THE 1¼-LITRE M.G. CHASSIS

A Small Sports Chassis of Modern Design

PRODUCTION of the modern motorcar is dominated in both design and manufacture by large-scale production if reasonable price levels are to be attained. Jigs, dies and a vast special tooling equipment are essential in view of prevailing high labour costs. Thus, the capital invested in equipment is necessarily so large that it could not be written off against a product in small-scale manufacture. In producing the M. G. cars, of which the new 1¼-litre chassis is a notable example, the Company are favourably situated in being part of the Nuffield organization and thus able to draw on it for many components suitable for use on more than one type of vehicle.

Many modifications have been made to suit the special requirements in a product with exceptional performance and appealing to the expert driver. Such a vehicle must of necessity embody a degree of refinement above that of the lower-priced cars. In the new chassis, the major components, namely engine, gearbox and back axle are produced with the equipment employed for the 10 h.p. Morris, with corresponding advantages from the cost point of view.

While the bodywork is traditional, with none of the modern trends, the car is technically quite up to date. The frame is of box-section giving the requisite stiffness, desirable in a car designed to embody exceptionally accurate handling at high speed. The independent front suspension is of interesting design, with rack and pinion steering and rubber wishbone bushes. A normal back axle is employed, but with a transverse radius rod to give the lateral location that is essential for high-speed cornering. Excellent performance is provided by a running weight of under one ton, associated with an engine with a capacity of 1,250 c.c. giving over 46 b.h.p. and a gearbox with close ratios allowing 50 m.p.h. on third speed at 4,730 engine revolutions per minute. On the road it well sustains the M.G. reputation for good handling in every way. A quiet close ratio third gear assists the relatively small engine in maintaining good average speeds while the excellent suspension makes for a minimum of lost time on bends and corners. The brakes are first class, and despite a slight oversteer, the steering is sure, and remains quite light at low speeds. In all circumstances the car provides the driver with a satisfying feeling of security.

SPECIFICATION

ENGINE. *Four-cylinder, overhead valves. Bore and stroke 66.5 x 90 mm. Swept volume 1,250 c.c. Three main bearings. Aluminium pistons. Chain-driven camshaft. Centrifugal water impeller controlled by thermostat. Battery and coil ignition. Pressure lubrication to main, big end and camshaft bearings, valve rocket gear, etc.*

TRANSMISSION. Borg *and Beck 7¼in* single-p.late *clutch. Four-speed* gear box *with synchromesh for* 2nd~ 3rd *and 4th gears. Final drive ratios:* top, 5.143 to 1; *3rd~* 7.121 to 1 *2nd,* 10.646 to 1 1st, 18.000 to 1 *reverse~* 18.000 to 1. *Hardy Spicer* tubular propeller shaft *with needle* type *universals.*

REAR AXLE. *Banjo* type *with spiral bevels* $^{3}/_{4}$*-floating* axle *shafts.*

FRONT AXLE.. *Wishbone independent* suspension.

BRAKES. *Lockheed hydraulic* on *all* wheels.

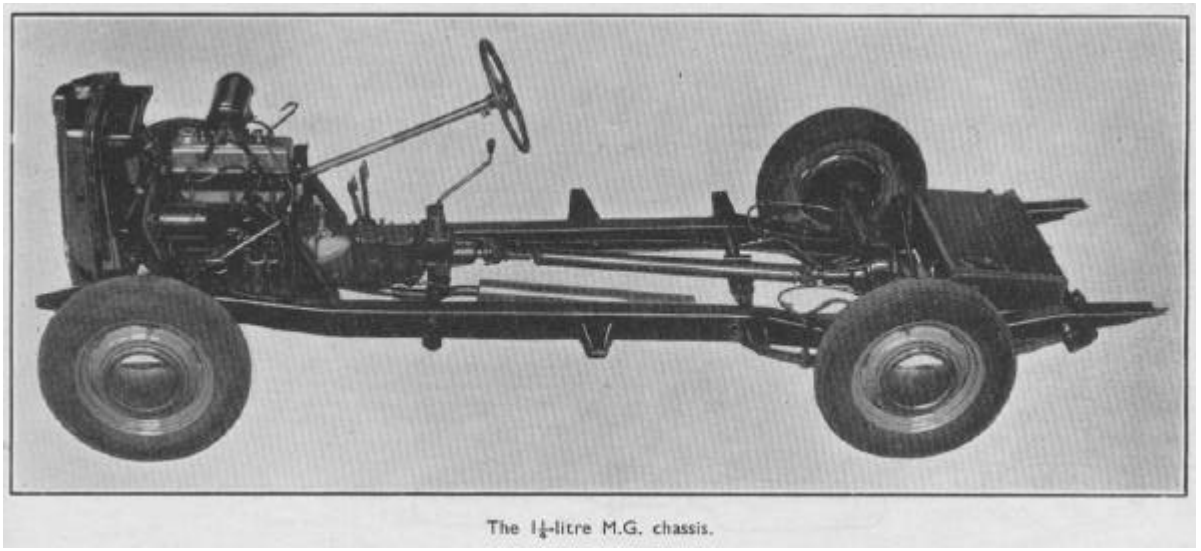
STEERING. *Rack and pinion.* 35ft *turning* circle.

REAR SUSPENSION. *Semi-elliptic with lateral* control *rod and Girling dampers.*

DIMENSIONS. Wheelbase~ *8ft 3in track — front, 3ft 11 in, rear 4ft 2in overall length, 13ft 5in width, 4ft 11in.*

Engine

The bore is 66.5 mm and the stroke 90 mm. The side-by-side overhead valves are slightly inclined in a combustion chamber giving a moderate amount of turbulence and a compression ratio of 7.3 to 1. Both inlet and exhaust valves are of silchrome steel and the port throat diameters are 30 and 26 mm respectively. The valve lift is 6.5 mm and 30 degree seats are used. The timing is modified in the interests of performance, the inlet opening ii deg early and closing 57 deg late. The exhaust opens 52 deg before B.D.C. and closes 24 deg after T.D.C. The maximum b.m.e.p. is ii6 lb per sq in at about 2,600 r.p.m. but over



The 1¼-litre M.G. chassis.

THE 1¼-LITRE MG CHASSIS (Continued)

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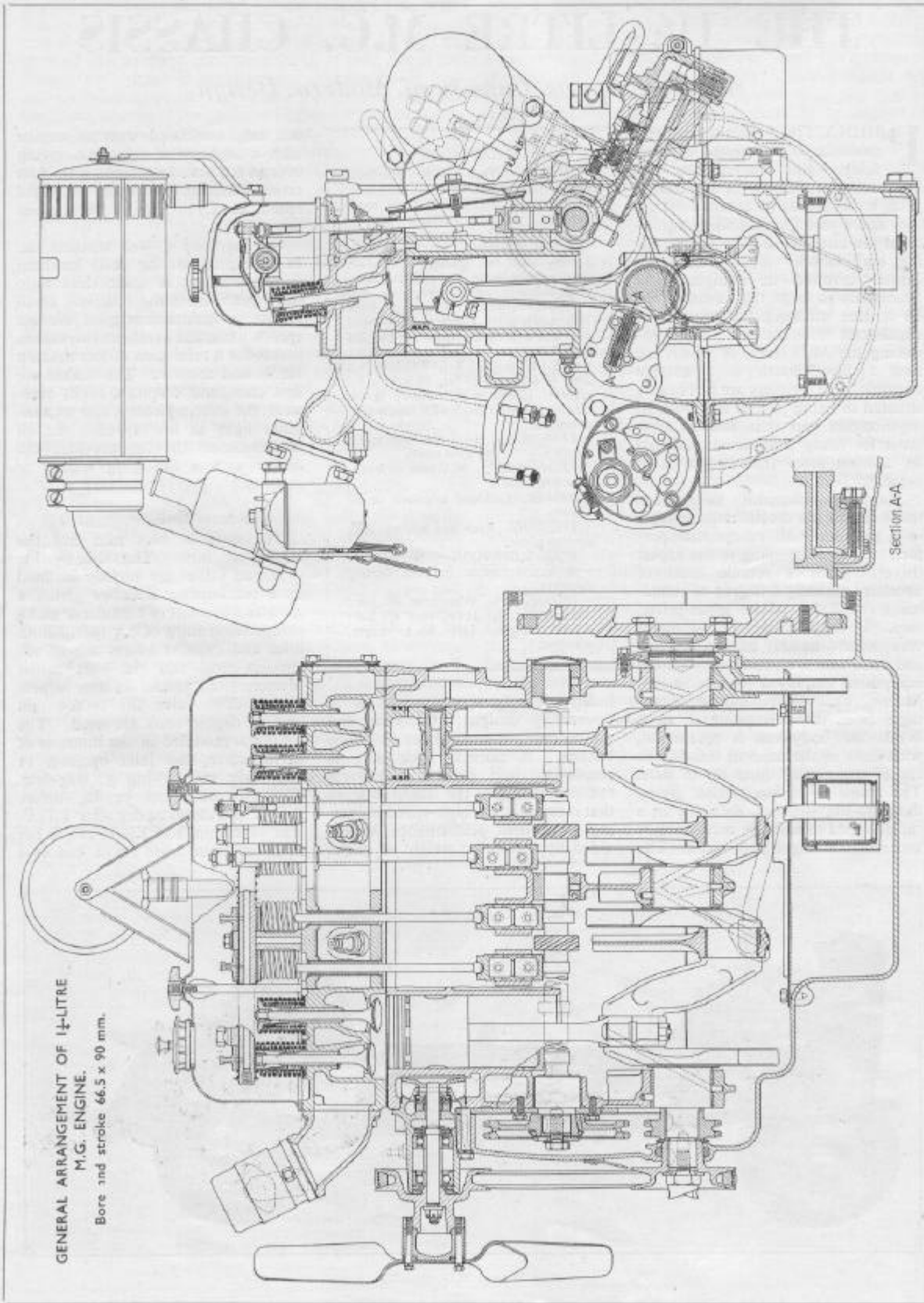


GENERAL ARRANGEMENT OF 1¼-LITRE M.G. ENGINE.
Bore 2nd stroke 66.5 x 90 mm.

THE 1¼-LITRE MG CHASSIS (Continued)

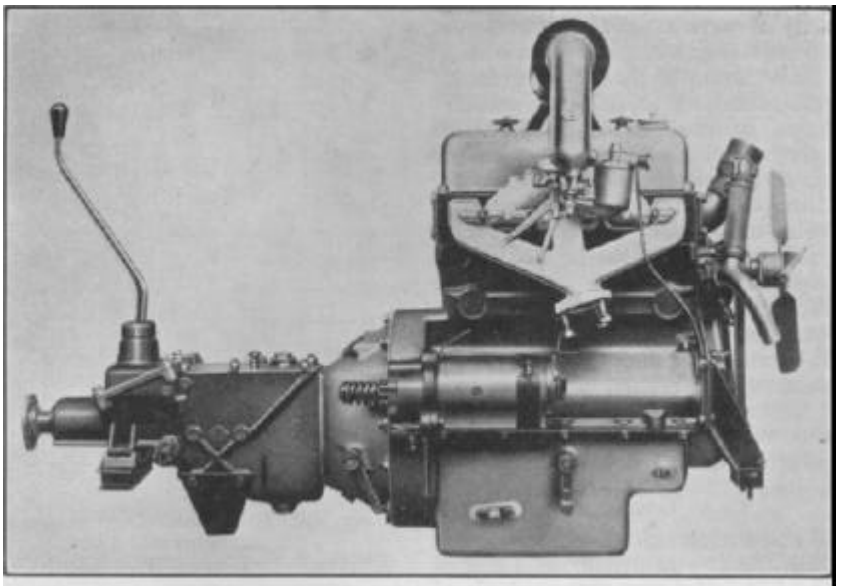
110 lb per sq in is sustained from 1,500 to 3,900 r.p.m. The maximum b.h.p. is 46 at 4,800 r.p.m.

Full load specific fuel consumption is about 0.52 pints per b.h.p. hr over a speed range of from 2,000 to 3,700 r.p.m. the carburettor being an S.U. of the horizontal type. The inlet manifold is cast integral with the exhaust but only a moderate amount of hot-spotting is provided.

The counter-weighted three-bearing crankshaft is stamped from 1 per cent nickel steel containing about 1 per cent manganese and 0.35 per cent carbon, heat-treated to give 27 tons per sq in yield and 43 to 50 tons per sq in ultimate stress. Both main and big-end bearings are of the steel-backed variety supplied by Vandervell Products Ltd. End location is by the centre main bearing and the diagonal oil-feeds to the big-ends are supplied from the main bearings by double drillings.

A flywheel of low-phosphorous cast-iron is secured by setscrews and two dowels, the starter ring being shrunk on. The main bearing caps are registered into the block to the extent of about kin, the sump joint face being below the crankshaft centre line to this extent. This arrangement does not prevent the rear main bearing cap being sealed off by a semi-circular cork seal against the edge of the rear wall of the die-cast aluminium sump.

As compared with a design having a deep block and a pressed-steel sump, the M. G. arrangement has several advantages. The block, while much lighter, has plenty of stiffness in a vertical plane, while the aluminium alloy which encloses the bottom half of the flywheel, is studded to the clutch bell-housing. This makes a notable contribution to the stiffness of the power unit as a whole, especially in maintaining alignment of crankshaft and gearbox driving shaft.



Off side of 1½-litre M.G. power unit.

Camshaft

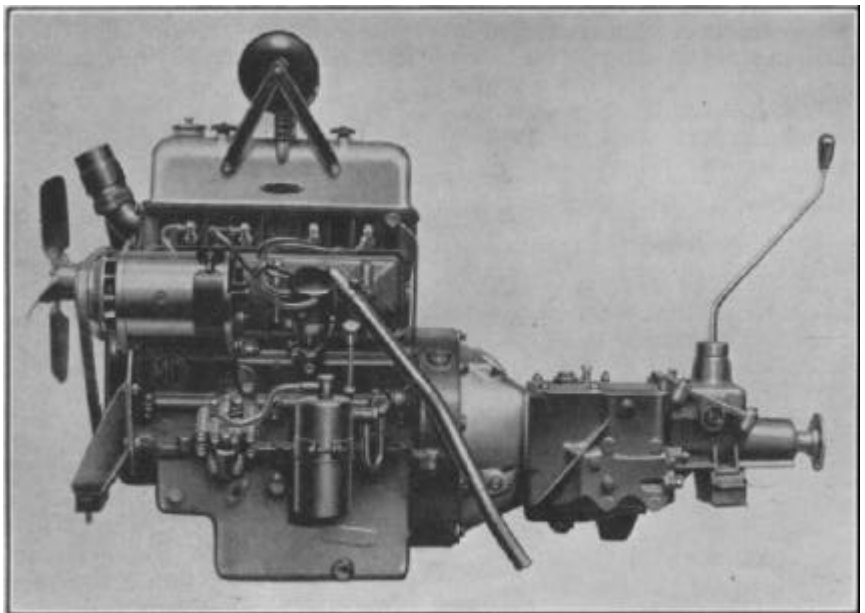
Of carbon case-hardening steel, the camshaft runs in three bearings and operates chilled-iron tappets. The timing wheel is of cast iron and the pinion of 0.50 carbon steel. A double roller timing chain is employed, tensioned by a curved shoe having raised ribs running on the chain rollers and supported by a cylindrical stalk. A light compression spring maintains contact and is supplemented by an oil feed from the adjacent main bearing. Excessive supply is checked by a small metering hole, with a larger escape hole in the stalk, the purpose of the arrangement being to give a damping effect besides supplying the chain with oil through the escape hole.

Lubrication

Following the accepted practice of the firm, the oil pump is external. being spigoted diagonally into the near side of the cylinder block. Suction is through a passage drilled in the block and communicating with a passage formed in the wall of the aluminium sump. The gauze suction strainer is detachably mounted in an air bell carried by a pipe bolted to the inner face of the sump.

Delivery is by an external pipe to a full-flow filter of the "throw-away" type, bye-passed in case of obstruction by a ball-valve loaded to 6o lb per square inch and carried in the block casting. The main relief valve is in the oil pump cover and is accessible from below. Great care is taken to ensure centralizing of the ball on its seat, a sliding winged guide being used in one case and a fixed tube with a circumferential escape passage in the other.

Feed is by gallery to camshaft and main bearings and by external pipe to the valve rocker tube. The big-ends are drilled for oil spray to the cylinder walls and the rim of the camshaft timing wheel is



Near side of 1½-litre M.G. power unit.

THE 1¼-LITRE MG CHASSIS (Continued)

recessed and drilled to take oil from the adjacent bearing to the inside of the duplex timing chain. There is also a feed to the chain tensioner previously mentioned. The sump capacity is 9 pints and the maximum oil pressure70 lb per square inch.
The layout of the oil pump is one that makes for accessibility and also helps to cool the oil. Particular care must of course be taken to observe that the sump joint is undamaged in the region of the oil hole, or an air leak may develop in the pump section. In view of the copious supply of oil to the valve rocker tube it may be noted that both inlet and exhaust valves have rubber rings sealing the stems to the valve spring collars, which in turn have tubular sleeves overlapping the valve guides and preventing oil from running down them.

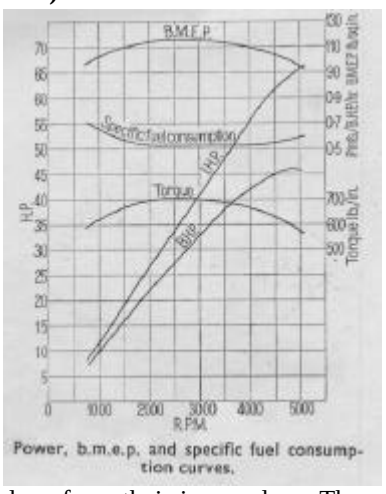
Cooling

Belt-driven in triangular layout with the 12-volt dynamo is a centrifugal impeller pump, the spindle of which is mounted on two ball bearings and carries the four-bladed fan. The pump gland is of the carbon disc type, driven by a cross-peg in the shaft and held against the sealing face by a rubber seal backed by a spring.

Delivery from the pump is to the back of the water jacket by a cored passage and a thermostat is fitted to the outlet from the cylinder head. It is of the type in which a bye-pass return is open when the main valve is closed, but is gradually shut off by a sliding sleeve as the bellows expand.

Power unit mounting

At the front the unit is carried by a central bonded rubber "sandwich" attached to a pressing bolted to the front face of the block. The rear of the gear box has two nearly horizontal facings with depending



Power, b.m.e.p. and specific fuel consumption curves.

lugs from their inner edges. These seat on two loose rubber blocks resting in a pressing carried by the lugs bearing on the inner faces of the blocks to give lateral location. The unit is held down at the rear by a central drawbolt, pin jointed to the gear box extension and having a nut, seated on a rubber washer in the frame pressing. This permits lateral oscillation of the drawbolt under power unit vibration.

The system as described lacks lateral stability at its upper extremities and this is provided by a cross-link in the front aimed at a point near the inclined line through the centre mass of the whole The cross-link has rubber washers at its ends to allow articulation.

Clutch and gear box

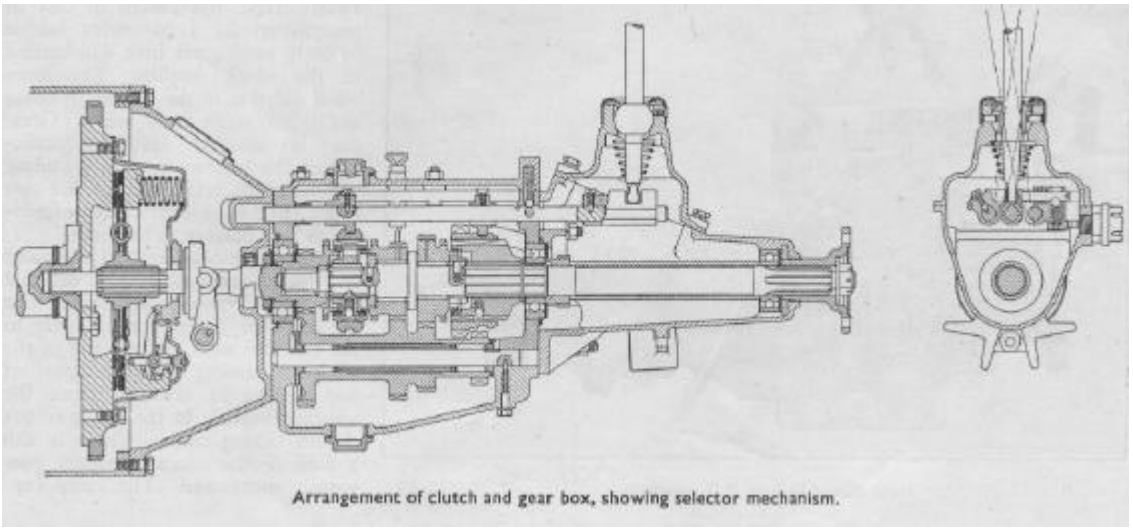
The 7¼in. Borg and Beck clutch has a spring-cushioned centre and a carbon ring withdrawal, connection between the pedal and the withdrawal cross-shaft being by a Bowden cable, one abutment of which is carried by the frame and the other by the power unit. The cable extends forwards to a hanging link on the engine, from which a compression rod runs back to a hanging lever on the cross-shaft.

While the gear box casting and certain other details are identical with those on the Morris lo, several important modifications are made to suit the characteristics of the M.G chassis. The gear ratios are closer throughout:-

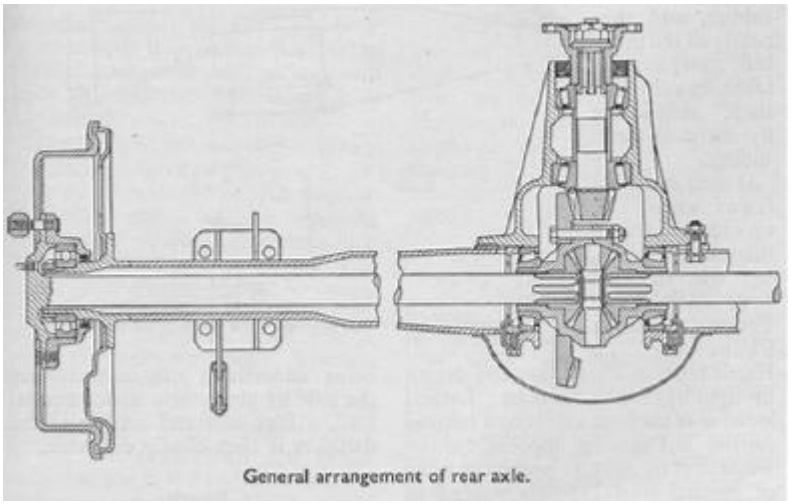
Top	1 to 1
Third	1.385 to 1
Second	2.07 to 1
First	3.50 to 1
Reverse	3.50 to 1

The three higher gears are engaged by non-positive synchromesh mechanism of normal type, with bronze outer cones. The gears are in 3 per cent. nickel-chrome case-hardening steel, the idle wheels, the layshaft and the spigot all running on needle-roller bearings. To give smooth running at the high engine speeds available the driven shaft has been extended to the rear by about 7in. It is carried in a steady bearing in the aluminium alloy gear box extension, an inclined face on which also takes the socket for the remote-control change-speed lever.

The striking rods are extended through the rear wall of the box casting and the selector forks are secured to them by setscrews. Reverse is ingeniously guarded by a spring-loaded plunger in the selector fork which has a groove engaged by a spring-loaded ball. The two springs offer definite resistance to accidental engagement, but once the cross-movement of the lever has been initiated, subsequent movement does not require so much effort as if a single large spring had been employed.
Reverse gear consists of a single idler meshing at will with the first speed pinion and wheel. The double travel necessary for engagement is provided by a hanging lever with a pin at an intermediate point engaged by a fork on the striking rod. Safety interlock is by the usual balls between the striking rods, with a short cylindrical distance-plug sliding in a cross-hole in the middle rod.


Arrangement of clutch and gear box, showing selector mechanism.

THE 1¼-LITRE MG CHASSIS (Continued)



General arrangement of rear axle.

Back axle

A Hardy Spicer tubular needle-roller bearing propeller shaft connects to a back axle almost identical with that on the 10 h.p. Morris. The ratio is 5.143 to 1, giving 70 m.p.h. at 4,782 r.p.m. on top gear and 50 m.p.h. at 4,731 r.p.m. on third speed. The crown wheel pitch diameter is about 6~in and the material is 3 per cent nickel-chrome casehardening steel giving a core strength of 6580 tons per square inch and a minimum Izod of 30. The pinion is of 44 per cent. nickel-chrome case-hardening steel giving a minimum tensile of 8~ tons per square inch and an Izod of 25. Mounted in opposed taper roller bearings the pinion is set to run with a preload giving about 5 inch-lb torque.

A four-pinion differential is employed, in a split cage carried in taper roller bearings in split housings with caps and screwed adjustment. The preload is here set by adjusting until two machined faces on the caps are sprung apart 6/1,000in.

The hubs run on ball journal bearings secured to nose-pieces flash-welded to the steel axle casing. The outer races are fitted to housings bolted to the brake-drums by the wheel studs, the upset flanges of the axle shafts coming between. These are made of manganese-molybdenum steel, heat-treated to give a yield figure of at least 52 tons per sq. inch, with an Izod of 35.

Front suspension and steering

Rack and pinion steering, with the rack bar in front, directly linked to the steering swivels, permits of the wishbone independent suspension being laid out without dihedral angle. This greatly facilitates checking of alignment after an accident since the lower wishbone axes are parallel. The geometry is fairly normal, and while there is no camber at normal load, there is a negative camber of 1½ deg at extreme bump and rebound, corresponding to 3in travel in each case. The king-pin inclination is 10 deg under static load and there is about 1 deg castor. Wheel scrub from normal to full bump is zero and from normal to full rebound only about 3/16in.

Each lower wishbone link, which is about 12in centres, is made up of two pressed steel arms, united by a bolted-in spring pan and by the outer fulcrum bolt. To the inner ends of the arms are welded sleeves taking rubber bushes clamped axially by washers on the overhanging ends of a pivot pin stamping attached to the lower face of the box-section front cross-member by four bolts.

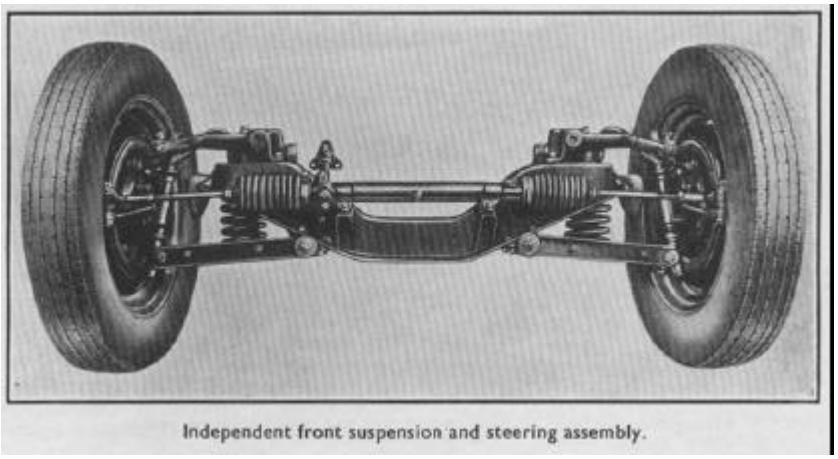
The bushes are in pairs and an easy fit. On drawing home the washers the compression of the rubber expands it to a tight fit and throws up a flange for end location.

Both upper and lower outer fulcrum pins consist of hardened sleeves secured by through bolts. They work in bronze bushes in the upper and lower swivel bearings, which work on screw threads cut on the long swivel pins. The threads take all vertical loads, and, in order to avoid any slight bias on the steering, are made R.H. thread on the offside and L.H. on the near side. Front hubs run on ball bearings on the swivel stampings, into which the swivel-pins are pressed. End location of the hub is by the inner bearing only.

The upper wishbone links are formed by the twin arms of the Girling dampers, which are bolted to the horizontal upper faces of the cross-member. The coil springs are made of ground bar and are located midway along the lower links, the effective static deflection being about 4.7 inches. Great care has been taken in the design of all the joints, the upper and lower fulcrum pins having hardened thrust washers, enclosed by pressings fitted with rubber seals, there being similar seals at the swivel pin bearings.

The steering rack is engaged by a pinion having slightly helical teeth. It is of round section lightened by three flats and works in a malleable-iron guide tube bolted to the front cross-member. Connection to the steering links, which are about io inches long, is by shim-adjusted spherical joints screwed into the ends of the rack bar. A completely oil-tight assembly is assured by the fitting of synthetic rubber bellows. The ratio works out to 2.625 turns from lock to lock, and some degree of damping is afforded by a plunger, loaded to 80 lb, bearing on the back of the rack bar. The efficiency of the mechanism is, of course, very near unity, and a notable point, common to most rack-and-pinion layouts, is the great stiffness of the mechanism between the steering column spindle and front wheel swivel.

Compared with normal I.F.S. steering there is only one arm (that on the swivel) to introduce springiness as against four arms and a highly-stressed steering-box drop-arm shaft. No ill effects are noticeable from an absence of "sponginess" claimed by some to be essential, while the accuracy of



Independent front suspension and steering assembly.

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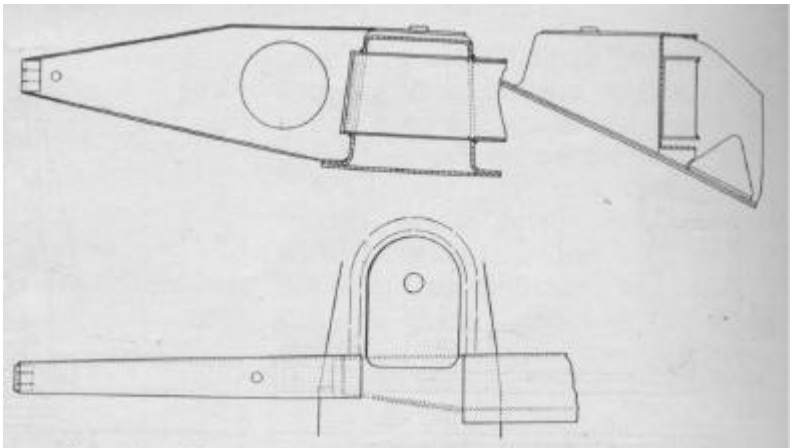
steering is obviously superior. The steering column is a separate component, coupled to the pinion shaft by a rubber-bushed universal joint. Since there is no hole through the pinion the electrical connections to the horn and trafficator switches on the steering wheel are made by four slip-rings mounted externally on the column.

Rear suspension

The underslung rear springs are 42½in long and have seven leaves, ¼in thick and 1½in wide. Static deflection is 3in and maximum deflection 6¼in. Thin square rubber pads are inserted under the tips of the leaves, being retained by snug-fitting holes drilled in the steel. The two spring clips are also lined with rubber, and thus nearly all the interleaf movement is taken by rubber in shear instead of by metal-to-metal sliding.

At their anchored front ends the springs have Silentbloc bushes, but the shackled rear ends have flanged rubber bushes of the Harris type, inserted loose and drawn up tight by the shackle bolts. Lateral location of the back axle is by a tubular control link having opposed rubber washers at its ends, gripping the webs of pressed steel brackets welded to the off-side frame member and the axle casing respectively. This is an eminently desirable feature in a car such as this, in which faultless road-holding at high speeds is essential. The separation of the functions leaves the designer free to use rubber in shackles and spring clips without in any way prejudicing the stability of the vehicle.



Junction of frame side-member and front cross-member.

Girling dampers are fitted, set to give rather more than twice the damping on the rebound compared with the bump travel. The frame being underslung and only clearing the axle by about 2¼in under normal load, a high rebound setting of the dampers is thus clearly desirable.

Frame

Of box section, the frame side-members are straight in plan with a ruling depth between the axles of 41in and a flange width of $2^{5}/_{8}$in. Made from 14G steel the members are boxed throughout their length by pressings inserted with the flanges inwards and secured to the main flanges by spotwelds at 1¼in pitch. There are four cross-members, all welded in position, a front-member of boxed trough section, an intermediate 2in diameter tube, another one of the same size at the rear spring front anchorage and a 1½in tube at the rear with the shackle fulcrum bushes welded to it.

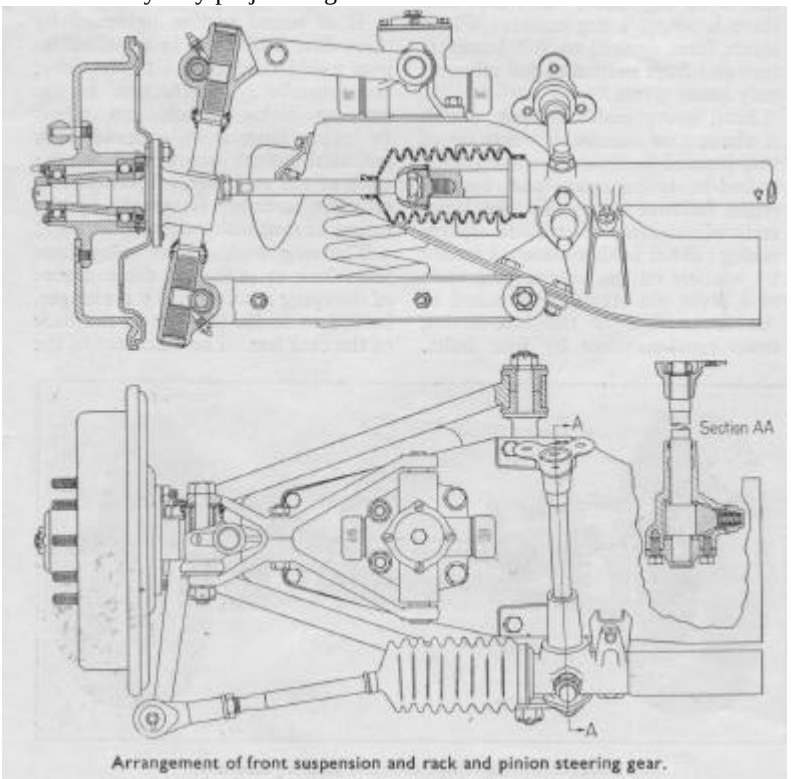
The front cross-member is an inverted trough, downswept at the centre and boxed throughout its length by a spot-welded cover plate, pierced at the ends to admit the suspension springs. The flanges of the side-members are trimmed down to the boxing web and pass right through the cross-member, to which they are arc-welded.

Front end stiffness

The forward extensions of the frame to carry the bumpers are welded on as separate parts since they have to be much deeper than the side-members to accommodate large holes in their webs for clearance of the covers of the rack-and-pinion steering gear. Care has been, taken to make the modulus of the front cross-member, to which the linkage points of the I.F.S. are bolted, much greater than that of the side-members.

In the event of accidental damage to the frame, any distortion of the front end is almost certain to be confined to the side-members, which, being straight in plan, are easy to rectify and check. Of practical importance also is the absence of dihedral angle in the wishbone attachments, their centre-lines being parallel can easily be checked with lines and rules, if special tackle is not available.

The second cross-member supports the back of the power unit and has pads on its ends for body mounting. The third one is in line with the rear spring front brackets, which are secured to the frame by four bolts. It is downswept at the centre to clear the propeller shaft, Between these two members there are a pair of outrigger body brackets welded in position.



Arrangement of front suspension and rack and pinion steering gear.

THE 1¼-LITRE MG CHASSIS (Continued)

Welded to the frame is a tube passing through the offside member to take the pedal shaft and a box enclosing the brake pedal lower lever and supporting the Lockheed master cylinder. The box-section side-members are also reinforced by internal distance tubes where throughgoing bolts are subject to notable strain. Horizontal tubes, for example, surround the long bolts attaching the rear dampers and also the bolts holding the *check* straps of the rear axle.

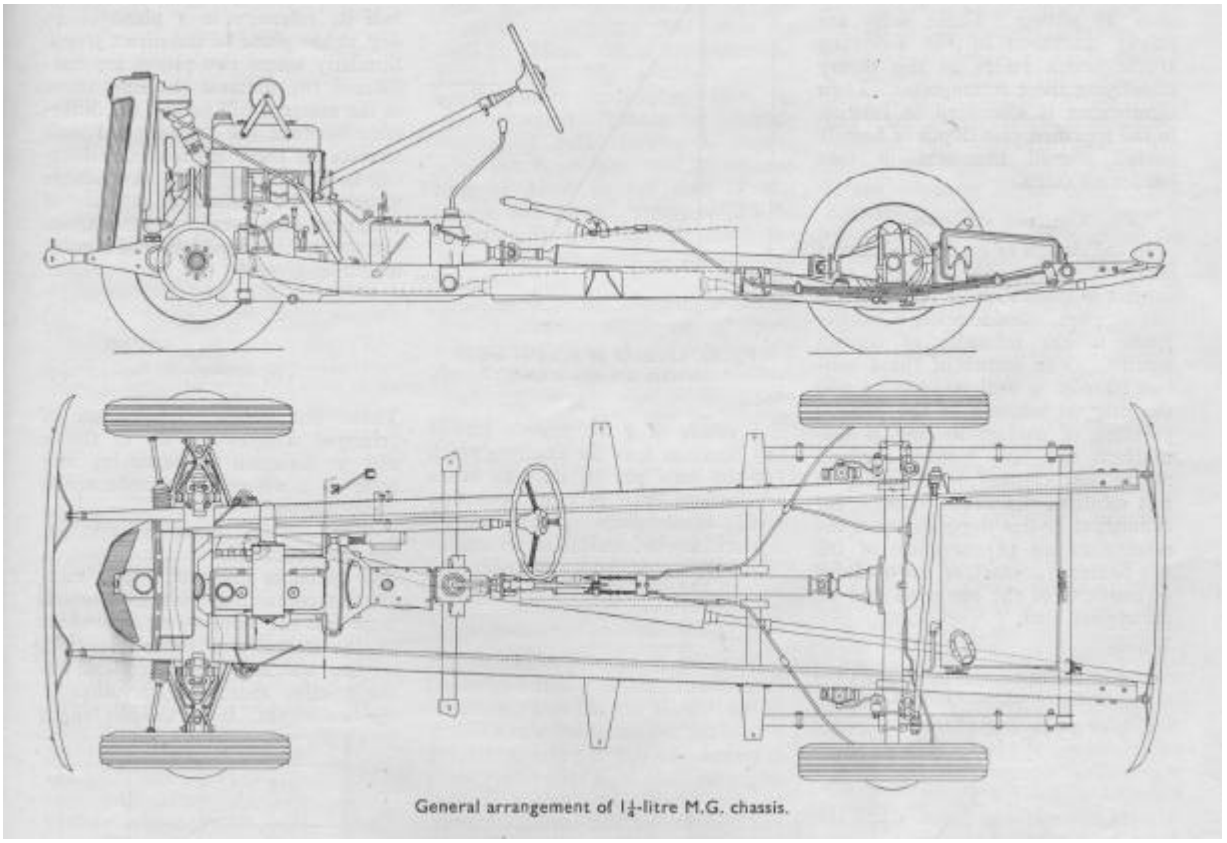
Brakes

Of Lockheed manufacture the hydraulic brakes have drums 9in in diameter and shoes 1½in wide. The hand brake operates on the rear wheel shoes only, connection being by flexible cables to a pull-up lever mounted on the propeller shaft tunnel. Each cable terminates in an adjusting screw on the cross-pin in the handbrake lever.

Equipment

Among the very full equipment are Jackall hydraulic jacks, adjustable Steering wheel, 12 volt lighting set including twin tail lamps, fog lamp and reversing lamp. The 8-gallon petrol tank feeds the carburetter by means of an SU. electric petrol pump.

The 3.00in x 16in wheels have 5.25in x 16in E.L.P. tyres, the front track being 3ft $11^{3}/_{8}$in and the rear 4 feet 11in. The wheelbase is 8ft 3in and turning circle 35 feet, A ground clearance of 6in is pro-vided and the overall length is 13 feet 5in and the width 4 feet 11in. The weight of the chassis only is about 10 cwt 2 qr and the complete car 19 cwt 2 qr. The power unit, with gearbox, weighs 3½ cwt.



General arrangement of 1¼-litre M.G. chassis.