

# PEN FRIEND

**BUILD THIS SPRIGHTLY SPORTSTER FOR 0.20 ENGINES AND LIGHTWEIGHT RECEIVERS. SUCCESSOR TO "BLISTER", A PYLON RACER IN MINIATURE BY THE LATE P. E. NORMAN**

**T**his model, which has been designed and built to have simple but attractive lines should appeal to those modellers who require a small fairly straightforward model to build and fly. It is in effect a small edition of my "Blister", but with a very much simplified construction, and is powered by a Cox 0.20 engine.

Two types of wing construction are described, one the straightforward type which has the usual ribs, main spar, leading edge, trailing edge construction and tissue or silk covering, the other extremely simple to make and consists of a slab of expanded polystyrene, sanded to section and suitably reinforced where necessary with balsa wood. The Rx employed on the original is an Otation working a

Citizenship actuator, the whole battery requirements being 3 volts supplied by two U7 batteries.

Total flying weight of the model is 11 oz. using area about 140 sq. in. These small models are very sensitive to rudder, so only a slight amount (about  $\frac{1}{16}$  in. either way) is ample when first testing. This may easily be adjusted by the simple method of decreasing or increasing the angle of the actuator rod, which fits in the slot in the leading edge of the rudder itself.

Radio space should permit the use of MacGregor Minimac, R.C.S. Guidance System, or any of the other subminiature receivers now available, which do not require extra actuator batteries.

## CONSTRUCTION

### Fuselage

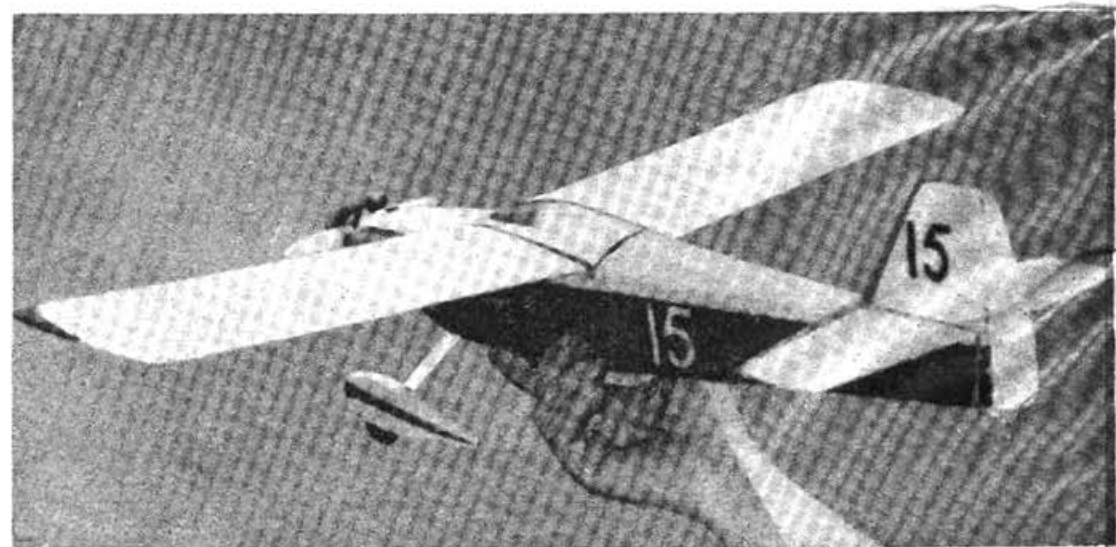
- Commence by cutting out the fuselage sides from  $\frac{1}{8}$  in. balsa sheet, and reinforce with another piece of  $\frac{1}{8}$  in. sheet back as far as F3.
- Cut out formers F1 to F7, and sternpost as shown in the drawing.
- Cut bottom from  $\frac{1}{2}$  in. balsa.
- Cement sides to F2 and F3.
- Turn fuselage upside down and cement bottom in position commencing from rear end and pin in position to hold till dry. Cement F1 between the sides, coax up bottom into position and cement. Add reinforcing pieces in bottom sides of nose and add  $\frac{1}{8}$  in. piece of ply where wing and tail holding wires pass through.
- Add balsa runners for actuator plate and fit this in position.
- Make undercarriage as shown from  $\frac{1}{2}$  in. wire corset steel or clock spring, carefully bend to shape and drill.
- Bend  $\frac{1}{8}$  in. reinforcing piano wire and bind and cement securely to steel.
- Insert axle bolts and secure undercarriage to underside of fuselage as shown, placing coil springs in position and locking up with nuts.
- Fuel proof inside of fuselage.
- Place engine temporarily in position on F1 and mark position for holding bolts. Drill F1 to take these 8 B.A. bolts (offset engine slightly to bring centre of spinner on centre line).
- Cut a piece of thin shim brass or tinplate and drill two holes to correspond to engine holding bolts. Solder two 8 B.A. nuts on to this plate and secure behind F1.
- Carve the upper portion of the nose from balsa block, hollow inside and cement in position.
- Complete turtle decking with  $\frac{1}{8}$  in. balsa, this may be damped to help curve when fitting. Cement in position and sand off surplus wood.

- Carve the under nose portion and fuselage sides by sanding away.
- Bolt engine temporarily in position.
- Cut block balsa wood for cowling and carve inside away to accommodate engine easily.
- When satisfied, cement lower portion of cowl firmly in position and sand outside to a fair line. A  $1\frac{1}{2}$  in. dia. spinner should be fitted to the engine to give the shape for the front end of the cowling.
- Carve the upper part of the cowling in the same way, leaving sufficient clearance for the exhaust, cooling fins and needle valve. (The original cowl merely relied on the needle valve itself to hold it in position, it is necessary to solder a short extension on the needle to carry it out of the cowling for adjustment.)
- The engine blisters should be carved from block balsa carefully fitted to the fuselage sides and securely cemented in position. These give a considerable amount of extra strength to the nose end of the fuselage.
- Note that the upper cowling will have to be made to fit snugly between the blisters to allow easy removal. Sand all parts smooth and cover with lightweight tissue.

### The Wheels

- Cut these from  $\frac{1}{8}$  in. ply wood. Mark out the discs and cut to shape with fret or piercing saw and tone up with files and sandpaper. Fair the edges off.
- Bush the centres with short lengths of brass or aluminium tubing so that the wheels are true. I have suggested this form of wheel as it means

The squat cabin line shows well in this photograph, despite its small size the model is quite easy to fly, providing rudder movement is kept down to about  $\frac{1}{8}$  in. each side of neutral ( $\frac{1}{4}$  in. total). Make sure those tail bands are tight; the fin must be quite true on the centre line.



that the spats may be made and carried on the model. These give that real Goodyear Racer appearance.

### The Wheel Spats

- Make these from  $\frac{1}{8}$  in. three ply wood — two side pieces and a doubler being required for each spat.
- Make the centre from  $\frac{1}{4}$  in. balsa, the space for the wheel being cut out first and this piece gives the necessary taper.
- Cement the sides in position, having first pinned the centre of the wheel in situ on to them.
- Sand the spat to give a curved section to the top and reinforce the inside with the third piece of  $\frac{1}{8}$  in. plywood, where the axle bolt passes through.
- Lock the spat on to the axle and apply a brass washer, a nut, and the wheel. Tighten this nut up to hold the spat in its correct place.

### Tail, Fin and Rudder Assembly—One detachable unit

- Cut these from  $\frac{1}{8}$  in. soft balsa, sand to section.
- Cut away the rudder and hinge by sewing.
- Ensure that the fin is dead true to the tail. Add  $\frac{1}{8}$  x  $\frac{1}{4}$  reinforcing balsa gussets between fin and tailplane, strengthen with long dressmaking pins pushed through from bottom of tail upwards into fin.
- Cut portion of fin away where actuator crank comes through, box in each side of this with  $\frac{1}{8}$  in. plywood, sand down.
- Apply  $\frac{1}{8}$  in. gummed paper strips chordwise to both surfaces of tail at 1 in. centres.
- Add  $\frac{1}{8}$  in. balsa locating piece to underside of tailplane.
- Cover unit with lightweight tissue doped on.

### The Wing — Method A

This follows normal practice.

- Cut mainspars from  $\frac{1}{8}$  in. hard balsa, and dihedral braces from  $\frac{1}{8}$  in. plywood. Cement braces in position and ensure that dihedral angle is correct — 1 in. per tip.
- Cut all ribs from  $\frac{1}{8}$  in. balsa.
- Cut leading edge and trailing edges as shown. Gently break these at centre and prop up to correct angle, glue and allow to set.
- Assemble leading edge ribs and trailing edge.
- Cut wing tips and cement in place.
- Carefully press mainspar down on to ribs ensuring that the notches slide home. Cement.
- Sand carefully. Add  $\frac{1}{8}$  in. sheet centre section covering trim and sand.
- Cut balsa block for centre and cut to approximate shape.
- Place wing in position allowing the  $\frac{1}{8}$  in. under leading edge to give incidence and trim and sand blocks to shape to follow a line.
- When satisfied, cut simple canopy from celluloid and cement in position, back up with  $\frac{1}{8}$  in. sheet decking over F2a including F3a.
- Cover wing with heavy tissue or thin silk. Water shrink and pin down before doping.

### Method B — Use of expanded polystyrene

A piece of  $\frac{1}{8}$  in. thick material 25 x 5 in. is required (Adrian Marchants, Princes Road, are suppliers of expanded polystyrene.)

- Cut leading edge and trailing edge (medium hard balsa.)

- Cut wing tips from  $\frac{1}{8}$  in. medium balsa, sand these to approximate sections.

- Gently break the leading edge and trailing edge to correct dihedral angle, block up, cement and allow to set thoroughly.
- Glue the leading edge and trailing edge to polystyrene with either Cascamite or P.V.A. glue. Do not use balsa cement as this dissolves the polystyrene immediately. Use only the glue specified for this material or possibly photo paste.
- Pin through the wood into the foam to hold in position. It may be necessary to crack the dihedral angle in the material. Now add the wing tips in the same way.
- When all is dry and firm the whole wing may be carefully sanded to the required section.
- Now pieces of gummed paper strip  $\frac{1}{8}$  in. wide should be added at 1 in. centres to simulate ribs and help strengthen the assembly.
- Next cover the wing with lightweight tissue using the adhesives previously mentioned and allow to dry.
- Now cut the portion forming the fairing forward for the turtle backing and forward of the cockpit canopy should be cut, shaped and fastened. This also to be covered with tissue. For finishing, the material applied must be compatible with the foam, i.e., it must not attack or dissolve it. The best finish seems to be ordinary domestic emulsion paint — applied fairly thickly and well rubbed in. When dry, a good fuelproof or polystyrene varnish may be applied.

### Colouring

The original model is coloured as follows:  
Fuselage: Black up to line from centre of spinner all the way back along fuselage. White above this line.

The Grundig spinner is red and also the engine blisters.

White spats and white undercarriage with red trim.

Racing No. (15): White.

Tail, fin and rudder: White with red leading edges.

Wing: White with red leading edges.

### Testing

Take the usual precautions and test over long grass. This little model is fast and a fairly fast launch is necessary. The incidence of the wing (which is obtained by  $\frac{1}{8}$  in. under leading edge) may be increased slightly to suit your own model.

When trimming use only fractions at a time and ensure that the glide is straight with no stalling tendencies. Ensure that the C.G. is correct (2 in. behind L.E.). The engine needs to be giving plenty of power.

Turning tendencies and too much or too little climb should be adjusted by engine angle, so be sure you have a screwdriver and some shim for resetting on the field. Take care, and don't fly to cause danger.

### MATERIALS

#### Fuselage

- 2 lengths  $\frac{1}{8}$  x 30 x 3 in. balsa.
- 1 length  $\frac{1}{8}$  x 36 x 2 in. balsa.
- $\frac{1}{8}$  x 6 x 2 in. 3-ply.
- $\frac{1}{8}$  x 2 x 2 in. 3-ply.

Scrap pieces  $\frac{1}{2}$  in. 3-ply.

- 1 sheet 4 x 2 x 3 in. block balsa.
- 2 pieces  $\frac{1}{8}$  x 36 x 3 in. block balsa.
- 1 piece  $\frac{3}{4}$  x  $\frac{3}{4}$  x 10 in. soft block balsa.
- 1 piece Celluloid or part of a commercial canopy.
- 1 length 3 ft. 20 s.w.g. piano wire, two 8 B.A. nuts and bolts (engine mounting).
- $1\frac{1}{2}$  x  $1\frac{1}{2}$  x  $1\frac{1}{2}$  in. scrap block balsa (cowl).

#### Undercarriage

- $\frac{1}{2}$  in. wide corset steel or clock spring, 7 in. approx.
- 6 x 6 x  $\frac{1}{8}$  in. plywood.
- 3 x  $1\frac{1}{2}$  x  $\frac{1}{8}$  in. plywood.
- 8 in. of 16 s.w.g. piano wire.
- $5\frac{1}{2}$  x 2 in.  $\frac{1}{8}$  in. balsa.
- Four 6 B.A. nuts and bolts — 2 short coil springs.

#### Tail Surfaces

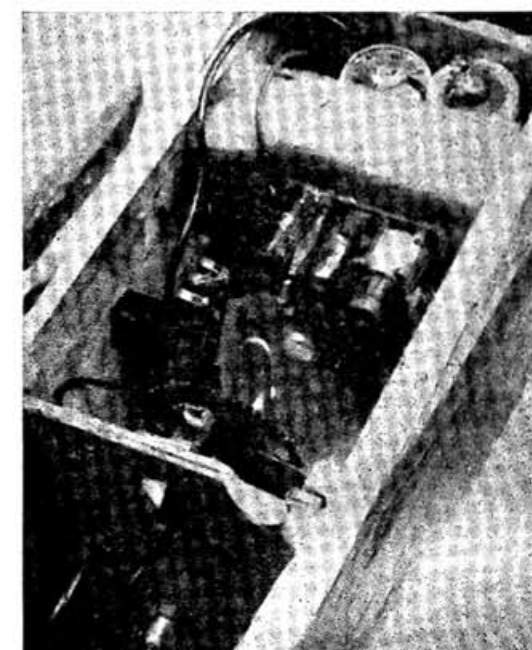
- 9 x 4 x  $\frac{1}{8}$  in. balsa (tailplane).
- $4\frac{1}{2}$  x 4 x  $\frac{1}{8}$  in. balsa (fin and rudder).
- Gummed strip paper.

#### Wing A

- 26 x  $\frac{1}{2}$  x  $\frac{1}{8}$  in. hard balsa.
- 24 x  $\frac{1}{8}$  x  $\frac{1}{8}$  in. hard balsa.
- 26 x  $\frac{3}{4}$  x  $\frac{1}{8}$  in. hard balsa.
- 36 x  $\frac{1}{8}$  in. medium balsa (ribs).
- 36 x 2 x  $\frac{1}{8}$  in. medium balsa.
- 12 x  $\frac{1}{8}$  x  $\frac{1}{8}$  in. medium balsa (tips).
- Scrap block balsa (canopy fairing).

#### Wing B

- 1 piece  $\frac{1}{8}$  x 5 x 25 in. expanded polystyrene.
- 26 x  $\frac{3}{4}$  x  $\frac{1}{8}$  in. medium balsa (L.E.).
- 26 x  $\frac{1}{2}$  x  $\frac{1}{8}$  in. medium balsa (L.E.).
- 12 x  $\frac{1}{8}$  x  $\frac{1}{8}$  in. medium balsa (tips).
- Scrap balsa block (canopy fairing).
- Gummed strip paper.



Installation shot shows (top to bottom) the two series wired pen cells, the Otation receiver glued to a sponge plastic pad, miniature slide switch bolted to the fuselage side and a Citizenship escapement on its removable ply panel, this panel also carries a threaded bush for the torque rod yoke. It is just possible to see the piece of plastic wire sleeving on the escapement crank; this reduces the chances of electrical noise interference. A drinking straw carries the escapement leads for neatness.