

# Motor



Even cleaner frontal treatment features contoured integral side lights and flashers and a steel bumper

## Lotus Elan + 2

*Longer, wider, sleeker and actually faster, Lotus*

*bring family appeal to the Elan series with the*

*+ 2 model which adds much in space and refinement*

*but lacks none of the usual Elan agility.*

1968  
CARS

WHEN the Lotus Elan replaced the complex, unit construction glass fibre Elite in October 1962, there seemed little chance of it following the same rather negative course of development. The Elite was an advanced design for its time, perhaps because of noise better suited to racing than a civilized road carriage, exceptionally elegant and, in the opinion of many, deserving of greater success and a longer production run than it actually achieved. However, the design was totally inflexible and to effect any but the most superficial changes to size, shape and specification, would inevitably involve a major redesign.

It is therefore interesting to consider the comparatively minor changes wrought upon the mechanical components of the Elan to produce a car of markedly different character and purpose which was at one time intended to revive the Elite name but which is now to be known as the Elan +2 (code-named M 20). Basically the car is derived from the Elan by adding 12 in. to the backbone frame and 7 in. to the track, though the fact that at one stage the whole scheme was re-worked, retaining little more than the windscreen and the radius of the compound curvature side windows, suggests that the

transformation was accompanied by at least a fair share of problems.

The chief limitation of the Elan (one also shared by the Elite) is its virtual appeal only to single men or the two-car family. For those, and this still means most of us, with the wherewithal to run but one car, as soon as the little woman makes that fatal pronouncement, Lotus owning days are certainly numbered, unless the Cortina-Lotus is counted as a genuine Lotus. There is scarcely room behind those two bucket seats for a Pekinese, let alone Junior, carry cot and associated accoutrements of parenthood. Most manufacturers of two-seater sports cars have encountered this problem and tackled it with varying degrees of success; the Austin-Healey 3000 Mk. II, Jaguar E-type 2+2 and MGB GT being examples. Of these three, only the Healey retained the soft top. The intention of the Elan +2 is to extend the feasibility of enjoying a Lotus at least into early middle age as the rear seats are quite tolerable for two children up to 12 years and the luggage accommodation quite generous for a car in this class. In return, one must sacrifice the soft top option and a little of the manoeuvrability, but not roadholding, of the

Elan. And as our road test shows, standardizing the latest specification special equipment engine ensures almost identical acceleration and a substantially higher maximum speed.

Lotus regard this as their first car to be immediately and evidently obvious as an everyday car. At 14 ft. long, 5 ft. 6 in. wide and 3 ft. 11 in. high, the +2 is 23 in. longer, 10 in. wider and 1 in. higher than the Elan; it looks a much bigger car and must appeal to a certain sector of the market who regard the latter as a bit of a toy. It is Lotus' first committee designed car with certainly a more than usual influence from the accountants. It is thus far more production-ized making full use of sub-assemblies where possible and pre-formed items including trim, which literally falls in from stock instead of being painstakingly cut to fit in the car. So far has this process gone that the car could possibly be built cheaper than the Elan. But since automobile costing involves far more than materials and labour, particularly when the firm has recently built a new factory, it will be marketed at a still competitive £1,672 in kit form or £1,923 built up. It will be noticed that this saves

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## Lotus Elan +2

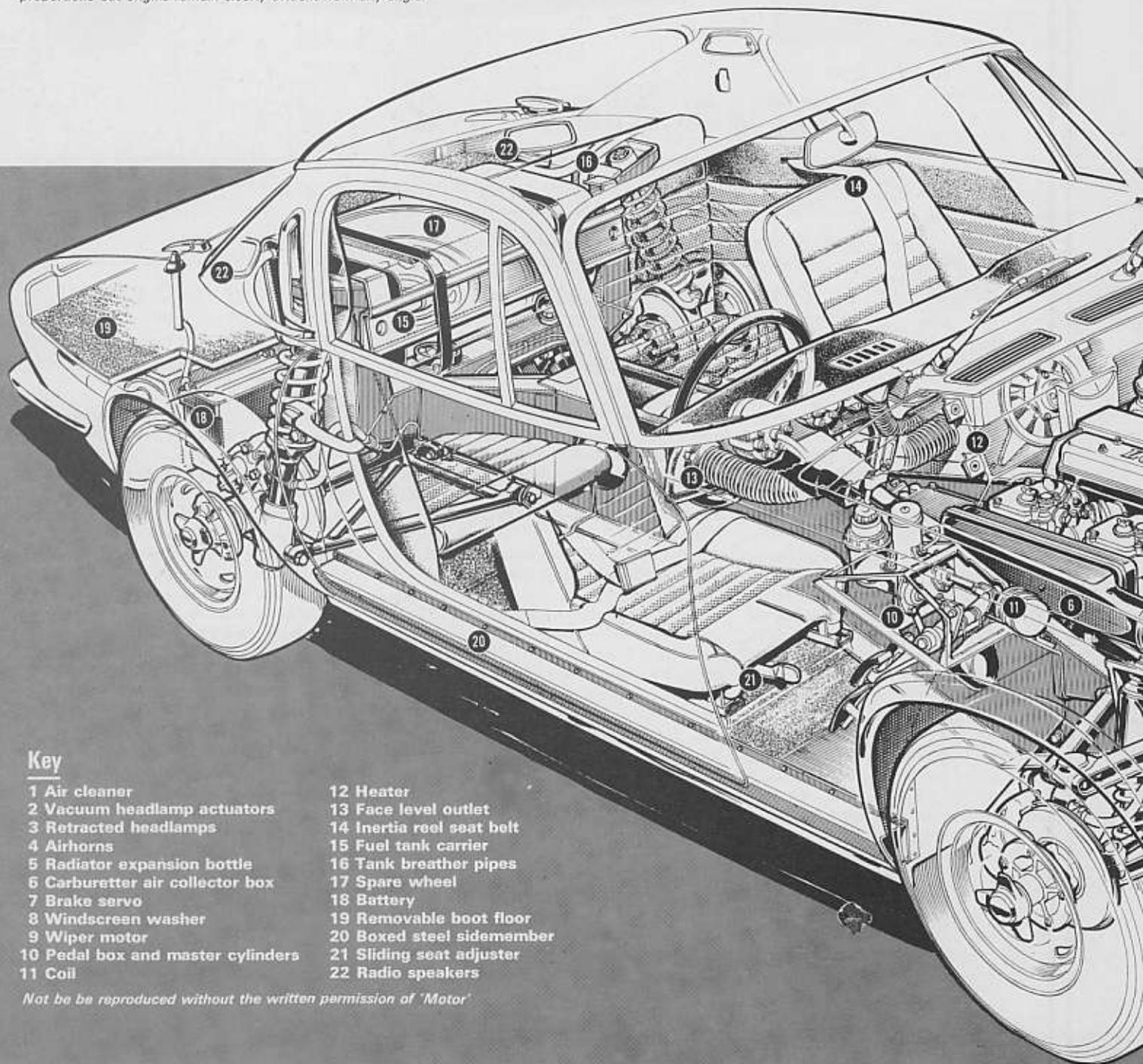
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Almost 2 ft. longer and 1 ft. wider but only 1 in. higher than the Elan, the +2 has much more elegant proportions but origins remain clearly evident from any angle.

somewhat less than the purchase tax because Lotus maintain that it costs more to produce a kit than a complete car. The first off will be kits and it was intended to have at least 40 sets in dealers' hands prior to announcement.

Apart from its greater length (raising the wheelbase to 8 ft. 0½ in.), width at the rear and reinforcement at points of high stress, the backbone frame is identical to that of the Elan. The central boxed section forks at either end to pick up the suspension mounts, one set on the end of each prong. The engine, a 118 b.h.p. version of the twin cam 116E derived unit, and Corsair close ratio gearbox sit between the front arms and the propeller shaft, suitably lengthened,



### Key

- |                                   |                           |
|-----------------------------------|---------------------------|
| 1 Air cleaner                     | 12 Heater                 |
| 2 Vacuum headlamp actuators       | 13 Face level outlet      |
| 3 Retracted headlamps             | 14 Inertia reel seat belt |
| 4 Airhorns                        | 15 Fuel tank carrier      |
| 5 Radiator expansion bottle       | 16 Tank breather pipes    |
| 6 Carburettor air collector box   | 17 Spare wheel            |
| 7 Brake servo                     | 18 Battery                |
| 8 Windscreen washer               | 19 Removable boot floor   |
| 9 Wiper motor                     | 20 Boxed steel sidemember |
| 10 Pedal box and master cylinders | 21 Sliding seat adjuster  |
| 11 Coil                           | 22 Radio speakers         |

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passes down the central tunnel to meet the differential (Ford internals in a Lotus housing) secured by short bolts at the top and rubber mounted tie-rods below.

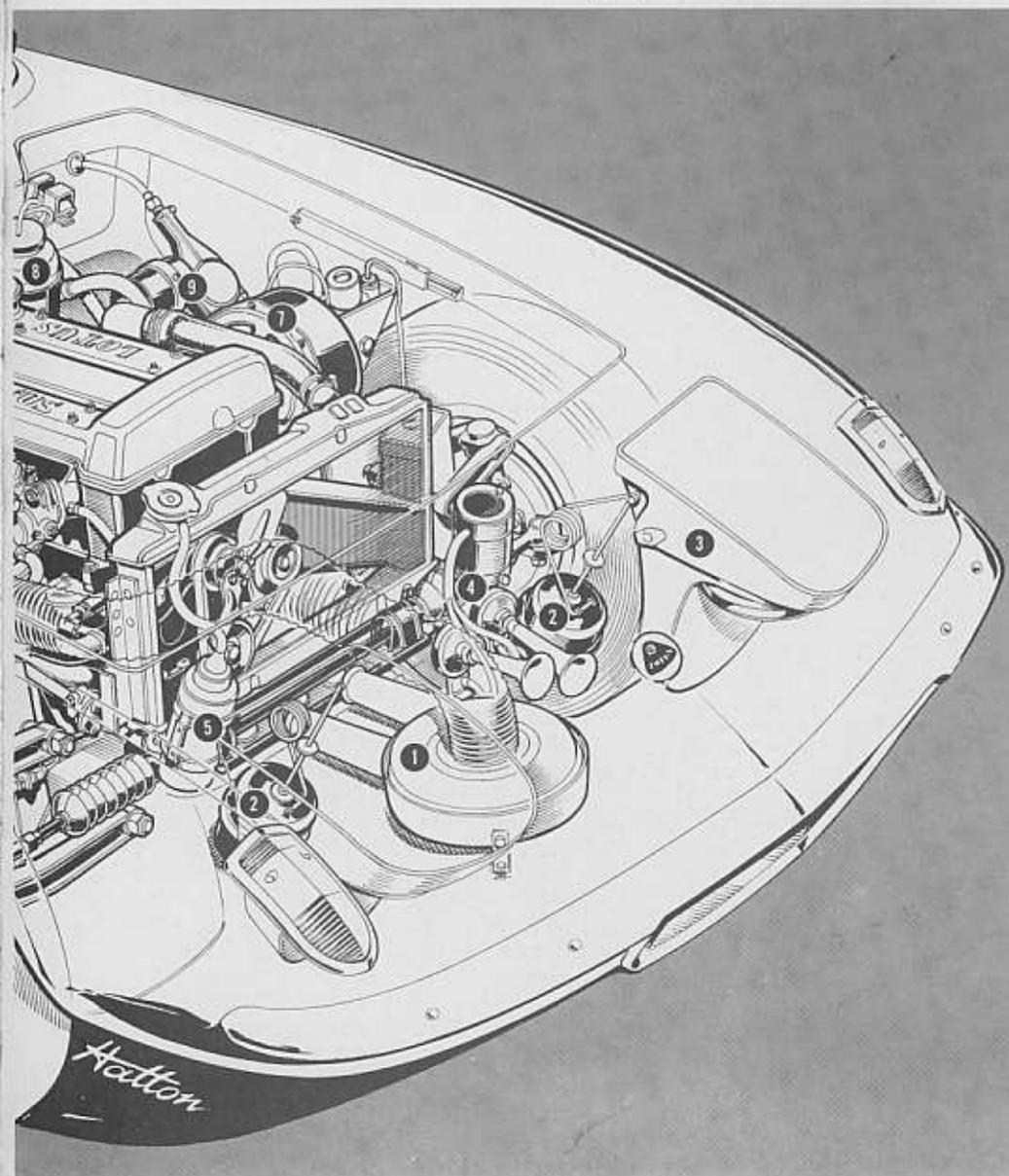
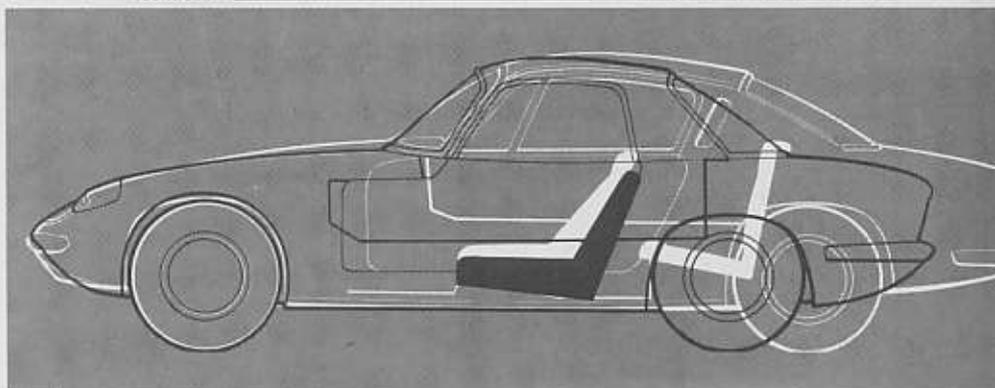
Any stiffness lost in elongating the frame is amply made up by the body which imparts a lot more rigidity than the lightly stressed structure of the Elan. Helping in this are a pair of triangulated 16 swg steel side members bonded into the door sills. Without resorting to very thick sections or woven mat, a bonded steel structure is possibly the only way to enable a plastic structure, substantially, to stiffen a steel frame. Young's modulus for steel is  $30 \times 10^6$  lb. per sq. in. against only  $1.4 \times 10^6$  for plastics reinforced with random mat. Without additional metal bracing, the frame would be approaching its elastic limit before any appreciable rigidity is forthcoming from the surrounding plastic.

The side members also play an important part in secondary safety. Although the agility of the Elan makes it an exceptionally safe car in a primary sense, it is not an ideal car in which to be involved in a shunt, particularly if the impact comes from the side. The lower anchorage points of lap and diagonal seat belts with concealed inertia reels are bolted to the side members although the reels themselves are bolted through a reinforced section of the body immediately above.

The rear suspension retains the system

*Facia layout is basically as before but the panel is higher with the addition of ammeter and oil pressure gauges and sliding heater controls. The Ford steering column gives a single stalk for direction flashers and headlight dippers. Push button radio is standard.*

*All the increased length is accommodated aft, the positions of windscreen base and pillars, facia and the leading edge of the front seats remaining practically the same for both cars. Bonnet and scuttle height are slightly raised on the +2 but front overhang is identical.*



of the Elite and earlier Lotuses with a single lower wishbone and coil spring damper strut. Drive shafts and wishbones have been lengthened to provide the necessary increase in track and the rear frame forks which support the tops of the suspension struts are spread wider to keep the inward inclination of the struts the same as on the Elan. A substantial cross brace links the two prongs to complete the rectangle of support for the suspension, strengthen the frame and prevent the fuel tank distorting forwards into the cockpit in the event of accident.

At the front all geometry remains the same as on the Elan except for longer wishbones, so, with the same uprights and inboard pivot spacings, the swing axle length is slightly increased and the position of the static roll centre works out lower. This is actually the reverse of what takes place when widening the rear track where the position of the roll centre tends to rise. When only the wheelbase is changed, there is usually a change in inclination of the roll axis as a result of the greater length between roll centre points. In this case, the effect is virtually nullified by the changes in height at each end. Thus since the weight distribution remains practically unaltered, 48/52 front/rear, with 150 lb. in the rear seats and boot, the handling may be expected to have been influenced very little. The total

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## Lotus Elan 2+2

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weight is substantially increased by some  $3\frac{3}{4}$  cwt. due to the larger size and more liberal use of sound insulating materials and spring rates have been stiffened accordingly: from 75 lb. per in. on the Elan front to 110 lb. per in. and from  $67\frac{1}{2}$  to 93 lb. per in. at the rear. Ground clearance has benefited slightly, going up from 6 in. to  $6\frac{1}{2}$  in.

It is perhaps worth noting here the Chapman sequence formula for laying out the handling of a car. First fix the static roll centre height and other associated factors. Then set appropriate swing axle lengths and wishbone sizes working on laden suspension frequencies of approximately 68 c/s at the front and 70 rear (the Elan +2 is actually 67 c/s at the front and 72 behind). From here suitable spring rates can be calculated leaving roll stiffness, weight transfer and other suspension characteristics to be determined practically by optimum settings for castor, camber, toe-in, tyre pressures and anti-roll bar dimensions.

A brake servo, which many owners think is desirable for the Elan, is standard for the +2 together with Girling discs all round (enlarged to 10 in. at the front) and the more sturdy 16P front calipers. With DA 3 pads at the front and DS 31s at the rear, Lotus were able to achieve retardation of 0.87g from 30 m.p.h. and 0.84g from 90 m.p.h. with 75 lb. per sq. in. pedal pressure and the brakes actually improved after fade. Our own figures confirm these claims.

Pedals are now mounted on a self-contained box which is detachable complete from the wheel arch.

Elan origins are very obvious from the exterior appearance although the car is obviously larger. At a time when waist lines are tending to fall, it is surprising that the door and scuttle heights should be about 3 in. higher than on the Elan, and for



*The rear bumper, also steel, is neatly contoured into a much longer tail which is perhaps the most appealing if not the most original feature of the styling. The filler cap has changed sides.*

shorter drivers, seated in the classic Lotus position at the lowest point of the floor, visibility may be a little restricted. Obvious features are the chromed steel bumpers instead of the very costly foam-backed glass fibre items on the Elan. In fact the car is still a component spotter's delight. The front bumper is Ford Anglia, the rear two halves of a Wolseley Hornet bumper with a bit extra in the middle. The laminated windscreen is Ford Capri, the through ventilation vents Rootes and the gear lever gaiter Rover 2000. Less obvious are the Cortina heater and Cortina GT steering column, which is new, although the steering gear itself is still the Triumph Herald rack. An energy absorbing column will be offered at a later date. Electric windows have Viscount motors which work much faster than the converted screen wiper motors used on the Elan.

The front is flatter and more pointed than the Elan's which does much to account for an even more slippery shape and a drag coefficient claimed to be down from 0.32 to 0.3 on which only the Europa can improve

at 0.29. Combined side lights and flashers are resited above the bumper in the ridge along the edge of the wings and are now clearly visible from the side. The headlights, still vacuum raised and spring lowered, lie in a flat part of the front and emerge flashing during daylight.

Other minor novelties at the front are shown clearly in Brian Hatton's cutaway drawing. The air cleaner mounted in the cool air stream ahead of the radiator is now horizontal with upward facing outlet into the duct feeding the twin choke Weber carburettors. Air horns are standard and the radiator has an expansion bottle. The front hinged bonnet is spring loaded and springs up automatically as soon as the inside catch is released. Not long ago curved glass side windows were a novelty; now the Elan +2 has double curvature glasses, the shape being obtained by taking a cut across the surface of a cylinder, diameter and inclination from the axis determining the eventual shape.

The interior is described in detail in the appropriate section of our road test and its size in comparison with the two seater is shown in our drawing. The front seats are on sliding runners instead of the rocking mounts used on the Elan.

The Royalite centre console, which runs rearwards from the base of the walnut veneer fascia to divide the rear seats, now contains a shallow map pocket with a padded lid at a convenient height for the left arm. Extractor grilles for the through-flow ventilation are sited immediately behind the door apertures at what is said to be a low pressure area. But they do not have a non-return flap valve and because low pressure areas do not always remain so at certain speeds, the fuel tank has a complex arrangement of venting with flexible pipes passing from each side over the roof under the head lining to emerge in the opposite wheel arch.

J.L.T. **M**



*The pop-up lights, the most characteristic feature of the Elan, sprout from a flat section of the bonnet on the +2 which gives the mouldings a more angular, asymmetric form less shapely than the Elan. In daylight they emerge flashing.*