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AERO MODELLER



A 1-IN. TO THE FOOT FLYING SCALE HARVARD II

By H. J. TOWNER

This month's flying scale model is contributed by one of the country's leading authorities on the type. It has been thoroughly flight tested, giving an excellent performance, and has proved itself very robust.

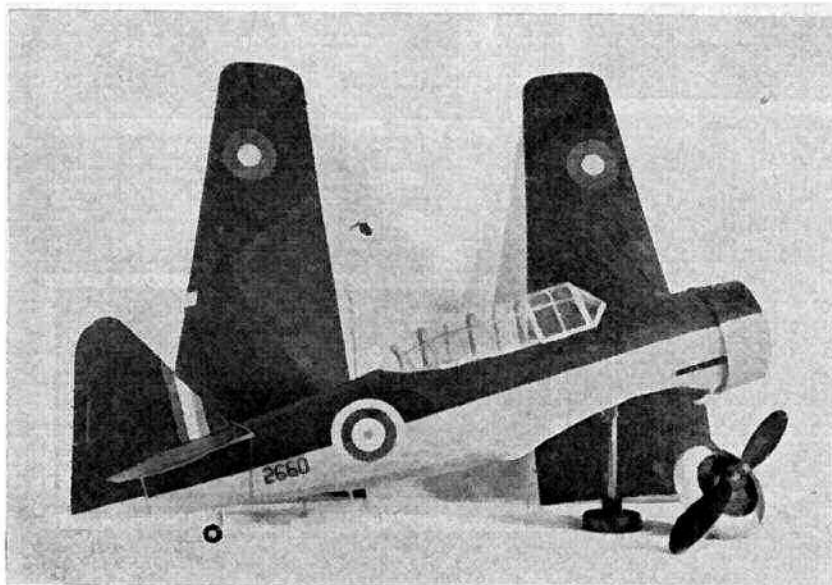
FULL SIZE WORKING DRAWINGS ARE AVAILABLE FROM THE AERO-MODELLER OFFICES, PRICE 5/6 POST FREE.

THE Harvard II is a revised version of the Harvard I designated NA-16-3 by its makers, the North American Aviation Incorporated, and is a two-seater advanced trainer used extensively in this country and Canada and is equipped to accustom the pupil to modern fighter practice.

It is powered with a 600 h.p. Pratt & Whitney Wasp motor and the top speed is in excess of 200 m.p.h.

Bearing this in mind, the builder will expect his model to have a performance on these lines, and consequently the model is sturdily constructed and will stand a tremendous amount of rough handling.

However, to suit all builders there are two versions of this model, the fully detailed type, *i.e.*, with gearbox and retracting undercarriage which of course is heavier and therefore faster, and the simpler type with a straight drive motor and no undercart (this



gives the effect of a retracted undercarriage in flight), each version giving a good account of themselves.

It must be remembered, however, that neither type model can be just thrown into the air, but must be properly flown and their respective performances will be in strict proportion to the ability of the pilot, but naturally the lighter job will give the longer duration.

The only controllable surfaces are the elevators and rudder and these are only controlled by trimming tabs.

The tab on the rudder is to correct any turning tendency in the glide or to make the model circle if desired, while the tabs on the elevators are chiefly to allow for any warping which may occur, most tailplanes being very bad in this respect.

The direction and altitude under power

are controlled by the front portion of the model which carries the propeller. It will be noticed in both the geared and ungeared versions that the crankcase is fitted to the distance piece and is independent of the front, packing pieces being inserted so that this central unit can be set at any desired angle in relation to the centre line of the model. This arrangement remains "put" and does away with the very bad practice of putting in bits of balsa or stalks of grass to give the correct thrust setting.

It will be appreciated that a clearance of about $1/16$ in. must be left between the crankcase and the rest of the front to allow for this movement.

To amplify the drawings on the plan, AA is the front, AC the crankcase, BP the backplate, DP the distance piece, and BB the bearing block.

The gears are assembled on BB, allowing a slight clearance between the teeth and the centres marked on the block, which is drilled and bushed and the gears fitted on their shafts.

DP is now screwed to this block, having previously cut away portions to clear the cup washers on the ends of the "lagshafts."

When all is running free, remove DP and screw the crankcase on to this distance piece ensuring the line up is correct and reassemble. A slight amount of fitting may be necessary to allow for a true running shaft and you will be surprised how very easily the whole assembly will run.

On the original, thin brass gears of $1/16$ in. across the teeth and 34 teeth per wheel were used, which gave quite a scream when revolving under power, and in no small way reproduced the characteristic whine of the prototype.

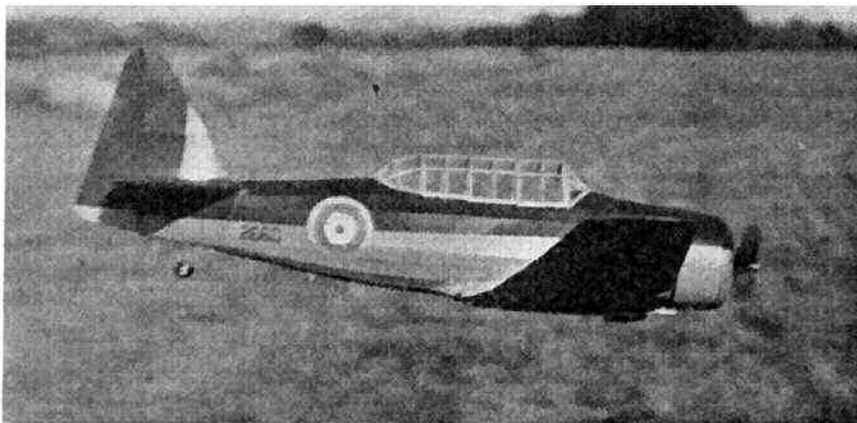
The gears were obtained from the scrapbox of the local watchmaker, who kindly bored out the centres and riveted and sweated bushes about $\frac{1}{4}$ in. long by $\frac{1}{8}$ in. dia., which in turn were soldered to the shafts. The cost was 2s. 6d.

Undercarriage.

As previously mentioned the simpler version of the Harvard has no retracting undercarriage but plug-in legs can be made for display purposes, and, of course, should be omitted for flying.

All landings are on its "tummy," hence there are no such things as "nose overs" and cracked up fins and rudders.

The original model was designed for automatic



retracting undercarriage, but eventually it was decided to cut it out and use a manually operated one instead, as the flying speed is high, and in the event of a landing with the undercarriage down the said undercarriage would be promptly written off besides ripping out a lot of the centre section.

The system used is quite simple if carefully carried out and consists of a crank on each leg connected by a wire 18 g. "link rod" to a gear wheel, so that the rod is on dead centres with the gear in either the up or down position.

Care must be taken to see that the distance travelled by the crank equals the distance between the two dead centres on the gear. A screw forms the shaft of the gear, the head of which is used to rotate the gear and thus lower or raise the undercarriage.

As both wing halves take apart, gears were used which mesh with one another, and should the wing halves separate the gears merely unmesh as each wing half contains its own retracting unit.

However, in practice the wing halves do not separate much owing to the following system of wing fixing.

Wing Fixing.

An arch is formed under the fuselage to house the two centre sections, which are dowelled together with 16 g. wire and suitable brass tubing, the front ends of which are supported by the air scoop carved from solid, which should just pinch the L.E. sufficiently to hold it in place, but also allow it to knock out if necessary.

The T.E. is retained by rubber bands hooked on to the fuselage fairings.

In a real bad crash the rubber bands just snap and the whole wing flies off, and up to the present no damage has ever accrued to either the wing or fuselage.

Wing Construction.

The wheel wells in either model called for a lot of planning to make them simple and although the simpler type has only an external shape, it was decided to build both to a common scheme.

The centre sections are completed with the $\frac{1}{4}$ in. square L.E. on edge inserted through ribs 1 and 2. The fairing in front is then built up by covering the space between ribs 2 and 3, as far back as the main spar, with $1/32$ in. sheet balsa top and bottom.

Then the spaces between ribs 1 and 2 are similarly treated, but with the $1/32$ in. sheet forming part of the wheel well

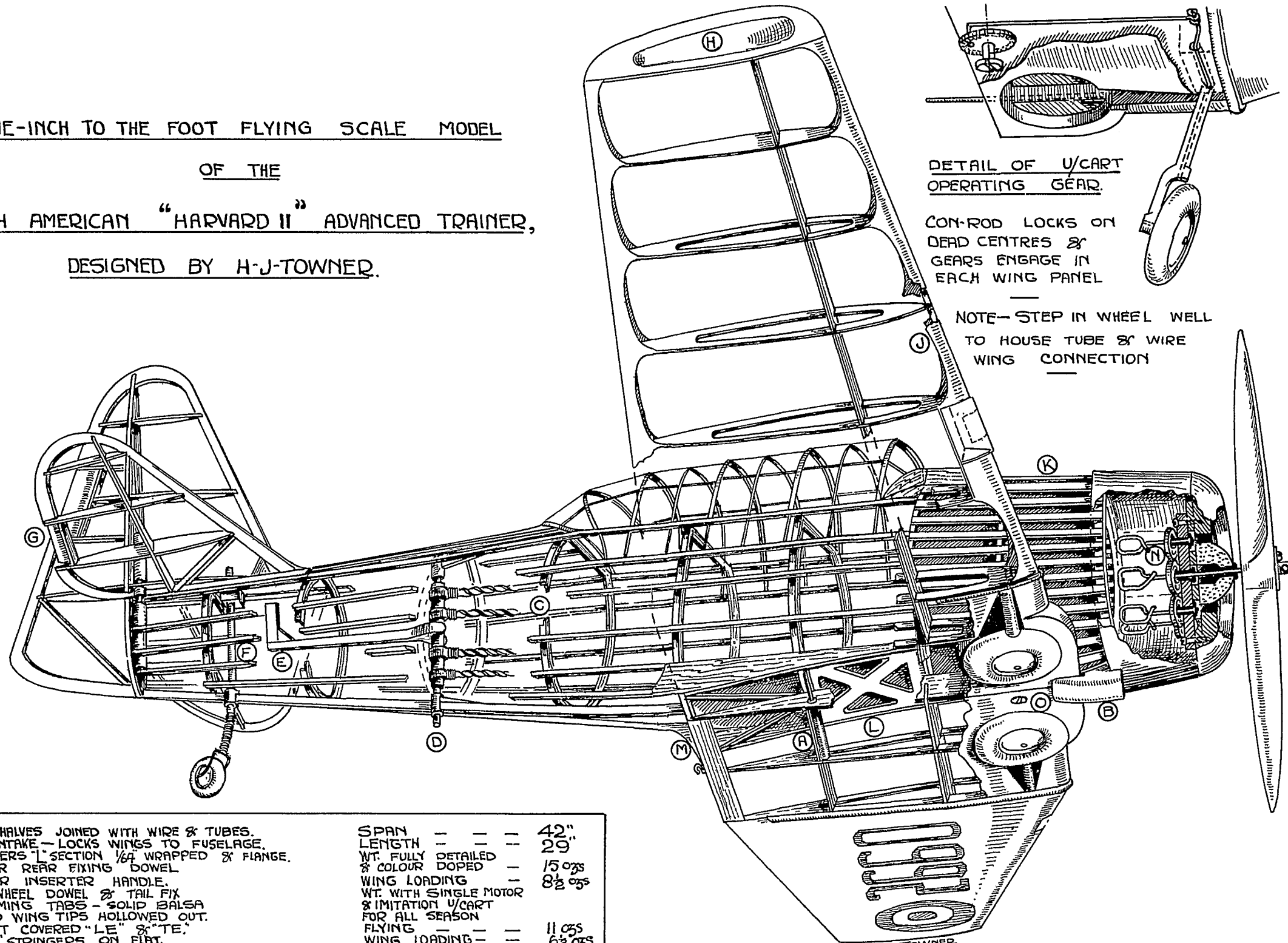


A ONE-INCH TO THE FOOT FLYING SCALE MODEL

OF THE

NORTH AMERICAN "HARVARD II" ADVANCED TRAINER,

DESIGNED BY H-J-TOWNER.



DETAIL OF U/CART
OPERATING GEAR.

CON-ROD LOCKS ON
DEAD CENTRES &
GEARS ENGAGE IN
EACH WING PANEL

NOTE—STEP IN WHEEL WELL
TO HOUSE TUBE & WIRE
WING CONNECTION

A WING HALVES JOINED WITH WIRE & TUBES.
B AIR INTAKE—LOCKS WINGS TO FUSELAGE.
C FORMERS L SECTION 1/64 WRAPPED & FLANGE.
D MOTOR REAR FIXING DOWEL
E MOTOR INSERTER HANDLE.
F TAILWHEEL DOWEL & TAIL FIX
G TRIMMING TABS—SOLID Balsa
H SOLID WING TIPS HOLLOWED OUT.
I SHEET COVERED "LE" & "TE."
J 1/8" x 5" STRINGERS ON FLAT.
K 3 PLY MAIN BRACE ON UNDERSIDE OF FUSELAGE.
L RUBBER BAND HOLDS "TE" TO FUSELAGE.
M GEARBOX ADJUSTABLE FOR SIDE & DOWN THRUST.
N U/CART OPERATING SCREW

SPAN — — — 42"
LENGTH — — — 29"
WT. FULLY DETAILED
& COLOUR DOPED — 15.055
WING LOADING — 82.055
WT. WITH SINGLE MOTOR
& IMITATION U/CART
FOR ALL SEASON
FLYING — — — 11.055
WING LOADING — — 62.055
WING AREA — — — 250.000
POWER WITH 16 STRANDS 3/16" FOR
SINGLE MOTOR WITH 12" PROP
OR 4 STRANDS 3/16" PER MOTOR 10 P

H-J-TOWNER

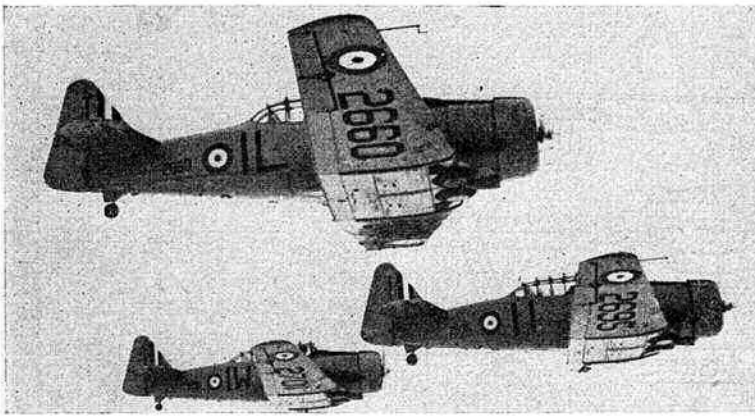


Photo: Fox Photos, Ltd.

which curves over the space between 2 and 3 already covered.

The open space between the top and bottom 1/32 in. covering just added is then filled in with scrap and sanded to shape and a simple wheel shape added on the simpler version to give the correct appearance.

With the detailed version, the top 1/32 in. covering is left to last and the wheel well completed and filled into place when the top covering can be added.

In making the well, a step must be allowed to cover the brass tube or wire fixing, therefore the remaining part of the base or really top, is made of 1/16 in. sheet and the sides built of 1/16 in. sheet in small sections with the grain running vertically.

It is as well to lay out these sections in a length equal to the circumference of the well, neglecting the part where the step occurs and back these segments with a strip of gummed paper or A.R.P. paper. They can then be easily curved round the base and fitted into place.

The correct incidence and dihedral are automatically built into the job, but when spraying the wings or doping, it is as well to give the tips about 3° negative in relation to the main part of the wings by packing up the T.E. at rib 9 while the centre section is held flat.

Fuselage Construction.

The formers of the fuselage follow latest Wakefield practice in that they are wound strips of 1/64 in., 3/16 in. wide. In addition, however, they are wound around an inner former of 1/16 in. flat and when completed make an "L" former. The inner former is made first and then without removing from the board the outer ring is wound on, sticking pins around the outside until the glue is set.

The wood glue is used here as it is supposed that some of the newer hard light woods will be used when, of course, balsa cement will not be of much use, although, of course, if balsa is available so much the better.

Having completed all the formers a longitudinal jig is obtained, say 1 in. by 1/2 in., by a few inches longer than the fuselage. Four pieces of 1/16 in. by 1/2 in. scrap are lightly attached to the formers in such a way that they embrace the jig on all four sides.

Great care must be exercised here to make sure the jig is in the correct position so that all the formers line up properly. No particular size of jig is stipulated but depends upon what size is available so long as it is rigid. The jig section should be carefully drawn on the plan on each former in the correct place as indicated on the drawing, and the former laid on the plan when the jury or temporary four pieces can be lightly cemented into place.

It will be seen that these formers can now be threaded upon the jig whilst former M is pinned to one end. Formers A and A1 need not be treated this way, as the complete cowl can be made separately and added afterwards.

The stringers, all of which are 1/16 in. by 1/2 in., are now added, those between formers B and D are laid flat on their sides about 3/16 in. apart whilst those from D to the rear are on edge. These are then sanded to an even contour and the jig removed when the jury pieces are easily taken out, as the hand can be inserted nearly the length of the fuselage from the front.

The cane for the cabin is either steamed or bent around a hot soldering iron and each end will be seen to go through two rows of stringers.

The celluloid is best fitted by cutting into sections that go right across and adding gummed paper to the edges, similar to passe-partout picture frames.

These sections are then glued into place starting from the rear end, so that each one overlaps the previous one. If desired a strip of 1/32 in. can be inserted between the laps so that the top of each section is distinctly higher than that of the previous one, giving the effect of a sliding cabin top.

Perhaps some ambitious builders will make the sections slide, and as has already been pointed out the model will not nose over, so that the structure should not come to any harm.

An 1/8 in. dowel is used to locate the elevator and rudder to the fuselage whilst a further dowel forward of this holds all in place.

This latter dowel carries the tail wheel and can be used as an alternative rear motor fixing as a fore and aft trimming device.

The forward rear motor fixing consists of a paper tube around which the motors are looped through which a further 1/8 in. dowel is inserted. A further short length of paper tube is fitted to both the top and bottom of the fuselage to anchor the 1/8 in. dowel.

This system is very handy for inserting motors especially if a handle is mounted on the central paper tube.

The power used is the same in either version, that is, the same amount of rubber.

In the simpler type, 16 strands of 1/32 in. rubber 20 in. long drive a 12 in. prop., with a blade width of 1 5/16 in. across its widest part, and a pitch of 16. 400 turns can be comfortably put on to this motor.

The detailed version has four motors of four strands each, 3/16 in. rubber 20 in. long and will take 800 turns, the power being expended through a 10 in. prop., 13 in. pitch and 1 1/2 in. across the widest part of the blades.

As the model has plenty of power and plenty of torque, side thrust is needed and the aircraft should be launched 45° to the right of the eye of the wind. That is to say the wind should tend to turn the model to the right and will counteract some of the torque in the early stages and the model should climb well. Don't be afraid of a little wind—the model likes it.

Well, fellows, build the trainer and train yourselves to fly it like pilots, don't be afraid of it, you can treat it rough.