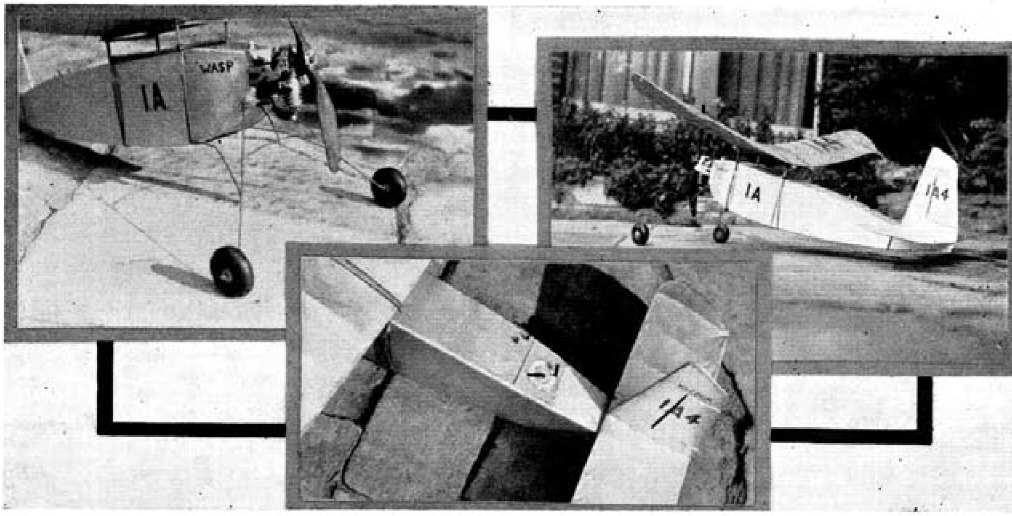
"THE WASP"

A 40-inch SPAN PETROL 'PLANE



***Designed and constructed by* L. S. WIGDOR.**

THIS stubby little parasol monoplane first saw the light of day in summer of last year, being the result of a sudden desire to possess a really small petrol model. The span is only 40 in., while the weight is as low as 17 oz. But the great thing is that its speed is very low, between 15 and 20 m.p.h. The construction is, of course, all balsa.

It will take any of the very small engines on the market. The weight of the motor installation should be at the least no more than 10 oz. This, of course, includes coil, etc. Remember that this is one of the smallest petrol models in existence. Consequently it will not take you long to build it, nor will it incur great expense. However, use only the finest quality balsa.

The order of construction does not make any odds. I always start on the fuselage, so here goes!

Fuselage.

Obtain some drawing paper and lay out the side view of the fuselage. This is done by using a datum line as a basis. The distance of the bottom to the datum line is shown alongside each former. When you have the points mapped out, join them up. If one or two seem a trifle out, don't worry but go ahead drawing the line in a gentle curve. This is not inaccurate, for the fuselage shape does not have to be exactly the same as the original, while accurate measurements are difficult to give in fractions.

Build two sides up of $\frac{3}{16}$ in. square balsa, using wax paper over your drawing. Gusset the joints where shown in the plan. Join up the two sides with cross pieces of $\frac{3}{16}$ in. square cut to size from a drawing laid out from the plan. Cut out two engines bearers from $\frac{1}{8}$ in. 3-ply as shown in Plate 1. Also rectangle of $\frac{1}{16}$ in. 3-ply to cover the front of the fuselage, and another for the second former. The latter does not cover the former fully (Fig. 6). Drill holes in these pieces of $\frac{1}{16}$ in. 3-ply to take the bearer legs (Figs. 6 and 7) in such positions as to suit your engine. Glue these parts to the fuselage and use plenty of cement. The dural fittings for the engine must also be made to suit the engine, and can be cut from sheet dural with tin snips. Use brass nuts and bolts, obtainable from most hardware stores.

Install the brass tubes that are to take the undercarriage legs. These tubes must have an internal diameter to take 14 s.w.g. See Figs. 2 and 3 for the installation. The outline of the millimetre 3-ply is shown by a dotted line on the plan. The piece of 3-ply transmits the landing shock over the fuselage. 1The $\frac{1}{16}$ in. 3-ply consists of a small square piece glued on for strength. The tail skid is fitted as in Fig. 1, with millimetre 3-ply to take the shocks. The length of the skid is something over $2\frac{1}{2}$ in.

Along the top and sides of the longerons cement strips $\frac{3}{16}$ in. × $\frac{1}{32}$ in. balsa, as in Fig. 14. Now sand the edges into a curve. This will give the finished covering a very neat aspect, as it raises the covering from the crosspieces. This finishes the fuselage for the time being.

Wing.

Draw a plan of the wing out on a sheet of paper, but only draw one half. Reverse the paper and trace the lines through from the other side. Thus we have the two sides. The next job is the main spar. This consists of $\frac{9}{16}$ in. × $\frac{1}{8}$ in. hard balsa, which will have to be cut from sheet. The dihedral is formed with the aid of two gusset plates of millimetre 3-ply (Fig. 11). Once the spar is formed, mark out the positions of the three section ribs. The leading edge is of $\frac{3}{16}$ in. × $\frac{3}{8}$ in. hard balsa, while the trailing edge is of $\frac{1}{16}$ in. × $\frac{1}{2}$ in. ditto. Cut out 15 ribs from hard sheet balsa. Don't cut the notches for anything but the main spar. Thread all the ribs into a small piece of same section as the main spar and cut all the notches out, using a 3-ply template. This ensures accuracy.

Thread seven ribs on to one half of the main spar and assemble that side of the wing on the plan. Cut the trailing and leading edges where the dihedral occurs, and put the centre rib in place. Use plenty of cement, and allow it to dry. Now remove the wing, reverse the plan, and assemble the other half of the wing. The wing tips must be cut out of $\frac{1}{8}$ in. flat material, so that the resulting piece has a uniform section of $\frac{1}{8}$ in. × $\frac{1}{2}$ in. Do not forget the bracing piece of $\frac{3}{16}$ in. square balsa. Cut and sand the leading and trailing edges to shape. Put in the two stringers of $\frac{1}{8}$ in. × $\frac{1}{16}$ in. underneath. Now cover the centre section, tips and trailing edge with 1/64 in. sheet balsa. This must be sanded so that there are no projections. See the plan for extent of covering. This accounts for the wing.

Tail Unit.

Cut out nine of ribs " A," as in Plate III, of $\frac{1}{16}$ in. hard balsa sheet. Draw out a plan of the tail-plane, and cut out the tips of $\frac{1}{8}$ in. sheet. The main spar is $\frac{1}{8}$ in. $\times \frac{3}{8}$ in. Assemble the tail unit much in the same way as the wing. Sand the leading and trailing edges and tips. Now cover the centre, tips and trailing edge in the same way as the wing with 1/64 in. sheet balsa.

Make the fin and rudder in the same way, covering with 1/64 in. balsa. The hinges are made as in Fig. 12. Fit the fin to the tail-plane by cutting a notch in the fin's main spar and cement it to the tail-plane, as in Fig. 13. Make hooks for the tail-plane, front and rear, as in Fig. 4, out of 24 or 26 s.w.g. piano wire. Incidentally, a small pin must be driven into the rear of the fuselage and cemented to take the rubber bands from the rear hooks.

Cabane.

The frame that takes the wing is built from $\frac{3}{16}$ in. $\times \frac{1}{8}$ in. birch or spruce, the latter preferably. Cut pieces to size and send to a circular section, except where joints are to come. Pin the pieces together, using a good glue, and bind them with cotton. Make the hooks that are to take the bands, passing round the fuselage, and glue and bind them in place. See plan for measurements.

Undercarriage.

This is made entirely of 14 s.w.g. piano wire. Cut and bend pieces to shape and size shown in Plate II. Bind the joints with florists' wire and solder up. I think it is policy in this case to use a solution of zinc chloride as a flux, but be sure to wash all joints afterwards. Solder small washer at the top of the legs as stops to take the elastic bands which keep the undercarriage in position.

The tailskid has been mentioned in connection with the fuselage. The wheels on the original were made of solid balsa, and can be purchased at your stores. They will need brass bushes, of course. There is no objection to using air wheels except that they are heavy.

Incidentals.

The coil and condenser are bound to a 2-ply balsa backing, which is in turn cemented to the back of the cross-piece at the third former. See that the coil is well packed with balsa (Fig. 8).

Two external battery connections are easily fitted in a convenient spot in the way shown in Fig 15. The contacts are made of sheet brass cemented in a balsa backing. Use crocodile clips with the brass tabs.

The battery box is built-up $\frac{1}{8}$ in. sheet to fit the size of the battery needed for your particular engine. Naturally, the smaller the battery the better. Incidentally, my Elf only needs one $1\frac{1}{2}$-volt cell broken off from a standard $4\frac{1}{2}$-volt cell. This weighs just 1 oz. Fit it in the machine as shown in Fig. 9. Be sure that the battery will have no chance of flying forward in a crash. (These things must be provided for.)

The timer is, of course, dependent on the builder, but personally I use one of the type in Fig. 10. Notice that the hatch is made of 2-ply balsa; $\frac{1}{16}$ in. $+ \frac{1}{16}$ in. $= \frac{1}{8}$ in.

In the prototype the tank was built into the nose of the machine. The tank was soldered up out of ·003 in. Shim brass (obtainable at a garage), while the cap was made from a toothpaste cap.

Covering.

The prototype was covered in bamboo paper and silver doped. However, there is no reason for not covering in silk, although it puts the weight up. I think it is policy to use aluminium dope, as this needs no undercoat, while it is lighter than coloured dope. I put my wing in a jig while it was drying, as I used rather strong dope.

I haven't said anything about the propeller, but I think a fine pitch screw with medium blade area is the thing. The actual design depends on your engine; try and get some wide straight-grained ash for it. If you leave it moderately heavy it will never break. I haven't included a wiring diagram; you get that with the engine. Incidentally, use rubber-covered wire, and on the high tension lead slip some insulating sleeving over it. The thrust line on the original was set at one degree negative to the datum line, the wing at $1^{\circ} - 15'$ positive.

Get the machine set up for flying, and try gliding it off a gentle slope. This is done by gently pushing it into the air from the ground. Obtain your glide by packing up the tail-plane with the wing leading edge of the wing midway between formers 2 and 3. However, your model having a different engine, will be weighted somewhat differently. Here a little of the builder's ingenuity is necessary.

Having got the glide settled, start your motor and let it rev. quite slowly. Give the timer three to five second run and push the machine as before. Do this until the machine does not lose height once it is off. See that the machine has no violent torque turn on take-off, and give the machine twenty seconds. There is no reason why she should not fly well.

Incidentally, this is not a machine to be flown in a gale.