TUNING BMC SPORTS CARS

By Mike Garton

CARS

SPEED SPORT MOTORBOOKS

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INTRODUCTION

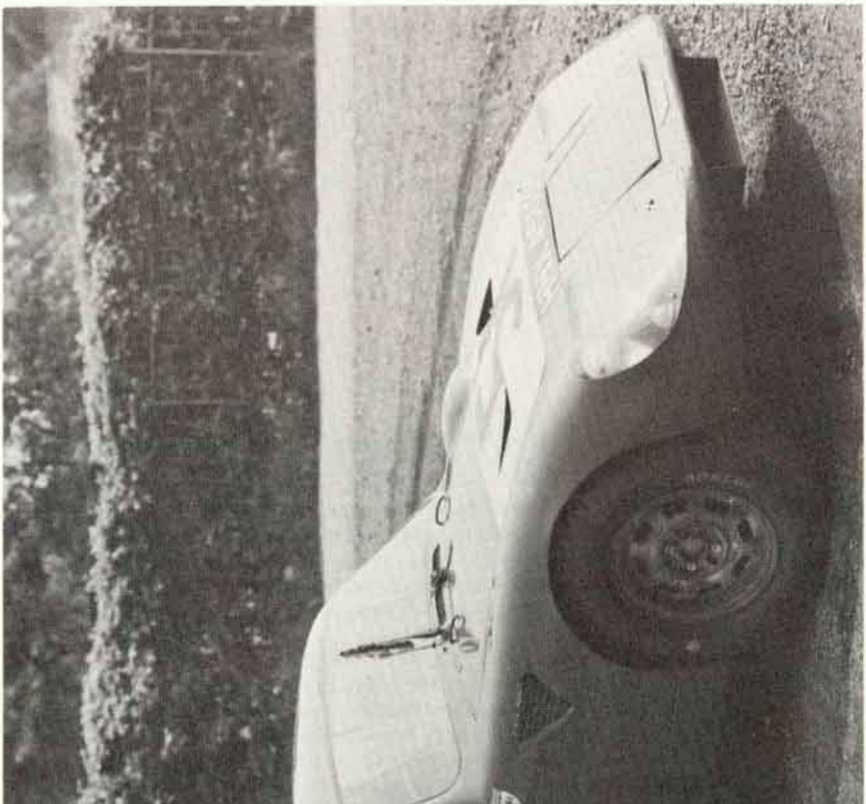
Former technical editor of 'Auto News', Sales Manager for Marcos Cars and journalist, 33-year-old Mike Garton turned to four wheels after several years' success on motorcycles in scrambles and ultra-lightweight road racing, with a season's karting as well.

In 1958 the bug-eyed Sprite was introduced, the 1935 MG 'PA' then owned was changed for a Sprite in '59. An early Austin-Healey Club member, he has remained faithful to this marque.

In 1962 a lightweight racing Sprite was built, MEG 199, which earned itself a formidable reputation and works support for Mike. First winner of the John Gott Trophy annual award, Mike acquired the Donald Healey-built Le Mans coupe ('62 car) in 1963. With the encouragement of Geoff Healey, Geoff Price, Stuart Turner and Peter Browning, private and works entries were to take him to successes on circuits at home, in France, Belguim, Germany, Italy and America. These include 2nd overall in the '65 Brands Hatch 1000 Miles, class wins at 1000Ks, Nurburgring in '67 (3rd in '66) and Sebring 12 hrs., '68. In 1966 Mike was elected a full member of the British Racing Drivers Club.

Since then assorted iron from Cooper S and single-seaters to Lotus 23B have been campaigned.

Now a technical correspondent with the Special Tuning Dept of British Leyland at Abingdon, Mike continues to race in long distance continental events.



1967 Donald Healey built Le Mans prototype.

CHAPTER 1
Early Sprites

B.M.C. Sports cars are synonymous with Abingdon, a quiet Thameside town where the first M.G.s rolled forth in the mid-1920s. We will confine this series to post-1955 models however, but never lose sight of the fact that M.G. development was hammered round the banking at Brooklands.

SPRITE MK I

We will commence with the model that brought an entirely new concept of sports cars to the motoring public, the Austin-Healey Sprite, which first emerged in 1958. The Sprite Mk I stemmed from an idea by Donald Healey, whose agile mind had been the birth-place of several brilliant designs. Much of its initial success was attributed to its 'frog-like' appearance, a bitter sweet reaction ! The 'bugeyed' headlights were, of course, a compromise to comply with export regulations.

A simple 'punt' chassis with all-steel monocoque bodywork, it had the A35 mechanical components grafted to it. The 2.478-in. bore x 3 in. stroke power unit was unchanged except for a sports car 'tweak': twin $1\frac{1}{8}$ in. choke H1 S.U. carburettors. With the very basic 8G712 cam (see chart I), output was all of 42 b.h.p. at 5,000 r.p.m. Compression was 8.3, head capacity 24.5 c.c., the pistons having a 4.2 c.c. dish. Valve sizes were as A35, Minor 1,000, at 1.095 in. inlet, 1.005 in. exhaust. The $6\frac{1}{4}$ in. single-plate, six-spring clutch and standard gearbox ratios were unaltered.

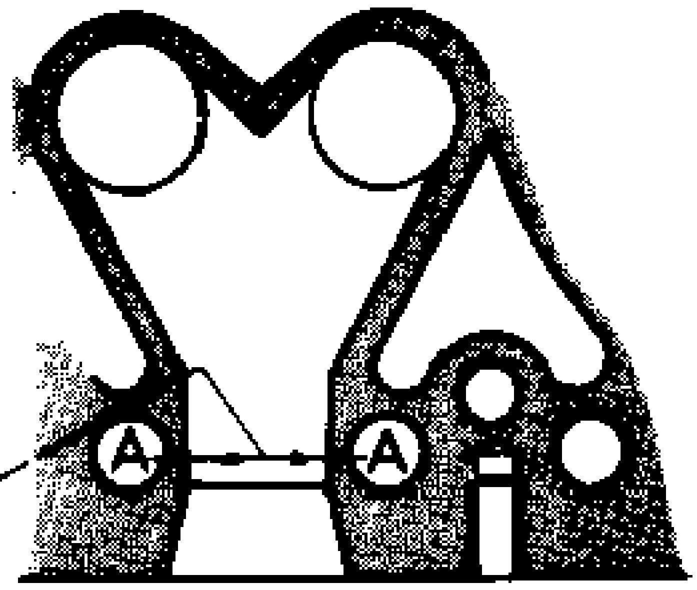
1st	=	3.628	
2nd	=	2.374	Top direct
3rd	=	1.412	
Rev	=	4.664	

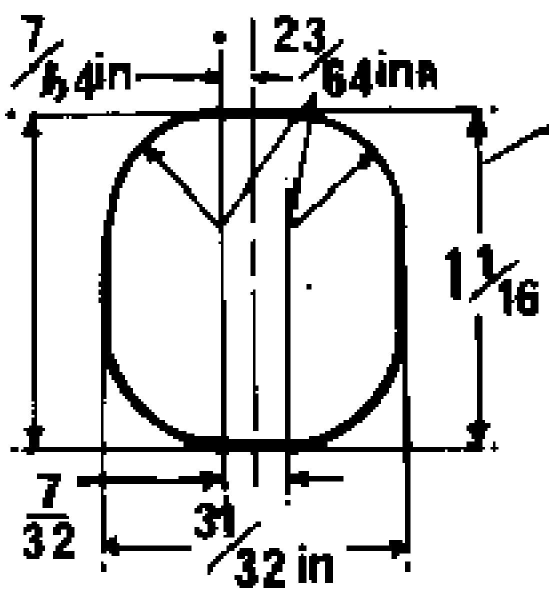
The final drive ratio became 4.22 giving 15.37 m.p.h. per 1,000 r.p.m. Wheels were 13 in. x $3\frac{1}{2}$ in. pressed steel, ventilated type. Suspension was independent by coil-spring and wishbone at the front, with rack-and-pinion steering. Some 200,000 assorted 'Spridgets' later, this remains unaltered. At the rear, the normal 'A' series three-quarter floating axle was located by 15-leaf quarter-elliptic springs and radius arms. Lever-arm Armstrong shockers were fitted all round.

This AN-5 chassis series was in production from May 1958 until May 1961, then 'purists' found that a conventional body line was introduced as the Sprite Mk II (H-AN6), jointly with a commonised M.G. Midget Mk I (G-AN1).

Performance was improved by getting flat-top pistons giving 9-1 compression (different head capacity 26.1 c.c.) and a slightly higher-lift cam, AEA 630. The cylinder head was similar to the 997 Cooper, with larger inlet valves (1.151 in.). Larger $1\frac{1}{4}$ in. choke H2 carburettors were fitted, on a better manifold.

Three camshaft bearings were now fitted, but clamp-bolt con-rods (2A 654 r.h.-2A inlet port

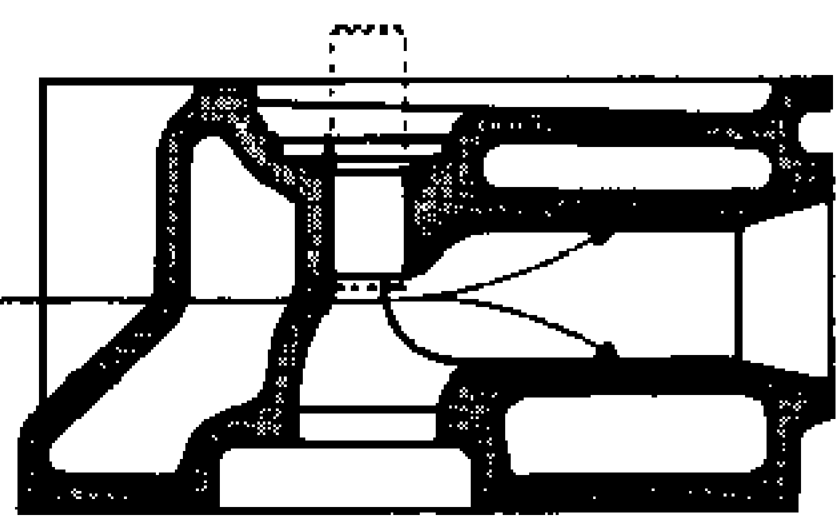




make metal template to this shape and grind out inlet port throat at section A.A. to allow plate to just pass through

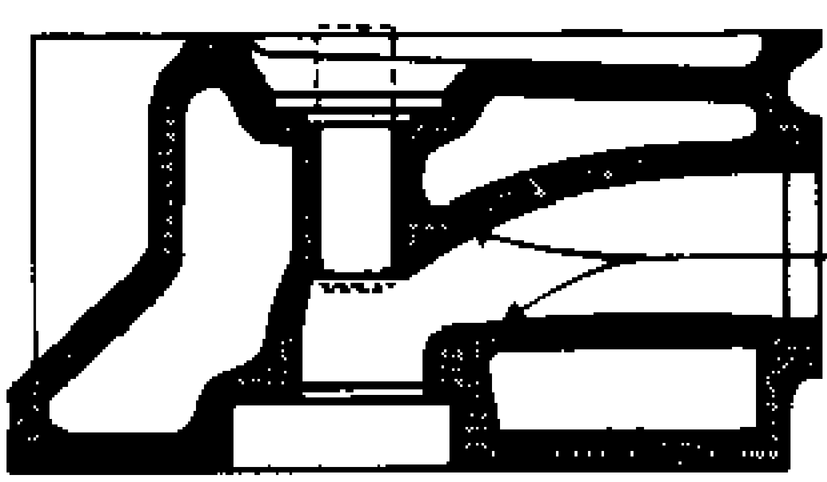
section through the inlet port

remove by grinding



section through the exhaust port

remove by grinding



IMPROVING PORTS ON THE AUSTIN HEALEY MK1

656 l.h.) were retained. The gearbox acquired needle-roller bearings with closer ratios, as follows: 1st, 3.2; 2nd, 1.916; 3rd, 1.357; Rev, 4.114.
Brakes were unchanged, with 7 in. drums all round, giving 70 sq. ins. total area.
The AN-5 chassis had power units with 9C prefix, this became 9CG with the H.AN6/G.AN1 series. It is important to get these correct.
A good set of A.F. ring and open-ended spanners, plus a socket set, are a basic tool kit, together with all the usual screwdrivers, etc., and an electric drill with flexible drive, complete with a set of grinding mops and stones. Petrol, a stiff brush and suitable washing-tin are handy too; make one by chopping a 10 in. x 5 in. hole in a gallon tin. Don't forget to turn back the edges.
A word of warning. It is easy to go ahead and improve performance, even by 100%, but some cars have now endured 10 years' abuse, and it is essential to ensure it is basically sound. There is no point in spending hours on the power unit if brakes and suspension are not up to scratch. It is all too easy to 'leave it till later'. *You* and your vehicle will be lethal.
What degree of tuning is required, for what purpose?
The 9C cylinder head will be improved by carefully polishing all casting marks, frazes, etc., from the combustion chamber, gradually radiusing the central projection. Do not remove it altogether. Inlet ports should be enlarged and polished (illustration A1). Make a template, and do not exceed this shape, as the wall is very thin at this point. The compression ratio can be increased by fitting the 9CG flat-top piston, to 9.3:1 or by removing approximately .065 in. from the head face. The head depth can vary tremendously and there is danger of penetrating the bottom oil way. A 'dodge' to check the available depth is to put a thin steel wire down the rocker feed hole; measure this depth, then deduct it from the measurement of the head-face-to-pillar-face depth. Remember to leave sufficient metal to prevent warping; .085/.090 in. is normally a safe maximum.
To establish your actual compression ratio you must obtain details, some of which can be regarded as constants. See Chart II.
After working on the combustion chambers you must also balance them. We can achieve this by placing the head face uppermost with plugs and valves in place (all polishing, valve grinding completed). Place a piece of perspex totally covering the combustion chamber, but with a small ⅛ in. hole in its centre.
Using Redex and a burette, the capacity is soon found. Alternatively, a crude but equally efficient method is to pack the combustion space with children's Plasticine, carefully levelling it flush with the head face. Remove *all* of it (shape is unimportant) and drop it into a measuring cylinder, graduated in c.c.s and containing a known quantity of water. Before-and-after readings give the volume displaced. Most good chemists retail these glass cylinders.
The volume of the compressed gasket is approximately 3 c.c. throughout 'A' series, except for Cooper 'S' and 1275 Sprite/M.G. at 3.8 c.c. The piston depth annular groove varies a little; Chart II shows that some models differ, in particular the 1275 c.c. units and the 998 c.c. Cooper.
Next we need to know what effect the piston has, e.g. flat top, dished (volume of dish) or raised crown (volume displaced). Finally, we need the actual engine capacity divided by four for the individual cylinder. Basic capacities are known but what if the unit is bored?

1. Geometry tells us Pi × radius² = Area (Pi = 22/7 or 3.1416)
2. 948 c.c. bored + .030 in. = Std bore 2.478 + .030 in.
3. = 2.508 in. bore diameter, 1.254 radius
4. (1.254 in. × 1.254 in.) × 3.1416 = 4.965 sq. ins. × (stroke) 3 in. = 14.985 cubic inches

   Multiply this by 16.38 to give 244 c.c., which is swept volume.

   The combustion chamber capacity (std) is 24.5 c.c.

combustion chamber vol	= 24.5 c.c.
gasket vol	= 3.0 c.c.
Annular groove	= .8 c.c.
9C Piston (12A 145) dish	= 4.2 c.c.
Unswept volume Total	= 32.5 c.c.

Add this figure to the swept volume 244 c.c. and divide this total by 32.5 for the correct compression ratio.

e.g. $\frac{\text{unswept vol} + \text{swept volume}}{\text{unswept volume}} =$

$$32.5 + \frac{244}{32.5} = \frac{276.5}{32.5} = 8.5{=}1$$

By using this formula and Chart II, you can obtain compression to suit, without machining heads. All the cylinder heads can be interchanged, but head clearance differs, with the result that larger valves overlap the bores and the block must be relieved for clearance by at least .060 in. This manifests itself to a greater extent when different cams are used (Chart I). AEA 400 exhaust valve in KE 965 material should be used in the 'A' series heads except for Cooper S and other 1275 c.c. units.

To obtain a moderate power increase on the 9C engine, therefore, we must polish and balance the head and fit 9CG Piston 12A 187 (or machined head). To take full advantage of the raised compression, the Cooper 997 camshaft, 88G 229, has higher lift with increased valve period. The cam profile determines the valve-crash point, relative to spring strength and weight of valve gear. There is no advantage in raising the valve-crash point by fitting too strong a spring, or combination of springs.

The only result is excessive load on the cam followers and lobes.

Always use the 12G 793 oil-pump when rebuilding; it is the most efficient for this type. As, initially, we have retained the clamp-bolt rods and, we assume ,standard crankshaft (balanced as an assembly with flywheel and clutch pressure plate) AEA 311 valve springs should be retained. These will restrict r.p.m. to approximately 6,400 with the 88G 229 cam.

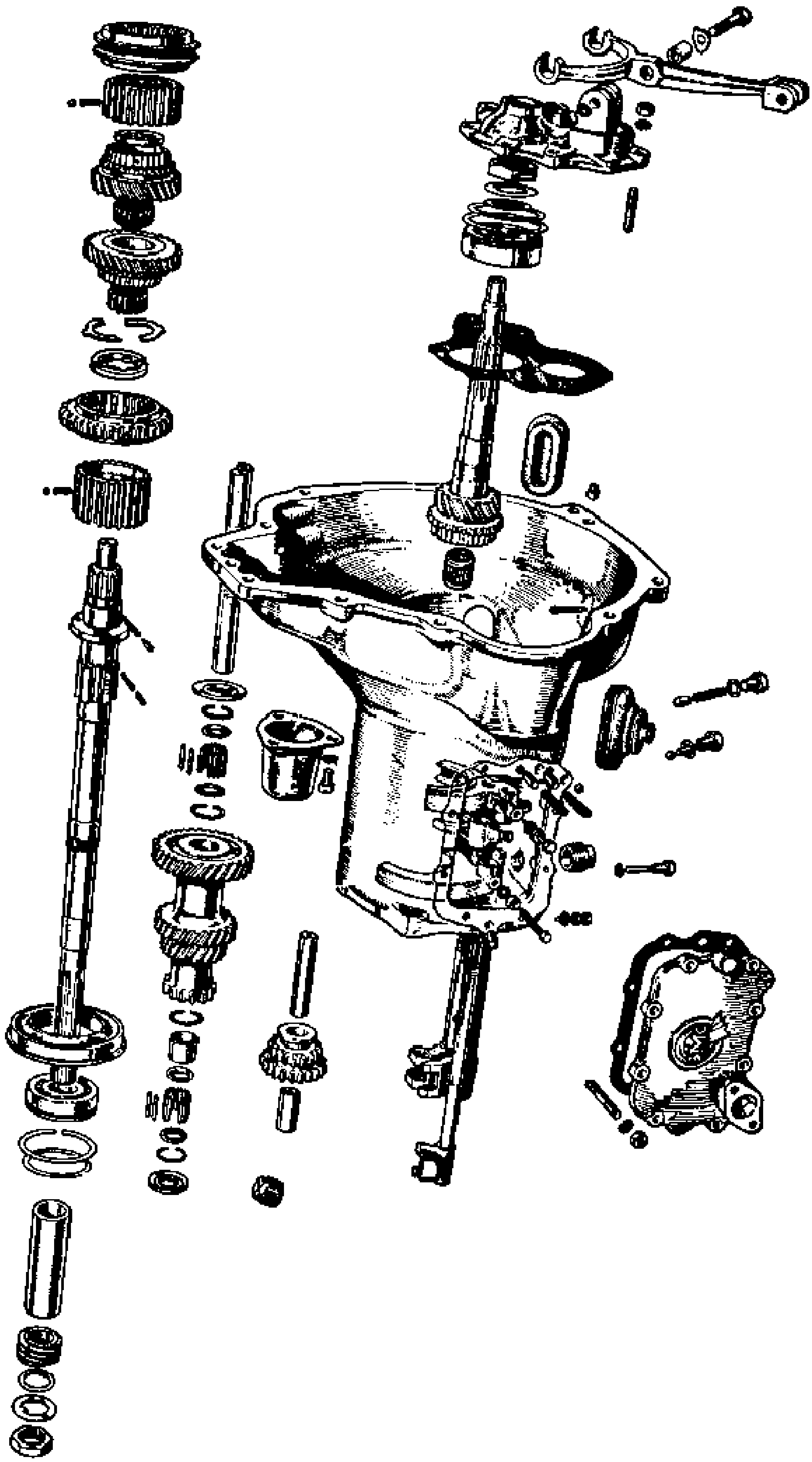
Use the Mk II (9CG) inlet manifold and H2 carburettors, carefully matching the manifold to the head ports. Replacing the production exhaust manifold by a good three-branch type is beneficial in scavenging the cylinders, and worth two to three additional b.h.p. The standard distributor is unsuitable, and should be replaced by the special competitions one, C-27H 7766, with matched advance curve. This is also ideal for the semi-race cam C-AEA 731. Static setting for the ignition should be one or two degrees before T.D.C., using N6Y plugs. Carburettor needles should be V3 with blue spring, AUC 4587.

Power output should now have increased from its normal 42.5 b.h.p. at 5,000 to around 55 b.h.p. at 5,800, more than the standard Mk II 9CG unit. For a further increase for competition it is wiser to increase capacity. At the same time we can use the fully floating gudgeon pins. There is a choice of pistons for this purpose; ideally, the 9CG block is a better basis, with bearings for all camshaft journals.

Crankshafts have been available which enabled high r.p.m. to be used safely. C-AEA 406 was an improved-material specification with identical measurements to standard; this was the 'red crank'. A safe maximum with this was around 7,500 when correctly balanced. (This is essential to the life of the component.) Always balance the crank with the flywheel and clutch. C-AEA 461 was a more expensive nitrided component for Formula Junior engines. Due to its thicker webs, the centre main casting of the block had to be reduced in width by .063 in. either side. At the same time the centre cap was 'strapped'. This is useful when building any 'A' series block, and is simply a matter of machining the cap flat and fitting a steel billet .5 in. thick on top. Retain this by longer high-tensile studs and Nyloc, or similar, nuts.

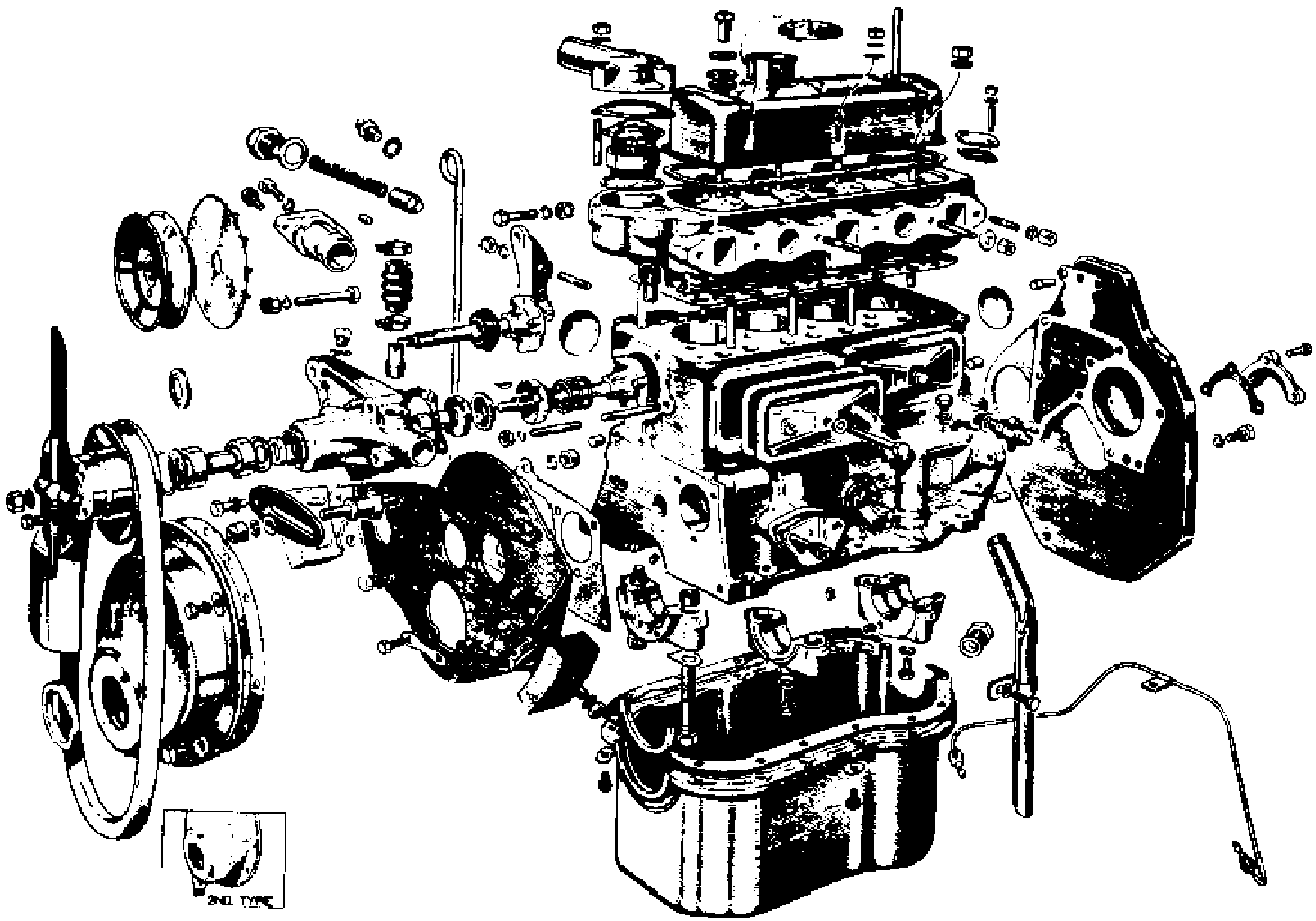
If you are fortunate to obtain one of these cranks your r.p.m. limit is considerably extended. A new Tuftrided crankshaft C-AEA 792 is now available from B.M.C., probably safe to 7,500 r.p.m. For a maximum-power unit the standard con-rods should be discarded. Replacements are a choice of the standard 9FA Cooper type, 12G 123/126, which can be fitted with 12A 674 original pistons to a 2.543 in. bore (.065 in. oversize). The Formula Junior pistons, C-AEA 639, have a slightly domed top, requiring special rods C-AEA 620 and 621 as the gudgeon pin diameter is larger than standard at .687 in. Bore size is 2.538 in. (.060 in. o/size). With the 3 in. stroke crankshaft, the respective capacities would be 998 c.c. and 995 c.c. The con rods should be carefully weighed end-to-end. Using the lightest one as standard, reduce the other to identical limits.

At this stage we require a more efficient cylinder head. The 12A 184 (9CG) is a



SPRITE MK1 GEARBOX

BY COURTESY OF BLMC



SPRITE/MIDGET ENGINE EXTERNALS

BY COURTESY OF BLMC

improvement on the 9C type. Its capacity is greater at 26.1 c.c. and this would give approximately 9.8 compression with the 'D' top Cooper piston.

Much better still is the MG 1100/Cooper 998 head, 28G 222. Its inlet valve head is larger, 1.219 in. and the general casting, is much better too.

Inlet ports should be carefully polished to a good finish, and exhaust ports can also be polished to remove casting marks, etc. Carefully smooth the combustion chamber leaving no sharp edges. The spark plug orifice is a favourite point to overlook; radius the peak away, and if valve seats have a 'sunken' appearance, blend them to the profile. Check that the ports blend smoothly to the valve seat and cut this to leave minimum area of contact: 'knife-edge' the valves in fact. Radius the non-contact areas of the insert. Unless one is extremely skilled, the production valves 12G 296 inlet, AEA 400 exhaust, should be polished but left alone.

This head has 28.2 c.c. capacity and this would provide 9:1 with the 12A 674 pistons. The C-AEA 639 piston does, however, rise .020 in. approximately above the compressed gasket height, displacing all the neutral volume except the combustion chamber. With these, the compression ratio would be 10:1 approximately. A similar ratio can be obtained by machining the head as detailed earlier, to reduce its capacity; approximately .045 in. should suffice. A compression ratio of 11:1 should be regarded as optimum for tractability, and this would require a 22 c.c. head capacity with 12G 674 piston, 25 c.c. head with C-AEA 639 pistons; these, would be in relation to approximately .095 in. and .050 in. from the head face.

Alternatively, the latest Sprite Mk IV (H AN9), M.G. Midget III (G AN4) head, 38G 399, could be used, with the 12A 674 piston. Its capacity, at 21.4 c.c. standard, is approximately correct, and it would require only light polishing. Valve sizes are increased to 1.307 inlet, 1.156 exhaust. This head would have to be relieved to be suitable with the C-AEA 639 pistons, though; compression would be 12.7:1 as standard.

The valve springs fitted to the 12A 184/28G 222 heads are AEA 311 outer, AEA 401 inner. The inner is fitted with different collars (AEA 402) at the top and also one is fitted at the bottom (AEA 403).

With these springs, with the C-AEA 731 and C-AEA 648 race camshafts, you will not experience valve-crash until 7,000.

The springs fitted to the 38G 399 head (12G 1136 outer/12G 1137 inner) have a slightly increased rate, but this would be cancelled by the weight of the valves to some extent.

CAMSHAFTS & CARBURATION.

The increased cam lift and spring load renders the standard timing chain unsuitable at high r.p.m. Convert to Duplex by using 'S' type components; B.M.C. make a kit (C-AJJ 3325) which includes the countersunk hardened screws for the front plate. A lightened steel camshaft sprocket, to suit the Duplex chain, is C-AEG 578.

Early rocker gear of the pressed-steel type should be discarded in favour of the forged rockers. Current production Cooper 'S' models have a new, lighter forged type, 12G 1221. These have adequate strength for all purposes, and can be lightened still further by lightly radiusing the bosses and valve contact area shoulders.

The shaft should be changed to C-AEG 399: this requires an additional tapped pillar on which the locating screw has been sawn off flush with the threads. The purpose of this is that the locating hole, which can cause failure with excessive loading, is moved in to a point where it is supported on both sides. At the same time, the springs should be changed to spacers (C-AEG 392) and washers (AEG 168) adjusted to locate each rocker centrally over the valve stem.

Whichever head is chosen, with a compression ratio around 11:1 you will now require better breathing.

The choice is between a pair of 1½ in. S.U. (.090 in. jets, blue spring AUC 4587 and AM or CP4 (race) needles) or a 45DCOE9 Weber. The 1½ in. S.U.s could be mounted on the Sprite Mk IV manifold opened out and matched to the head ports.

If the Weber is used, the approximate settings are:

Choke	36
Main Jet	1.50/1.55
Correction Air Jet	1.75
Idling Jet	.50/1.55
Pump Jet	.60

Emulsion	F2
Auxiliary	3.5 m.m.
Float	7.0 m.m.

With either C-AEA 731 or C-AEA 648 cams, the C-27H-7766 distributor is suitable, as is the Cooper 'S' distributor, 12G 445, with no vacuum advance. Static setting should be T.D.C. and power should be around 75 b.h.p. at 6,500 r.p.m.

If the ignition and carburettor are carefully set, there should not be any overheating problem. It is just as well to throw away the thermostat and replace it with blanking sleeve 11G 176. This *does* have a purpose! It prevents coolant rushing through the head without circulating around valve seats, etc.

When the bonnet is back on, it's just as well to check there are no gaps between the cowling and radiator on Mk I's or forward opening bonnets. In particular, the bottom of the radiator matrix should be checked.

Place your oil cooler (always a wise investment) alongside the radiator, *not* in front, and feed it with the fresh air intakes.

TRANSMISSION & SUSPENSION.

What do we do with the power now? Well, there is no point in wasting it with a slipping clutch and ruining the flywheel into the bargain. The flywheel itself should be lightened to the limits as shown (illustration B). Don't attempt to exceed these limits. A fractured flywheel is expensive, and *you* may never be the same again.

The standard six-spring clutch is useless for competition. Automotive Products can supply a $6\frac{1}{4}$ in. competition nine-spring assembly, under the following part numbers: Cover Assembly, 50333; Drive Plate, 45585/41; Release Bearing, 50345; This uses spacer washers (six off) 50332. A 'deep bowl' version has also been available, which eliminated the necessity for spacers. This clutch is perfectly suitable for most competition work, but special applications may need different driven plates and in this respect you should contact A.P. Competitions Department at Leamington Spa.

Little can be done with 9C gearboxes other than to bring it to the 9CG closer ratios. The following table shows the comparison:

9C		9CG
3.628	1st	3.2
2.374	2nd	1.916
1.412	3rd	1.357
4.664	Rev	4.114

The conversion was achieved by using the following parts: 1st Speed gear, 22A 426; Reverse gear, 22A 204; Lay Gear, 22A 207; 1st Motion Shaft, C-22A 228; 2nd Speed gear, C-22A 226; 3rd Speed gear, C-22A 227. Top is direct in all cases. These gears are no longer available.

There are no alternatives for the 9CG box. The stronger spur-gears cannot be fitted, as the 1098/1275 c.c. gearboxes have larger diameter mainshafts. The layshaft should always be replaced by the stronger, later type, 22G 673. The most satisfactory answer is to utilise the 1098 c.c. gearbox, 38G 374. Basically stronger (the 12G 673 layshaft should still be fitted), this box enables you to fit the noisier but stronger spur-gear set, C-AJJ 3319. Ratios on them are as follows: 1st, 2.573; 2nd, 1.722; 3rd, 1.255.

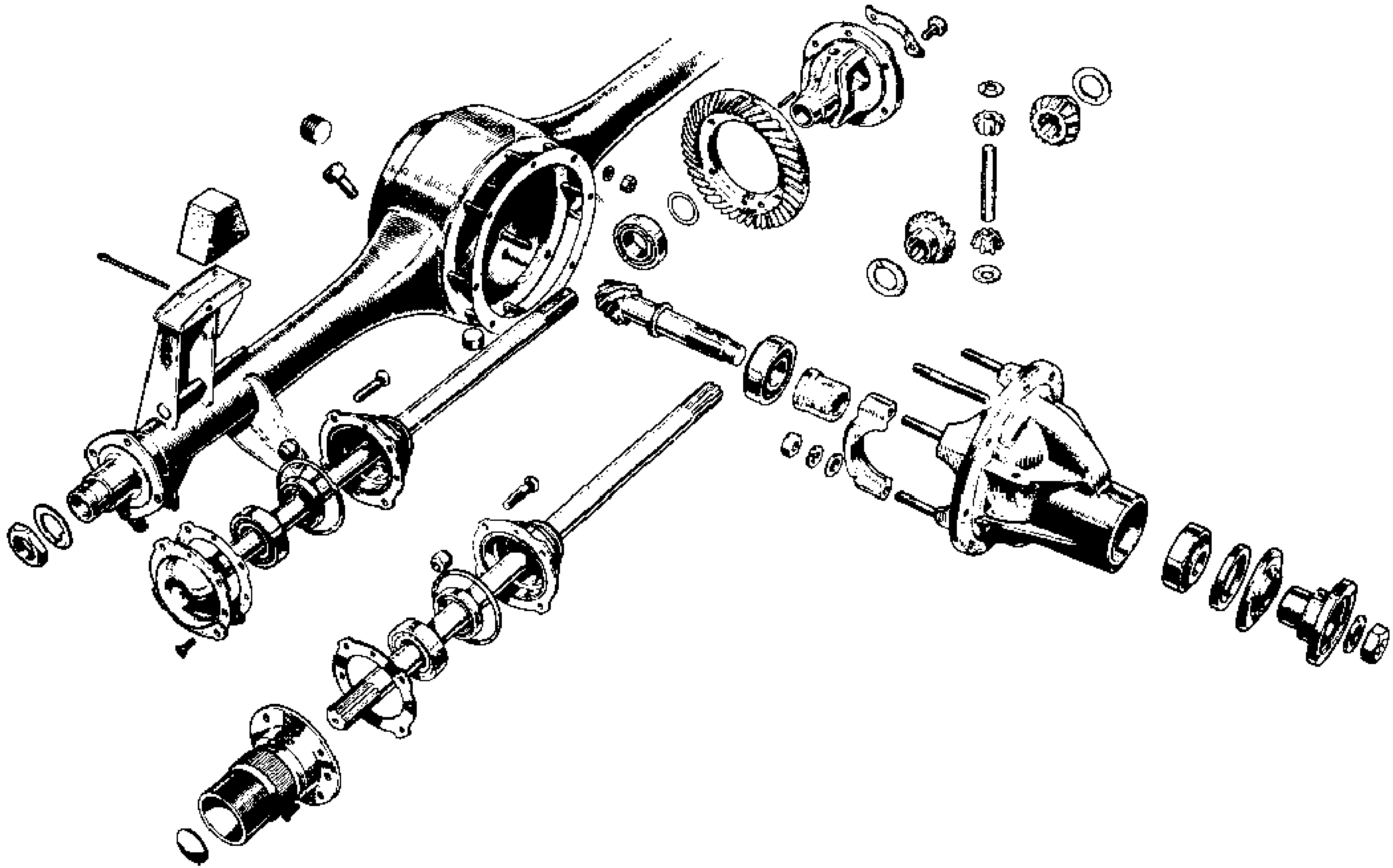
Fitting this box also enables the $7\frac{1}{4}$ in. 1098 competition clutch, C-BHA 4448, with driven plate C-BHA 4449, to be used, as the bell housing has more room. This requires the thicker mounting plate. Obviously the larger flywheel from the 1098 model has to be used, only 12G 180.

The 'A' Series rear axle serves its purpose well and has a wide choice of ratios:

		Assembly Part No.
3.727	Riley 1.5	ATA 7239
3.9	Competition	ATA 7353
4.22	Std Sprite	ATA 7326
5.55	Minor 1000	ATA 7093
4.875	A.35	2A 7230
5.3	Post Office	ATA 7230
5.3	Post Office Minor 1000	ATA 7073

Some of these can no longer be obtained, other than as complete diff assemblies, or secondhand. It is rare for the actual crown-wheel and pinion to be damaged so a search round breakers yards often provides them cheaply.

Later Sprite axles, after HAN7-24732/Midget G-ANZ 16184, have a different diff-assembly, with the filter on the case The nose assembly is interchangeable. (only 4.22, 3.9 and 3.7 can be obtained for this carrier assembly) but this would result in no level plug. The older assemblies can be fitted in later axles when there is a surfeit of fillers. If you are interchanging a crown-wheel and pinion only, you must beware of the difference in some pinion



SPRITE/MIDGET REAR AXLE

BY COURTESY OF BLMC

shafts. The inside diameter of the pinion bearing can be either 1 in. or 1.1875 in.

In all cases the HAN9/GAN4 axle-shafts, BTA 607, should be fitted. A special competition shaft is also available in limited quantities, under part number C-BTA 940. Limited-slip differentials, while expensive, reduce the strain on drive-shafts over bumpy surfaces, and eliminate power lost through spinning wheels. These were obtained from B.M.C. (C-BTA 696 or C-BTA 881 part numbers), or the latest type available C-BTA 1226.

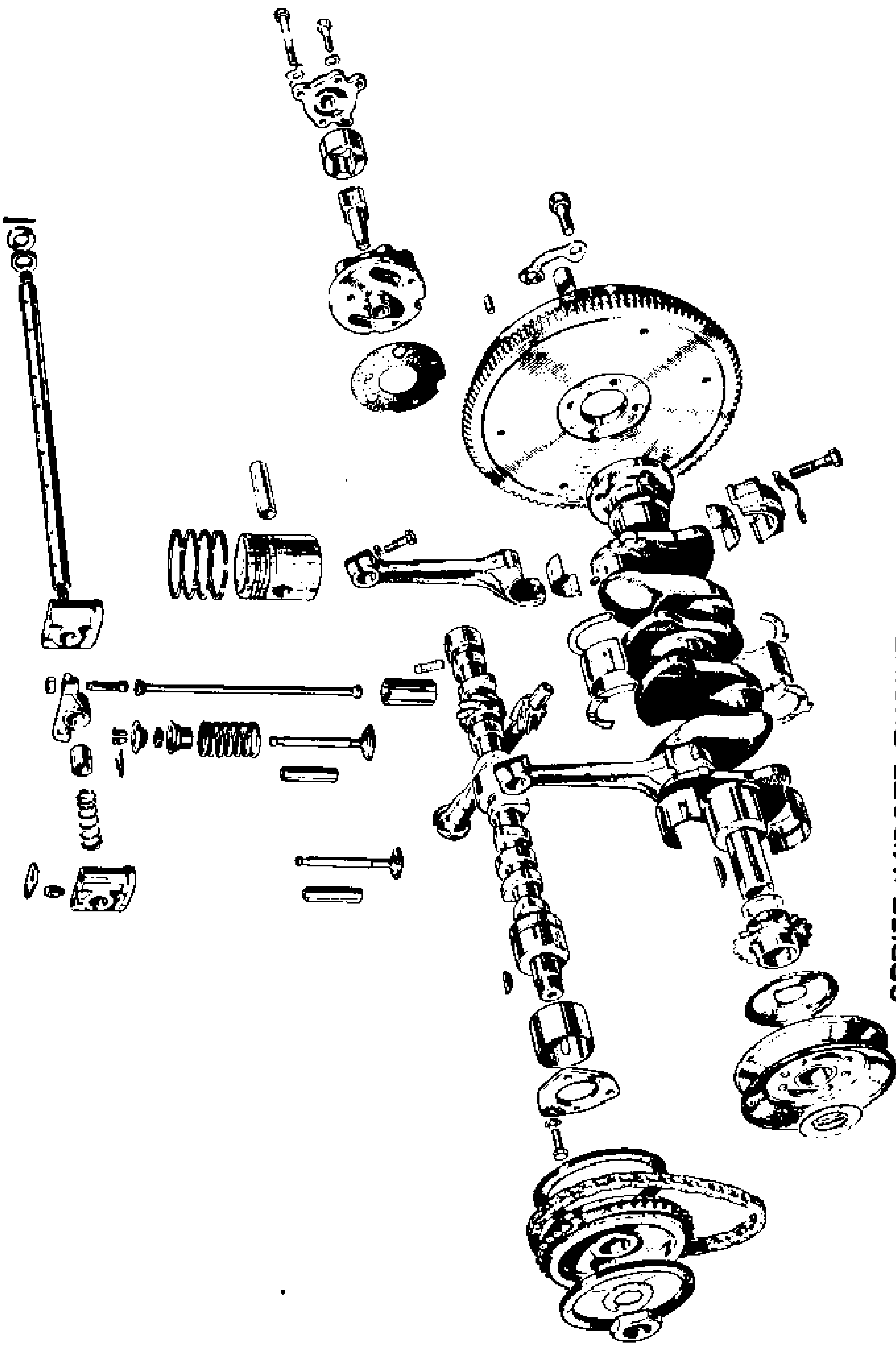
Suspension was always good with AN5 series and their early lighter bodies. It is not wise to lower the car too much if it is used for normal roadwork. Competition-wise, the front can be lowered by using spacers above the spring pan; these increase the fitted length and reduce the pre-load of the spring. The springs fitted to later 1098/1275 models are increased in rate by 50 lbs which, with spacers, would not lower the car quite so much, yet be stiffer. It is possible to get them cut and ground, thus lowering the car without spacers at all but this should not be attempted willy-nilly. The coils must be ground accurately to stress the working coils correctly; approximately 0.2 in. reduction would reduce the rate by 50 lbs. A number of roll bars can be obtained varying in diameter from 9/16 in. to ⅝ in. Remember that stiffening and/or lowering the front increases understeer. This can correct oversteer caused by lightened bonnets, etc. Drill the bottom links for the fittings, or alternatively, you can obtain bottom links ready drilled, AHA 7029/7030. Competition shock absorbers are available that effectively control the stronger rate springs. Replacement valves can be obtained but these should only be used when the original equipment is in good condition. Mount the shocker upright, and pump it a number of times to expel all air.

It is not possible to get lowered springs for the rear quarter elliptics. A stiffer, heavy-duty type, AHA 5468, is available with thicker but fewer leaves. A popular 'mod' is to reduce the number of leaves on the standard spring, again especially when light fibreglass rear ends are used. Wedges to change the ride height, by angling the springs up or down, are available (AHA 6456). Adjustable shock absorbers were available for quarter elliptic models after HAN5-4333. C-AHA 6453/6454. At this point the mountings changed. These shock-absorbers are no longer available but later 7906/7 type can be used by changing the links (4¾ in. on early models) and using a 5/32 in. spacer between the shocker and chassis.

The axle locates itself quite well but owners often experience wheel lift in corners, attempting to combat this by continuously stiffening the shockers. Practice often proves that the opposite will effect a cure, more so with softer springs.

Wheels present a problem, in that the rim-width continues throughout the range at 3½ in., both disc and rim type. B.M.C. only make a 60-spoke wire wheel (C-AHA 7573) with 5 in. rim for competition. Stronger 3½ in. disc wheels, without perforation, were introduced under part number AHA 6455. The practice of cutting and welding wheels is undesirable, as there is no way of checking the stress limits or accuracy: for 1969, such wheels will in any case not be permitted by scrutineers. The expensive alternatives are alloy or magnesium wheels. These can provide rim widths to choice which do not require spacers. Spacers are always undesirable, as they increase the load shared by studs and hub bearings; a 1 in. spacer can increase such stress by 25 per cent. A 5 in. rim is a good medium for the all-purpose owner, but for a full circuit car, the low-profile Formula 2-style tyres require 7 in. or 8 in. rims. These present problems peculiar to themselves, not least being premature failure of hub bearings. There are no acceptable mods for the front bearings, but it is wise to fit the later stub axles BTA 744/745, which have a stronger specification.

Rear hubs also present a problem. They must always have the bearing lock nut absolutely tight. Any play will result in the bearings turning on the casing and in the hub itself. This will fracture the half-shaft flange under side thrust. Various mods have been tried, including special hubs with an additional inner bearing. While



SPRITE/MIDGET ENGINE INTERNALS

BY COURTESY OF BLMC

these do stiffen the hub they introduce greater stress on the casing, leading to failure! You can't win.

Brakes are quite suitable for normal roadwork but hopeless for competition work. Ferodo VG 95 linings help reduce fade, but require more pedal effort. This was dealt with on the Warwick-built 'Sebring' cars by homologating a Girling 8 in. disc/8 in. drum system for use with wire wheels only. All the works entries were so equipped. This had separate master-cylinders for clutch and brakes.

The standard system has always been Lockheed, and Healey's also introduced a Lockheed conversion for AN5-6/GAN 1 models. This was a good improvement for disc wheel cars, using PL caplliers. The combination master-cylinder had an extension fitted, and the residual valve changed. Discs were 8.75 in. diameter, larger than the Girling system, and it was much cheaper. To convert early models now presents no difficulty, for the production disc brakes introduced with HAN7/GAN 11 models easily adapt. The master-cylinder should be changed to BHA 4365, as well as the callipers, discs, hoses, etc. You must ensure the hoses do not foul when the wheels are turned, lock to lock. Special DS 11 pads (C-AHT 16) are readily available for these, but you should retain the standard linings on the rear for balance. The swept area of these discs is some 25 per cent. greater than the special Girling set-up.

During these early years, apart from the Warwick-built 'Sebring' (so named after their successive class wins and identified from normal production cars by the special Donald Healey chassis-plates) there were also limited production specials by Speedwell, Doug Wilson-Spratt's Healey Centre (W.S.M.) and the Abingdon-built Midgets campaigned successfully by Dick Jacobs. These appealed by having pretty aluminium bodies grafted on to the Sprite platform. The Donald Healey and M.G. cars were in some cases homologated within Appendix "J" regulations, as were the Speedwell versions.

Various special engine capacities were introduced in these competition versions for particular events. B.M.C. units from their development had the XSP prefix, with various strokes and bores, some of which are now in private owner's hands. Dimensions are as follows:

960=(948 .020 in.) 2.498 in. × 3 in.
995=(948 .060 in.) 2.538 in. × 3 in.
999=2.82 in. × 2.438 in.
1098=2.667 in. × 3 in. (short stroke) 1.75 in. mains
1138=2.59 in. × 3.3 in. 2 in. mains
1293=2.8 in. × 3.2 in. 2 in. mains

Speedwell also had their own developments; of notable interest was an 1100 unit with six-port alloy head and using *four* motor-cycle AMAL carbs. With dual pumps operating a scavenge system, they were supplied by a weir principle. Alexander Engines also introduced a special version complete with 'speed' stripe in tuned and super-charged form.

Alloy heads were available in normal or six-port form, most of which were liable to either warping or porosity. Biggest power gain from a single item was the crossflow head, also in alloy and very expensive. Unfortunately, these were liable to lose guides at inopportune moments, leading to even more expensive repairs.

The supercharging method is often adopted since it can be cheaper than advanced conventional tuning, but I feel you should still strip and fully balance the power unit. The C75B 02 Shorrocks was a four-vane type unit, driven at under crankshaft speed. This had a displacement of 730 c.c. per revolution. Using a single H.4 1½ in. S.U. with 100 in. Jet and R.F. needle, the power output was around 68 b.h.p. The 'Sebring' models also offered one on a race-tuned engine, giving around 90 b.h.p.

CHAPTER 2
The 1098cc Sprite Midget

During production of the Austin Healey Mk 11/MG 1 at HAN6-24731/GAN1-16183, a larger power unit and baulk-ring synchromesh gearbox was introduced. These HAN7/GAN2 versions also had the disc brakes (referred to earlier and still current) and half-elliptic rear springs. Wire wheels became a factory option instead of the specialised conversion.

These early 1098 models (10CG Prefix) had 2.543 Bore × 3.296 in. stroke, still retaining 1.75 in. mainbearings: no special crankshafts were available. Unsuited to tuning, a peculiarity was local overheating, causing the core-plugs to pop out with increasing regularity.

Other than mildly polishing the combustion chambers, these units are best left untouched.

Introduction of the H-AN8/GAN3 models, in March, 1964, with smoother bodyline, curved screen, wind-up windows and repositioned instrument panel, also brought the 10 c.c. 1098 engine which, with 2 in. main bearings, was much more robust. Basic compression ratio 8.9, with the same head capacity as the 10CG at 28.29 c.c. inlet valves were larger, however, at 1.219 in. diameter, the head being basically identical to the 998 Cooper 28G 222.

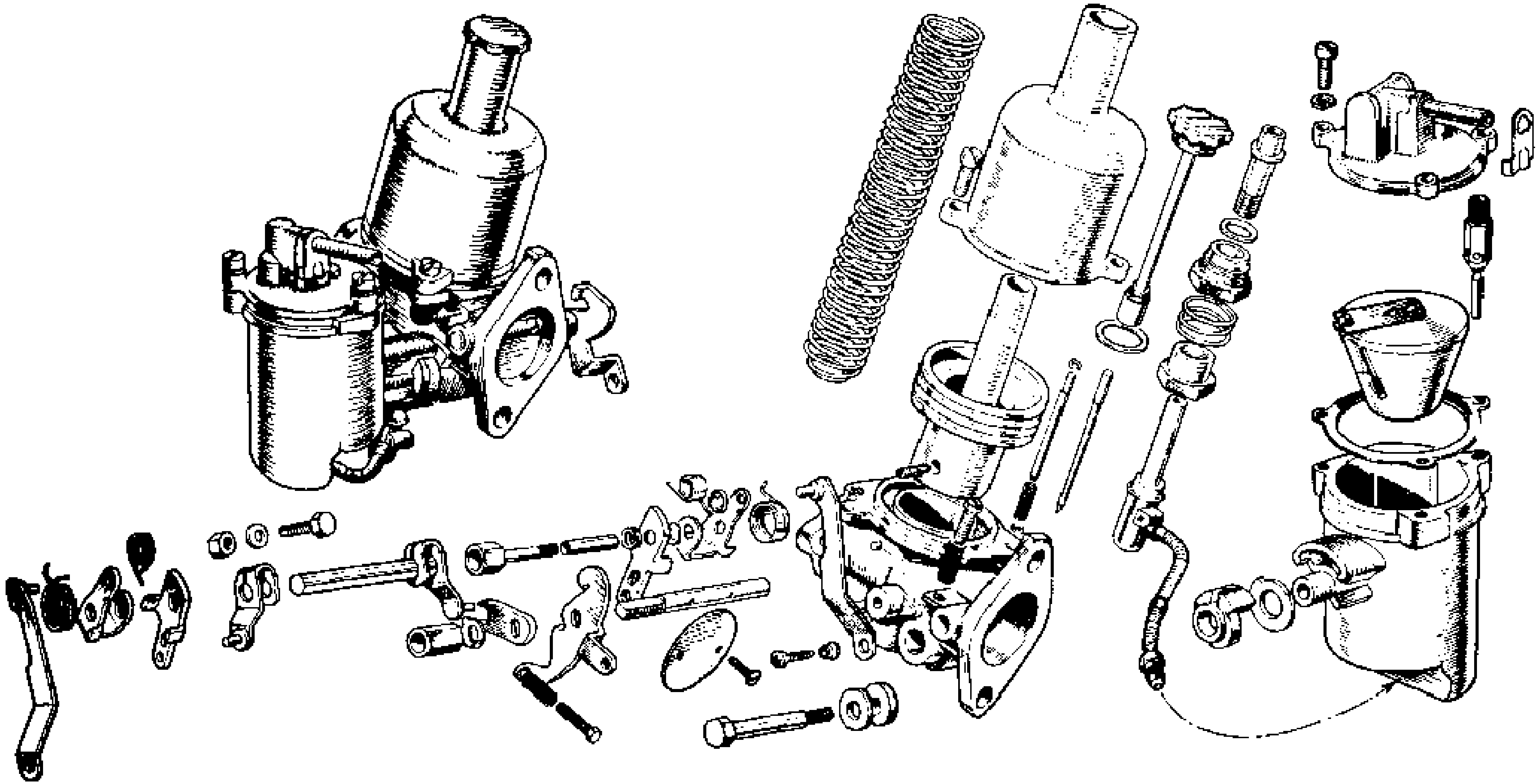
The efficiency will be improved by carefully polishing and radiusing sharp edges. NEVER radius the combustion chamber/head face angle. The throat width in illustration A1 can be taken to 11/32 in. on this head, with extreme care. It is still possible to obtain the domed competition inlet valve (C-AEA 628) of 1.280 in. diameter to fit this head, with the seat suitably ground out.

Special crankshafts are no longer available for these models, but suitably balanced as a complete assembly, with clutch, lightened flywheel complete, it should be 'safe' to 7,000 r.p.m. If you have a crank reground undersize or change any reciprocal parts (clutch, flywheel) you must rebalance the whole assembly. R.p.m. should be restricted with undersize cranks also.

Pistons present a problem due to their very small compression height (Chart II). What we need are rods .15 in. shorter between centres, but they don't exist!

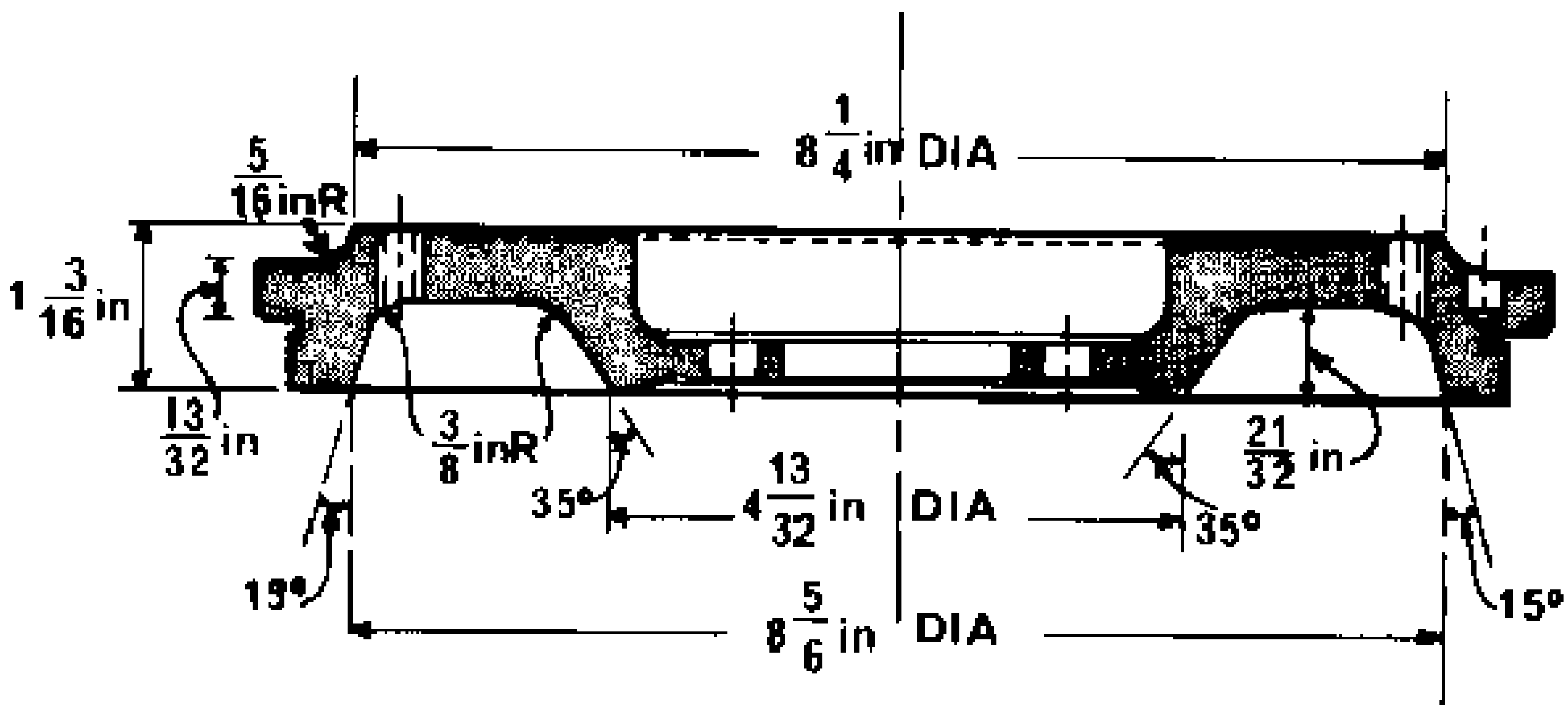
For all-round use, the compression can be increased to 10:1 by removing approximately .060 in. from the head. To get the full benefit, fit the 88G 229 cam (the block has three bearings as standard); this requires the competition distributor, C-27H-776. With ignition at T.D.C. and standard needles, the power, will be over 65 b.h.p. at 6,000 r.p.m.

Removing the air cleaners will need a mixture correction which involves fitting AH2 needles and red springs AU C4387. Replace the cast exhaust manifold with a three-branch type, as before. The earlier valve spring and tuning gear points still apply. Competition valve springs, increasing the total rate to 165 lbs., will enable



TWIN SU CARBERETTERS

BY COURTESY OF BLMC



MACHINING LIMITS FOR LIGHTENING 948cc FLYWHEELS the valve bounce point to rise from 6,250 to 7,350 r.p.m. (part no's C-AEA 494/ C-AEA 524). Lightened cam followers C-AEG 579, help to lessen the load, too. The competition clutch mentioned earlier should be fitted, but for special purposes, a more suitable driven-plate (cemented and rivetted) would be advisable. Refer to Automotove Products, Leamington Spa.

Searching for more power, with the bottom end dealt with as before (fully-floating small-end con-rods standard) the competitions C-AEA 731 and C-AEA 648 camshafts are available. Compression should be 10.5 (23 c.c. head) or 11:1 (21.3 head). Ideally one can use the latest HAN 9/GAN 4 cylinder head; the capacity will give 11:1 exactly, and you have the immediate benefit of larger inlet and exhaust valves.

With the 731 and 648 cams, in particular the latter, it will be essential to check each valve on lift. With the head fitted (using an old gasket) obtain at least .060 in. clearance by relieving the blocks with a cutter. Check valve springs too; adequate clearance between the centre coils when the springs are compressed is .060 in.

These amounts may seem excessive, but at high r.p.m., with valve float occurring and heat expansion effects, it is possible for contact to occur between valve and block. This imposes considerloads on valve gear, push rods, cam followers and cam lobes. Valve springs becoming 'solid' at full lift have the same results.

When reboring bear in mind that .060 in. oversize is 1144 c.c. To exceed this takes you out of the popular 1150 c.c. Class.

To get maximum power, fit 1½ in. S.U. carburettors to the standard manifold having carefully polished it to the correct diameter and matched it to the head ports; kits C-AUD 194 and C-AJJ 3304 provide all necessary parts. Flare pipes in place of the air-cleaner will aid the venturi effect. Use No. 6 needles, No. 7 with the 648 cam. Using the competition distributor and a static timing of 2°-3° B.T.D.C. a useful 80 b.h.p. at 6,000 r.p.m. should be available, dependent on the camshaft used. For absolute maximum use a 45DCOE Weber carburettor. B.M.C. can supply a manifold and kit (less carb) for this purpose (C-AJJ 3360) and although it will be necessary to experiment a bit suitable settings should be as follows:

Choke	38 m.m.
Main Jet	1.85 1.90 m.m.
Air Correction	2.10 m.m.
Slow Running	50 F2
Pump Jet	.60 m.m.
Auxiliary	3.5 m.m.
Float	5 m.m.

A racing exhaust manifold, with maximum extractor effect, and large bore outlet should be used (C-AHT 11). The HAN 9/GAN/4 pipe and silencer will match up with this for road use. Maximum power, with careful attention to timing and carbs, should be a peak 85 b.h.p. around 7,000 r.p.m.

Front suspension is dealt with as before, but the rear springs, being half-elliptic, can be replaced by lowered ones (C-AHA 8272) for racing. The rear springs were uprated 50 lbs. just before the 1275 version was introduced, and this should be remembered when a fibreglass rear is fitted, for instance. Adjustable rear shock absorbers for these models are part numbers C-AHA 7906 R/H, C-AHA 7907 L/H.

No changes are necessary to the standard braking system. Retain the normal linings on the rear, and fit D.S. 11 Pads (C-AHT 16) to the front discs.

CHAPTER 3

1275cc Sprite MK4 / Midget MK3

From October 1966 these ever-popular models grew up a little more. The HAN 9/GAN/4 acquired a larger, de-rated version of the Cooper 'S' power unit, allied to the previous model's features. Block design differed in that there were no covers giving access to cam followers (unchanged). Main bearing diameter remained 2 in.

Cylinder dimensions are bore 2.78 in. × stroke 3.2 in.; smaller valves were used than on the 'S' at 1.309 in. inlet and 1.219 in. exhaust. These 1275 units have 8.8:1 compression as standard, using a piston with extremely large dish, 11.13 c.c. A power output of 65 b.h.p. at 6,000 r.p.m. is obtained in standard form.

Early models came out with standard material crankshafts, this quickly being amended by a special batch of nitrided-type marked AEG 517. These were replaced in production with a nitrided production crank (AEG 565) and this continued until late 1967, when a tuftrided version, with the same markings, was introduced. This is considered to be perfectly satisfactory for all purposes. The con-rods (AEG 520) are extremely good—actually an improvement on the Cooper 'S' types. Other than carefully matching them for weight, no problems should occur and nothing else need be done to them.

Remove the head and carefully polish the combustion chamber and ports, do *not* alter the shape. Carefully blend the inlet manifold and head ports, retaining the sleeves. Polish out the manifold to accept the 1½ S.U.s C-AUD 194 (No. 6 needles blue springs) with fitting kit (C-AJJ 3334 for this model) and use flare pipes C-AEA 485 (or C-AHT 10). Fit the large bore exhaust manifold (C-AHT 11).

Static ignition should be set around 8° B.T.D.C. This should provide another 10 b.h.p. to give a total of 75 at 6,000 r.p.m. Valve bounce with the standard springs occurs around 6,700 r.p.m.

To gain more power we require a cam, and the opportunity should be taken to strip the power unit. Have the lightened flywheel (C-AHT 70) fitted, with the competition clutch (C-AEG 546), driven-plate C-AEG 547 (6½ in. diaphragm type) and balance the complete assembly.

Carefully match the connecting-rods AEG 520. These now supersede the earlier 'S' type, as mentioned earlier.

The Cooper 'S' piston can be used in either dished (9.75:1) or flat top (12:1) form. The dished-type (8G 2434) are possibly best. Bored ; .020 in. gives 1293 c.c., while to exceed this would go out of the 1300 c.c. class (.040 in 1311 c.c.). When rebuilding use VP3 material (Vandervell) for main and big-end bearings. The lightened cam-wheels (C-AEG 578) and cam followers (C-AEG 579) should be used.

The camshafts in the 12CC series differ from normal B.M.C. practice, in that a 'spider' drive replaces the older pin-type to the oil pump. This eliminates drive failure. A drive flange, 12G 729, is necessary for the end of the cam.

Choosing C-AEG 567 for road and competition use, use distributor C-27H-7766, and T.D.C. static ignition. Remove .060 in. from the head face to get 16.4 c.c. combustion chamber capacity and a compression ratio of 11.5:1. Power is increased to 83-85 b.h.p. at 6,000 r.p.m., and is usable to 6,500 r.p.m.

Fitting a Cooper 'S' head (larger inlet and exhaust valves), similarly polished and machined, would give around 90 b.h.p. at 6,500.

Using the C-AEG 529 cam provides no power below 3,000 r.p.m. but pulls from 4,500 to a peak 95 b.h.p. around 6,500 with 85 b.h.p., still usable, at 7,500 r.p.m. The longer cam period puts less stress on the springs and thereby extends their valve bounce figure with C-AEA 652/524 springs.

To obtain maximum power, still using the 529 cam and 8G 2434 pistons, have the standard head modified to accept the larger C-AEG 544 inlet valve 1.406 in. Carefully match the combustion chambers and polish them thoroughly; capacity should be reduced to 16.4 c.c. (.060 in. from head face). (Alternatively, a race head can be purchased, C-AHT 221, with this work completed.) Use Cooper 'S' head gasket AEG 226 (3.8 c.c.). With ignition and distributor as before, replace the S.U.s with a 45 DCOE Weber, settings:

Choke	38
Main Jet	1.95
Air Correction	1.75
Idling	50 F2
Pump Jet	60
Emulsion	F2
Auxiliary	3.5
Float	7 m.m.

Maximum power should be 104 b.h.p. at 7,000 r.p.m. evenly rising from 5,000 r.p.m. odd.

These results can only be obtained by careful attention to detail in preparation.

CHAPTER 4
MGA

The first production sports car from Abingdon with a B.M.C. power unit was a very pretty roadster which departed completely from the traditional MG. Available in coupe form also, this model was designated MG A. By 1962 over 110,000 models in various forms had gone to owners around the world.

The conventional box section chassis was retained and given a new-look streamlined body. The 1489 c.c. power unit was borrowed from the Austin A50/Morris Oxford range, output being increased by stepping up compression to 8.3:1. An improved cast exhaust manifold, twin 1½ in. S.U. carburettors and camshaft (chart B.1) with increased lift and period, contrived to produce 68 b.h.p. Bore and stroke were 2.88 in. × 3.5 in. The head capacity was 38.7 c.c. nominal and piston dish 4.85 c.c. Valve sizes were unchanged at 1.5 in. inlet, 1.281 in. This output was transmitted through an 8 in. single plate clutch to the gearbox with ratios:

3rd	1.374
2nd	2.214
1st	3.64

Top gear being direct of course. These did not change and indeed were current to the MGB until the Mk II all-synchromesh gearbox was introduced. The three-quarter floating rear axle was fitted with a 4.3 final drive (4.55 optional) relative to 17 m.p.h. per 1,000 r.p.m. (16.4 m.p.h. 4.55).

Braking was via 10-inch drum brakes with a total area of 134.4 square inches; nevertheless, these proved efficient.

Originally the power units had narrow throats and ports, the early version having mods to tappets, push rods and piston, after 15GB 38484. These later pistons have stiffer gudgeon pins.

15GD units have all these modifications plus a new gearbox with repositioned starter motor and the sliding spline prop shaft replaced by a Hardy Spicer joint, output then being around 72 b.h.p. at 5,700 r.p.m.

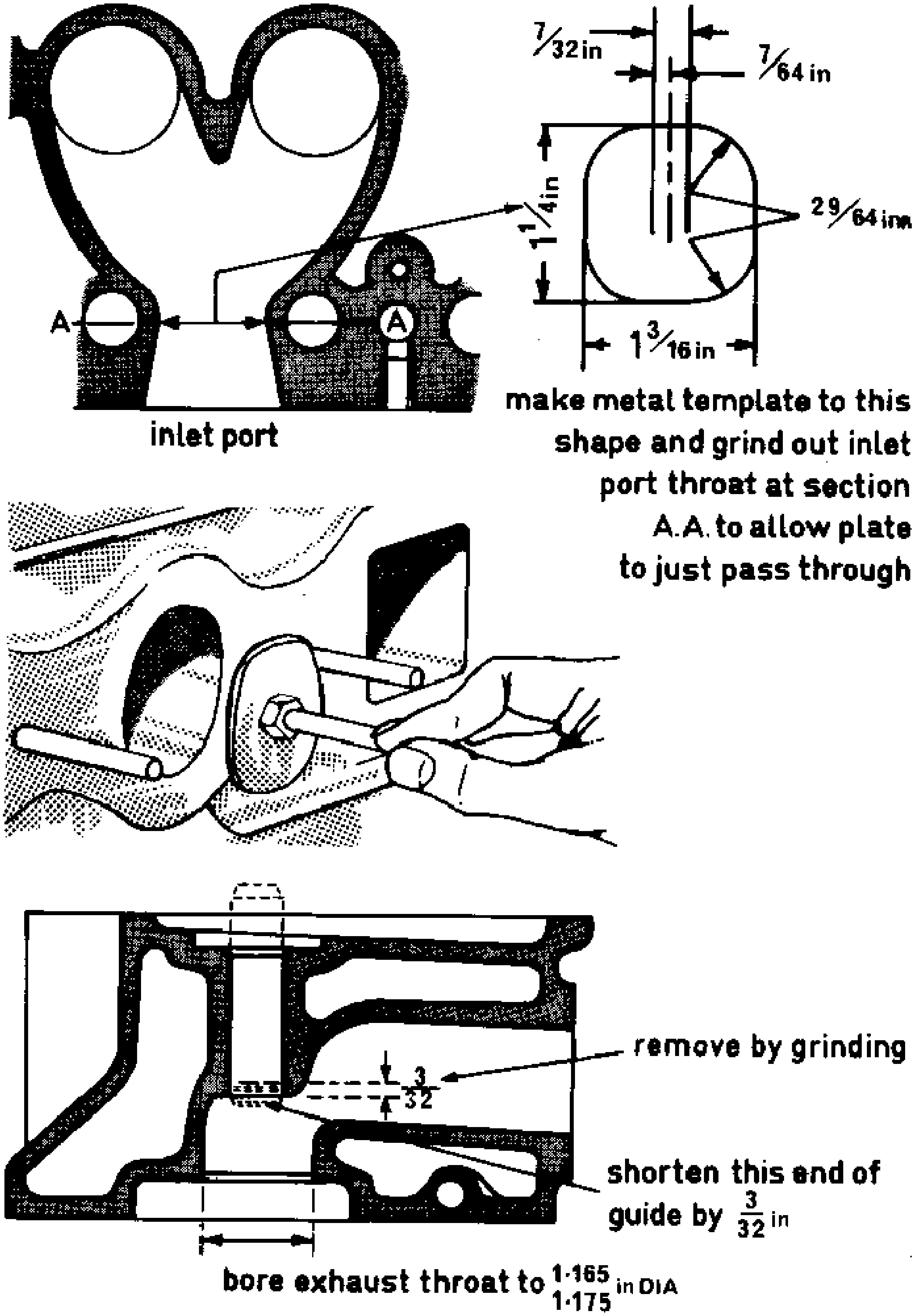
Before you attempt any modifications carefully examine the vehicle, some have 15 birthdays and probably as many owners' You must ensure it is basically sound. The MG slogan has always been 'Safety Fast', let's keep it that way.

Reference to the earlier 'Spridget' sections will find suggestions of suitable equipment. Most car enthusiasts soon gather a good selection of tools anyway! Never waste money on tools, buy top quality every time.

The first step is to remove the cylinder head, strip it and clean all parts. Possibly it may show signs of being modified previously, this work should be checked.

Early versions should have their inlet ports opened out as illustrated in diagram Ba. 1. Also grind out the exhaust throat to 1.170 in. — 005 in. and shorten the exhaust guide by .094 in. grinding away the boss to flow the port.

This would bring the motor into line with the later production versions. A special material exhaust valve was fitted to some models (1H 1025), and should



ENLARGING PORTS ON EARLY MGAs

always be fitted as this has an improved surface finish.

We are looking for something more, but the snag is that no special crankshafts exist for these models. The standard one carefully balanced is safe to around 6,500, but continuous running above 6,000 r.p.m. is not really on. Con-rods also limit the r.p.m. as they are the clamp bolt type, but here at least, an alternative exists.

For a mild increase the head should be polished and all surface irregularities removed. Where valve seats have been fitted, blend them into the combustion chamber roof. The valve seats in the port should be gently blended back also. The centre peak which creates turbulence should be gently ground to a 3/16 in. radius and any sharp edges radiused away. Do *not* spoil the chamber walls or gasket overlap, or failure will result. Balance the chambers (see Spridget section) and return to the nominal 38.7 c.c. capacity by lightly grinding the face (.010 in = 1 c.c. approx.). The face should be lightly finished in any case to ensure it is absolutely flat. Match the inlet ports carefully to the manifold and smooth out the manifold without increasing its diameter. Using a slightly richer needle, the CC, and keeping the standard ignition, this stage will show a mild increase to around 75 b.h.p. at 5,750 r.p.m.

Fitting the old Riley 1.5 camshaft (48G 184) with reduced camlift and timing (see chart B1) increases power in the low and mid range at the expense of performance above 5,000 r.p.m. Tappet clearance .015 in. and ignition should be around 4° B.T.D.C.

Assuming that we are aiming to get the maximum possible for road use, then remove the power unit. Having stripped it and cleaned all parts carefully, examine the block and cam bearings.

The crankshaft should be examined and scrapped if in doubt. Reground cranks are not a good prospect! Better to start with a new one and have it fully balanced with flywheel and clutch pressure plate. The strongest crank is that fitted to the 1622 c.c. version, but this requires the centre main housing to be machined to reduce its width.

Con-rods should be carefully matched and weighed end to end. A highly polished finish increases surface strength.

For increased compression for road use, British Leyland Special Tuning can supply the flat top piston C-1H-1178 to suit the standard rods. This would give 9:1 compression. Static ignition at 4° B.T.D.C. and the standard cam would increase output to around 80 b.h.p.

Harder N3 plugs would be required for fast motoring.

A higher compression is obtained by using the special C-1H-1180 pistons (chart III) that are also available from Special Tuning. As these are competition pistons they have extra tolerances and should only be fitted to bores with minimum wear. Oversizes are available if reboring is necessary.

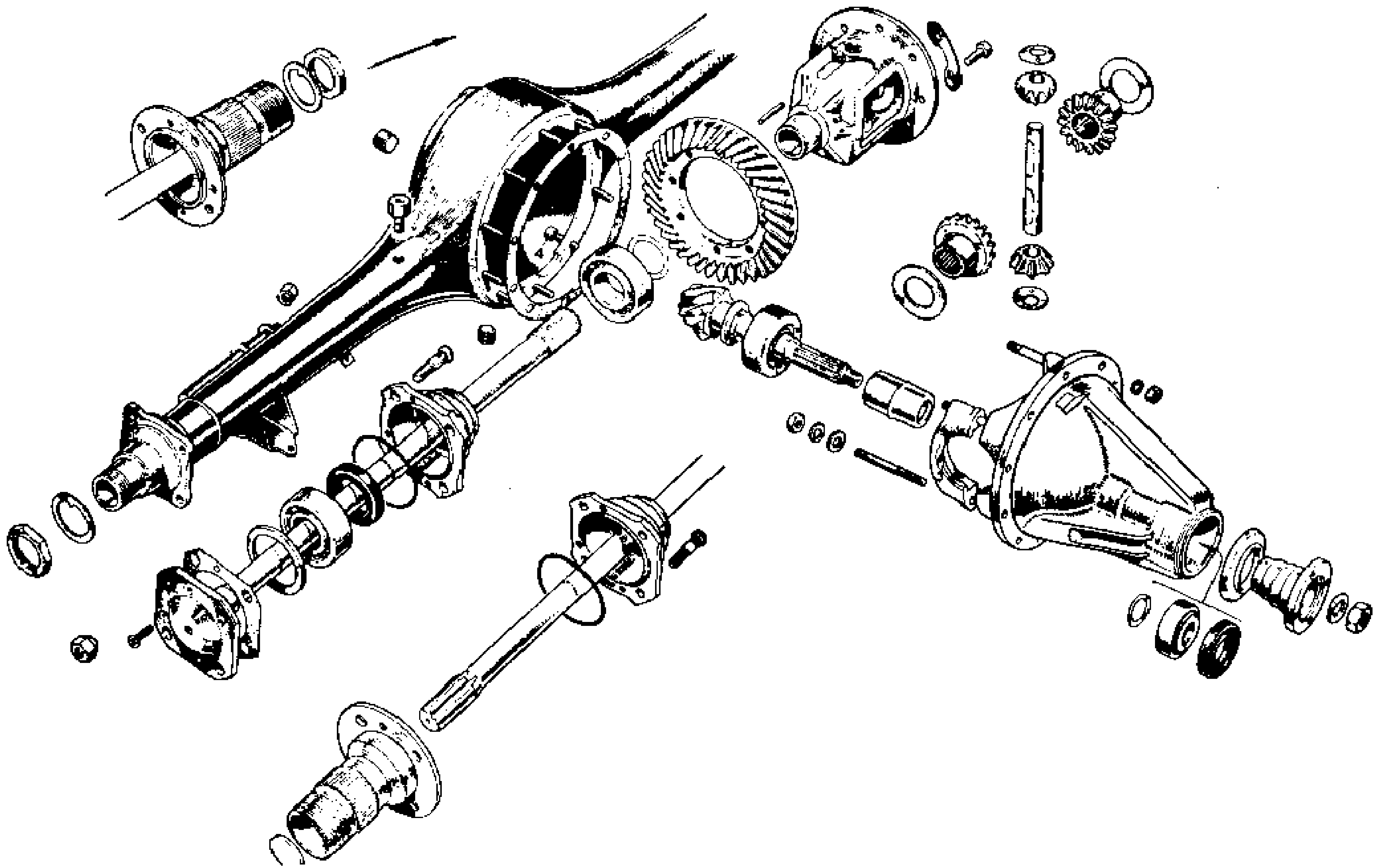
These pistons must be fitted correctly with the deflector face towards the plug and require the special Twin-Cam rods with large diameter solid small ends, C-AEH-642/644. The rods are difficult to obtain, remaining stocks being disposed of as matched sets (C-AJJ 3357). If you can get these they are superior to any other type. Again they should be carefully balanced.

With the pistons fitted, check their height by putting plasticine on the crown and placing the head in position (use an old gasket). Clearance should not be less than .060 in. Maximum power should now be around 85 b.h.p.; but can be further increased by larger carbs.

The MGB manifold 12H 911 is an improvement on the standard version as it has a larger diameter balance pipe (⅝ in.). Match this to the cylinder head first and then fit 1¾ in. S.U. H6s (C-AUD 229). Use studs long enough to fit the thick Neoprene gasket C-AHT 178 and retain the carbs with double coil spring washers and two locking nuts. This method absorbs vibration and reduces frothing in the float chambers at high r.p.m. Use the ram pipes C-AHH 7209 to reduce turbulence and create a venturi effect.

Competition and higher revving will demand additional fuel flow. The standard pump should flow at 9 gallons per hour but if it's clapped, then it may only pass 6 gallons.

In maximum racing tune the units could easily require 7-8 gallons per hour; thus



MGA & EARLY MGB REAR AXLE

BY COURTESY OF BLMC

fuel starvation and weakened mixture could result. Pump AUA 73 has ample flow rate but may need alteration to the bracket to fit.

Static ignition would be approx. 2° B.T.D.C. The 1¾ in. varbs should have .100 in. Jets with KW needles. Maximum should be just below 90 b.h.p. at 6,000 r.p.m. Tappet clearance in all cases should be .015 in. Maximum power being developed around the adopted rev limit of 6,000 r.p.m.

Other camshafts should be considered with care as the power is always higher in the rev range. The C-AEH 714 camshaft would give another 5-8 b.h.p. at the expense of torque below 3,500 r.p.m.

Don't fit heavy valve springs unnecessarily: the standard 1H 722 outer/1H 723 inner suffer bounce around 5,800 normally. The different profile of the 48G 184 cam restricts performance above 5,200 whatever springs are used.

On the other hand the C-AEH 714, as used in the 1961 Sebring cars will not encounter valve crash until approx. 6,400 r.p.m. As this is about the tolerance we want, stronger springs would only load camshaft and followers for no reason or gain.

With the standard 88G 252 camshaft the standard outer 1H 1111, with C-1H 1112 inner (total load 174 lbs.), would extend valve crash to a similar figure (6,400 r.p.m.).

It should be borne in mind that careful attention to the valve gear, reducing the operative weight by grinding surplus metal from rockers, will also postpone the valve crash point. A 10 per cent. reduction would enable the standard springs to be retained in this instance. There are physical limits though so do *not* go mad with the grinder (down, Myrtle, down!) and have a rocker shear under load.

Fitting the 1H 1111/C-1H 1112 springs with the race cam would extend the valve crash point to around 6,800 r.p.m. A very short term prospect that would be!

The later 1600 Mk II had a 1622 c.c. unit and the head has slightly larger valves; porting is also improved. This head could be fitted to earlier models where every ounce of power is sought. By the way, its combustion chamber is 43 c.c. and approximately .045 in. would need removing from the head face to obtain the 1500/1600 MGA volume of 38.7 c.c. nominal. With this larger valve head the race camshaft 714 and ignition at 2° B.T.D.C. it should be possible to achieve 100 b.h.p. at around 6,000 r.p.m.

Having dealt with the power unit, we move to the clutch. Again we begin by checking it carefully.

Early cars up to 15GB 16225 were fitted with Black/Yellow pressure springs; replace these with Cream/Green 1H 1024s increasing pressure by some 15 lbs. The competition clutch plates are no longer obtainable through British Leyland, but Borg and Beck usually have the answer to most clutch problems.

The gearbox can be improved by converting to close ratio gears using the following parts:

Lay Gear	C-1H-3298
First Motion Shaft	C-1H-3297
2nd Speed Gear	C-22H-1094
3rd Speed Gear	C-1H-3300

C-22H-1094 is a modified version of the superseded second speed gear C-1H-3299 and must be fitted with 22H-249 baulk ring.

Ratios would now be:

3rd	1. 268	(1.374)
2nd	1. 65	(2.214
1st	2. 45	(3. 64)
2nd	1. 65	(2.214)

Standard ratios in brackets; top being direct.

For competition and acceleration the 4.55 final drive ratio is best unless the MGB wheels are fitted to obtain wider rims. These are smaller diameter and even though the wider rims permit larger section of racing tyres, the speed reduction may prove too great.

Final drive ratio's have been available as follows:

4.55:1	88G 284
4.3 :1	(std) 88G 243
4.1 :1	(1600 Mk II) C-ATB 7240
3.9 :1	BTB 414

Possibly the standard 4.3 ratio will be a happy medium. For road work the 4.1 or early MGB tourer 3.9 ratio would prove best.

MGB wheels fitted as standard are:

4J × 14 Steel Disc (correct (p.c.d.) AHH 6132

5J × 14 Steel Disc (correct (p.c.d.) AHH 8112

4½J × 14 Wire (60 Spoke) AHH 6487

5½J × 14 Wire (70 Spoke) C-AHH 8530

For road work the speedometer will need to be corrected. Return it to Messrs. Smith Industries through your distributor, quoting the tyre size and final drive ratio.

The standard braking system should be thoroughly overhauled, replace the hoses on principle. Examine all metal pipes for possible chafing or rust, replace any questionable leaks, exchange cylinders are preferable to bodge jobs with kits of rubbers.

BRAKES & SUSPENSION.

The brakes can cope with the extra performance but brake fade will be noticed. Prevent this by using the Ferodo VG 95/1 lined shoes (C-8G 8215) still available through Special Tuning. These require more pedal effort which a servo will compensate for, but servo assistance is a matter of individual preference on a high performance car.

The MGA's most appealing factor to the enthusiast was its handling. Relatively stiff all round, it was designed with oversteer which is easily corrected. This warns the over-indulgent before they can lose it completely.

The only change to the front was that the early springs were changed after 15GB 15152. The coil and wire diameter were increased and the free length reduced; fitted length and load remained the same. This spring AHH 5546 was fitted to all MGAs, except the Twin-Cam and its push rod version, the 1600 De Luxe. The rear springs remained standard through the series also; the part number is AHH 5461.

Modern radial and racing tyres extend the limits of adhesion so that for fast motoring or competition a more 'neutral' handling is required. We can achieve this by stiffening the front end. Additional shock absorbers are available for the 1500/1600 models, C-AHH 5609 for right hand drive; C-AHH 5610 left hand. These require spacer blocks C-AHH 5570 and mounting brackets C-AHH 5608/5609, stocks of which are exhausted. Drawings of these are still supplied by the Special Tuning Department at Abingdon with the shock absorber. Existing shock absorbers can be stiffened by fitting the MGB valves, part number C-AHH 7218.

A similar effect is obtained by fitting an anti-roll bar. *Under no circumstances fit both bar and tweaked shockers.* Check all the steering parts carefully at the same time as you are working on the suspension.

For competition or motorway conditions an oil cooler—if not fitted already—should be obtained.

Concurrently built with the push rod model was the 1588 c.c. double overhead cam Twin-Cam. This project was not entirely successful. As it was considered to be developing maximum performance at approximately 110 b.h.p. at 6,700 no special parts were available.

Some two thousand were built between 1958-60 and they still give service around the world. An enthusiast in America recently purchased a brand new power unit in its original crate! Another innovation was all round disc brakes by Dunlop and centre lock disc wheels. The front suspension springs were numbered AHH 5789, and are now fitted to the B GT to counteract additional weight. Later chassis appeared as 1600 De Luxe models using the 1588 push rod unit but still having the all round disc brakes and centre lock wheels.

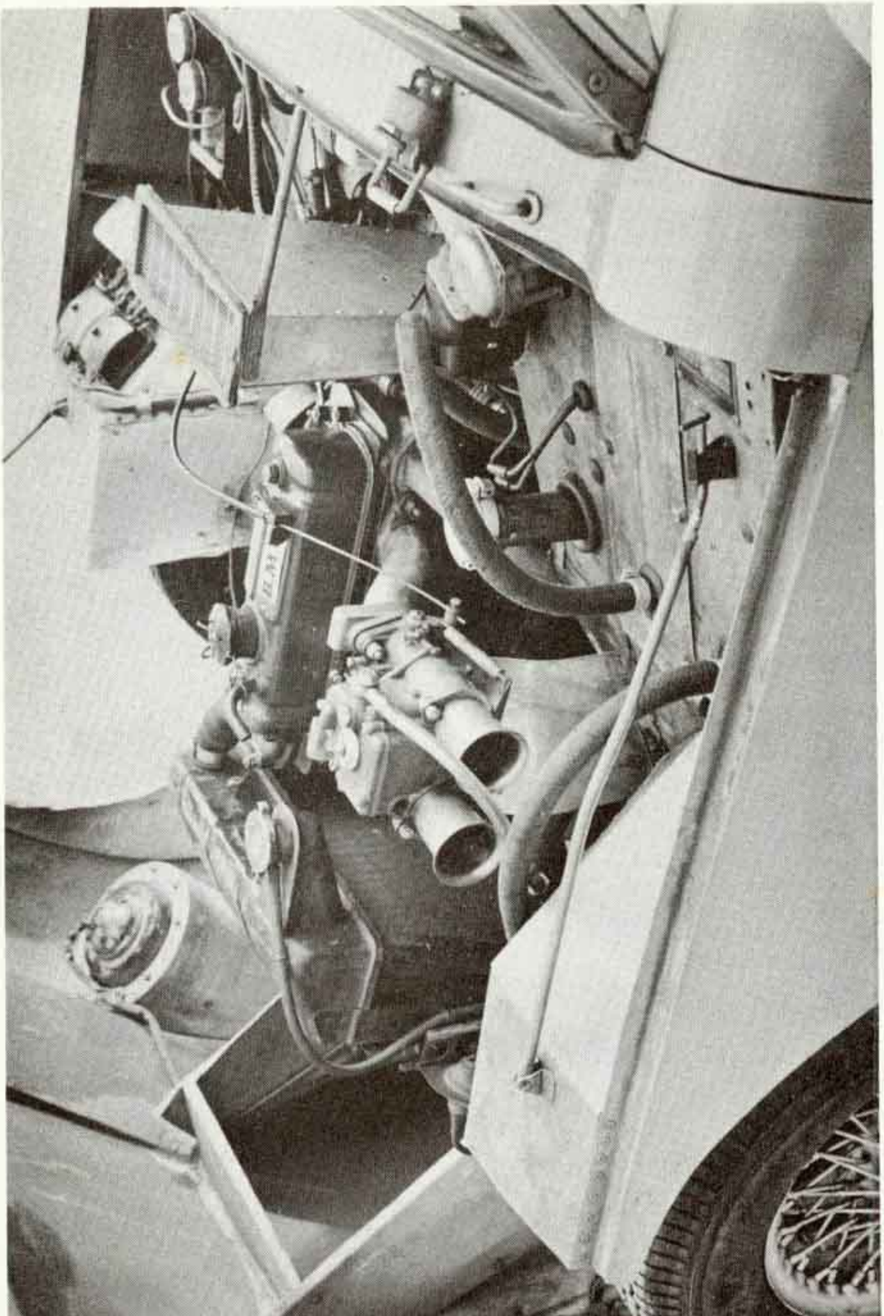
In May, 1959, the normal production MGA was given increased capacity with a 1588 c.c. version of the 1489 c.c. unit. Virtually it was bored out and little else. It is possible to overbore the early model to 2.97 in. and fit the 1600 pistons 12H 178, at least gaining additional torque. Standard output was 80 b.h.p. at 5,600 r.p.m.

Lockheed front disc brakes appeared on this model, with the 10-inch drums remaining at the rear, using slightly narrower shoes. Apart from capacity it was identical to the previous model and all the previous mods apply with correspondingly increased performance. The early head improvements were standard to this unit, but careful polishing will give around 82 b.h.p.

Alan Woode in the 'Fastest Frog-Eye in the World'.

Unloading the Ted Lund/Hans Waeffler MG 'A' at Le Mans, 1955.

Bob Evans 26 (999 c.c Sprite) and John Visors (998 Sprite) demonstrate the old and new style in Sprite racing.



Underbonnet view of the 1961 Sprite Le Mans coupe, built by Donald Healey and subsequently raced by Mike Garton.

The flat top pistons for the 1600 (9.25:1) to suit the Twin-Cam rods part number: C-12H-173 are no longer available. It is possible to obtain a 9:1 (14986) or 9.5:1 (15059) piston to suit the standard rods from Hepolite stockists. With the former piston and preparation similar to the 1500 model, output would be approximately 85 b.h.p.

Fit the $1\frac{3}{4}$ in S.U.'s with MC needles, .100 in. jet and static ignition at 8° B.T.D.C. planing approximately .020 in. from the head face with the 15059 piston would give 10:1 compression. The combustion chamber should be modified as diagram Ba II and the head could then be modified (Ba III) to accept the MGB valves, 12H 436 exhaust, 12H 435 inlet, by grinding out throats and ports. It's simpler by far to acquire the 1622 head, 48G 215, and correct the combustion chamber volume by machining the face approximately .050 in.

Fitting the C-AEH 714 cam and again pointing out the rev limit power can be increased to around 105 b.h.p.

All transmission mods are as the 1500 except where the brakes are concerned. The 1600 has Lockheed discs; for competition work the DS 11 pads should be obtained by sending to Messrs. Ferodo for details. If this transfers a bias to the rear, causing them to lock up prematurely, then fit VG95/1 lining material.

MGA 1622

In April, 1961, the 1600 Mk II was introduced, this carried on the same styling with an uprated power unit. This actually was a new unit with a stiffer crankshaft, improved cylinder head with larger inlet 1.565 in. (formerly 1.5 in.) and exhaust 1.345 in. (formerly 1.281 in.) valves and increased combustion volume at 43 c.c.

The high compression version (8.9:1) had flat-top pistons as standard and developed around 90 b.h.p. at 5,500. This was a new block and *not* an oversize 1600; the standard bore size is 3 in.

The difficulty is that no special pistons exist for this model from any source, nor are we helped by the fact that the small end diameter was increased to .75 in. from .6869 in.

Head machining after polishing and balancing chamber volume detailed earlier could increase compression to approximately 9.5 but at .060 in. removed this would be on the limit.

Fitting the $1\frac{3}{4}$ in. S.U. on the 12H 911 manifold and using the race C-AEH 714 cam should achieve 105 b.h.p. at about 6,000 r.p.m.

The standard valve springs fitted were 6K 873 outer and 1H 723 inner, with a total load on full lift of 163 lbs. These need not be changed; with the standard cam valve crash occurs around 6,200. With the 714 cam around 6,600 r.p.m. is more than ample.

The transmission mods apply although the final drive ratio was 4.1 on this model. The clutch had light grey springs increasing the pressure to 205 lbs.

All the previously suggested modifications to gearbox, wheels, brakes and so on, also apply.

If a power unit has been damaged beyond repair the owner should consider fitting an MGB power unit, with or without gearbox. One has to be prepared to modify parts to some extent but it is not too difficult. Using the B power unit you must first ensure that the first motion shaft has the same number of splines as the centre of the clutch driven plate to be used. A point also to watch here is that the 18GB (5 main bearing) MGB power unit has a larger diameter crankshaft bush. If the MGA small diameter first motion shaft is used than a smaller diameter bush must be made. Alternatively the larger diameter first motion shaft could be fitted to the gearbox. The pump unit is longer and the water pump is too close to the radiator. The easiest answer is to space the radiator approximately 5/16 in. further forward.

It is possible to use the MGA water pump, part number 12H 839 but this does not have the same capacity and can lead to overheating. If this pump is fitted, the correct pulley 8G 742 must also be fitted to keep the fan pulley in line. It's better to use the MGB pump 12H 766 with pulley 12B 174.

If the MGB unit is fitted complete with gearbox the first motion shaft problem does not arise. The rear mounting is different and the MGA rear gearbox extension must be fitted in place of the MGB one.

Fit the speedometer drive gear to the output shaft also.

Retain the MGB starter motor, as the MGA one may find it too much; the B starter is larger and the floor will have to be modified.

Have a free flow exhaust fabricated, the MGA one is restrictive and the MGB one requires too much modification to fit.

With the additional weight at the front handling will be affected, and it may prove useful to fit the stronger AHH 5789 front springs to compensate.

A useful hint for all MGAs is that B oil cooler fits with little trouble:

12 Row Oil cooler	ARO 8909
Block adaptor	AHH 6701
Pipes	(AHH 8536
	(AHH 8537

CHAPTER 5
MGB

All good things have to end sometime (don't cry Myrtle!) and after seven years of the MGA production came the final move away from MG traditions. Sports car purists accepted certain inconveniences for years as necessities but the MGA had buried many of them (traditions not purists).

Introduction of the MGB in October '62 saw the demise of a separate box section chassis—the B falling into line with modern techniques by being unitary construction. Some felt this to be a retrograde step but the B proved itself to be no mobile blancmange. In fact smooth lines and increased comfort were contained within a smaller package. Length and height had been reduced while more important still, so had weight.

Other than this body change basic essentials remained as the MG A 1600 Mk II. Front discs were slightly smaller diameter, 10¾ in., with increased pad area; rear drums remained at 10 in. diameter but with wider shoes. Front suspension geometry was slightly altered and softer rate, longer springs fitted. Rear leaf springs and shockers were basically unaltered.

Not only were creature comforts catered for with wind-up windows and so on, but a new power unit exclusive to the MGB effectively increased the power to weight ratio from 100 b.h.p. ton to 117 b.h.p. ton. Following established BMC practice it was a conventional three main bearing job with a 3.16 in. bore, 3.5 in. stroke, giving 1798 c.c. total capacity. Derived from the 16 GA unit it retained the cylinder head unaltered. Main bearings were increased in journal diameter to 2.167 in. with their length reduced by .25 in.

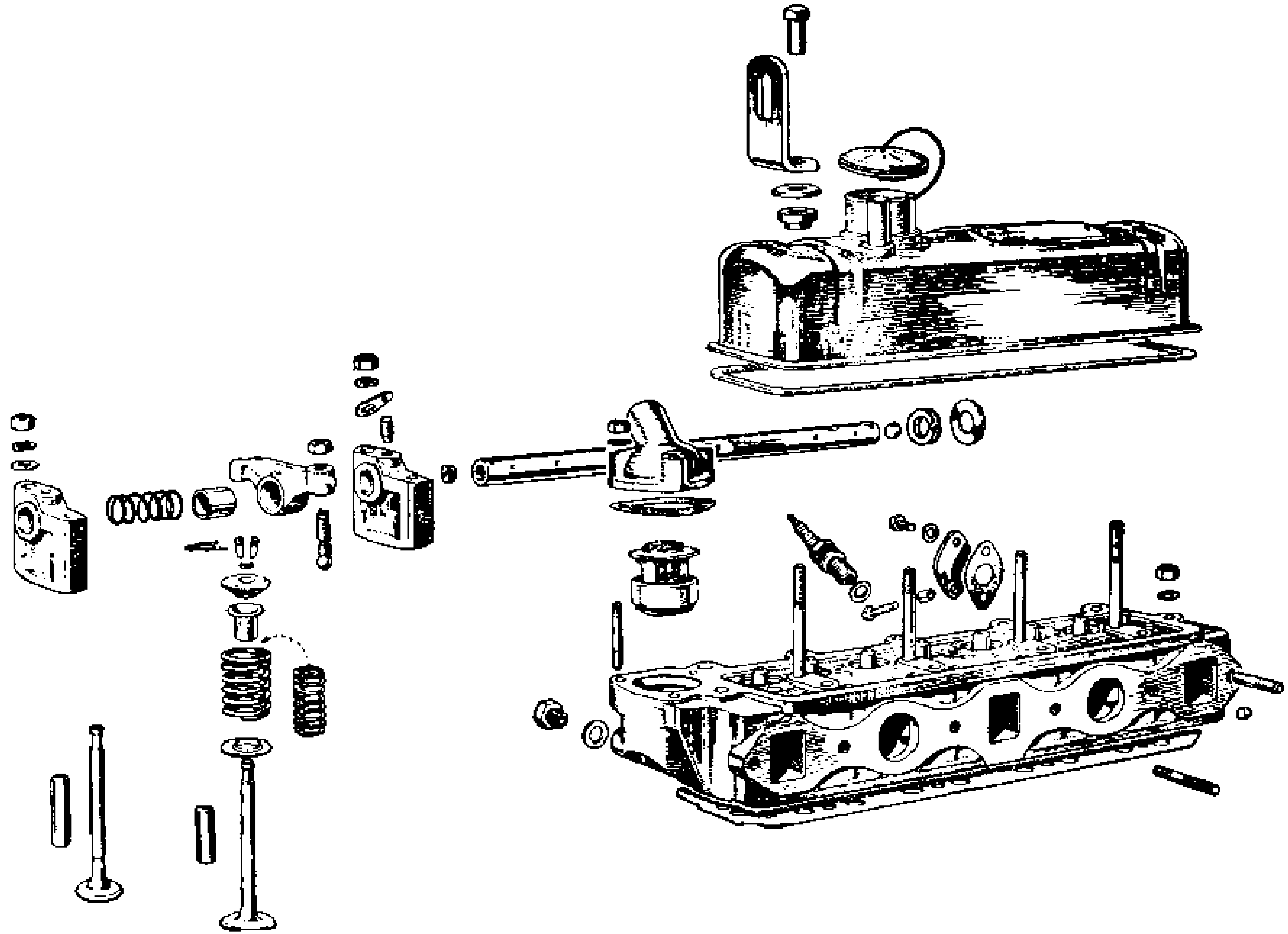
The 43 c.c. capacity combustion chamber and 6.25 c.c. piston dish gave a compression ratio of 8.8:1. The camshaft was also unaltered in specification (88G 252) while the carburettors changed from H4s to the improved HS4s with no change in choke size. Nett output for this power unit was 95 b.h.p. at 5,400 r.p.m. nett with maximum torque up to 110 lbs./ft. at 3,000 r.p.m.

The unit was completely new and not a bored out 1622, and had the prefix 18G. A diaphragm clutch replaced the six-spring MGA type; although it remained at eight in. diameter.

The gearbox ratios were unchanged but going from 15 in. to 14 in. wheels had necissatated reducing the axle ratio from 4.1 to 3.909. Overdrive was an optional extra, giving a .82 reduction.

CYLINDER HEAD.

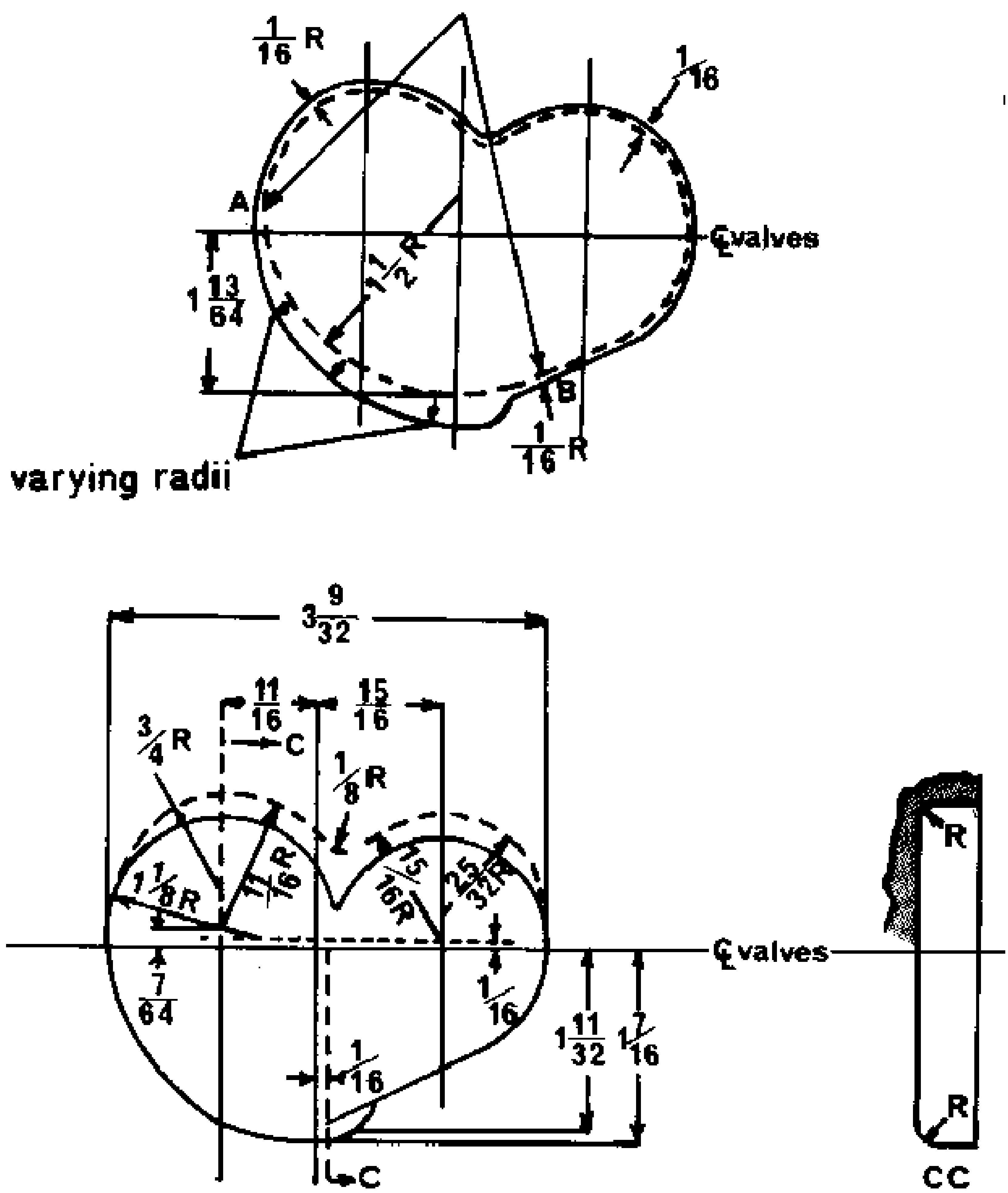
As we are dealing with the early models it is again emphasised that the condition of the vehicle, bodily and mechanically, is



MGB CYLINDER HEAD COMPONENTS

BY COURTESY OF BLMC

constant radius of $\frac{1}{16}$ between points A and B



machining dimensions – enlargement of cylinder head combustion space NOTE – ·020 in. (·508 mm.) may be removed from the standard cylinder head face

MODIFYING THE 'B' SERIES COMBUSTION CHAMBER all important. It would not be unreasonable for some of these models to have exceeded 60,000 miles—not without a few incidents either!

Unless the car's history is well known it should be thoroughly examined. Any extensive tuning will involve stripping components and the owner would be wise to obtain the workshop manual (AKD 3529) which details any special tools that may become necessary.

First steps are to remove and strip the cylinder head, Examine all valves, having first removed all carbon. Then lightly polish their stems, neck and heads. Any light pitting in the seat or face may be removed by grinding in; you should check the stem diameter for wear with a micrometer and at least check it in a *new* guide. Similarly if the valve guides themselves are worn, replace them. Assuming the head is as standard and shows no sign of cracks or warping by carefully polishing out the combustion chambers. Remove all possible sharp edges from the plug orifice and also radius the outer walls to reduce the peaks intruding in the kidney profile. Don't remove them completely, smooth the contour of the smaller ridge near the plug and take the peak between inlet and exhaust valves back by approximately .25/3 in. Radius from this point on the profile round ,fading out around the centre line of the two valves. Do not chamfer the edge of the combustion chamber or this will lead to burnt gaskets, just lightly level the edges. Check gasket clearance with an old gasket. Attention to the valve ports can remove casting errors or burrs from seat areas and in the throats. Inlet ports should be carefully polished without destroying the original throat or port diameters. I think its important to be 'extremely careful when polishing the inlet ports so as not to weaken the structure between the valves, causing cracking. Also this bridge point encloses the water passage cooling the valve seats; too much enthusiastic grinding results in a ruined head.

This work will have increased the capacity of each combustion chamber. The head face will have to be machined accordingly to correct this. The standard capacity is 43 c.c. and for the normal compression ratio you must return to this.

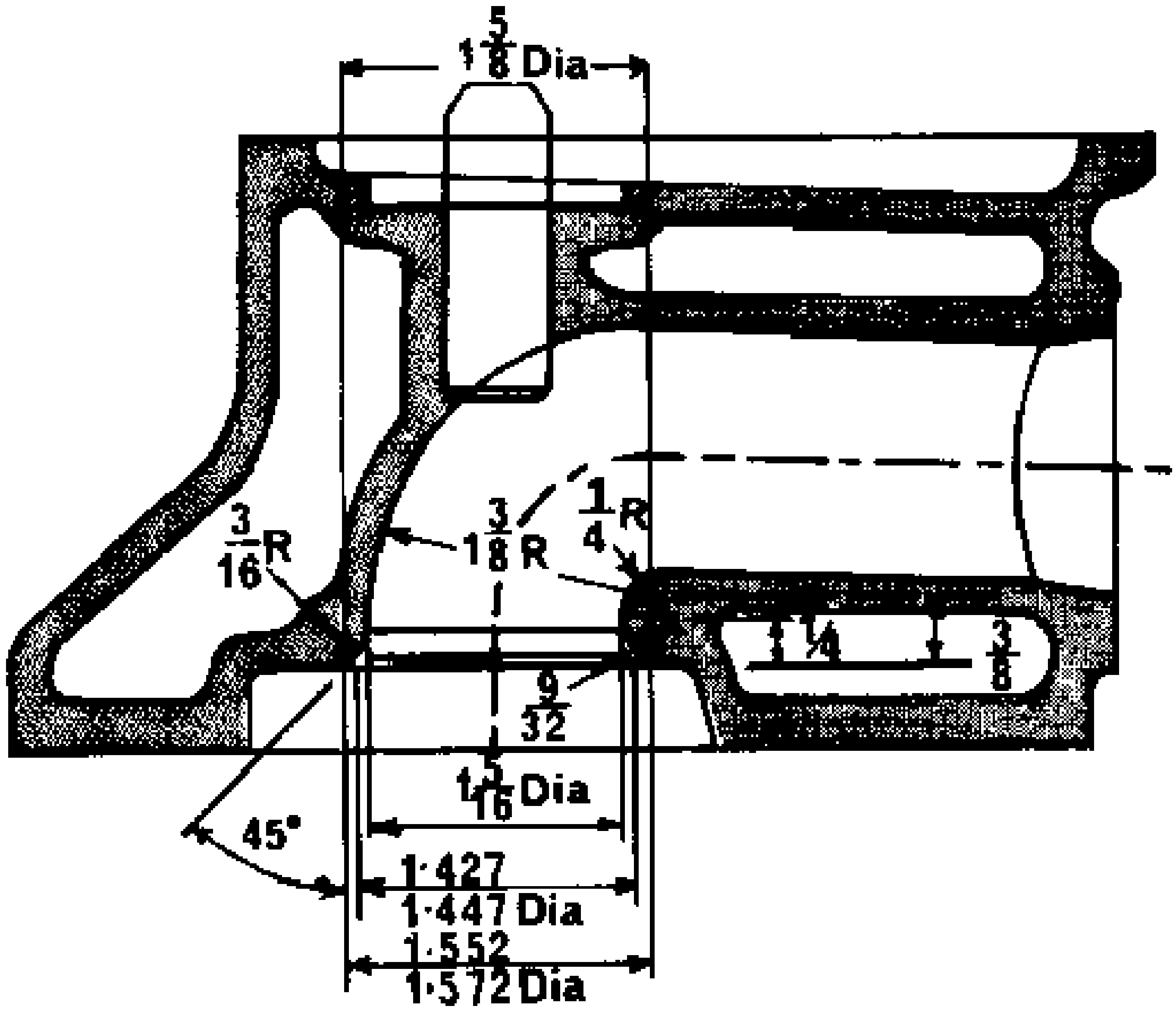
Measuring combustion chambers has been dealt with earlier, but to recap you require a quantity of light oil (Redex is ideal), a piece of flat Perspex to entirely cover the combustion chamber with a .5 in. hole in the centre and a measuring cylinder.

With valves ground in and lifted together with the usual sparking plug, the head should be mounted with the head face horizontally uppermost. Start with a known quantity of oil in the measuring cylinder and gradually pour through the hole in the Perspex which seals off the chamber. When oil closes the bottom of the hole you can read the capacity from oil reduction in the measuring cylinder: if you spill any start again. Sometimes small corrections can be made by lightly grinding the valves deeper into the head but on no account let the valves become 'pocketed''. The largest capacity chamber becomes your 'datum' so reduce the head face to return the chamber to the required capacity. About .009 in. from the head face is approximately equal to 1 c.c. The other combustion chambers should then be polished out so that they are all within .5 c.c.

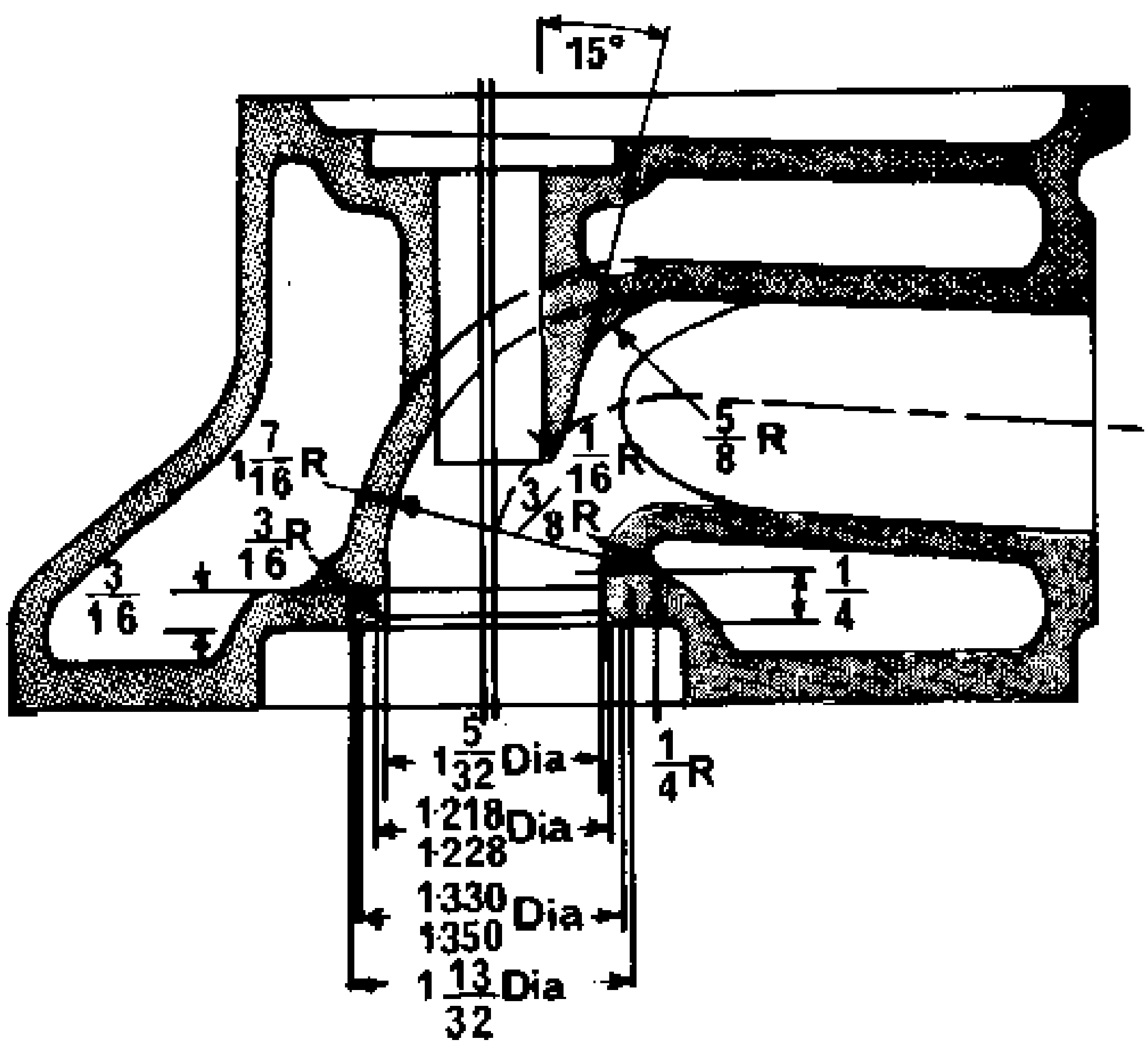
Having completed this work a small 2-3 b.h.p. increase will result, a greater benefit will result from taking the opportunity at this stage to increase the compression ratio.

A completely polished cylinder head is available from British Leyland Special Tuning through dealers under part number C-AHT 100. This will increase the compression to 9.5:1: the combustion chamber capacity is approximately 38.5 c.c.

Before replacing any cylinder head which has been modified to give higher compression, or where high compression pistons have been fitted, counter sink the head stud holes, this prevents any tendency for the block to lift around the base of the stud, causing gasket failure. Head nuts should be torqued down to 50 lb./ft. and more rigid high tensile steel washers used,



inlet port



exhaust port

MACHINING LIMITS FOR LARGER VALVES–'B' SERIES a minimum thickness of .100 in., with an outside diameter .75 in. is recommended. Always use the competition head gasket (C-AEH 768); this is well worth the additional cost, as it reduces the risks of gasket failure with thicker copper facing and reinforced water way holes. High compression not only increases potential output, it also requires a greater volume of air/fuel. Open out the standard inlet manifold carefully, matching it to the cylinder head. Also fit 1¾ in. S.U. HS6 carburettors, C-AUD 229, using the kit, C-AJJ 3321, which has all the necessary spacers and gaskets. TZ needles with red springs should be correct and static ignition remains at around 10° B.T.D.C.

Power output should be just over 100 b.h.p. at 5,500 having torque progressively increased through the range.

At this stage it would not be wise to fit stronger valve springs. The standard springs 1H 1111 outer/1H 723 inner bounce at 6,200 r.p.m. which is well within the rotating parts' limitations.

Before continuing the engine should be removed and stripped.

The 18G and later 18GA (closed circuit breathing) three bearing units are renowned for long distance reliability but this depends on preparation *and* keeping to rev limits.

If the crankshaft shows no signs of scoring or wear outside normal tolerances it may be acceptable, if its seen a heavy mileage it would be more prudent to replace it. Use a new crank if possible as each regrind has some weakening effect. If you do have a crank reground it must be balanced, even if it had been balanced previously. Ideally of course you should use a nitrided shaft (C-12H 1167); unfortunately stocks have long been exhausted. The crankshaft should be balanced as an assembly with its rotating parts, i.e., clutch assembly, front pulley and flywheel which should be lightened by a reputable firm.

When reassembling use bearings in Vandervell VP 3 material, but if it is to be built as a competition unit then use the main bearings set C-8G 8843, with big end bearings (complete set) C-8G 2259. These have greater clearances (more noise starting from cold!) but are essential; a relatively small mileage is required for running in.

Connecting rods are best replaced by the Twin-Cam type for competition. (C-AEH 642/C-AEH 644) or set number C-AJJ 3357—if you can obtain them! Carefully balance the rods, obtaining equality of weight at the ends, whichever type you proceed with. Polish to reduce surface cracking and lightly rub a file over the cap/rod mating surface edges.

Twin-Cam rods have a larger diameter with ⅞ in. small ends (fully floating) which will require special piston C-AEH 0736. This can only be supplied as .040 in. oversize (C-AEH 073643) giving 1840 c.c. engine capacity; *but* more important this piston is *flat topped* resulting in a compression of 10:1 with standard head capacity. The C-AHT 100 cylinder head would give 11:1.

The standard rods, 12H 997/998 (12H 426/424) on early 18G units) have small ends which anchor the gudgeon pins with a clamp bolt, the pin diameter is ¾ in. British Leyland do not make a flat top piston to suit these rods though it is possible to obtain one from Hepolite, part number 16225. This should be acceptable for road use but is not recommended for competition.

Balancing considerably extends the life of components in any state of tune, so if the engine is rebuilt at this stage with flat top pistons and the Sports camshaft C-AEH 714, the result would be a smooth pulling engine with considerably improved output. Maximum b.p.h. would be approximately at 6,000 r.p.m.

The 1¾ in. HS6 carbs would need SY needles (AUD 1338) with light blue springs; dispense with the air cleaners and use C-AHH 7209 ram pipes. The free-flow exhaust manifold, C-AHH 7103, will help the extraction effect giving an improvement through the range. Static ignition remains approximately as standard, i.e., with the production distributor 10° B.T.D.C.

Where the engine is rebuilt using the normal dished piston, a higher compression is obtained by machining the head face as detailed earlier; remember it is essential to check valve clearance. Bolt the head in place with an old gasket and check each *exhaust* valve on full lift, at least .060 in clearance must remain. Do not attempt to run the limit with less. To obtain clearance use a flat cutter diameter 1.531 in. having .063 in. radius at its edges.

Unless the Twin-Cam rods and hardened crankshaft are available there is little point in going to a higher compression or in attempting to obtain a higher rev limit. As it is, due to the larger overlap and better profile of the C-AEH 714 camshaft, the valve crash point is raised to around 6,500 r.p.m.

Should you be lucky enough to locate the crank and rods you can continue to get more power. Tuning from now on should be considered race tune only! The 6,500 r.p.m. mark should always be regarded as a constant limit, with around 6,800 r.p.m. as absolute.

If these figures are exceeded there will be a lot of hot bits: I don't mean the sort to upset your girl friend either!

Commencing with the stripped power unit again, continue as before with balancing, making the following changes.

The block should have the exhaust valves undercut to a depth of .140 in. Camshaft bearings should be replaced if showing signs of wear.

Bore out the cam followers' holes to .9375 in.; –.005 in., —.002 in. so that the 'C' type followers AEC 264 can be fitted with shorter push rod C-AEH 767, alternatively if available use the MGC follower and push rod, 12B 1363 and 12B 1364 respectively. This may seem peculiar but when fitting the race camshaft C-AEH 770 which has a 300° period and width increased to .562 in., there is a risk of the standard followers (1H 822) digging into the flank. At all times the maximum eccentricity of contact should be less then the followers' radius.

To ensure maximum oil pressure replace the oil pump, but before fitting machine the pump cover to obtain two inlet ports. This will prevent oil starvation at high r.p.m. and is detailed in the illustration BaIV. When assembling the oil strainer check carefully that no distortion of the plate is possible and that the gasket seals perfectly. If an air leak occurs at this point the oil suction will be lost. Pack the relief valve spring with two AEH 798s (.100 in. thick). For long distance racing or touring an extended sump is available C-AHH 7252 (18G/18GA). Not only is the capacity increased by over two pints, the sump is also baffled to reduce size.

With the deep sump a one inch packing piece C-AHH 7238 *must* be fitted between the oil strainer and pump extension, again ensure there is no distortion on fitting. The dip stick should also be extended by welding an additional 1.25 in. to its length then "blue" the dip stick after. Alternatively mark a new level on the existing dip stick an inch *above* the original mark. Mark it clearly so there is not any confusion. For short circuit work the original sump capacity is OK but still fit the baffle, illustrated in BaV.

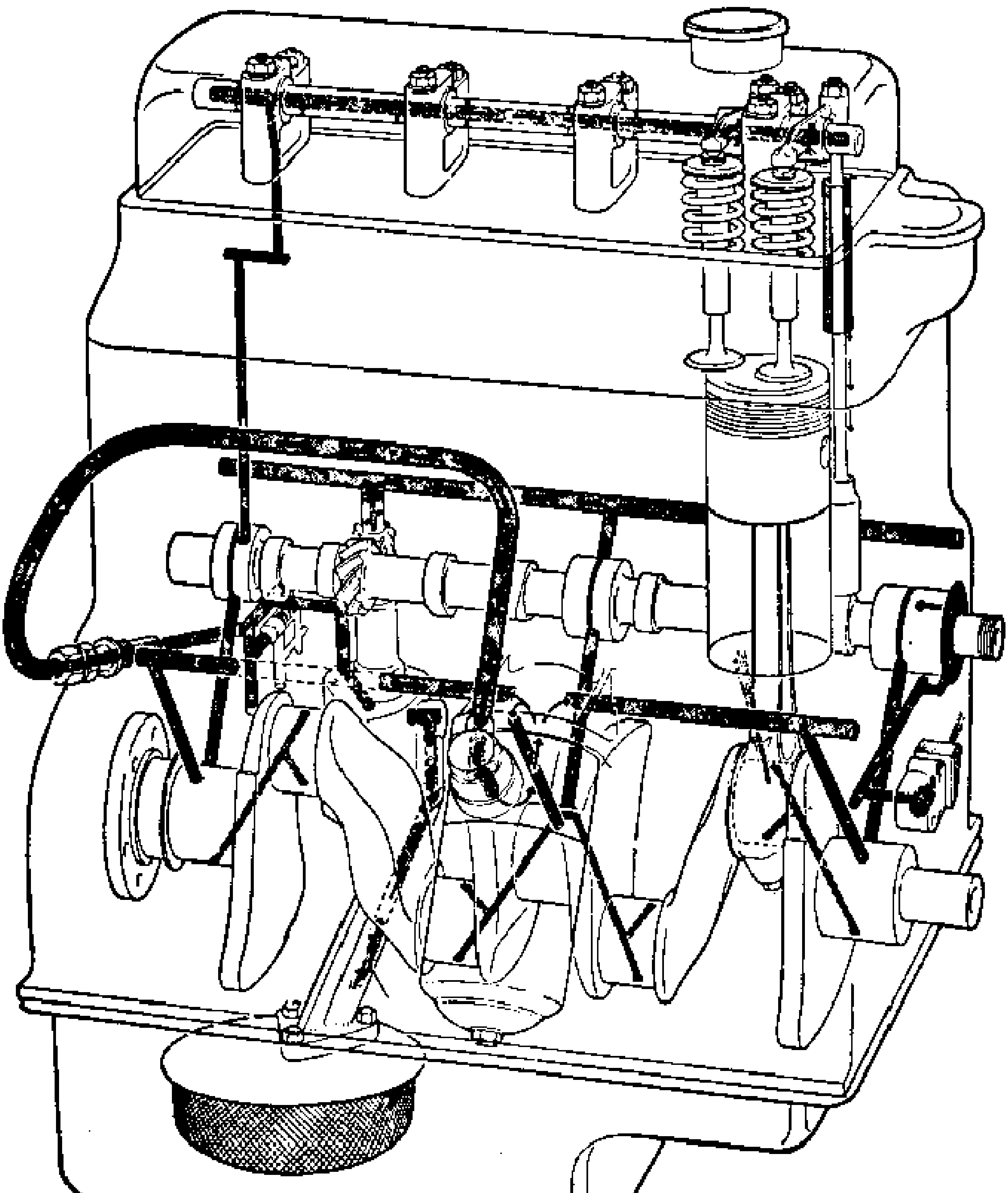
Use new studs and nuts for all main bearing caps and big end bolts. Do not overtighten the big end bolts and make certain they have clearance at the bottom of 'blind' holes.

As mentioned earlier use the camshaft C-AEH 770. The lift of this cam is increased considerably (.452 in. at the valve with .015 in. clearance).

Check that end float is within limits .005 in. plus/minus .002 in.

Replace the timing gears with steel ones, 12H 244 for the crankshaft and C-AEH 771 for the cam. The C-AEH 771 can be effectively lightened by some seven ounces. Drill six additional holes equally spaced from, and on the same pitch circle diameter as the two original holes.

Diameter of the holes should be 49/64



MGB OIL CIRCULATION

in. Further lightening can be completed by carefully radiusing the centre boss and outer flanges. Use the standard timing chain 2H 4905. Finally thread and plug the small hole in the centre of the block face. Drill out the two rear water ways to 9/16 in. diameter.

With the sump fitted we can return our attention to the cylinder head. Before completing the head modifications you should fit aluminium water tight plugs to the two large core holes in the centre of the head face by tapping threads.

Replace the standard valves by C-AEH 757 inlet, C-AEH 758 exhaust, which are in nimonic 80 material. These have half round grooves in the stem and require special collar C-AEH 761 and top collars C-AEH 760. Longer Hidural guides C-AEH 755 inlet. C-AEH 756 exhaust should be fitted to the head. They must be pressed to the head. They must be pressed in to stand between 49/64 in. above the valve seat face. This distance is greater than standard; therefore leave out the metal oil shroud (only fitted 18G/18GA engines) and valve stem oil seal.

Due to the higher lift of the 770 cam the valve spring load at full lift will be increased by some 10 per cent. thereby extending the valve crash point to around 6,700 r.p.m.

It will be more satisfactory to use the competition valve springs C-AHH 7264/7265. These greatly increase the full lift load and assisted by the cam profile will not encounter valve crash before 7,200/7,300 r.p.m. This will only result in engine damage—so you must observe the strict rev limits as quoted before. To cater for the additional load on the valve gear the end rocker pillars should be replaced by special ones with extra support to the rocker shaft ends, part numbers C-AEH 762 and 763. Reassemble the rocker gear using the special steel spacers C-AEH 764 (1) and C-AEH 765 (2): the end float tolerance is .003 in. - .005 in. The rockers can themselves be polished and the bosses gently radiused. Similar attention to the thrust pad (without reducing its bearing area), all helps to reduce the operative gear weight and its stresses.

The standard tappet adjusting screws are "waisted" for an oil feed, but ample oil is supplied to the push rod cups by splash only. Replace these with the solid adjusting screws C-AEH 766.

Compression will either be 10:1 with the 43 c.c. combustion chamber flat top piston combination, or for shorter sprint races 11:1 c.r. can be obtained by reducing the head thickness to 3.115 plus/minus .007 in. Those ratios take into consideration the 1840 c.c. engine capacity resulting from the + .040 in. special pistons.

A special distributor with advanced curve matched to the C-AEH 770 camshaft must be fitted. This distributor C-BHA 4415 will require a static setting around 6° B.T.D.C.

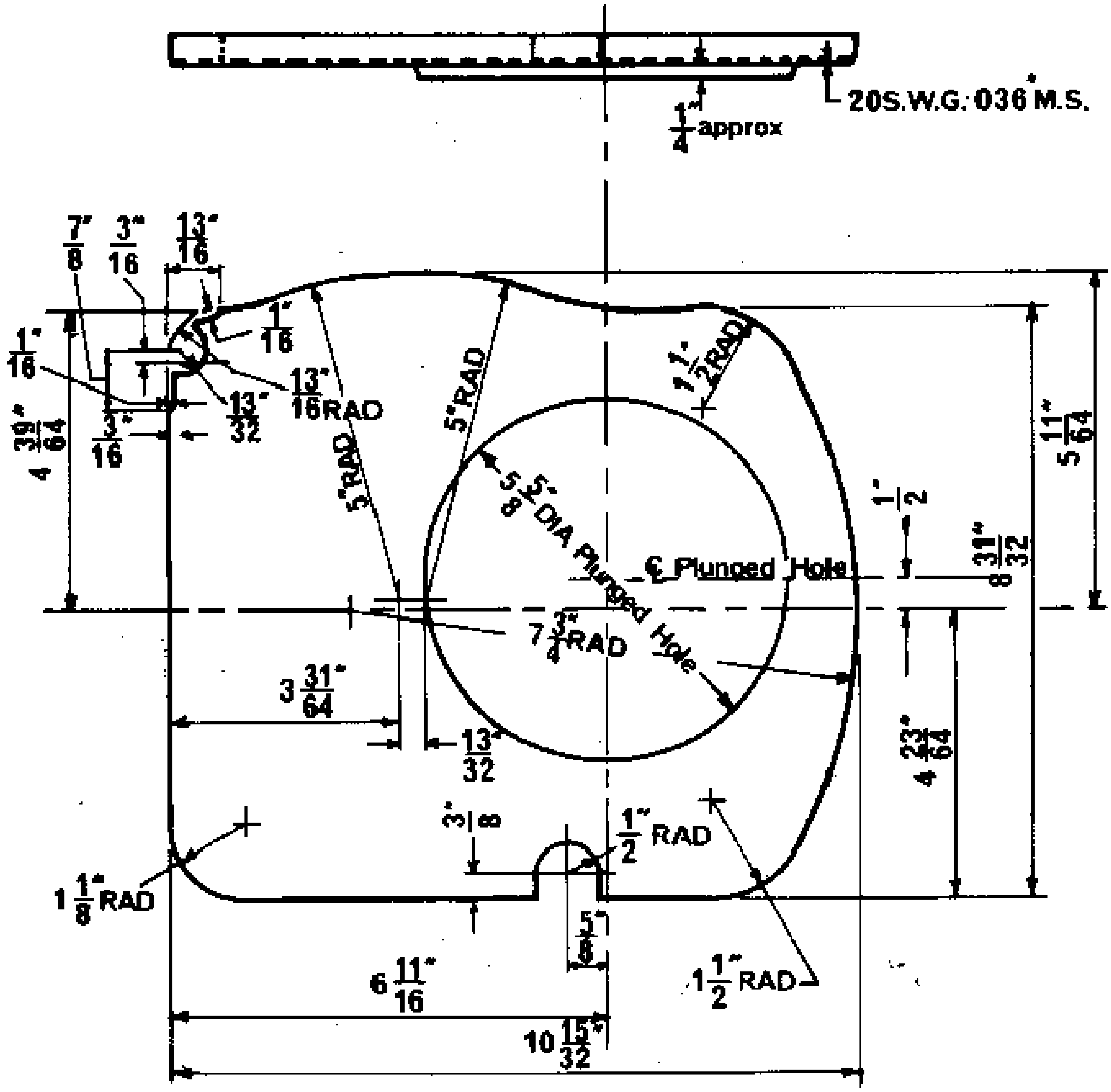
Most suitable sparking plugs will be N58R (11:1) or N63R (10:1); for road work the N3 will be more suitable. In this tune it's no town car!

With the 1¾ in. HS6 carburettor still retaining SY needles, .100 in. jets and light valve springs the power will increase from nothing below 3,000 r.p.m. to just over 120 b.h.p. at 6,000 r.p.m., with a 10:1 compression.

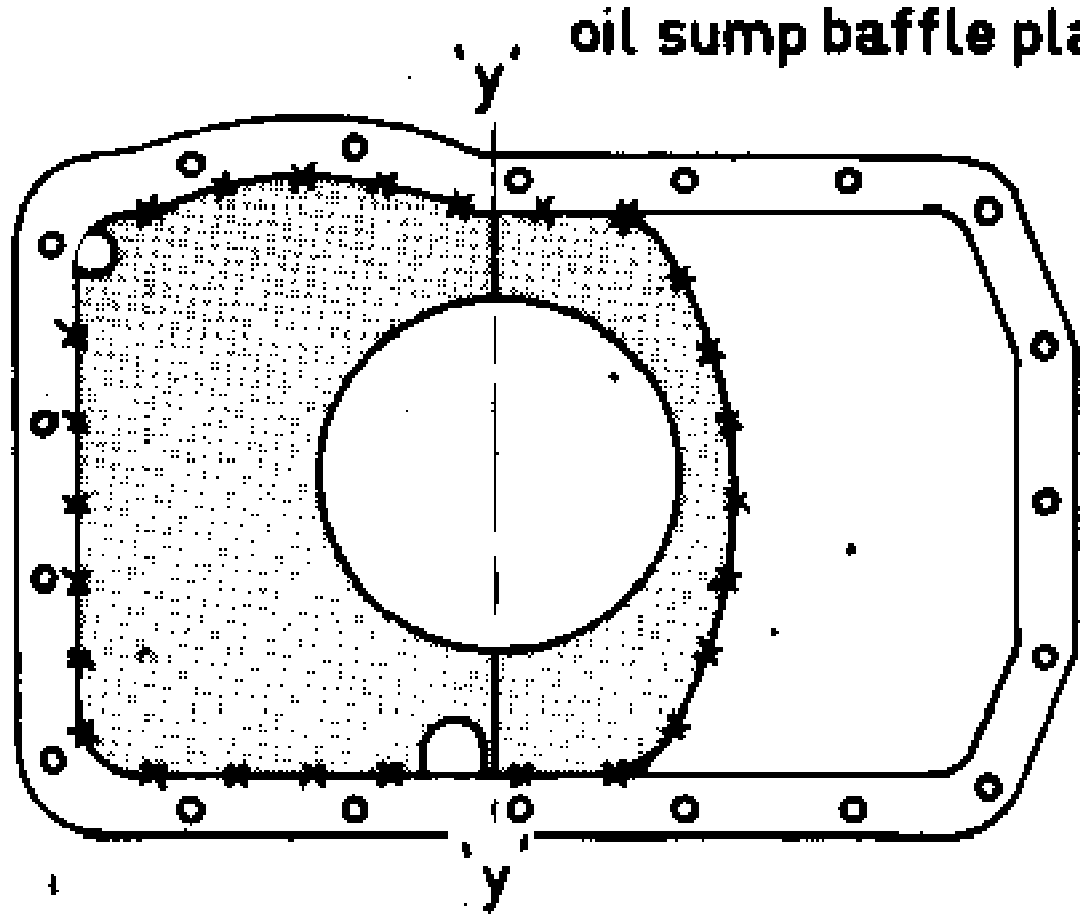
Fitting a 45 DCOE Weber in place of the HS6 S.U.'s will require a special manifold which should also be carefully matched to the cylinder head ports. Both can be obtained from your dealer under part numbers C-AEH 785 (Weber) and C-AJJ 3312 (Installation kit with manifold). This will improve the b.h.p. output by around 3 b.h.p. from 3-6,000 r.p.m. where it evens out.

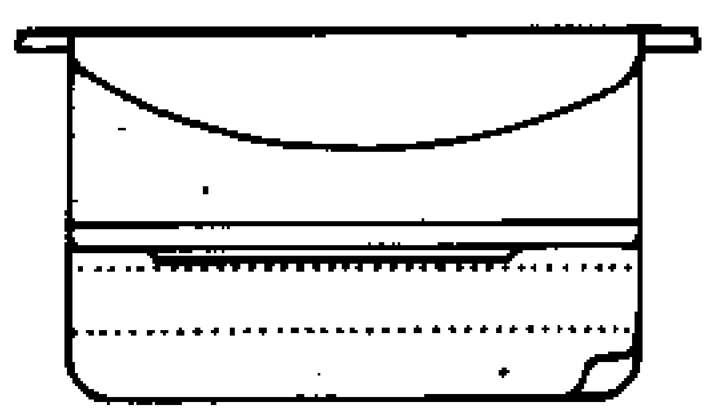
Weber settings are as follows:

Choke	36 m.m.
Main Jet	1.70 m.m./1.75 m.m.
Air Correction	1.6 m.m.
Emulsion	F16
Idling Jet	60/F8
Pump Jet	60,
Float Setting	5 m.m.
Auxiliary Venturi	3.5 or 5 m.m. (dependent on conditions)



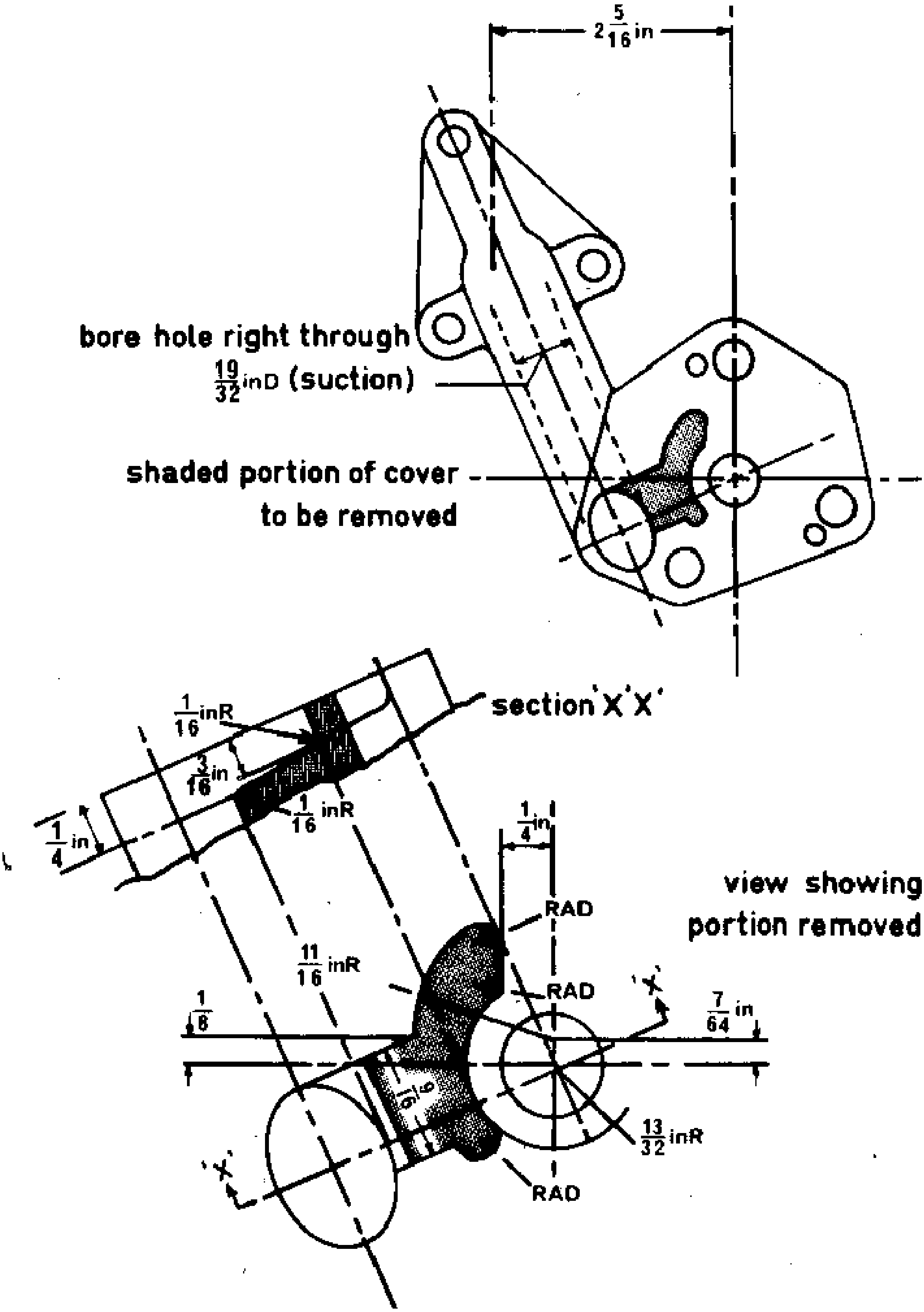
oil sump baffle plate





section 'y' 'y' additional section welded in place

THE INCREASED CAPACITY OIL SUMP (18 G / 18GA ONLY)



OIL PUMP MODIFICATION–'B' SERIES

The centre cylinders tend to run hotter and it is often an advantage to duct cooling air to the manifold. With siamesed centre exhaust porting greater heat is generated in this area. For short events use N63R plugs in centre cylinders, N3 in the outer ones. For long distance events use N63R in the outer cylinders, N58R in the centre cylinders. (How does that grab you schizophrenics!)

With the higher compression ratio (11:1), a further increase in power output will result with a greater increase in the higher rev range. With the HS6 S.U.'s maximum output will be around 130 b.h.p. at 6,500 r.p.m. The 45 DCOE Weber increases the mid range power up to 6 b.h.p. evening out at 6,000 r.p.m.

Greater power in the 5,500-6,500 r.p.m. range can be obtained at the expense of lower pulling power up to 4,500 r.p.m. in long distance events where this would be acceptable use:

Choke 38 m.m.
Main jet 1.80/1.85 m.m.

At all times 100 Octane fuel *must* be used!

CHAPTER 6
MG Transmission

Many clutch modifications have been introduced during the M.G.B.'s production run, all remain dimensionally similar. As the driven plate splines do not alter from the multiple (23) type introduced with the later 1622 M.G.A. you should always use the 18GB series assembly and driven plate 13H 3935/13H 3020.

For road use even with a reasonably tuned power unit you will be wiser to retain the standard clutch. Competition versions have a positive action that does not take kindly to heavy traffic work with an accent on slipping.

For racing the competition cover assembly C-BHA 4642 and driven plate assembly C-BHA 4519, with stronger diaphragm and linings that are bonded as well as rivetted, are essential.

The total rotating weight of the flywheel and clutch is some 43 lbs., which absorbs power overcoming inertia. You cannot get the steel flywheel C-AEH 746 any longer, a competent engineering firm or specialist (Brabham, Laystall) can lighten the flywheel and pressure plate.

Such work is critical and not a case for home 'bodging'. After any work of this nature the complete rotating assembly should be balanced.

The clutch needs to be well ventilated so remove the split pin and drill out the hole at the base of the bell-housing to ⅝ in. diameter; leave the rubber grommet off the withdrawal lever.

At the top centre of the bell-housing approximately 3 in. down from the flange, drill 1¼ in. hole and cover it with a 22 SWG aluminium box section as shown in the illustration 8a VI. The open end should be toward the clutch lever side. Fix the flanged section to the bell-housing with ⅛ in. rivets.

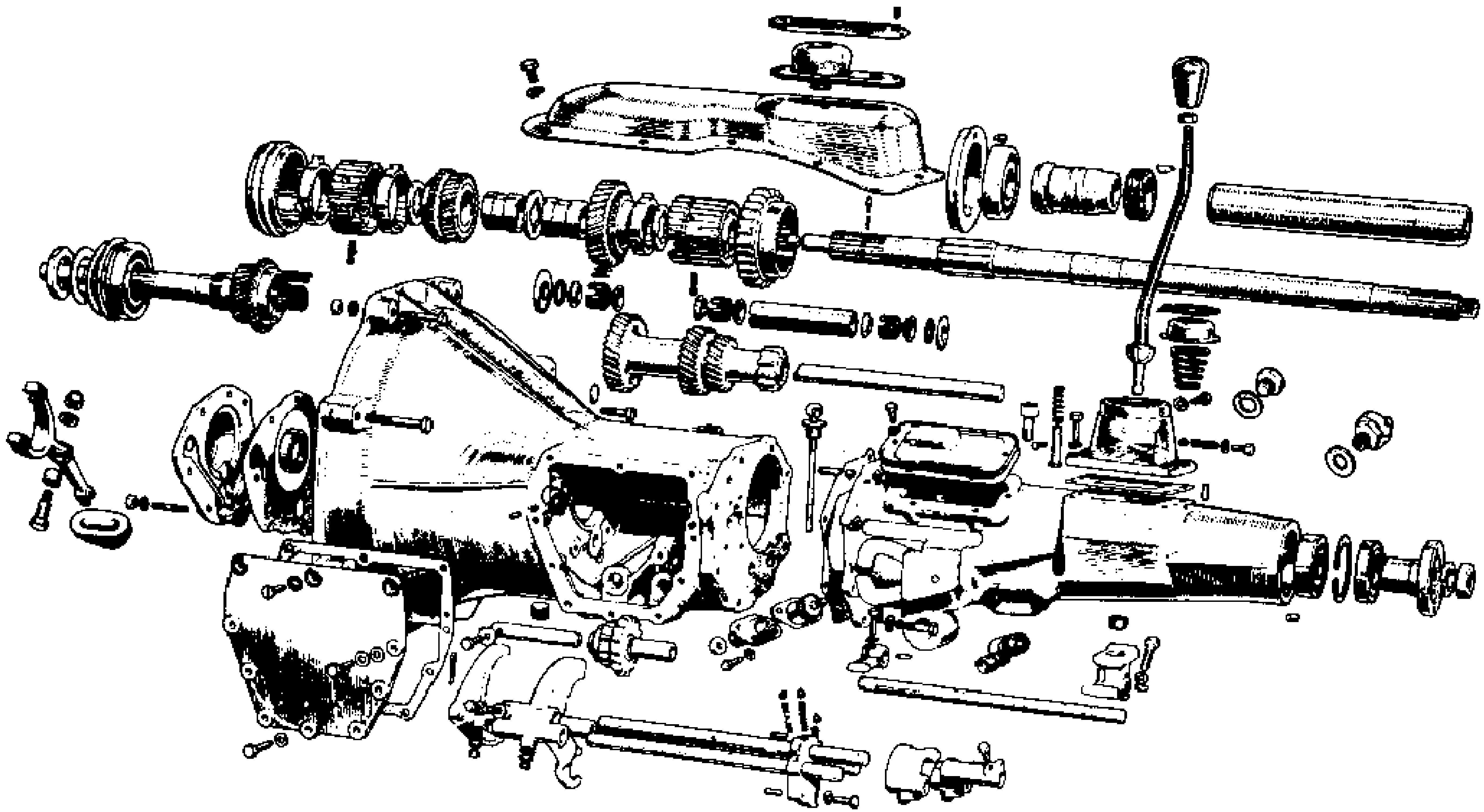
GEARBOX MODIFICATIONS

The normal gearbox dip stick can leak and this should be replaced by AEC 3683 from the Healey 3000. This has rubber sealing rings. As this is too long, cut off 2 7/16 in. and mark High and Low levels coincidental to those on your old dip stick.

The standard gearbox ratios can be improved immensely by fitting the close ratio:

1st motion shaft	C-22H 472
Lay gear	C-1H 3298
2nd Speed Gear	C-22H 1094
3rd Speed Gear	C-1H 3300

C-22H 1094 is a modified version of C-1H 3299 previously supplied and it is essential that whenever these gears are fitted or interchanged the correct baulk ring is used also. 11G 3063 with C-1H 3299 and 22H 249 with C-22H 1094. Remember this when rebuilding boxes converted with the older gears. The 22H 249 baulk ring became a standard part



MGB GEARBOX – NON OVERDRIVE

BY COURTESY OF BLMC

after 18GB/U/H31472 / L29123 (Five bearing models).

For competition the above still applies but again, it is better to modify the box to accept the larger diameter lay shaft 22H 571.

Alternatively purchase the later gearbox casing 48G 413 (Standard) or 48G 414 (O/Drive).

Modifying an earlier box means you must bore out the existing hole to .6688 in./.6699 in., remember these must be exactly aligned.

With the larger diameter layshaft you would use the later competition lay gear C-22H 932. Ratio's are unaltered.

		Std
Top	1.00:1	(1.00)
3rd	1.268:1	(1.374)
2nd	1.62:1	(2.214)
1st	2.45:1	(3.636)
Rev	4.755:1	(4.755)

Where overdrive is fitted this remains at .82 in all cases.

With the larger layshaft/lay gear you will also need to replace the following parts:

Front thrust washer 22H 466
Rear thrust washer (see parts list)
Needle roller (caged 22H 471)
Distance tube 22H 672

Providing the overdrive is in good condition it can provide an ideal range of speeds for competition by allowing a choice of lower axle ratios.

In racing, however, gear changing is a split second operation: time is often saved by fitting a gear lever, o/drive switch, as Paddy Hopkirk has done.

This must be fitted correctly, if it flicks up for o/drive it is far too easy to knock it out of of overdrive when intending only to change down, say, o/drive top to o/drive third and thus engage third.

If you were pulling 5,000 r.p.m. on 550 × 14 R7 tyres with a 4.3 axle ratio you would drop to 6,300 r.p.m. o/drive third *but* normal third would give 7,800 r.p.m. The instant acceleration loading on the flywheel and rotating parts would break the crank or put a leg out of bed

Two points. Check the switch regularly and have it down for overdrive. Check your prop shaft too; dirt and grease build up and put it out of balance, which soon leads to gearbox problems. Spin it over between centres to see if it is 'bowed' in any way. Regularly check the Hardy Spicer couplings also.

Prop shaft lengths vary between

AHH 7488 (30 in.): early tourers, o/drive gearbox, Banjo axle. later tourers, std. gearbox, Tubed axle. Mk II all models, Tubed axle.

AHH 7487 (28.875 in.): early tourers, std. gearbox, Banjo Axle.

AHH 7486 (32 in.): later models o/drive gearbox. Tubed Axle.

So get the right one. 3·909

REAR AXLE

The 18G/18GA all have the Hypoid, three quarter floating axle, the ~~3.909~~ ratio having always been standard. See chart B4 for all the axle ratios available. This axle was replaced on the GT and later five main bearing tourer, and is dealt with later. British Leyland no longer supply the ZF limited-slip differential for these axles. It is ideal for racing as it can double the driving torque efficiency.

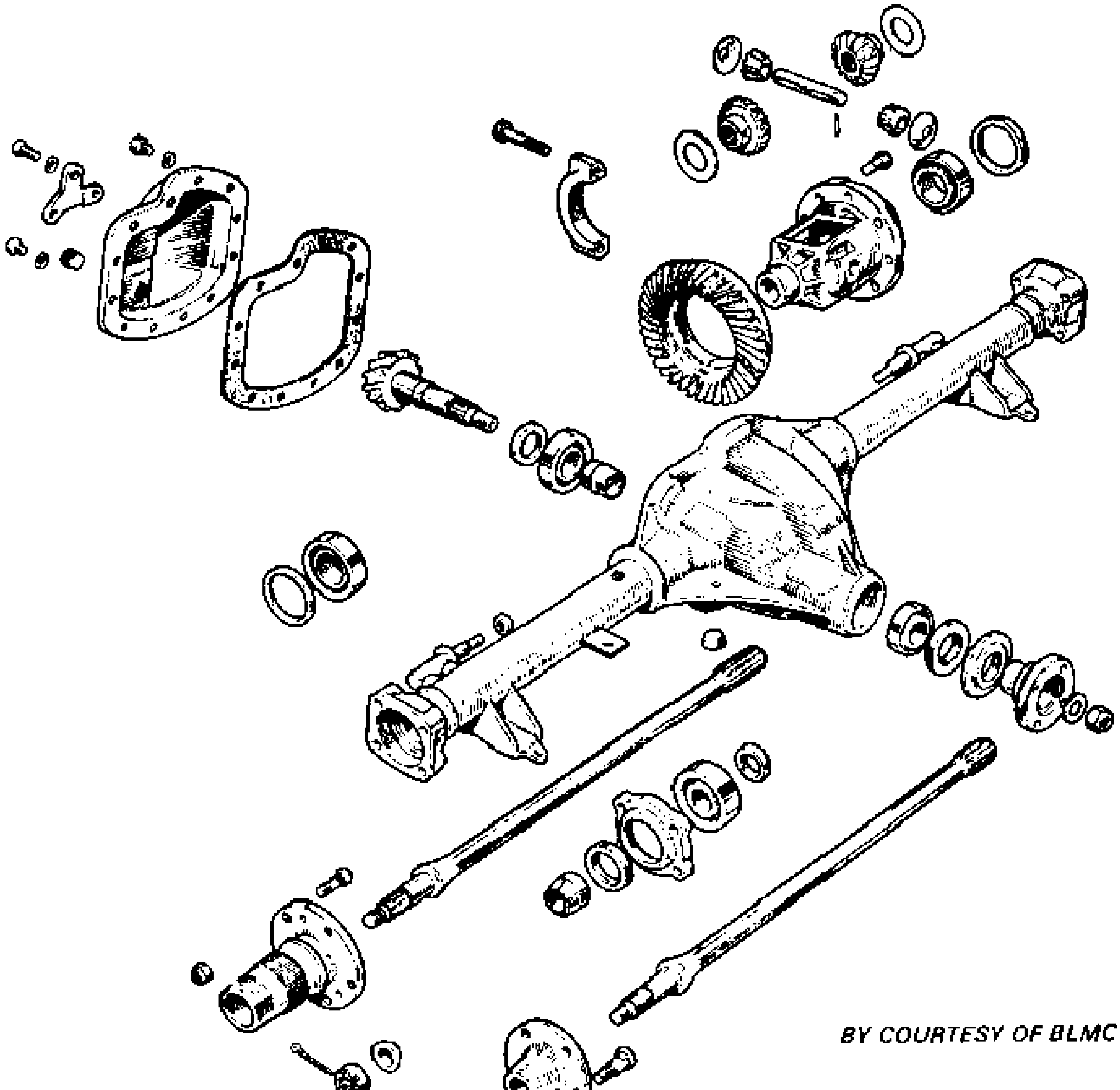
An interesting 'No Spin' differential from America is gradually becoming available, this operates on the Salisbury Power Lok principle and is the smoothest I have ever used.

You may find a self-locking differential upsetting to begin with as it has a tendency to provoke understeer. Its benefits soon become apparent however.

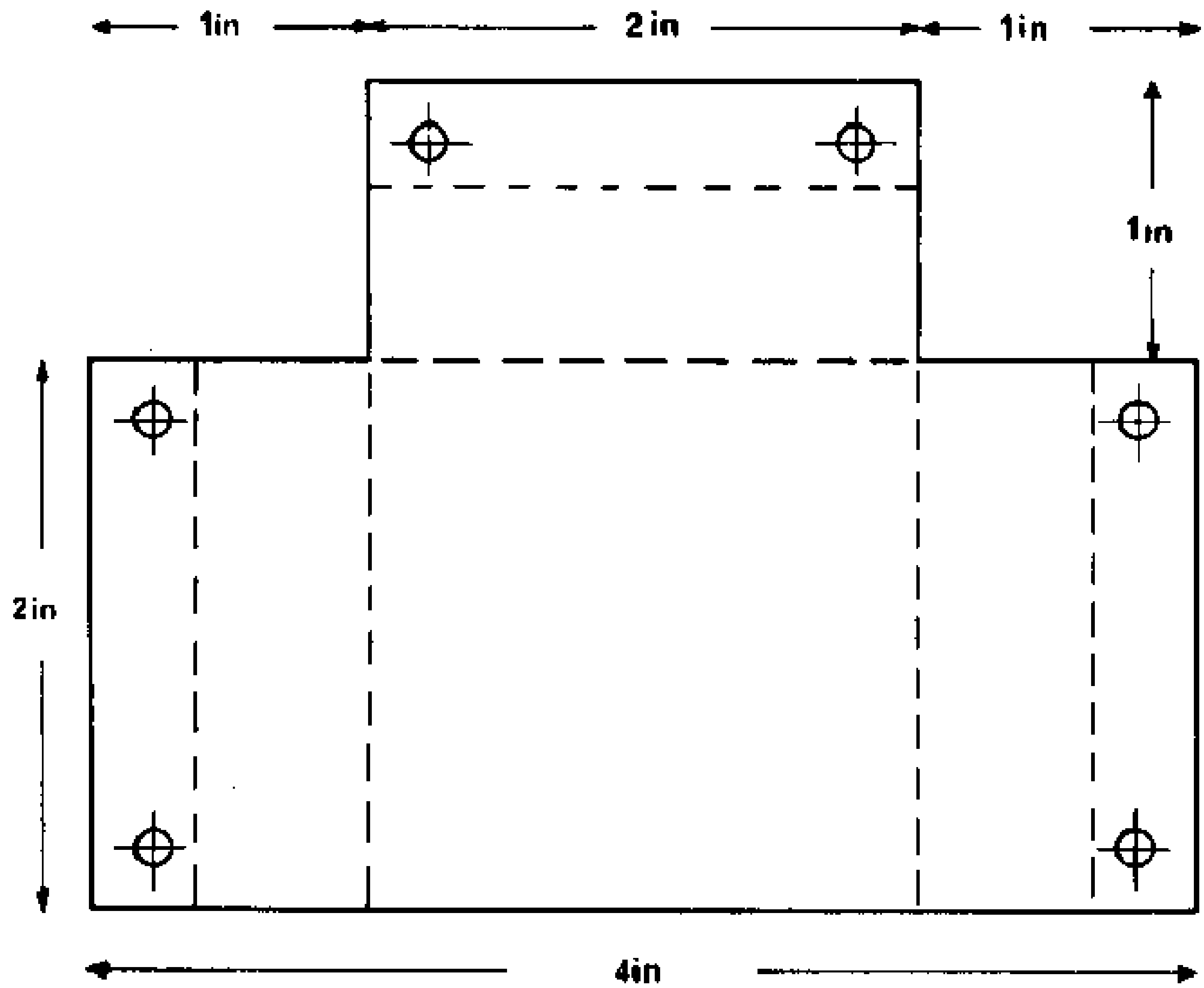
Up to car GHN3-30850 the hub extension on wire-wheels models had twelve threads per inch, after this point this was reduced to eight threads per inch. This also applied to front hubs and only the correct hub nuts can be used.

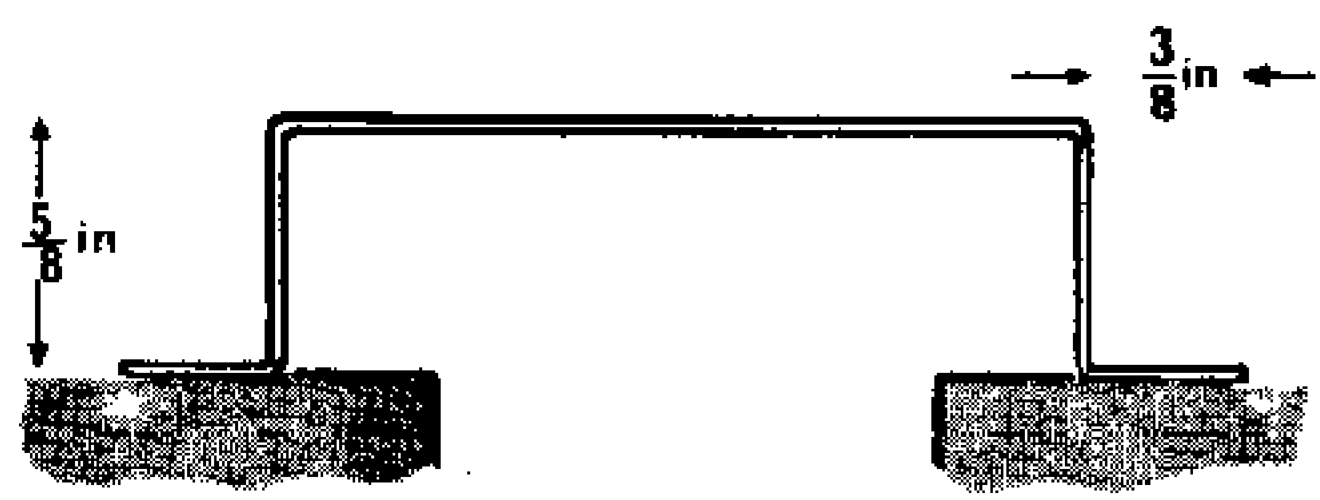
Early Cars AHH 7317 R/H
AHH 7318 L/H
Later Cars AHH 7373 R/H
AHH 7374 L/H

The M.G.A. ratio's are directly interchangeable in these 'Banjo' axles (ref. B4) and you can find one to suit your choice by multiplying the ratio by the revs per mile of the tyre to be used. Divide the resultant figure into 60,000. This will give the road speed (m.p.h.) per 1,000 r.p.m. of the engine with reasonable accuracy. Sample tyre data appears on chart IV.


BY COURTESY OF BLMC

THE LATER TYPE MGB REAR AXLE (AFTER 1967)





MGB GEARBOX BREATHER

A change of axle ratio or tyre size can upset the speedometer. Either have the existing one recalibrated or purchase a new one (very little cost difference.) Messrs. Smiths Industries will do this but must have details of tyre size, gear ratio's, axle ratio etc. Often the manufacturers list different speedometers in their parts list.

Although racing tyres are included please remember these must never be used for road work. They are specialist tyres with no wall protection and variable compound mixes to suit special conditions, not those encountered in day to day travel, which could prove dangerous.

BRAKES

Before dealing with suspension it is about time you did something about stopping the beast.

The standard 10¾ in. disc/10 in. drum arrangement copes happily under normal circumstances. Hard driving will, however, induce fade and the following suggestions do not just apply to tuned models.

Repeated hard application introduces fade (loss of efficiency) up to total loss if common sense doesn't prevail. This is caused through friction-generated heat. Removing the dust shields helps the air flow to the disc and well-placed scoops or ducts can emphasise this.

AXLE RATIOS TYRE DATA MGA/MGB/MGC

Remember that International racing under Group III of the Appendix J may insist on the dust shields *not* being removed. You *can* cut them back so that only the supports (mounting) remain. Next step is to introduce a different pad material. C-9G 8834 are pads with Ferodo DS 11 material; this withstands much higher temperature but does require a bit more pedal effort when cold.

Increased pedal effort can be obtained by fitting a servo. This is a matter of personal choice, the lack of 'feel' can be disturbing in wet or greasy conditions. DS 11 pads may show a tendency for the rear wheels to lock: this can be compensated for by fitting VG 95/1 Ferodo linings, C-8G 8829 to the rear. Complete lined shoes are also available, C-8G 8828.

Further improvements to the braking ratio can be introduced by replacing the rear wheel cylinders, .75 in. bore, 17H 8735 with 17H 8773, .625 in. bore.

These have a dowel on the fitting face, a hole .170 in./.175 in. must be drilled to accept it. Braze the existing hole and face flush with the back plate. The cylinder must be accurately positioned so a template should be made. The new hole is .578 in. above the centre of the cylinder mounting hole, radially offset .350 in.

Rear drums can be lightened by drilling a series of .75 in. holes, equally spaced on the p.c.d. of the adjuster hole to total eight including the adjuster hole.

Never use other than the correct Lockheed Disc Brake Fluid. Other fluids can prove injurious to seals and, more important, its specification must exceed SAE 70R3. Incorrect specification can lead to total loss of brakes through the high temperatures, dissipated via the pistons, evaporating the fluid. Disc surface temperatures can exceed 1,000°F., a considerable percentage of which is transmitted to the fluid.

The complete system must be 100 per cent. at all times.

Appendix J regulations insist upon dual line braking for groups IV and VI into either of which the modified 'M.G.B.' would be classified. Obviously it is a major safety factor for any type of racing.

The more expensive U.S.A. models have a dual brake master cylinder as standard to comply with Federal safety regulations, 37H 2780. This can be adapted into other models with pushrod 37H 2781 although ideally the complete pedal-box assembly should be converted. Bore sizes are identical so no changes to the system are required.

One outlet is led to the front brakes, the other to the rear. It is immaterial which outlet is used for which. Line pressures are identical even after failure of one circuit, additional pedal movement is noticeable though.

It is not uncommon during long distance events to experience evidence of loss of pedal. I am thinking of ardous events like the Targa Floria, Mugello etc. Continual pounding loosens wheel bearings, allowing the discs to oscillate in the caliper, 'kicking' back the piston. Disc calipers have no return springs so that the first pedal operation may not bring the pads effectively into contact with the discs, requiring a second dab. If nothing else it can improve your braking points!

The only answer under those conditions is to use the left foot to dab the pedal occasionally.

Pedals themselves can be improved. A Paddy Hopkirk Mini Throttle pedal fits the M.G.B.; just right for heel and toe. Brake and clutch pedals should have their rubbers replaced by wire mesh rivetted to their surfaces (I have seen worn Surform blades used).

CHAPTER 7
Tuning the Suspension

Suspension requirements vary enormously between individual drivers, as standard the M.G.B. has very predictable handling. A little roll is evident but this curbs the over-enthusiastic. There are logical sequences to follow, to correct, or emphasise, road holding points.

Basically the M.G.B. is neutral but when pressed will oversteer slightly. For slight alterations tyre pressures can be varied, where this difference exceeds 8 lbs./in.^{2} it is time to start on the suspension (put the tyre pressures back to normal).

Lowering the rear lessens roll, alters the tyre slip angle and causes earlier bump stop contact. Stiffer springs will result in oversteer. Stiffening the front springs or fitting an anti roll bar (increasing diameter if one is fitted) will introduce understeer, as can a lowered front. Before deciding on any work think what the car will be used for.

A road car with occasional passenger for fast road work carrying little weight could have similar to race suspension. The family man/enthusiast with a car for all purposes wants anything but.

Overall weights have to be considered, the racing car will for instance, be lightened with alloy/glass fibre panels etc. Conversely for long distance events its fuel capacity may be doubled.

The standard tourer 18G/18GA had a total kerbside weight of 1975 lbs., split into 1065 front/90 lbs. rear. Add two people, a couple of cases and full tank and this could easily become 1165 lbs. front/1310 lbs. rear, a different kettle of fish. Don't therefore fit the softest rate spring to lower the car willy-nilly.

The front coil spring has an easy life with no complications. The leaf rear spring on the other hand controls many factors. It locates the axle laterally and axially, through its design it absorbs torque and prevents 'wind up' a major cause of axle tramp. Oh yes, it acts as a spring! Apart from bump loadings, too soft a rear spring could fracture under excessive torque loadings. Prevent this with a radius arm you say. O.K. but, this can cause axle tramp and the car to skate about in the wet too.

All the available springs with data are shown in Chart V.

For the front, you must consider the free lengths and rate, against the weight of the front of the car divided by two. Here it gets complicated because the front spring does not bear the car's weight directly as the rear springs do. And also you must estimate the unsprung weight to be allowed each side; including wheel, tyre hubs and a portion of the suspension itself.

Barry Sidery-Smith (11) has an MGB battle with Jean Denton at Brands in 1967.

The works MG B Group Three car showing monstrous petrol-filler cap and method of securing the spare wheel.

At the Brands 'BOAC' the Enever/Poole MGB is chased out of Stirling's Bend by a crossed-up Mirage.

MG's 1966 entry in the Marathon de la Route at the 'Ring. This car not only won the event but went on to take the GT class of the Targa Florio in the same year.

(Some is self supporting). From a known weight $\frac{1065}{2}$ is 532.2 lbs. less 66.5 lbs. (say) = 466 lbs.

Before you jump down and point out that the spring chart shows a working load of 1030 lbs. remember I said it gets complicated.

The spring is located less than half way along the bottom wishbones and therefore becomes a function of the suspension geometry, resulting in the spring being compressed less than half the wheel deflection. Thus the standard spring's 348 lb./ins. rate becomes 73 lbs./ins. at the wheel. Six inch wheel movement from its free length would be equivalent to 2.9 ins. at the spring approx: 6.4 × 73 = 467 at wheel. 2.965 × 348 = 1030 give or take a splash of mud.

Some of this movement is of course already taken up in the static fitted height of the spring during assembly. The balance of compression is when the car bears its own weight. From this you can then deduce that fitting AHH 5789 spring will give a stiffer ride without raising or lowering the car appreciably.

C-AHT 21 also stiffens but also effectively lowers the car just over an inch in relation to the normal weight of the car. At the rear the choice is yours from the many offered. Load and ride height must be considered and again weight is the rear total, less the axle, wheels etc. (approx. 130 lbs.) divided by two.

Early 18G springs AHH 6453 did not have the plastic interleaving and have slightly stiffer rate than the later AHH 7080. C-AHH 8343 has increased rate (110 lbs.) but less deflection and is flat at a lower load, ideal for light sprint motor.

AHC 31 is a good high load short movement spring for stiffening and lowering while AHH 7346 has even greater load capacity and movement for rallying etc.

Lastly the competition C-AHT 20 with similar load capacity but less deflection. Ideal for long distance events demanding lowered cars with a high fuel load. As the fuel load reduces the ride height is not too greatly affected.

The anti-roll bars offered for the 'B' Series are:

9/16 in. diameter	AHH 7329
⅝ in.	C-AHH 7593
¾ in.	C-AHH 7924

Cars not already equipped with an anti-roll bar would need a fitting kit C-AJJ 3306 in addition.

Competition shock absorbers to dampen the spring movement are readily available.

C-AHH 7104 front (2)
C-AHH 7105 rear (r/h)
C-AHH 7106 rear (l/h)

If the shock absorbers are in 100 per cent. condition (be honest with yourself) you can fit valves C-AHH 7217. This is a waste of time if they are not. Whether new or with changed valves, always mount the shock absorber on the bench and pump it through its full stroke for several minutes to expel all air.

Directly affecting the suspension are changes to wheels and tyres. Many wheels are now offered to unsuspecting buyers with no consideration for safety or stresses involved. The wide-rim wheels are much heavier and in many cases totally unsuitable for the suspension design.

I feel we shall soon have legislation bringing them under the Construction and Use regulations, as is already operative in many European countries. A number of points must be watched, obviously clearance of suspension and body work are essential but these are taken for granted. Wheel arches would have to be modified for racing tyres anyway. Weight is important, a wider rim means an oversize tyre and subsequently further increase to the all important unsprung weight.

Luckily M.G.B. owners are well catered for without purchasing suspect wheels. The M.G.B. GT has an inch wider disc wheel than the Tourer, as standard, and a competition 70-spoke wire-wheel is also available. For all average purposes these are ideal and there is little point in departing from type recommendations. This only results in unsatisfactory tread profile, contact patch, etc., thus negating all your careful suspension work.!

For a carefully tweaked racer the aim is to reduce unsprung weight whenever possible and the following wheel data gives an indication of what I mean.

Magnesium alloy with its very high weight/strength co-efficient is ideal (A bolt-on 8 inch rim can weigh less than the standard 4 inch steel disc type). Cost is a problem though as always, all the more reason to invest wisely.

Strength means safety and also being properly manufactured. I do not intend to evaluate the merits of the good or bad alloy or magnesium wheels now offered, suffice to say leading manufacturers like British Leyland, Ford, Rootes have *all* chosen the Minilite after stringent tests.

M.G.B. Tourer (disc)
AHH 6132—4J—16.1 lbs.

M.G.B. GT (disc)
AHH 8112—5J—17.62 lbs.

Optional Wire
AHH 6487—4½J—15.75 lbs.

Competition Wire
AHH 8530—5½J—17.87 lbs.

Magnesium Alloy
C-AHT 69—5½J—15 lb.

(centrelock for wire wheels)

Appendix J only permits homologated wheels for Group III events so your choice would be either the Competition Wire C-AHH 8530 or magnesium alloy C-AHT 69 (same rim width). The Dunlop R7 550 L × 14 ins. is happy on this rim width, the 550 M × 14 is *not.*

Racing tyres' sectional height to width ratio are getting smaller each year and demanding wider rims, owners should therefore take the advice of the respective Racing Tyre Division.

FUEL SUPPLY

The fuel pump is quite adequate for all purposes when in good condition (4½ minutes per gallon) and this can drop to one gallon every ten minutes with a faulty pump, insufficient for a racing engine. Better in any case to fit the AUF 400 duplicated diaphragm and electrics type, in case of failure simply move the live lead to the other connector. Tank capacity is also sufficient for normal and club racing requirements. The early ten gallon tank was increased to 12 gallons from body number 56743 onwards.

A larger tank brings problems of weight and handling. For competition an additional tank was available but this has been discontinued for some time. It amounted to an additional ten gallon tank inverted and mounted in the boot supports. Modified, they were connected through the boot floor with lengths of hose. A filler was placed in the centre of the tank and the boot lid modified to suit.

This would only be entertained for a purely racing model and such an owner wishing to make one could no doubt obtain full details from the Special Tuning Dept. With the emphasis on fire precautions it may be felt more suitable to have a one piece tank with inner sealing bag manufactured by a specialist company.

CHAPTER 8
The Five Bearing Engine

September 1964 saw the introduction of a new power unit with five main bearings, given the engine prefix 18GB.

A completely new block with the same bore and stroke had a more rigid cross drilled crankshaft, better connecting rods and pistons. The cylinder head was unchanged in any way at all; as the new pistons still retained the 6.25 c.c. dish, compression was unaltered at 8.8:1.

The new connecting rods 12H 1019 still have diagonally split big-ends but are a big improvement over the 18G/18GA type. These conrods are not handed and have larger diameter (.812 in.) fully floating small ends. The flywheel was modified and is not interchangeable with the 18G/18GA one, mounted with six set screws and two dowels.

The earlier modification outlined for the 18G/18GA oil pump and filter were standard on the model, as was an oil cooler. A modified water pump had less vanes without reducing efficiency.

In October 1965 the GT version was introduced with a chassis prefix GHD3. Apart from the obvious difference and stronger springs with a ⅝ in. anti-roll bar as standard, the major component change was the rear axle. On the GT only at this time, a tubed semi-floating type was introduced, being slightly heavier but quieter.

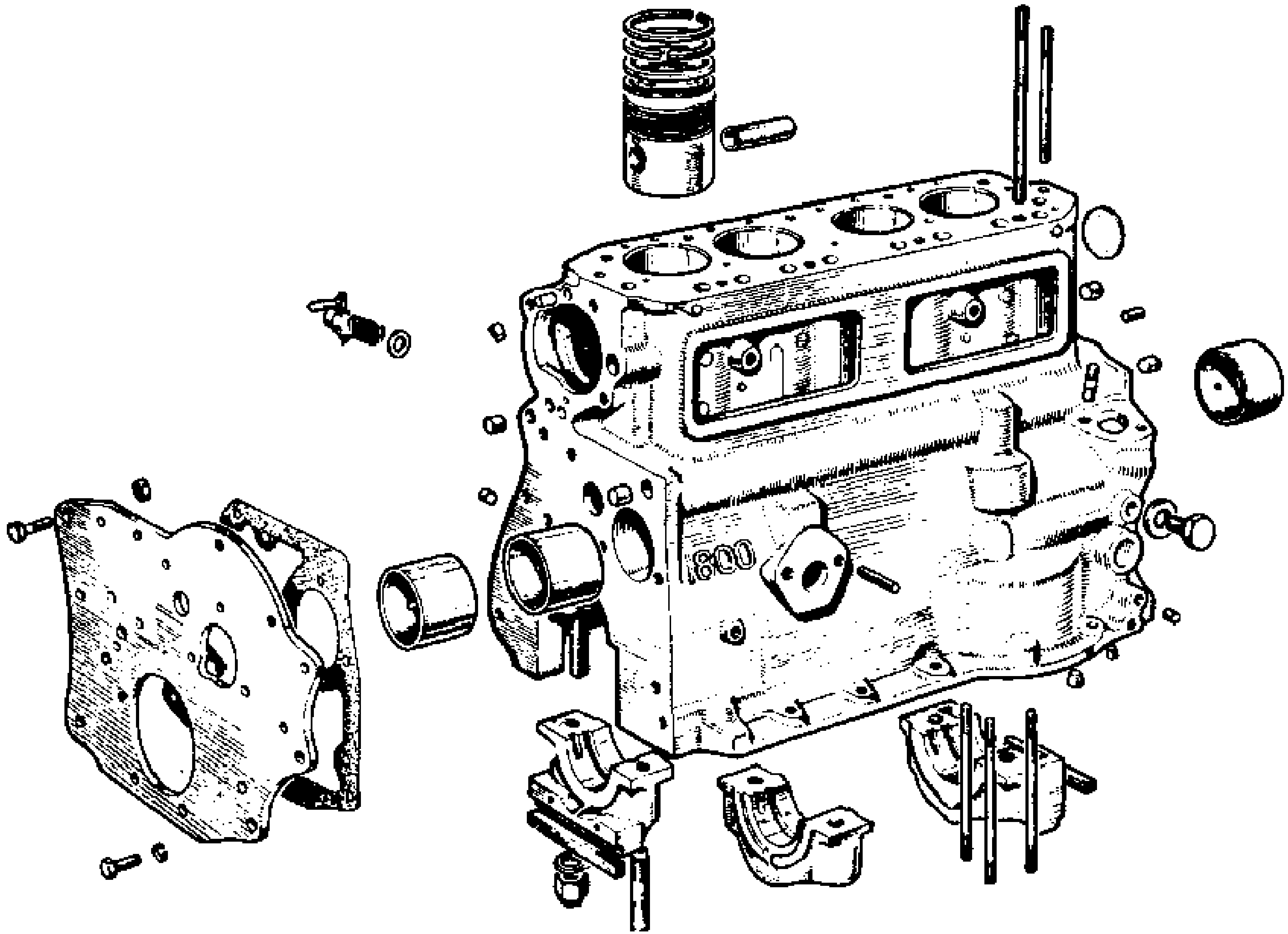
One snag with this axle is changing ratios for competition, or anytime in fact. Quick changes are out and I mean OUT, the quickest way is to change the complete axle. As the axle is one piece, to change the diff ratio you remove the axle from the car, then remove the shafts.

Unscrew the ten bolts holding the metal cover, exposing the works. As the axle is one piece you first remove the bearing caps. Reminiscent of the Spanish Inquisition we now insert a 'stretcher' (sit down Myrtle you're safe). Two dowels locate in holes in the casing. Winding the stretcher, take the sideload off the bearings enabling you to lift out the diff cage, crown wheel and all. This only briefly outlines the job, replacing the pinion means its bearing must be pre-loaded exactly, the crown wheel mesh set with a dial gauge. No job for amateur or average mechanic, only a specialist with correct equipment.

From GHNS- 132916 disc wheels, 132923 wire wheels. This axle was also fitted to the Tourer version. No parts are interchangeable with the earlier Banjo axles.

From late 1966 (GHN3- 108030)the Tourer also acquired an anti-roll bar as standard, 9/16 in. diameter. Overall weight changed.

Tourer	2030 lbs.	1090/940
GT	2260 lbs.	(1180/1080)



MGB CYLINDER BLOCK COMPONENTS

BY COURTESY OF BLMC

Modifying this model for increased performance closely follows that for the 18G/18GA.

Head modifications are the same (until full race anyway) carburettor and ignition suggestions are identical, so we can refer to the 18G/18GA for earlier stages.

High compression piston are readily available C-AEH 853 up to .040 in. oversize, with a special forged lightweight C-AJJ 3377 at .80 in. oversize only, to obtain 1,880 c.c. Compression would be 9.8:1 normally, progressively increasing with capacity to 10.3 approx. with 1,880 c.c. This is in conjunction with a standard cylinder head volume (43 c.c. nominal). Always use the special head gasket C-AEH 768.

Before stripping the power unit check the depth of each piston in the bore when it is at T.D.C. and make a note. The standard con-rods are perfectly suitable but as a precaution fit the Twin-Cam high tensile set-screw AEH 647 for the big ends caps. Carefully balance, overall and end for end, polish and deburr any mating faces.

The Twin-Cam rods C-AEH 642/644 can only be fitted after machining to reduce width and as they introduce piston problems, are best forgotten. Piston C-AEH 853 can be balanced and 5/16 in. carefully removed from the skirt for a competition power unit.

Special lead indium bearings with additional clearance can be fitted with the Nitrided crankshaft C-12H 2968 (formerly C-AEH 822). The increased clearance emphasises the 'bearing rattle' characteristic of the 'B' power unit when cold. The bearing references are, connecting rod C-18G 8022, main bearings C-18G 8103.

A lightened flywheel is no problem as C-AHT 86 is readily available, this is over 12 lbs. lighter than the standard one. Taken for granted that all rotating parts, crank/flywheel/clutch/pulley are balanced.

Remember to complete the block modifications as for 18G/18GA, countersink the head stud holes, plug the small hole in the centre of block face and open out to 9/16 in. diameter the two water ways at the rear end of block face.

As we are only considering tuning for maximum the block should be bored to .080 in oversize to accept C-AJJ 3377 piston set. Machine the block face approx. .020 in. to bring the piston crown .010 in. from block face at T.D.C. Refer to your earlier measurement for the exact amount, don't forget to allow .010 in. clearance though! Open the cam follower bores to accept the MGC's 12B 1363 which will also require the MGC push rod 12 B1364. This is a specialised job.

Have the block thoroughly cleaned out after this work, make sure no swarf or dust remains in oil ways etc. Always be scrupulously clean. Check that core plugs are secure.

Fit the race camshaft C-AEH 770 (see B1). Fit the steel timing gears 12H 244 crankshaft and C-AEH 771 camshaft, having lightened C-AEH 771 as outlined for the 18G/18GA.

Remove the thermostat from the head and fit the blanking sleeve 11G 176 in its place. If the C-AHT 100 head is the basis, this already has Hidural valve guides, the valves should however be changed to C-AEH 757 inlet, C-AEH 758 exhaust in Nimonic 80. These will require different cotters and top valve springs cups, C-AEH 761 and 760 respectively, also bottom collar C-AEH 801. Do not fit the metal shroud, or normal stem oil seal, use only the MGC oil seal 12B 2014.

The best valve spring combination will be C-AHH 7264/12H 723 for road and C-AHH 7264/7265 for competition. See chart B3 for the springs available.

Carefully polish and lighten the rocker gear as for 18G/18GA. Ensure each one is correctly located over its valve stem by spacers, grinding rocker bosses if necessary. Use only the special rocker adjuster screws C-AEH 766.

With the head fitted to the block using the thicker, high tensile washers as for 18G/18GA, and rocker gear in position, aim to have the centre point of the arc described by the rocker arm when the arm is horizontal i.e. at half the cam lift.

Before fitting the rocker cover, drill a $\frac{5}{8}$ in. hole in the top and braze in a short elbow with $\frac{1}{2}$ in. bore and flared end. A length of polythene tubing can then be led from this and the side plate breather to a suitable catch tank, a quart oil can is ideal. Remember the pipes must still be able to breathe, don't seal the catch tank!

The HS6 S.U. carburettors could remain but we will fit two HS8 2 in. S.U.'s, C-AUD 279. These can be fitted to the standard manifold but a better manifold is included in the fitting kit C-AJJ 3374. Flare pipes C-AHT 145 will lessen low speed blow back. Use a UVE needle with a blue/black spring AUC 8114.

An alternative to the two S.U. would be the 45 DCOE Weber C-AEH 785, with manifold etc., in the fitting kit C-AJJ 3312. The Weber must be loosely fitted, just enough to seal the 'O' rings. Use the double coil washers and wire the locating nuts in pairs to prevent them vibrating free.

Do not omit the steady rod included in the kit, this reduces the load on the manifold. Settings are:

Choke	40 m.m.
Main Jet	180/185
Air Correction	160
Emulsion	F16
Idling	60 FS
Auxiliary	3.5 or 5 m.m.
Pump	60
Float Level	5 m.m.

The pump inlet should have a 2 m.m. hole in the top. Exhaust hole in the side 1 m.m. diameter. N64Y (C37H 4208) sparkplugs will do for running-in but for maximum power use N60Y (C-37H 2148). The competition distributor C-BHA 4415, Lucas 40943, must be used with a static setting of 6 B.T.D.C.

The power unit in this form shouldt develop in the region of 135/138 b.h.p. a 6,000 r.p.m. approx. 6,500 r.p.m. should be the rev limit imposed with 7,000 r.p.m. for emergency.

Further power can be obtained by increasing the valves size. MkII 1800 Saloons have head 12H 2594 with larger inlet valves (1.628 in.) 12H 2891, the nominal capacity is 40 c.c. Combustion chamber shape basically is improved.

Alternatively, and more suitable for racing, oversize Nimonic 80 valves are available for which the standard head can be opened out, C-AEH 860 1. 11/16 in. Inlet, C-AEH 861 Exhaust 1. 7/16 in. Depending on finance, Special Tuning could supply a complete race head with these valves to special order. With the carburettors as detailed the power available would be increased to in excess of 138 b.h.p. After fitting a power unit go over all the mountings, drain plugs (including sump) and wire lock wherever possible.

With the introduction of these 18GB units the crankshaft pilot bush was increased to accept the larger diameter 1st motion shaft spigot. Clutch splines and diameter remained unaltered. The lightened flywheel C-AHT 69 and competition clutch C-BHA 4642 driven plate C-BHA 4519 are used. The gearbox mods for dip stick and breathing 18G/18GA still apply. A different first motion shaft C-22H 846 is used however.

The larger diameter lay shaft 22H 571 was standard after 18GB/U/H74720 L60597. Before this change point use laygear C-1H 3298, or modify as outlined an 18G/18GA patr. After the change point fit C-22H 932. Obviously the larger diameter shaft is a 'must' for racing.

Use only the extractor exhaust manifold C-AHH 7103. For road use the standard system should be used, the front silencer can be replaced by a length of 2 in. diameter 3/32 in. thick but this will increase the noise level.

For racing modify the system to exit ahead of the rear nearside tyre. This must not let the exiting exhaust gases impinge upon the tyre, deflect it clear. Check that exhaust system mountings are secure and put a 'U' shaped strap under it at two points fixed to the body. If a mounting fails this lessens the risk of being black flagged for a trailing exhaust.

Fit a larger diameter pulley to the dynamo/alternator and only use 13H 923 fan belt (pre stretched). If the engine is running cool enough you can run without the fan. Use flat washers when bolting the pulley on the pump flange.

Details of the alternative axle ratios are given in the chart IV. For modification to suspension or brakes refer to the relative paragraphs on 18G/18GA with the exception that the GT model has larger rear wheel cylinder .875 in. diameter.

Although the preceding pages do not detail tuning work for the six cylinder engines as fitted to the big Healeys and lately the MGC, they do provide a sound and accurate guide to the four cylinder

BMC sports-car engines. It is our contention that there has not been a book of such technical accuracy and completeness on this subject before, and it is hoped that it will prove the 'Bible' on the thousands of MG and Austin-Healey fanatics throughout the world.

The chequered flag falls on Mike Garton in his Sprite coupe at the Nurburgring in 1965.

CHART I
'A' Series Camshafts

PART NOS.	Pin drive oil pump	8G 712 2A 297 2A 571	12G 165 AEA 630	AEG 148	88G 229 2A 948	AEG 510	C-AEA 731	C-AEA 544	C-AEA 648	—	—
MARKING		—	2 rings	—	1 ring	1 ring	3 rings	AEA 544	AEA 649	—	—
STANDARD USE		Mini 850 Mini 998 9C Sprite 1	1100 range 998 Cooper 9CGAH/MG	Early Cooper 'S' 10CC AH/MG	997 Cooper	Cooper 'S' From: 9FSAY-40006	Race	Early full race	Race	— — —	— — —
CAM LOBE WIDTH		3/8"	3/8"	1/2"	3/8"	1/2"	3/8"	1/2"	1/2"	—	—
INLET OPENS B.T.D.C.		5°	5°	5°	16°	10°	24°	34°	50°	60°	60°
INLET CLOSES A.B.D.C.		45°	45°	45°	56°	50°	64°	74°	70°	80°	80°
EXHAUST OPENS B.B.D.C.		40°	51°	51°	51°	51°	59°	69°	75°	75°	85°
EXHAUST CLOSES A.T.D.C.		10°	21°	21°	21°	21°	29°	39°	45°	45°	55°
INLET PERIOD		230	230°	230°	252°	240°	268°	288°	300°	320°	320°
EXHAUST PERIOD		230°	252°	252°	252°	252°	268°	288°	300°	300°	320°
CAM LIFT		.221"	.250"	.250"	.250"	.250"	.252"	.306"	.315"	.315"	.315"
VALVE LIFT		.285"	.318"	.318"	.318"	.318"	.320"	.388"	.394"	.394"	.394"
RUNNING CLEARANCE		.012"	.012"	.012"	.015"	.015"	.015"	.015"	.015"	.015"	.015"
TIMING CLEARANCE		.019"	.019"	.021"	.019"	.021"	.021"	.021"	.021"	.021"	.021"
PART NO.	Spider drive *oil pump	12A 1065	12G 726	AEG 522 AEG 537	C-AEG 567	C-AEG 542	—	—	C-AEG 529	C-AEG 597	C-AEG 595
MARKING		—	2 rings	—	AEG567	1 ring AEG 543	—	—	AEG 530	AEG 598	AEE 596
STANDARD USE		Automatic Mini 850/998	Automatic 1100	12CC AH/MG	Semi-race	Rally Road	—	—	Race	Race	Race
CAM LOBE WIDTH		3/8"	3/8"	1/2"	1/2"	1/2"	—	—	1/2"	1/2"	1/2"

*Requires flange 12G 729

CHART II
'A' Series Pistons, etc.

ENGINE PREFIX	PART NO.	STANDARD BORE	NOMINAL C/RATIO	VOLUME of DISH	* 'C' HEIGHT	OVERALL HEIGHT	STANDARD DEPTH IN BORE 'NOM.'	VOLUME UNSWEPT BORE.	GASKET VOLUME	CON-RODS	GUDGEON PIN DIAMETER	STANDARD HEAD VOLUME
9C	12A 145	2.478"	8.3	4.2c.c.	1.339"	2.592"	.010"	.8c.c.	3c.c.	2A 654/656	.625"	24.5c.c.
9CG	12A 187	2.478"	9.0	Flat	1.339"	2.592"	.010"	.8c.c.	3c.c.	—	—	26.1c.c.
10CC 10CG	12G 306	2.543"	8.9	2.46c.c.	1.194"	2.288"	.008"	.7c.c.	3c.c.	12G 123/126	—	28.2c.c.
9FA	12A 674	2.543"	9.0	Dome	1.366"	1.616"	—		3c.c.	—	—	28.2c.c.
12CC	*Set* 8G 2545	2.78"	8.8	11.13c.c.	1.495"	2.745"	.040"	4c.c.	3.8c.c.	AEG 520	.813"	21.4c.c.
970 S	*Set* 8G 2432	2.78"	10.0	Flat	1.495"	2.745"	.010"	1c.c.	3.8c.c.	AEG 309	.813"	21.4c.c.
9FSAY 1275 'S'	*Set* 8G 2434	2.78"	9.75	6.6c.c.	1.495"	2.745"	.040"	4c.c.	3.8c.c.	AEG 176	.813"	21.4c.c.
F/Jnr	C-AEA 639	2.538"	—	Dome	1.400"	2.152"	—	—		C-AEA 620/621	.687"	—
F/Jnr	C-AEA 711	2.667"	—	Flat	1.339"	2.092"	—	—	—	C-AEA 706/709	.687"	—

* 'C' Height G/pin centre line to crown

CHART III
'B' Series Pistons, etc.

MODEL OR PREFIX	PART NO'S	STANDARD BORE	NOMINAL C/RATIO	PISTON DISH VOLUME	STANDARD DEPTH IN BORE	BORE VOLUME	GASKET VOLUME	* 'C' HEIGHT	OVERALL HEIGHT	PIN DIA.	CON-RODS	HEAD VOLUME
MGA 1500	1H 1142	2.875"	8.3	4.85c.c.	.035"	3.8c.c.	3.3c.c.	1.656"	3.031"	.687"	1H 701/703	38.7c.c.
,,	C-1H 1178	2.875"	9	Flat	,,	,,	,,	,,	,,	,,	,,	,,
,,	C-1H 1180	2.875"	10	'Pent' Special	,,	-4.5c.c.	,,	1.718"	3.094"	.875"	C-AEH 642/644	,,
MGA 1600	12H 178	2.969"	8.3	7.75c.c.	,,	4.1c.c.	,,	1.656"	3.031"	,,	12H 93/91 1H 701/703	,,
,,	☐ 14986	2.969"	9	3.8c.c.	,,	4.1c.c.	,,	,,	,,	,,	,,	,,
,,	☐ 15059	2.969"	9.6	Flat	,,	4.1c.c.	,,	,,	,,	,,	,,	,,
1600 MK II 1622c.c.	12H 437	3.0"	8.9	Flat	,,	4.2c.c.	,,	,,	,,	.75"	12G 424/426	43c.c.
MGB 18G/GA	12H 961	3.16"	8.8	6.25c.c.	,,	4.6c.c.	,,	,,	,,	.75"	,,	,,
,,	C-AEH 736	3.16"	9.7	Flat	,,	4.6c.c.	,,	,,	,,	.875"	C-AEH 642/644	,,
MGB 18GB	*Set* 8G 2474	3.16"	8.8	6.25c.c.	,,	4.6c.c.	,,	,,	,,	.813"	12H 1019	,,
,,	C-AEH 853	3.16"	9.7	Flat	,,	4.6c.c.	,,	,,	,,	.813"	,,	,,

* 'C' Height G/Pin centre line to crown.
☐ Not B.M.C. parts; Hepolite manufactured components only.

CHART IV
'B' Series Axle Ratios

Tyre Data

CROWN WHEEL PINION PART No.	RATIO	DIFF CAGE	PINION/ GEAR TEETH	STD MODEL	LIMITED SLIP	AXLE TYPE	STD MODEL	SIZE	RIM ✱	OVERALL WIDTH	REVS/MILE
BTB 900	3.07	BTB 840	14/43	MGC early Std	C-BTB 776	Tubed	MGC	165 × 15	5K	6.7	820
BTB 841	3.307	,,	13/43	MGC Auto/o/drive	,,	Tubed	MGB	165 × 14	5K	6.7	854
BTB 1244	3.7	BTB 866	10/37	MGB Auto	C-BTB 777	,,	MGB	155 × 14	4½J	6.2	873
BTB 856	3.909	,,	11/43	MGB GT†	,,	,,	MGB	560 × 14	4J	5.7	853
BTB 314	3.909	BTB 328	11/43	MGB Tourer □	*	Banjo	MGA	560 × 15	4J	5.7	814
C-ATB 7240•	4.1	,,	10/41	MGA 1600	*	,,	MGA	590 × 15	4J	5.9	803
C-BTB 975	4.22	BTB 866	9/38	Spl	C-BTB 777	Tubed	Racing	550L × 14	6/6½	8.3	807
88G 283	4.3	BTB 328	10/43	MGA 1500	*	Banjo	,,	550M × 14	7/7½	9.4	807
C-BTB 966	4.55	BTB 866	9/41	Spl	C-BTB 777	Tubed	,,	500L × 15	6	7.7	807
88G 284	4.55	BTB 328	9/41	Oxford VI	*	Banjo	,,	550L × 15	6	8.3	775

• No longer available
* Not available British Leyland. Use ZF or 'Nospin' (U.S.A.)
† After GHN3- 132916 (Disc). GHN3- 132923 (Wire)
□ Up to above change point

✱ Recommended
For competition consult tyre manufacturers.

Formula to obtain m.p.h./1000 revs/minute

$$\frac{60{,}000}{\text{Axle ratio} \times \text{revs/mile (tyre)}}$$

CHART V
Suspension Springs

PART No.	TYPE	WORKING LOAD (lbs.)	DEFLECTION AT LOAD (ins.)	RATE (lb./in.)	COMPRESSED HEIGHT AT LOAD	MODEL
AHH 6451	Coil	1030	2.965	348	7.0	Tourer
AHH 5789	„	1193	2.49	480	6.6	GT
C-AHT 20	„	1193	2.49	480	6.14	Special
AHH 7080	Leaf	450	4.97	93	—	Tourer†
AHH 6453	„	400	4.04	99	—	Tourer [ ]
C-AHH 8343	„	375	3.75	100	—	SPL
AHC 31	„	510	3.2	99	—	GT
AHH 7346	„	542	4.37	124	—	Police
C-AHT 20	„	542	3.37	124	—	SPL

At working loads, leaf springs are flat.

[ ] Fitted from G-AN3 11313
†Fitted up to G-AN3 11312

CHART VI
'B' Series Camshafts

PART NO.		48G 184 ✱2H 76✱/12H 34✱	1H 1066[⌝] (1H 603[⌝]) 1H 1433[⌞] 1H 1432	12H 2436 12H 2435	12H 1294	88G 252 88G 303 ●(12H 2747)	C-AEH 714	C-AEH 770
MARKING		Single groove	—	Two grooves	—	—	AEH 714 8A 1601	AEH 770 8A 1622
CAM LOBE WIDTH		½"	½"	½"	½"	½"	½"	9/16"
STANDARD MODEL		Riley 1.5 1800 Mk I† MG Magnette	Later 1.5 4/68 models	*1800 Mk I/II	Early and intermediate 1800 Mk I	MGA and MGB	MGA (Sebring 61) MGB half race	MGB race
INLET	OPENS B.T.D.C.	T.D.C.	5°	5°	5°	16°	24°	50°
	CLOSES A.B.D.C.	50°	45°	45°	45°	56°	64°	70°
PERIOD		230°	230°	230°	230°	252°	268°	300°
EXHAUST	OPENS B.B.D.C.	35°	40°	40°	51°	51°	59°	75°
	CLOSES A.T.D.C.	15°	10°	10°	21°	21°	29°	45°
PERIOD		230°	230°	230°	252°	252°	268°	300°
CAM LIFT		.220"	.220"	.250"	.250"	.250"	.252"	.315"
VALVE LIFT		.320"	.320"	.350"	.346"	.365"	.3675"	.452"
RUNNING CLEARANCE		.015"	.015"	.015"	.018"	.015"	.015"	.015"
COMMENT		✱Not available *was tacho. drive version	Only 1H 1433 available	12H 2436 has fuel pump drive cam		Early MGA running Clearance .017" Valve lift .362"		

† Fitted to 1800 Mk I 8 AMW H27523/L20548 to H97273/L97810

[⌝] Fitted to 1800 Mk I up to H27523/L20547 and from H97274/L97811 to H101630/97850

* Fitted from 1800 Mk I from H101631/L97851. Mk II 1800 18H 101 on.

● Mk II 1800 'S' model (special pump drive)

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1 1" rubber rotary pad together with	7/6
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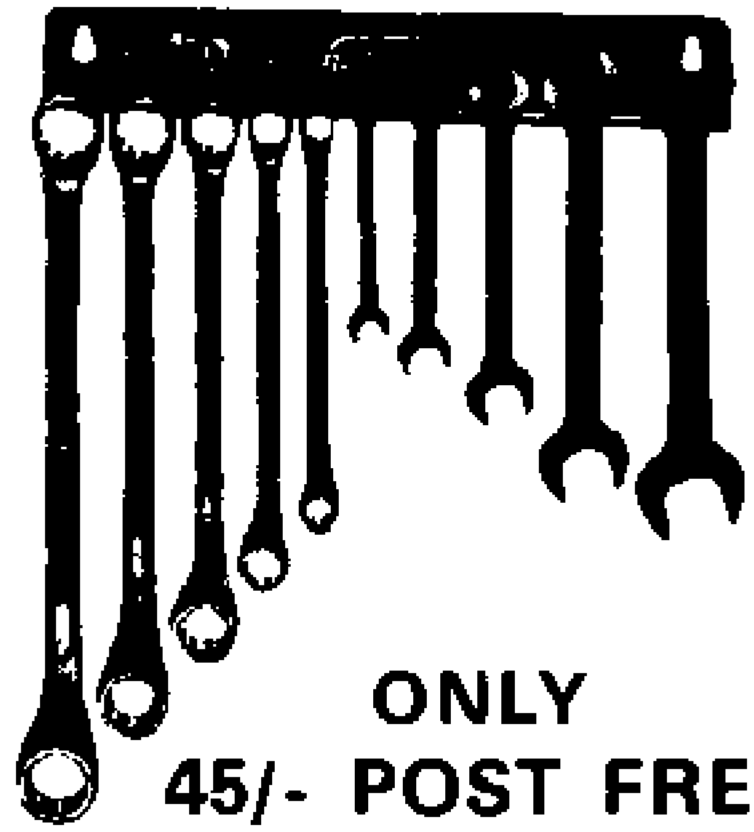

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