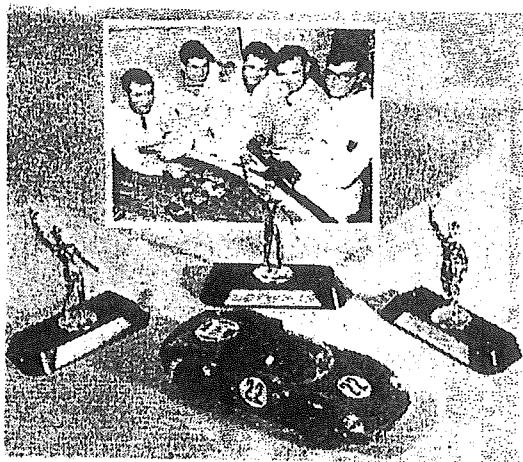
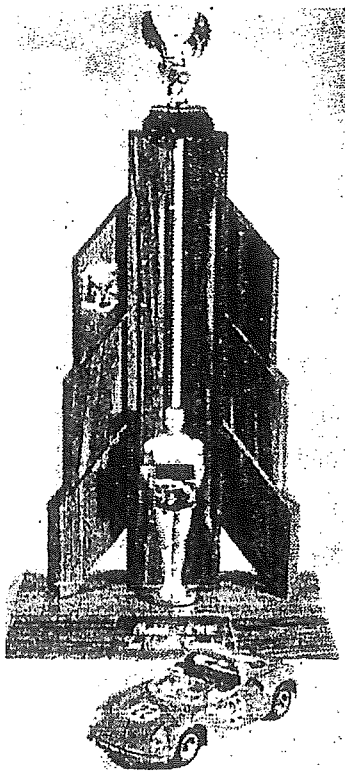


A NEW SERIES BY ROSS MCLENNAN

ENDURANCE RACING



I. IN THIS PART THE
AUTHOR DISCUSSES
THE PROBLEMS OF RACING
AWAY FROM HOME. . . .

The Mobil trophy won by the South Australian team; the team themselves, the car, and their miniature "Oscars".

General Introduction by the Editor

THIS is the first of a new series of articles by Ross McLennan, who will already be known to many for his theoretical articles on model car performance, and perhaps rather better known for his part in helping South Australian teams to win first the original Duncan 150 Trophy for achieving an endurance run of over 150 miles in 24 hours and then playing a large part in getting the Duncan 200 when the mileage requirement stepped up to 200 miles. The most recent effort of his club group has been a round trip journey of some 3,500 miles to the other end of Australia to compete in another interclub event. This venture was for 1/24th scale cars (of which the South Australian club knew little or nothing), and involved considerable "night driving" with headlights on for fourteen of the twenty-four hour period.

These articles recount, first of all, some of the problems of competing 2,000 miles from home (this may yet seem child's play when true international model car racing gets going, so pay attention, children!); how the massive amount of headlight driving was tackled and the general approach to training for this kind of event; next will come the details of headlight installation and the ingenious battery "charging" arrangements to provide light at all the right times: re-working of motors to provide the ideal power unit for endurance racing, and designing for reliability.

We do not believe that anyone has as much experience of the subject as Ross, or that anyone with the right sort of analytical mind has devoted so much effort to sorting out the answers . . . We hope that both parties will feel flattered if we describe him as Australia's answer to Barrie Wade . . .

* * *

The Perth, Western Australian 24 hour race held many pitfalls for our club, the Milluna (Racing) Modellers Club, First and foremost, 1/24th scale cars instead of the normal 1/32nd scale club car. Secondly, 14 hours of "night" during the race, our first attempt at this phase of the hobby. Last, but by no means least, the organisation of a team almost 2,000 miles away from home, were

enough to over tax the so called "boffins".

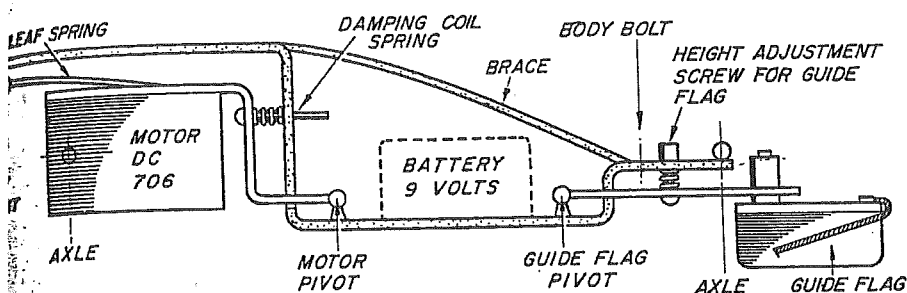
Castrol Limited accepted an offer to sponsor the team—a further step in the direction of a miniature Le Mans team. Castrol offered to pay the major part of the teams expenses whilst in Western Australia, in addition they arranged the publicity side of the venture, press and television interviews etc. They also arranged for the Chrysler Valiant to be suitably decorated with decals etc. for advertising purposes—in short a real breakthrough in Australian Model Car racing sponsorship. Our thanks must go to Castrol, their support made this a very pleasurable exercise indeed.

No team of five drivers can survive a project of this nature without additional club support, by members who may have to spend hours of preparation work without seeing the end product. Our club, not being a 1/24th scale Club sought the help of the Road Runners Club and the use of their successful Duncan 150 and 200 mile circuit—135ft lap length, to set up and prepare these strange (to us) 1/24th scale projectiles.

The natural tendency of any club, branching out into another field is to follow a know system of car development. Could we possibly use a 1/32nd scale motor assembly in a slightly larger body. Only one driver had had prior experience of headlight racing. The preparation phase in South Australia would have to include a headlight training session. One training car, a Lotus 23 was hurriedly fitted with headlights running directly from the power rails. Initial testing brought the unanimous comment that lights must run from a source which did not vary with track voltage. This immediately raised the space and excess weight problems of batteries within the car itself. Further testing confirmed that battery life was only in the order of one and half hours. It was then decided to combine the two systems to prolong battery life. Testing showed that a drycell battery could be 'charged' to prolong its life, both cars were fitted with this system of continuous lighting/charging.

The decision to carry batteries automatically increased the car's weight at the expense of acceleration, suddenly the cars were overweight at around 8 to 9ozs—a horrifying

set of circumstances. On this basis alone the motor would have to be a hearty one capable of lots of torque and long lasting performance under extreme conditions. The Pittman DC.706 became an automatic choice, two 24 hour wins in Victoria and an additional 2nd place this year made it an automatic choice. Space requirements were satisfied with the Monogram 275 P Ferrari—Car number one had been selected—building began at minus 28 days from the team departure date of May 27th. 1966. Ron Inwood, a stalwart of the "Sprung rear ends" system began the task of building this car and revamping his suspension to suit the DC.706 side winder layout. Basically the unit consisted of a main chassis frame which carries the motor frame pivot assembly, springing being achieved by means of a leaf spring and two coil springs mounted in the horizontal plane. The sketch below illustrates the layout in diagrammatic form.



The front end incorporated a floating axle in bronze bearings plus free rotating wheels. The guide flag assembly plate was spring loaded to allow adjustment for height, a truly ingenious layout. An extension of the main chassis was added to the nose in order to transmit any frontal crash loads directly into the chassis. The streamlined roll bar was incorporated into the chassis thus relieving all loads from the plastic body shell in an effort to prevent body damage during the event and thus save a 15 minute penalty for each body repair.

The second car developed for the event was an 'Atlas' T70 Lola with AT.406 ball raced motor—a high RPM motor giving low torque characteristics. The car was assembled and tested using the kit components except for tyres and guide flag—it could be said that this car was in 'kit form' as no serious mods except free rotating front wheels were carried out on it. Initial testing in S.A. indicated that the car was only slightly faster than the worked over Ferrari.

Testing of both cars, as heavy as they turned out to be, was satisfactory, although both lacked acceleration, each put in times compatible with 200 miles in 24 hours on the Duncan 200 Road Runner circuit. Headlight driving was an experience, times however were slightly slower.

The Perth race was a complete change of life for we South Australians, racing in all six lanes and 14 hours of headlights certainly achieved this in no uncertain manner. The first requirement is a complete knowledge of the rules and regulations for the event, snap decisions, after un-retractable ones will have to be made on the spur of the moment, to hesitate may mean vital laps with some hot Ferrari breathing fire at close range. The fact that the race would consist of 12 heats of 2 hours, allowed a practicable study of what lanes would be used during the night session. This would also be affected by the starting lane choice. Questions such as, do you want to drive in the outside lanes during the night session, who will lead off, who drives in which lane, for how long etc., etc., can only be answered if the rules are known backwards and if the drivers/car capabilities are known fairly accurately before the event starts.

The team comprising John Shelton, Manager, Rick

Bishop, Roy Shelton, Alan Radley, and Max Gilgen left Adelaide at 9 p.m. on May 27th. The Chrysler Valiant Station Sedan was loaded to "the gills" with baggage, test gear and sleeping kit. Thirty Eight hours later, after an almost non-stop driving spree the team arrived in Perth, Western Australia, the 500 mile Nullarbor Desert well behind them and the speedo reading an additional 1,750 miles. The trip had been an experience—3 punctures of the fuel tank, one damaged headlight, and one dead Kangaroo (no damage to the car), lay behind them, the fuel consumption was around the 21 miles per gallon. After settling into their accommodation, the team unpacked, found the sundry pieces of test gear and car maintenance kits and "set sail" for the track and some expected practice.

Can you imagine the down-cast feeling which must have overcome them when they found that the circuit modifications had not been completed, no practice was possible, in fact, tape still had to be laid, painting, and scenery had also to be completed! Early on Monday morning they returned to the circuit and began laying tape, painting the road surface in an effort to get the circuit into a state of useability. By late evening the first laps were under way. Monday night was club night and the Perth Model Car Club held its eliminations after a ½ hour practice. The leading team, Écurie Safari Lotus 40 lead the W.A. field with 57 laps in the 12 minute period—our team stood and watched not particularly impressed with either the times or the cars, which seemed to be stock Cox and K & B Kits unmodified.

Track training for our team began after the Perth teams had finished their club session, all training cars came on and it soon became obvious that this was a tricky circuit to drive on. The Lola settled down quickly and was soon lapping at 10.5 seconds (equivalent to 68 laps in 12 mins.). The Ferrari didn't handle as well and seemed slow on the straight and out of the corners. Initial timing indicated around 54 laps for a grid session. The car would not handle and seemed to de-slot disconcertingly and in an unpredictable manner. The team arrived early the next morning for additional practice, track voltage was low, the Valiant battery was removed and connected to the circuit in order to get near race conditions. The Lola stopped in cloud of smoke, overheated armature and no forward movement at all, the other cars also showed signs of overheating including the hearty DC.706 Ferrari—this was serious, only one spare Atlas motor was left.

This motor was fitted and also stopped within 5 laps. The team went into a huddle and decided that they would request an investigation of the power supply for suspected excess ripple and/or A.C. leakage. A request to fit a battery in parallel with the supply was carried out and from then on no over heating troubles were experienced for the remainder of the event—BUT the damage had been done. The team decided to fit a DC.196B to the Lola, this was done and the car lapped at around 11.5 seconds, but the weight it was carrying seemed a little too much for the 1/32nd scale motor.

It was during this period, that the complete lack of scratch building components was discovered, the DC.196B and 77-6 were almost unheard of, only two sets of 4:1 bevels could be found in Perth. The next result was that all previous practice and development was down the drain, the Ferrari would have to be made ready inside two hours for the elimination period.

to be continued

because of the expected frictionless running, but because of the almost permanent axle alignment which is associated with them. To use ball races, all side play must be removed, suitable axle and gear spacers are required, but beware of over tightening the axle spacer on to the inner race of the bearing, this could lead to a ball failure or at its worst a complete seizure of the bearing. It goes without saying that the front and rear axles must be parallel in at least 2 places, no one likes a three wheel or crabbing layout—at least I hope not.

Gear mesh is most important, gears can become quite inefficient if not aligned and meshed correctly during the manufacture stage. I find it difficult to mesh a set of low ratio bevel gears effectively, for some reason it appears that the shallow bevel angle takes a disliking to long running—life seems to be related to bevel angle. The in line layout with bevel or contrate gears allows the facility for remeshing to take up wear, this however, should be avoided after final setting up of the car's gear train. Spur gears on the other hand cannot usually be remeshed unless the axle centre distance is altered. Such circumstances seem to indicate a deeper mesh at the initial setting up, so that wear can take place. Road and rubber dust are items which are associated with endurance racing, unfortunately they do not provide or aid lubrication, but to the contrary provide an abrasive compound guaranteed to decrease gear and bearing life. Consideration should be given to providing facilities for excluding and removing the hazard. Lubrication is a vital part of bearing and gear operation, unfortunately it tends to seep out and provides an ideal dirt catcher, it seems we cannot "have our cake and eat it too". A definite stop should always be programmed for a complete wash down and re-lubrication exercise, would you expect your sprint racer to operate for 18 months and not be re-oiled or cleaned? If you decide on an in line installation with bevel gears, always ensure you use a thrust spacer between the bevel and axle bearing on the gear thrust side. The importance of this item arises from a failure case where the grub screw can work loose, the spacer will prevent the gears from demeshing with the resultant decrease in gear life which will occur before it is actually noticed or heard. It is assumed that all alignment techniques, axles at right angles etc. have been carried out early in the assembly stages and that provision has been made to ensure similar alignment during re-assembly. You will have to remove the motor at some time or other, so beware, this could occur during the race when time can or should be, awful short.

The chassis is becoming more specialized as the months roll by, not only does it perform the function of tying the car together, but in future it will be the only answer to the high performance motor's reliability. The brute force, high speed type engines have come with increased heating, the endurance car designer is faced with the problem of getting rid of

this heat in an efficient manner or run the very real risk of motor failure. The chassis will have to be designed as a heat sink layout with large area dissipation surfaces designed and assembled in such a way that increased air flow is obtained to get the heat away. If possible paint the chassis and motor matt black to improve heat dissipation. Conversely the important feature of getting the heat into the chassis must be considered high on the list of musts. Few, if any manufacturers are considering these features, or there would not be so many brass chassis' about with such flimsy strengths and dimensions. The fact that large areas must be incorporated automatically indicates that the chassis must be "thin" or made of light material. This seems to indicate that alum should be used, it's light and it does accept and get rid of heat at a quicker rate than say brass, which is a heat reservoir, it doesn't like to get rid of its heat. Of paramount importance is stiffness, the chassis must be rigid enough to prevent "flapping" remember that strength doesn't necessarily come with weight, a properly designed alum chassis can have a much higher strength to weight ratio. The advent of alum solders has made this much easier on the constructor, with practice it's not any harder than normal soldering.

The heat generated by the current flowing through the armature windings heats up the armature, which in turn heats up the bearings and motor magnet and side frames, air flowing over these parts does accept a proportion of the heat, but as time goes on the overall temperature rises. Failure of the motor occurs if the winding insulation breaks down, solder can be melted and thrown, fatigue can occur with a consequential drop in speed or an increase in lap times—strict organisation can pick up these failures early enough to prevent complete and utter failure. Most teams however, prefer to put such things in the lap of the gods and trust to luck. Isn't it better to reduce the odds by good design and management?

It's of little point to design a chassis with increased area if the motor is mounted in such a way that the heat cannot get away. To quote example: A motor pivoted or hung on thin mounting screws does not constitute good design. The motor must of necessity be mounted so that the heat can transfer into the chassis. We must almost consider the blanket idea, there are greases available which promote increased heat flow between touching objects, particularly ones which are a little rough in surface texture. Heat transfer is dependent on weight, the motor being bulky and heavy takes time to heat up, in reverse it takes time to give up its heat, the chassis must be, by similar reasoning, light to induce a quick "drawing" type heat flow effect. The area in contact with the motor must be as large as possible. It's very likely that the mounting plate will form part of a channel section, the quantity of heat transferred is dependent on the temperature of the motor bulk and the outside temperature—see diagram.

