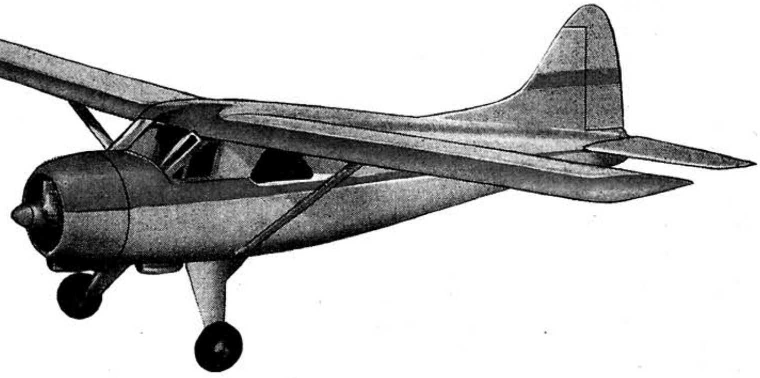
The D.H.C.2 Beaver



BY J. H. SHEPPARD

WHEN designing a flying scale model one has to bear in mind that even if it has a fast flying speed, as the majority of flying scale models have, it must be able to withstand heavy landings and the flying surfaces must be easily displaced in the event of a crash or hard knock. Also, it must have a practical motor installation—motor trouble is bad enough in a freelance design, but an inaccessible engine in a scale model can lead to gory propellers, cut fingers, and bad language!

The D.H.C.2 Beaver fulfilled my requirements admirably providing a model with a radial cowling which allowed plenty of room for an upright motor, a reasonably long undercarriage sprouting from an ample fuselage, and filletless wings permitting an easily detachable fixing. Above all the Beaver is a good looking aeroplane having rugged yet clean lines.

The original model was powered by an E.D. Bee though an Amco 0.87 or any other good engine of a similar capacity could manage as efficiently. Anything smaller would have difficulty in dealing with the fairly high wing loading.

The pendulum rudder was fitted to cure instability which resulted from the small dihedral angle.

The sprung undercarriage was fitted after the prototype had been flown because it was found that downwind landings on tufty ground or ploughed fields tended to tear Former No. 5 away from the fuselage sides. The installation of sorbo pads and gussets cured this and the present undercarriage will deal satisfactorily with all landings on reasonable terrain in normal weather conditions.

The weight of the original was $16\frac{3}{4}$ oz., but in spite of this, with the C.G. at about 50 per cent. of the chord, quite a slow glide was obtainable.

The model has stood up well to " cartwheel " landings, which occured before the fitting of the pendulum rudder. On one occasion half of the tailplane became loose and began to fall off. Once clear of the locating peg it turned through 90 deg. so that it was vertical in relation to the airstream. The only damage resulting from the ensuing 50 ft. plunge to earth was a cracked rudder!

Wings

These are perfectly straightforward, but it should be carefully noted which ribs are made from $\frac{1}{16}$th in. and which from 1/32nd in. sheet. The multi-spar construction is used to minimise tissue sag and so preserve scale appearance care should be taken to bind and cement the brass tubes securely to the web between the spars.

The strut anchorage consists of a wire hook to take tensioning rubber bands and a small housing made of plastic wood into which the bevelled edge of the struts fit.

Fuselage

Start by building the basic side frames on the plan from 3/32nd in. sq. and 3/32nd in. sheet. When these are set, join them together with the small former stop and bottom using F5 as a means of keeping the whole job square. The undercarriage should be attached to F5 before it is installed. The sorbo pad could be made of a sorbo tyre off an old wheel. Add the engine bearers not forgetting to incorporate the downthrust.

Plank the " bonnet " and under the fuselage; also sheet the " corners " of the fuselage. These parts can be planked with single pieces of sheet as they are not compound curves; the wood should be soaked in hot water and then bound with rubber round a broom-stick and left to dry thoroughly. It will then be roughly the right shape for the corner curves. The fin outline is constructed from laminations of 1/32nd in. sheet. When the fin is completed it is cemented to the fuselage. The rudder is attached and the pendulum installed. Take care to cement the pendulum supports securely into position.

The tail-wheel strut is sewn to F18 and cemented; the rear strut is dummy and merely protrudes through a piece of 3/32nd in. sheet into the fuselage.

The wire wing fixing is soldered to two 6 B.A. nuts and bolted to F5. The correct dihedral angle is incorporated by bending the wire as shown on the plan. This fixing, provided it is made from good 12 s.w.g. spring wire, makes a very efficient wing mount, being sufficiently flexible to spring backwards, forwards, upwards or downwards to take shocks and yet being sufficiently rigid for normal flying. The undercarriage fairings are made and installed as shown on the plan.

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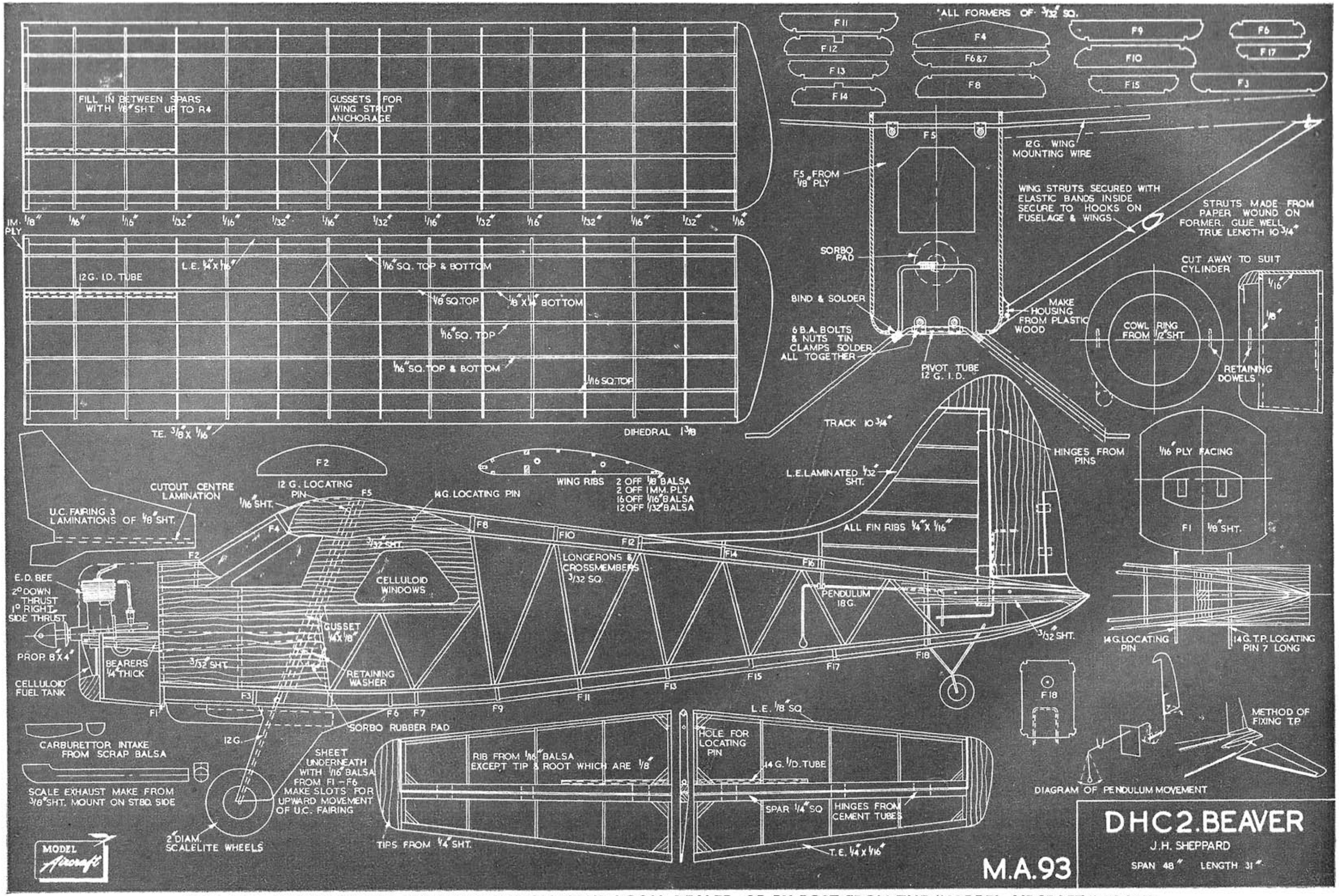

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equivalent b.m.e.p. being slightly in excess of 50 lb./sq. in. at approximately 6,000 r.p.m. The maximum b.h.p. indicated was .16 b.h.p., this being realised at 10,000-10,500 r.p.m.

In the course of practical tests by the manufacturers with a radio-controlled "Centurion" model, an 11 in. × 5 in. airscrew was found to be most suitable. With such a propeller the speed of the "250" is about 6,000 r.p.m. A check on the test unit with an 11 in. × 6 in. airscrew of medium blade area, yielded 5,800 r.p.m.

For free-flight contest models of around 300-400 sq. in. area and 15-20 oz. weight, a somewhat higher speed can be aimed at in order to utilise more of the engine's available output and 10 in. × 4 in., 9 in. × 5 in. and 10 in. × 5 in. propellers should be suitable. On a Stant example of the largest of these three sizes, the test engine recorded 7,900 r.p.m. For C/L work, 8-9 in. diameter and 6-8 in. pitch should be most useful, the smaller diameter, higher pitch propellers, of course, being chosen for lighter and faster types. A brief check provided 7,600 r.p.m. on a Truflex 9 in. × 8 in., 8,700 r.p.m. on a 9 in. × 6 in. and 9,000 r.p.m. with an 8 in. × 8 in.

As a matter of interest, the test unit is now being installed in a high-wing semi-scale R/C model with Aero-Trol equipment. This model has a span of 59¼ in., an area of 432 sq. in. and all-up weight is 2½ lb.

Power/Weight Ratio (as tested) 0.465 b.h.p./lb.

Power/Displacement Ratio (as tested) 64.2 b.h.p./litre.

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The cowling is made from $\frac{1}{16}$ in. sheet—the front ring being from ½ in. sheet. The bottom half of the cowling is cemented to F1 and braced to the engine bearers while the top half is made detachable in order to provide access to the motor. Carve the exhaust pipe and carburettor air intake from ½ in. sheet and stick on after doping.

On the original model since the E.D. Bee is not fitted with a cut-out a celluloid fuel tank was constructed as shown and graduated. This proved to be quite satisfactory since accurate timing of engine run is not of great importance with scale models. The tank shown held sufficient for about a 30 sec. engine run. For choking, a length of wide neoprene tubing was pushed over the carburettor intake of the engine and led out of the side of the cowling.

In order that the compression lever can be adjusted without removing the cowling, a small extension may be made. It was found on the original that the engine started and ran efficiently without any adjustment to either compression or needle valve. Extensions to either are, however, easily made.

To avoid the possibility of the engine mounting nuts vibrating loose 18 s.w.g. wire clips were made to snap over the bolts just above the nuts. The wing struts are made of cartridge paper wrapped round a balsa former and cemented. They are then clear and silver doped.

Tailplane

The tailplane is of quite simple construction. The elevator hinges are made from strips of cement tube. The tips of the elevators should rub against the tailplane tips so that the elevator cannot be easily displaced.

Finishing

The wing, tail, and fin are covered with ordinary rag tissue, the fuselage is covered with double-thickness rag tissue, and given three coats of clear dope. The rest is given two coats of clear dope and the whole aircraft finished with two coats of silver dope (sprayed on, if possible). Registration letters and the top of the engine cowling are maroon in colour and a maroon stripe is painted down the fuselage sides with the aid of "Sellotape" for masking purposes.

Ailerons, doors, hatches, etc., are marked with Indian ink, which is then given a coat of clear dope for protection.

Flying

First make sure that all flying surfaces are free from warps and check the C.G. position. All being correct, choose a calm day and glide test over very long grass. Trim (by moving elevators slightly up or down) until you have obtained as slow and as flat a glide as possible.

On the original model a Truflex 8 in. diameter × 4 in. pitch propeller was used. For the first power flight the engine should be throttled back until it is running slowly, or if you cannot get your motor to run slowly, use a wooden propeller and stick a piece of $\frac{1}{16}$ in. sq. on the leading edge of the blades. This will reduce thrust and revs. If a light airscrew is used, gyroscopic forces will be minimised and the model, will therefore, be easier to trim.

Normally the pendulum rudder will tend to keep the model on a straight course, but circling flight may be obtained by adjusting the inset tab on the rudder.

If the model tends to oscillate from side to side it is probable that there is either too much movement on the pendulum rudder or that the model has not been launched straight and a weaving motion has been started by the action of the rudder.