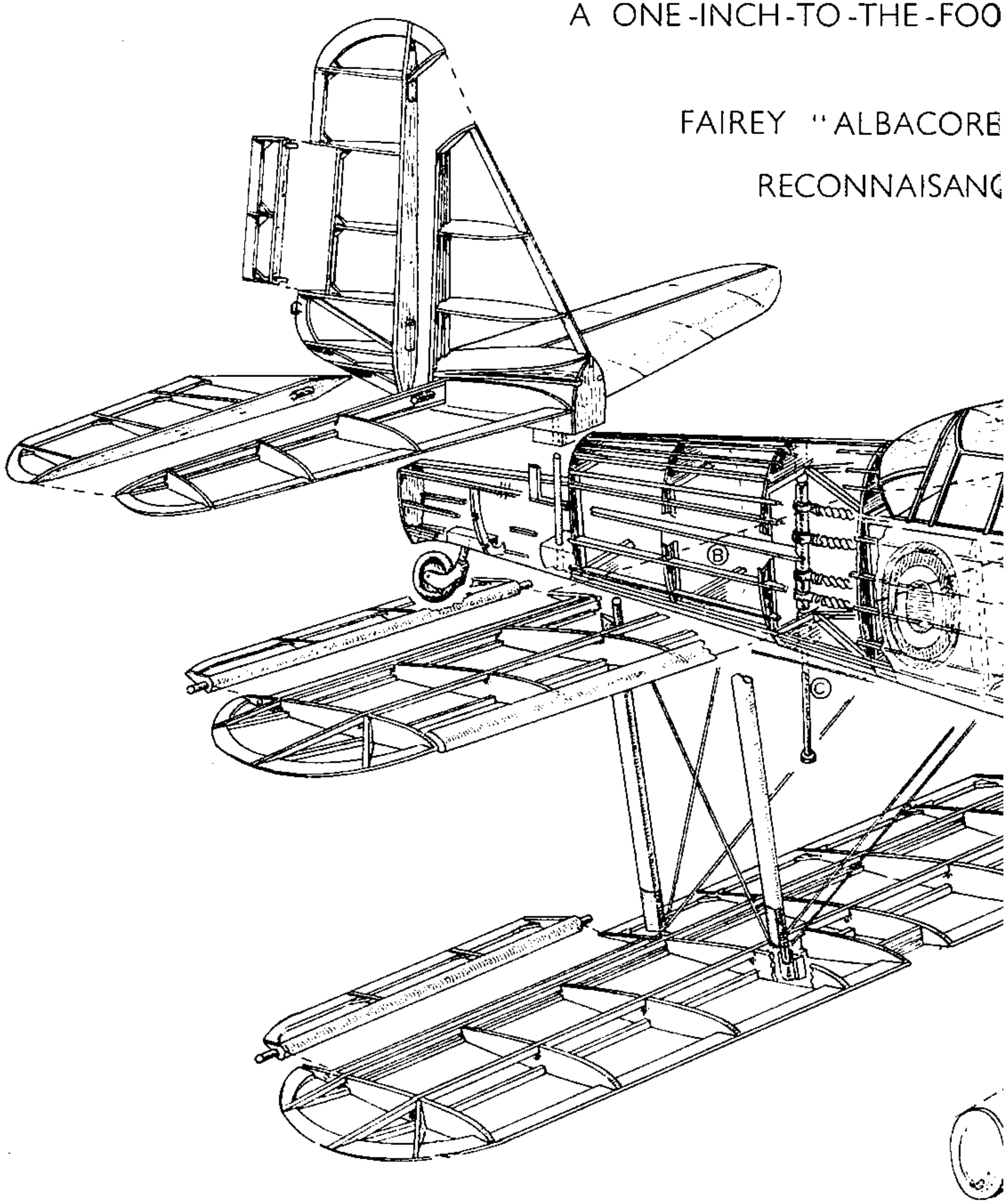
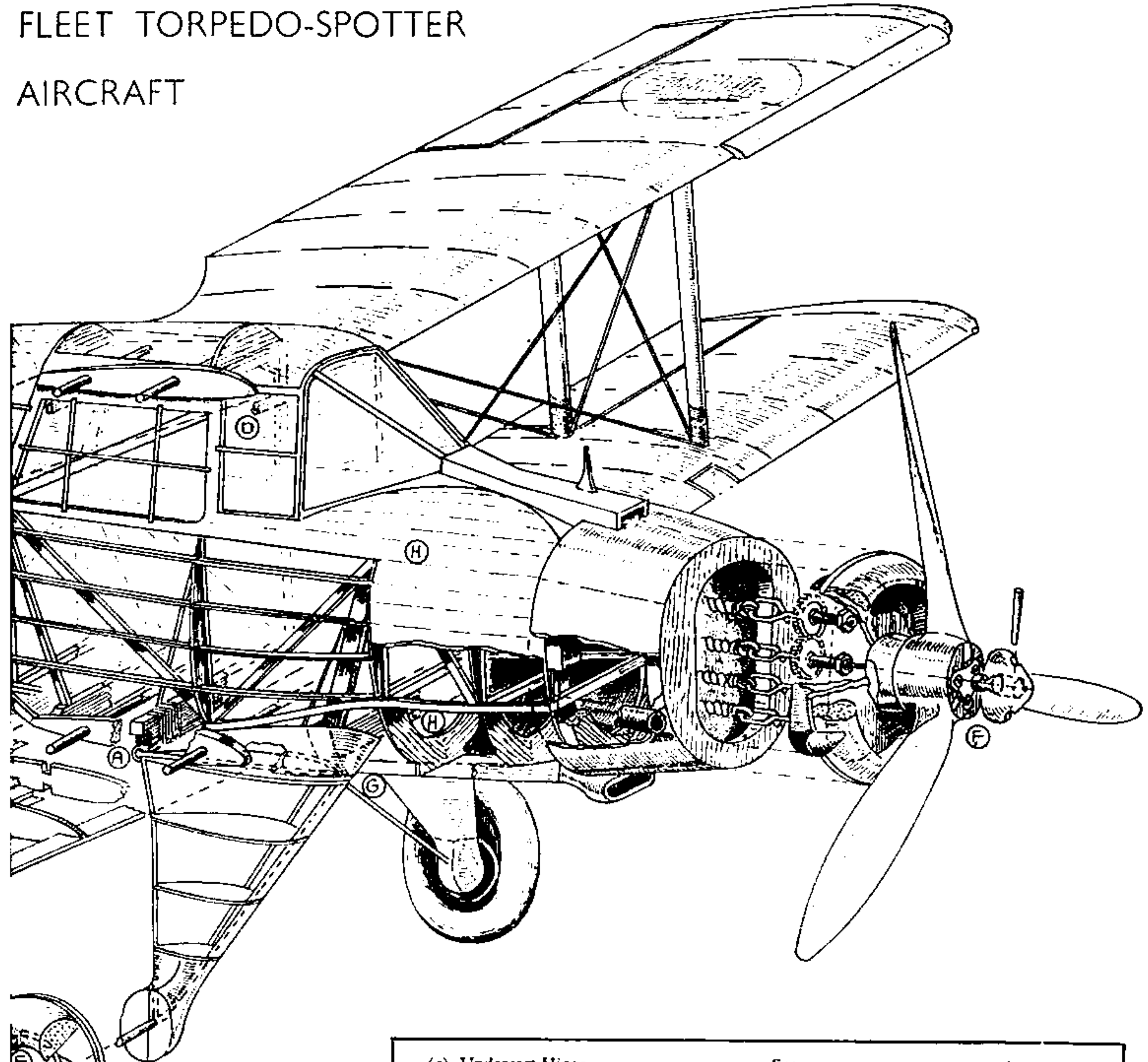
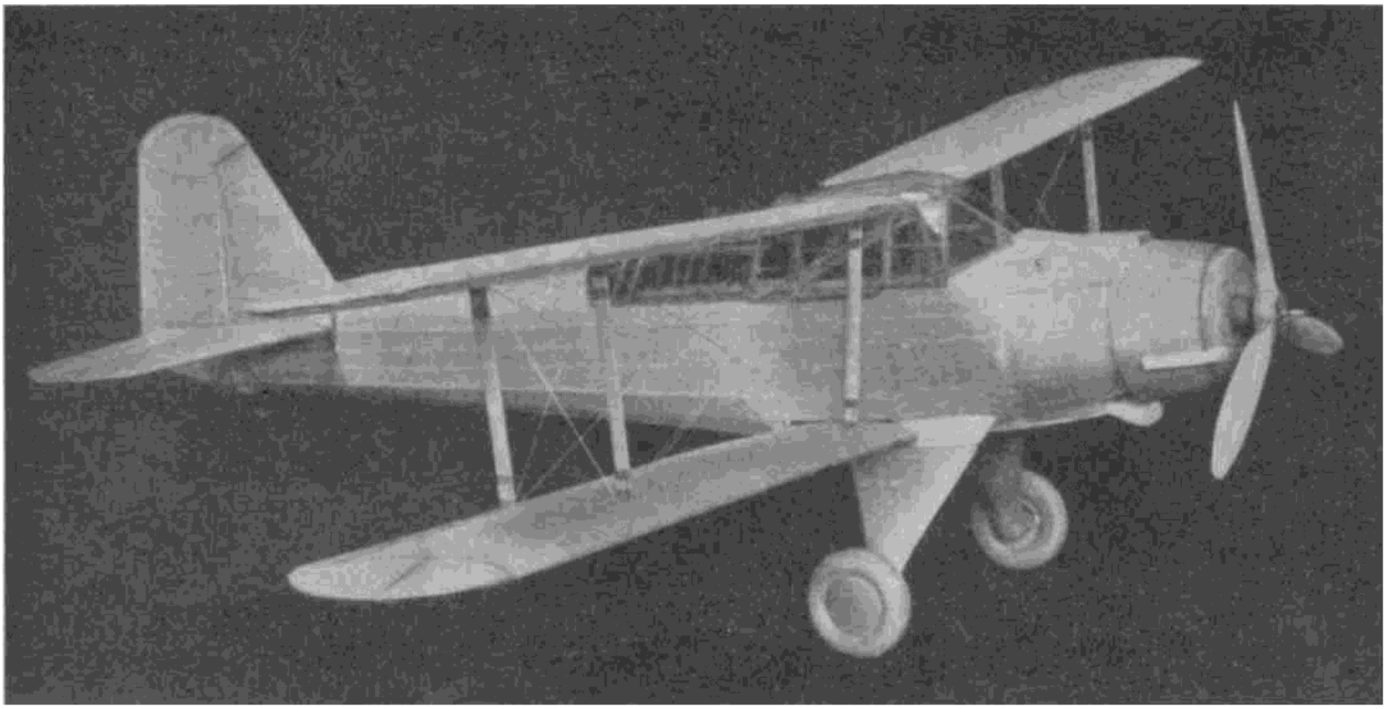
A ONE-INCH-TO-THE-FOO FLYING SCALE MODEL
THE
FAIREY "ALBACORE FLEET TORPEDO-SPOTTER
RECONNAISANC AIRCRAFT





(a) Undercart Hinge.	Span	50 ins.
(b) Motor Insertor Handle.	Length	10 ins.
(c) Motor Rear Fixing Dowel.	Weight	22–25 ozs.
(d) Tubes for Rubber Bands.	Wing Area	620□ ins.
(e) Internally Sprung Wheel.	Wing Area Effective ..	450□ ins.
(f) Winding Eyelet.	Wing Loading	±7 ozs./□ ft.
(g) Rubber Suspension.	Stressed for either Rubber or Petrol and also for soft and hard woods.	
(h) Main Frame.		



THE FAIREY "ALBACORE"

A 50 in. Span Flying Scale Model Designed by H. J. Towner

MOST readers of THE AERO-MODELLER are well acquainted with the Fairey Albacore, which made history at the Battle of Matapan. They will remember that it is a biplane without stagger, a span of 50 ft. and length of 39 ft. 10 in., and is chiefly in use with the Fleet Air Arm's T.S.R. squadrons on the aircraft carriers. Hence the wings are made to fold back neatly to form a very compact unit to stow away in the hangars between decks. It is also used as a seaplane, when the wheels are replaced with floats.

The flying scale model of the Albacore is built to a scale of 1 in. to the foot, giving a span of 50 in. and a total all-up weight of 20 oz. This weight is achieved by the use of hard balsa wood. However, during construction it was realised that anyone contemplating building the model might not be able to procure sufficient balsa, or only a very poor quality balsa at the best. With this in mind, it was decided to load the model to approximate to the probable weight should harder woods, and therefore heavier woods, be used.

The model was therefore covered with a heavy bamboo paper, fully doped, in place of the lighter type papers usually used for rubber-driven jobs.

The reader may query whether this would be sufficient extra weight, but by the judicious use of a good quality hardwood of the bass variety, now obtainable at some of the best-known model aircraft stores, it will be found that the difference in weight is very small. To accomplish this, however, the main dimensions and depth of wood will be the same as that used for balsa, but the thickness will be less. For instance, longerons shown as 1/8 in. by 1/16 in. for balsa will be 1/8 in. by 1/32 in. for bass. Thus, by halving the width or thickness, the strength and rigidity will be maintained and very little extra weight added to the structure. Where, however, the structure is visible from the outside, such as the four main pillars which support the top centre section, this should be kept to the original dimensions. Should, however, a certain amount of balsa be available, then let this be used on the tail-unit, which is detachable, and thus help the trim.

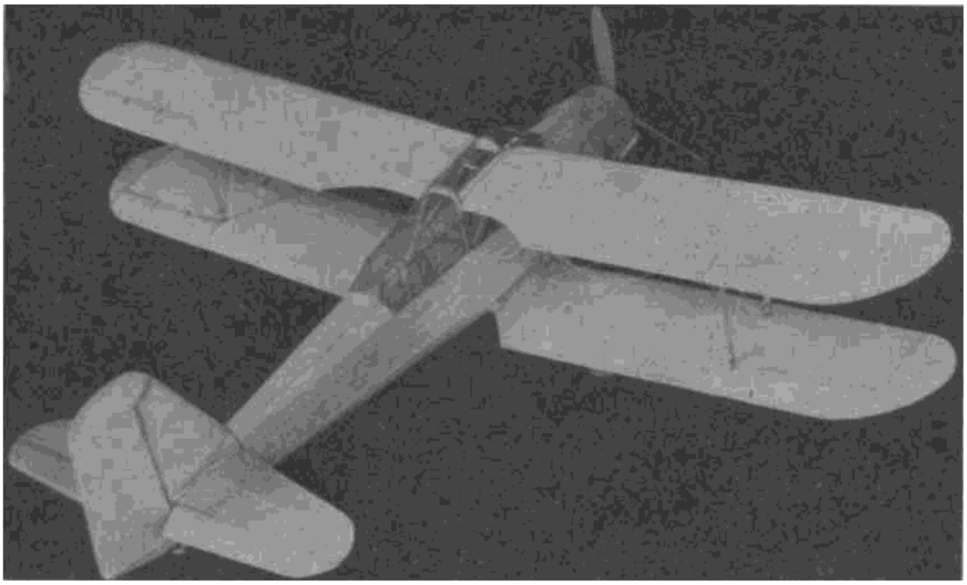
Balsa, too, can be used to plank the front part of the fuselage, and a poor quality here will not matter, as it will all be sanded down to shape. In any case, a certain amount of weight will probably have to be added to the nose, and it is suggested that plasticine or putty with some bits of scrap lead mixed up in it is formed into a rectangular shape and pinned to the inside bottom of the cowl, where it is out of harm's way and easily adjustable.

Another method of obtaining trim is by the use of two separate rear motor anchorages, one forward of the other, so that weight can be taken off the rear by bringing the motor forward. This is accomplished by using two short paper tubes, one in the bottom of the fuselage and one in the top to receive a birch dowel pushed through from underneath. Between these two short tubes is inserted another paper tube—through which the dowel also passes—on the outside of which the four rubber motors are looped and rubber bands slipped on to keep them in position.

A long handle is attached to this last tube, so that the complete tube, with motors, can be inserted from the rear, and the dowel pushed up into place.

Naturally, by using the rearmost fixing which also locates the tail-unit, a longer motor can be used, but as more weight will probably have to be added to the nose, an extra loop or so of rubber per motor will have to be used to speed the airscrew up. This in turn will reduce the number of turns available, but the builder will find out which suits his particular model and flight characteristics best.

It might be suggested that this extra speed could be achieved by stepping up the airscrew revs. to that of the rubber. This was originally tried, but in view of the fairly



large airscrew used—12 in. diameter (in order to keep to scale)—it was found that the power required was excessive, unless the pitch was very considerably reduced. This 12 in. propeller, with a pitch of 16 in., has an effective pitch of about 12 in., allowing for slip. Should this be stepped up to a ratio of 2—1, the airscrew not only has to turn over twice per revolution of the rubber, and meets twice the amount of air as one having a 1—1 ratio would, but its pitch travel is also doubled to 24 in. It will be seen, therefore, that the pitch must be reduced to at least 9 in., if not less, and in so doing it must be remembered that the efficiency is being impaired. So it was for this reason a ratio of 1—1 was employed, with quite narrow blades, to keep the revs. up. Perhaps a step-up ratio of 1½—1 might be a good compromise.

While we are on the topic of design, it would be as well to explain the theory of longitudinal stability as applied to this model. In the April issue of The Aero-Modeller Arnold Wathew gives a very lucid explanation of biplane stability, and points out that an arrangement of aerofoils without stagger or decalage is unstable—decalage is really difference of angle of incidence. Now the Albacore has no stagger, so something had to be done about it. Of course, on the full-size job there is a pilot who is at the controls, but in our model inherent stability has to be incorporated to keep the craft on an even keel. To achieve this stability, the lower aerofoil is built to an R.A.F. 32 section with a C. of G. approximately one-third chord, while the upper aerofoil has a section of R.A.F. 34, whose C. of G. is rather less than quarter-chord. In this way a slight stagger effect is achieved. R.A.F. 34, however, has a fairly constant C. of P., although its lift may not be so good as R.A.F. 32.

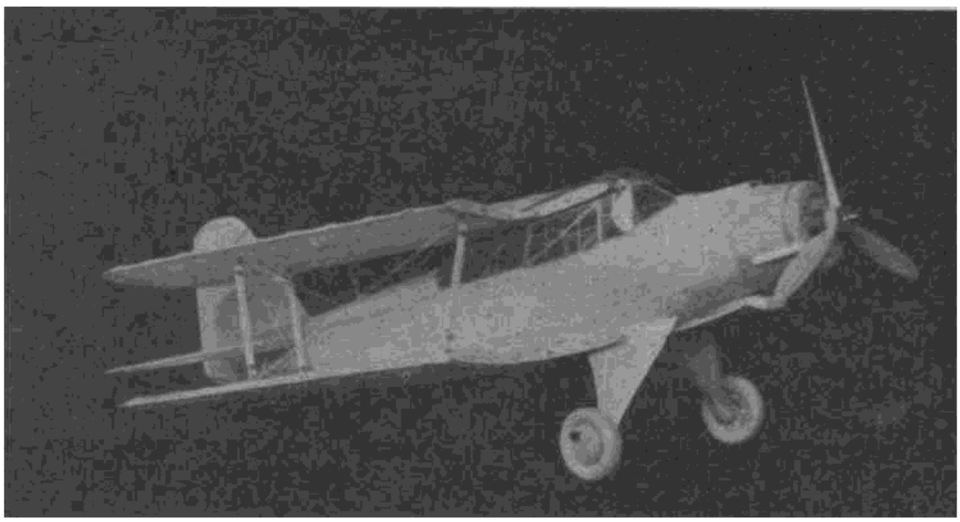
In most model biplanes the lower aerofoil is merely a passenger, otherwise the fact of adding a lower plane to an ordinary high wing job should improve its performance—but it doesn't, especially where the gap or distance between the aerofoils is not large. R.A.F. 32, therefore, in the lower wing, helps to a certain extent to overcome the interference of the upper plane and to keep the average lift fairly distributed.

In a model of this type it seemed essential to cut wing drag down as low as possible, although this, of course, cuts down the lift as well. However, with a wing area of 620 sq. in., reduced, let us say, to 450 sq. in., taking the wing interference into account and with an all-up weight of 22—22 oz., gives a wing loading of only 7 oz./cu. ft., which is quite good. Both wings, therefore, top and bottom, are set at 2° above minimum drag, which results in the lower plane being set at 0° and the upper plane at 5°, giving a decalage of 5°. This may seem high, but is not noticeable on the job, and, referring again to Arnold Wathew: "Decalage of 2·5 deg. and 4 deg. give progressively increasing degrees of stable travel." This is borne out in practice, as the model does not appear to suffer from bad stalls. As the ailerons, however, are adjustable, a large part of the wing section can be varied. That is to say, the convex under camber of R.A.F. 34 can be made to simulate R.A.F. 32 by slightly lowering the aileron, whilst R.A.F. 32 can be given more lift by lowering the aileron, or less lift by raising the aileron, with a subsequent more stable C. of P.

It will be noticed that all the control surfaces are free, revolving upon ⅛ in. birch dowels in their ends. They are fixed in the required position by the use of small gummed paper tabs top and bottom, stuck to both the aileron and wing surfaces.

For those who like plenty of detail, these birch dowels can be extended by the use of $\frac{1}{16}$ in. round cane to the wing roots, and coupled up to the interior of the fuselage to a central control. This central control in its turn can be controlled by the rubber tension to counteract torque, or, when the model is powered with a petrol motor, the timer, when cutting the ignition, can snap the ailerons into neutral for the glide.

With the tail unit, however, it is suggested the trimming



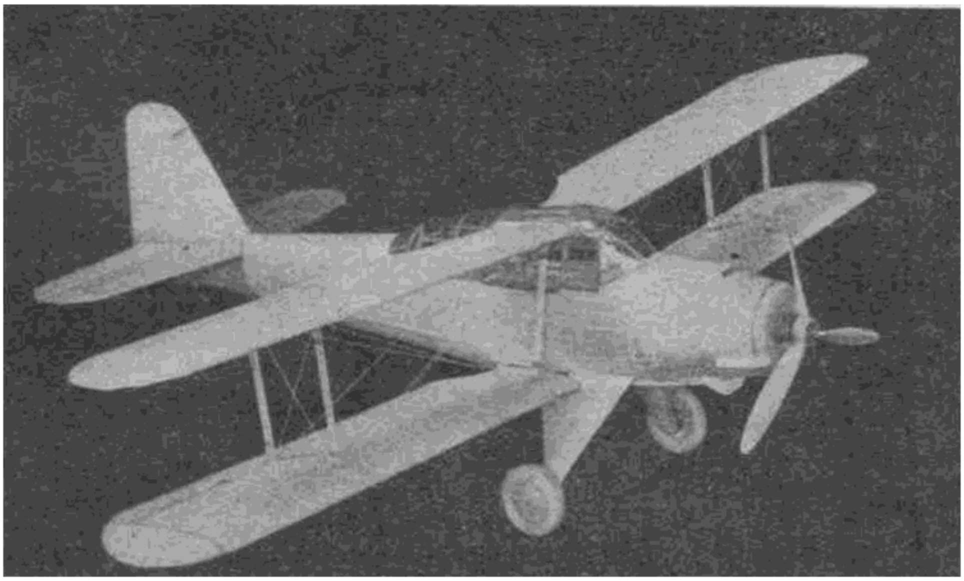
tab only is used, as the rudder area is large and adjustment is very delicate if the rudder only is moved.

The undercart, as usual, was a headache to design, as the upper fairing of the legs forms part of the lower wing root. It was eventually decided to stress the fuselage at this point to withstand all landing strains by using a "hefty" transverse beam and two stout compression struts to distribute the load. In practice, however, should the model be trimmed properly, the landing loads are not great, but on a badly trimmed job the spinner takes most of the crash. There is, however, the possibility of the model hitting an obstacle and carrying away its landing gear, if this part is rigid. Therefore, the rear top portion of each leg is hinged to another transverse beam, so that the entire unit can be knocked backwards, and is held in place by rubber bands connecting the two converging wires from the axles to the underside of the fuselage.

The use of airwheels, of course, is a great advantage, but as these may be difficult to come by, it was decided to incorporate internally sprung wheels. The centre of each wheel is made of $\frac{1}{16}$ three-ply, with the centre cut out and a volute steel spring of 16-gauge wire attached to it. The method of attachment is to sew the wire to the three-ply for about an inch from its outer end with thin wire, and this thin wire is then soldered to the 16-gauge wire to hold all firm. A bush is bound and soldered to the centre of the volute spring to fit the axle. The wheel is completed by adding two tyre halves carved from balsa, the inner tyre half being undercut to allow movement to the spring.

This method of springing not only absorbs vertical and horizontal shocks but also side strains in the event of a drift landing.

Should the wheel get out of true, it is easily pressed back again to its original position.



Construction.

The construction is straightforward, being built on a basic frame and the various formers added afterwards and by $\frac{1}{8}$ in. for bass and kindred woods. The front is planked with $\frac{1}{16}$ in. balsa to give a hemispherical effect.

The lower longerons of the main frame have a compound curve forward, which is best curved over a heated iron. A soldering iron is quite good, but it musn't be too hot.

The top and bottom centre-sections are now added, with the correct incidences.

Both legs of the undercart are made of one piece of 14-gauge wire bent to shape, with the brass tubes for the rear hinges threaded on. These tubes are now bound and soldered to another wire, which is bound to the top rail of the basic frame on either side and firmly bound and glued with thread to the transverse beam. Similarly, a further wire is bound to the top rails and converges down to a loop and lashed to a cross member, which is in reality the continuation of the lower leading edge. This loop forms a base to attach rubber loops to hold the undercarriage in tension.

Formers are fitted in the legs, and each leg covered with $\frac{1}{16}$ in. sheet balsa. The former at the top of each leg is sewn to the wire frame and abuts or presses against a similar former just beneath the wing root, this latter forming the base of the fairing.

The cowling can now be added, and is covered with $\frac{1}{16}$ in. hard balsa or similar thickness hardwood, made up of four segments, the necessary formers being quite thick, all adding strength and weight in the right place.

The cabin framework is made of cane steamed to shape or bent round the previously mentioned soldering iron, and glued together with good strong fish glue and the celluloid panels fitted. The joints of the panels can be covered with gummed paper $\frac{1}{8}$ in. wide, such as A.R.P. paper, cut to width, and makes a neat finish.

If it is not possible to procure celluloid with a slight curve, as shown over the pilot's office, a flat piece of celluloid can be used, as this part is designed to take either.

Paper or celluloid tubes to take $\frac{1}{8}$ in. birch dowels are fitted in both the wing roots and the fuselage, so that each dowel is in one piece and fits in one wing through the fuselage and into the opposite wing. These dowels are not cemented but just a push fit, so that if they break they can easily be replaced.

The flying and landing wires are fitted after the wings are covered, the method being thuswise: A small hole is made in the covering and through the nearest rib at the same angle that the wire, or thread in this case, makes to the surface. A small square—say $\frac{1}{4}$ in.—is then cut out of the covering on the opposite side of the wing, so that the thread can be pulled through and pinned in position to give the correct dihedral and incidence. In order to achieve this, the wings are propped with suitable pieces of wood, and when finally satisfied and the thread taut, it can then be well cemented in place and the small square hole re-covered.

The gearbox is mounted behind the "exhaust collector ring," the whole being a push fit into the cowling, care being taken to set the hooks at different angles to each other, to avoid fouling.

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