones, but ensure that there are at least 2 good coats of fiberglass sealer applied before any other paint. The sealer should under no circumstances be rubbed down before priming as this breaks the seal, as its name implies, and could cause problems when applying the color coat. We have found through experience that the car is best painted without any body parts fitted i.e. door frames, locks, screens, bumpers etc..as this ensures that there are no unsightly marks and lines when the masking tape is removed.

Radio Noise Suppression. It must be pointed out that the cheaper radios are always harder to suppress. The antennae must be mounted at the rear of the car and not on the roof or near the engine compartment. A large suppressor should be fitted to the coil so the current runs through it. A smaller suppressor should be fitted to the alternator. In some cases it might be necessary to put a small one on the lead wire to the wiper motor as well. Ordinary cooking foil can be glued to the underside of the hood and should be grounded to the chassis by a wire.

Should you have any difficulty obtaining any of the parts needed to complete your Marcos, we should be able to supply what you need.

It is clearly understood that Marcos Cars of America cannot be held responsible for any purchasers of body chassis kits who use parts which we do not recommend.

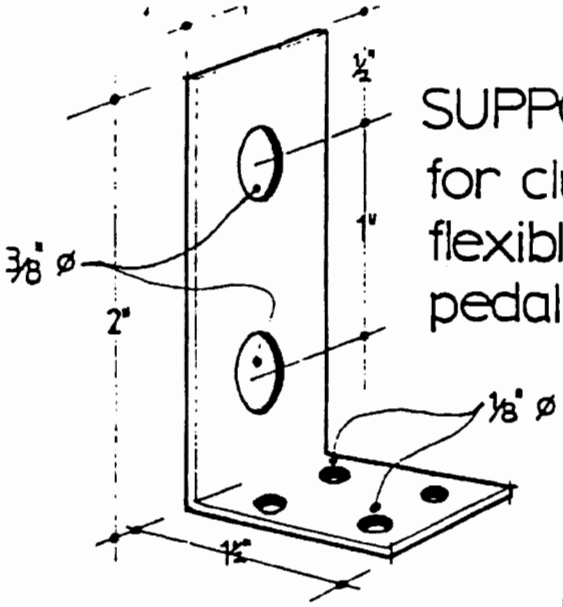


MACHINE SHOULDER OFF TO ALLOW STUD TO SEAT SQUARE

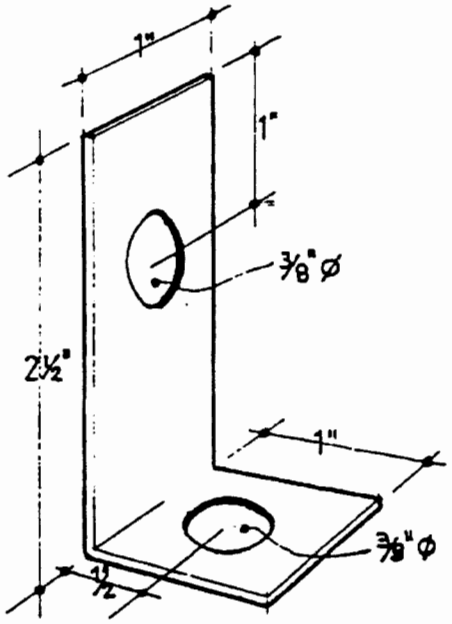
REDRILL BRAKE DRUM THE SAME

HALF SHAFT MODIFICATIONS

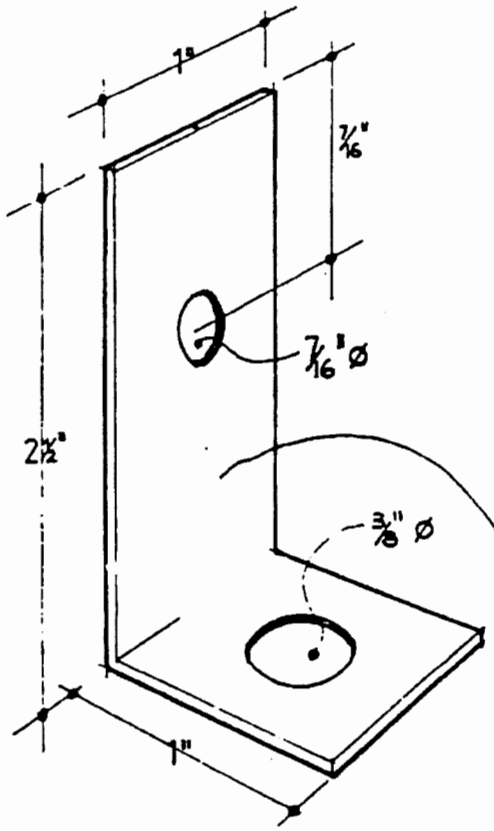
FIGURE A



SUPPORT BRACKET
for clutch and brake
flexible pipes from
pedal carriage



SUPPORT BRACKET
front flexible brake
pipe to wishbone



SUPPORT BRACKET
flexible pipe to caliper

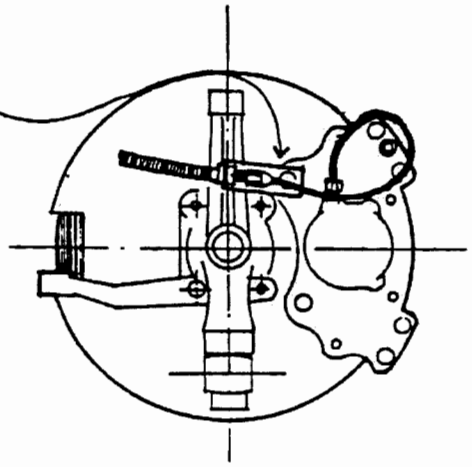
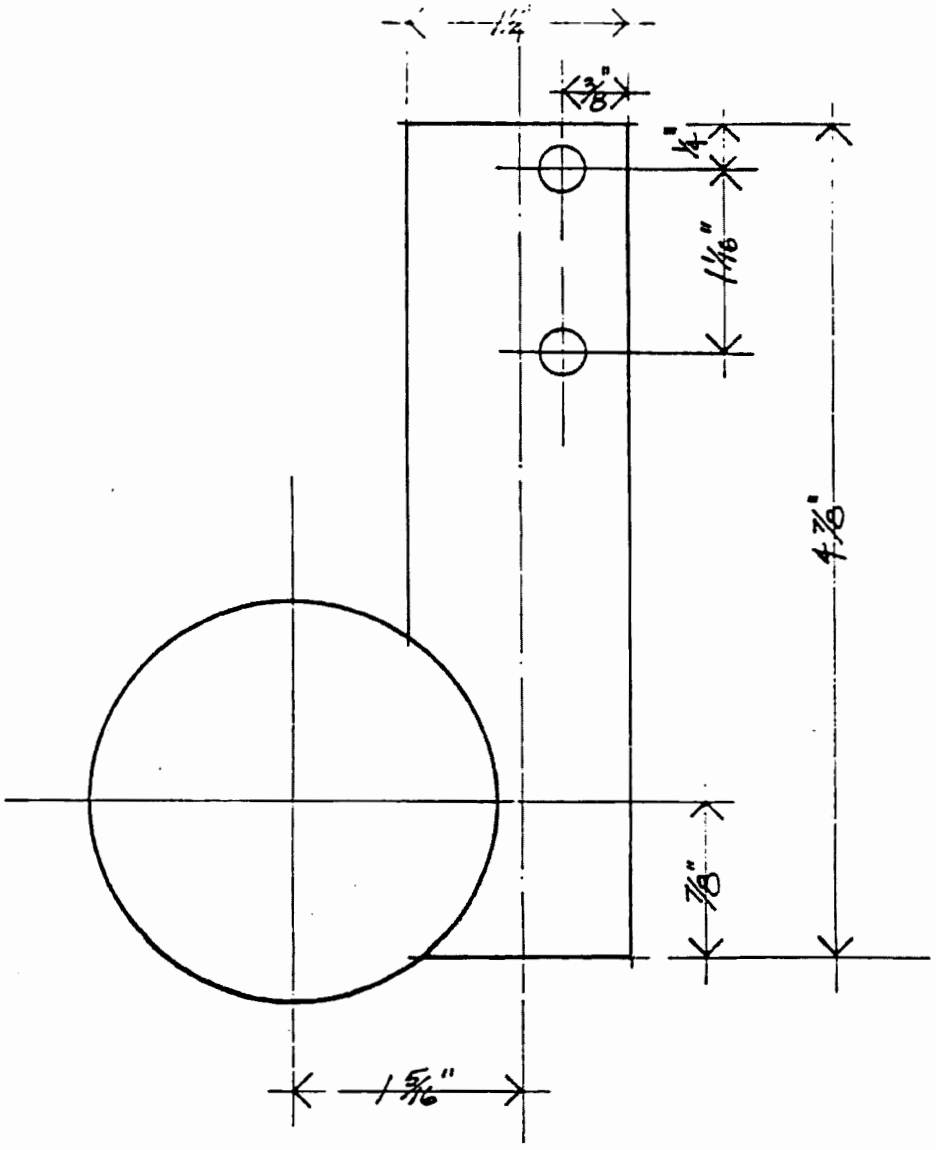
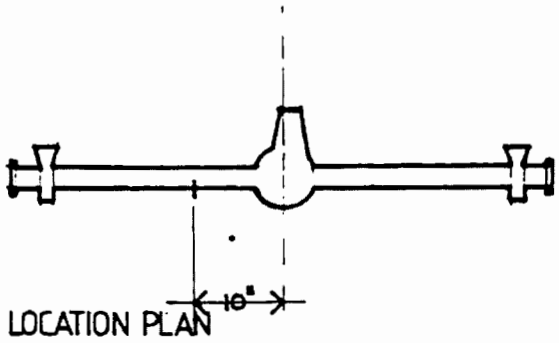


FIGURE B



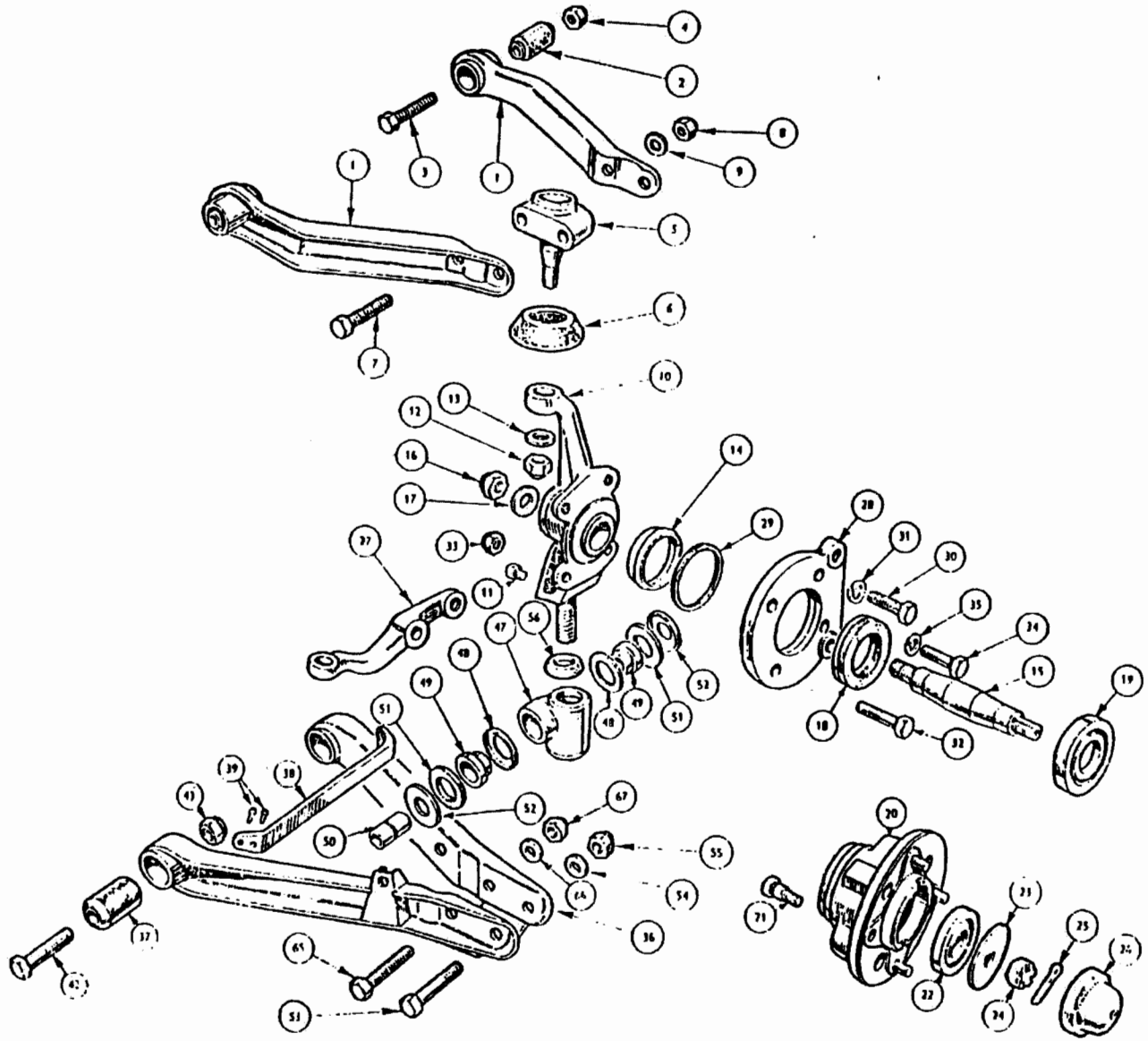


LOCATION PLAN

HANDBRAKE BRACKET

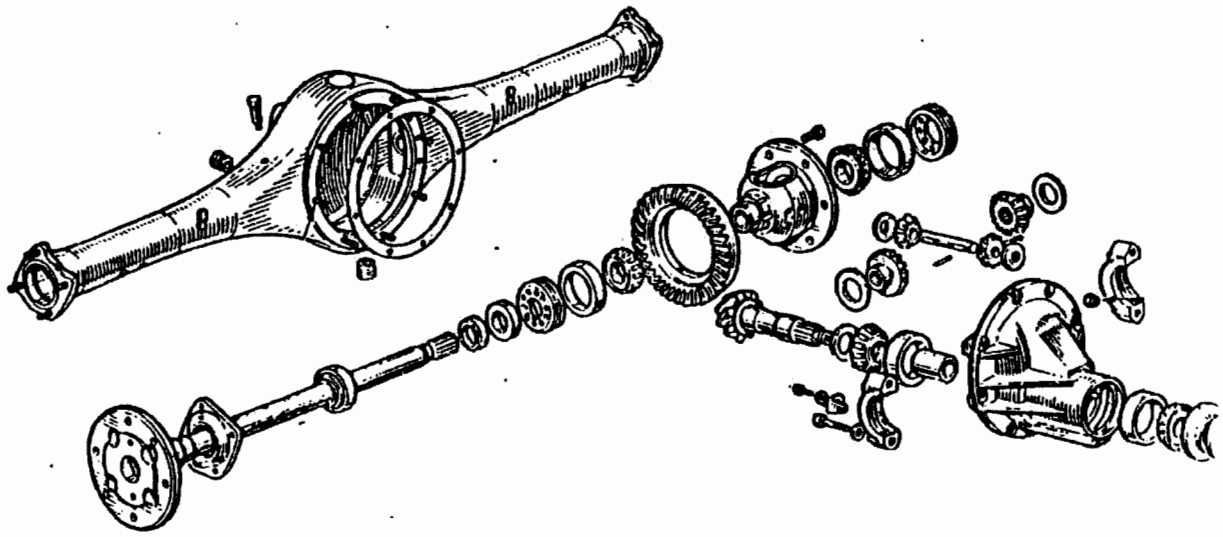
FIGURE C

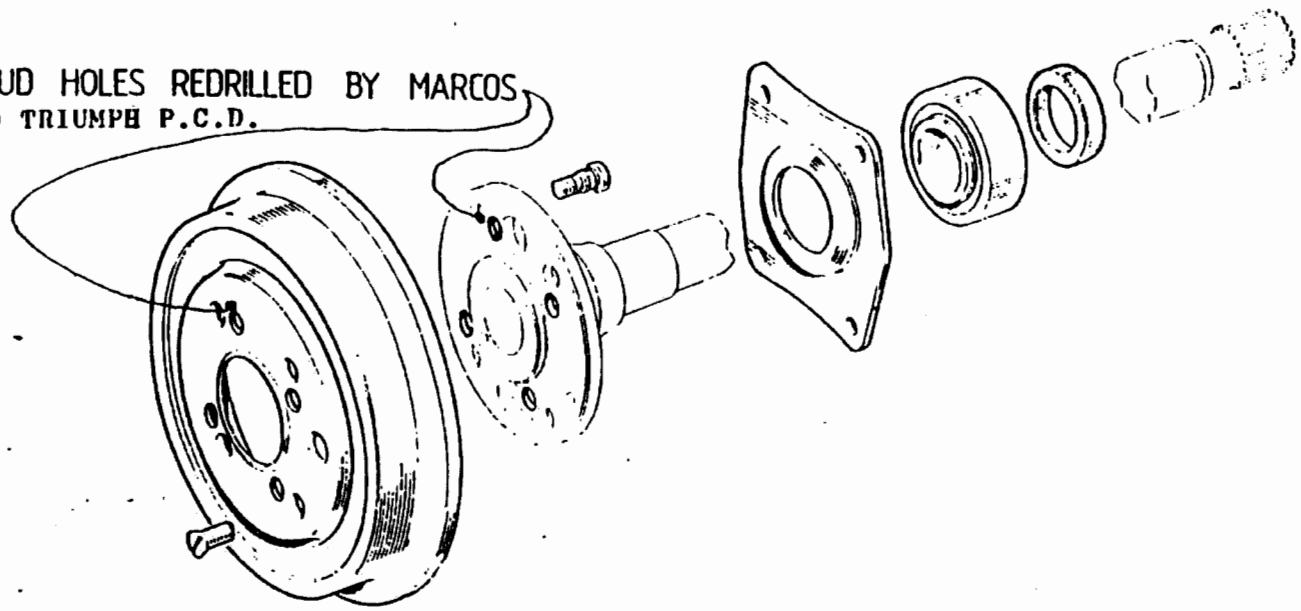
FIGURE D



TRIUMPH VITESSE MK 2 FRONT SUSPENSION

FIGURE E

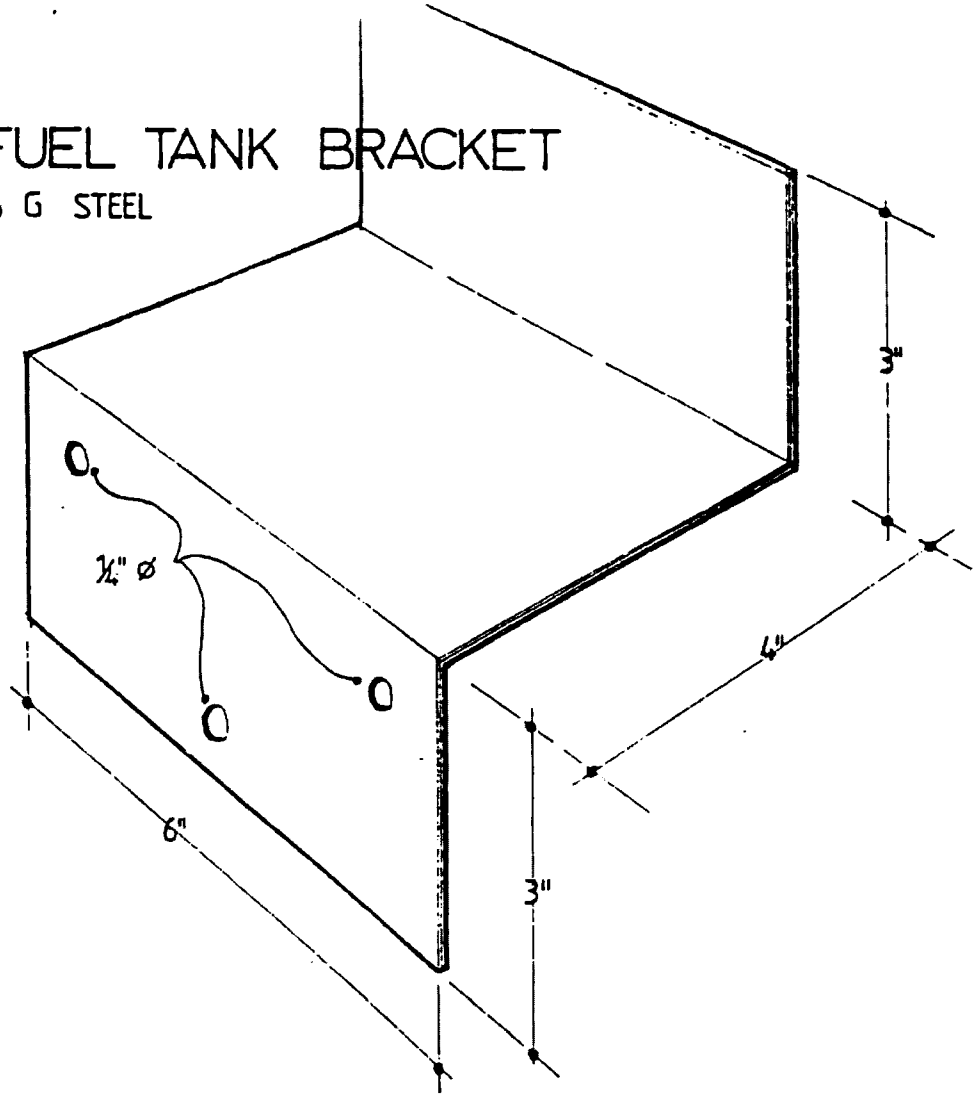


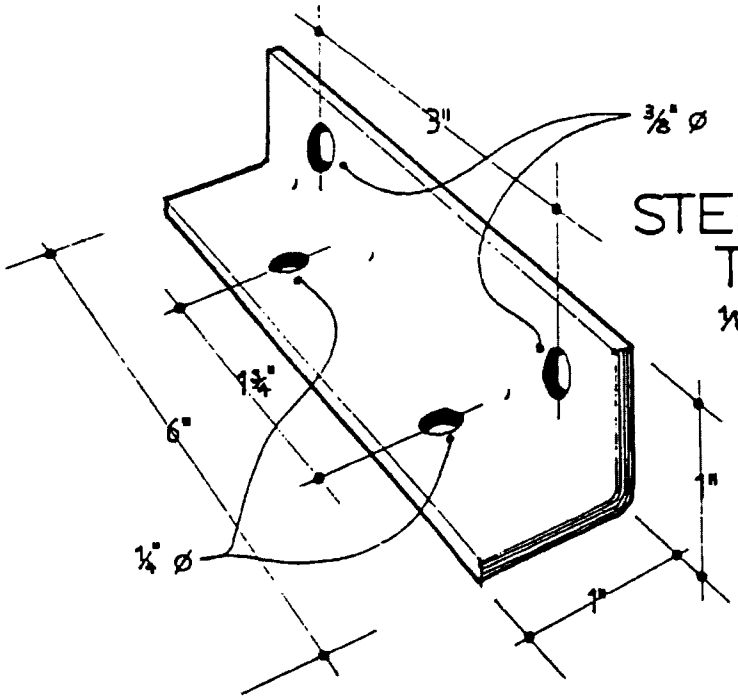


CORTINA MK 2 REAR AXLE AS USED BY MARCOS

FUEL TANK BRACKET

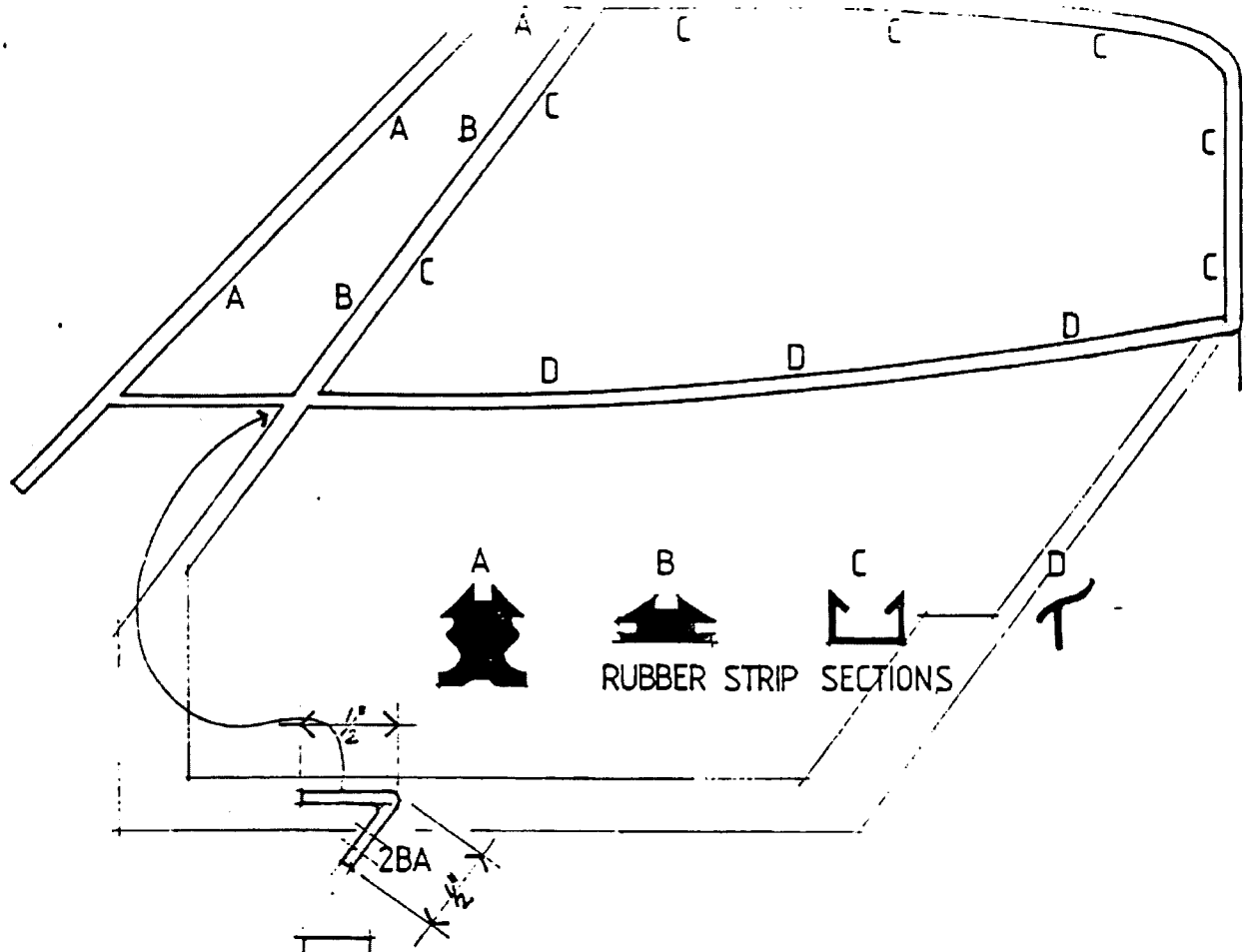
14 G STEEL

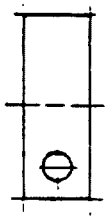




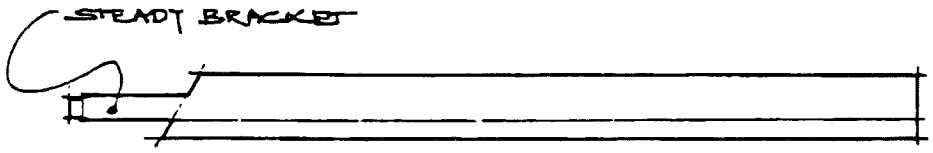
STEERING COLUMN TOP BRACKET

⅛" MILD STEEL





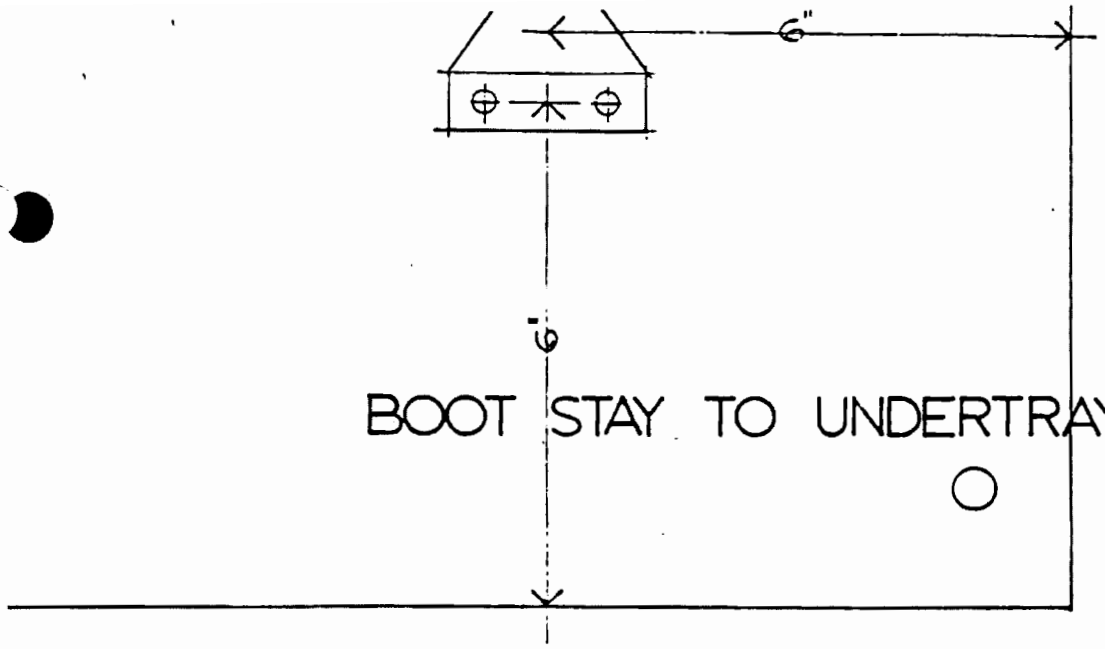
QUARTER LIGHT FIXING BRACKET



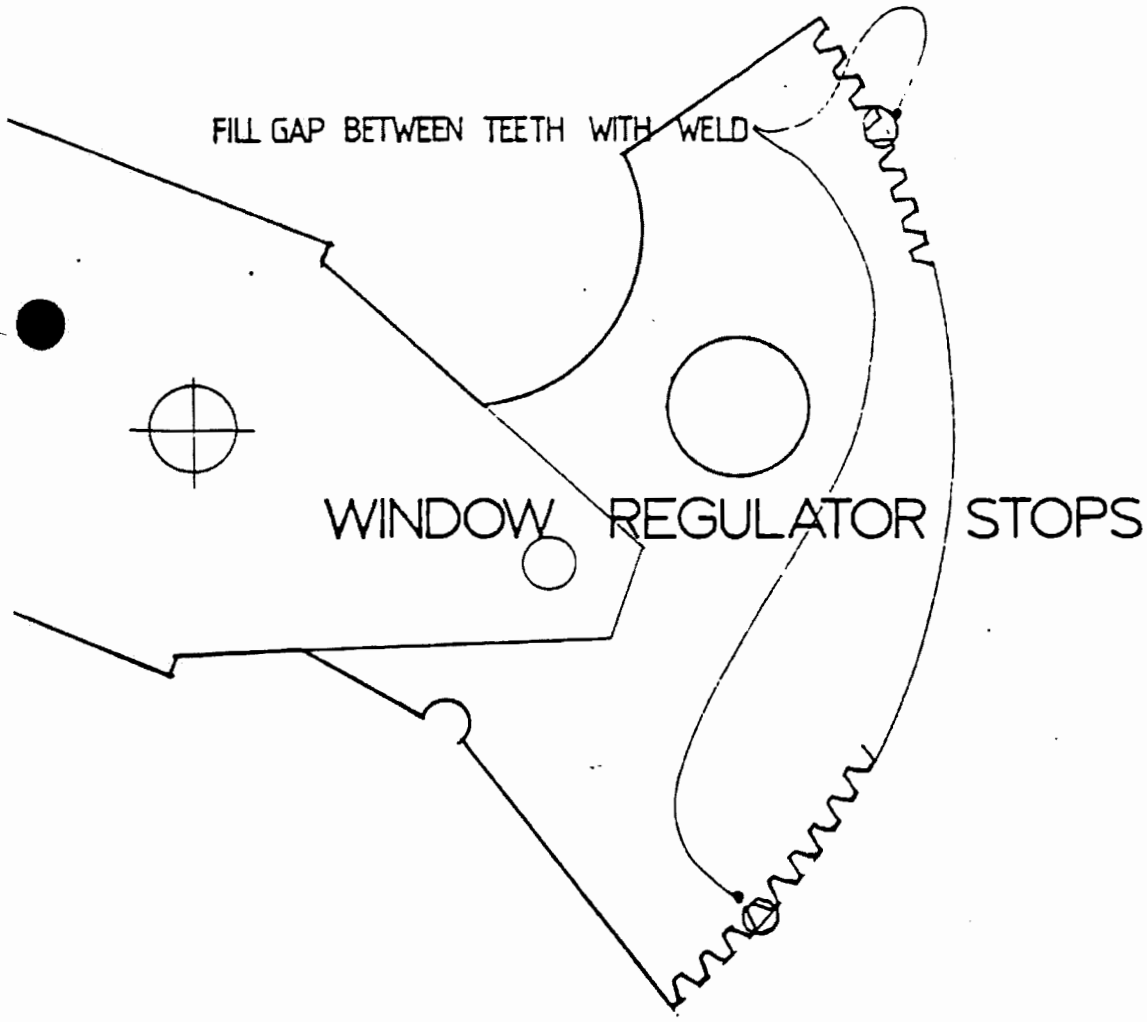
WINDOW REGULATOR CHANNEL

WINDOW FRAME

DRAWING G



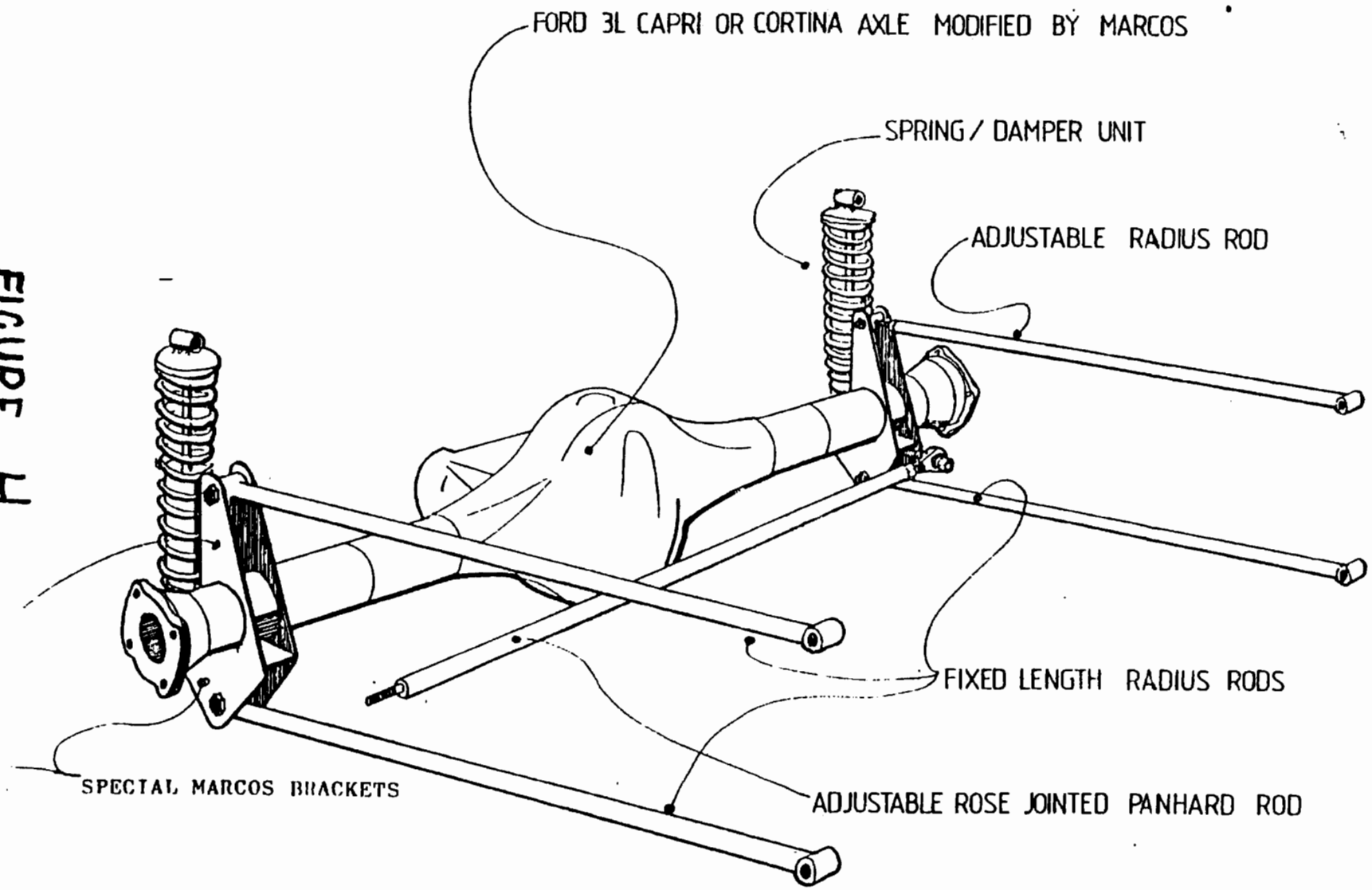
BOOT STAY TO UNDERTRAY



WINDOW REGULATOR STOPS

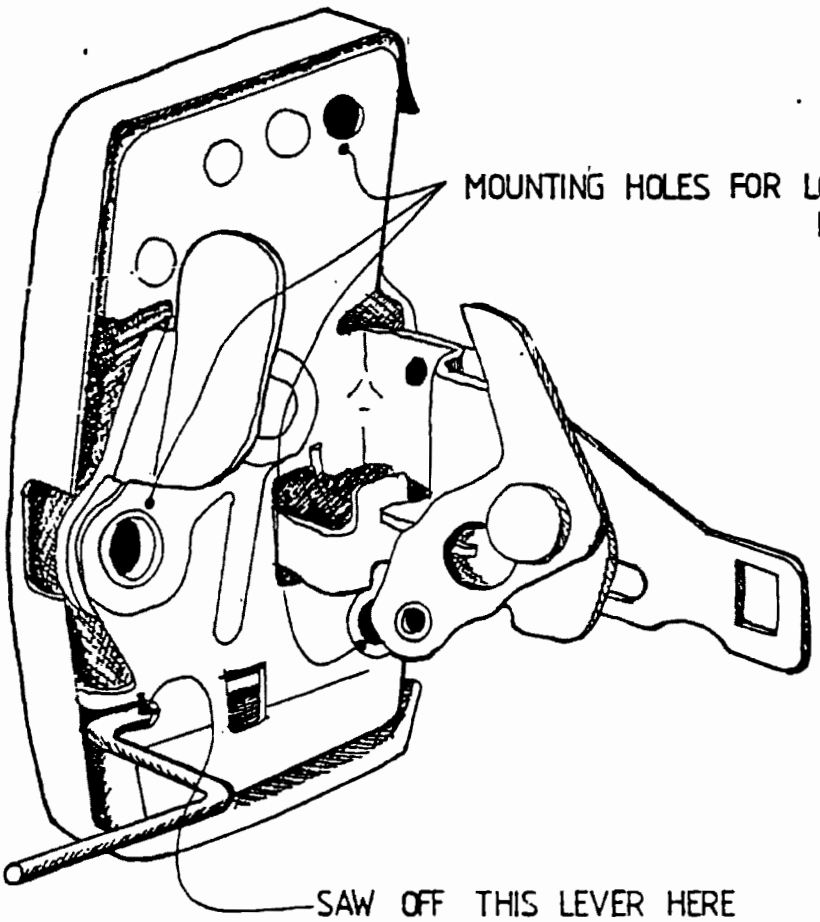
DRAWING G2

FIGURE H

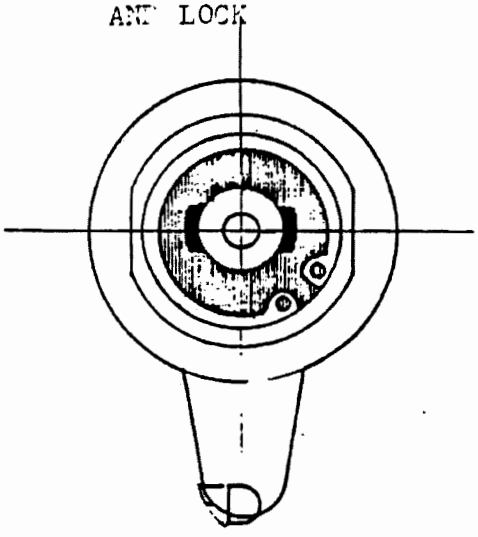


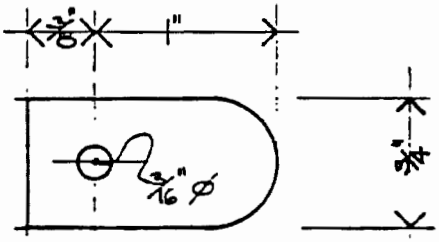
MARCOS REAR SUSPENSION SY

MODIFIED NOS OR T-6 DOOR LATCH ASSEMBLY

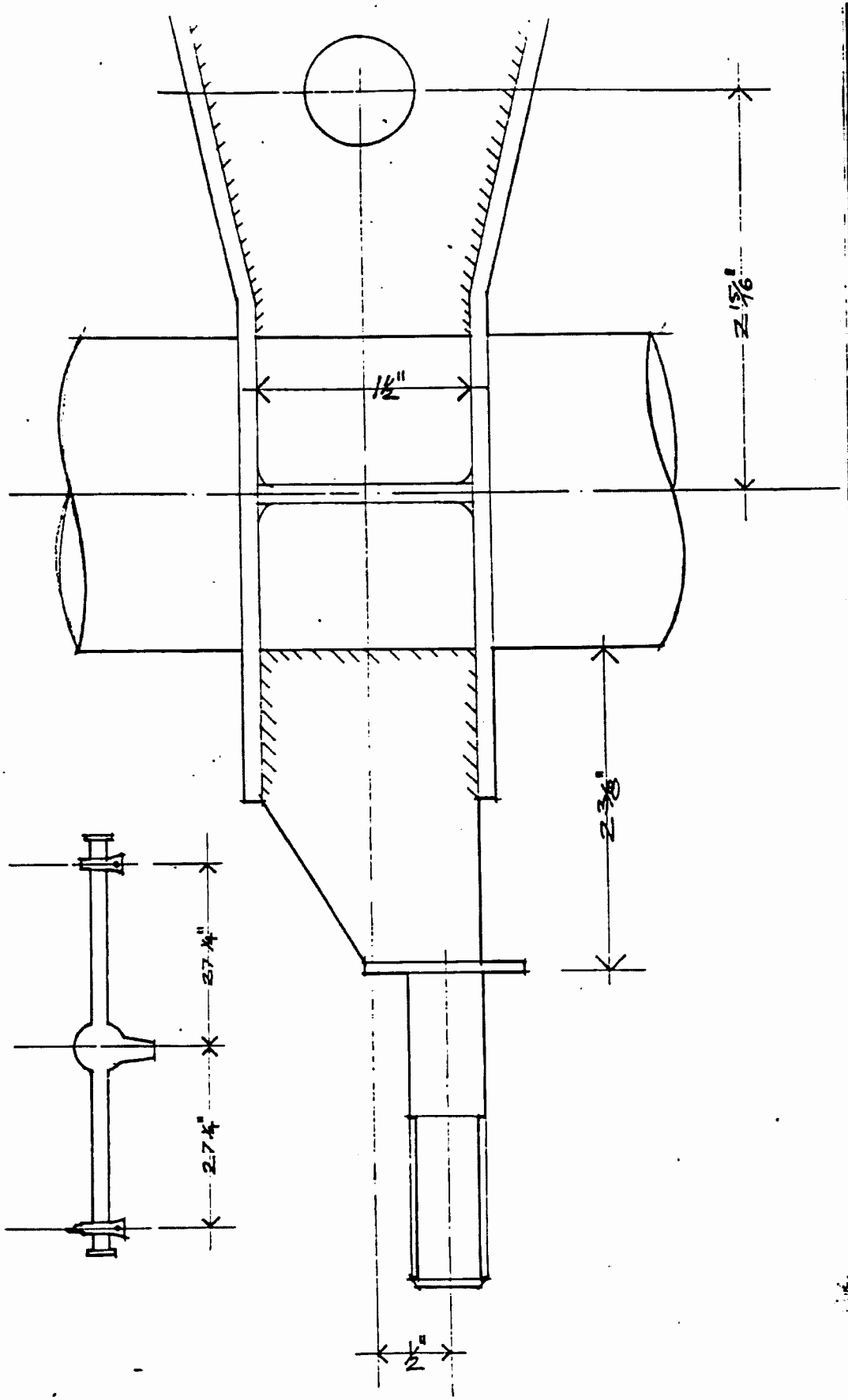


MGB TRUNK LID HANDLE AND LOCK





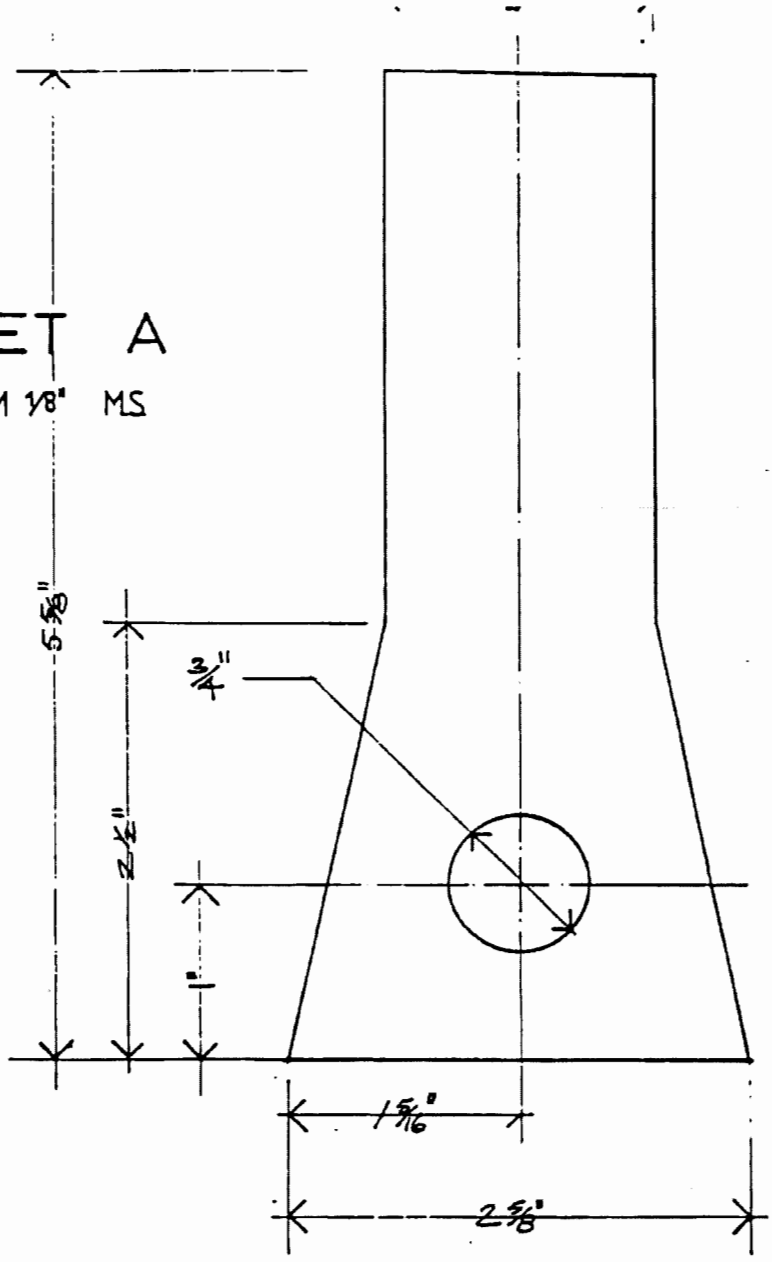
DRAWING H2



TOP VIEW RIGHT HAND BRACKET

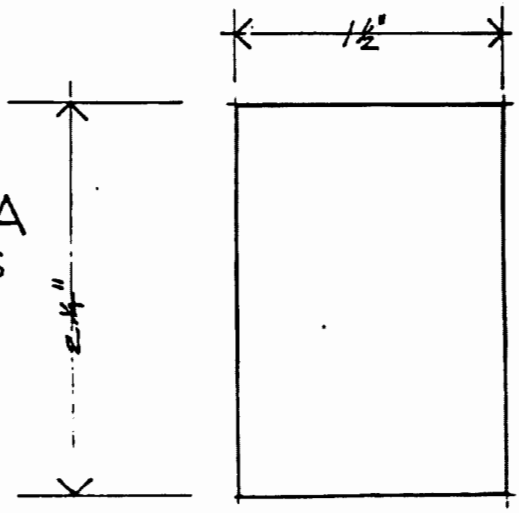
GUSSET A

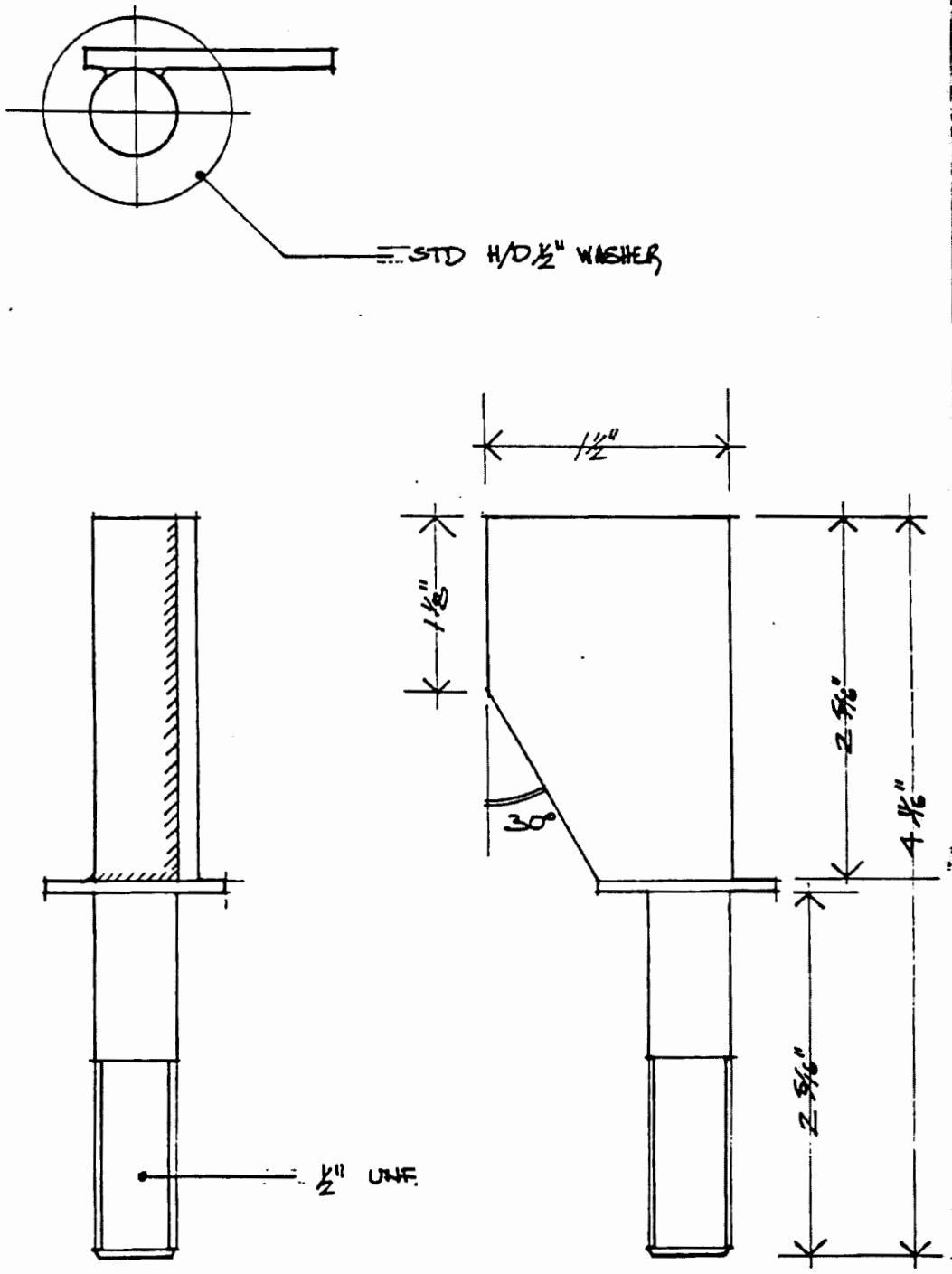
MAKE FROM 1/8" MS



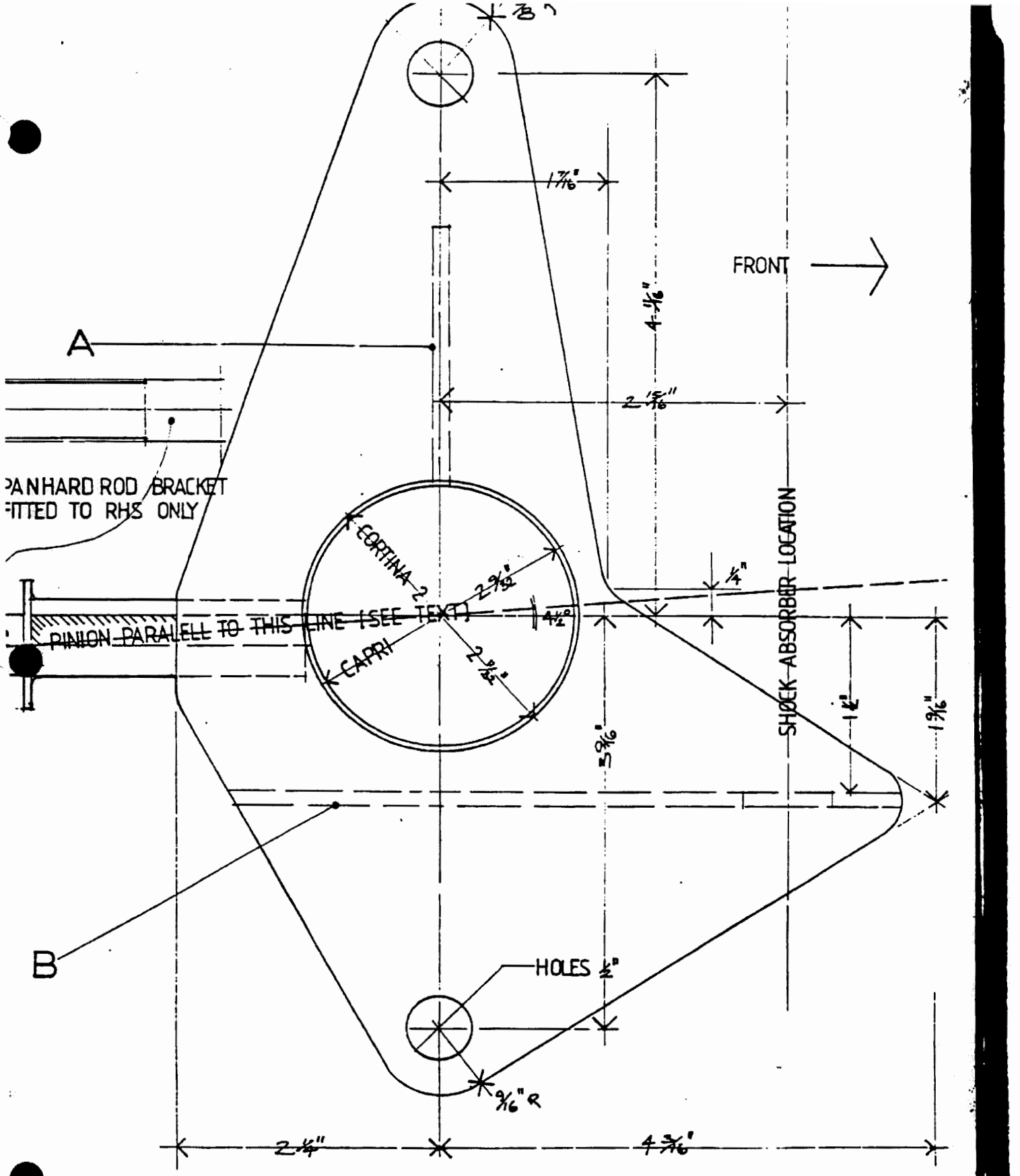
GUSSET A

MAKE FROM 1/8" MS

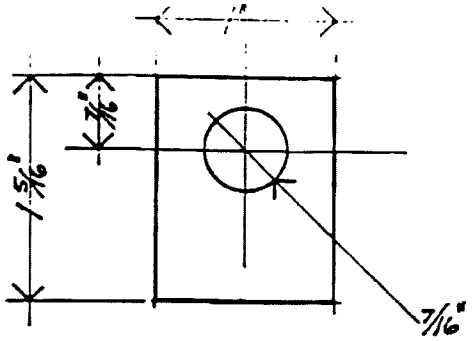


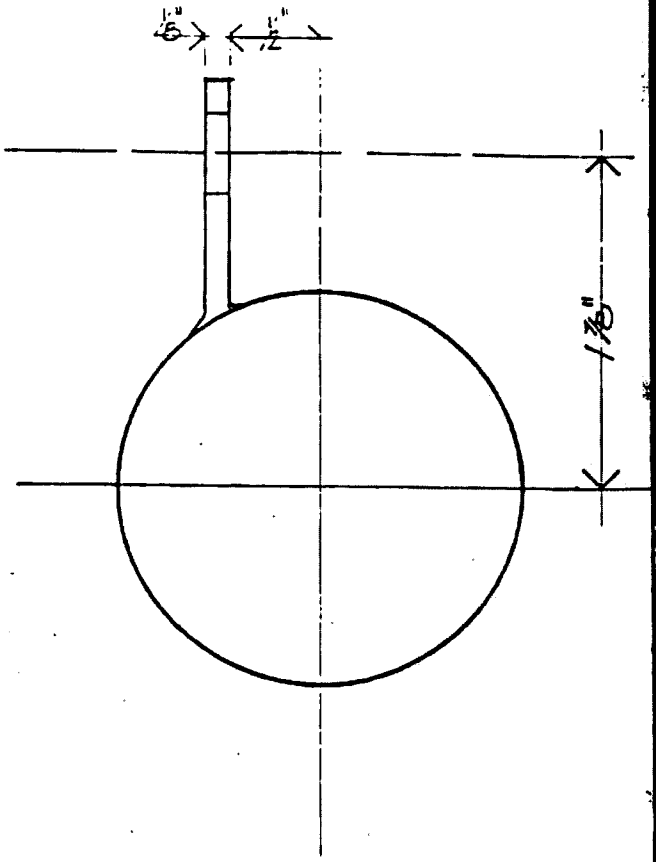


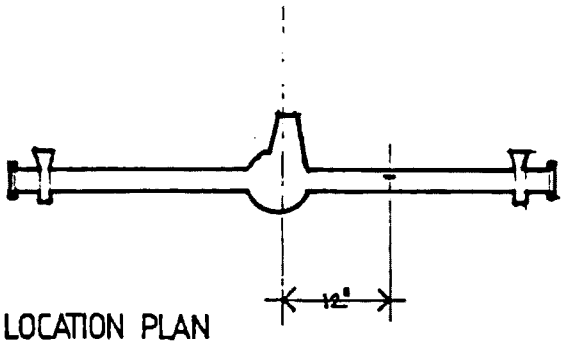
PANHARD ROD BRACKET



RADIUS ARM BRACKET

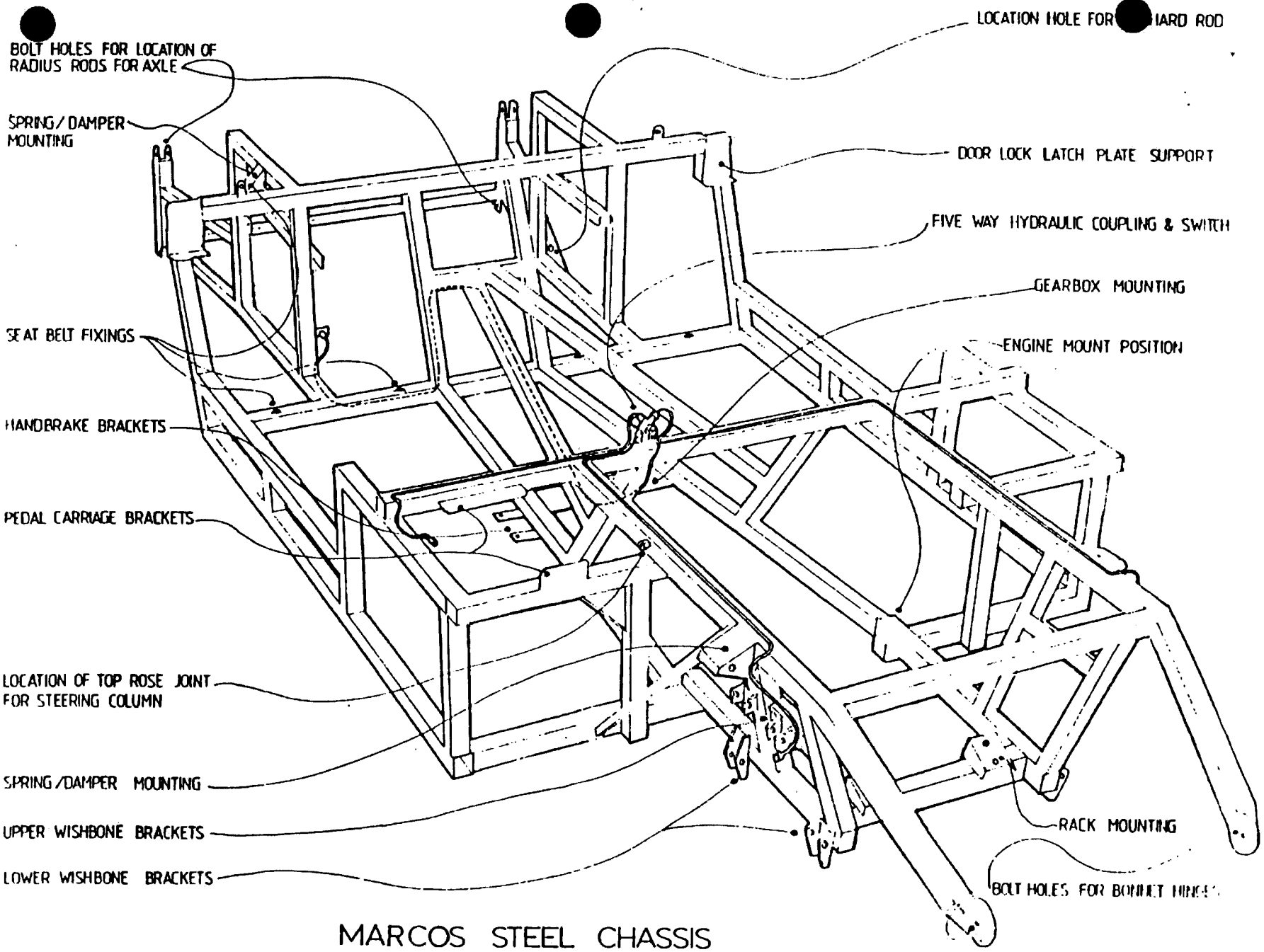






LOCATION PLAN

BRAKE PIPE SUPPORT BRACKET



MARCOS STEEL CHASSIS

EQUIPMENT	JUNE 1964 - APRIL 1966			MAY 1966 - MARCH 1967			APRIL 1967 - 1970		
	SMITHS INDUSTRIES CODE No.	SPEC.	VEHICLE MAKERS PART No.	SMITHS INDUSTRIES CODE No.	SPEC.	VEHICLE MAKERS PART No.	SMITHS INDUSTRIES CODE No.	SPEC.	VEHICLE MAKERS PART No.
MODELS 1500S and 1600									
Speedometer (Miles)				SN.6135/11	AC		SN.6135/11	AC	
Speedometer (Kilos)				SN.6135/12	AC		SN.6135/12	AC	
Speedometer Flex Complete (RHS & LHS)				DF.1334/00	3'9"		DF.1334/00	3'9"	
Inner Flex only				DI.1314/05	3'9"		DI.1314/05	3'9"	
Outer Flex only				DO.1334/00	3'9"		DO.1334/00	3'9"	
Revolution Indicator				RVI.2402/02	AD		RVI.2410/02	*AE	
Temperature Indicator				BT.2204/08			BT.2204/08		
Transmitter (Temp. Ind.)				TT.6811/00			TT.6811/00		
Fuel Gauge				BF.2201/09			BF.2201/09		
Tank Unit				TB.1114/013			TB.1114/013		
Oil Pressure Gauge				PL.2302/27			PL.2302/27		
Voltage Stabiliser				BR.1300/01			BR.1300/01		
MODEL 1800S									
Speedometer (Miles)	SN.6135/08	AB		SN.6135/08	AB		SN.6135/08	A3	
Speedometer Flex Complete (RHS)	DF.1104/00	F 4'9"		DF.1104/00	F 4'9"		DF.1104/00	F 4'9"	
Speedometer Flex Complete (LHS)	DF.1104/00	F 5'3"		DF.1104/00	F 5'3"		DF.1104/00	F 5'3"	
Revolution Indicator	RVI.2402/02	AD		RVI.2402/02	AD		RVI.2410/02	*AE	
Temperature Gauge	TL.2302/17	3'0" Cap		TL.2302/17	3'0" Cap		TL.2302/17	3'0" Cap	
Fuel Gauge	FG.2333/12			FG.2333/12			FG.2333/12		
Tank Unit	FT.5300/112			FT.5300/112			FT.5300/112		
Oil Pressure Gauge	PL.2302/27			PL.2302/27			PL.2302/27		
MODELS 1500S 1600, and 1800S									
Heating Equipment (F.260)	PES.3086			PES.3086			PES.3086		
Heater Unit	FHF.2301			FHF.2301			FHF.2301		
Radiator & Seals only	SHF.7914			SHF.7914			SHF.7914		
Water Valve only	FHW.1273/30			FHW.1273/30			FHW.1273/30		
Blower Unit	FHB.3392			FHB.3392			FHB.3392		
Motor only	FHM.4342			FHM.4342			FHM.4342		
Push/Pull Control (Air)	FHC.6132/05			FHC.6132/05			FHC.6132/05		
Push/Pull Control (Water)	FHC.6101/02			FHC.6101/02			FHC.6101/02		

★ Indicates a change NOT INTERCHANGEABLE with previous code
▲ Indicates a change INTERCHANGEABLE with previous code

FINISH & SPECIFICATION		
	A	Chrome Bezel Black Dial White Printing & Pointer 12 Volt.
	B	4" Nemag Angle Trip 140mph 1152rpm.
	C	4" Nemag Angle Trip 140mph 1000rpm/220kph 620rpk.
	D	4" Impulse Type 8000rpm 4 Cylinder Positive Earth.
	E	4" Impulse Type 8000rpm 4 Cylinder Negative Earth.
	F	Inner Flex only DI.1110/00 Outer Flex only DO.1104/00

ISSUED: MAY 1977

EQUIPMENT	OCTOBER 1969 - OCTOBER 1970			NOVEMBER 1970 - 1973					
	SMITHS INDUSTRIES CODE No.	SPEC.	VEHICLE MAKERS PART No.	SMITHS INDUSTRIES CODE No.	SPEC.	VEHICLE MAKERS PART No.	SMITHS INDUSTRIES CODE No.	SPEC.	VEHICLE MAKE PART No.
Speedometer (Miles)	SN.6135/11A	AB		SN.6135/13	*AC				
Speedometer (Kilos)	SN.6135/12A	AB		SN.6135/14	*AC				
Speedometer Flex	N.O.M.			N.O.M.					
Rev. Indicator 2 LITRE V.4	RVI.2410/02	AD		RVI.2410/02	AD				
Rev. Indicator 3 LITRE V.6	RVI.2611/02	AE		RVI.2611/02	AE				
Temperature Indicator 52mm	BT.2204/08			BT.2204/08					
Transmitter (Temp. Ind.) FORD ENGINE	TT.6811/00			TT.6811/00					
Transmitter (Temp. Ind.) VOLVO ENGINE	TT.3802/00A			TT.3802/00A					
Fuel Gauge 52mm	BF.2201/09			BF.2201/09					
Tank Unit	TB.1114/013			TB.1114/013					
Oil Pressure Gauge 52mm	PL.2302/27			PL.2302/27					
Voltage Stabiliser FORD ENGINE	BR.1300/01			BR.1300/01A	▲				
Voltage Stabiliser VOLVO ENGINE	BR.1311/00			BR.1311/00					
Heating Equipment	PES.7569			PES.7569/3	▲				
Heater Unit	FHF.2301			FHF.2301					
Radiator & Seals only	SHF.7914			SHF.7914					
Water Valve only	FHW.1273/30			FHW.1273/30					
Blower Unit	FHB.5402/24			FHB.5402/24					
Motor only	FHM.5352/04			FHM.5352/04					
Push/Pull Control (AIR)	FHC.6132/05			FHC.6132/05					
Push/Pull Control (WATER)	FHC.6101/02			FHC.6101/02					
Runner only 4½"	SHB.3134/04			SHB.3134/04					

★ Indicates a change NOT INTERCHANGEABLE with previous code
▲ Indicates a change INTERCHANGEABLE with previous code

FINISH SPECIFICATION		
	A	Chrome Bezel Black Dial White Printing & Pointer 12 Volt.
	B	4" Nemag Angle Trip 140mph 1000rpm/220kph 620rpk.
	C	4" Nemag Angle Trip 140mph 900rpm/220kph 562.5rpk.
	D	4" Impulse Type 8000rpm 4 Cylinders Negative Earth.
	E	4" Impulse Type 6000rpm 6 Cylinders Negative Earth.

SMITHS INDUSTRIES LIMITED
MOTOR ACCESSORY SALES & SERVICE DIVISION

MARCOS
MANTIS (M.70)
(1970 - 1973)

SERVICE REPLACEMENTS AND OPTIONAL EQUIPMENT

EQUIPMENT	SEPTEMBER 1970 - APRIL 1971			MAY 1971 - 1973					
	SMITHS INDUSTRIES CODE No.	SPEC.	VEHICLE MAKERS PART No.	SMITHS INDUSTRIES CODE No.	SPEC.	VEHICLE MAKERS PART No.	SMITHS INDUSTRIES CODE No.	SPEC.	VEHICLE MAKERS PART No.
Speedometer (Miles)	SN.5226/19	AB	000635	SN.5226/19	AB	000635			
Speedometer (Kilos)				SN.5226/22	*AB				
Remote Control (Speedometer)	41-741-168-00	9"		41-741-168-00	9"				
Speedometer Flex	N.O.M.			N.O.M.					
Revolution Indicator	RVI.1613/01	AD	000643	RVI.1613/01	AD	000643			
Temperature Indicator 52mm	BT.2204/21		000640	BT.2204/21		000640			
Transmitter (Temp. Ind.)	TT.6811/01			TT.6811/01					
Fuel Gauge 52mm	BF.2201/27		000642	BF.2201/27		000642			
Tank Unit	TBS.1114/012		000760	TBS.1114/012		000760			
Tank Locking Ring	31-634-583-01		000761	31-634-583-01		000761			
Tank Sealing Ring	31-781-538		000762	31-781-538		000762			
Oil Pressure Gauge 52mm	PL.2312/04		000638	PL.2312/04		000638			
Battery Condition Indicator 52mm	BV.2204/03		000641	BV.2204/03		000641			
Voltage Stabiliser	BR.1307/00		000619	BR.1307/00		000619			
Heating Equipment	PES.7775		000777	PES.7775		000777			
Heater Unit only	FHR.3425/05			FHR.3425/05					
Radiator & Seals only	SHF.7925/06			SHF.7925/06					
Motor & Mounting Shell only	FHB.8301/011			FHB.8301/011					
Motor only	FHM.1201/02			FHM.1201/02					
Rotor Assembly only	SHF.3824			SHF.3824					
Lever Control (DIST)	FHC.1830/10			FHC.1830/10					
Lever Control (WATER VALVE)	FHC.1830/09			FHC.1830/09					
Water Valve	FHW.1306/03B			FHW.1306/03B					
Engine Cooling Fan	FFF.1215		000755	FFF.1215		000755			
Engine Cooling Motor	FHM.5761/03		000756	FHM.5761/03		000756			

★ Indicates a change NOT INTERCHANGEABLE with previous code
▲ Indicates a change INTERCHANGEABLE with previous code

ISSUED: JUNE 1977

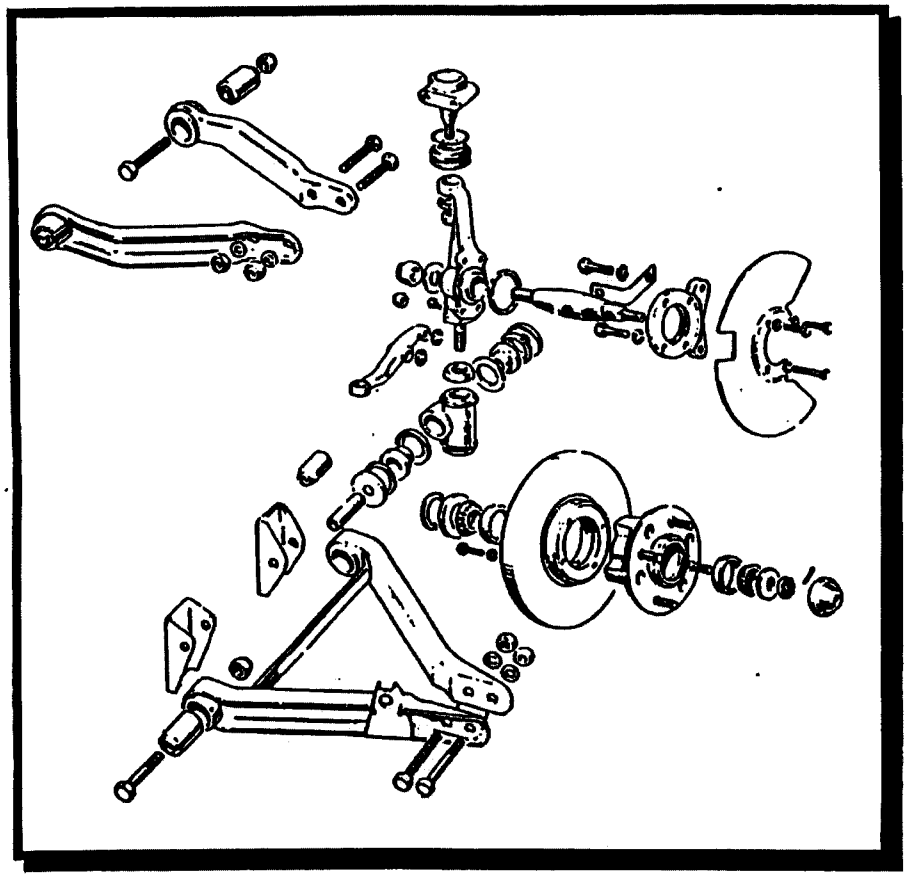
FINISH SPECIFICATION		
	A	Black Bezel Black Dial White Printing 12 Volt Negative Earth.
	B	80mm Nemag Remote Trip 140mph 1000rpm/230kph 620rpk.
	C	
	D	80mm Impulse Type 7000rpm 6 Cylinders.
	E	
	F	

MARCOS
MANTIS (M.70)
(1970 - 1973)

TRIUMPHANT!

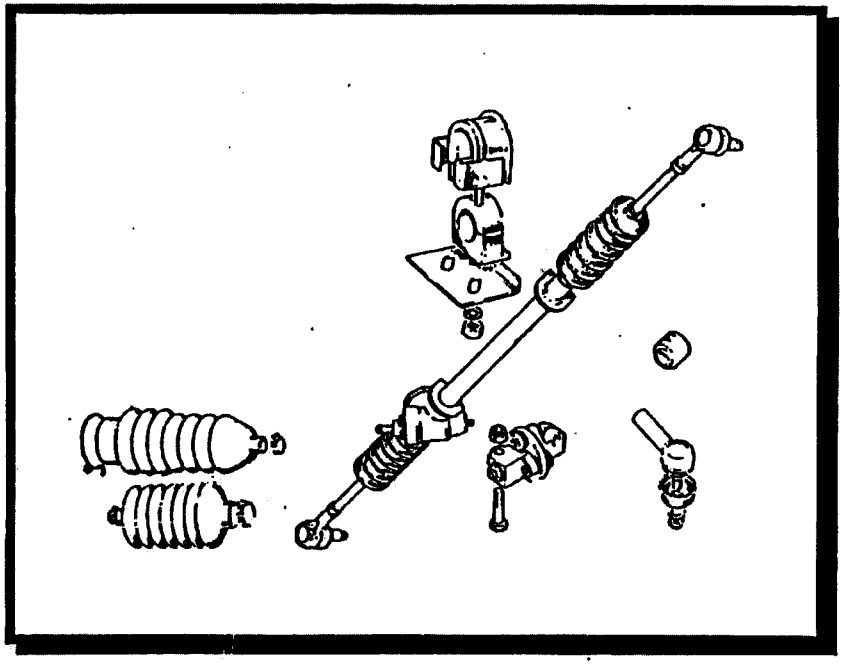
Ok, so most of you realise what parts of your Marcos come from various donor vehicles, However for those of you who don't I will try to explain which parts of your Marcos are from the Triumph Herald/Spitfire/Vitesse and GT6 range. Basically the Triumph sourced parts can be split into two distinct groups:

1. Front Suspension

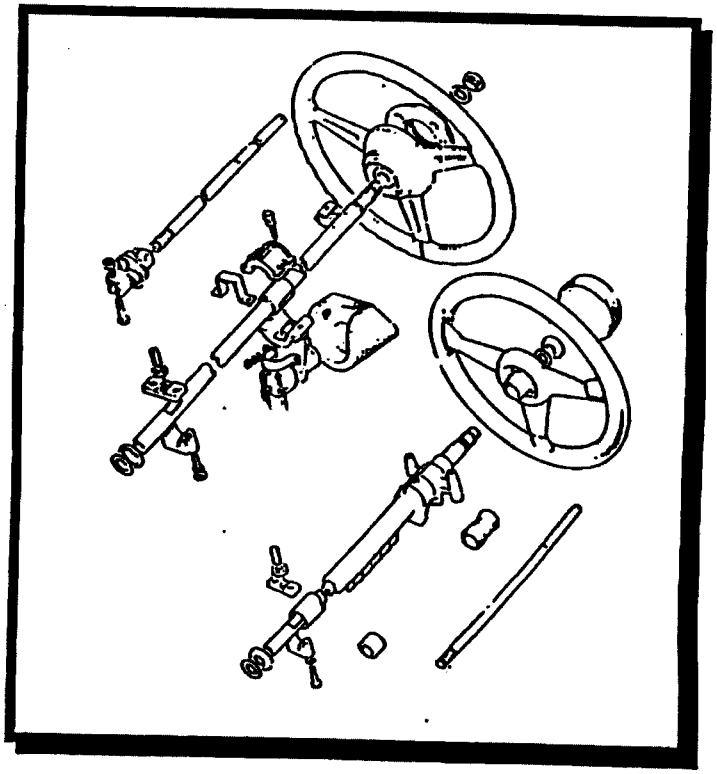


2. Steering Components

The Steering Rack, Column and lower steering coupling are all from the Herald/Spitfire/Viteesse & GT6 range of cars. The steering racks only differ in the number of turns required for full lock, however all steering racks should be fitted with a spacer within the assembly to limit the full lock capabilities which would otherwise result in wheel scrub against the headlamp pods (especially on short bonnet cars).
Triumph produced three types of steering column for the Herald/Spifire /Vitesse and GT6. These all retain the same physical dimensions but differ in the switches fitted.
All Herald,Vitesse,GT6 and Spitfire MK 1,2 & 3 were fitted with the standard column found in most Marcos (see below). The differences appeared in the Spitfire Mk 4 and 1500 cars.
The Spitfire Mk4 and pre 1977 1500's had a steering column lock fitted with integral ignition key. The basic column and switching is the



same the only difference being a 'flat' machined on the inner shaft and a hole in the column for the lock to fit over.
The post 1977 1500 Spitfire had a totally different column which was required due to a different set of column switches. These switches gave not only lights and indicator functions but also included push button horn, windscreen wipers and washer. A different pair of switch covers was also used.
It should be remembered that the linkage between the inner steering column and the rack coupling is in fact unique to Marcos and differs depending on whether your car is a wooden chassis'd model or steel.



Most of the front suspension is common throughout the Herald/Spitfire/Vitesse & GT6 range however the differences can be summarised as follows:

The vertical links (upright) and stub axle differ for the Hearld/Spitfire which uses smaller brake calipers. The vertical links have the brake mounting points within the one piece upright. GT6/Vitesse have separate caliper mounting brackets which bolt to the back of the upright.

Vitesse MK1 used the GT6/Vitesse upright/stub axle but had a smaller caliper mounting bracket and used the early Spitfire calipers.

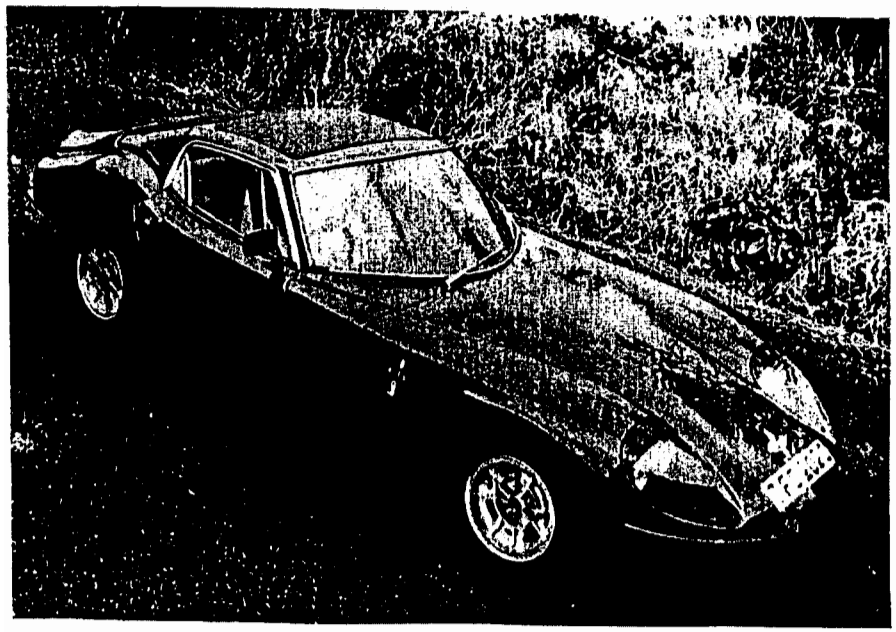
Some pre-1967 Marcos will have had this set-up (Mine included). To upgrade to the later GT6 calipers you simply need the larger mounting plates and the GT6 discs.

The GT6/Vitesse hubs are bigger than the Herald/Spitfire and cannot be interchanged without using the corresponding upright/stub axle assembly.

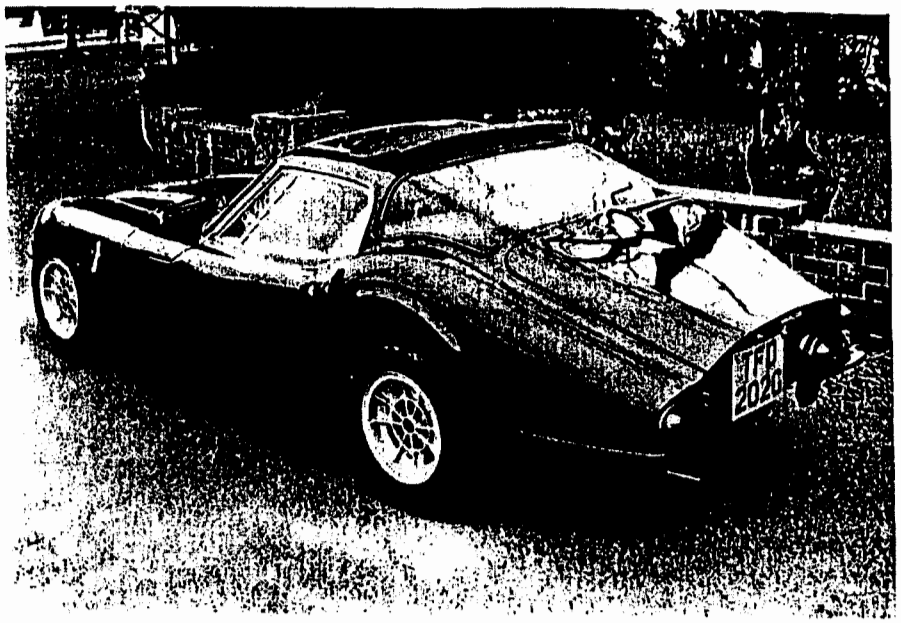
The front anti rollbar (not illustrated) differs in thickness depending on the model/year of the Triumph car involved, some late 60's Marcos appear to have left the factory without rollbars (the chassis's having no attachment points). A breakdown of the available rollbars follows :

Spitfire Mk 1,2,3,4/Herald/Vitesse used a 0.875 inch bar:
part no 207093.
Spitfire 1500 & GT6 used a 1.00 inch bar :
part no 217033

All other anti rollbar components (links etc) are the same for all models.



1600 Coupe - Glynn Kerr, Devon



The following is a breakdown of components and their associated part numbers together with a guide to cost as of December 1992. Some suppliers will recognise the parts against their own numbering system, it is therefore best to give a description and where applicable left or right hand, as well as the quoted part number.

Front Suspension		Price
514191	Trunnion overhaul kit	3.00
140919	Trunnion right hand	12.00
140920	Trunnion left hand	12.00
122126	Trunnion to vertical link seal	1.00
119142	Trunnion nut & bolt	1.00
206685	Lower wishbone RH	48.00
206686	Lower wishbone LH	48.00
119451	Bush - all wishbones	0.75
145007	Front hub - GT6	75.00
112429	Wheel stud	1.30
132065	Stub axle - GT6	20.00
	Front wheel bearing kit	10.00
132665	Front bearing grease cap	2.30
132666	Front bearing D washer	1.15
	Front hub casalated	0.50
209072	Vertical link RH - GT6	36.00
209073	Vertical link LH - GT6	36.00
205504	Steering arm RH - GT6	16.50
205505	Steering arm LH - GT6	16.50
145106	Caliper Mounting plate RH - GT6	S/hand
145107	Caliper mounting plate LH - GT6	S/hand
119272	Top wishbone	15.50
	Top ball joint	8.00
	Nut & Bolt - top ball joint	0.50
122022	Camber adjustment shims	1.00

Anti Rollbar		Price
207093	Early anti rollbar	15.00
217033	Late anti rollbar	35.00
123998	Bush for early rollbar	0.60
155310	Bush for late rollbar	0.90
123502	Clamp for early rollbar	1.40
155308	Clamp for late rollbar	1.00
139126	U bolt for early rollbar	0.75
155307	U bolt for late rollbar	0.75
125074	Stud (link to anti rollbar)	1.25
125481	Anti rollbar link - RH	9.00
125482	Anti rollbar link - LH	9.00

Steering		Price
307830	Steering rack GT6	30.00
156024	Steering rack mounting	8.50
139385	Rubber bush (sits under mounting)	1.45
	Track rod ends	5.00
	Steering rack gaiters	8.00
209423	Steering column bush	3.75
142140	Steering coupling	14.00
	Coupling nut & bolt	0.40
152616	Headlamp column switch	S/hand
158966	Indicator column switch	21.00
142534	Horn brush	8.50
159761	Horn push button (with Triumph name)	8.50

Finally there are serval very reputable Triumph specialists which stock all the parts you might require and offer a next day delivery service. Four of the top ones (according to the Triumph Sports Six Club) are currently :

John Hill's Ltd
Arthur Street,
Lakeside,
Redditch.
Tele : 0527 20880

Rimmer Brothers Ltd,
Triumph House,
115 Lincoln Rd,
Branston,
Lincoln.
Tele : 0522 791965

TriumphTune
22-28 Manor Rd,
Richmond,
Surrey.
Tele : 081-948-6668

John Kipping
Parrots Grove
421 Aldermans Green Rd,
Coventry.
Tele : 0203 645333

I have personally used all of the above companies who will also supply second hand spares when available. All take over the phone orders via the major credit cards and are very helpful if you have any problems.

Andy Derrick.

Marcos Component Source List

The following component parts lists have been assembled from member contributions as cars have either been restored or newly built, and carries no official factory backing.

Please note that with the early generation cars, it is highly probable that parts other than those listed have been used as replacements. The reccomendation is therefore to check part numbers yourself if there is any possible doubt.

Where possible the original fitment has been quoted to allow for any alternative suppliers of proprietory parts or possible up-dating of the original factory part numbers.

Remember, this list has been compiled by ordinary members like yourself. The next time you replace an item on your Marcos, you now have an easy way to contribute to YOUR club.....

SEND THE DETAILS IN !

Location	Model	Description	Original Fitment	Part Number(s)
Bodywork	1800 Volvo	Door locks	Austin A40	BL 14A 4485
	1800 Volvo	Interior Chrome door pull	Vitesse range	BL 609256
	1800 Volvo	Interior Plastic door pulls	BL Midget range	BL 3479
	General	Chrome Bonnet catch	Triumph	BL 607663
	General	Chrome bonnet catches	Vitesse & Spitfire	Triumph 514191
	General	Door Window seal strips	Triumph range	BL 608278 & 608279
	General	Door handle - metal chassis	MGB GT	
	General	Interior Door Pulls	BMC 1100 & Spridget Range	
Front Suspension	1800 Volvo	Axle Stub Shaft	Herald	Unipart 132488
	1800 Volvo	Inner wheel bearing	Herald & Spitfire	Timken 07100S & 07210C
	1800 Volvo	Outer Wheel Bearing	Heralf & Spitfire	Timken 03162 & 03062
	1800 Volvo	Vertical Links	Herald & Spitfire	Unipart 205483 & 205484
	General	Axle Stub Shaft	Vitesse	Unipart 132488
	General	Brake Caliper mount plate	Vitesse	Unipart 210892/210893
	General	Brass Trunnions	Vitesse	Unipart 140919/140920
	General	Castellated hub nut	Vitesse	Unipart LN 2211
	General	Front hub felt seal	Vitesse & Spitfire	Unipart GHS 146
	General	Front wheel bearing (inner)	Triumph Vitesse	Timken L44649 & 44610
	General	Front wheel bearing (outer)	Triumph Vitesse	Timken LM11949 & LM11910
	General	Hub grease cap	Vitesse	Unipart 102689
	General	Top Ball joint	Triumph range	Quinton Hazel QSJ 101
	General	Vertical Links	Vitesse	Unipart 209072 & 209073
Rear Suspension	General	Halfshaft Bearing	Ford Cortina rear axle	Ford 2925E 1225C
	General	Panhard Rod bushes	General Damper mounts	BL 21 A 860
	General	Radius arm bushes	BLMC range	BL 88 G 274
	General	Radius arm bushes	BLMC range	Metalastic 13/908
	General	Small Radius arm bush	General Damper mountings	BL 21 A 860
Engine	1800 Volvo	Oil Pump	Volvo B18B series	SE PQL 745
	2LV4 Ford	Engine mounts	Ford V4 range	Ford 1422736
	3LV6 Ford	Engine mountings	Ford Zodiac	
Transmission	1600 Ford	Speedo driven gear	Ford	109E17322B (24 teeth/green)
	2LV4 Ford	Speedo driven gear	Ford	Ford 107E 17322
	3LV6 Ford	Gearbox rear bush	Ford Zodiac IV	Ford 1711053
	3LV6 Ford	Gearbox rear seal	Ford Zodiac IV	Ford 1518659
	3LV6 Ford	O/D Relief valve	Ford Zodiac	Ford 7K677C
	3LV6 Ford	Speedo driven gear	Ford	Ford 211E 17322-C
	3L Volvo	Speedo driven gear	Volvo	
	General	O/Drive relay (when fitted)	Lucas	Lucas 6RA
	General	Propshaft UJs	Ford	Ford 1792216
	General	Propshaft UJs	Hardy Spicer	HU-50/K5-6B150
Wheels	General	Wheel Studs	Ford Corsair	
Steering	General	Lower column/rack coupling	Triumph range	

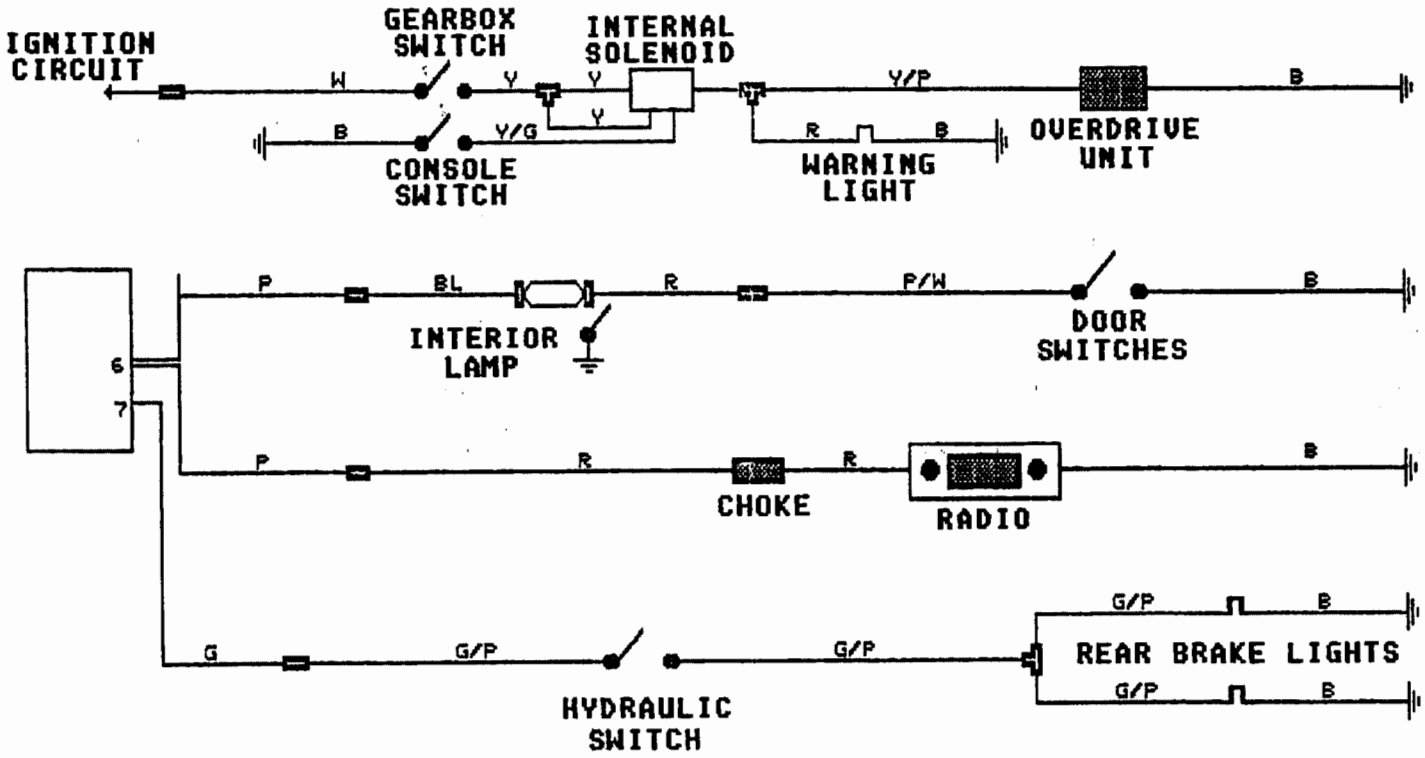
Location	Model	Description	Original Fitment	Part Number(s)
Steering	General	Steering Column Escutcheons	Vitesse & Spitfire range	
	General	Steering Column UJ	Triumph 2000 MkII (UJ only)	QSH 1176
	General	Steering Links	Vitesse	Unipart 205504 & 205505 (R/L)
	General	Steering column bushes	Triumph range	Unipart 209423
	General	Steering rack bellows	Triumph range	Quinton Hazel MB 1
	General	Steering rack mount clamps	Vitesse	Unipart 136885
	General	Steering rack rubber mounts	Triumph Vitesse & Spitfire	Unipart 139386
	General	Track Rod ends	Vitesse	QR 1572
Braking System	General	Caliper Bleed Screw	Girling (3/8" UNF x 24 tpi)	Girling 64470445
	General	Front Caliper seals		Girling SP2697/1
	General	Front Calipers	Triumph	64032668/69 or 64032149/50
	General	Front brake pads	Triumph range	Girling GDB 533
	General	Front caliper o/haul kit	Triumph Spitfire or GT6	Girling SP 2501/3
	General	Front caliper piston	Triumph Spitfire or GT6	Girling 64325561
	General	Handbrake components	Ford Cortina	
	General	Handbrake system (1966-)	Ford Cortina Mk I (Late)	
	General	Rear brake shoes	Ford Cortina Mk II	Ford 2920E 2218 2219
	General	Rear brake adjuster	Ford Cortina	Ford 1720014
	General	Rear wheel cylinder	Ford Cortina 1600	Ford 64676001
Cooling System	1600 Ford	System Hoses		Quinton Hazel RH694 & RH783
	3LV6 Ford	Water Pump	Ford Zodiac	Ford 2720E 8501C
	3L Volvo	Water pump	Quinton Hazel	QCP 771
Fuel System	1600 Ford	Petrol pump o/haul kit (mech)	Ford	AC Delco 465/25 (93151242)
	3LV6 Ford	Mechanical fuel pump	Ford V6 series	AC Delco MP 1464
	General	Petrol filler cap	Norton Commando	Ceandess P2518/3A or P4199
	General	Petrol filler neck grommet	Various applications	Someday
Electrical System	1800 Volvo	Rear Lens (Amber)	Hillman Imp	Lucas 54581233
	1800 Volvo	Rear Lens (Red)	Hillman Imp	Lucas 54581204
	1600 Ford	Rear lens (amber - oval unit)	Vauxhall Victor FB	Lucas 54574292
	1600 Ford	Rear lens (red - oval unit)	Vauxhall Victor FB	Lucas 54574292
	1600 Ford	Rear light unit (oval)	Vauxhall Victor FB	Lucas 684 541518 & 541528
	1600 Ford	Starter motor (inertia model)	Ford Cortina & BL A series	Lucas M35G1 25083DH or 25147
	1600 Ford	Starter motor (inertia)	Ford Cortina & BL 1100/1300	Lucas 25147 (late part No)
	1600 Ford	Starter motor (pre-engaged)	BL Maxi 1750 & Ford unit	Lucas 25209
	1600 Ford	Starter solenoid (inertia)	Triumph range	Lucas 76771 (later part no.)
	2LV4 Ford	Indicator Flasher Unit	Mini	Lucas 8FL36
	2LV4 Ford	Window winder motor		BL 217350 LH
	2LV4 Ford	Windscreen Wiper Gear Unit	BL Allegro	Lucas 54702587
	2LV4 Ford	Windscreen Wiper Motor	BL Midget	Lucas 75664
	3LV6 Ford	O/D reverse light switch	Ford Zodiac	Ford 1458708
	3LV6 Ford	Wiper Switch unit	Morgan	Lucas 35889
	3L Volvo	Alternator	Volvo	Volvo 419420-5
	3L Volvo	Petrol sender unit	Smiths	Smiths TB 114/013
	3L Volvo	Starter Motor	Volvo	Volvo 241615-4
	General	Front Indicator/sidelight	A40 & Morris Minor	Lucas 52572

Location	Model	Description	Original Fitment	Part Number(s)
Electrical System	General	Fusebox (2 fuse system)	BL ranges 1961-66	Lucas 54038068 (late part No)
	General	Hazard Flasher (where fitted)	BL range - Mini etc	Lucas 35053
	General	Headlight (Rectangular Unit)	Vauxhall HB & HC	
	General	Headlight unit (rectangular)	Vauxhall Viva HB & HC	
	General	Ignition Switch	Hillman Minx Hunter early Imp	Lucas 34680
	General	Ignition Switch unit	General component	Lucas 35870
	General	Indicator Flasher unit	BL range - Mini etc	Lucas 35048
	General	Indicator switch (Column)	Triumph Vitesse	Lucas 54033733
	General	Interior light assembly	Bedford Commercial range	Vauxhall 6353758
	General	Light Switch (column mount)	Triumph Range	Unipart 35778
	General	Number Plate light unit	MGB Bumper unit (?)	Lucas 54108
	General	Stoplight switch unit	Hillman Imp	Lucas 34619
Heating/Ventilation	3LV6 Ford	Heater mounting bushes	Hillman Minx & Rover 2000	
	General	Heater Blower unit	Hillman Super Minx 1967	
	General	Heater Control valve	Smiths (some models)	Smiths FHW/1279/14
	General	Heater Unit		Smiths PES 7569/2
Clutch	1600 Ford	Clutch Slave cylinder kit	Ford	Girling SP 2085
	1600 Ford	Clutch Thrust bearing	Ford range	Quinton Hazel CCT 95
	1600 Ford	Clutch plate	Ford Cortina	Borg & Beck HB 1600
	1600 Ford	Spigot bearing	Ford 1600	Ford 170169J
	3L Volvo	Clutch plate assembly	Borg & Beck 9" unit	75699/26 & 47626/227
Final Drive	General	Differential oil seal	Ford Cortina	Ford 1482506
	General	Half Shaft bearing	Ford Cortina	SKF 41592
	General	Pinion pre-load washer	Ford Cortina	Ford 1461760
	General	Rear Axle	Ford Cortina Mk II	V68CB-4004DA Ratio 3.77
	General	Rear Wheel/Axle bearing	Ford Cortina	Quinton Hazel MTW 119
Misc. Parts	General	Ash Tray	Wilmot Breedon	Wilmot Breedon 7/4[illegible]9
	General	Boot Stay	Wilmot Breedon	Wilmot Breedon 7/7[illegible]
	General	Pedal Rubbers	Ford Anglia	Ford 105E 2454

MODEL SPECIFICATION CHART

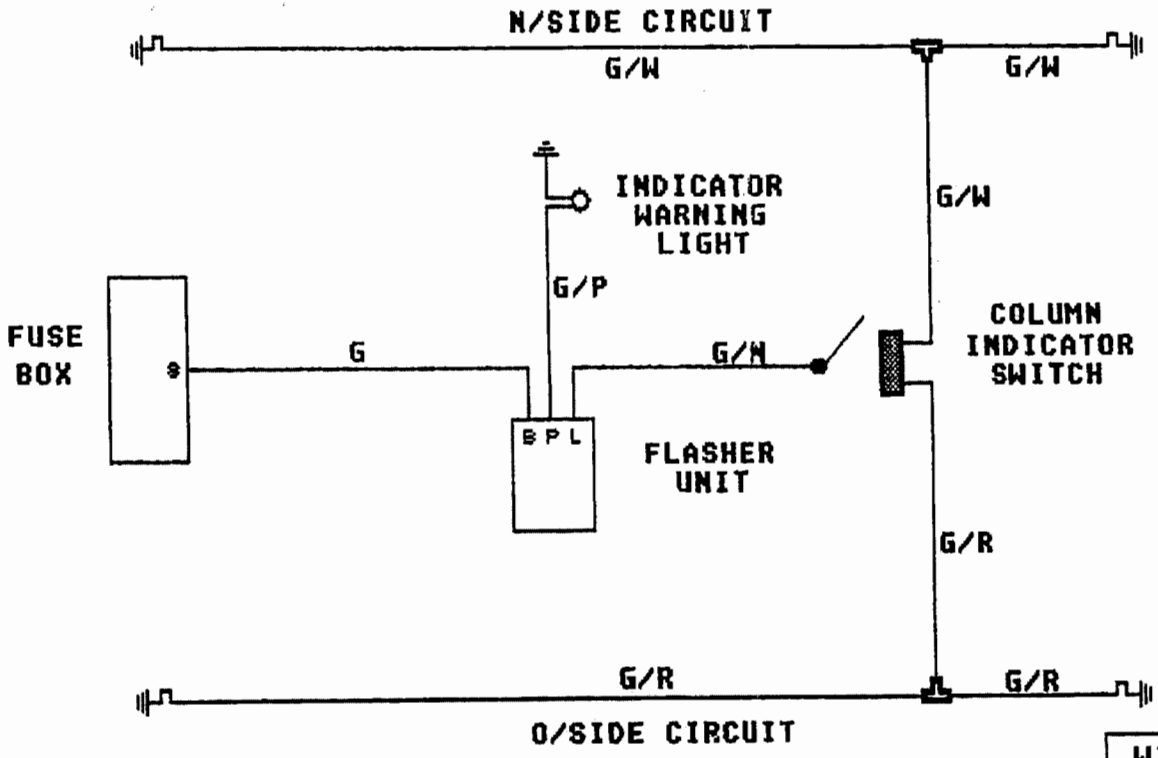
MODEL	ENGINE	GEAR BOX	REAR AXLE	FRONT SUSPENSION	STEERING RACK	FRONT BRAKES	REAR BRAKES	FRONT WHEEL TYRE ASSY.	REAR WHEEL TYRE ASSY.
MARCOS MANTULA	Rover SDI 3500 - 1977 On Rover 3500 S 1969-76	5-speed Rover SDI	Ford Capri 3-litre Mark I II III 1969-on	Triumph Vitesse Mark II GT6 1968-on	Triumph Spitfire Vitesse GT6 1965-on	Marcos Ventilated Triumph Vitesse Mark II GT6	Ford Capri 3-litre Mark I II III 1969-on	195 x 60 VR 14 tyre. Max. load 1136 lb. @ 44 PSI. 6" wide rim.	205 x 60 VR 14 tyre. Max. load 1230 lb. @ 36 PSI 6" wide rim.
MARCOS 3-LITRE	Ford Capri 3-litre 1969 ON Mark I II III	Ford Capri 3-litre 1969-on (Single rail box preferred)	Ford Capri 3-litre Mark I	Triumph Vitesse Mark II GT6 1968-on	Triumph Spitfire Vitesse GT6 1965-on	Triumph Vitesse Mark II GT6	Ford Capri 3-litre Mark I	185 x 70 HR 13 tyre. Max. load 1140 lb. @ 36 PSI. 6" wide rim.	185 x 70 HR 13 tyre. Max. load 1140 lb. @ 36 PSI. 6" wide rim.
MARCOS 2-LITRE	Ford Cortina 3-litre OHC Ford Capri 2-litre OHC	Ford Cortina 2-litre Ford Capri 2-litre	Ford Capri 3-litre Mark I	Triumph Spitfire Vitesse GT6	Triumph Spitfire Vitesse GT6	Triumph Spitfire Vitesse GT6	Ford Capri 3-litre Mark I	185 x 70 HR 13 tyre. Max. load 1140 lb. @ 36 SPI. 6" wide rim.	185 x 70 HR 13 tyre. Max. load 1140 lb. @ 36 PSI. 6" wide rim.
MARCOS 1600	Ford Cortina 1600 OHN Ford Capri 1600 OHC	Ford Cortina 1600 OHC Ford Capri 1600 OHC	Ford Capri 3-litre Mark I	Triumph Spitfire Vitesse GT6	Triumph Spitfire Vitesse GT6	Triumph Spitfire Vitesse GT6	Ford Capri 3-litre Mark I	185 x 70 HR 13 tyre. Max. load 1140 lb. @ 36 PSI. 6" wide rim.	185 x 70 HR 13 tyre. Max. load 1140 lb. @ 36 PSI. 6" wide rim.

DRAWING NOT TO SCALE | MARCOS 1800L | MISC. CIRCUITS



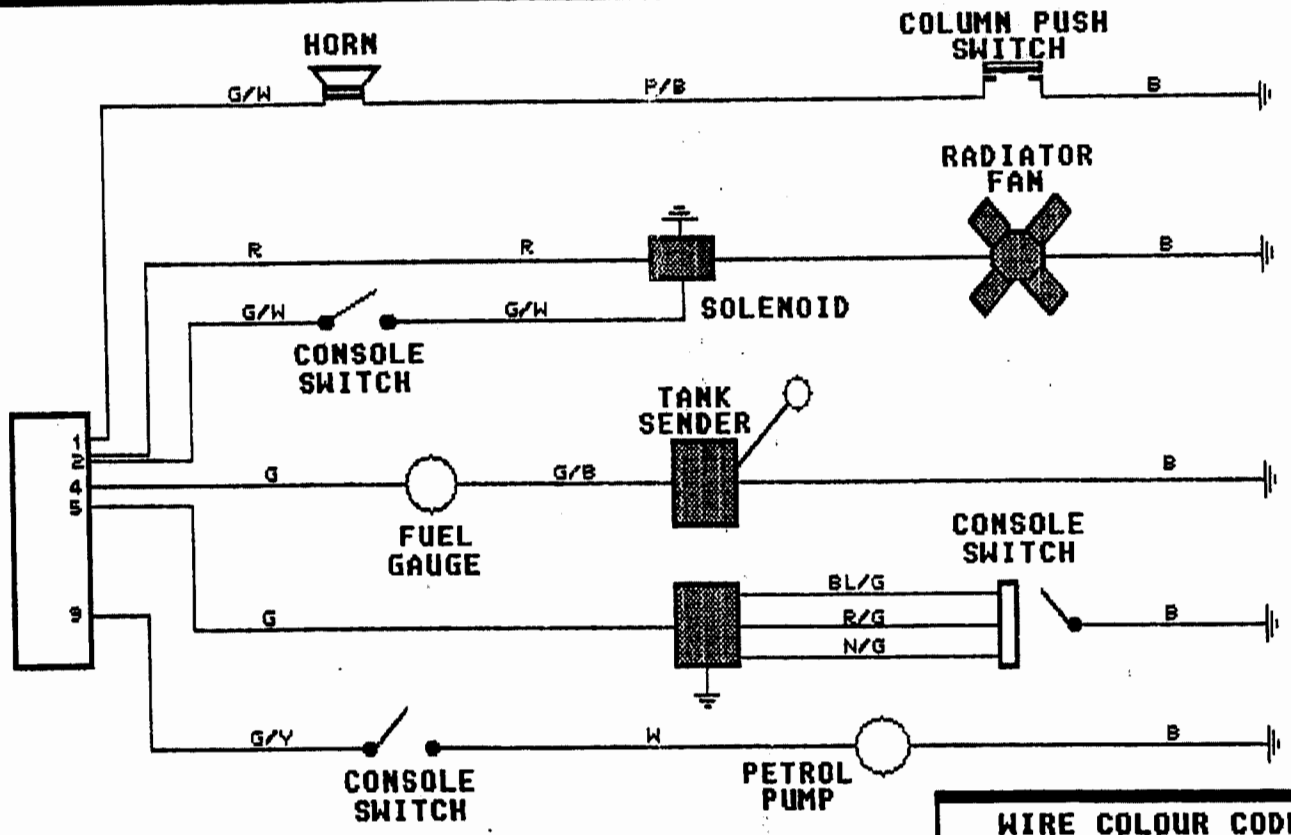
WIRE COLOUR CODES	
B	BLACK
BL	BLUE
R	RED
W	WHITE
G	GREEN
P	PURPLE
N	BROWN
Y	YELLOW
O	ORANGE

DRAWING NOT TO SCALE | MARCOS 1800L | INDICATOR CIRCUITS



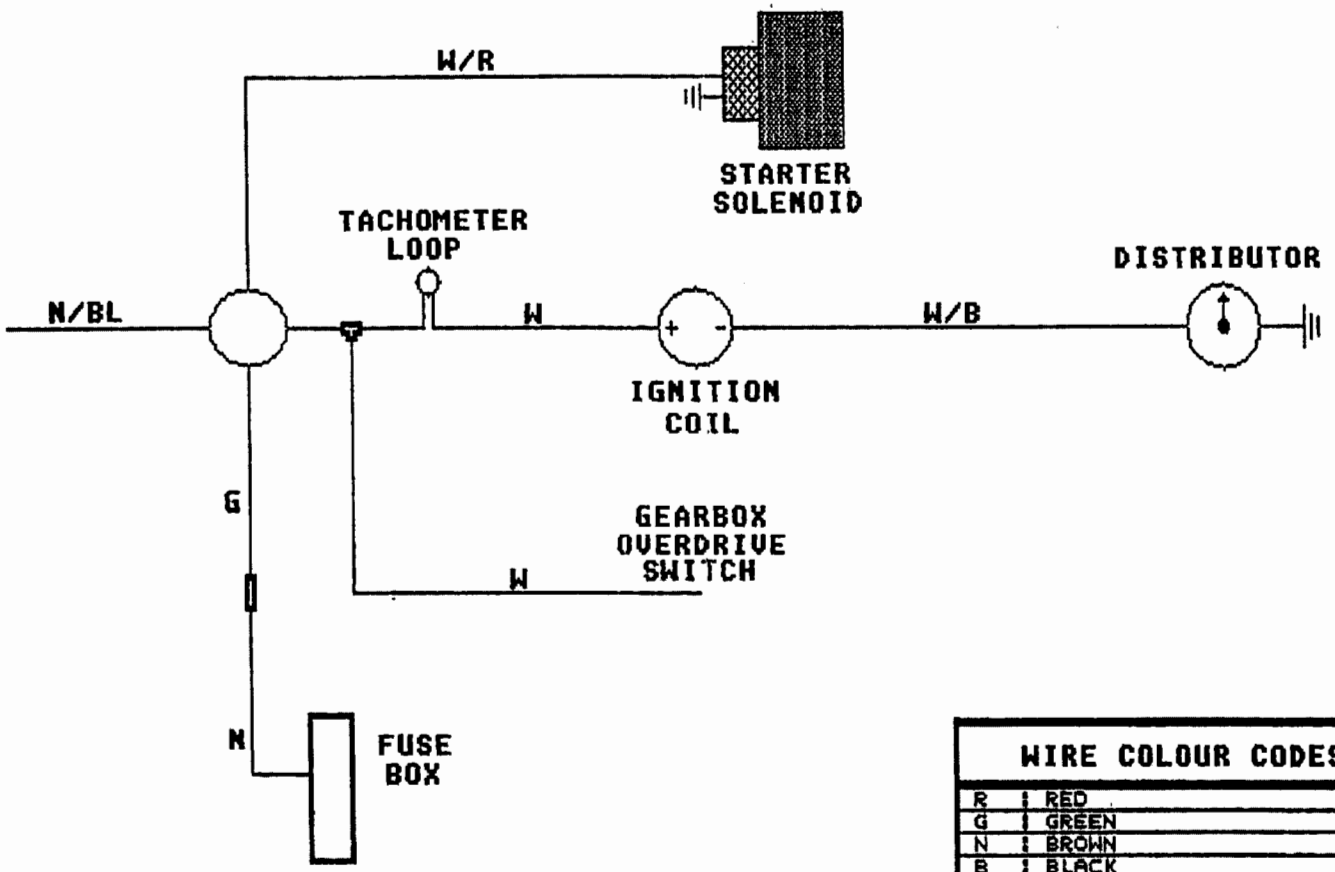
WIRE COLOUR CODES	
G	GREEN
R	RED
W	WHITE
P	PURPLE
N	BROWN

DRAWING NOT TO SCALE | MARCOS 1800L | MISC. CIRCUITS



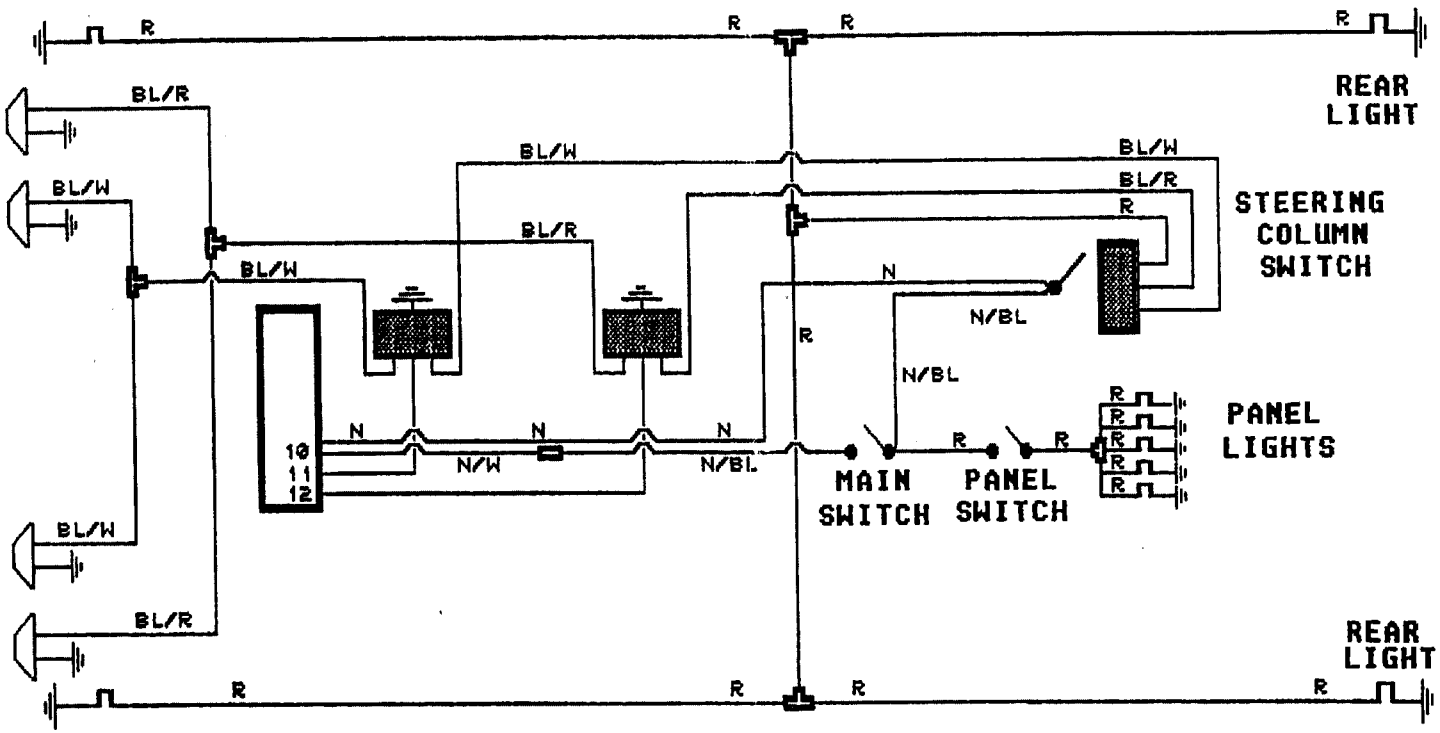
WIRE COLOUR CODES	
B	BLACK
BL	BLUE
R	RED
W	WHITE
G	GREEN
P	PURPLE
N	BROWN
Y	YELLOW
O	ORANGE

DRAWING NOT TO SCALE	MARCOS 1800L	IGNITION CIRCUIT



WIRE COLOUR CODES	
R	RED
G	GREEN
N	BROWN
B	BLACK
W	WHITE
BL	BLUE

DRAWING NOT TO SCALE	MARCOS 1000L	LIGHTING CIRCUITS



WIRE COLOUR CODES	
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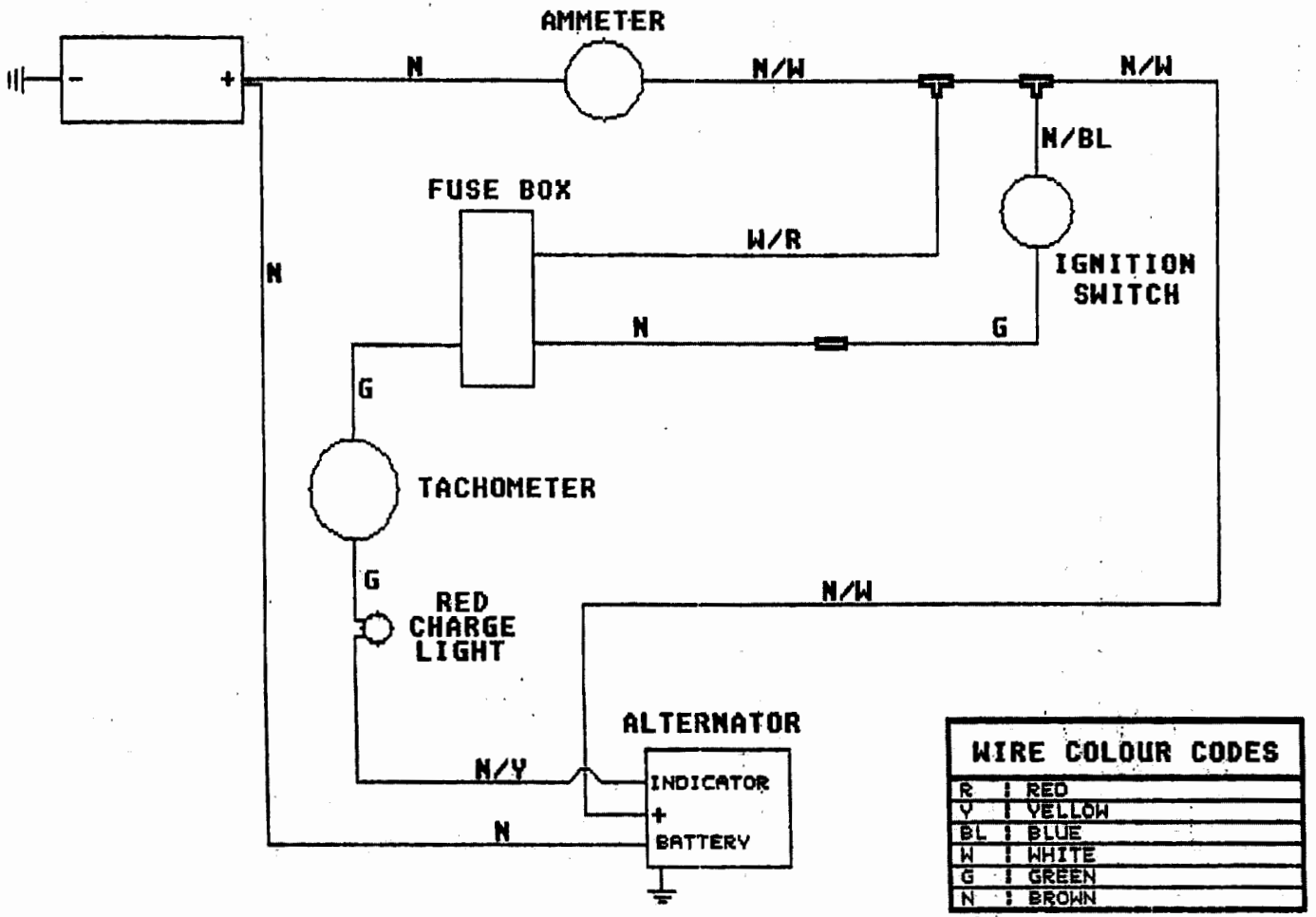
R	RED
W	WHITE
G	GREEN
P	PURPLE
N	BROWN
Y	YELLOW
O	ORANGE

DRAWING NOT TO SCALE | MARCOS 1800L | CHARGING CIRCUIT



MARCOS WIRING DIAGRAMS

ISSUE DATE	CHANGES	SYM
26-5-69	Production issue	
27-5-69	Transfer of bulkhead	A
	Changed for double eyelet 105.	
	Sockets drawing No. 54957287	
	To replace bulkhead	
	Junction block 54935515	
	5½ dimension changed to 7½ dim.	
	5" dim. changed to 7" dim.	
	44" dim. changed to 36½" dim.	
	Addition of eyelet and snap.	
	Cond on heater	
	9" dim. changed to 10" dim.	
	5" dim. changed to 4" dim.	
	Eyelets 119 changed for 192.	
8-9-69	194 @ Fog & Spot lamp was 102.	B
11-12-69	5½" dim was 7½". Lead No. 3 491/492 was 493/494. 493/494 was 498/501 Lead No. 2.	D
31-7-70	Mouldings 54935511 & 16 altered pictorially.	E

These drawings have been redrawn by Roger Tripp and Chris Poolton. Could the member who sent in the originals please contact me. Unfortunately, the article has had to be split into two parts the r emaining diagrams and legens will be in the next issue.

If any of these diagrams reproduced here after reduction and printing, appear too small to read even with a magnifying glass!! then they will be reprinted in the next issue, in a different size to overcome the problem.

RAMS

SYM
A
B
D
E

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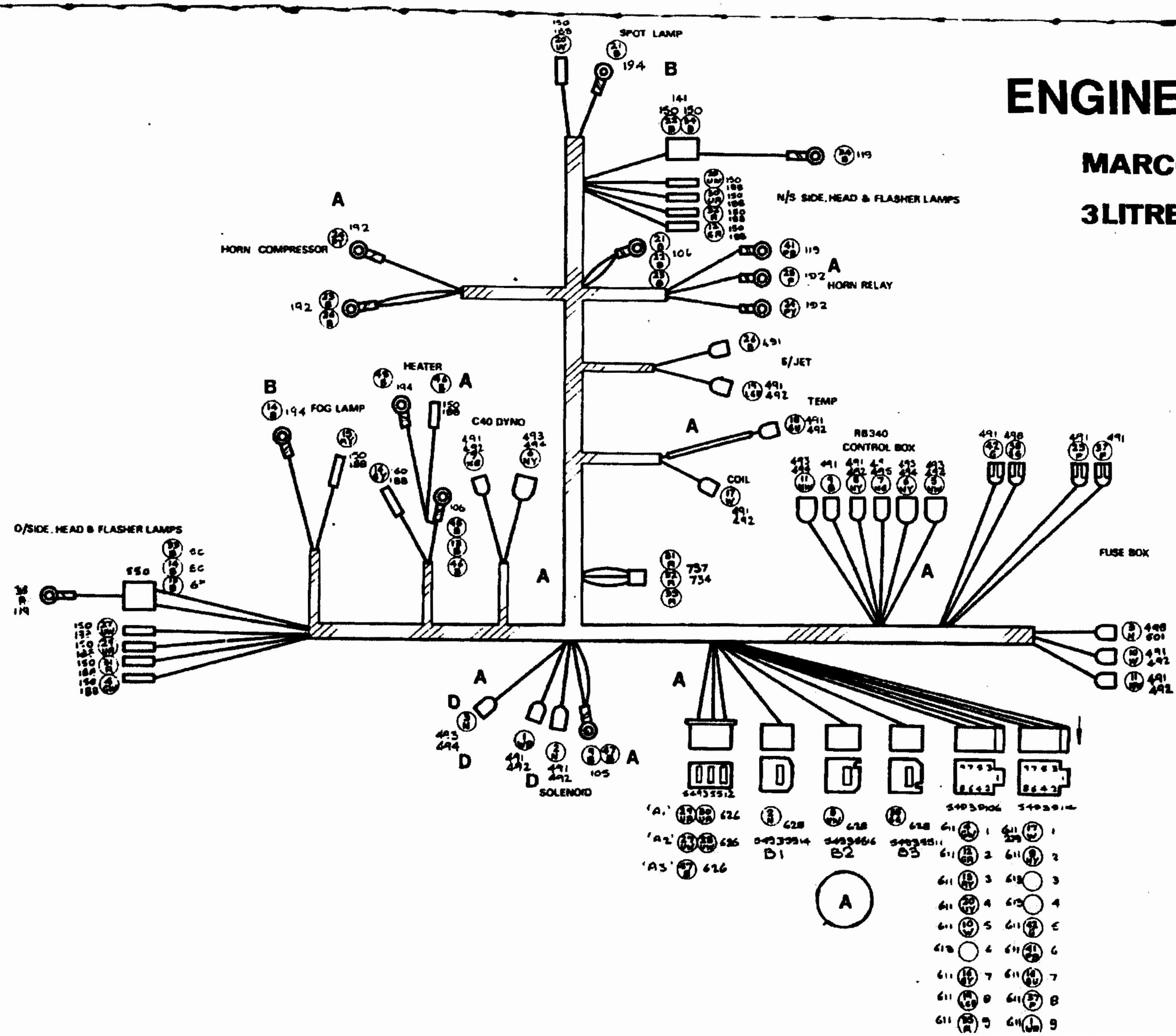
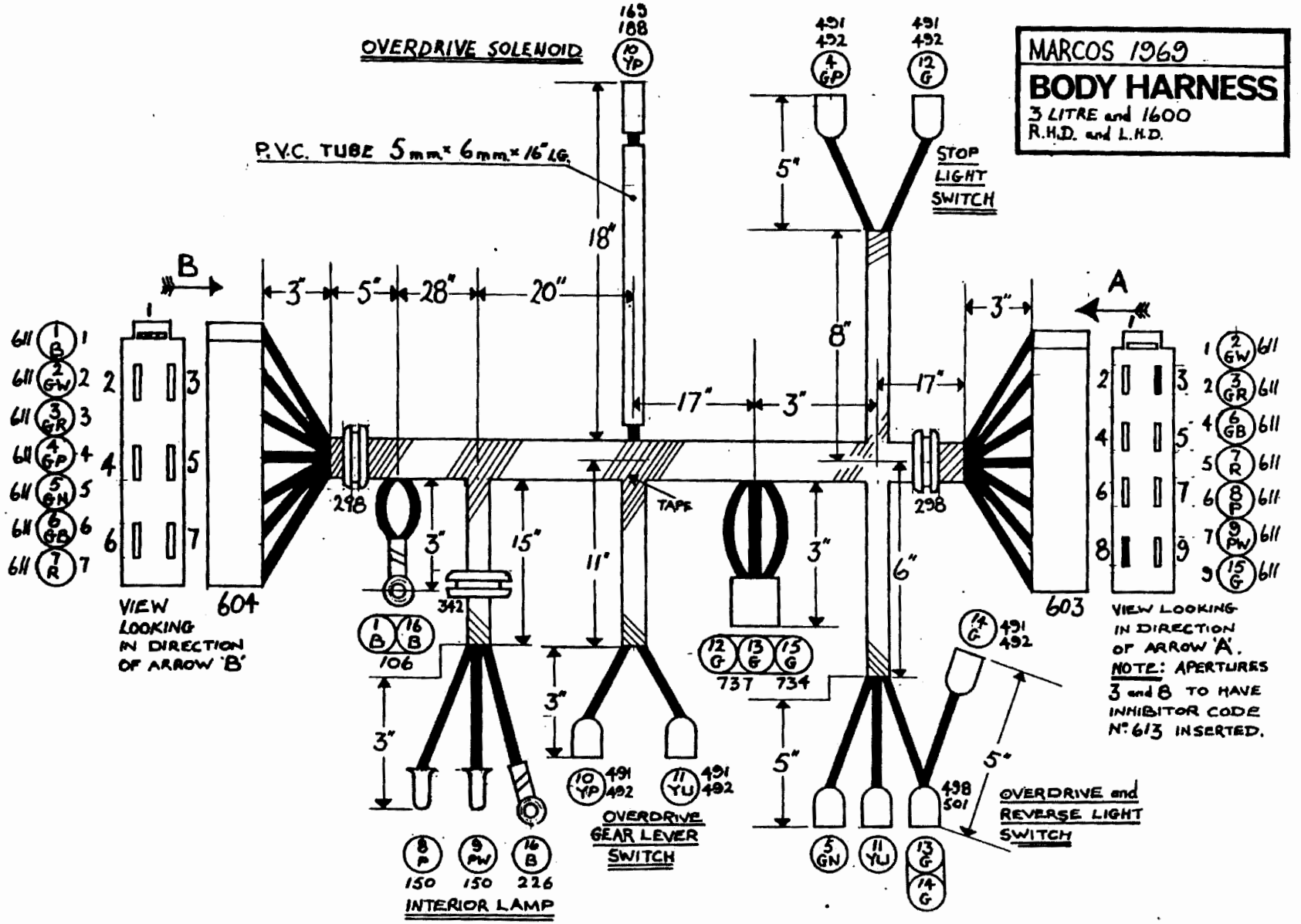
ENGINE HARNESS

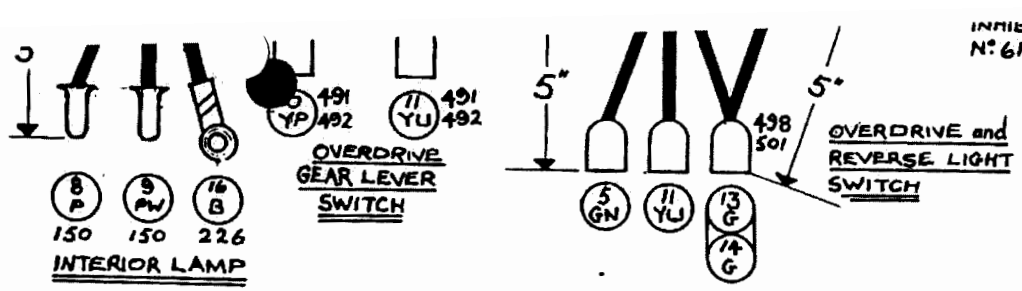
MARCOS 69

3LITRE RHD



MARCOS 1969
BODY HARNESS
3 LITRE and 1600
R.H.D. and L.H.D.





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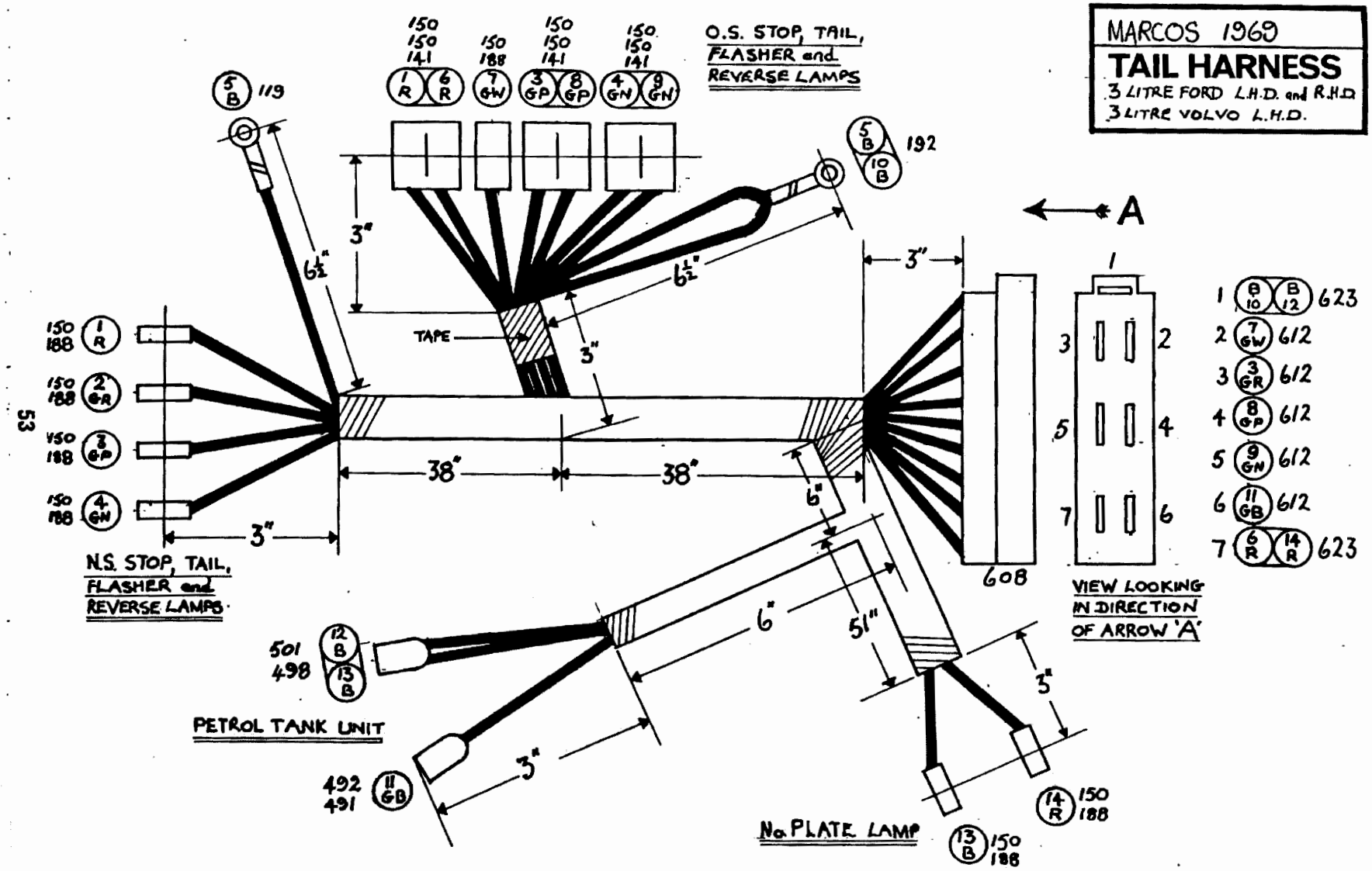

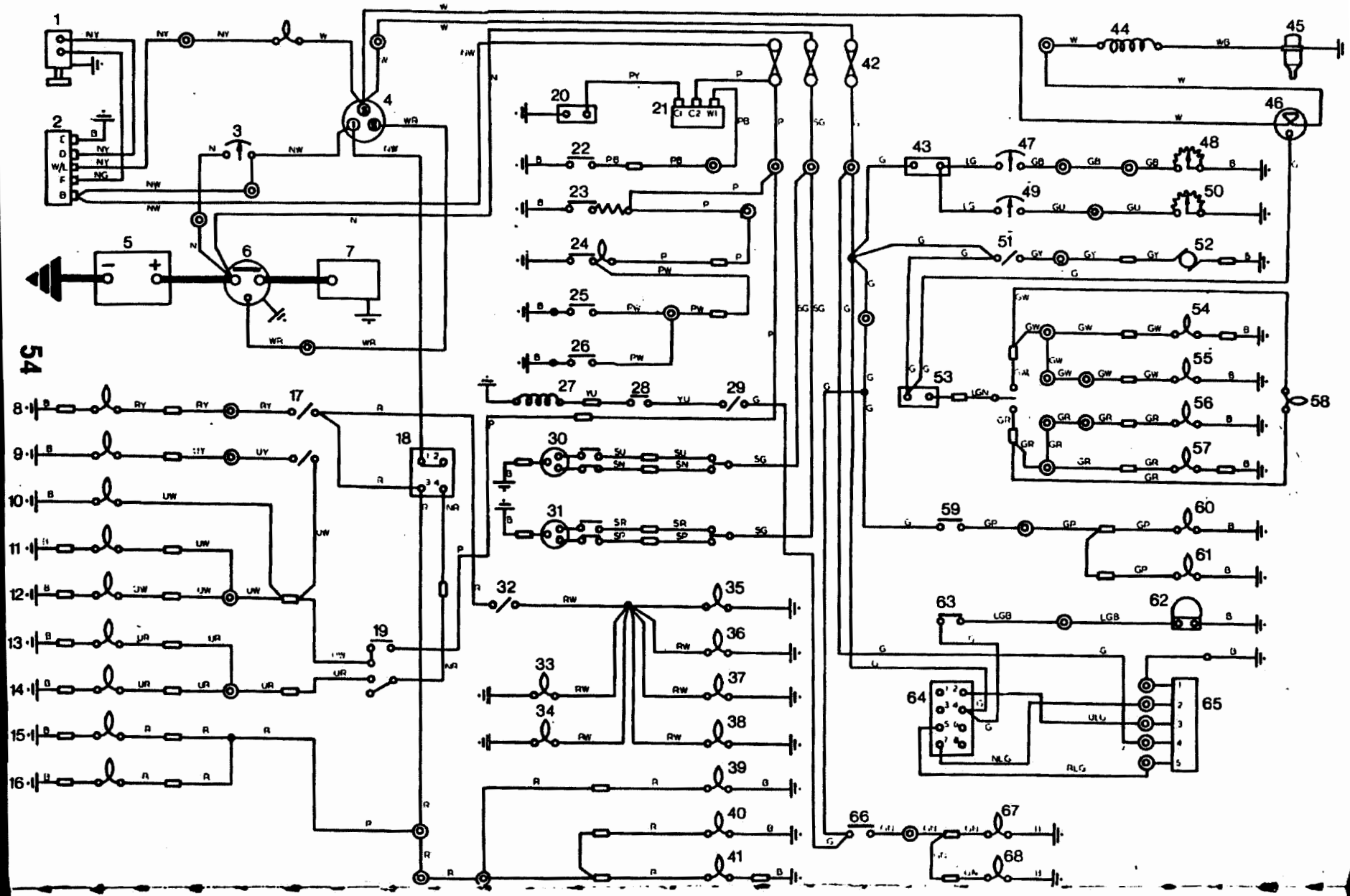
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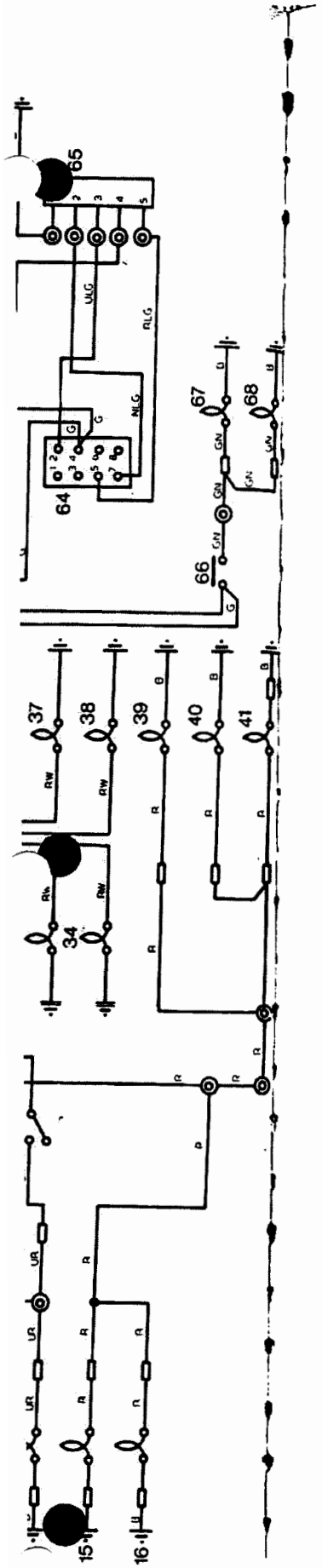
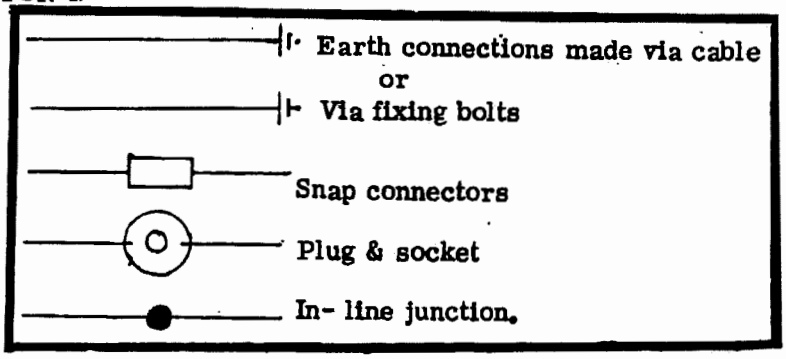


1. GENERATOR
2. CONTROL BOX
3. AMMETER
4. IGNITION SWITCH
5. BATTERY
6. STARTER SOLENOID
7. STARTER MOTOR
8. FOG LAMP
9. LONG RANGE DRIVING LAMP
10. MAIN BEAM WARNING LAMP
11. R.H. MAIN BEAM
12. L.H. MAIN BEAM
13. R.H. DIP BEAM
14. L.H. DIP BEAM
15. R.H. SIDELAMP
16. L.H. SIDELAMP
17. FOG LAMP SWITCH
18. MASTER LIGHTING SWITCH
19. HEADLAMP SWITCH AND FLASH
20. HORN COMPRESSOR
21. HORN RELAY
22. HORN PUSH
23. CIGAR LIGHTER
24. INTERIOR LIGHT AND SWITCH
25. L.H. DOOR SWITCH
26. R.H. DOOR SWITCH
27. OVERDRIVE SOLENOID
28. GEARBOX SWITCH
29. OVERDRIVE SWITCH
30. L.H. WINDOW LIFT MOTOR & SWITCH
31. R.H. WINDOW LIFT MOTOR & SWITCH
32. PANEL LIGHT SWITCH
33. PANEL LIGHT
34. PANEL LIGHT
35. PANEL LIGHT
36. PANEL LIGHT
37. PANEL LIGHT
38. PANEL LIGHT
39. NUMBER PLATE LAMP
40. L.H. TAIL LAMP
41. R.H. TAIL LAMP
42. FUSES
43. VOLTAGE STABILISER
44. IGNITION COIL
45. DISTRIBUTOR
46. TACHOMETER
47. FUEL GAUGE
48. TRANSMITTER
49. WATER TEMP GAUGE
50. TRANSMITTER
51. HEATER SWITCH
52. HEATER MOTOR
53. FLASHER SWITCH
54. R.H. FRONT FLASHER
55. R.H. REAR FLASHER
56. L.H. REAR FLASHER
57. L.H. FRONT FLASHER
58. FLASHER WARNING LIGHT
59. STOP LAMP SWITCH
60. R.H. STOP LAMP
61. L.H. STOP LAMP
62. SCREEN WASHER
63. SCREEN WASHER SWITCH
64. SCREEN WIPER SWITCH
65. SCREEN WIPER MOTOR
66. REVERSE LAMP SWITCH
67. R.H. REVERSE LAMP
68. L. H. REVERSE LAMP

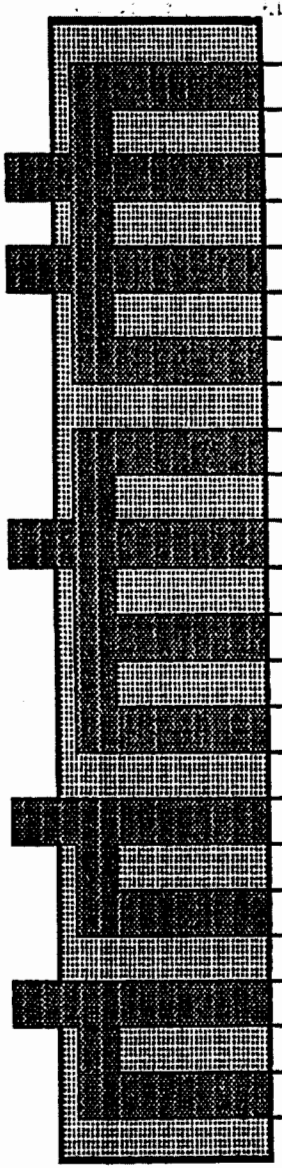


NONE STANDARD FUSE BOX

1964 1800 COUPE

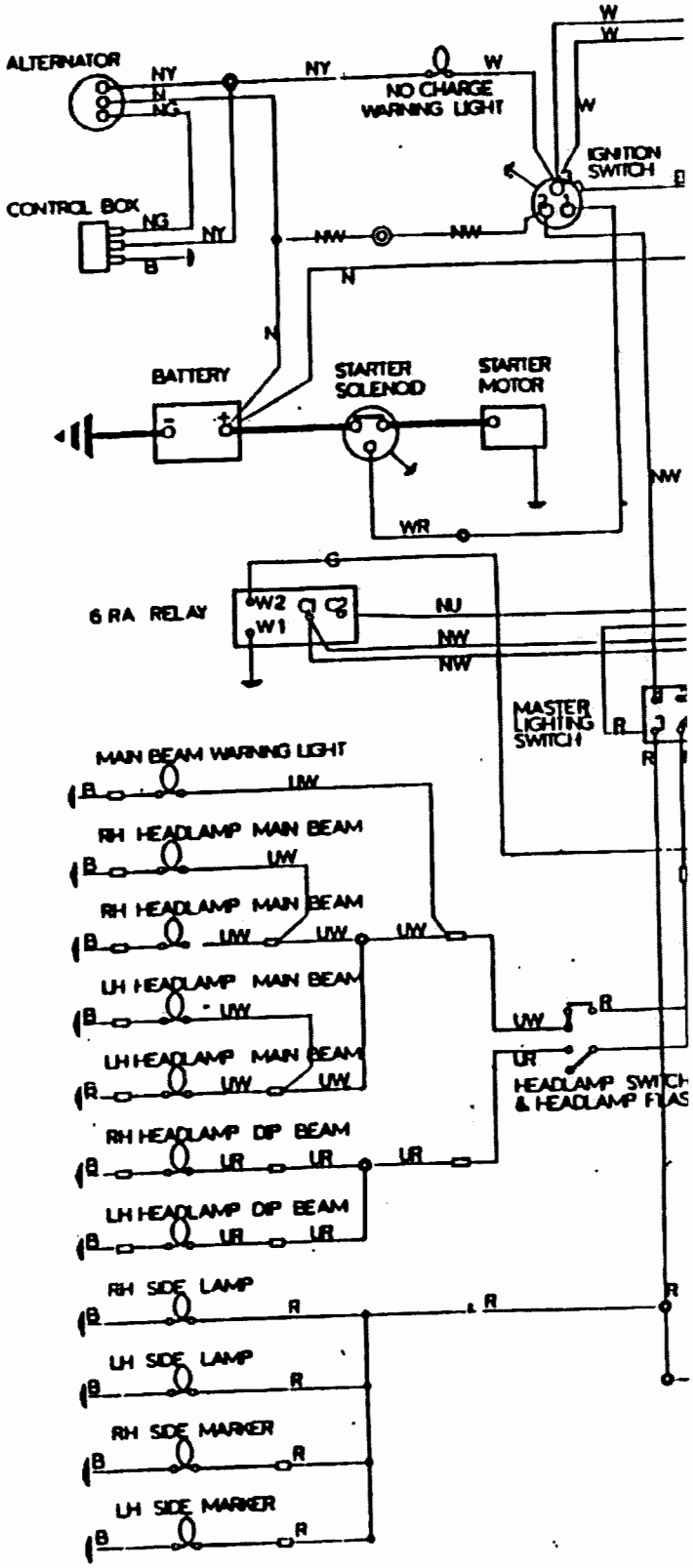
ORIGINAL GUIDING WIRING NOT AVILABLE, OR COMPANY WHO MADE IT. SORRY.

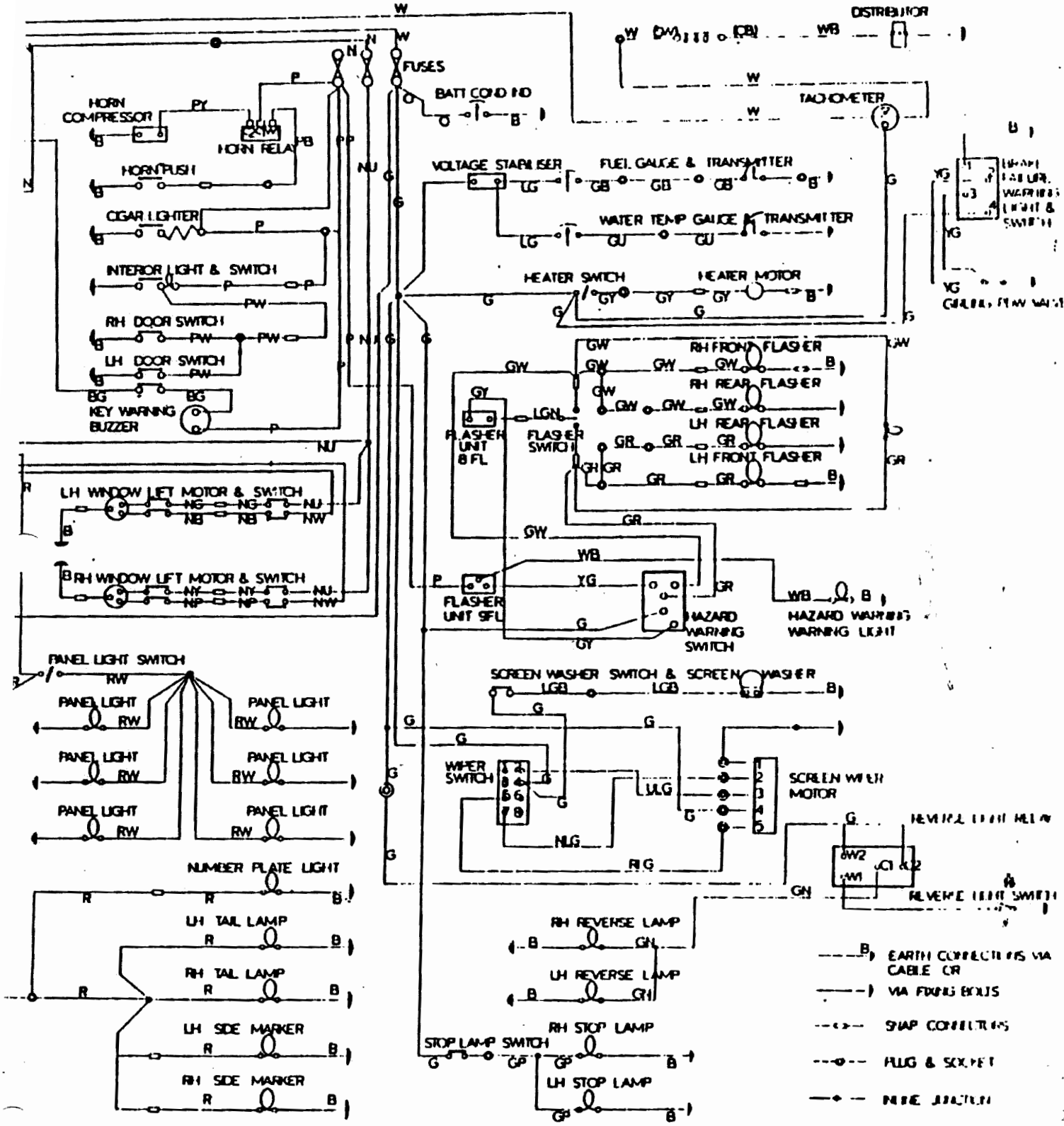
DAVE

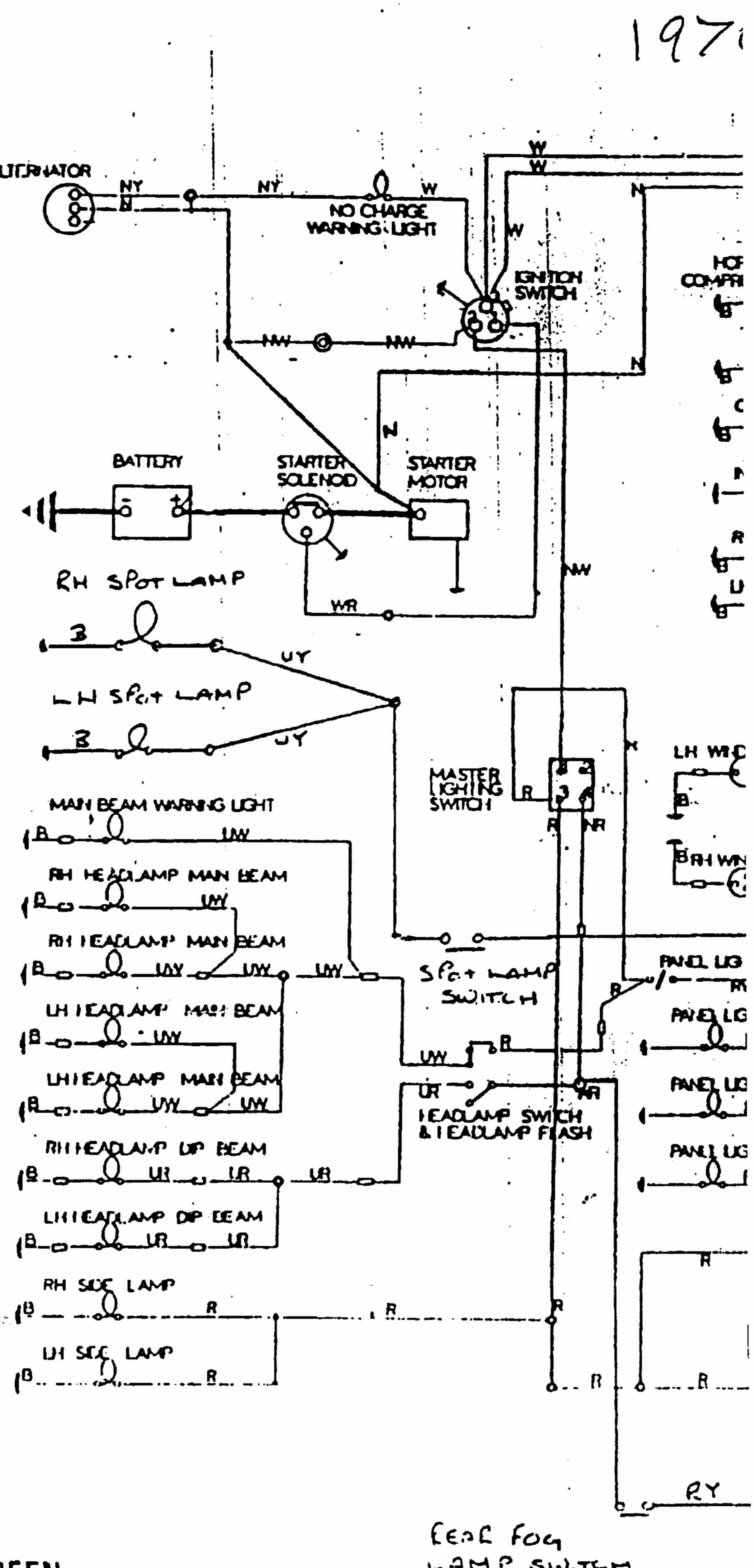


1	HORN	GREEN/WHITE
2	RADIATOR FAN SWITCH & SOLENOID	GREEN/WHITE & RED
3	ACCESSORY FEED TO BOOT (NOT USED)	GREEN
4	FUEL GAUGE	GREEN
5	WIPER MOTOR	GREEN
6	RADIO & INTERIOR LIGHTING	PURPLE
7	BRAKE LIGHT SWITCH	GREEN->GREEN/PURPLE
8	INDICATOR FLASHER UNIT	GREEN
9	PETROL PUMP	GREEN/YELLOW
	CONSOLE LIGHT SWITCH	BROWN/WHITE->BROWN/BLUE
10	STEERING COLUMN FLASHER SWITCH	BROWN
11	HEADLAMP SOLENOID (MAIN)	RED
12	HEADLAMP SOLENOID (DIP)	RED

VOLVO 3 LITRE MANUAL



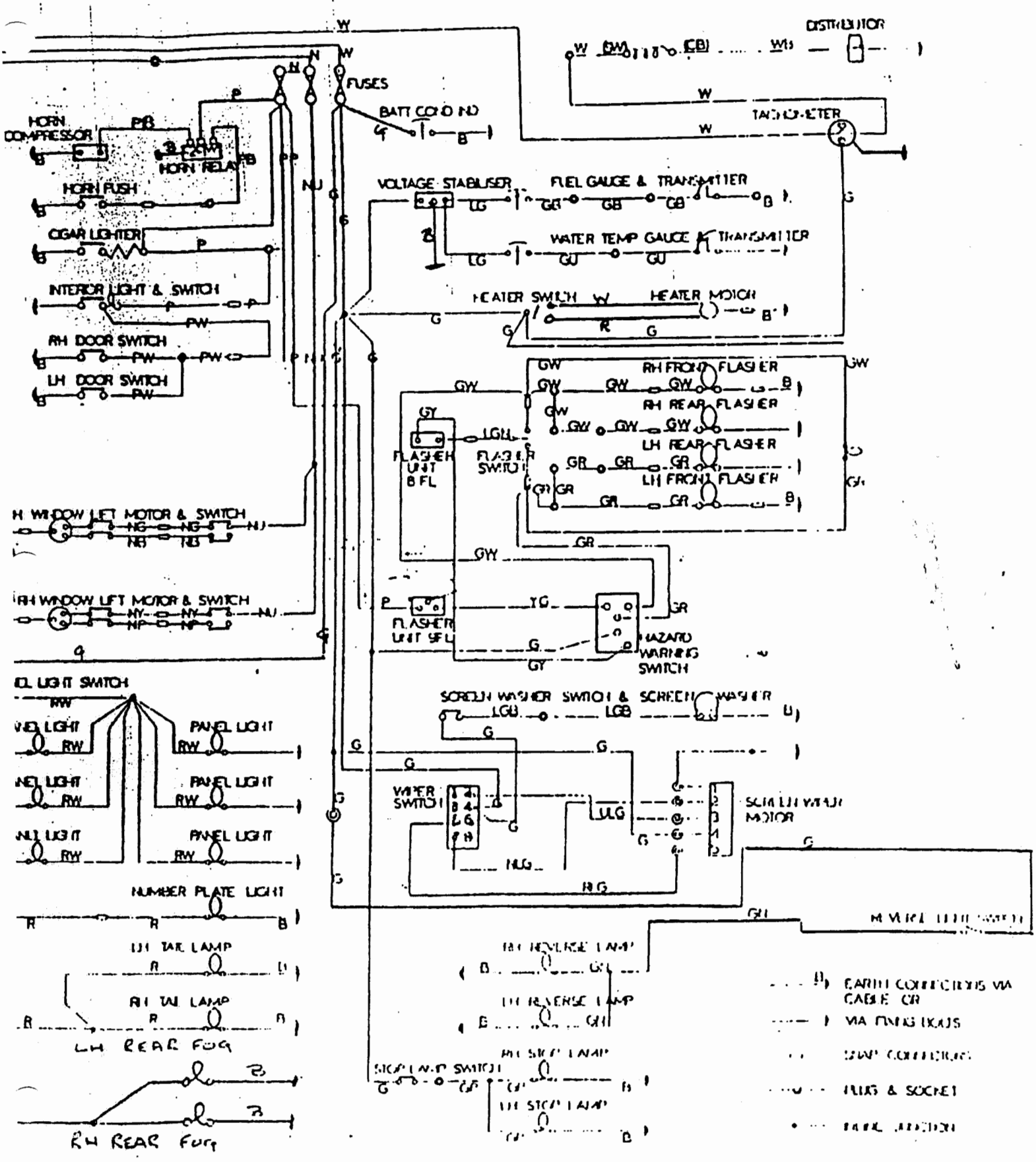

DISTRIBUTOR
FUSES
BATT CONN NO
HORN COMPRESSOR
HORN RELAY
HORN PUSH
CIGAR LIGHTER
INTERIOR LIGHT & SWITCH
RH DOOR SWITCH
LH DOOR SWITCH
KEY WARNING BUZZER
TACHOMETER
VOLTAGE STABILISER
FUEL GAUGE & TRANSMITTER
WATER TEMP GAUGE & TRANSMITTER
HEATER SWITCH
HEATER MOTOR
RH FRONT FLASHER
RH REAR FLASHER
LH REAR FLASHER
LH FRONT FLASHER
FLASHER UNIT 8 FL
FLASHER SWITCH
LH WINDOW LIFT MOTOR & SWITCH
RH WINDOW LIFT MOTOR & SWITCH
FLASHER UNIT SFL
HAZARD WARNING SWITCH
HAZARD WARNING LIGHT
PANEL LIGHT SWITCH
PANEL LIGHT
SCREEN WASHER SWITCH & SCREEN WASHER
WIPER SWITCH
SCREEN WIPER MOTOR
NUMBER PLATE LIGHT
LH TAIL LAMP
RH TAIL LAMP
LH SIDE MARKER
RH SIDE MARKER
RH REVERSE LAMP
LH REVERSE LAMP
STOP LAMP SWITCH
RH STOP LAMP
LH STOP LAMP
EARTH CONNECTIONS VIA CABLE OR
VIA FIXING BOLTS
SNAP CONNECTORS
PLUG & SOCKET



OLOUR CODE

BLACK
GREEN
BROWN
PURPLE
RED
BLUE
WHITE
YELLOW
G LIGHT GREEN
SLATE/GREY

70 – 80 COUPÉ.



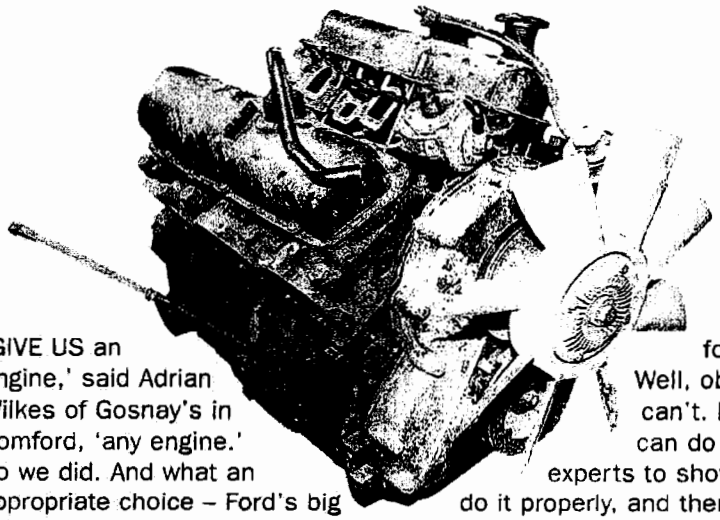
MARCOS 1981

Essex 3-litre V6

Could you rebuild Ford's flagship motor from the Seventies for just £1? Maybe not, but we could do it for you

part one

FANCY AN ENGINE FOR A QUID?



'GIVE US an engine,' said Adrian Wilkes of Gosnay's in Romford, 'any engine.' So we did. And what an appropriate choice – Ford's big V6 going back to its Essex roots.

This was part of the family of new V-engines developed by Ford UK in the Sixties, and first seen under the bonnet of the top-of-the-range Mk IV Zodiac in April 1966. Rough, rugged and a bit of a slapper, it went on to power Mk I and II Granadas and Capris as well as a host of cars from smaller manufacturers – TVR, AC, Gilbern, Reliant and Marcos have all turned to Essex for a bit of extra power.

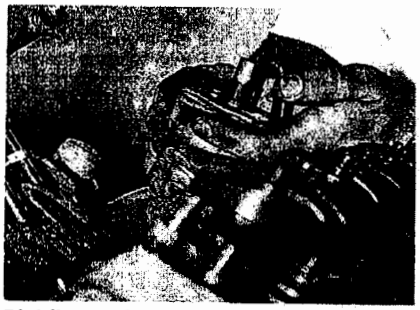
But since the Essex is a for just £1? Well, obviously we can't. But what we can do is pay the experts to show us how to do it properly, and then give the finished article away in an easy-to-enter competition that costs just a pound to enter. Get the idea?

Now, you may well be ahead of me in guessing which particular Essex we sent trundling down the A1 from Peterborough. Ever since editor Will Holman hoiked the original motor out of his Mk I Capri to make way for a Ford V8, we've had a 3-litre Essex gathering dust in the workshop. We knew it was a runner; we knew it was down on power and we knew it would cost a

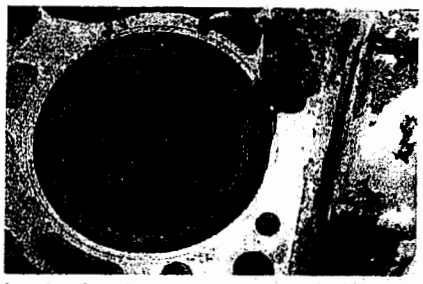
Going topless

THE FIRST step for our expert Dave Woods was to strip off the bits that didn't form part of the rebuild. If you're paying someone else to do the work, you should really do this before handing your engine over, because it minimizes the danger of anything getting broken. It's mostly the bolt-on ancillaries that need removing, stuff like the alternator, distributor, fuel pump and fan.

Unfortunately, not everything was ready to come off just yet. The distributor should have lifted out once its retaining bolt was removed, but corrosion, muck or a mixture of both was locking it firmly in place. And the fan, because it contained a viscous coupling, couldn't be locked into position firmly enough to undo its bolts. It would



Distributor should lift out, but was stuck. Instead of using force, we left it until later.



Loads of carbon suggested that too much petrol had been sloshing down the bores.

Bearing the strain

STRIPPING any engine involves a bit of a detective work: figuring out both how it has worn and what has been done to it in the past. The fact that the rocker gear was

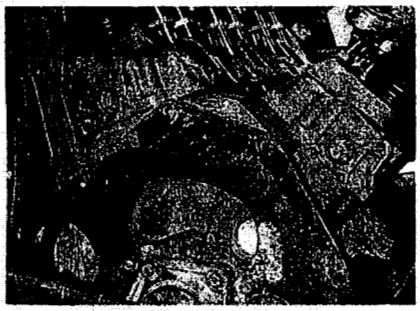
ave been easier to take this off with the
in belt still in place to provide some grip.
nstead, we had to leave both fan and
istributor where they were until we had
er access to them.
ut Dave did take off the clutch and
ywheel to lighten the load, before lifting
ne block onto his engine stand. Whenever
ossible, he prefers to hang the engine off
ne of its side-mounting brackets rather than
n the end of the crank. That way he can
trip the engine from all angles in one go.
There is no single order that other
omponents have to come off the engine.
)ave started with the front pulley, holding it
tationary with a pry bar held between two
olts in the other end of the crank. Then,
sing one lever on either side of the pulley to
top it getting twisted on its shaft and stuck,
he persuaded it forwards and off the crank.

The timing cover could have come off next, but there is a row of bolts underneath holding this to the sump. So while the engine was this way up, Dave took the heads off. The head bolts didn't feel like they were torqued down properly, but there were none of the usual signs (black lines or bits missing on either the heads or their gaskets) to indicate that the head gaskets had failed and the engine was blowing. But there was a whole lot of black carbon on pistons and valves, showing the engine had been running with the fuel mixture way too rich.

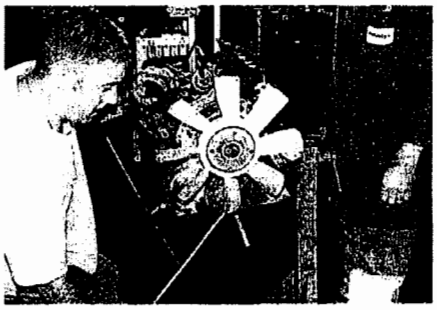
When the heads come off, the pushrods will get lifted up and drop. So if you only expect to be carrying out minor repairs, make a record of where each one came from so that they can go back in the same place.

With the heads off, we got our first view of the bores. These looked good and there was virtually no wear ridge at the top, indicating that the engine had undergone some internal surgery in the past. Unfortunately, the pistons were so carboned up that we couldn't yet read the markings on their crowns to see how far, if at all, the block had been re-bored.

Next step was to remove the timing cover complete with the fan, giving us access to the timing gears themselves. Of these, the smaller wheel on the crank is cast iron, while the larger one on the crank has fibre teeth. The idea is that having fibre meshing with iron is quieter than metal-to-metal contact. It's not unknown for the timing gear to strip the fibre teeth, but this rarely happens unless there is a separate major fault in the engine. In normal use, the cast wheel wears first.



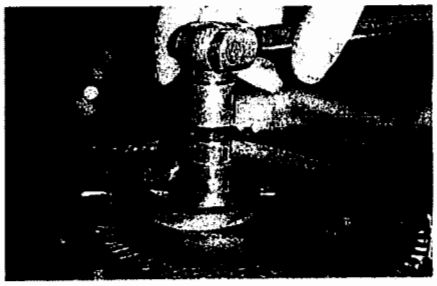
ake care not to damage the backplate, r you may struggle to align gearbox later.



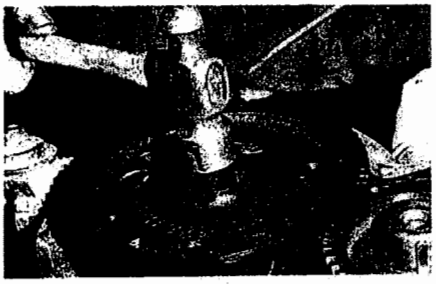
While Dave senior locks the crank, his son applies muscle power to the front pulley.

This is when an extra pair of hands is useful, to gather and label pushrods.

ut minimal bore wear suggested this was ot the result of a long-running problem.



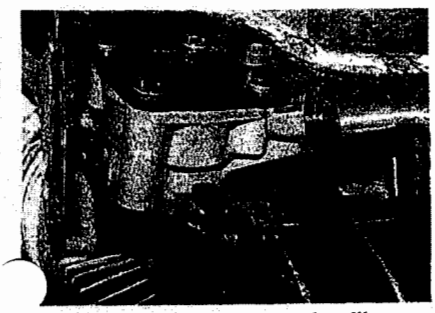
One bolt releases the eccentric cam that drives the mechanical fuel pump up front.



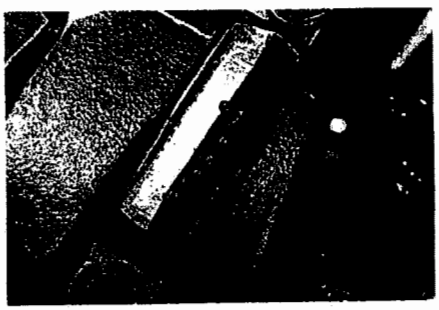
Wind bolt back in to shift timing wheel with gentle taps and a little leverage.

ntirely free of sludge suggested that this
ngine had either enjoyed very frequent oil
hanges or had been recently cleaned, and the
moothness of the bores hinted at over-size
istons. With the sump off, we could add
ome facts to our speculation.

The oil pump was still a light grey colour rather than blackened like the crankshaft webs, which suggested that it hadn't been fitted long. Unfortunately, as we lifted it away the pick-up strainer fell off. This had clearly been broken in the past and soldered back into position. We could also see for sure that the pistons had been out in the past because someone had dot-marked the big-end caps. This is essential because conrods and caps are manufactured as a pair and mixing them up during reassembly will accelerate future wear.



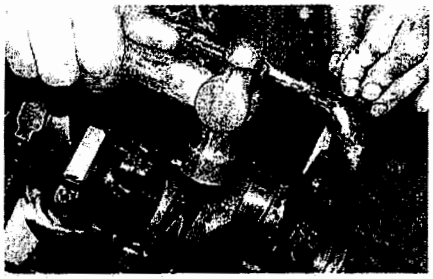
lew oil pump was shiny grey. It will ventually dull like the crankshaft webs.



Six dots mean this big-end cap belongs with the conrod from number six piston.

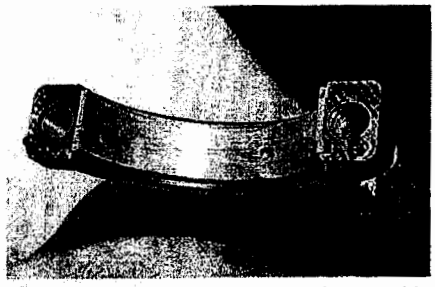
Previous soldered repairs to the oil pick-up strainer proved to be less than durable.

Bearing the strain/cont

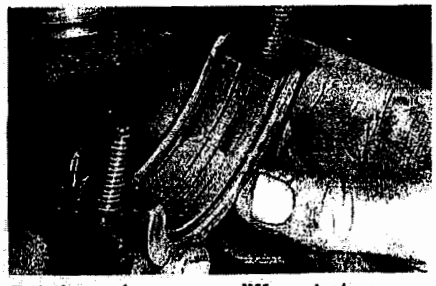


Light taps to loosened bolts will separate conrod and cap, but you must be gentle.

Pistons and con rods can then be pushed out from below. Ours were almost new.



This big-end bearing was worn, but would have stayed quiet in a running engine.



But the mains were a different story. Three of the four were completely shot.

This might not mean anything to us, but

The caps themselves are located on a dowel, and they can be hard to shift. Dave undoes the retaining bolts a couple of turns, then lightly knocks them with a hammer to push the conrods away and break the join. But he stresses that it takes just a light tap – damage the threads in the conrods and you'll have to buy a new set of those too.

The big-end bearings themselves and the crank journals beneath them looked in pretty good shape, with just some slight marking where specks of muck had been carried through in the oil. But when we took the front big-end bearing off, this was in considerably worse shape. The white lining material had worn away in places so that the copper backing below was showing. It might have already started knocking in this condition, and left to its own devices would certainly have started to do so soon. But if that one was bad, the rest were terrible, with virtually no lining material visible.

If you've never examined a shell bearing before, a quick summary of how they work will show why I have described these as terrible. Each bearing is made up of two semi-circles, one sitting in the conrod and the other in the cap. These are clamped around the crankshaft. The main part of the shell is made up of steel and copper for strength, with just a very thin layer of softer tin on the face that sits around the crank.

In theory, this tin is an insurance policy because the crank and bearings should always be separated by a layer of oil and never come into contact with each other. But any muck in the oil scrapes away at the soft lining. Once this has gone, you get hit with a double whammy – the effective diameter of the bearing becomes larger, allowing the crank to slap around, and as this then rubs against the harder shell material, the crank's smooth surface gets damaged.

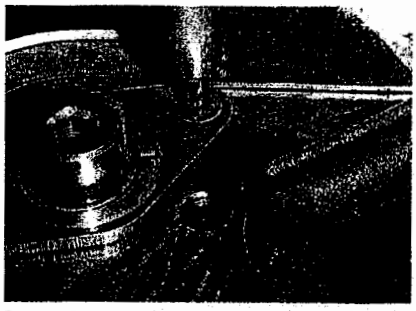
Now for some more detective work. All the bearings were genuine Ford parts, the mains marked BA and the big ends CA. A quick check in an ancient parts book showed that these were standard size and 0.010 inch respectively. Always take the old bearings with you when ordering new ones because some engines had to be line-bored at the factory to correct minor errors, creating, in effect, over-size bearing housings. Put standard size bearings in these caps and the crank will wobble all over the place.

It is quite possible that the engine left the factory with these different-sized bearings fitted because manufacturers in the Seventies still found it cost-effective to re-machine faulty components. But it's also possible that someone splashed out on new pistons and grinding the big-ends journals, then saved a few quid by re-using the main bearings.

Dave is a bit more charitable and suggests a third possibility. With the fuel mixture being so rich, petrol washing down the bores could have diluted the oil, leading to new bearings failing very quickly. This observation is based on many years of bitter experience when customers have paid for a reconditioned engine, only to slap on the

A matter of timing

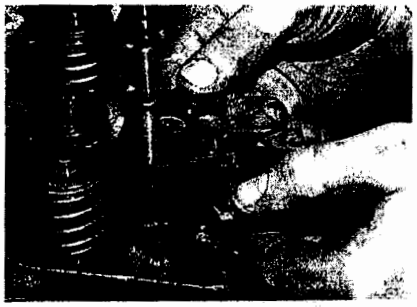
THE CAMSHAFT was next to come out. This is held by a thrust plate, and the two screws securing this can be difficult to shift because of the locking compound on their threads. An impact screwdriver should shock them loose, but don't use too much



Firm whacks will shift these screws, but take care not to break the thrust plate.

Two heads, no aches

THE HEADS do an incredible amount of work in a running engine and look really complex, but stripping one down doesn't take long. A quick tap on the valve stems with a copper hammer frees them up enough for the valve spring compressor to



Remove pushrod guides early because they're easily broken if left on the heads.

Our experts

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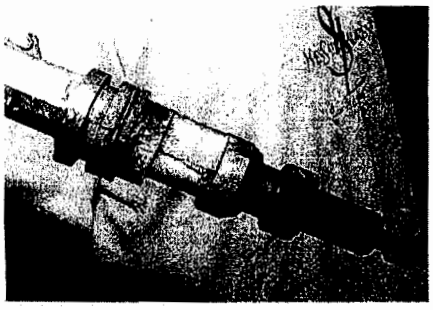
Keeping a watchful eye on our project is Dave Woods, Gosnay's workshop supervisor and one of the company's directors. He's racked up 39 years with the company and is being helped on this job by his son, also Dave, a mere youngster with just five and a half years' company experience.

Next issue:

welly – the screws sit in a taper and they can crack the thrust plate.

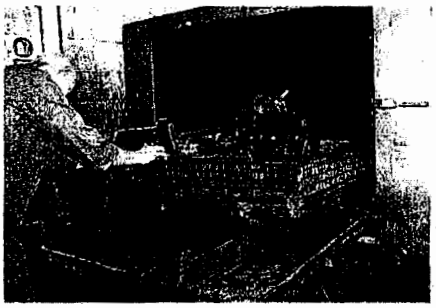
With the thrust plate out of the way, the camshaft should slide out towards the front of the block. Ours came out part way, but then got stuck. This can happen when crud builds up on the cam next to a bearing. As the cam is slid along and this build up tries to pass through the next bearing, it's too big to fit through the hole and gets stuck. But when a few light taps on a drift failed to shift our cam, instead of reaching for a bigger hammer Dave went in search of the obstruction.

First suspects were the cam followers which could have fallen between the lobes and got the cam jammed, but all of these were already out. Then he remembered that we'd had to leave the distributor in place earlier. This was now snagging on the cam. He knocked it out from below and the camshaft slid out without further aggro. Then, once the filter and the engine front plate had been taken off, the whole lot was loaded into the degreaser for cleaning.



This crud on the distributor shaft was the reason why it wouldn't leave the block.

Rust points to previous water leak, but this shiny core plug had been replaced.

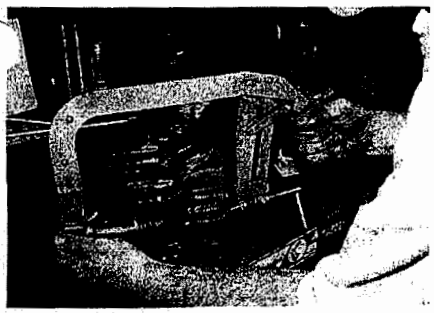


Final step before detailed examination is a thorough clean with chemicals and steam.

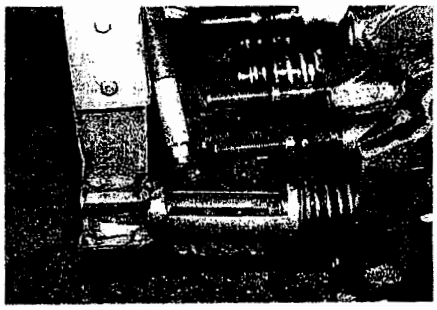
squeeze the springs and free the collets (there's a washer on top of the valve spring, and the collets are the two semi-circular rings that stop it sliding off the end of the valve). Dave picked off the collets with a special tool, although the rest of us can make do with a magnetic screwdriver.

The valves themselves were in reasonable condition and seemed to be seating all right, but both they and the valve seats had a slightly rounded profile instead of a machine-fresh line at 45°. That suggested they had been lapped-in by hand in the past, but that the seats hadn't been re-cut. Waggling the valves in their guides showed that these were slightly worn, but not excessively so.

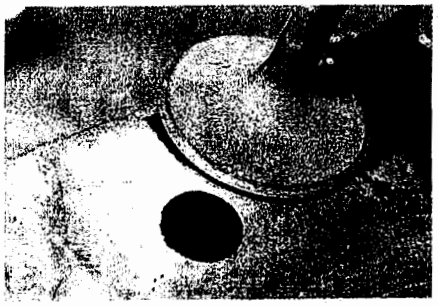
If we were simply cleaning up the faces and re-using the valves, we could leave the guides alone. But we want to convert the heads to unleaded, which involves re-cutting the seats. Whenever you do this, you have to fit new guide inserts too because the cutting machine uses them to locate itself. If your guides are worn, your valves will end up off-centre too.



Dave's universal spring compressor makes a tricky job very simple and costs around £20.



Count the collets and store them carefully. Getting replacements will slow the rebuild.



Seating face of valve is concave, so they've previously been lapped-in by hand.

Essex 3-litre V6

Cutters, grinders and milling machines all take chunks out of our motor. But that's good news for the lucky reader who's going to win it

Part two

FANCY AN ENGINE FOR A QUID?

UNWANTED and unloved, this is the engine that editor Holman callously hoiked out of his Mk I Capri and abandoned in the workshop. Surely it didn't deserve such a fate? After all, it might have been down on power but at least it ran after a fashion and didn't belch any more smoke than your average steam train.

So we sent it down to Gosnay's Engineering in Romford and asked them to take a look.

As a rule, they charge a little over £1100 to recondition an Essex V6 to the industry standard BS AU257. That sound's like a lot of money, but then the standard requires a lot of new parts. These have to include new pistons, rings, gudgeon pins and retainers along with new main bearings, big end bearings, thrust washers and small end bushes (if fitted). Then you can add to the list new gaskets, oil seals, core plugs, timing chain, lock washers and a rebore or resleeve and hone for the block.

If necessary, the heads must be skimmed, the guides checked and replaced, the valve seats re-faced and the whole lot pressure tested. Finally the engine has to be tested for oil pressure, compression and oil leaks protected against the ingress of dirt or damage in transit. It doesn't seem quite so expensive now, does it?

Gosnay's director Adrian Wilkes is keen to point out that this is the bare minimum for any engine advertised as reconditioned, and that all engines they sell undergo this treatment.

But we wanted to take a different approach. As well as ending up with a top motor, we wanted the story to be as helpful as possible to those of us working at home on our own projects. That means assessing the individual components to decide which can safely be re-used without compromising performance or limiting engine life, and which require us to dip into our pockets to buy a replacement.

So we persuaded Gosnay's to rebuild it on this basis as a home restoration, or as close to that as they could get while enjoying the benefit of vast engineering experience and top class machining facilities close at hand.

Last issue we watched the father and son team of Dave and Dave Woods strip the Essex down to its individual components and pronounce it as basically sound. This issue we take a closer look to discover which

Starting at the top

THE TWO main places to look for wear in the heads are the valve guides and the valve seat faces. If the guides are worn, then oil will get sucked through the gap and into the cylinders. And if the valves aren't able to mate with their seats in an airtight seal, then you will lose compression. Of the two, valve guide wear is the harder for a novice to gauge because it relies on waggling each valve in its guide and deciding whether there is too much play. And that, of course, requires experience.

If you aren't confident of judging this accurately, don't worry. Just have a waggle at home before taking your heads along to a machine shop for assessment, then you'll start to develop this engineer's feel.

On the valves and seats, any pockmarks

Rocking the valves in their guides gives a skilled engineer a quick test of wear.

A dedicated cutter took off the excess liner that was sticking out of the guide...

will break the airtight seal. You can get away with slight markings as long as they don't spread right across the seating face to allow an escape route for the gases. But ideally you uld lap in the valves using grinding paste get a totally gas-tight seal.

Dave decided that our guides were within acceptable limits and that the valve seats could be cleaned up. But that was academic really because we wanted to convert the heads to run on unleaded petrol, and that requires new and harder exhaust valve seat inserts. And since the machine to cut these new seats relies on the valve guides to locate itself accurately, we had to replace them as well.

With the right tools and plenty of experience, Gosnay's made replacing the guides and fitting new inserts seem a quick and simple job. But we are talking about many thousands of pounds in machinery investment here, which is why it costs us a few bob to have the work done professionally.

Take the valve guide liners, for example. As the picture sequence shows, Dave used no less than five special hand tools just to fit each of them. And if, for example, the original casting had been broken, he would have needed to fit complete new guides instead of just liners, and that would have required yet more tools.

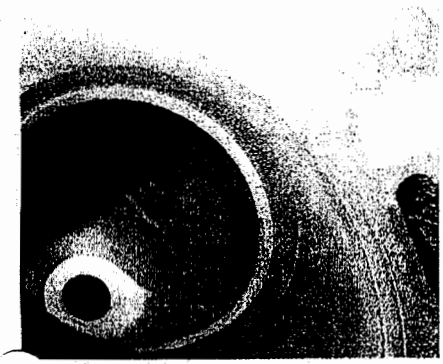
The valves in an Essex run directly in holes bored into the heads without a separate liner. That works well enough, but when these guides become worn, you have to fit a bronze liner to bring them back to size, or bore them out and fit a thin-wall sleeve. Ultimately liners should last longer than the original set-up, partly because an interrupted spiral on the inside helps keep the oil in place.

It was then over to Dave senior to fit the inserts. This is another job that is clearly beyond the home mechanic, but it's interesting to know just what gets done for around £22 per seat.

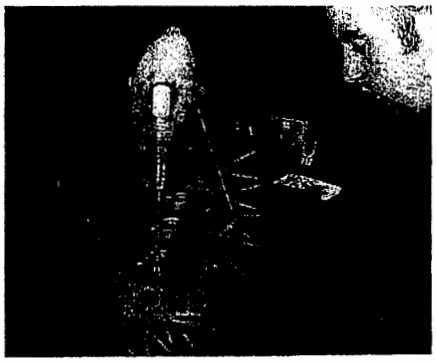
First job is to select the most appropriate size of insert, measure its diameter and set the cutter slightly undersize to create an interference fit in the head. Then, using a state of the art Serdi cutting machine, Dave cuts the heads to the required depth and width. There's plenty of metal for this on the Essex, although great care has to be taken with the 2.8 Cologne unit or you'll break through into the water jacket

While this was going on, Dave left the inserts hanging in a vat of liquid nitrogen to freeze them. That caused them to shrink enough to be an easy fit into the new holes, only to expand as they defrosted to become locked permanently into position. Dave then trimmed them with the same cutter he'd used to cut the holes in the first place.

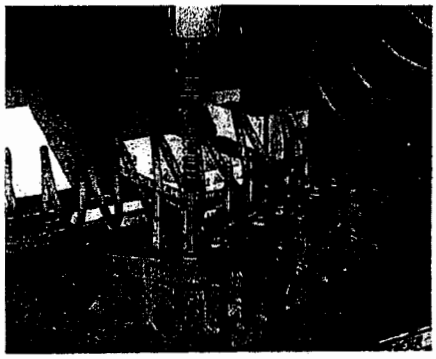
The next stage is to cut the inserts to



nimal marking on valve seat faces, so ney could have been lapped-in at home.

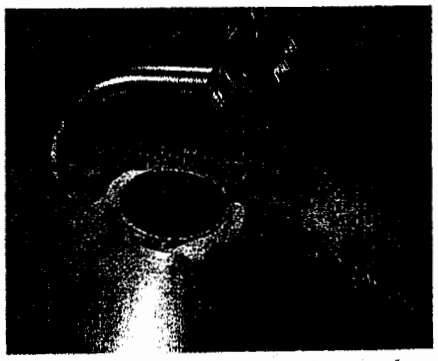


Just a pistol drill, but special cutter in it widened old guides in under 10 seconds.

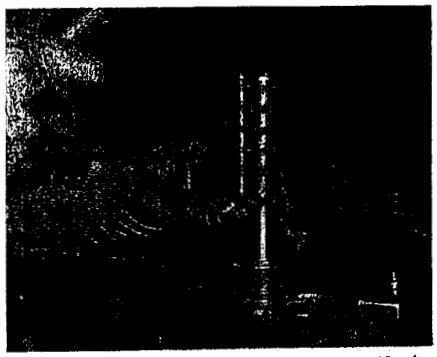


Five seconds more had the new bronze liners pressed firmly into position.

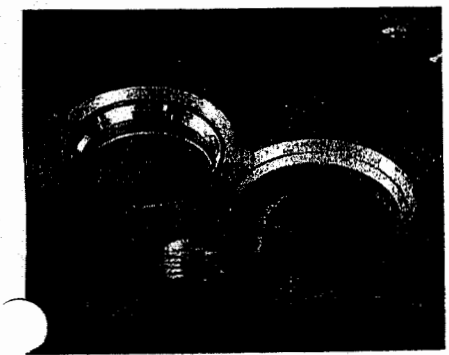
... and two different broach tools sized the internal diameter perfectly for valve stem.



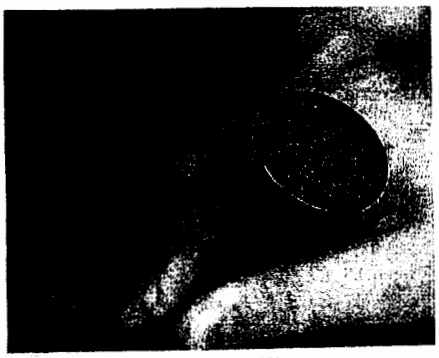
Two minutes in liquid nitrogen is enough to freeze inserts and make them shrink.



Knocking them into place is comparatively low-tech, but still requires a special drift.



So is cutting a three-angle profile around the face with one pass of the machine.



Pitting is from corrosion. We can re-use because seating face is sound and thick.

But seating faces must be re-cut to give a perfect seal where they meet new inserts.

At the top (continued)

shape, and this is where you need the valve guides to be in perfect condition. First the seats are drilled out to the same internal diameter as the originals, and then a single pass with a three-angle cutter takes care of the seating face. After this, lapping in the valves is not strictly necessary and a simple vacuum test will show whether the valves are seating correctly. But once the valves have been refaced on a dedicated grinder, Dave still likes to give each one a few turns with a fine grinding paste.

The final step with the heads is to check them for flatness. One of them had a 0.005in bow in the middle. There hadn't been any sign of blowing past the head gaskets, but often this sort of distortion is held in check by the head bolts and only gets released when they are undone. Dave took 0.006in off the head to clean it up, not enough to seriously affect the compression ratio. He also took the same amount off the other head, simply because it's good engineering practice to keep them even.

Re-ground valve (left) is straighter and smoother than uncut version on right.

A vacuum test is the surest way of ensuring the valve is seating properly.

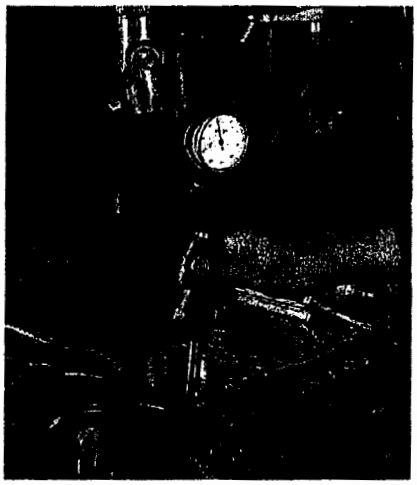
Finally, a skim takes care of distortion

Pistons and bores

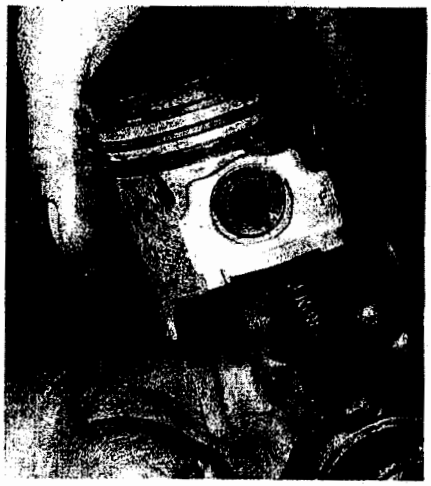
WHEN THE pistons came out, they were too black with carbon to read any size markings on the crowns. But a short spell in the blast cabinet with a very fine media had them shining like new and we could see they were 0.020in oversize.

As we mentioned earlier, Gosnay's would normally replace the pistons as a matter of course. But we wanted to know whether ours could be reused. So Dave measured the cylinder bores to check that they had been bored correctly for these pistons and that they hadn't worn oval. With no problems there, he took a closer look at the pistons themselves.

On these, the gudgeon pin is a press fit into the conrod so there is no little-end bush to worry about. Instead, wear takes place



If you want to re-use pistons, first check that bores and pistons are the same size.



Next, check that there is no vertical movement between piston and conrod...

Getting cranky

MAHENDRA KUNWARDIA is Gosnay's crank man. He explained that any grooves on the crank bearing journals are bad news because they allow more oil to fit between each journal and its bearing. This in turn lowers the oil pressure and, as insufficient oil gets forced between the surfaces, you end up with metal-to-metal contact and accelerated wear. Our main journals were obviously scored, a result of the shell bearings having been worn down to the copper backing. But the only way of knowing just how deep they went was to grind the journals back until they were clear and smooth.

Mahendra's first job was to centre the crank on his grinding machine and measure in the centre for bowing. It was only 0.002in out, which left us a limit of 0.008in to take the journals to the next undersize. If they were still marked at that point, we would have to go down a further 0.010in to the next size. In the event, 0.002in was sufficient to clean off the scoring, so we only had to go down one size. Then a quick polish with a strip of fine emery cloth had it cleaned up and ready for reassembly.

Grinding reveals how deep the scores are and what size bearing you'll need.

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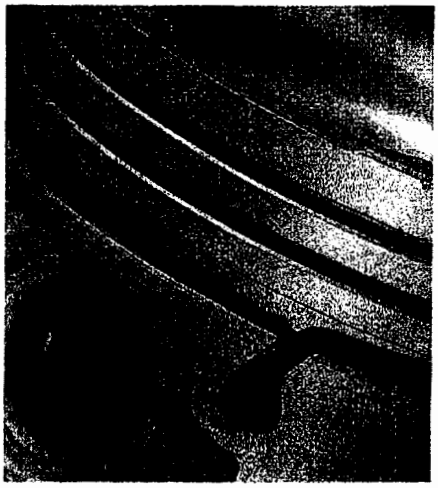
where the piston boss rotates around the pin. Dave couldn't feel any movement when he tried pulling the piston up and down along the conrod and, with the piston slid o one end of the pin, there was no sign of any metal being scraped off the piston boss. So he settled on taking 0.0005in off the bores, basically just enough to take off the glaze and clean the lip at the top, and fitting a new set of rings.

Dave was only willing to re-ring our pistons because he could use standard items. You will hear of people fitting oversize rings to compensate for wear. But these are at best a dodge to clean up a smokey engine in the short run. You can fit special oil control rings to compensate for up to 0.004in of wear, but if your bores are any bigger than this, then you have to bite the bullet and go for a rebore and new set of pistons.

... and ensure the piston bosses round the gudgeon pin are smooth and undamaged.



Finally, make sure that the piston grooves are scrupulously clean or rings won't seat.

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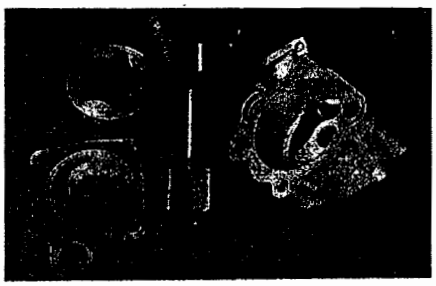
Sample prices

- Supply and fit 12 valve guide liners: £67
- Supply, fit and cut six hardened exhaust valve seats: £150
- Skim both heads: £47 (prices inc VAT)

Next Issue: Reassembly explained, and your final chance to win the finished engine for just £1. Don't miss out.

And the rest

Sharp straight edges to timing teeth mean fibre wheel can be used again.



Oil pump looked as good as new on the outside, and was perfect inside too.

Shiny areas on the flywheel are hard spots. In time, they become high spots.

Wear rings become more visible during refacing, but ours needed minimal skim.

Cam followers should be slightly convex. These tops are dished, and need replacing.

WE WERE confident that the oil pump was a recent fitment because the alloy casting was still light grey and hadn't been blackened by use. Stripping it down showed that there was no scoring on the rotor, housing or relief valve and the rotor was a good tight fit with minimal clearance, so we were happy to use it again.

It was a similar story with the timing gear. The fibre teeth looked good when we first took it off, but Dave cautioned that you can only tell properly once it's been cleaned up. Fortunately ours came out of the degreaser with clean, square-edged teeth and got Dave's nod of approval.

The flywheel didn't do too badly either. The ring gear teeth around its outside edge were good, but there were some slight lines and a couple of hard spots on the surface. A light touch with a grinder took care of these; really more of a clean-up than a re-grind.

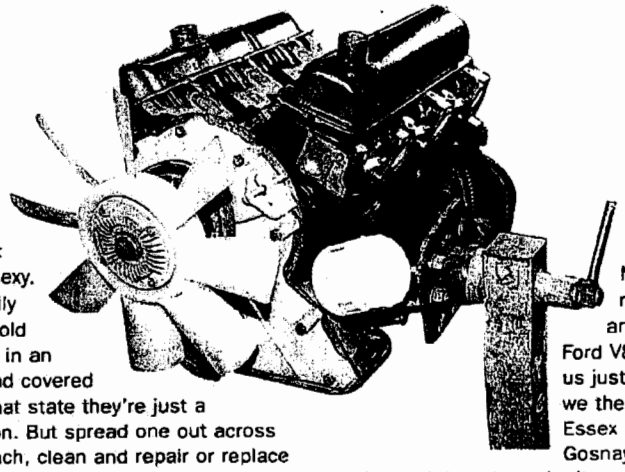
Finally, the cam followers had worn to the extent that their faces had become dished. They'll have to be be replaced, but the pushrods could be cleaned up and re-used. For the cam itself, we'll fit a reprofiled replacement to get the breathing spot on.

Essex 3-litre V6

She's bored, painted and well-oiled. Simon Goldsworthy watches our Essex girl get ready for action

part three

FANCY AN ENGINE FOR A QUID?



IT'S OFFICIAL: engines are sexy. Not necessarily when they're old and tired, sat in an engine bay and covered in grime. In that state they're just a bit of a turn on. But spread one out across your work bench, clean and repair or replace every last piece, then build it back up to fully-functioning perfection and it becomes pure mechanical raunch.

Now, I've little doubt that the guys at Gosnay's who've just rebuilt our Essex are reading this and wondering what the hell I'm on about. But they spend all day, every day rebuilding engines and, just like the Page Three photographer whose idea of a steamy evening is sipping a mug of cocoa and watching Blind Date, their sense of excitement and anticipation has been blunted. For the amateur like you and me, there's nothing quite as exciting as starting the day with a bare engine block and finishing with a complete motor.

But what's the story with this one? Well, when you're talking about sex and raunch, there is a school of though that says 'more is more'. Editor Holman subscribes to this theory, which is why he took the Essex 3-litre V6 out of his Mk I Capri and replaced it with an American Ford V8. That suited us just fine because we then took the Essex down to Gosnay's in Romford and asked them to make it as good as new. So in the January issue they stripped it, and in February they machined out any faults. Now, in our third and final visit, it's time to see how they slotted everything back together.

All of which just leaves us the very enjoyable task of finding a lucky reader to get better acquainted with the old girl. You've got until February 28 to get your name into the hat, using the competition form on page 141. All it costs is £1 per entry, and you can photocopy the form as many times as you wish for multiple entries, or if you don't want to cut up your magazine. It's well worth having a go – there were just over 600 entries for the A-series engine we finished rebuilding in December, making the odds of winning considerably better than on the National Lottery. Sure, we can't offer you the chance of winning several million quid, but we'd rather have a rebuilt Essex any day.

Cleaned and greased

WE STARTED with the block clamped sideways onto the engine stand, much like we left it at the end of part one. But now it was clean, the bores were shiny and the top faces had been lightly skimmed to take off any gasket marks and rust. The father and son team of Dave and Dave Woods had also given it a light dusting of black paint on the outside to stop it developing surface rust while in storage. They'll go over it more carefully again after reassembly to make sure it looks as good as it runs.

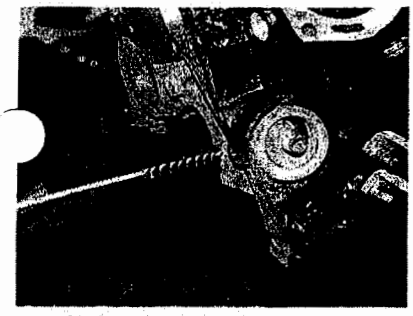
But all this cleaning is more than just cosmetic. There are numerous threaded plugs that provide access to the oilways, and all of these have to be uncovered and removed. That way you can get a wire brush and compressed air right inside the block to clean everything out. You have to do the same with the larger core plugs which provide access to the water jacket but, unlike the threaded plugs, these cannot be re-used. Only when the block is thoroughly clean both inside and out can you start to put the moving bits back in.

Throughout this rebuild, we've tried to make it as relevant as possible to the DIY mechanic working on a limited budget. This issue is no exception, but the two Daves doing our dirty work have one major advantage over the rest of us. Because they did all the machining themselves, they were confident enough of its accuracy to bolt everything back together in one go. If you give the machining work to one place, buy the replacement parts from another and tackle the rebuild yourself, then you

Six of the best

AT THIS point the crank was still very easy to turn by hand. It's only when the pistons go in that it should tighten up appreciably. They were next to go in, but not before Dave had given the bores a quick wipe (with paper rather than a cloth to minimise the risk of stray fibres getting left behind) and a generous squirt of oil. He also staggered the ring gaps to gain a little extra compression during initial start-up, and checked that they were fitted correctly. The

The ring ends of this central portion should butt up together, not overlap.



i need a long wire brush to clean all the galleries. Make sure you don't miss...

... this threaded plug below the oil filter. It hides a common collection point for muck.

Assembly compound sticks to bearings for longer than engine oil if engine is stored.

ed to check everything more carefully. Turn engine over by hand after each component added to make sure it hasn't tightened up nificantly. And if you suspect that there's an a mistake with either the bearings or journals, use some Plastigauge (£9.50 n specialists such as Frost, 01706 3619) to check the clearances.

The crank is the first bit to go back into block. The main bearings to hold it in sition come in colour-coded packs for top d bottom halves to make sure you get m the right way round. But the two halves re in any case different, because only the s had an oil feed hole. As a general rule, ou're not an experienced engine builder, e your time and look carefully at every nponent. If two sides, two ends or two ves are in any way different, don't put m in until you understand why they are erent and so which is the correct way round.

faces where the back of the bearings ed to be clean and dry, but the bearing es themselves have to be lubricated. You n use engine oil for this, particularly if the

Endfloat should be between 0.003-0.006in. Ours was spot on at 0.004in.

Remember to check marks and replace caps into the same place they came from.

motor will be run soon. But if it is likely to end up stored for some time, a graphite past or an oil-based assembly lube will cling to the bearings for longer and provide guaranteed lubrication when the engine is first run.

The thrust washers slide around number two main bearing, with the copper face pointing towards the rotating crank. You shouldn't have to force them into position, nor do you want any more than 0.003-0.006in running clearance. If you suspect that something is wrong, then measure carefully to ensure that the thrust washers are the right size – the running faces on the crank may have been machined to true them up with the main bearings themselves. If so, you'll need a different thrust washer.

The main bearing caps were torqued straight up to the recommended 76-83lb ft, and Dave made it look effortless with his long wrench.

two are clearly marked, so getting them right way up is easy. But the bottom one made up of two solid rims that sandwich springy central portion. It's vital that the ds of this central portion butt up against ch other without overlapping, otherwise ey'll stand proud and pick up on the bores. e ends are painted red, so you can locate em instantly and check before fitting the ston into its bore.

The Essex is no different from any other gine in that you need to use a piston ring mpressor to stop the brittle rings from agging on the block and snapping. Oil this liberally and knock it down squarely onto the block before pushing the piston down and into the bore with a hammer's wooden handle. Dave senior prefers to knock each piston through in turn while his son guides the big ends onto the crank and fits them. He can then go back and refit the bolts permanently one at a time, using a dab of locking compound on the threads. He also likes to use new bolts for this because they're much smaller then those holding the main bearing caps down but take more of a battering, and he doesn't want to take the risk of having one break.

With all six pistons in position and resisting movement up and down the bores, it will become difficult to turn the crank by hand at this point. But it should still turn smoothly if you put couple of flywheel bolts back in and use a screwdriver between them as a lever. Never assume that an engine which needs masses of grunt to turn over at this stage will free up in use. Far more likely is that something has been assembled or machined incorrectly. Ignore the problem now and you can be sure that something will fail in use. It's much easier and much cheaper to investigate and sort it out at this stage.

ou can do it alone, but an assistant guide big ends onto crank is helpful.

More assembly lube on the big ends, just in case the rest of the resto takes a long while.

And some locking compound on the new big end bolts stops them shifting.

Sealing it up

THE CRANKSHAFT rear oil seal is a large rubber O-ring. This needs a liberal coating of oil before you push it into the closing plate, and plenty more when you slide it over the crank. You'll also need a smear of sealant on both sides of the plate's paper gasket because this is very thin and the bolts won't reliably crank up enough pressure to seal it.

At the other end, the camshaft can be slid into position. We fitted a re-profiled cam (a reconditioned one where the lobes have been ground back to the original shape and case hardened again). That makes them slightly smaller overall than the original, but only by a minute amount and that can be adjusted out on the valve clearances.

It takes some fiddling to get the furthest end of the cam located properly, but there is a core plug that affords finger access if you haven't fitted it yet. Alternatively you can fit the sprocket bolt and turn it with a spanner until the cam slides home. You know it's gone in far enough when it sits flush with the front of the block. The clamp will hold it in this position, while tightening the timing wheel will pull it forward to the limit of spacer travel. The two crosshead screws holding that clamp in place can do with a dab of locking compound, and a modest tap with an impact screwdriver will nip them up tight.

Complex paper gaskets can be tricky to line up, particularly if they've been crumpled up in a packet for years. (Cork gaskets dry out and shrink. Never try to stretch them out in this state because they will break. Soak them in water for several hours to restore some elasticity.) Jointing compound can help by holding gaskets in one place while you smooth them out elsewhere. But when we came to the timing cover gasket, this looked like the wrong one. In fact it had dried and shrunk to the extent that getting the two ends into position left the middle part bulging away from the plate. Fortunately there are plenty of bolts holding this cover on, and they were able to clamp it down. We got as many hands involved as possible so we could locate the gasket at several points, then fit all the others before tightening any down.

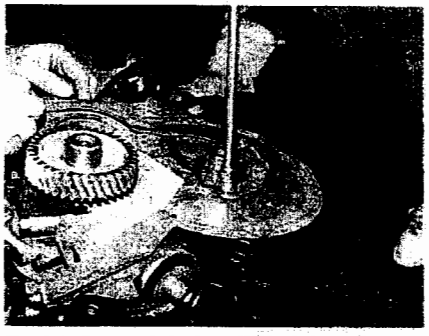
Even then, we still didn't get the gasket and front plate to sit flush with the bottom of the block. That's not unusual on these engines, but the thick cork sump gasket is capable of taking up this slack. On engines with a thinner sump gasket, you'll need to slacken off the bolts again, knock the plate round until it is flush and trim off any excess gasket.

Before the sump could go on, we had a couple of things to take care of. There's a clip holding the driveshaft into the oil pump body. This had been fitted the wrong way round when we stripped the engine – not a disaster, but if you get it right (see picture) it stops the shaft getting pulled out if you ever have to remove the distributor. Dave also primed the pump by filling it with oil. Some of this will drain out as the engine is turned around during the rest of the rebuild, but there'll still be plenty left in there.

The oil strainer had been brazed back onto the pick-up shaft, and Dave took care to ensure there was a good seal between the pipe and the pump. Otherwise, air would get drawn in and pushed around the engine instead of oil. Then the sump could go on, taking care not to over-tighten any bolts that pull into aluminium.

With the bottom end sealed up, we moved on to the timing gear and heads. New cam followers dropped into place after a coating of oil, and the head locating dowels (which had to come out when the block was skimmed) were knocked back in. Then a quick wipe with blue paper cleaned all oil off the head gasket faces (they go on dry) and the heads could be tightened down. Dave does this in three stages of 40, 65 and 90lb ft, working in a diagonal sequence starting at the centre. Then he went around again to make sure that he hadn't missed any.

A non-setting sealing compound helps to stop thin paper gaskets from leaking.



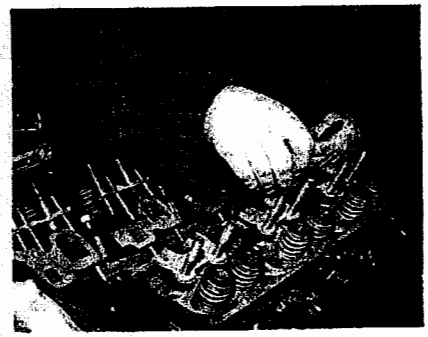
Engine front plate has little integral strength, and needs this reinforcing section.

Take care to ensure that the distorted gasket doesn't pop out before bolts go in.

Finishing touches

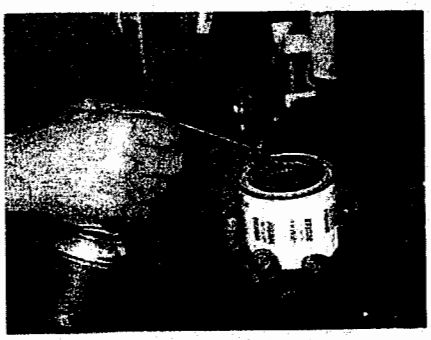
THE FORKED pushrod guides will go on either way up, but will only line up with the pushrod holes in one direction. When we came to tighten down their fixing bolts, these were very tight. Rather than force them, Dave ran a tap up and down the threads to clean off any surface rust that had formed. That didn't help, so he took a closer look at the threads and discovered that somehow some metric ones had got mixed in with the imperial. The correct imperial ones went straight in, reinforcing the maxim that you should never force something into place. If it won't go, you should go in search of the problem and a bigger spanner is rarely the answer.

The pushrods were followed by the rockers, half-round spacers and nuts. These

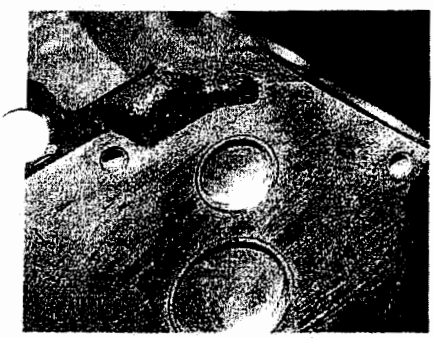


Pushrods have oil hole through the middle, so make sure these are clear.

If gaps are hard to get right, make sure that the finger hasn't moved off-centre.

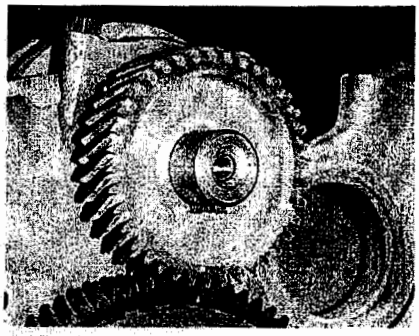


And fill the filter with oil for more immediate lubrication on initial start-up.

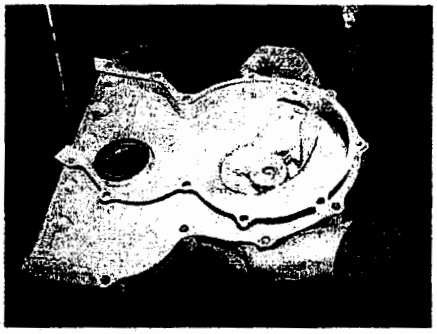


you leave the smaller core plug out at ils stage, it'll be easier to locate the cam.

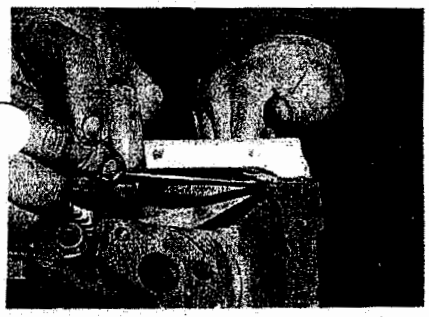
You're aiming to get it to this position, so the clamp sits flush with the front plate.



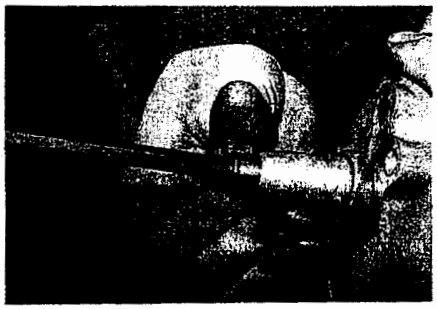
'iming marks must be lined up before he petrol pump cam is tightened.



The wrong gasket? No, just an old one that had dried and shrunk in storage.



And the metal plate can spring out of line too, so don't force reluctant bolts in.



This clip should locate in the groove on the pump and on the shoulder of the shaft.

nuts are crimped on top to provide a self-locking mechanism. That does make them stiffer to turn than you might expect, but also means you only need two hands to set the valve clearances, one for the feeler gauges and one for the spanner. Dave resisted the temptation to tighten them up with an air gun. He doesn't like to use this during reassembly because it doesn't give you any feel for when a thread is about to let go.

On in-line four-cylinder engines, you can set the clearances using the rule of nine: if number one valve is rocking, adjust number eight. If number four is rocking, adjust number five and so on. But the order for V-engines is far more variable so you'll need a workshop manual. Just remember that the cylinders are numbered from one to three starting at the front right, and then four to six starting again at the front, but this time on the left. And rocking? That means that a valve is just moving past the highest point on its cam lobe and starting to pop back out again. Both head bolts and valve clearances will need to be checked again after 500 miles, but the new owner should also be prepared to check the valves earlier if they are noisy (too loose), or so tight that they cause a misfire.

That just left the flywheel and rocker covers to go back on, though we couldn't tighten the covers down yet without the inlet manifold in place. With this engine being used in so many different cars, we have no way of knowing whether the distributor, manifold and front pulley it comes with will be the correct ones for the lucky winner. But whichever bits are eventually fitted, Dave had one final plea to make – please make sure that the carburettor, radiator and distributor are in excellent shape. He's seen too many rebuilt engines suffer damage or give poor performance when dodgy old ancillaries are bolted back on. He's more than happy to rebuild this engine for you again, but it'll cost more than a quid next time.

Our experts

GOSNAY'S Engineering in Romford, Essex (01708 740668) have over 65 years of reconditioning experience. They supply a huge range of engine components from stock and provide precision engineering services, from a simple skim to a full rebuild. Keeping an eye on our engine is Dave Woods, the workshop supervisor and one of the company's directors. He's been with Gosnay's for 39 years and is being helped on this job by his son, also Dave, who has five and a half years' company experience.

Total costs

How the costs stacked up:	
Main bearings:	£36.77
Thrust washers:	£9.73
Big end bearings:	£44.19
Conrod bolts:	£14.38
Piston rings:	£72.16
Gaskets and seals:	£28.42
Head set:	£82.67
Cam followers:	£104.62
Re-profiled cam:	£52.86
Parts total:	**£445.80**
Skim heads:	£47
Fit new guide liners:	£67
Unleaded conversion:	£150
Hone bores:	£51.11
Skim block:	£82.25
Grind crank:	£70.50
Machining total:	**£467.86**
TOTAL EXCLUDING LABOUR:	**£913.66**