

A $\frac{1}{8}$ th SCALE
DE HAVILLAND

TIGER MOTH

BY C. RUPERT MOORE

The accompanying colour and flying photographs by our chief photographer Mr. D. B. M. Wright, splendidly illustrate the scale appearance of this unique model. Its authenticity both in flight and appearance are a pleasure to observe. So difficult is it to differentiate between the model and its full sized counterpart that we would mention here our cover painting. This is in fact a view of the original machine over the Wirral Peninsular, Cheshire, and, together with the photographs, will, we hope, tempt readers into building one of the finest scale models the "Aeromodeller" has yet published.



THE model here described is a second and greatly improved version of the original appearing in Plans Service in October, 1943, and incorporates the "Moore Diaphragm," a self-adjusting tailplane, a "knockoffable" false nose and airscrew, and other unusual features. In order to deal fully with certain features I shall have to skim over the more usual portions.

The Structure.

The centre-section struts are the key unit of this biplane, and, therefore, the top longerons are cut to allow them to continue unbroken to the bottom of the fuselage. The joints are reinforced with ply biscuits. The two sides, complete with centre-section struts, are built on a board and then assembled with temporary spacers in the top. Aft of the pilot's cockpit the stringers are braced with $\frac{3}{32}$ sq. balsa after being fixed.

The Wings.

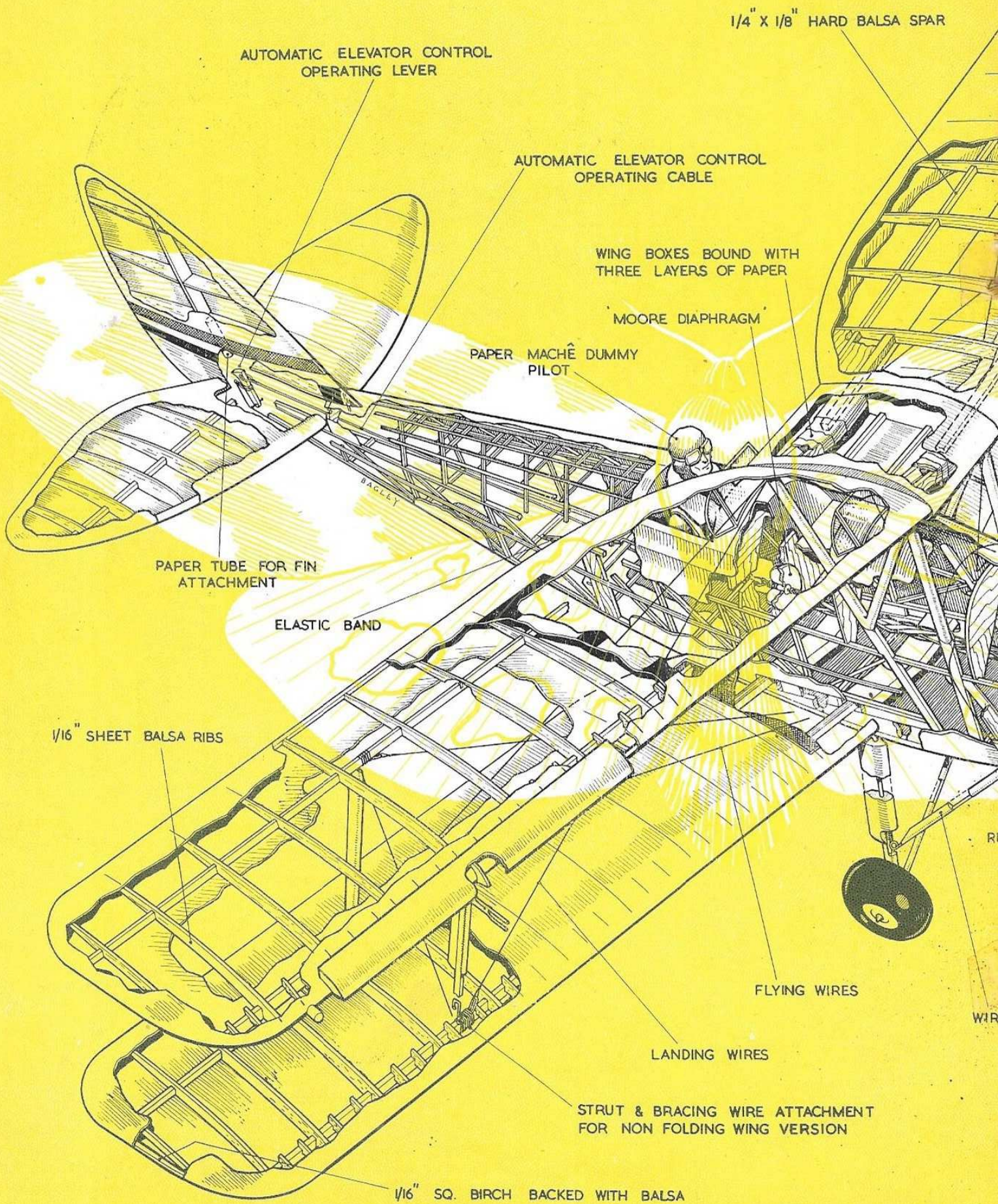
Dihedral and sweep-back differs on top and bottom wings, so sweep-back is built into wing peg boxes and dihedral into the wing pegs themselves. These peg boxes are wide to prevent breakage of pegs. The interplane struts are hinged in such a way that the top plane folds on top of bottom for transport.

The Undercarriage.

The undercarriage is a structure of piano wire, faired with balsa. Every joint should be tinned first, bound with fine copper wire (fuse wire) and soldered solid. The rubber band shock-absorbers pass through two holes under the motor cowling to a wire saddle, located through two holes, at the bottom of bulkhead No. 1. These rubber bands are tied with thick thread to their attachment loops on the undercarriage. Note—the holes under the cowling are much closer together than

their attachment loops, which causes the rubber to absorb much of its own backlash. The wheels are my usual laminated paper structure (so is the pilot). A half model of the wheel is turned in wax or plasticine attached to a 1 in. oversized disc of plywood, through the middle of which is a bolt to facilitate holding in the chuck of a lathe or twist brace. The brace, if used, is held in a vice and convenient sized boxes used as tool rests. When the half wheel is finished, a cardboard wall is stuck round the edge of the plywood. Fine plaster of paris is mixed; about $2\frac{1}{2}$ desertspoons to $\frac{2}{3}$ large cup of water, added by sprinkling into water. A film of plaster is brushed over the half wheel to prevent bubbles, and then the whole poured in. When set, remove from plywood and carefully remove model. With very slow heat, the mould should be dried out, painted, and, when dry, greased. The pressing is made from five layers of newspaper, the first being soaked only in water, and the others in Gripfix. Press from the middle outwards and over the edge like a hat brim (all five layers). Gripfix the inside, press in second layer and Gripfix—third—fourth and fifth.

After three or four hours, temporarily fill back of pressing with plasticine and turn out and allow to dry hard. *On no account use artificial heat.* When dry, banana oil inside and out and cement thick celluloid washers inside and out of hub. Lay pressing on its "brim," "crown" upwards, and with razor blade flat on "brim," trim off. Make and cement a balsa hub inside one of the pressings and allow to dry. Cement the edges and hub end and bring the two halves together. Thread on an axle, and, by twisting the pressings, adjust till wheel spins true. Edges can be pinned temporarily. Over the joint paste $\frac{1}{4}$ in. strip of newspaper and over that again a black bias binding tread, using 50-50,



1/4" x 1/8" HARD Balsa SPAR

AUTOMATIC ELEVATOR CONTROL OPERATING LEVER

AUTOMATIC ELEVATOR CONTROL OPERATING CABLE

WING BOXES BOUND WITH THREE LAYERS OF PAPER

MOORE DIAPHRAGM

PAPER MACHÉ DUMMY PILOT

PAPER TUBE FOR FIN ATTACHMENT

ELASTIC BAND

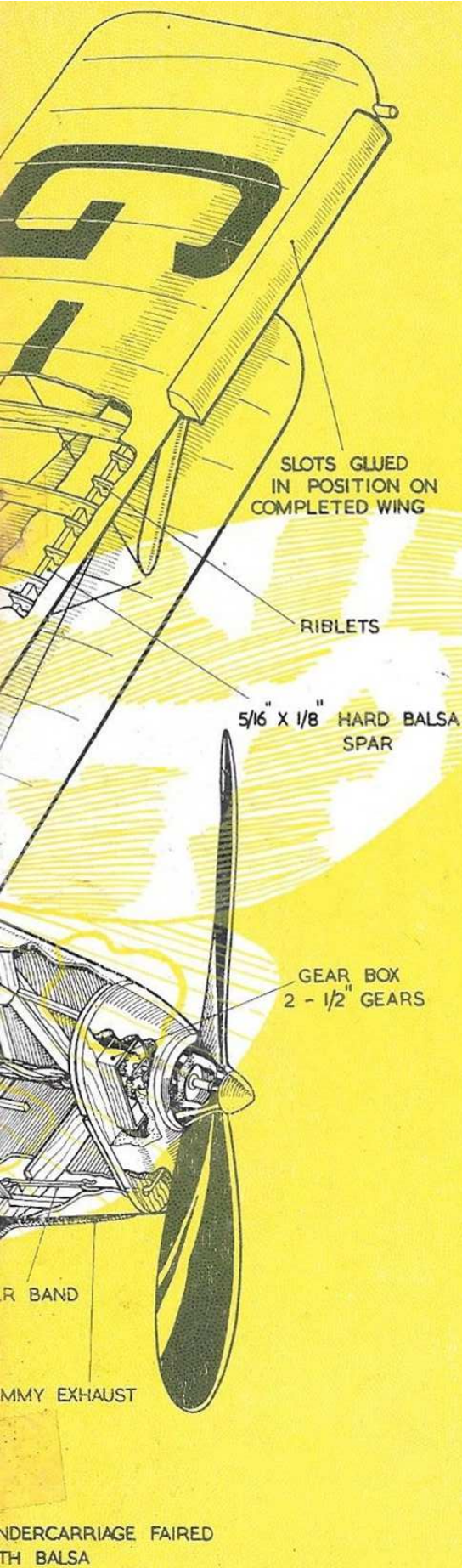
1/16" SHEET Balsa RIBS

FLYING WIRES

LANDING WIRES

STRUT & BRACING WIRE ATTACHMENT FOR NON FOLDING WING VERSION

1/16" SQ. BIRCH BACKED WITH Balsa



Durofix and banana oil. Give four coats black dope. Remember when making moulds or taking pressings, vaseline prevents sticking.

The Gearbox and Nose Block.

The gear box and false nose are separate units, joined by powerful spring clips. The propeller shaft is cut in halves in order that the whole false nose and airscrew can knock off in case of obstruction. The rear half engages the front half of the propeller shaft by means of a simple fork and T-piece. Gears are used to throw the rubber motor below the internal structure.

Step-up gears were tried but found a disadvantage. The lower shaft has $1/16$ in. (or more) forward travel and is spring-loaded. The top of the spring is so shaped that it comes into contact with a curved T-piece on the end of the top shaft, as tension dies away, the curved ends of this locking plate allow the spring to ride over it for several revolutions.

Before soldering the airscrew driving plate, the airscrew should be turned to a horizontal position so that it locks itself there out of the way. A freewheel on a model of this weight-airscrew ratio is less advantage than a good landing. The $1/4$ in. three-ply base plate is cut and built up with plug portion behind and also in front. It is then drilled to take brass-screwed bushes and also $1/8$ in. holes for spring clips. The top shaft is cut a little too long. All shafts, gears, driving plates, etc., should be sanded bright with glass-paper. Inside the gear axle hole should be cleaned with suitable drill and the gear teeth painted with coloured dope. This makes sure solder sticks where it is wanted and does not stick to the gear teeth.

Tin the front $3/4$ in. of the shaft and wipe off all surplus solder with a clean rag while molten. Slide on gear and solder in place. Make the cross-pieces which hold the driving fork prongs by folding a strip of 20 s.w.g., brass double and drilling both together. Drills are easily made by filing piano wire to a square taper point. Build up between plates and also right up to gear face with two or three layers of fine tinned copper wire (fuse wire). It is wise to bind round the plates themselves. The holes for the prongs should be aligned by pushing match sticks through, then solder into one *solid unit*. Prongs should be cut, tinned and put in place (ends should touch gear face) and soldered. The other end of the shaft should be tinned and well wiped.

Put shaft in its bush and thread on paper washer (to prevent solder sticking to bush end). Next, put on locking plate and build up behind and up the face of plate, a conical collar of fuse wire, $3/16$ in. long and $1/8$ in. diameter, and solder solid. All soldering is done in this way.

Soft solder will not stand the strain of a heavy motor unless it is spread over a considerable area, so use fuse wire generously. One or two points about the lower shaft:—To allow for $1/16$ in. travel, use cardboard in place of the paper washer. A $3/8$ in. tin disc is soldered behind this card on which the spring rides. Behind this is a $1/16$ in. bore brass collar (or fuse wire). Behind this again is the 16 s.w.g. silver steel or soft iron rubber loop which is also bound on and soldered into a solid unit.

When these gears are in place a box of cigar-box wood is built up round the gears, which are on the front of the base plate. This box acts as a locating plug for the false nose. The $1/16$ in. plywood false nose back-plate should be cut to fit exactly over this box and then trimmed to the outside. The nose should be roughed out, well oversize, and the $3/8$ in. shaft hole drilled right through



The model coming in to land. Note the nose-up attitude obtained with the automatic trimmer.



Just after take-off in a steady climb, for all the world a full-size "Tiger."



Tail up, full throttle, and the model speeds off the tarmac at Eaton Bray.

it. Carve out block to fit snugly over box.

Fit powerful 20 s.w.g. piano wire clips through gear-box and clear wood from side of false nose cavity to accommodate them. Screw on doubled tin catches, then nose should snap on and off with considerable force.

The airscrew shaft should be made complete with driving plate. The bearing for this shaft is a brass bush which is screwed tightly through the centre of an $\frac{1}{8}$ in. thick plywood disc, and a locknut added. *This bush projects forward* and the back of the airscrew is hollowed out to clear it. With the false nose in place and the propeller shaft in its bush, place the disc on the front of the false nose. Add washers until the end of the propeller shaft just touches fork shaft. Cement back of the disc well and, spinning the shaft between the fingers, move disc about until it turns freely with no stiff positions. The false nose can then be shaped up. Leave $\frac{1}{4}$ in. of shaft beyond the airscrew and use plenty of fuse wire: it will need it. Finally fix the locking spring.

Covering, Doping and Colouring.

The fuselage is covered with heavyweight tissue, the wings with medium, and the tail and rudder with lightweight. Waterstretch everything and give two coats of banana oil (half and half). Coloured dope was sprayed on with a Flit spray. The model is in the livery of the Liverpool and District Aero Club and is an early version of moth. Fuselage: all struts and undercarriage—medium chrome; wings, tail and rudder—silver; registration letters—black; rudder bands—top: grass green, middle: gold, bottom: burnt umber (chocolate). Airscrew—silk covering: ocean grey; boss: french polished; L./E. (brass): gold-tarnished green.

Rigging.

Assemble the wings and check dihedral and sweep-back by plan. The struts should be eased to take their natural angle and bound in position. The incidence wires should be cut to length and fitted and then the struts faired. (28 s.w.g. piano wire is used throughout for bracing.) Cut flying wires, fit at strut lugs and form loop at attachment end so that wire is $\frac{1}{8}$ in. too short. A stout thread loop goes through wing to rubber tension band. Cut and fit landing wires in a similar way, $\frac{1}{8}$ in. too short.

The Tailplane.

The adjusting mechanism is well shown on the plan.

Care should be taken that the tail in gliding position is as on plan, and packing under spar added to allow *only* 1 m.m. travel to "power" position. This packing can be cut away and downthrust removed gradually with experience.

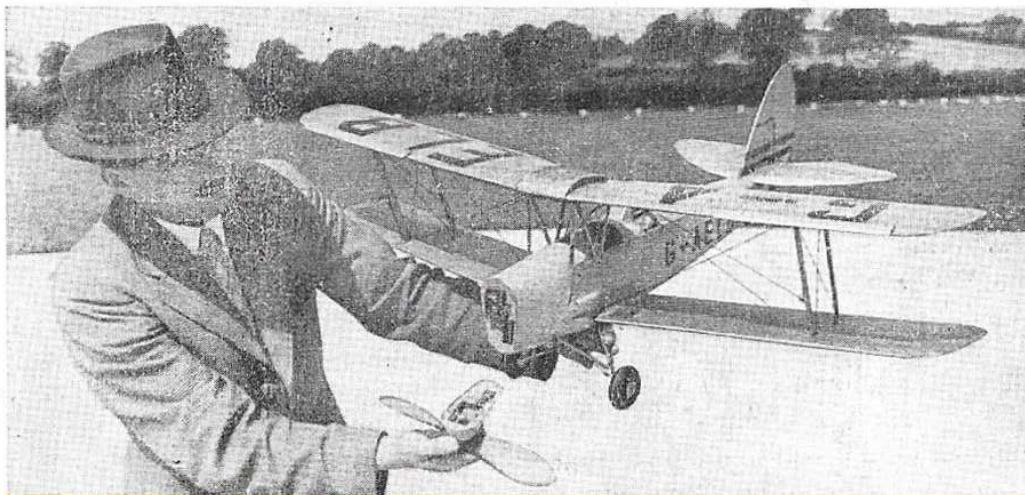
The Rubber and "Moore Diaphragm" (Patented).

To overcome the necessity of ballast, I have evolved a method of installing the rubber so that a greater mass of rubber is in the front half of the motor. This is simply done by fixing a bulkhead or diaphragm, at right-angles to the rubber line, halfway between the front and rear rubber anchorages. In this diaphragm is a circular hole in which is located a circular plug, through the centre of which is a shaft running in a brass bush. This plug is free to dislocate and locate itself when winding and does so without help automatically. A very much overlength motor is divided into two unequal skeins (ratio about two to one), but containing an equal number of strands. These skeins are pre-wound and attached to the plug, the long skein in front and the short behind. The attachment is by means of pig-skin (soaked in castor oil) stitched firmly to the plug shaft ends and similarly to gearbox and tail shackle. When wound and nose block is in place, the plug prevents the short skein pulling the long skein through the diaphragm: hence there is *twice* the weight in *front* of the diaphragm.

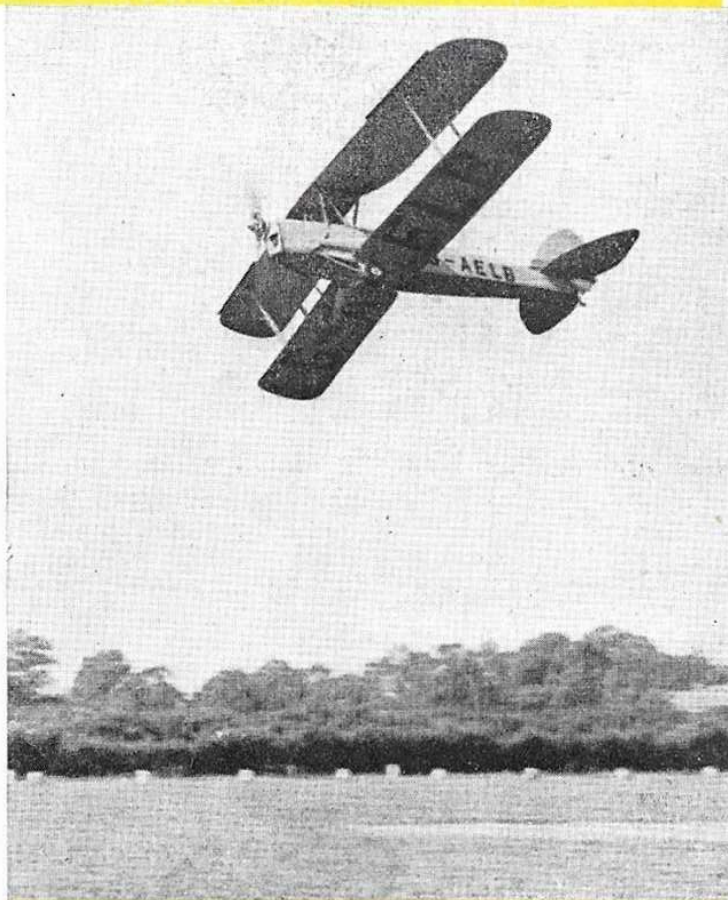
The leather ends prevent all rubber bunching.

Testing.

Check for centre of gravity as plan. (If necessary, temporarily ballast.) Add 1/16 in. packing at top of nose block and give 100 turns. Lift tail and *fly off ground*. Adjust downthrust, adding 50 turns at a time *only*. C.G. can be adjusted finally by adjusting ratios of rubber skein lengths. Full duration tests have been impossible owing to poor quality rubber, but at pre-war rates, allowing 63 per cent. airscrew efficiency and 700 turns, power flight alone should be 700 feet, *i.e.*, 38 to 40 sec.



The designer displays the "innards" of the gearbox.



Now which is it? Your guess is as good as ours.



Compare the two! Only the airscrew betrays the model and incidentally the flying shot above IS the model