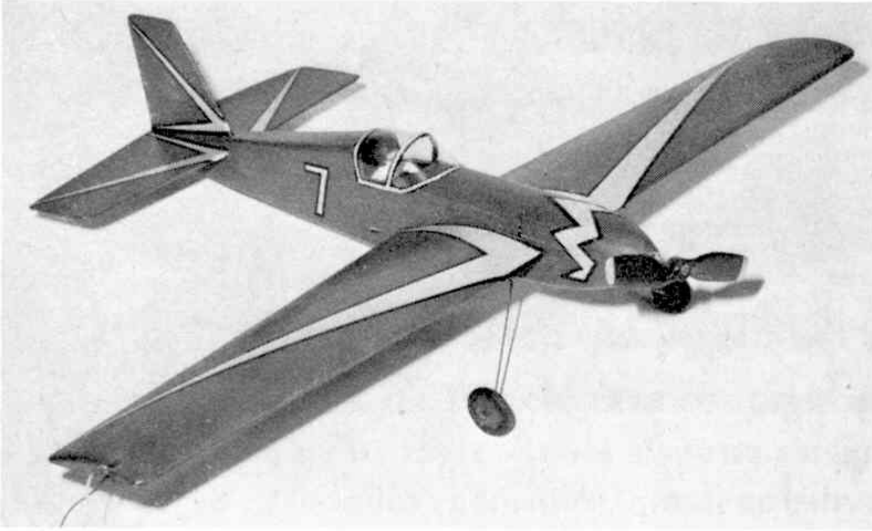


Electric R.T.P. Flying

Part One — with full-size plans of Vic Smeed's "WATTSNAME"

ELECTRIC ROUND-THE-POLE FLYING dates back a few years—possibly the first large-scale demonstrations were at the Dorland Hall exhibitions in London twenty-five years ago. However, these models required specially built motors, and despite occasional attempts by individuals, and one kit model in about 1947, interest languished until in 1968 various of M.A.P. staff experimented with slot car motors and an assortment of prototype models to see if a simple combination could be found for demonstration at the Model Engineer Exhibition.

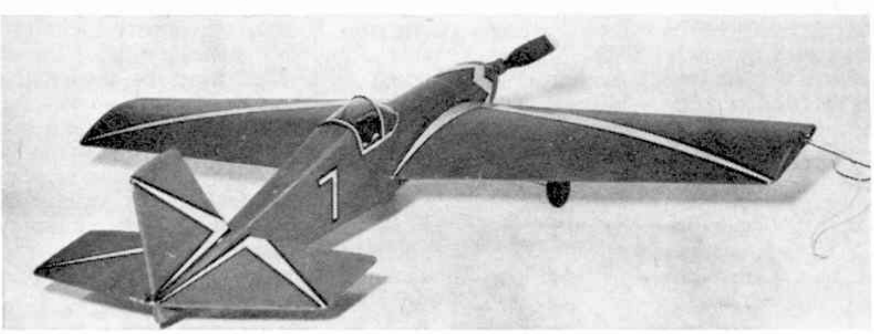
It took about a dozen models by four or five different people before success was achieved, but once the path to follow was found, few succeeding models had much difficulty. Since that time, several clubs have taken electric flying up, and as a result a fair amount of development has taken place. Our original aim was to fly on 12 ft. lines, but one club now flies on lines up to 46 ft. long and finds that the longer the lines, the less exacting is the model required.

We will come on to the lines and the pylon head in the second half of these notes, next month, but for those who have heard little of this type of flying, we can perhaps mention that the pylon head is mostly simple Meccano and that besides aircraft, lines, and pylon the only requirement is a controlled power source, which can either be a 12v car battery and model slot car hand controller, or a model railway transformer/rectifier able to deliver $1\frac{1}{2}$ amps. Also needed is a space large enough to fly in, and we recommend a minimum circle diameter of 20 ft., so unless your house has very big rooms, flying must take place in a church or school hall, Scout hut, or similar, or in the open air, provided there is very little breeze and a smooth surface on which to land and take-off.

Now to the model. This was the fifth design by the writer, based on experience with the previous four (and some from many years ago), and also observation of a number of other models. The original was built and heavily used at the 1969 M.E. Exhibition, where it was easily the fastest model of the twenty or so flown. It survived rough handling by novice pilots and flew again in 1970, when it became so battered that it was retired. A second model was built for this year's show, and again proved the fastest of a large number of models, even when re-engined by a "cheap" motor. It therefore seems that the design is responsible for the performance, rather than a good motor in the first model. The two points contributing most are light weight—just under $2\frac{1}{4}$ ozs. complete—and the tapered nose, which allows all the propeller area to be effective. A fat-nosed model blankets much of the prop, and though larger props can be used, it is then better to use a gear reduction which makes the model a little more complex.

Initially, we used Rikowhip motors, costing close to £2 each and, we understand, no longer made. Actually, any good 16D size slot car motor should be suitable but we would suggest that a figure of about 60p should be the minimum you should expect to pay. Anything costing less than this is unlikely to have a high enough performance. The inexpensive motor we found very successful was the Rikochet, available at the time at about 65p.

What you need, then, is the motor, two sheets of $\frac{1}{16}$ in. × 3 in. balsa (one very soft, one medium to soft),



Pictures on this page show the original model. Only difference, apart from the colour scheme, is the cabin construction, made up of two pieces of acetate instead of one single wrap-round piece. If you prefer it, simply cut the top rear $\frac{1}{4}$ in. panel off at the back of the cockpit and fit the overhead acetate first. Leave to dry before adding the front screen.

The second model, with cabin as on drawing. Operations on the nose to change motors rather spoiled the lines. The first motor burned out after repeated dunkings in the pool round which it was flown at the M.E. Exhibition, due to inexperienced flyers climbing it too high and hitting an overhead sign!

a Cox .010 3 in. propeller, a stub of 12 g brass tube, a pair of wheels, a few inches of 20g. piano wire, a small piece (about 12 × 1 or 6 × 2 in.) of very soft ¼ in. balsa, two press studs, a couple of feet of fine hook-up wire, washers (to hold the wheels on), cement, sanding sealer, colour dope, and just a dab of epoxy glue.

Construction starts with the wing, which requires the sheet of very soft 1/16 in. Trace or pin-prick the outline and cut out; the bottom panel should be just a shade under the full width of the sheet. Use this panel to mark out the second, which is the full width. The slight difference in width allows for the curve of the top panel. Trace and cut out the six ribs and cement them to the bottom panel, pinning it down on a flat surface. Nick the ribs to allow the two wires to pass, and cement them in place, poking the ends out through two small holes so that they can later be soldered to the press studs which will be cemented on the outside. Make sure you put them in the right wing! The wing will have to be pinned down with its tip projecting over the edge of the board once the wires are through. Leave a couple of inches spare on each wire at each end. Also fit the wire tethering eye, which needs to be firmly cemented in place.

Now sand the bottom panel to a chamfer all the way along the leading and trailing edges, sanding the ribs as well if they happen to be a little long. Run cement right round the outline and across each rib, then place the top panel in position and pin down with either weights or pins pushed through at a slight angle, every inch or so. Make sure that the two panels are in smooth contact all round, and leave to dry. Note, incidentally, that the wing has no dihedral, i.e., it is flat from tip to tip.

Trace and cut out the fuselage sides from medium to soft 1/16 in. sheet; be careful to get the wing and tailplane seats accurate to the drawing. You can also cut out the tailplane, B1, the fin, and sub-fin from this sheet.

Cut a short length of 12g brass tube (length as on plan) and file the ends clean. Scrape inside one end with a piece of wire, then put on a tiny amount of epoxy resin and slide it on to the motor shaft. Don't let resin get near the motor case. Run the motor on a dry battery (or up to 12v power source) to check that the tube is dead in line, and leave in a warmish place for at least 24 hours.

Now unpin the wing and sand it lightly with fine glasspaper, rounding the top surface at leading and trailing edges as shown on the section. Check that the centre cut-out just accepts the motor. The fuselage sides must now be slid on to the wing, one from each end. Place the motor in the wing cut-out and slide the sides up to it; slip a rubber band or narrow strip of adhesive tape round the sides and motor to keep it in place temporarily. Cement B1 in, then cement the fuselage sides in position on the wing, tight up to the motor. Leave to dry thoroughly after first checking that both sides are "square" to the wing and that the tail ends are level.

Cut the ¼ in. block that fits under the wing centre and cement in place, also the 1/16 in. cockpit "floor" if required, then bend up the undercarriage. Start bending from the middle, which makes it easier to get a good fit and also to get both legs the same. The wheels can be soldered on before attachment to the fuselage, or later.

Remove the band or tape from the motor, slide it round, and solder the two wing wires to the brush terminals—it doesn't matter which goes to which. Just a quick touch with a really hot small iron and resin-cored solder is all that is needed, but check that the joints are good, as it is not easy to get to them without cutting the model up once it is finished. Solder the other ends of the wires to the two No. 2 press studs, cement the studs in place, then try the motor on a dry battery to see that it spins.

Push the motor back in position and replace the band or tape, then cement the undercarriage in place. Make a thorough job of this. The bottom of the fuselage can now be covered with 1/16 in. sheet (remember to take the motor band or tape off) and the tail ends cemented together and held by a pin or clothes peg at the tip.

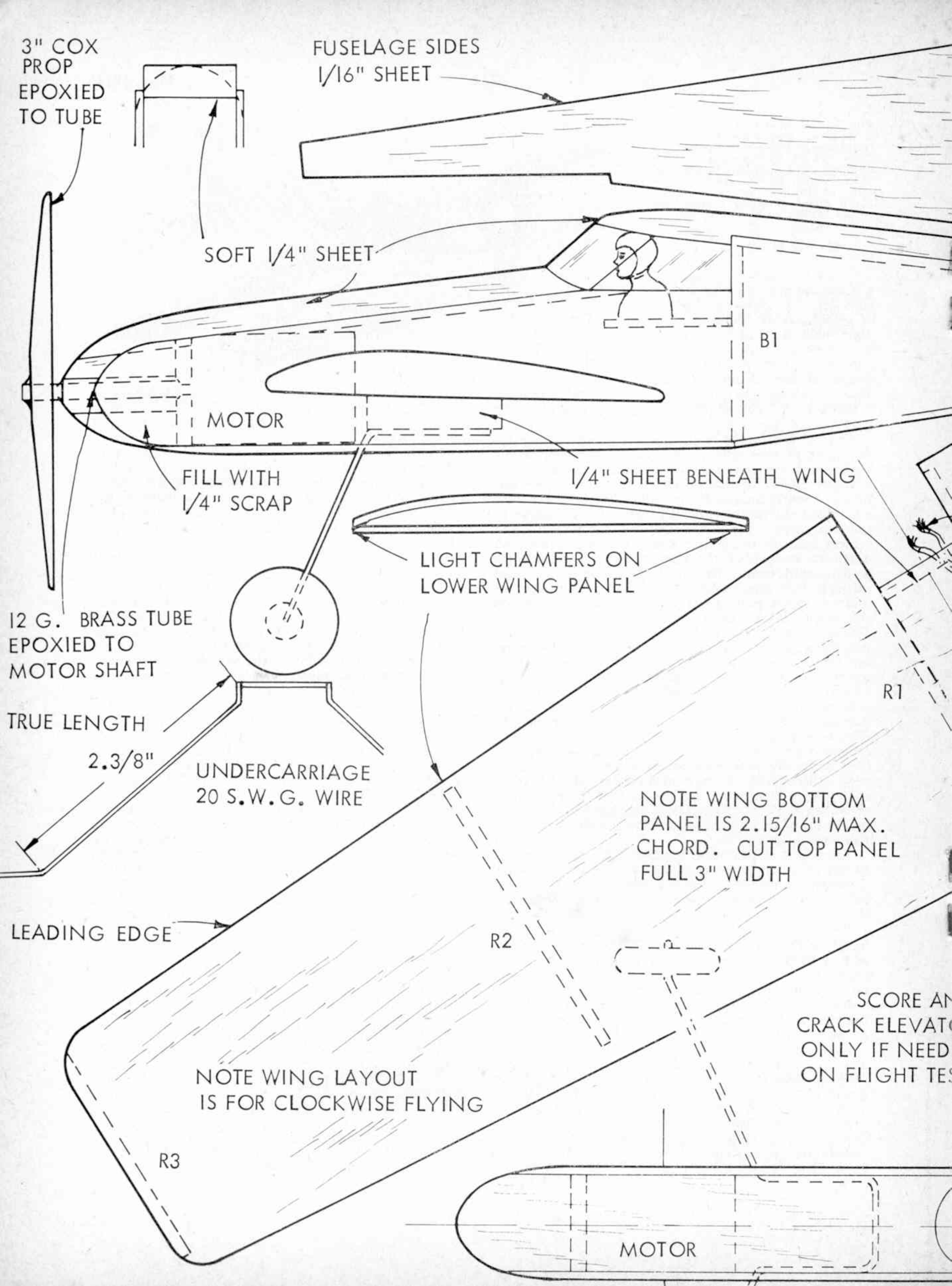
Cut some very soft ¼ in. filler pieces for the nose and fit in place; cut the top front ¼ in. piece and cement in at the same time. Lay the tailplane on its seating and check that it is parallel with the wing when viewed from the nose. Trim the seating carefully if not. Cement in place, checking it is square from above. Cover the rear underside with 1/16 in. and finally fit the ¼ in. top rear decking. Leave to dry, then carefully pare and sand the fuselage to finished shape.

Cement on fin and sub-fin, checking that these are truly vertical and aligned properly fore and aft.

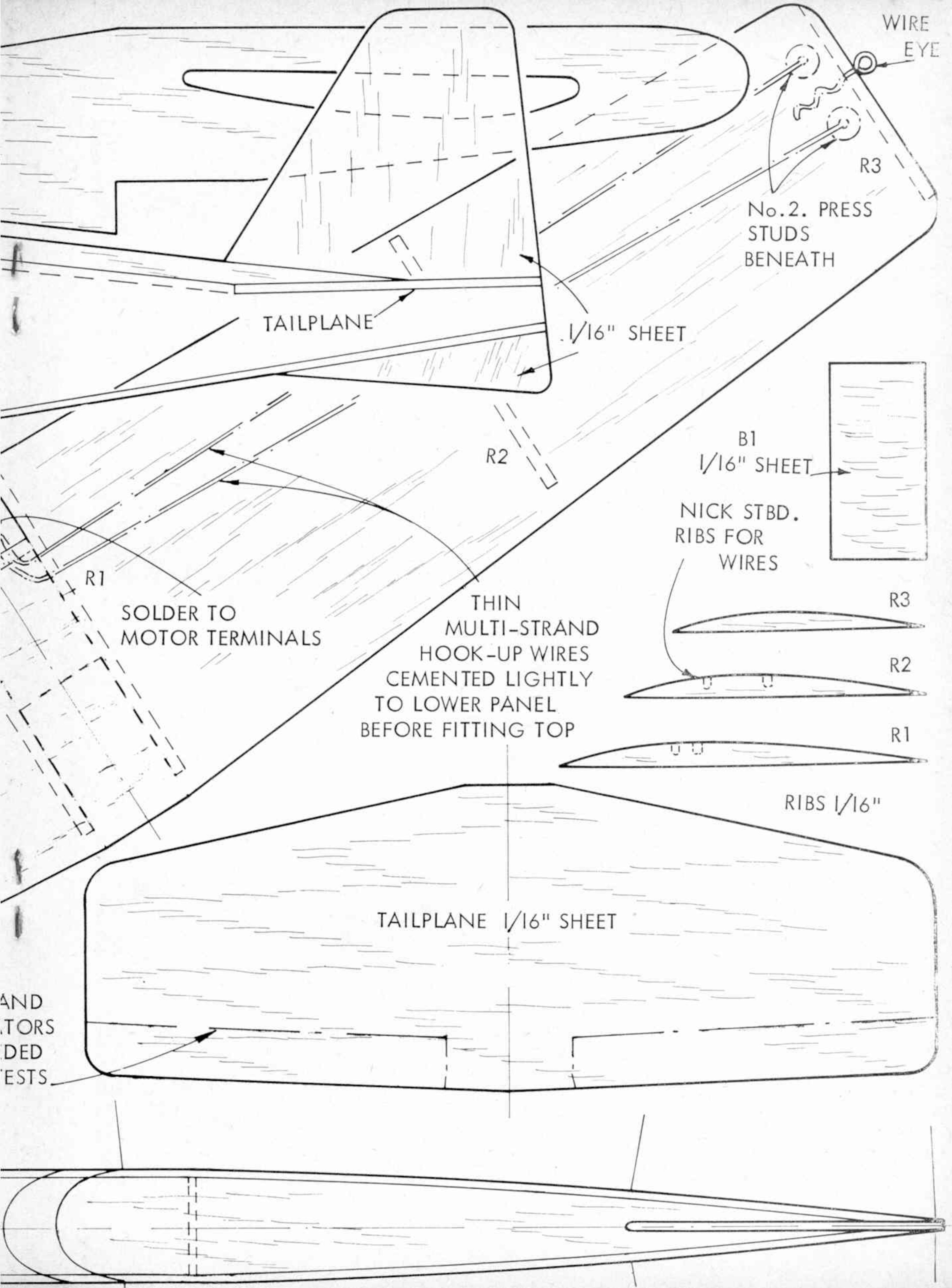
When dry, sand the entire model with very fine glasspaper or garnet paper and apply one or at most two coats of sanding sealer. Sand off the sealer almost completely, and apply one coat of thin colour dope. Paint the inside of the cockpit to contrast, and add a pilot, if required. A suitable pilot can be made from a 1/24 slot car driver.

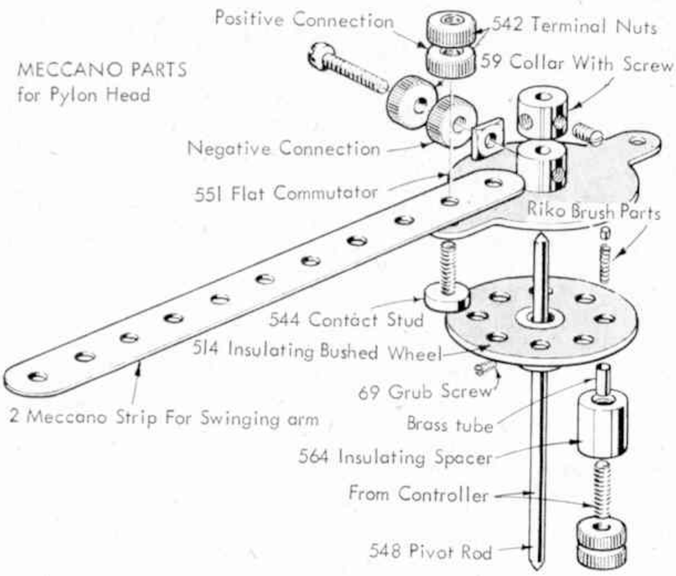
Now cut a paper pattern for the windshield and when satisfied cut out a very thin acetate copy. Cement in place carefully. Add any colour or transfer trim but avoid adding too much weight.

All that remains is to epoxy the propeller to the shaft and then we can turn our attention to the pylon head, to be described next month.



3" COX PROP EPOXIED TO TUBE
FUSELAGE SIDES 1/16" SHEET
SOFT 1/4" SHEET
B1
MOTOR
FILL WITH 1/4" SCRAP
1/4" SHEET BENEATH WING
LIGHT CHAMFERS ON LOWER WING PANEL
12 G. BRASS TUBE EPOXIED TO MOTOR SHAFT
TRUE LENGTH
2.3/8"
UNDERCARRIAGE 20 S.W.G. WIRE
R1
NOTE WING BOTTOM PANEL IS 2.15/16" MAX. CHORD. CUT TOP PANEL FULL 3" WIDTH
LEADING EDGE
R2
SCORE AN
CRACK ELEVATO
ONLY IF NEED
ON FLIGHT TES
NOTE WING LAYOUT IS FOR CLOCKWISE FLYING
R3
MOTOR


WIRE EYE
R3
No.2. PRESS STUDS BENEATH
TAILPLANE
1/16" SHEET
R2
B1
1/16" SHEET
NICK STBD. RIBS FOR WIRES
R1
SOLDER TO MOTOR TERMINALS
THIN MULTI-STRAND HOOK-UP WIRES CEMENTED LIGHTLY TO LOWER PANEL BEFORE FITTING TOP
R3
R2
R1
RIBS 1/16"
TAILPLANE 1/16" SHEET
AND
TORS
DED
ESTS



Electric R.T.P. Flying

Part Two

The Pylon Head and How to Fly

This pylon head is necessary to fly the model drawn full-size last month

Conveniently, a simple and very adequate pylon head can be made from standard Meccano electrical parts, and our original head made in this way has seen some hundreds of flights with never a falter.

The main spindle is a Rod (No. 548) to which is Grub-Screwed a 1½ in. Insulating Bushed Wheel (No. 514). An Insulating Spacer (No. 564) is glued to the wheel with epoxy resin, and at a later stage a Riko 3/32 in. square motor brush and spring will be inserted into the Spacer and retained by a short screwed Rod and Terminal Nuts (No. 542).

Above the Bushed Wheel is a Flat Commutator (No. 551) which has a copper printed circuit. The holes in the Bushed Wheel (through one of which the motor brush projects) register with a continual circle of copper, so that electrical contact exists all the time through the brush to the Commutator, even when the latter is rotated.

A Contact Stud (No. 544) or a bolt of the correct thread is fitted with two Terminal Nuts and a square nut. It is then introduced into the grub-screw hole of the Commutator boss and the square nut tightened up against the boss to secure the Stud or bolt firmly but not touching the Pivot Rod. The Terminal Nuts form one connector for the lines to the model.

A 5½ in. Flat Strip (No. 2) is now firmly clamped to one ear of the Flat Commutator by means of another Contact Stud and a Terminal Nut, and a second Terminal Nut screwed on. This forms the second connector for the flying lines.

Final assembly of the head entails dropping the spring and brush into the Insulating Spacer and slipping the Commutator assembly on to the Pivot Rod, retaining it in place with a Collar with screw (No. 59). Ensure that the brush is rubbing against the copper of the Commutator but that the Commutator rotates without too much drag. Screwing the rod in or out of the Insulating Spacer will adjust brush pressure.

Wiring is very simple. The Pivot Rod is " live ", i.e. the negative lead from the transformer (or 12v battery) is connected to its lower end. The positive transformer lead goes to the controller, and thence to the Terminal Nuts on the Insulating Spacer. This wire should be insulated and taped to the Pivot Rod as shown in the photographs.

With the pylon in the photos, two heads were used so that two models could be flown together (much more difficult than it sounds) and to do this a slot had to be milled in the Pivot Rod so that the second positive wire could be passed through the lower head without interfering with its rotation.

Current passes to the flying wire terminals from the brush to the positive terminal on the Commutator ear (via the copper printed circuit on the Commutator) out along the positive wire to the model, back along the second wire to the negative terminal, and through the Commutator boss to the Pivot Rod and back to the transformer. The polarity is not important since the wires can easily be changed over at the model end if the model's motor runs backwards.

Quite a strong pull is exerted by the model on the pylon, so the Pivot Rod needs to be firmly fixed to a heavy base or to a base frame which can be fixed solidly to the floor. A Face Plate (No. 109) screwed solidly to a strong box which could be filled with bricks is one way of doing it. In our experience, a pylon head about 18 in. above floor level is best for lines up to 16-20 ft. long; the model will still fly 8 or 9 ft. high.

The lines to the model should be .030 shellacked copper wire, fitted with the male halves of No. 2 dressmaker's press-studs at the model end. Scrape the shellac off before soldering, and also at the terminal ends. A third line of, preferably, Terylene thread should be tied to the end of the rotating Flat Strip and fitted with a wire hook on to the model's tethering eye. This takes the strain off the thin copper wires, acts as a safety line, and also makes starting from a standstill easy, since the model will pull the head round via the leverage of the Flat Strip.

Any transformer/rectifier giving 12-16v. D.C. at 1½ amps or more can be used, in conjunction with a model slot car hand controller; we have found the Riko " Giant " controller extremely good. Better is a model railway transformer with a control knob, which allows smoother control. There is quite a high resistance in the copper wires, so that current actually reaching the model shows quite a drop, and a transformer giving only 1 amp at just 12 volts won't be likely to give 100% results. A car battery at 12v is satisfactory on shortish lines (up to 20 ft.) because of the amperage that it can deliver; this form of power needs a hand controller.

The circle described by the model needs to be smooth and unobstructed all the way round, since at least early flights will need a full lap or more to take off. On a normal floor the wires out to the pylon will lie across the flight path, and should be covered by a sheet of thin card or thick paper, preferably taped to the floor so that the model can taxi smoothly over.

Set up the pylon in the centre of the space and position the transformer convenient to a mains socket. Ordinary multi-strand household flex is best for taking the current from the transformer (or battery) out to the pylon; it is best to have the pylon ready wired and to connect the flex carrying the power supply to the pylon wires by means of a connector block. This enables reliable joints to be made—the positive terminal will not run the risk of altering the brush pressure and the negative wire can be wrapped round the pivot rod and soldered.

Cover the flex with card, as mentioned, then snap the flying wires (studs pre-soldered on) on to the model, and placing the model at the point of minimum clearance, cut the wires to length and connect to the pylon. Hook the tether line to the model, cut to length, and tie to the Meccano strip. Now pick up the model and, keeping the lines reasonably taut, walk round the flying circle and check that no obstacle has been overlooked. It is amazing how something obvious, perhaps a shelf on a wall, can be missed in the excitement of preparing for the first test.

Switch on the power and give a touch on the controller to check that the propeller is turning the right way. If not, reverse the press-stud connections on the wingtip, or if you are using a sophisticated transformer with a changeover switch, simply switch over.

Now slowly increase the power until the model starts to roll. Free-running wheels are essential, and there should be no tendency for the model to roll towards the pylon. If this happens, twist the undercarriage legs gently with a pair of pliers until the wheels point straight ahead or even track outward (both) very slightly.

Slowly is the watchward on the tests; once the model is rolling increase power slowly until the tail comes up. Just a fraction more power and the model will take off. If the trim is right it will fly more or less level only a few inches off the ground; more power will cause it to accelerate to climb, but try to keep it not more than four feet up until you have learned a little about flying it. It should fly at this height on 3/4 power or less, but the motor will not give its maximum power until it is run in, which takes half an hour or so, so you may need slightly more than 3/4 power when the motor is new.

You may think that there is little to learn about flying such a model, but it is by no means so easy as it looks. The problem comes when the model flies higher on one side of the cirle than the other, when it will slowly get higher and higher and correspondingly lower and lower until it hits the floor. This can be started by a draught, by taking off too quickly, by a build up of power variations, or by changing power too quickly. What makes it difficult is that to stop the model climbing you have to take power off about half a lap early, and to stop it diving you increase power about half a lap ahead. The amount of increase and decrease, and how far ahead you make it, varies from model to model, so to be able to control a model you have to learn its characteristics.

The model flies clockwise, because this way the torque reaction from the propeller tends to want to bank the model outward. This keeps the line tight and in some measure offsets the weight and drag of the wires. However, there is an unwanted effect, since flying this way round tends to make the model less willing to take off. This is because of gyroscopic precession—the propeller, turning at high speed, produces a gyroscopic

(please turn to page 298)

Two pictures of our original pylon head; this particular one enables two models to be flown, hence the extension and extra wire above the Flat Commutator. Wires taped in place with plastic insulating tape are tidier and prevent an inadvertent tug from breaking a connection. Brush can be seen in photograph at left. For a single model, milled slot visible in Pivot Rod is unnecessary.