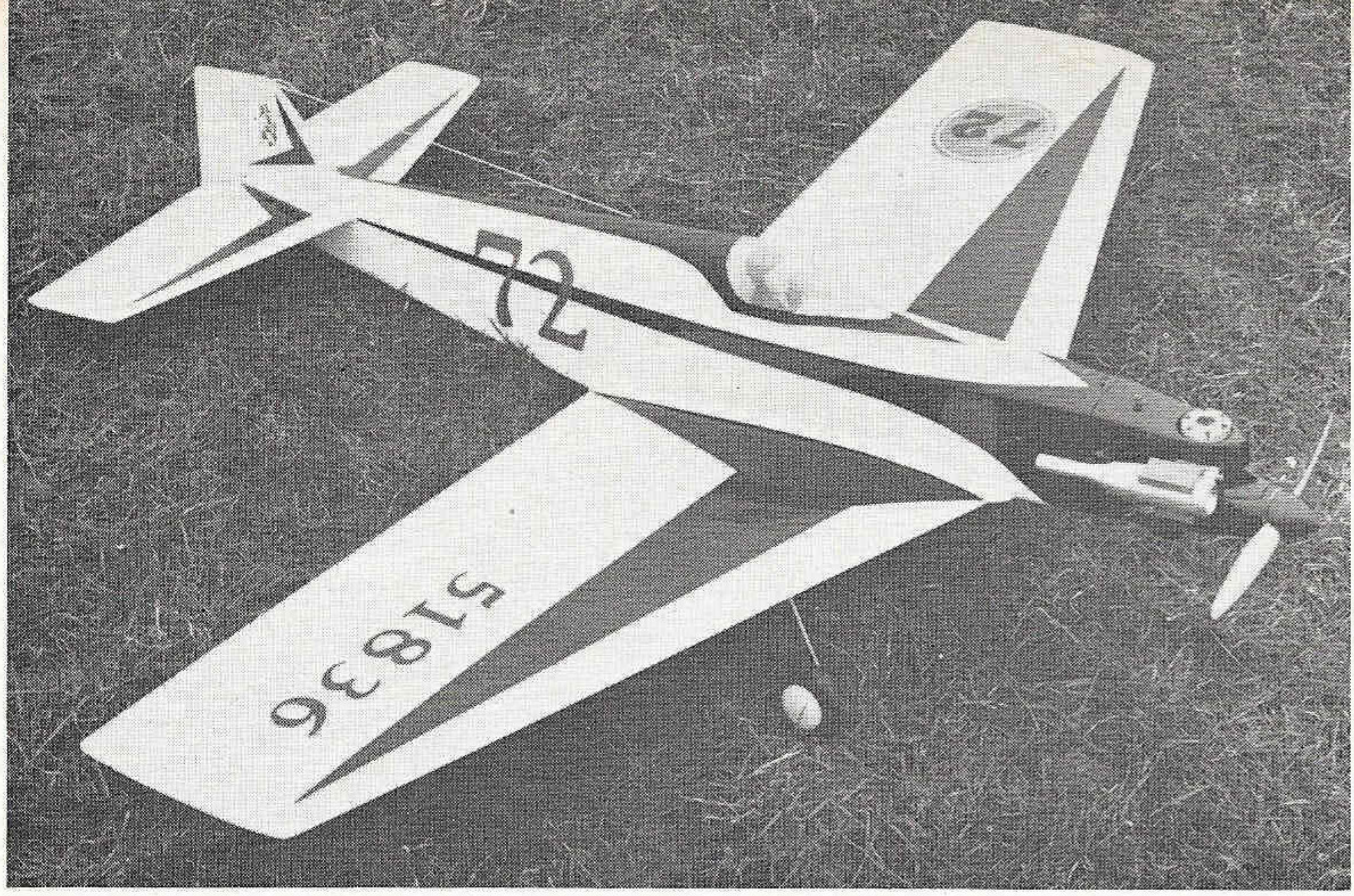


FRENZY

exciting new F.A.I. Pylon Racer

by ARTHUR GIFFEN

THIS, my 1971 racer, is the product of hours of brain-teasing, evoked by the sight of Frank Van den Bergh's *Phaeton* lapping my *Cosmic Wind* at least twice each heat, at the 1970 Nationals and at the Middle Wallop meeting.

I just had to do something about that, so I started the old grey matter working overtime and came up with the following requirements. 1. Minimum frontal area. 2. Minimum drag—profile and induced. 3. Minimum weight. These three add up to maximum acceleration from take-off and out of corners—a fact which was confirmed by Fred Deudney's articles on induced drag which appeared, comfortingly, after the prototype was built. Let's look into these requirements a little closer. . . .

Minimum frontal area was relatively easily provided by the control-line speed type engine cowling, minimum wing span and a very low fin/rudder.

Minimum drag. This really had me scratching my head, and I eventually arrived at the idea of *very* sharp leading edges on wing, fin and tailplane with a fully symmetrical rib shape coming down to a very thin section at the tip. The wing and tail surfaces would also have swept-back leading edges, to produce a shape as near as feasible to a delta—the fastest wing planform. The fuselage has smooth flowing lines from the spinner to the maximum height/width position at the rear of the cockpit—and this area is kept to a minimum by the gradual taper to the tail, which commences thereafter. The canopy is the streamlined rear section of a standard bubble canopy, which blends and directs the airflow around the rear turtle decking.

I have not used a retractable undercarriage, as I feel that any theoretical advantage is outweighed by the practical disadvantages, of which not the least is the weight penalty. Which leads me to the third requirement—

Minimum weight. This is largely up to the individual builder, but I can only say that my models have been designed and built so that the structure is strong enough, with the grades of wood specified on the plan. These have been arrived at over three racers, each one using lighter wood and modified structures, so that this model will stand up to all the 'G' you can pull on it but, if you hit the ground (like I did at the Nats.), there won't be much left. After saying which—if you are still with me you really must be interested in pylon racers, so now to explain as best I can the constructional methods I have used.

CONSTRUCTION

Cut out all the parts and make sure that you understand the plan before you use any glue. This should not take very long because, if you are going to build this racer, you will have built and flown quite a few planes already. If you haven't—don't build it !

Fuselage

After marking the former positions on the inside faces, join the fuselage sides and doublers together and set aside to dry. Mark the positions of formers F1 and F2 on to the engine bearers, find a block of wood to mount the bearer/former assembly on to and Araldite these together; remove from the block and check the alignment when hard. Heat curing the Araldite gives a better job.

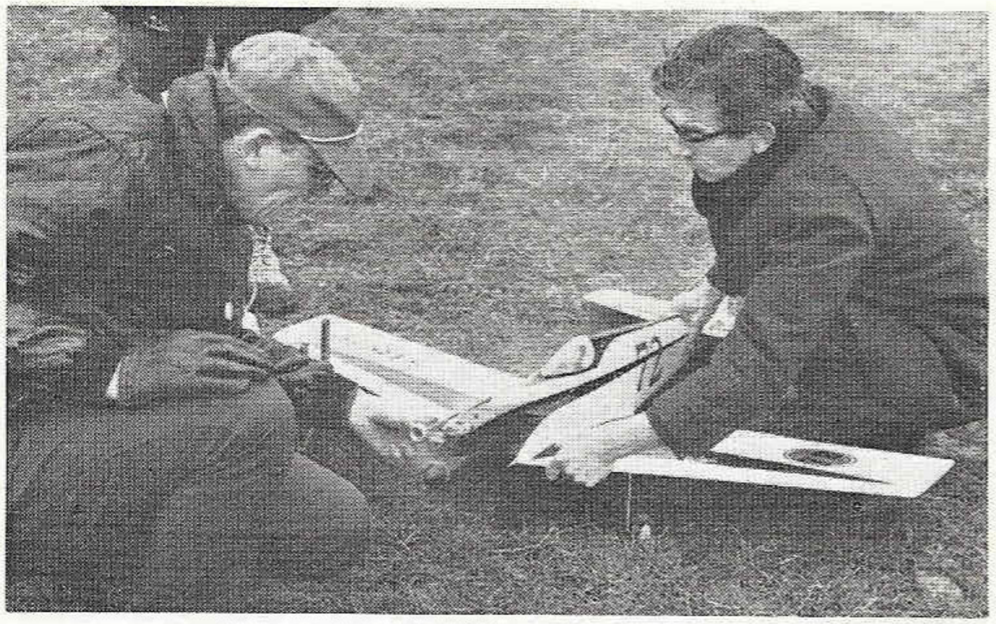
Next stick the sides to this assembly and then build the fuselage in the normal way. The sequence is: formers, tailplane support block, fin/tailplane sub-assembly, backbone, top turtle decking and, lastly, nose blocks under and alongside bearers. Now cut a recess in between the bearers to allow the engine to sit down on to them, and drill the mounting holes. I used tapped mounting plates under the bearers, instead of washers and nuts, as they give more support and allow one really to pull the engine down tight on to the bearers. The nose may now be shaped, but be careful not to go right through at the engine position!

You will notice that no holes are shown in the bulkheads, on the plan, for pushrods. This is because I don't use them, having for the last two years used cable linkages (wire inners in nylon or PTFE—not nylon in nylon), for rudder and elevator, and have found them very satisfactory. I support them at approximately 2-3in. intervals and solder the ends of the cables for 3 or 4in. after the length has been determined.

Cowl

This is the ticklish part so, in addition to the exploded view of the cowling parts shown on the plan, I will explain the sequence of assembly. The first step is to lay the baseplate on to the cowling/noseblock sides, marking the position of the cylinder, which is then cut out. Now fit the engine and make sure the cowl base has $\frac{1}{8}$in. clearance around it. Next glue the cowl, noseblock, sides and top to the base and, when dry, with the engine bolted in place, cut out the hole for the cylinder head, leaving approximately $\frac{1}{8}$in. clearance all round. When the hole is deep enough to reach the top of the cowl, push the cowl down on to the glowplug so that you can then use this hole as a centre by which to mark the head opening accurately. Next glue the two small blocks, which fit at the back of the cylinder, then the two pieces of $\frac{1}{8}$in. sheet which make the inside walls of the outlet ducts and, lastly, the bottom plate of the outlet ducts.

When the glue is set, the outlet holes have to be cut through the sides at an angle to meet the deflector blocks and duct sides, then the small slot is cut in the front block, measuring approximately $\frac{3}{4}$in. × $\frac{3}{8}$in. Lastly, shape and sand as shown on the plan. The cowl is secured to the nose by a long quick-link wire, formed and fitted as shown, with the nylon clevis cut down and slotted to take a screwdriver. It is also advisable to fit the two small $\frac{1}{8}$in. diameter locating pegs at the rear of the nose, to prevent the cowl shifting with vibration.

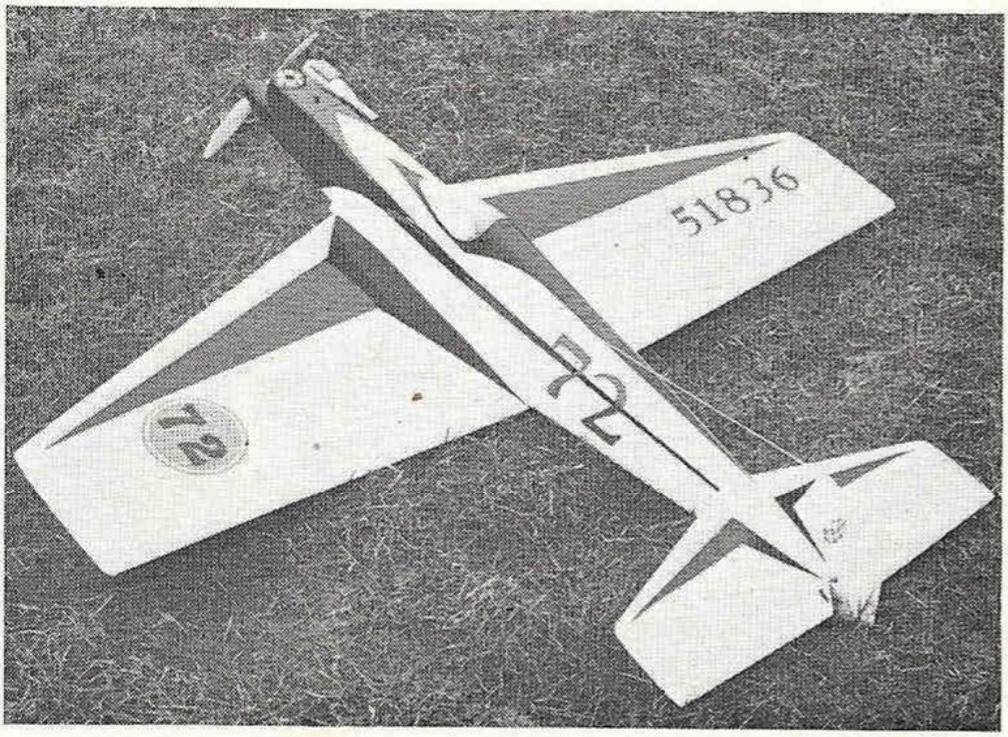


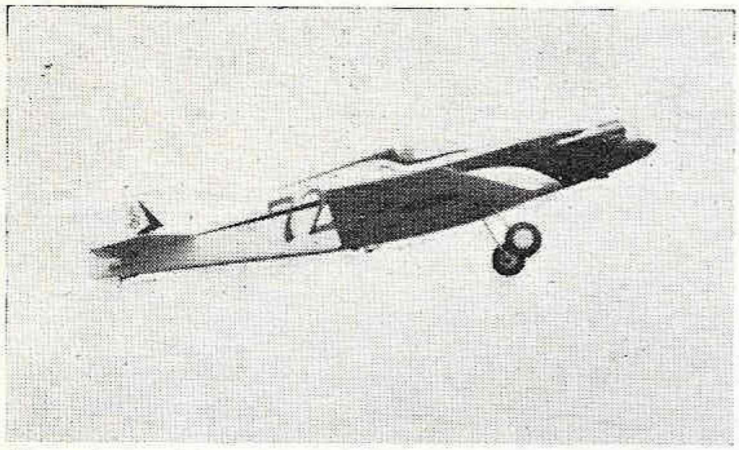
Tuning up that K & B 40 for a winter work-out.

For the air scoop, drill a $\frac{1}{4}$in. diameter hole at an angle through the bottom of the nose so that it comes through just behind the carburettor. Clean up the hole with a round file, then cement the airscoop itself, made from a piece of $\frac{1}{2}$in. sheet scrap, over it, making sure that the two rear edges line up nicely, as fresh air must be fed to the air intake and not just turbulate around in the scoop.

Wing assembly

I will describe my method of wing assembly fully because, from talking to clubmates, it seems I build quite differently from most people. The first step is to cut *all* the ribs roughly to shape, marking them 1, 1a, 2, 2a, etc. Next they are stacked in that order and pinned together. That is to say, the ribs for *both* wing panels, but stacked, as it were, for one wing-half. (Not having access to long thin bolts, I use pieces of 14g. piano wire sharpened at one end, just pushed through the ribs.) Because of the shape of this wing, it is only possible to plane and sand from mainspar to trailing edge, so make sure that the fronts of the ribs are all nicely lined up, with the centreline on them, and that they give a straight line, viewed from tip to root. Next take the stack apart and divide the ribs into left and right wing sets. Having made all the ribs at one go, rather than a left-hand and a right-hand stack, it will be appreciated that one rib of each "pair" is actually slightly longer than the





Above: *Frenzy* shows us profile view on take-off, Right: low-speed characteristics are good, too, as Arthur shows on this non-pressurised fly by.

other. This is dealt with by tacking each pair of ribs together with spots of cement, shaping the larger of the pair to the smaller, with the chamfer going the opposite way, so that they come to a point at the centre where they join. Next mark the spar positions and cut off the leading and trailing edge portions (shown by dotted line on the plan).

Assemble each wing-half as follows. Over the plan, place the root and tip ribs in position on to the lower main spar, lining up their trailing edges as per plan. Having thus positioned the main spar, and pinned it down, all the other ribs may now be cemented on to it, followed by the top spar. While the glue is still wet (I use PVA throughout) fit top and bottom t.e. spars and the leading edge, and leave overnight to dry out. The structure is now removed from the board and the undercarriage blocks fitted, checking that the wheel axle is level with the leading edge of the wing, to get the correct rake. Now plane and sand the leading edge to the correct shape and then, with the wing panel turned over, fit the bottom sheeting—*at leading and trailing edges only*, using 4in. wide sheet. (This leaves the structure still flexible, and the washout is then built in at a later stage.) The t.e. sheet overlaps as shown on the plan, and the leading edge sheet goes *over* the leading edge member; that is to say, it is not butt jointed to it. When the assembly is dry, pin the t.e. of the wing to the building board and fit the t.e. stiffener, planed and sanded to the shape of the rib trailing edges.

The next stage is to fit the aileron hinge-blocks and we are then ready for that washout to be built in, as follows. Pin the root rib and bottom main spar to the building board, with a piece of $\frac{1}{16}$in. packing under the root rib. Measure the distance from building board to trailing edge and cut wedge-shaped blocks from scrap, slipping them under the tip until it is raised the required $\frac{1}{4}$in. Sight along the t.e. and slip wedges under at any place that seems to need them to keep the t.e. straight. Now mark the aileron by cutting through the bottom sheeting at the t.e. spar and No. 7 rib. Then glue the top t.e. sheeting on, and next the top l.e. sheeting. Whey dry, remove the structure from the board and the washout will be built in. Repeat for the other wing half.

Now cut out the ailerons and finish them off, fit bellcranks and join the two wing halves together, as per plan, with centre sheeting going right across the middle of the wing in an unbroken length. This takes the place of dihedral braces.

Rigging

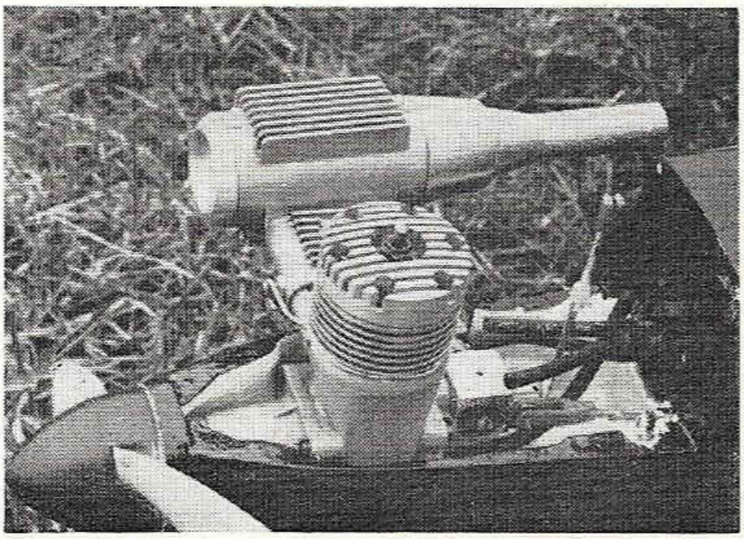
I have shown the wing and tailplane incidence, and the wing washout in fractions of an inch rather than in degrees, as I have found it rather awkward to use a protractor on the parts I am building—a ruler is much easier. The wing has $\frac{1}{4}$in. positive incidence, and the tailplane, being half the chord, has $\frac{1}{8}$in.—relative to the top edge of the fuselage side, which is taken as a datum. (They are thus at 0-0° relative to one another.)

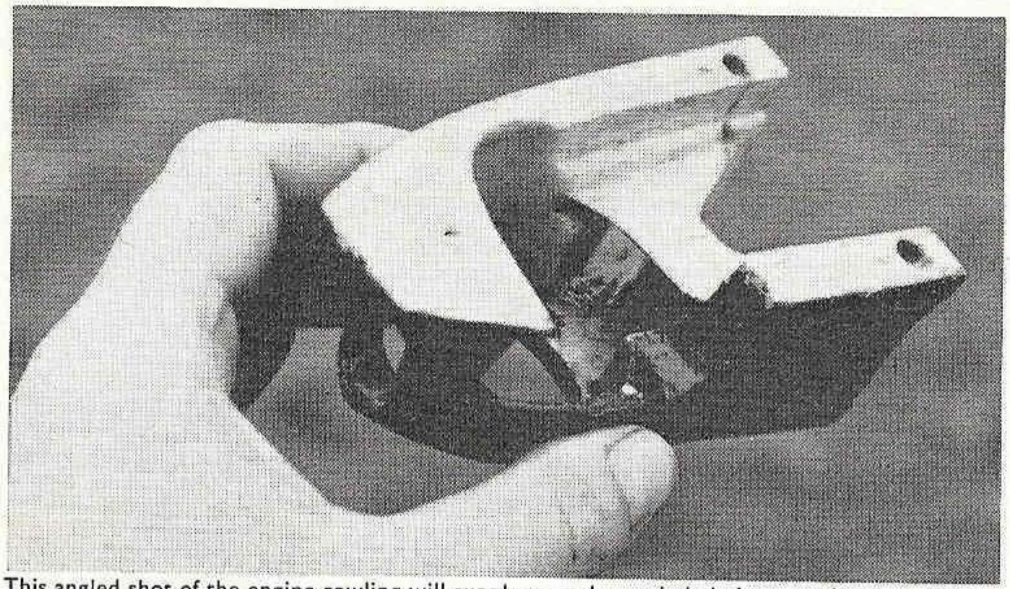
The $\frac{1}{4}$in. washout at the wingtips means that when the aircraft has reached flying speed, there is minimum drag, as only the tips are at negative angle of attack and the engine has a downthrust effect.

Fuel-proofing and finishing

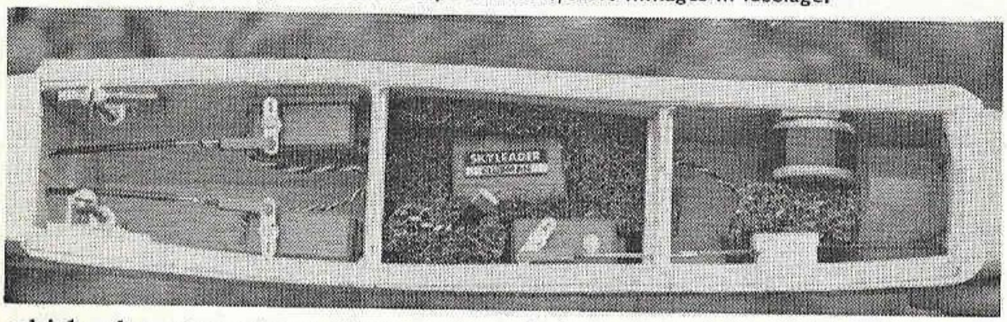
The areas all around the engine bay, fuel tank and cowling are fuel-proofed by giving them a couple of coats of fibreglass resin,

Close-ups show the speed-type cowling and the upright installation of the rear-induction K & B.





This angled shot of the engine cowling will supplement the exploded views on the plan. Below: prototypes use servo tape and tube/cable linkages in fuselage.



which also strengthens them considerably. (If you have used the grades of wood specified on the drawing there will be no weight problem, as my model came out at 4lb. 9oz. all-up and ready to go—which meant I had to add about 5oz. to get it up to BMPRA minimum weight requirements!

The wing and tail surfaces are all covered in Solarfilm on my prototypes, and the fuselage is brush painted, after covering with lightweight Modelspan tissue, doped on, and rubbed down. The paint I used was Crown Plus Two, as I have found that this stands up to the fuel we use for FAI racers.

Pressure feed

If you use "timed pressure," as I do, you will have to cut a recess in the nose sheeting behind the engine to allow for the pressure nipple. I use a standard three-vent tank with the pressure pipe connected to one of the vents. The other vent pipe has a length of rubber fuel tube on it and this is blocked off, while flying, with a 6 BA bolt. (By the way, don't forget to disconnect the pressure pipe from the tank when you are refuelling or you will have an extra ounce of fuel—in the crank-case—not the best thing for a quick start!

Flying

If you have flown racers before, I think you will be delighted with this one. If you haven't, just wait until you start putting *Frenzy* through its paces . . . those near-vertical climbs from take-off . . . vertical rolls . . . and (rather more important in a racer!) snap turns, seemingly without losing speed—it's marvellous!! (Sorry—I get carried away.)

The minimum control-throws are marked on the plan—ailerons $\frac{5}{16}$in. each way, elevators $\frac{3}{8}$in. each way and rudder 1in. each way. If the c.g. is as indicated, you won't need any adjustment for a true aircraft—and you'll find that you can make the model "mush" on landing, without any trace of wing-dropping. The normal landing pattern seems to be about $\frac{1}{4}$-mile out, 10ft. high approach, to land at your feet, as the glide seems to go on forever!

If you are going in for racing for the first time, may I suggest a few things which will help you? First: run your engine in very carefully—*not* on pressure, as this loads the bearings too much. Also, use a 9 × 6 prop for the running in. Secondly, learn to fly your plane without pressure feed to start with, as you then at least get a bit of throttling that way, and you can gradually open it up and lean it out as you get used to it. Thirdly: fly "the course" every time you go out—even with a sport 'plane and no pylons—as there is no substitute for practice. See you at the races?