23 DECEMBER 1966 2s 0d

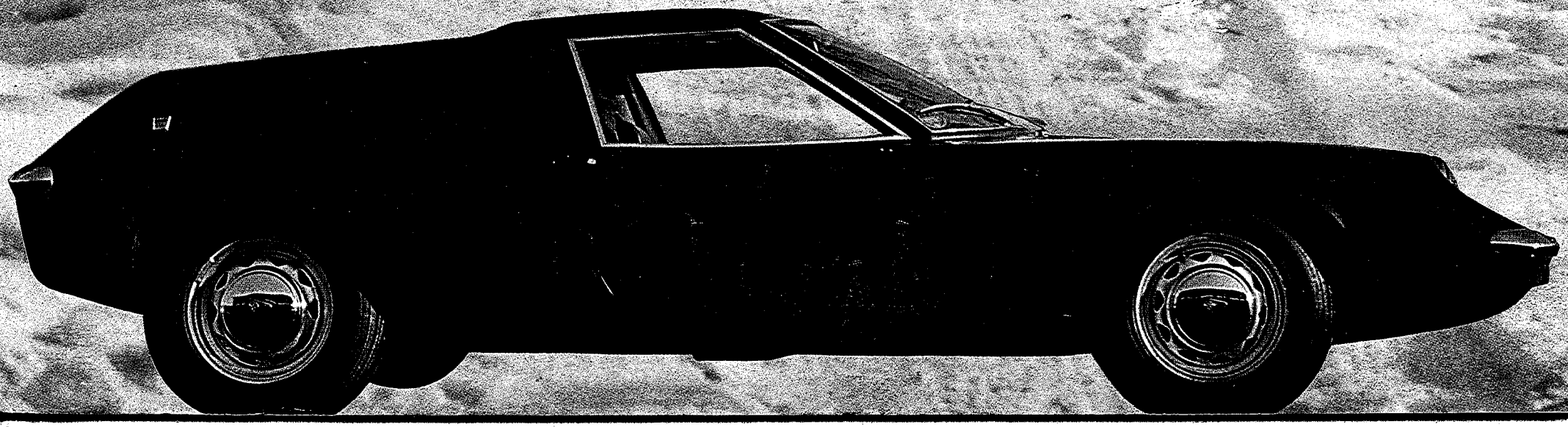
Autocar

CHRISTMAS NUMBER

Road Test: Vauxhall Viva de Luxe

Ronald Barker retests a unique 1933 blown Alfa

NEW LOTUS with Renault 16 engine, mid-mounted : Full descriptions



LOTUS EUROPA

New shape in sports cars, the Anglo-French way

New mid-engined Lotus GT powered by Renault for French market first — full description

COMPETITION cars always used to be derivatives of road cars suitably modified for the type of event in which they ran. Formula racing cars started a new concept of a vehicle designed for just the one purpose, and the latest successful sports and GT cars have all been not much more than adapted formula designs embodying the same layout and constructional details. It was only a matter of time before a sports car manufacturer came up with a road car based on the same principles. Apart from Matra (*née* René Bonnet) and Lamborghini, Lotus are the first company to go into production with a mid-engine coupé for use on the road.

When the idea was first conceived as a serious plan about two years ago, it was decided very early on that the new Lotus (code-named the P.5) was to be developed quickly and cheaply. All avenues and short-cuts were therefore explored to speed up its introduction and from beginning to end only a handful of engineers have spent just 18 months on the project. One reason for the haste has been to phase the start of production with the recent move of the entire Lotus factory from Cheshunt to Norwich.

The theme of the new car is a "Lotus for Europe" and much valuable time has been saved by the helpful co-operation of the Régie Renault, who are supplying engine and transmission packages ready for installation. This side of the engineering has been undertaken entirely by the French and Lotus have had only the installation, chassis and suspension and bodywork to occupy them. A description of the Renault engine and transmission follows on page 1314.

In designing a mid-engined sports car, the weight of the power unit is obviously an important basic consideration, and the alloy unit used in the Renault 16 weighs only 200lb without gearbox. Coming from a front-wheel-drive saloon, the transmission is integral with the final drive and it has been necessary only to reverse the pinion and change the ratio to adapt it to the Lotus configuration.

Derek Sleath has been in charge of the development, and another reason for its speed has been a keen interest in every stage by Colin Chapman himself. An approach dubbed "direct development" has been employed mostly, whereby much of the drawings and paperwork have been dispensed with to speed up manufacture and modifications; obviously the small size of the team has made this a practical working method that would probably collapse through lack of liaison in a bigger outfit.

Chassis and Suspension

Similar to the backbone frame of the Elan, the chassis of the new car is fabricated from 16 s.w.g. sheet steel with electric arc stitch welds along the box seams. The shape of the frame is like a capital letter "Y," with engine mountings in the forked end and the front suspension attached to the extremities of a cross-piece at the other end. Rear suspension is carried by a boxed cross-member, above the gearbox, which has the upper spring mountings at each end, with long transverse links and semi-trailing radius arms below. The depth of the main backbone box is 10½in. and the width 6in. The two arms of the Y-fork taper sharply to a depth of only about 2in. at the rear engine mounting.

The front suspension utilizes the Alford and Alder double wishbone layout used on the Triumph Herald and Spitfire range, with rack and pinion steering from the same supplier. Front disc assemblies and hubs are also the same as those used by Triumph to the latest heavy-duty specification for the GT6 and 2-litre Vitesse. At the rear, the drum brakes, like the front discs, are from Girling, but adapted from stock parts to suit the job.

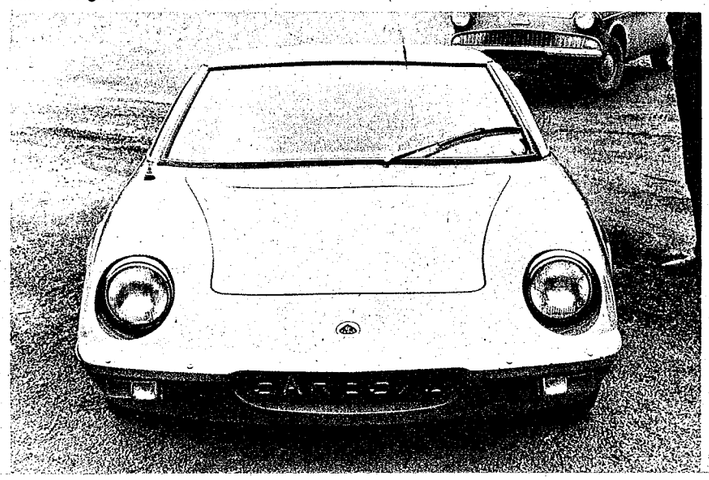
Rear suspension is characteristically Chapman in layout, with very long fabricated box-section radius arms pivoting on the sides of the Y-fork very close to where it divides. Rear hub posts have very long lower extensions which come below the wheel rim. They carry the lower spring and damper unit mounting and the outer end of long transverse links, which pivot only an inch or so each side of the car's centre line. This combination forms a wide-based lower wishbone each side, with over 2ft 6in. between its chassis pivots and an effective semi-trailing inclination of only about 10deg. from the centre-line. Wheel location is completed by fixed-length drive shafts with Hooke-joints at each end. Static laden wheel camber is —1deg. All link pivots are mounted in rubber to eliminate greasing and insulate the body from road noise.

The wheels are the same as those used on the Elan, 13in. dia by 4½J rims, and 155 section Dunlop SP 41 tyres are standard.

Body and Styling

As might be expected, the body is moulded in glass-fibre and is mounted on the chassis through a number of rubber-insulated attachments. The prototype cars have been made by Specialised Mouldings, with a high surface finish in unpainted, colour-impregnated resin. Lotus will be experimenting with colour impregnation when production starts, but they expect to apply cellulose on top of this for some time to come. The unusual styling is the work of John Frayling, who was responsible for the Elan coupé and the revisions to the latest Elan convertible.

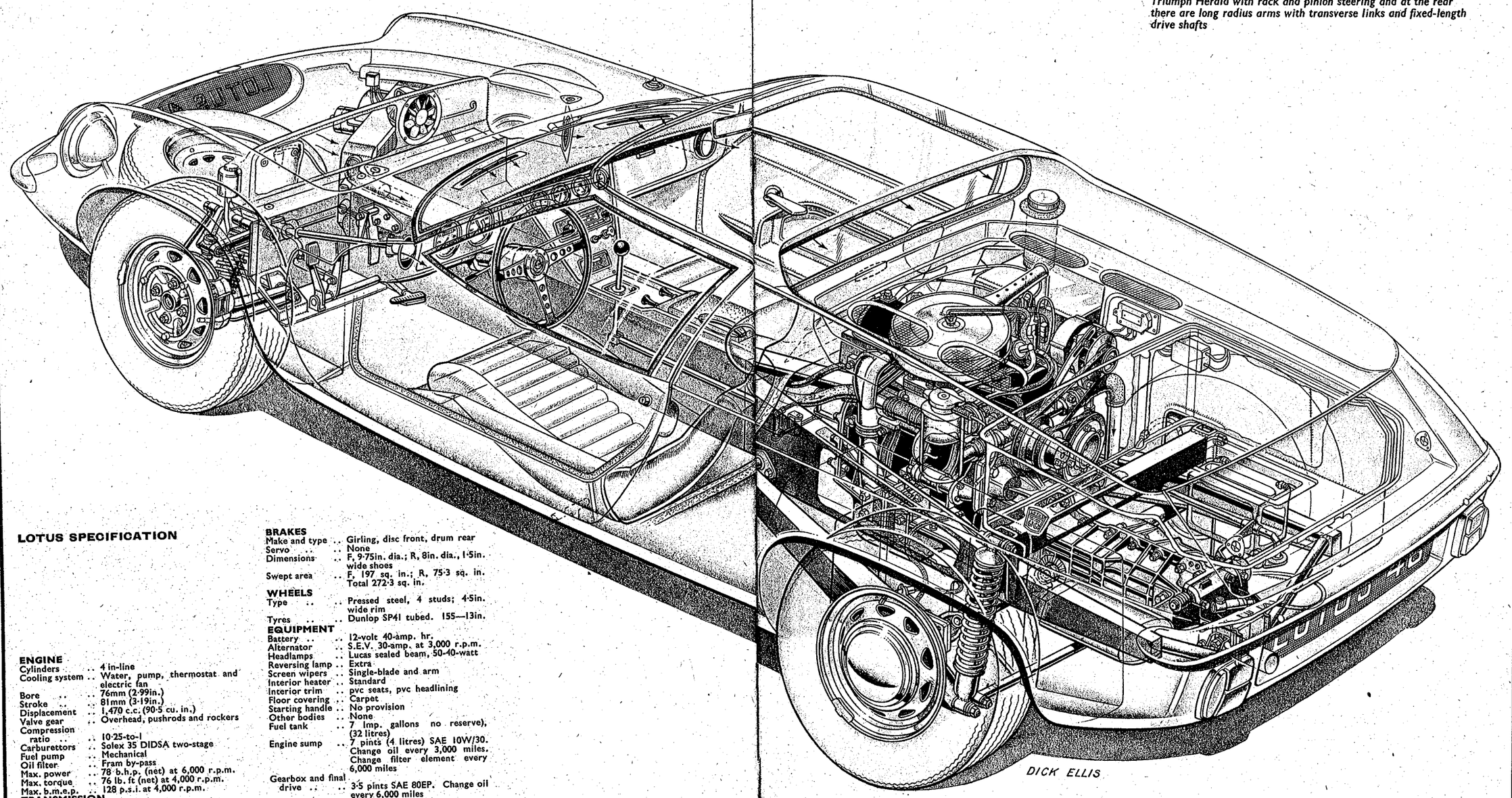
In order to avoid the high tooling costs for special bumpers, the new car has been built between two existing Ford parts. At the front an Anglia bumper is used with the number-plate cut-out neatly surrounding the radiator air intake; at the rear, a Cortina front bumper runs across the full body width, high up above the tail lamps and mesh number plate through which the engine compartment exhausts some of its hot air. The rest of the air from the engine bay passes through four oblong grilles in the flat deck of the rear lid to fill the well behind the rear window and im- ▶



Above: The rear bumper is bolted directly to the glass-fibre body and is a stock part from the Ford Cortina. Below: Front bumper is another Ford part, this time for the Anglia, as can be recognized on the car behind

LOTUS EUROPA . . .

The Renault 16 engine and gearbox are turned round and mounted behind the cockpit. Front suspension is like that of the Triumph Herald with rack and pinion steering and at the rear there are long radius arms with transverse links and fixed-length drive shafts



DICK ELLIS

LOTUS SPECIFICATION

ENGINE

Cylinders	4 in-line
Cooling system	Water, pump, thermostat and electric fan
Bore	76mm (2·99in.)
Stroke	81mm (3·19in.)
Displacement	1,470 c.c. (90·5 cu. in.)
Valve gear	Overhead, pushrods and rockers
Compression ratio	10·25-to-1
Carburettors	Solex 35 DIDSA two-stage
Fuel pump	Mechanical
Oil filter	Fram by-pass
Max. power	78 b.h.p. (net) at 6,000 r.p.m.
Max. torque	76 lb. ft (net) at 4,000 r.p.m.
Max. b.m.e.p.	128 p.s.i. at 4,000 r.p.m.

TRANSMISSION

Clutch	Single dry plate, diaphragm spring, 7·9in. dia.
Gearbox	Four-speed, all-synchromesh
Gear ratios	Top 1·03; Third 1·48; Second 2·25; First 3·61; Reverse 3·08
Final drive	Hypoid bevel, 3·56 to 1

CHASSIS and BODY

Construction	Separate steel backbone chassis, glass-fibre body

SUSPENSION

Front	Independent coil springs, double wishbones, telescopic dampers
Rear	Independent, radius arms, transverse links, fixed-length drive shafts, telescopic dampers
Steering	Alford and Alder, rack and pinion

BRAKES

Make and type	Girling, disc front, drum rear
Servo	None
Dimensions	F, 9·75in. dia.; R, 8in. dia., 1·5in. wide shoes
Swept area	F, 197 sq. in.; R, 75·3 sq. in. Total 272·3 sq. in.

WHEELS

Type	Pressed steel, 4 studs; 4·5in. wide rim
Tyres	Dunlop SP41 tubed. 155—13in.

EQUIPMENT

Battery	12-volt 40-amp. hr.
Alternator	S.E.V. 30-amp. at 3,000 r.p.m.
Headlamps	Lucas sealed beam, 50-40-watt
Reversing lamp	Extra
Screen wipers	Single-blade and arm
Interior heater	Standard
Interior trim	pvc seats, pvc headlining
Floor covering	Carpet
Starting handle	No provision
Other bodies	None
Fuel tank	7 Imp. gallons no reserve), (32 litres)
Engine sump	7 pints (4 litres) SAE 10W/30. Change oil every 3,000 miles. Change filter element every 6,000 miles
Gearbox and final drive	3·5 pints SAE 80EP. Change oil every 6,000 miles
Grease	No points
Tyre pressures	F, 18; R, 28 p.s.i. (normal driving)

DIMENSIONS

Wheelbase	7ft 7in. (231cm)
Track: front	4ft 5in. (135cm)
rear	4ft 5in. (135cm)
Overall length	13ft 0·5in. (397cm)
,, width	5ft 4in. (163cm)
,, height (unladen)	3ft. 6in. (107cm)
Ground clearance (unladen)	5·5in. (14cm)
Kerb weight	1,350lb (613kg)

PERFORMANCE DATA

Top gear m.p.h. per 1,000 r.p.m.	17·7
Maximum speed	115 m.p.h.

prove the aerodynamics of the body.

The drag coefficient for the body is only 0·29 and a vital part affecting this low value is the small spoiler which is formed by a transverse lip only 1¼in. high above the tail. During wind tunnel tests it was found that the stream lines passing over the cockpit roof fell to meet the tail panel about half-way along its flat deck. Adding the spoiler shifted this contact point appreciably rearwards, and exhausting hot air into the well gave the same pattern as when the whole tail was faired in with a contoured panel. Air enters the engine compartment through the rear wheel arches. At the front it was found that the chosen nose height and inclination were naturally at the perfect partition point for air flow.

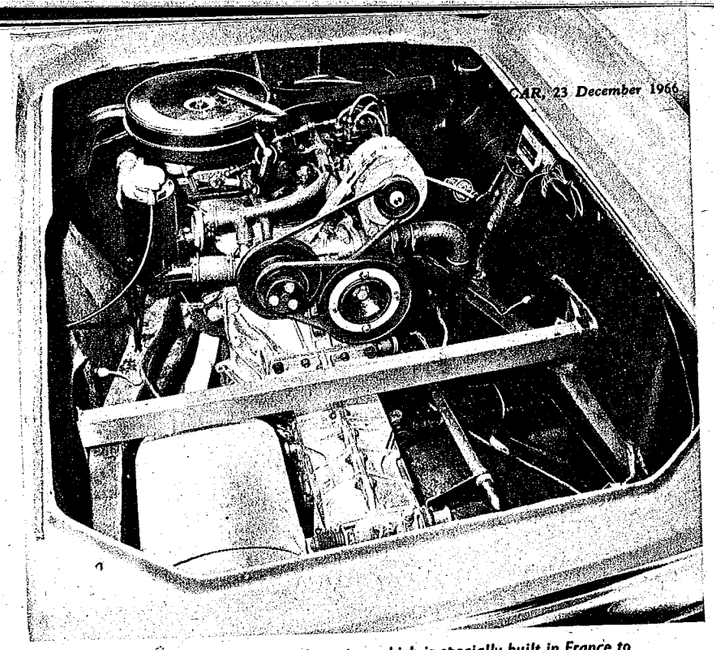
Neither front nor rear lids have hinges, overlapping flanges on the mouldings serving to secure the leading edges in each case and the rear edges being locked down with key catches. The radiator is mounted on the skew in the right-hand side of the front compartment with a thermostatically controlled electric fan forcing air through into the low-pressure zone of the wheel arch. Behind the horizontally mounted spare wheel is a transverse, vertical bulkhead which seals off a shallow luggage tray from the air intake in the nose.

Set into this bulkhead is another electric fan; this pressurizes the luggage well, which forms a plenum chamber with three separate outlets. The central one feeds air through the heater matrix and the two outer ones feed fresh air through adjustable Renault butterfly nozzles in the facia. Slots above the rear window carry cockpit air into the low-pressure zone behind to encourage a through-flow, since the double curvature side windows in the doors are fixed. Cooling water is carried through the backbone of the chassis to and from the engine, with separate small-bore pipes connecting the heater to a take-off on the engine side of the main thermostat.

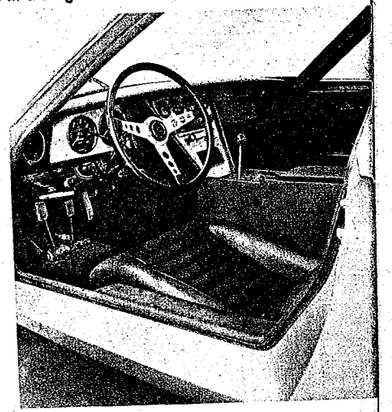
In the tail a glass-fibre tray fits in over the transmission to form the main luggage compartment and the battery is sunk into a recess in the right-hand side of this. A single 7-gal fuel tank forms a pannier on the wing to the right of the engine and a second tank balancing it on the left is an option.

Seats are fixed and the pedals can be adjusted for reach with a spanner. The steering column is telescopically adjustable, in Triumph Herald fashion, with a clamp that slips under a heavy impact as a safety feature. Reclining backrests come up high to form an integral headrest and the upholstery is well curved for lateral support as well as hammock-like fore-and-aft comfort. The main instruments are directly in front of the driver, with supplementary dials and all the switches on a central console.

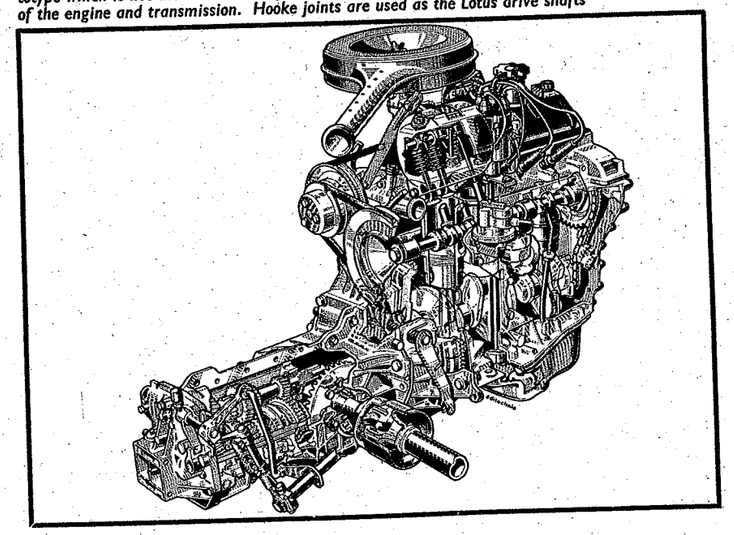
The gearchange works in a ball and socket passing through the top face of the main chassis backbone, and the lever connects to the gearbox via long tubular links and short rocking arms. The handbrake has an umbrella handle and works through long cables to the rear wheels.

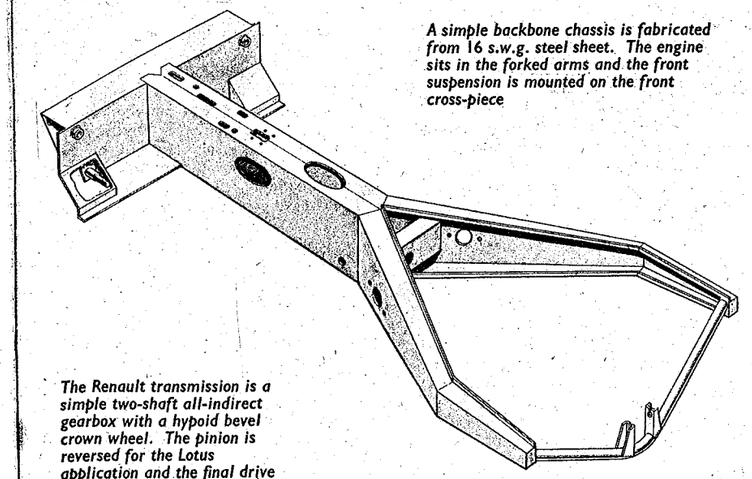


An alternator is standard on the Renault engine, which is specially built in France to develop 78 b.h.p. at 6,000 r.p.m. The fuel tank is in the right-hand rear wing



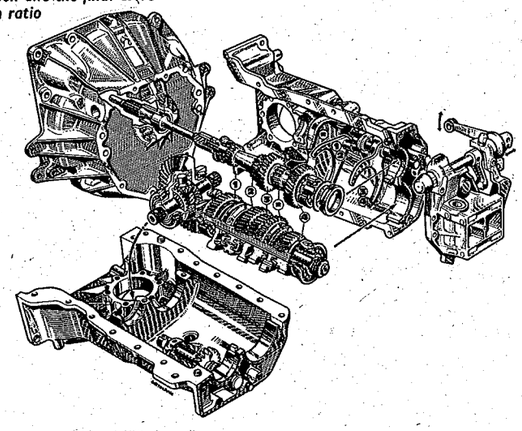
Above left: A glass-fibre tray fits in over the gearbox and silencer as a luggage compartment, with the battery on the right. Above right: This is the interior of the prototype which is not the same as the production cars. Below: Renault cutaway drawing of the engine and transmission. Hooke joints are used as the Lotus drive shafts

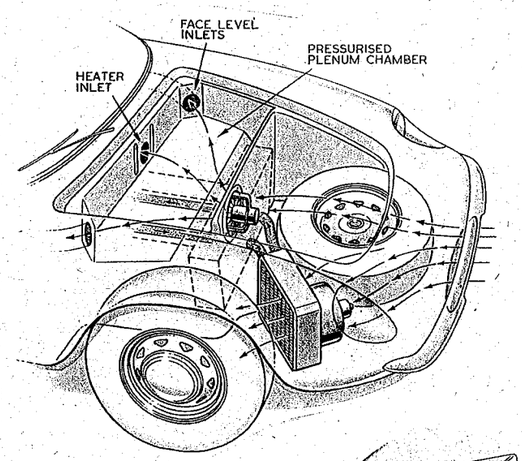




A simple backbone chassis is fabricated from 16 s.w.g. steel sheet. The engine sits in the forked arms and the front suspension is mounted on the front cross-piece

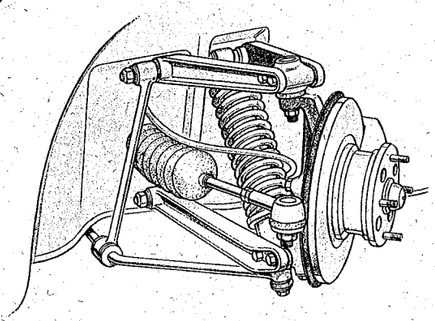
The Renault transmission is a simple two-shaft all-indirect gearbox with a hypoid bevel crown wheel. The pinion is reversed for the Lotus application and the final drive raised in ratio





Two electric fans are fitted in the front, one to force air through the radiator and the other to pressurize the plenum chamber cum luggage tray which supplies the heating and ventilating system

Front suspension is by parallel wishbones and coil springs and is made by Alford and Alder who supply Standard-Triumph with the same parts. This drawing shows the prototype and the mounting for the anti-roll bar will be different in production



Just as these pages closed for press Colin Chapman changed his mind about the interior trim, and we understand major revisions will be taking place before production starts. As yet there is no indication of what these changes will entail.

Readily available parts produced for other models are used wherever possible to cut costs and, in addition to the Ford bumpers, B.M.C. Mini headlamps with integral side lamps are used. The Carello tail lamp clusters were designed for the Lancia Flavia Zagato Sport and Renault 16 interior door handles and locks are fitted.

Road Impressions

Apart from the difficulty of getting down into the car, the driving position is extremely comfortable. Because the scuttle is low vision is very good despite the reclining angle of the backrest, and the setting of all the controls seems naturally correct. The interior mirror is so close to the back window that the field of vision through this "letterbox" is surprisingly good and the high, blind rear quarters do not present the expected problem.

The big, single wiper arm sweeps a wide arc which covers nearly all the steeply sloping screen. Despite the "sealed" cockpit, ventilation is good and any window misting in heavy rain is soon cleared by switching on the heater blower.

As Colin Chapman had ordered that no one outside Lotus was to drive the new car before production started, we were able only to ride in the passenger seat for a few miles around the Cheshunt area. Three features of the new car impressed immediately. One was that the noise nevel had been suppressed remarkably well, considering the engine was working only a matter of a few inches behind the occupants' ears. There was no wind noise and the exhaust was effectively subdued. Handling felt, from the passenger seat, to be well up to, or even above, the established Lotus standards and with the car's mass concentrated well inside the wheelbase corners seemed to be taken in one bite without any front or rear end effects that could be felt. Third, the ride was very level and much more comfortable than expected from a high-performance GT car of this nature.

Acceleration seemed brisk and the Renault engine revved freely without any temperament and with good flexibility. Lotus claim the car is not quite as quick as an Elan from rest, but because of its good shape the top speed will be higher and only limited by the engine revs and gearing chosen.

Production and Marketing Plans

In France the new Lotus will be handled by Lotus distributors and not Renault agents. The French market has an option on the first 500 cars which will account for the next 12 months' production, but it is hoped eventually to reach a target of 50 cars per week. ▶

LOTUS EUROPA . . .

Renault are backing their engine and transmission with their usual 12-month warranty. All the first year's cars will be in left-hand-drive form, and it is not expected to make any right-hand-drive cars for the home market until late in 1967 at the earliest.

Lotus emphasize that this new car is not intended ever to become an Elan replacement; it will be built completely at the factory and therefore subject to full British purchase tax. If and when it is available here, the price is expected to be close to the £1,000 mark, including tax. As mentioned earlier, it is intended as a Lotus for Europe, and will not be exported to the U.S.A., where many of its features would fail the Federal safety requirements.

Renault Engine and Transmission

The Renault 16 engine is a five-main-bearing unit made largely in light alloy. The block is a pressure die-casting in aluminium with removable wet cylinder liners, whereas the head is an aluminium gravity die-casting. Bore and stroke are 76×81mm, giving a ratio of 0·94 to 1 and a capacity of 1,470 c.c. The Lotus version is not changed in size or construction, but the compression ratio is increased from 8·5 to 10·25 to 1 and a new camshaft is fitted with higher valve lift and more advanced timing and greater overlap.

Exhaust valve size is not changed, but the inlet valves are increased from 1·38in. to 1·48in. dia. The standard single-choke Solex carburettor is changed for a double-choke unit with 26mm throats feeding progressively in two stages. The water-heated hot-spot is dispensed with. The inlet ports are opened out and fettled to match the larger valves and a new inlet manifold, but siamesing of the inlets into two pairs and of the exhaust ports into a central pair and single outers remains. Combustion chambers are wedge-shaped, with the valves inclined in-line at 20 deg to the centre-line of the cylinders.

The camshaft runs in four bearings, and is mounted at the top of the block in an open trough. This position simplifies die casting and enables the push-rods to be very short. With its Lotus tune, the engine can sustain 6,000 r.p.m. and run to 6,500 r.p.m. temporarily in the gears. Valve bounce is designed to occur at 6,800 r.p.m. as a safety measure. Lotus have marked the rev. counter with an amber warning sector from 6,000 to 6,300 r.p.m. and solid red from 6,300 to 8,000 r.p.m.

The effect of this tuning has been to increase maximum power from 58·5 b.h.p. net at 5,000 r.p.m. to 78 b.h.p. at 6,000 r.p.m. Peak torque is down very slightly from 78 to 76lb. ft. although at much higher revs, 4,000 instead of 2,800 r.p.m.

An alternator is standard on the Renault engine and the cooling system is sealed. The alternator remains but Lotus prefer to use a remote header tank mounted on the chassis near the carburettor and connected to the head by flexible pipes. Initially there were some problems with overheating, but these have now been cured by careful matching of the radiator core size.

The diaphragm-spring clutch has a diameter of 7·9in., and because the Lotus weighs only about 11cwt compared with the Renault 16's 19·4cwt it has not been necessary to increase the capacity of this unit. Gearbox ratios are similarly unchanged, although the final drive ratio has been raised from 3·77 to 3·56 to 1 by using two fewer teeth on the crown wheel. Since the pinion is offset a new one has been necessary anyway, to reverse the direction of rotation for the rear installation.

The overall gearing in top corresponds to 17·7 m.p.h. per 1,000 r.p.m., so that the sustained maximum speed estimated for a short burst (6,500 r.p.m.) is 115 m.p.h. Speeds in the gears at 6,500 r.p.m. are 33, 53, 80 m.p.h.

Aluminium is used for the gearbox casing, which is made from two pressure die-castings joined along a mating vertical face. The gears are carried on two shafts with an all-indirect train employing Borg-Warner synchromesh on third and top, and Renault's own heavy duty system on first and second.

The drive passes through a quill shaft from the clutch above the differential to the gearbox input and then back to the pinion which is below. The upper shaft has tapered roller bearings at each end, whereas the lower shaft has a plain roller bearing at the pinion end and a pair of opposing taper roller bearings at the opposite end, to withstand the axial thrusts either way.

Because the driven wheels are not required to steer, as they are on the Renault, the drive shafts on the Lotus have simple Hooke joints at both ends instead of the constant-velocity type. The standard Renault selector mechanism mates with the linkage engineered by Lotus which runs down the right-hand side of the engine, through a short rocking link and into the chassis backbone to meet the gearlever.

Geoffrey Howard ■

There is a low spoiler behind the flat part of the rear deck to reduce drag and vision through the shallow rear window is better than would be expected. Side windows have double curvature and are fixed

TALES OF TWO CHEERS

FROM JOHN O'GROATS BY PRIMUS

63-Year-Old Tale of a Heroic Winter Trip

J. REGINALD EGERTON set out from John O' Groats on a proving run for his little Primus car, and on arrival in Ipswich he settled down to write the account of his adventures. We have the original manuscript, never before published, and dated 27 January 1903. Extracts from his fascinating narrative follow: Mr. Egerton, who sent the material to us, still lives at Ipswich.

80, Christchurch Street,
Ipswich.
January 27th, 1903.

Late on Saturday night Mr. Egerton accompanied by his young mechanic Herbert Warren, arrived in Ipswich on his little "PRIMUS" Car, after a most eventful journey. He was met in Carr Street by a large cheering crowd who were awaiting his return to welcome him home. Many amongst that crowd would not have been in the least astonished if the little Car had not returned, for from the brief accounts which reached them from time to time in the "East Anglian" they knew what wonderful escapes the Car had had, and possibly anticipated "one too many". *Read on overleaf...*

Mr. Egerton (left) and his mechanic Herbert Warren wave seaweed on the shore at John O'Groats