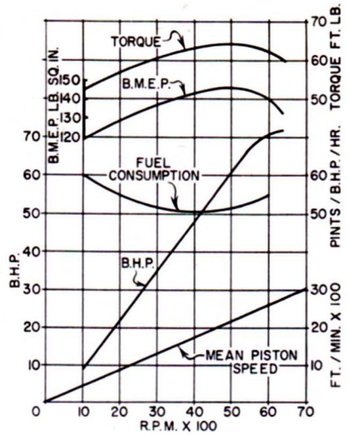

SCI Technical Report:

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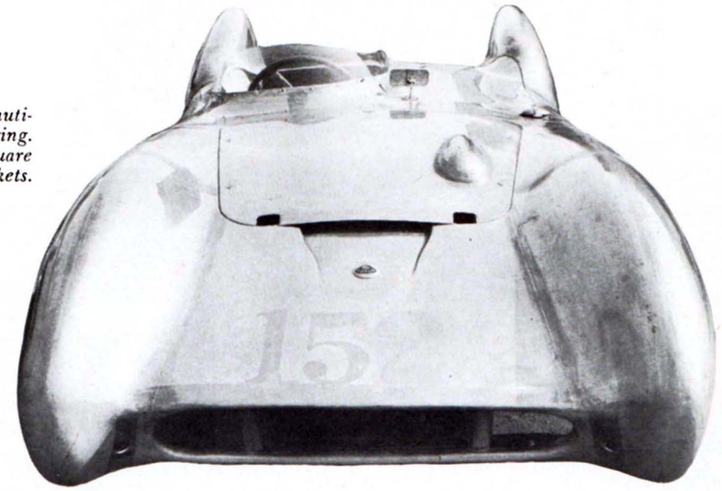
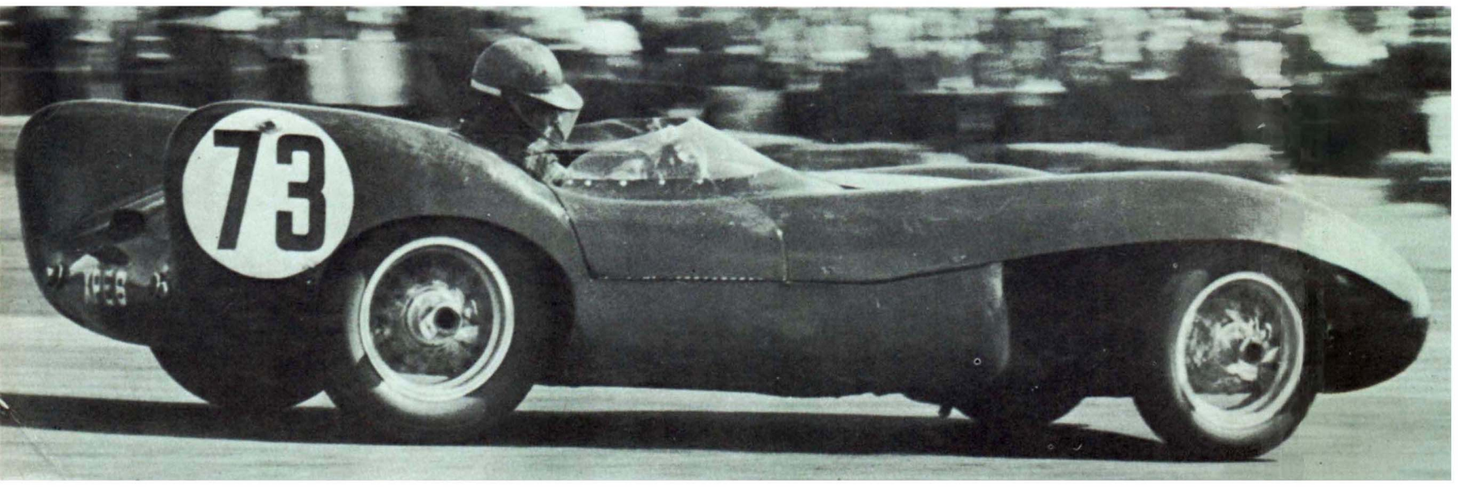
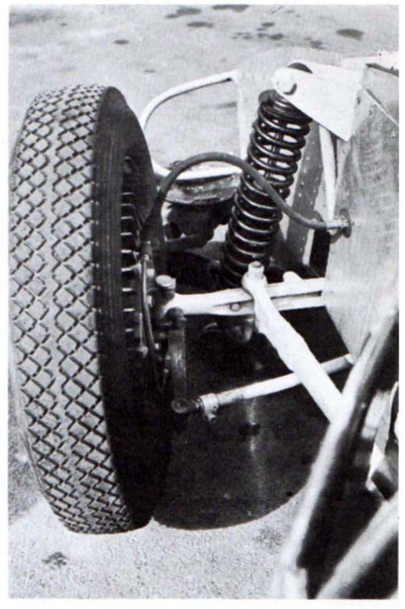


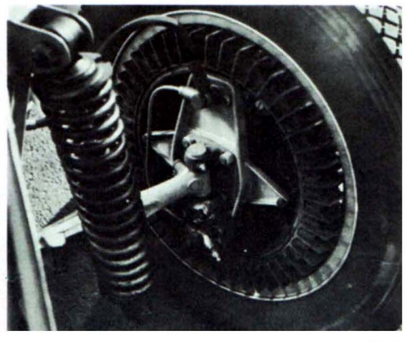
View of Lotus from eye level shows beautifully proportioned aluminum covering. Bump on hood accommodates carbs; square holes are for recessed headlight brackets.



A Mark IX Lotus at speed. This 1100 cc Coventry-Climax-engined newcomer has aroused a great deal of interest among owners in the small class.

RIGHT: Front suspension is similar to Allard, with a light Ford axle cut in two with plates welded to each half for attachment to frame. Fore and aft location is obtained with radius rods. BELOW: The Lockheed hydraulic brakes are open back type and have Elektron drums with steel liners of 11½ inch diameter and 2¼ inch width.





By RUSS KELLY

TO U.S. ENTHUSIASTS who take their racing seriously, a headache of no small proportions is the rapidity with which a ten-thousand-dollar automobile can become obsolete. The history of the under 1500 cc class here, for example, is littered with expensive bones. The MG and Simca Specials gave way to the Porsches. The early Porsches in turn submitted to the dohc OSCAs and the OSCAs to the four-overhead-camshaft Porsche 550. Now it looks as though the new 1500 Maserati could take over in class domination. This quick obsolescence is a major deterrent to those who would like to continue participation and many who would like to begin but can't afford such an all-out financial risk.

One bright spot in this situation has been the famous Miles MG Special. The success of this car points to the chance of some stability in at least one of the smaller classes of racing. MG, from the earliest U.S. tuning efforts to the Ken Miles car, had a long and successful period of competition. There were two good reasons for this. First, it was relatively cheap. Second and more important, it responded favorably to attempts to tune and extract more power from it. In any city where sports cars enjoyed popularity, you could find a mechanic who could return your MG to you running better and faster than when you gave it to him. This meant step-by-step development, which culminated in the Miles Special. Without the introduction of hyper-expensive, esoteric equipment, the 1500 cc class would be fairly stable today. Obviously, however, it is not, and enthusiasts with limited resources, bumped out of the demanding 1.5-litre class, are beginning to watch the smaller classes closely. To ask for a machine in any class that would not become obsolete would be to deny the basic idea of competition. But it is reasonable to wish that another machine would come along with the same possibilities given in another day by the MG.

This is the reason for the tremendous interest aroused by the 1100 cc Coventry-Climax-engined Mark IX Lotus, which is just beginning its career in the U.S. When you keep in mind the basic requirements a car needs to establish a class governed by evolution through skill rather than revolution by the dollar, the Mark IX Lotus looks not only like an exciting newcomer, but like an extremely significant one as well.

Recently I made a trip to the road races at Palm Springs

PRICE:
$4390. FOB factory

ENGINE:
Cylinders .....4, in line
Bore and stroke .....2.8 in x 2.6 in (72.39 mm x 66.6 mm)
Capacity .....1098 cc
Firing order 1, 3, 4, 2
Compression ratio .....9.75 to 1
Output:
Max. horsepower ....75 @ 6200 rpm

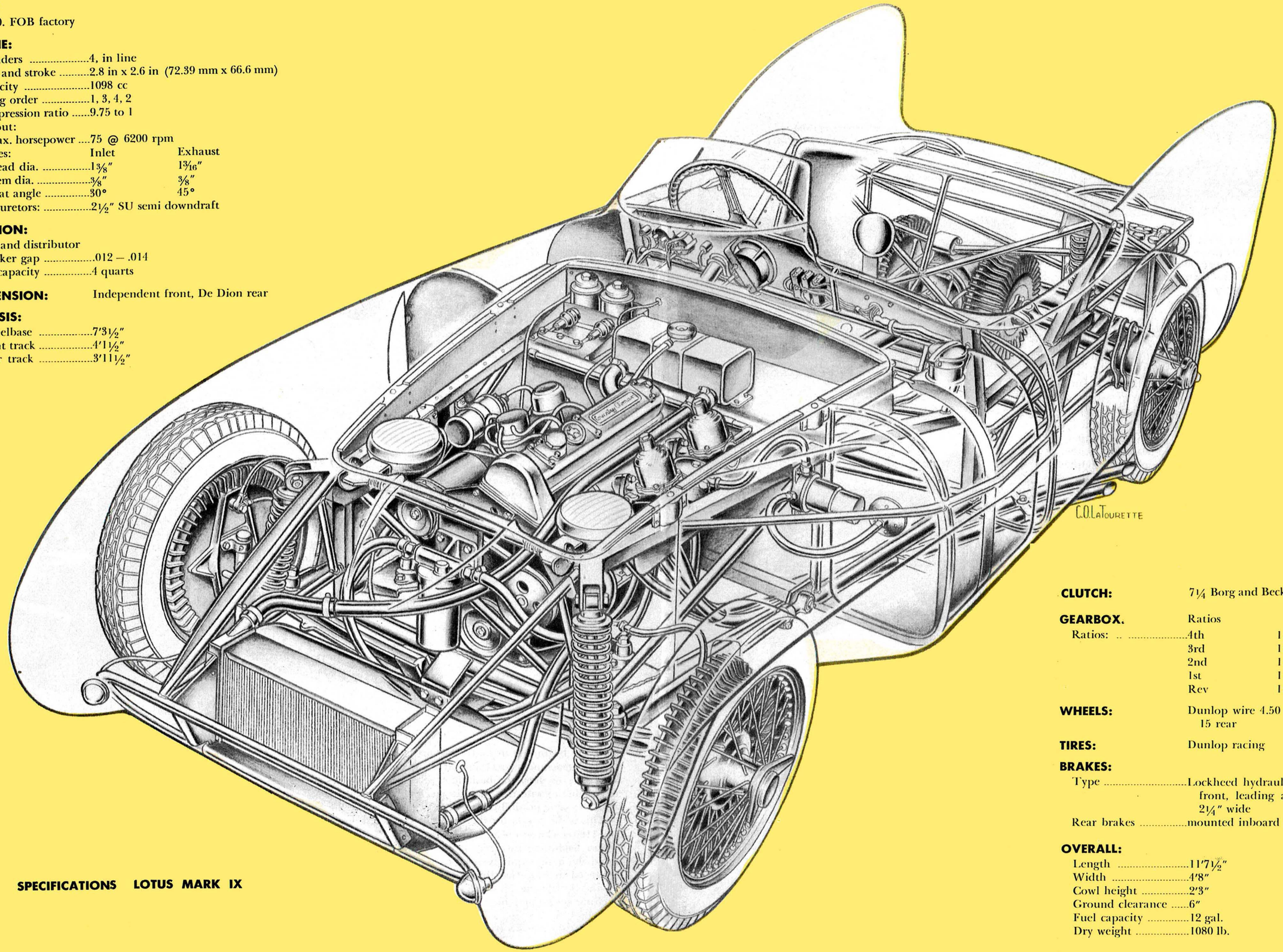
Valves:	Inlet	Exhaust
Head dia.	1⅜″	1⅜₁₆″
Stem dia.	⅜″	⅜″
Seat angle	30°	45°

Carburetors: .....2½″ SU semi downdraft

IGNITION:
Coil and distributor
Breaker gap .....012 – .014
Oil capacity .....4 quarts

SUSPENSION: Independent front, De Dion rear

CHASSIS:
Wheelbase .....7′3½″
Front track .....4′1½″
Rear track .....3′11½″



SPECIFICATIONS LOTUS MARK IX

CLUTCH: 7¼ Borg and Beck

GEARBOX. Ratios

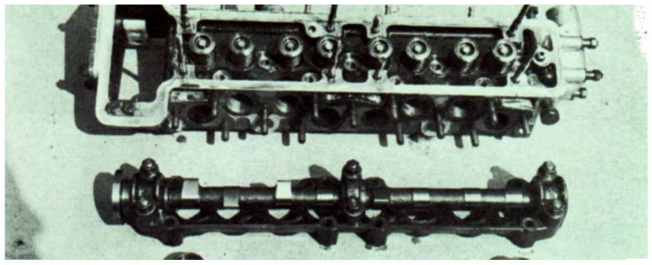
Ratios:		
	4th	1:1
	3rd	1:1.35
	2nd	1:1.96
	1st	1:3.38
	Rev	1:3.38

WHEELS: Dunlop wire 4.50 x 15 front, 5.25 x 15 rear

TIRES: Dunlop racing

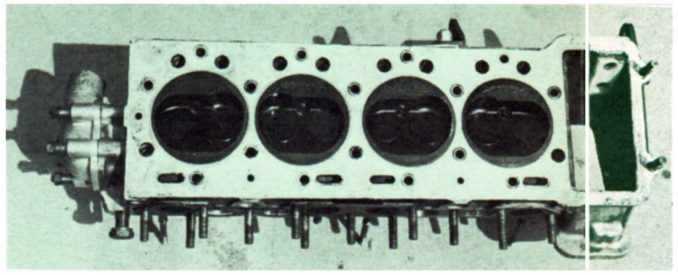
BRAKES:
Type .....Lockheed hydraulic, 2 leading shoe front, leading and 11 in. dia. x 2¼″ wide
Rear brakes .....mounted inboard

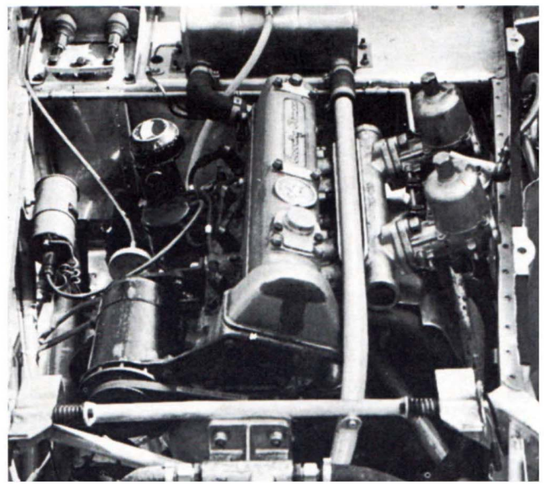
OVERALL:
Length .....11′7½″
Width .....4′8″
Cowl height .....2′3″
Ground clearance .....6″
Fuel capacity .....12 gal.
Dry weight .....1080 lb.



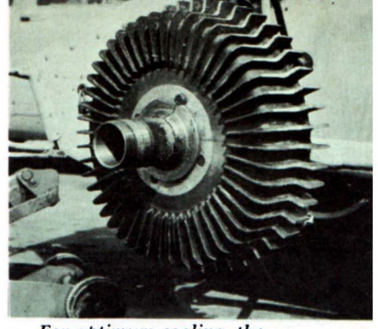
Top view of head. Valves have helical springs, and are operated through guided cam followers. Buttons, shown below cam followers, are used to adjust clearances. Standard lift is .300 of an inch.

Combustion chambers are wedge shaped, and the in-line valves are slightly inclined to sit horizontally upon the chamber surface. Note contoured corners around intake valves to accommodate their extra size.

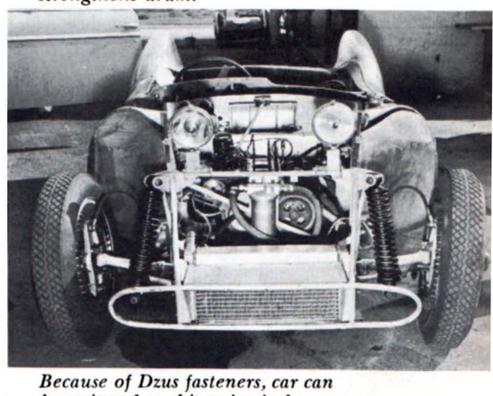




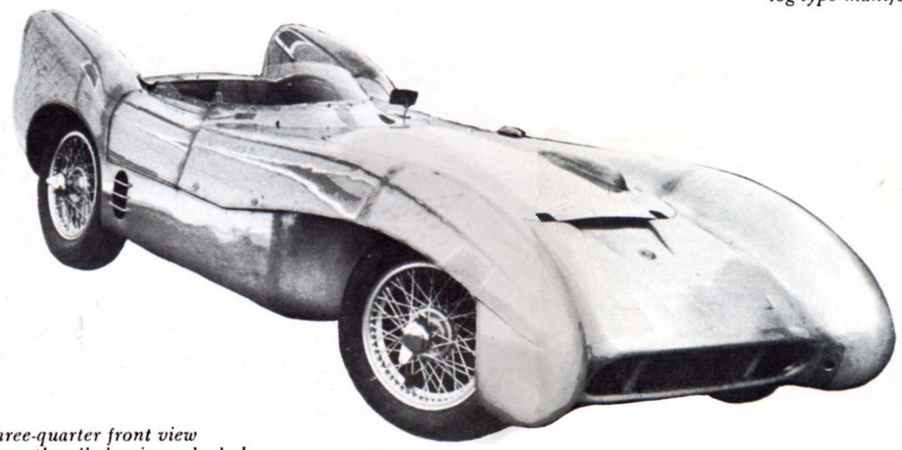
The Coventry-Climax engine with a total weight, including starter and generator, of only 208 lbs., is fed by two 1½ inch SU carbs through a log-type manifold.



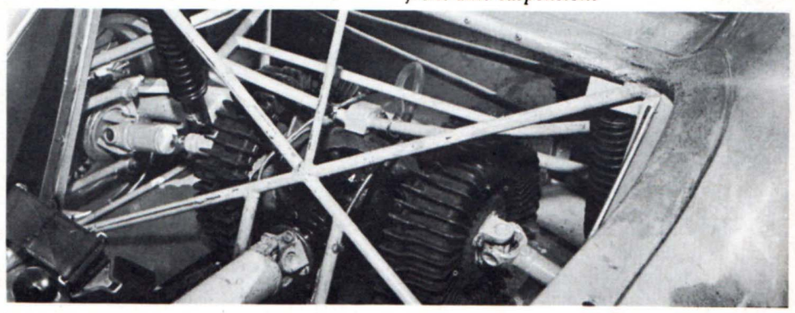
For optimum cooling, the magnesium-alloy steel lined front brakes are finned almost to the hub. This type of rib-fin also strengthens drum.



Because of Dzus fasteners, car can be stripped to this point in less than one minute. Note strong positive chamber due to the divided front axle suspension.



Three-quarter front view shows the all-aluminum body has two main sections, which can be removed in less than one minute.



Final drive unit is de Dion type with 11-inch inboard brakes. Ring gear and pinion, however, are Austin-Healey and fitted into massive Elektron casting.

with the specific idea in mind of watching the Mark IX in action. It was a revelation. In the capable hands of Jay Chamberlain of Burbank, a Mark IX finished fifth behind four 550 1.5-liter Porsches and ahead of another Porsche and a pair of OSCAs. In view of what we have learned to expect from 1100 cc cars in the past, the Lotus' ability to hold its own in fast company raised a lot of questions in my mind. As the car headed for its pit, sounding as healthy as at the start of the race, I headed there too. I congratulated the owner on his car, and he urged me to follow him to his shop and check it out as thoroughly as I wished.

At the Burbank shop the Lotus stood in the company of a D-type Jag and a Monza Ferrari, and in looks it suffered not at all by comparison. It had no shiny, mistake-concealing printed finish and it needed none. Its bare aluminum skin was flawless. It had a look of pared-down leanness that contrasted effectively with the rounded, organic lines of the other cars.

Chamberlain offered to let me check out on the road any one of three different Lotus Mark IXs, each with different final drive and gear box ratios. I chose the Palm Springs car because it was soon to be torn down for inspection, and I'd be able to see if any modification had been made in the engine that I'd seen perform so well. Furthermore, driving the car would give me an idea of how far it had been extended to place as it did.

Colin Chapman, designer of the Lotus, is of the opinion that even a sports car designed for racing should be a competent road machine as well. With this in mind, I drove the Lotus to the test area instead of hauling it there on a trailer. This wasn't a mistake. From the time the engine was started and allowed to turn over at a fast, warm-up idle until the time we reached the test area, the car was as tractable as a stock MG. The lowness of the seating position was a little disturbing in the Los Angeles traffic at first, and the desire to raise the busy exhaust note just a bit by foot pressure had to be firmly resisted.

Top speed of the Lotus with a 3.9 rear axle ratio is about 130 mph. Chamberlain's car, with a 4.2 ratio, was clocked at 114 mph on the Straightaway at Palm Springs. The Lotus' acceleration is equally surprising for a car of only 1100 cc. Its 0 - 60 mph time is about eight seconds, and the standing quarter should be covered in under 16 seconds. The aerodynamic form gives this little car a real shot in the arm on acceleration at speeds over 70 mph.

The Lotus' clutch is light with a pleasingly short travel and a healthy bite. A driving position with arms extended nearly straight to the wheel gives the feeling of lots of room. The TC gearbox will seem like an old friend to many. With the slightest throttle pressure the engine loses all trace of roughness, and the close ratios in the box make full use of the turbine-like power that comes from the little mill. I made a couple of trials runs without exceeding 5000 rpm in any of the top three gears. I noticed no engine vibration, and the absence of body panel drumming and vibration at high engine speeds was welcome and surprising for such a light car.

The ride is flat and solid. Surface roughness noticeable at low speeds becomes less so as speed goes up. To avoid over-controlling at high speeds, this car calls for a light grip on the wheel – a condition to which I'm always happy to accustom myself.

The brakes are phenomenal. They had been used in the race and they probably had been used hard. All my stops from high speeds were in the nature of crash stops. Still, there was enough pedal there to run another race. I can only compare these brakes with those on a 500 cc Cooper, which is saying a lot. As with the Cooper, the Lotus brakes feel as though they could suffer the worst sort of abuse and remain effective.

The Mark IX Lotus has a de Dion rear end and driving it on a winding road, especially a familiar one, is a pleasure indeed. Rough corners that demand caution with live or swing-axle rear suspension can, in this car, be taken on the line chosen almost without regard for surface conditions. The absence of bounce, roll, or squeal makes driving through the slower corners seem effortless. I made many tries in these corners to provoke the unexpected and the potentially dangerous but failed.

In fast corners the car's English airport course breeding thoroughly asserts itself. The long, flat, incredibly fast corners peculiar to English racing have turned out some drivers noted for their command of a fast drift. And what this environment has done for some English cars. The Lotus' steering is almost neutral, with a slight tendency

(Continued on page 56)

Lotus

(Continued from page 37)

towards understeer

The day after I drove the car it was dismantled and I had the opportunity to take a good look at what was inside. This tiny engine that had been so impressive was as stock as a stove. The ports were rough and the valves, both intake and exhaust, could easily have been enlarged. The compression ratio was just 8.8 to 1 and could have been almost a full point higher. In short, this was the kind of raw material that a good MG man could have a field day with.

The Coventry-Climax engine was primarily designed as an industrial unit, but the possibility of its being used for racing was never overlooked. The result of this approach has been an unusually happy blend of light weight, reliability, high performance, simplicity, and parts availability. Light alloys have been used in the engine extensively and the complete weight of the unit is only 208 lbs., including the starter and generator. With an oversquare bore and stroke of 72.4 x 66.6 mm it develops 72 bhp at 6200 rpm. Piston speeds at this rpm are well below 3000 ft. per min.

The cylinder liners are renewable and the heat-treated cylinder head has shrunk-in austenitic-iron valve seat inserts. A husky, fully counterweighted crankshaft is used. Main and connecting rod bearings are of the steel-backed lead-bronze insert type. The three mains are one inch by 2⅛ inches and the rods are ⅞ by 1¾ inches.

The con rods' big ends are split diagonally to allow them to be pulled up through the bore. The camshaft is carried in three white metal bearings and is driven by duplex roller chain. The in-line valves are slightly inclined, have double helical springs, and are operated through guided cam followers in the same manner as the Jaguar. Clearances are effected by the use of buttons of various thicknesses inside the follower body. Standard lift is 0.30 of an inch, intake valve diameter is 1.35 and the exhaust is 1.20. The combustion chamber is wedge-shaped. A floating-type oil pickup is used, the engine of course being wet sump. Two 1½ inch SU carburetors of semi-downdraft type are used on a log-type manifold.

The space-type chassis frame of the Lotus uses a square and round section tubes of various dimensions, load being the size-determining factor. It may seem surprising in this day of high-specification alloys that the tubing is mild steel. There's good reason for this however; the chassis is acetylene welded and gas welded nickel alloys joints can be trouble makers.

The frame has two main longitudinal members on each side, the lower ones are of 1⅞ inches round section and the upper tubes are one inch square. The bracing between these two members and all bracing throughout the frame is designed to eliminate any cantilever loading. To put it a little more simply, the frame is braced at carefully-engineered points so that multiplication of cornering, braking, and acceleration stresses by leverage within the frame is held to an absolute minimum. All of the attachment points for the engine, final drive and suspension are welded to the frame and no bolt-up brackets or clamps are used. Total weight of this frame is given as just 63 lbs.

The front suspension is similar to the Allard's, inasmuch as it consists of a light Ford axle cut in two with plates welded on each side for attachment to the frame. Ford hubs are also used. The pivot point is kept low, resulting in a roll center six inches above ground level. One of the traditional disadvantages of this otherwise excellent and simple form of suspension is gyroscopic "kick" that can be felt through the steering wheel at moderate speeds over rough surfaces. In the case of the Lotus, light weight reduces this tendency of the wheels to steer themselves at high rotating speeds. The fore and aft location of these half axles is obtained by the use of radius arms, again of Ford manufacture, attached to the lower main frame tube by a ball joint.

Suspension is by coil-spring telescopic damper units and each end of each unit is mounted in rubber bushings. The lower mount is a bracket bolted to the half axle that sets the anchor point a considerable distance below the axle center. The top point of anchorage is an orthodox bracket facing outward and forward, welded to the top main frame tube and top front cross tube where they join. The engine is mounted well back from the front wheel center line.

The Lotus steering is by worm and nut. The forged steel steering arms are obviously of special manufacture and are bolted to the stub axles. The linkage between these arms and the steering box consists of divided track rods attached to a bell crank mounted on the bottom front cross tube. The bell crank is actuated by a drag link that angles back to the arm on the steering box.

The Mark IX rear suspension and final drive unit is a moving thing to contemplate. The de Dion layout with its tremendous 11-inch inboard brake drums is responsible for a good share of the Lotus' excellent handling characteristics. Standard layout practice is followed and the execution is ingenious. The axle tube passes behind the final drive unit housing and is of the non-articulated type. This axle is made of three-inch diameter tubing. Housings are fabricated on the ends to receive the aluminum castings that carry the short shafts and bearings for the wheel hubs. The axle tube and hub unit castings are bolted together with four 5/16-inch bolts, making a very clean, light-looking job.

Acceleration torque is absorbed by two long parallel arms of ¾-inch square tubing. They are anchored with rubber bushings to a vertical frame tube at the front, and at the rear to the top and bottom of the wheel hub unit. This method of relieving the de Dion tube of torsional stresses was first used by Ferrari on his grand prix cars. The lateral location is controlled by a husky Panhard rod.

The brakes are Lockheed hydraulics of an open backing-plate type. The Elektron drums have steel liners of 11½-inch diameter and 2¼-inch width. There are two leading shoes at the front and one leading and one trailing shoe at the rear. Dual master cylinders are located on the cowl where they can be directly actuated by the foot pedal. A very simple adjustable balance bar mechanism is used to link those cylinders, and provision is made for altering the braking ratio between the front and rear wheels.

The radiator header tank is located on the cowl and a long tube and hose arrangement passes forward to the radiator core. Part of this tube is in close contact laterally with the log-type induction manifold and serves as a heater.

The more time I spent with this car the more I wondered if Colin Chapman, its designer, might not have several heads, all of them busily solving automobile racing problems. The rapid development of this car, its obvious soundness on all engineering points, and its general execution would lead one to believe that it was conceived in a large research laboratory staffed by many British boffins. Research on Chapman established that he is a mechanical engineer and has one head, an excellent little factory, and a lot of enthusiasm.

The Mark IX's U. S. delivered price of $4800 or $1000 less without engine makes it mighty attractive to the small-displacement competitor who wants the most. The large undeveloped potential of the 1100 cc Climax engine would be a rewarding challenge to all those who have served their time on the MG. I believe that the chassis is of advanced enough design to hold its own with any competition it will encounter here for some time. And it's available.

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