January Volume 3 -10

February 1st, 1974.

Dear Members;

Club Elite Newsletter, Vol 3, No 10

This newsletter has special significance for me as it represents my last effort at organizing the letter for a good while. Next month Dr. J.P. Mohr of Lexington, Mass, will be handling the writing, editing and distribution of the letter, and in March Barbara will take over with an updated Club Register and then in April Dennis Ortenburger will give us another break here. We are willing to publish it five or six times in 1974-75 and Dennis and Jim Goodman have generously offered to help us out later in the year, but this still leaves us several issues short and we are really looking for a response from you during this month to help out with a few issues and make sure that the newsletter will in fact continue in 1974-75. So what's itworth?

Our cover again shows some of the Elites that turned out for the Hollywood Bowl Concours in September, but this time we spent the extra dollars to print it by off-set. We were very disappointed with the quality of our cover last month, and indeed the appearance of all of that part of the letter published in Clarksville as it compared very badly with the fine contributions from our members. Please excuse the poor quality last month.

#1479

Our article reprint this month from the June 22nd 1960 "Motor" came to us by way of Mr. J. Streets, of Palo Alto, California, who owns EB 1479 and also a vintage Lotus single seater. New articles continue to come into our files which we have never seen and just recently our Australian member S.A. Schagen sent us film of several writings that will make good reading in later issues. We certainly appreciate these efforts by the members.

We know you will enjoy G.J.Gardner's description of swift but economical motoring. Over 48 miles per gallon requires a light foot and a slippery shape at 70 mp.h.!

We are continuing our Lotus XI and Elite chassis listing as usual. As promised you will find some most interesting reading on the two liter Elite project courtesy of Club Elite of Great Britain.

Now, a matter of utmost importance is where and when to organize the third Annual Club Meet, if at all. We have narrowed the locations to three possibilities as a result of a few replies to an earlier questionnaire - Greenfield Village, Limerock, Conn, for a Vintage car meet, or Watkins Glen for the Grand Prix in October. If you have a preference, or if you can assist in the organization, of a meet at one of these, we would be pleased to hear from you.

Jim Davis of Orange, California, writes that the Elite has been certified by the "Milestone Car Society" to rank among the "The Great Cars" produced from 1945 to 1964. Apparently Lotus also realizes the impact the Lotus has had on the motoring world for we are informed by Dennis Ortenburger and also by an East Coast source that the new 4 seater Lotus may bear the same name as the successful Mark 14 model. If so, that won't hurt the value any!.

Take Care,

Barbara and Bill Hutton

HELPFUL HINTS

1. The clutch unit on the Climax in an Elite seems to be the source of some of the vibrations from which an Elite suffers. At one time a diaphragm type clutch was available through specialty manufacturers, but no more. I am told a Rover 2000 diaphragm clutch will fit with the exception of having to move the locating dowels on the flywheel. Truett Lawson, Aurora, Minn, has written regarding his installation of a Laycock diaphragm unit. Unfortunately the part numbers are not available, but we copy from his letter below -

" You asked me to give you a run down on my diaphragm clutch conversion. I have had clutch vibration problems in both of the Elites I have owned and I don't think they are unusual. With this car, I bought a new clutch and had it balanced on the flywheel but it did not help. I got a diaphragm unit a few years back and put it in this winter.

The problem I am talking about is a vibration which is most noticeable from 4000 rpm's upwards. I realize all Elites have some of this. However, mine had it to the extreme. It was caused by the clutch disc not centering properly when the clutch was engaged. One can identify this problem by jabbing at the clutch with the foot and thus re-centering the clutch when the vibration is felt. If this jabbing helps the vibration, its a clutch problem. (Also the crankshaft pilot bearing should be suspect. B.H.)

I think the problem can be traced to the alignment of the release bearing with the release plate. It could also be related to the positioning of the release lever on the bell housing. Whatever the problem, one can see the evidence of misalignment on the face of the pressure plate.

The results of the diaphragm clutch installation were satisfying. Vibration is not serious and the clutch action is delightful. I was worried it would be either in or out. With my ZF and 4.55 it is very pleasant to drive. "

2. Eric Jewett of MonteVista, California, sheds additional light on the vibration matter. On the standard MG spring type pressure plate, he has had a problem with one of three releasing arms hanging up on letting the clutch out. With two of the arms fully extended and one arm partially extended the pressure plate face will not be pressing evenly on the clutch disc and thus causing a bad vibration. Once again jabbing the clutch pedal several time might release the third arm and cause the vibration to leave. No doubt a new pressure plate would be in order here.

3. Don Galarneau of Portland, Oregon, writes that during a conversation with Bob Green of Pacifica, Calif, he found a good way to remove paint from the Elite by way of a heat gun. "It worked great, got one front fender, nose and half the other fender done Monday afternoon. The heat (my gun has a 750 watt element) softens the paint and broad blade putty knife lifts it off right at the prime coat. Slick! The mess is easy to clean up also, not like using a paint remover." (And if you get a more powerful heat gun, you can stand back and watch the whole car being stripped of paint in 5 minutes completely on its own! B.H.)

The Elite's most distinguishing racing successes were achieved at Le Mans, and quite a few members have asked about the failure of one very special Elite prepared for the 1960 Le Mans with a 2 liter FPF Coventry Climax installed. Recently Club Elite of Great Britain researched the matter and located two reports; one from a source not known to us, gives a report prior to the race, and the second, from a book by Innes Ireland, sums up the reasons for the failure of this potentially all conquering Elite to even start.

TWO LITRE ELITE FOR LE MANS

" Lotus hopes for Le Mans this year are very much centred on the Elite, and in particular on a new 2 litre version of the car, which will be making its first appearance in the 24 hours race. Due to the current Appendix C windscreen regulations, there is little to be gained from running open cars on high speed circuits such as Le Mans, and the Elite, with aerodynamic bodywork could well be better this year than an open car of comparable output. Support for the two litre car will be provided by three standard models, similar to the two which did so well last year finishing first (Lumsden-Riley) and second (Clarke-Whitmore) in the 1500 cc class and eighth and tenth overall. These three will have Stage III engines producing around 100 bhp and will in most respects be as raced in British events throughout the season.

Outwardly, the 2 litre Elite is indistinguishable except for the fitting of 6.00 x 15 rear tyres and 5.00 x 15 front tyres. Structurally it is almost identical with normal production cars. The front suspension is modified by double wishbones to cater for the increased braking loads from high speeds. The diameter of the front discs has been increased to 10½ inches. The rear suspension is standard but stiffer springs and adjustable dampers are used all round.

The big block 1960 c.c. Coventry Climax twin overhead camshaft engines fits into the Elite quite comfortably. The transmission is by front mounted ZF gear box (four speeds synchromesh) and a ZF diff unit with 3.2 to 1 final drive ratio. Other non standard features of this car are fuel tanks with a total capacity of 29 gallons, racing seats and a special Lucas windscreen wiper. It will be interesting to see how the latter works at speeds of which this car is capable As 1216 cc cars with less the 100 bhp last year reached over 130 mph it is obvious that the potential speed of the 100 bhp Elite is extremely high. The pairing of drivers has not yet been settled, but the 2 litre car will probably be driven by Innes Ireland and Alan Stacy. "

From Innes Ireland's Book

"It was only a week after Alan Stacey's death that I was contracted to drive in the Le Mans 24 Hour Race and I found that yet more disaster was to overtake me.

The awful thing about the circumstances of that Le Mans engagement were that I was to drive an experimental 2 litre Lotus Elite owned by Michael Taylor's father. Michael himself was to be my co-driver. When he got badly injured in his crash at Spa, he asked Alan Stacey to take over his place and Alan agreed. Now Alan was dead.

A third co-driver stepped in, young Jonathon Sieff, but he never drove in the Race either. I wasn't too happy when I got to Le Mans, and even less happy when I first took the car out. This experimental Elite was not fully developed and consequently rather a handful to drive. Flat out on the straights, it was rather like a ship at sea, and it had no brakes to speak of. In fact one night on the way back to the hotel, I went thundering down the Mulsanne straight, and into the circuit escape road which was in fact the road home. Too late I discovered that the Police had failed to take away the straw bales placed over the road when racing was in progress and the brakes being what they were, I hit two rows of them. The funny thing was that I had come to rest and sitting in silence when one of the bales which I must have sent flying straight up into the air, landed on the roof of the car with a tremendous bang, which nearly made me leap out of my shoes.

Apart from this, I didn't like the Elite at all; I had one of my own, which I used for my personal transport for some while, and I found the rear suspension always weaving badly and other strange things happening. So I was none too happy about things, and I began to think of what might happen to the car during 24 hours of racing.

When Jonathon came along to the circuit, we arranged for him to take an ordinary Lotus Elite around for the first day or so of practice so that he could get to learn the course while I tried to iron out the tweaks in the 2 litre that we were to drive in the Race. On the second night there, Seiffy decided to take his car out for a bit of night practice.

He was motoring along quite happily and must have been doing something in the region of 130 miles an hour when something went terribly wrong. The car slewed off the straight by the Hippodrome cafe, and caved in the side of a house after hitting a telegraph pole. The car was a complete and absolute wreck. Seiffy was shot out of the car, and landed in an orchard 80 yards away. It was about 20 or 30 minutes after this dreadful crash before they found him, terribly seriously injured. I went along to the Hospital afterwards with Roy Salvadori, and in the French manner, they took us up outside the operating theatre. I'll never forget it. The noise he was making inside was indescribably horrifying. Now I was in the depths of appalling depression. Three men who were supposed to have been driving with me had met with terrible accidents. One was badly injured, one dead, and one hanging between life and death. Seiffy's life was saved, I am sure, only by the sheer weight of medical and surgical experience which was summoned from all over the world, regardless of cost. The fact that he can now walk about is, in my view, a miracle.

It was about midnight by the time I got back to the Hotel, where I met Stan Chapman, Colin's father, who was in charge of the car I was to drive in. He told me that a fourth driver, John Whitmore, was standing by - if I wanted to race. I remember Stan Chapman in the Hotel room tense and worried looking. He put the ball in my court right away. "Do you want to go on with the Race?", he asked, "It's up to you - no one will think any the worse of you if you don't want to. It's up to you." And it was up to me, I suppose, but I didn't feel any better about having to make the decision. All sorts of things flashed through my mind, as you can imagine. One factor was that I doubted if the 2 litre Lotus could stand up to the 24 Hours of continuous racing. I had the fear in the back of my mind that the car would break while I was driving it. Already three drivers had met with accidents within a few days. In the end, I made up my mind.

"No, I said, "I'm not racing. For one thing, it wouldn't be fair to call in a fourth co-driver, and for another, I just don't want to go out in that car."

Obviously, the car did not race at Le Mans that year, nor again anywhere else to our knowledge, and in fact, it has not been heard of since by us, but perhaps someone has a real brute of an Elite stored in a shed somewhere.

While on the subject, one Elite went to Le Mans for the 50th Anniversary Race last year, held prior to the 24 Hours. Unfortunately, it failed to finish, completing 8 of 9 lap race in 52 mins 14.3 secs. We hope to give you an account of this venture, as we receive a report from Club Elite of Great Britain.

PARTS WANTED

1. Elite ventilation duct grill - Jim Davis 175 C, South Hamlin, Orange, Calif, 92669. (714) 532-2817.

2. Dual SU intake manifolds - Carter Alexander, 44 Gloria Drive, San Rafael, California, 94901.

ELITES FOR SALE

1. 1113-RHD-Series I-MG-Konis rear-Stage I-Rebuilt complete drive train and
#1113 suspension - Interior needs tidying and outside needs paint $2500.00. Doug Frazer, Beringer Way, Marblehead,Mass,01945, Tel(617)631-2500.

2. EB1718,RHD-Special Equipment,Stage II,Dual SU's, ZF, 57,000 miles, Konis rear, new battery and exhaust system. Engine in good shape. All gauges and controls working except speedometer and choke cables broken. A very
#1718 solid car. Wires are tight and tires are good. Interior just carpeted. New yellow paint. Over $1500 cash and 500 man hours invested. Need ready cash, $1700.00 firm. Mike Middleton, 210 Gilbert Avenue, Bloomington, Indiana, 47401 ; Tel(812) 336-6941.

3. 1179 - LH - new body replaced damaged original. MG-Stage 1- only 25,000 miles. New Michelin X's - new battery - Pearlized white - Red Interior - very
#1179 good condition, except cracked rear glass. Ray Stevens - Route 3, Box 7A Cambridge, Maryland 21613. Tel (Business) (301) 228-4242.

4. PXEB 1464 -LHD, one SU, MG-2nd Owner, blue- Natural interior, chrome wires, with only 2400 original miles, this could be least used Elite available
#1464 anywhere. Professionally stored 10 years. $5700.00 firm. Serious enquiries only. Cal Person to person - Louis Wood - Business (408) 244-1585, Residence (415) 961-5700. Mountain View, California.

5. EB2091.898-RHD-Yellow and green exterior, pale grey interior and black seats. Stage III, presently with SU and BMC but Webers and Zf available if required.
#1898 Shipping to any east coast port arranged. All offers considered. P.Robinson 56, the Priory, Blackheath, London SE3, England.

6. 1086,RHD-Excellent body - partially restored, konis, Cosworth Ford engine with
#1086 full syncro transmission (rebuilt) - Jim Davis, 175C, South Hamlin, Orange, California, 92669 - Tel (714) 532-2817.

		EK 50237		
1481	9006	EK 50160	11/1/62	M. Gresham
1482	9063	ELC 912	27/1/61	[illegible]
1483	9357	ELC 1168	10.1.63	Lewis Shirley
1484	9055	ELC 845	7/10/60	Percy Chamberlain
1485	9039	ELC 838	26/10/60	Percy Chamberlain
1486	9129	ELC 912	3/1/61	[illegible]
1487		EK 50036	17/11/61	M. Cooper Evans
1488	9346	ELC 1022	24/8/61	F. Stannard
1489	9149	ELC 905	12/1/61	Eric L. Beauchamp
1490	10620	ELC 1141	11/10/62	Brainard W. Parker II
1491	10430	RK 50704 EK 50455	8/5/62	P Wood
1492	9052	LC 1490	1/11/60	Commercial Cars (Hire) Ltd
1493	8176	ELC 909	30/1/61	Arabic Motor Service
1494	9130	LC 1493	7/11/60	Fossett (Hire) Ltd
1495		LC 1494	8/11/60	Hampshire Dairy Co Ltd
1496	9046	ELC 912 ELC 1163	14/11/60 10.1.63	Percy Chamberlain Lewis Shirley
1497	9331	ELC. 1170	21.1.63	Messrs. A. Fraser-Kerr
1498	9168			
1499	8962	ELC 912 RK 50174	27/1/61	[illegible]
1500	10183	EK 50102	19/12/61	I. McLean
1501	10250	RK 50486 EK 50252 ELC 1174	18/1/62 14.2.63	F. R. Moore Co. for P. Wootton
1502	9147			
1503	9357 8971	ELC 998 ELC 1167	30/8/61 10.1.63	Chas. Fisher (C.C.) Lewis Shirley
1504				
1505	10251	RK 50181 EK 50113	17/1/62	D. Smith & Sons
1506	9343	ELC 1011	31/8/61	Cattistock & Uggeshall
1507	9333	ELC. 1157	12/12/62	Messrs. Watts
1508	10836	ELC 1143	23.10.62	Lewis Shirley
1509	9208	ELC 1019	16/9/61	D. Simmonds
1510	9142	ELC 884	26/10/60	Percy Chamberlain
1511	10767	ELC 1144	23.10.62	Lewis Shirley
1512	9376	ELC 1036	5/10/61	Western Distributors Ltd.
1513	9134	ELC 875	1/11/60	Percy Chamberlain
1514		RK 50487 EK 50456		
1515	9125	ELC 1173	6.3.63.	Lewis Shirley
1516	9127	ELC 1014	31/8/61	Percy Chamberlain
1517	9142	ELC 1153	31/12/62	J. P. Seabrook
1518	8178	ELC 1190	22.4.63	Dunlop Rim & Co.
1519				

Chassis No.	Body	Engine/Gearbox	Engine No.	Axle	Date	Customer
286	Le Mans	Coventry Climax 1100cc Stage II	7062	De Dion 4.5	27.3.57.	D.Davis
287	Sports Eleven	100E	S.107830E	4.5 N/M	22.5.57.	R.Walker
288		100E	S.111836E	4.5 N/M		Best
289	Le Mans	Replacement chassis				J.Sopwith
290	Le Mans	Replacement chassis		De Dion		R.Hicks
291	Replacement body/chassis unit					D.Piper
294	Club	Stage 1	7071	4.5		Roberson (USAF)
295	Sports	100E		4.5 N/M	20.7.57.	Waters
296	Replacement body/chassis unit				15.7.57.	Ireland
297	Replacement body/Chassis unit					Zerwasachi
298	Club	FWA 1100 Stage I	7122	4.5 N/M	23.8.57.	J.Chamberlain
299	Sports	E93A	Own engine	4.5 N/M	6.8.57.	M.A.Hemens
300	Le Mans	Stage II	7063	De Dion		D.Margulies
301	Le Mans	Own engine "Maserati"		De Dion A90	3.4.57.	B.Naylor
302	Le Mans	Own engine Coventry Climax		De Dion	31.3.57.	K.Hall

Chassis No.	Body	Engine/Gearbox	Engine No.	Axle	Date	Customer
303	S II Eleven	1100 FWA/2	7085	De Dion 4.5	4.4.57.	Ashdown
304	S II Eleven	1100 FWA/2	7084	De Dion 4.5	3.4.57.	Stacey
305	S II	FPF 1500	1005	De Dion 4.2	5.4.57.	J.Coombes
306	S II	FWA	6963	De Dion 4.2	5.4.57.	Rae Fraser
307	Series II	Customer supplied own parts			15.5.57.	W.Frost
308	Series II	FWB	6631	De Dion	4.5.57.	C.Allison
309		FWA 1100 Stage II	7107	De Dion 4.5		I.Bueb
310	Series II	Stage I	7074	De Dion 4.5	18.6.57.	Manton
311	Topkit	Le Mans		De Dion 4.5	18.6.57.	J.B.Jones
312	Series I Replacement body/Chassis unit					Ireland
313	Eleven	1100 FWA Stage II	7260	De Dion 4.5	7.12.57.	Slater
314	Le Mans	C.C.		De Dion		Lumsden
315	Topkit	Stage II FWA 1100	7161	De Dion 4.5	23.9.57.	Romanes

Mr. G.J. Gardner sent us the following letter and we are sure you will find this interesting:

Boise, Idaho,
December 4th, 1973.

Gentlemen:

In April of 1960, I purchased my first Lotus from Jay Chamberlain
#1151 in Los Angeles, Calif. This car was a Lotus Elite. A few years later I purchased a Lotus Elan from the Lotus Dealer in Manhattan Beach, California, at the same time keeping the Lotus Elite.

Our town of Boise, Idaho, had at that time, and still has a very active sports car club. As a member, I participated in many club events such as rallies, auto crosses, etc. About 1962, another club member and I got a brainstorm and decided to put on an event for the Club, and any sports car owner, called "July Jackpot Jamboree."

The name of this event has some significance and perhaps should be explained. Boise is located about 200 miles from Jackpot, Nevada, about 245 miles from Elko, Nevada, and about 265 miles from Winnemucca, Nevada, and as all of these towns have legal gambling and slot machines galore, from which you sometimes get a jackpot, we thought "Jackpot" was a novel name and as the event was held in the month of "July", we decided on the name "July Jackpot Jamboree",

This has become an annual event, however, it is now usually held during the month of May, so it is now called "Jackpot Jamboree." It has also been held as far away as Reno, Nevada, which is about 440 miles from Boise. Due to the distance travelled this was always a two day event, or a three day event. It consisted of a time and distance ralley, an autocross and economy test.

For the economy test, the cars were divided into groups depending on engine size only. The number of classes depended on number of cars entered. We do not go into details of ton miles or body styles or modification of engines, but based winners strictly on miles per gallon of gas a car could get in each group with an overall winner for the most mileage received by any car, based on ralley miles from the starting point to destination.

Due to a Club rule, I was not permitted to participate in this event because of being one of the event masters, however, nearly every year until the last two or three years, I loaned the Lotus Elite to some couple to drive and sometimes loaned both of the Lotus cars to couples to drive in this event.

The Lotus Elite was always driven by someone who was not very familiar with it.

Of the 7 ot 8 years that the Elite was driven in this event, it received the trophy for the best overall gas mileage received by any car, except 1 year. This Lotus never got less than 42 miles per gallon of gas and one year it got over 48 miles per gallon. Unbelievable. Rallye speeds were sometimes as high as 70 mph which means that in order to average this speed a car had to be driven 75 miles per hour or faster. At the same time the mileage

test was going on, the cars were also participating in a time and distance rallye, hence the required high speeds. In case you may be wondering about the high speeds that were required, open highways in the State of Nevada have no posted speed limits.

The Lotus Elite that is mentioned here has a Stage I engine with
#1151 one carburetor, but when properly tuned gives good all around performance in addition to fantastic gas mileage and over the years has been able to garner several trophies in other rallies and speed events sponsored by the Club.

This is the only Lotus Elite that has ever been in this part of Idaho, as far as I know, and the only one that has participated in sports car events in this area.

I am now a member of the Senior Citizens Group so drive the Elite very little and do no participate in sports car events anymore, but would add that if gas rationing is put into effect, much gas could be conserved by driving this car. In my opinion the Lotus Elite is a super car but must have excellent care.

Yours truly,

G.J. Gardner
7423 Denton
Boise Idaho, 83704.

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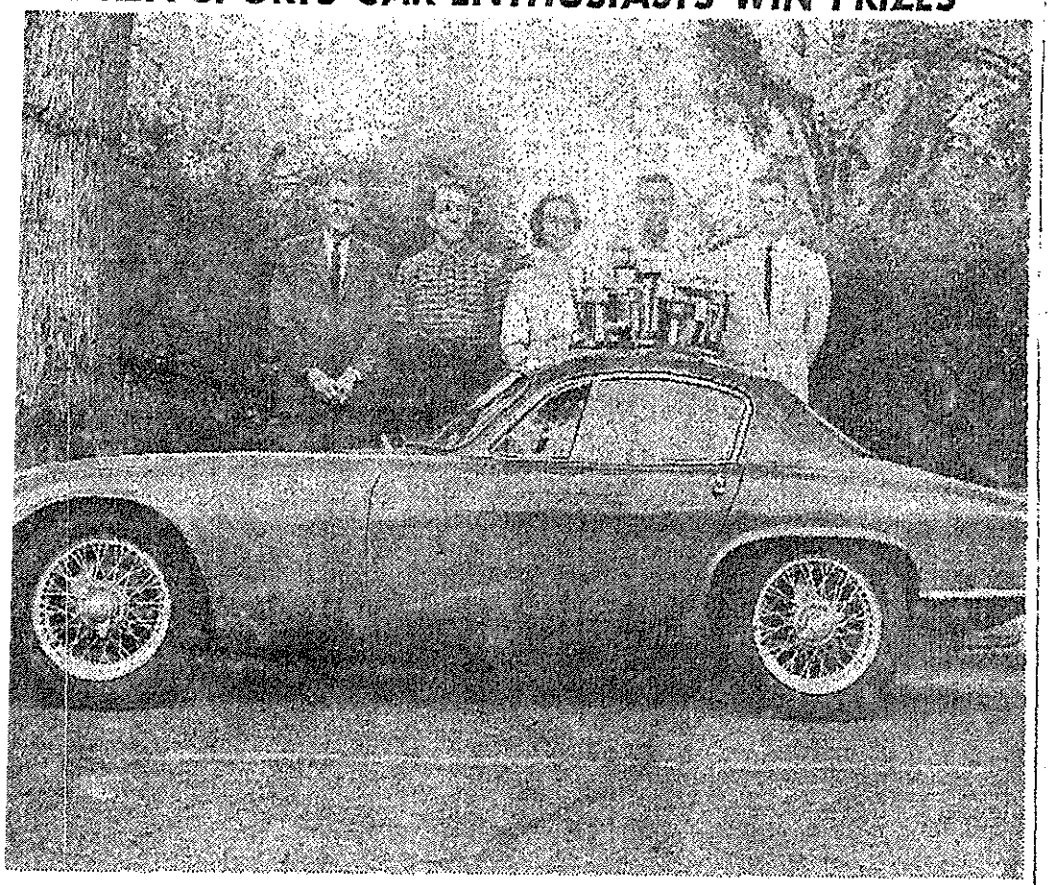
AREA SPORTS CAR ENTHUSIASTS WIN PRIZES



OUTHWEST IDAHO SPORTS CAR CLUB MEMBERS display some of the trophies won t a meet at Winnemucca, Nev., last weekend. The group shown here includes, from left, Jerry Gardner, Russell Fereday, Mary Jo Woods, Mick Williams and Pete Rolfe.

Winners Told For Sports Cars On Elko Run

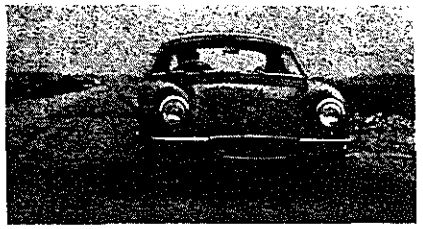
The Southwest Idaho Sports Car Club listed Sunday winners of its July Jack Pot Jamboree, a run to Elko, Nev., which began Saturday.

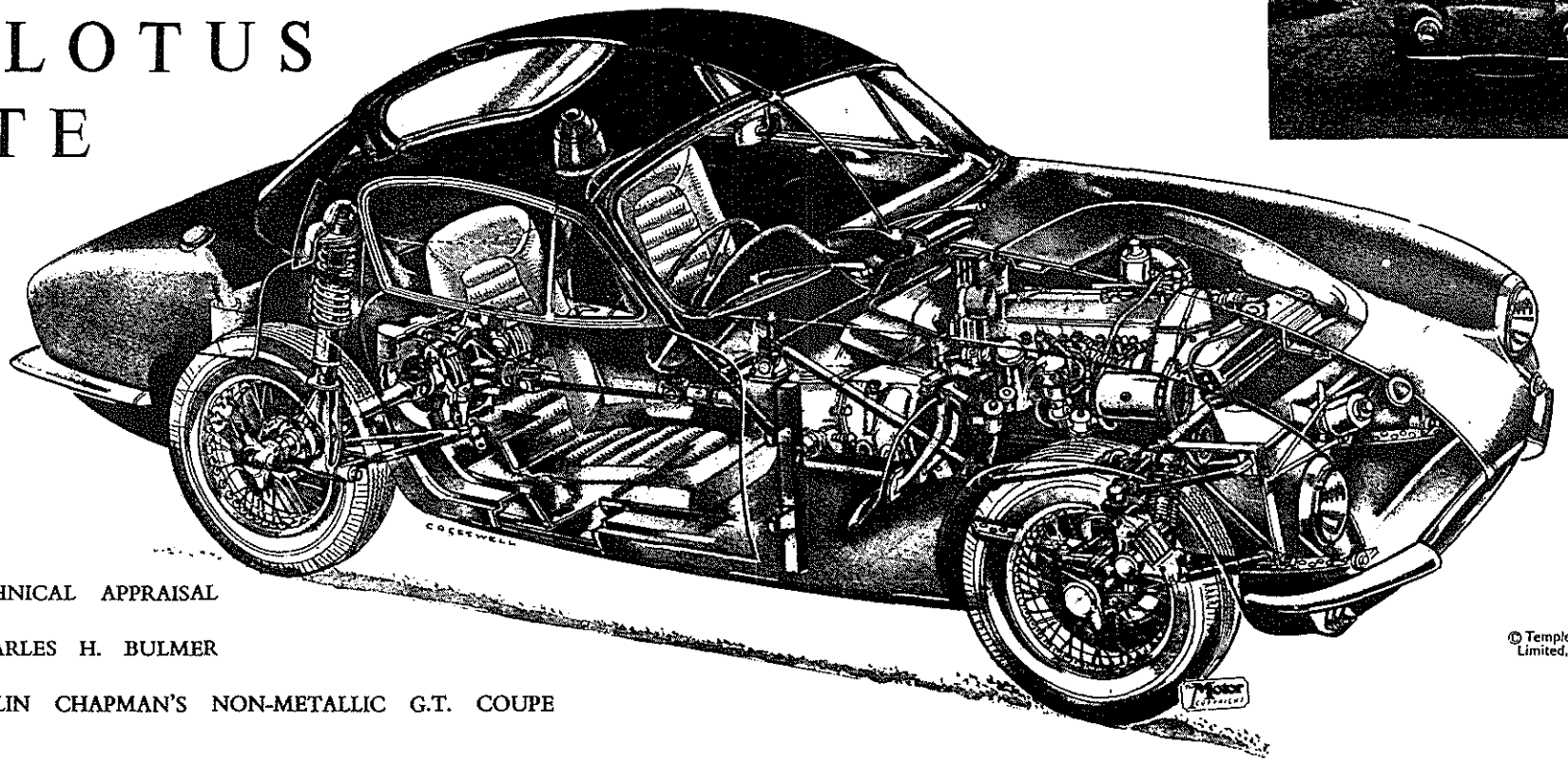
Winners included Tom and Nola Foster of Star, Bob and Lois Baker of Emmett and Mike Terry and L. Simmons of Nampa.

In the economy run, Mr. and Mrs. Russell Fereday of Boise were first on estimate of mileage, coming to within .20 miles per gallon of their estimated mileage; Dr. and Mrs. Charles Gardner of Boise, 46.3 miles per gallon, winners of Class 3; Mr. and Mrs. H. Hitt of Boise, 36.62 miles per gallon, first in Class 2, and Mr. and Mrs. Baker of Emmett, 23.84 miles per gallon, Class 1 winners.

Winners in the special race at Elko, called the Auto Cross, were Tom Foster of Star, overall winner, Russ Fereday, Class D; Don Woods, Boise, Class 7, and Mary Jo Woods, Boise, ladies section, according to G. J. Gardner, rally chairman.

The LOTUS ELITE





A TECHNICAL APPRAISAL

BY CHARLES H. BULMER

OF COLIN CHAPMAN'S NON-METALLIC G.T. COUPE

THREE years ago when the decision was made to develop a Grand Touring Lotus for quantity production, this type of car was hardly manufactured in Britain except in the heavier, large-capacity classes. The Lotus company was in the fortunate position of having a number of chassis and suspension components highly refined by years of racing and perfectly suited to such a car provided the weight could be kept low.

The existence of the 1,100 c.c. Coventry Climax, with its astonishing power-to-weight ratio, was obviously a major factor in establishing both the practicability of the project and the scale of the car. Without alteration of other components, it was originally intended to use a slightly cheaper version of the engine with cast iron block and crankcase and a capacity of nearly 1,300 c.c., but this has never materialized and all Elite engines still retain the light alloy block. They are, however, bored out to 1,216 c.c. and, fitted in standard form with a single 1¼ in. S.U. carburetter, give 75 b.h.p. (gross) at 6,100 r.p.m. Much more highly tuned versions are available for competition purposes, but this engine is now so well known and documented that it will not be described here in detail. It is attached to the M.G. Magnette version of the equally familiar B.M.C. "B" type gearbox either with standard ratios or the special close ratios that are available as an optional extra.

The original planning committee comprised Colin Chapman as chairman and structural engineer, John Frayling and Peter Kirwan-Taylor on the styling side (the former sculpted the models) and Frank Costin for aerodynamic advice. The body shape that finally emerged from their sometimes conflicting requirements was never wind tunnel tested at the design stage, although Costin made some low-speed airflow experiments with models, and the result is a demonstration of what can be done by a combination of scientifically informed guesswork and a careful regard to some of the less obvious parts like the undertray and the cooling system. Full-scale tunnel tests made since suggest a drag coefficient in the region of 0.29 and although this figure should perhaps be treated with reserve because of the difficulty of simulating ground effects in tunnels, the maximum speed obtained in our Road Test (May 11, 1960) suggests that the true value cannot be greatly in excess of 0.3 compared with the figure of 0.5 which is more representative of most modern cars. At a steady 100 m.p.h. the fuel consumption was as low as 29.5 m.p.g.

Rigid Plastic Structures

Whilst it was clear that these cars could not be built at a reasonable price with hand-made sheet metal bodies, it was equally clear that, for the sales envisaged, the cost of dies for pressings could not be contemplated, so that the choice of a plastic body was almost automatic. This could have clothed a separate chassis frame of some sort, but it was felt that the Lotus tradition of minimum weight and maximum number of functions for any given part would be violated by a design which allowed all this structurally well-positioned plastic material to escape unstressed, and the decision was made to build an integral body/chassis unit mostly in glass-reinforced polyester resin.

This material has properties very different from the usual metals. With approximately one-third of the tensile strength of steel, but only one-fifth of the weight, there is no difficulty in producing structures of high strength to weight ratio. But with reasonable design, strength is seldom the limiting criterion of a chassis and it often follows automatically on the attainment of adequate stiffness in bending and torsion. In this respect the material is at a disadvantage since the modulus of elasticity, which represents the amount of elastic stretch or distortion which corresponds to a given stress, is only about 6% of that of steel, and the stiffness to weight ratio of a structure like this may be reduced by a factor of nearly 4, other things being equal.

Fortunately, other things are not entirely equal; one of the hidden assets of this form of construction is the ease of varying the thickness and shape of the material to accord with the local loads, and with clever design the weak points, which may account for much of the total flexibility, can be greatly reinforced. Basically it can be seen that at the front of the car the scuttle structure, the wheel arches and front wings and the nose cowling all combine to form a box structure of immense rigidity. Similarly the wings and wheel arches, the boot, the rear bulkhead and the spare wheel tray form another inherently rigid closed structure at the back.

Stiffening the Centre

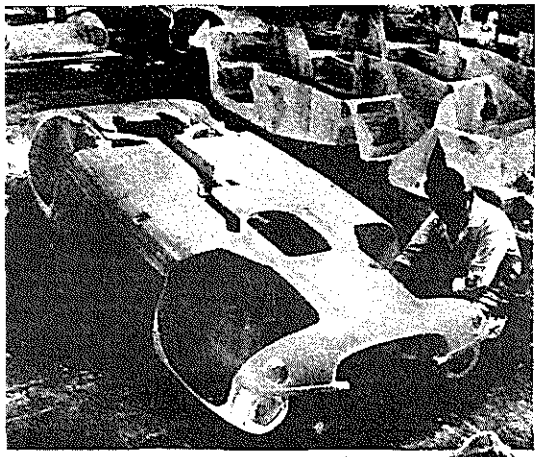
The real problem is to join these ends with an equally stiff centre-section despite the enormous cut-outs for the doors and windscreen. At floor level the various mouldings combine to form a very deep central rectangular tube (containing the propeller shaft) and torque boxes of roughly triangular cross-section running under each of the door sills. The roof panel, of course, is the other vital bridging structure with considerable inherent rigidity but joined to the front part of the car only by two windscreen pillars which must be as slender as possible for the sake of visibility. Tests on a prototype showed that much of the car's overall stiffness was lost here, torsional loads causing lateral bending of these pillars whilst their fore and aft bending permitted vertical flexing of the shell; the pillars are now reinforced by bonding-in the steel hoop structure, shown in the drawing, welded to square vertical tubes which take the door hinges and provide jacking points at their lowest extremities.

This kind of development has raised the torsional rigidity to approximately 3,000 lb. ft. per degree of chassis twist (measured between the fore and aft wheel planes), a figure which although not unusually high by current standards of unit steel construction, is more than adequate in relation to the light weight of the car and its major components, and on the road it certainly feels outstandingly rigid.

The only other metal component of any size is the steel subframe which is bonded to the plastic front structure and carries the wishbones, the anti-roll bar, the steering rack and pinion, and the engine front bearer bolts. Including this subframe, the windscreen hoop, the doors, bonnet and boot lid, but without glass or interior trim, the whole of this body/chassis unit weighs about 300 lb.

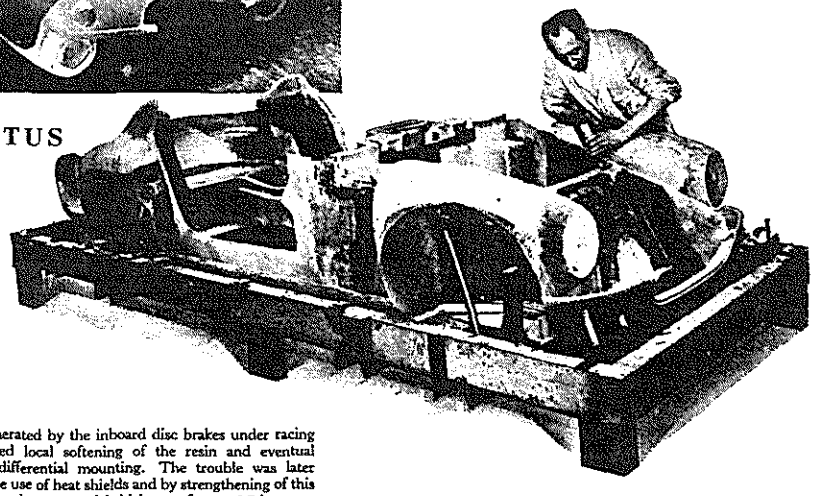
Experience has shown that it is quite unsatisfactory to bolt rigid components directly to the plastic structure. Compression of the resin allows local fretting, and crumbling of the glass reinforcement brings increasing looseness. By interposing rubber in compression between the two parts this trouble can be avoided, and the engine, differential casing and rear suspension are all mounted by means of rubber bushes or rubber sandwiches. Where metal parts have to be bonded to the plastic directly, no reliance is placed on adhesion between the two, but by liberal drilling of the metal or other means a mechanical key is formed.

Initially, a batch of 25 experimental Elites was built and sold to selected competition drivers who could be relied upon to uncover any inherent weaknesses. It was soon found that the



Left: An inverted view of the undertray section, showing the hole for the sump and the moulded channels for the exhaust system which bifurcate at the back just in front of the differential mounting.

Below: The floor moulding being bonded to the undertray. As the former is narrower, it can be seen that open "trough" sections are left at each edge under the door openings. These are closed by the third moulding to give boxes of great strength.



The LOTUS ELITE

intense heat generated by the inboard disc brakes under racing conditions caused local softening of the resin and eventual failure of the differential mounting. The trouble was later eliminated by the use of heat shields and by strengthening of this section which now has a material thickness of up to 0.7 in. compared with the average of about one-eighth of an inch, diminishing to less than one-tenth of an inch in lightly stressed areas.

Forming the Structure

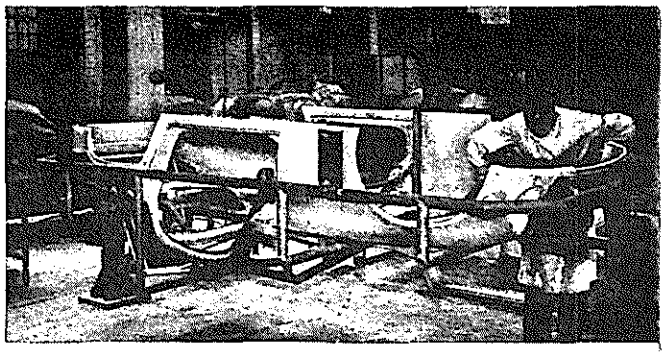
The various body components are built to the required shape by forming them in female moulds. These are first coated with a parting agent, to prevent the finished product adhering permanently, followed by a thin coat of resin, called a "gel coat," which is allowed to dry and which ensures that a smooth finish is presented, free of flaws, blowholes and glass texture. Onto a further thick, wet coat is laid the glass reinforcement in the form of a thin mat of randomly arranged short glass fibres which is pressed well into the former and thoroughly impregnated with more resin to remove trapped air. Several layers may be built up in this way depending on the thickness required, and finally, to accelerate the curing process, the whole is moderately heated for a few hours before removal from the mould.

The main structure comprises three large separate mouldings and a number of smaller subsidiary ones which are finally bonded together. The foundation section is the undertray, which embodies the front and rear wheel arches, the differential mountings, and some of the rear suspension attachment points, and to which is bonded the fabricated steel sub-frame for the front suspension and steering. The second moulding includes the floor, the deep propeller-shaft tunnel and the spare wheel tray, and a photograph shows the fixture in which it is being bonded to the separate bulkhead and the undertray which closes in the fourth side of the central tunnel. A further illustration shows the remaining part of the main structure comprising the upper parts of the body again inverted for insertion of the inner roof panel. Bonding of these components over their contact areas with local pressure fixtures produces a shell which encloses numerous box sections and which is double-skinned throughout so that only the presentable surfaces are visible, greatly improving the finished appearance of the car. In similar fashion the doors, bonnet and boot lid are moulded in separate inner and outer skins (using the stronger epoxide resin) and assembled to produce hollow sections of great rigidity. It is impossible to watch the assembly of these bodies without being greatly impressed by the structural forethought and detail planning that has gone into the design.

The bodies are finally delivered to Lotus with all glazing in place, doors mounted, fully painted and complete with interior trim and sound damping. At present the Plastics Division of Bristol Aircraft, Ltd., is producing them at the rate of over 100 a month and it may well be that the amount of hand work involved will limit the economic field for glass construction to production rates of not more than two to three times this number; the figure is very dependent on possible improvements in production technique and on the value the designer sets on his greater freedom to abandon the design and scrap the relatively inexpensive manufacturing tools when this is considered technically desirable.

Turning now to the suspension, the strut assembly used at the back, which made its first appearance on the original Formula 2 Lotus, has caused a degree of confusion in the past, some writers referring to it as a swing-axle system, but true swing-axle geometry, as exemplified by the Volkswagen and Renault Dauphine, is characterized by the use of only one universal joint in each half-shaft.

The Lotus rear suspension, like the Macpherson front suspension of current Ford cars, is geometrically related to the large family of double-wishbone systems, the lower wishbone being formed by the fixed-length half-shaft and the triangulated radius arm. If the Armstrong spring/damper unit were of fixed length instead of being telescopic, and if the upper mounting

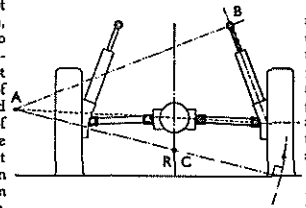


The upper parts of the body are shown inverted in a fixture whilst an inner panel is bonded to the roof. Through the front wheel opening can be seen the square door pillar which is welded to the windscreen reinforcing hoop.

(B in the accompanying diagram), instead of being bolted to the body shell were constrained by a link or wishbone coincident with the line AB, it will be seen that the motion of the wheel would be little affected for small movements, although exact equivalence would demand an upper wishbone of infinite length. Those who are interested in suspension geometry will see from this diagram that in bump and rebound the wheel moves about an instantaneous centre at A, so that the roll centre (RC) is at the intersection with the plane of symmetry of the line joining A to the tyre contact point. This centre is actually about 6 in. above ground level in the normal loaded position and the rear wheels have about 2° negative camber.

From the mechanical point of view, the advantages of the design include the ingenious duplication of functions which has reduced the number of parts to a minimum, and the way that the loads applied to the structure are reduced by wide separation of the attachment points. Disadvantages include the height of the suspension strut, which imposes a limit to the wheel movement which can be provided, and the considerable bending moments applied in certain load configurations which can greatly increase the normal sliding friction of these units, although this has caused no difficulty with the Elite.

In the earlier cars, a cranked longitudinal radius arm gave fore and aft location of the rear wheels and also, by means of a forked end engaging with the lower part of the wheel carrier, kept them pointing in the right direction. Because of the narrowness of this fork it was necessary to use taper roller bearings for precision of control and even then bending of the arm, together with some tendency for the fork to spring, made this rather expensive construction less than satisfactory. It is not widely appreciated what accuracy of control is needed to prevent unwanted steering effects, but as an illustration, 1° of lock on both rear wheels would steer the car sharply enough at 80 m.p.h. to put it into a slide. In the revised design, seen in the sectioned drawing, the single arm has become a triangulated wishbone. Adequate separation of the two bearings on the hub carrier has enabled rubber bushes to be used, and the forward mounting on the chassis has been moved considerably inboard, practically eliminating the previous wheel toe-out on bump and rebound movements.



The geometrical construction for determining the position of the roll centre of the rear suspension.

The front suspension is of double wishbone design using an Armstrong coil spring/damper unit and an unusually large and powerful anti-roll bar which forms one member of the upper wishbone and increases the overall front roll stiffness by a very large factor. The wheels are set at zero camber angle, the roll centre is about 4 in. above ground level, and a total wheel travel of 6 in. is provided. Although the 9½ in.-diameter Girling brakes are outboard at the front, the unsprung weight (54 lb. each side) is only 1 lb. greater than at the rear where the hub carrier, bearings and half-shafts compensate for the inboard mounting of the brakes.

The Elite really does embody the combination of soft suspension and heavy damping that is often extolled but seldom encountered. Unladen, but otherwise ready for use, the front suspension rate of 42 lb./in. gives a nominal static deflection of 6.9 in. at the wheel, whilst at the back the corresponding figures are 57½ lb./in. and 6 in. In touring condition, with two people aboard, the static deflections increase to approximately 8 in., which is the kind of figure one expects in a comfortable family car of medium size—the sort one might describe unkindly as "rather soggy." No one could possibly describe the Lotus this way; firm damping eliminates all trace of wallowing, and many competent people who drove this car on test thought it combined excellence of roadholding and ride more successfully than any car in their previous experience.

The Designer's Headache

The very low centre of gravity and high roll stiffness have almost eliminated the brake dive and cornering roll that might have resulted from the soft springing, but load variation at the rear is still a designer's headache. A total wheel travel of 7 in. is available, but two people and some luggage can easily increase the sprung weight at the rear by one-third and lower the static position 2 in. Progressive rubber stops are now used to absorb some of the load well before the end of the travel, but of course this will also lead to a rising rear roll stiffness.

The steering, by Alford and Alder rack and pinion, is conventional in layout but, in common with several other high performance machines, the orthodox Ackerman geometry has been abandoned. It is now recognized that this traditional layout will give an approximation to correct steering angles only at very low cornering loads when the tyres are running at negligible slip angles and it is hardly likely that Lotus owners will drive in this unenterprising way. The Elite, however, is unusual in having gone a stage further than keeping its wheels parallel on lock and uses negative Ackerman effect so that the outer front wheel on a corner turns through a greater angle than the inner one. Whilst this is undoubtedly correct for fast cornering, it would be interesting to know whether it has any connection with the unusual sensitivity that the steering displays in other conditions.

In this description it has only been possible to touch on a few of the many interesting facets of a car which has been evolved by a team of singular ingenuity and analytical ability with little regard for convention. As regards any future models they may design, it is most encouraging to find that they drive their own product far and fast enough to be more aware of its faults than anyone else.