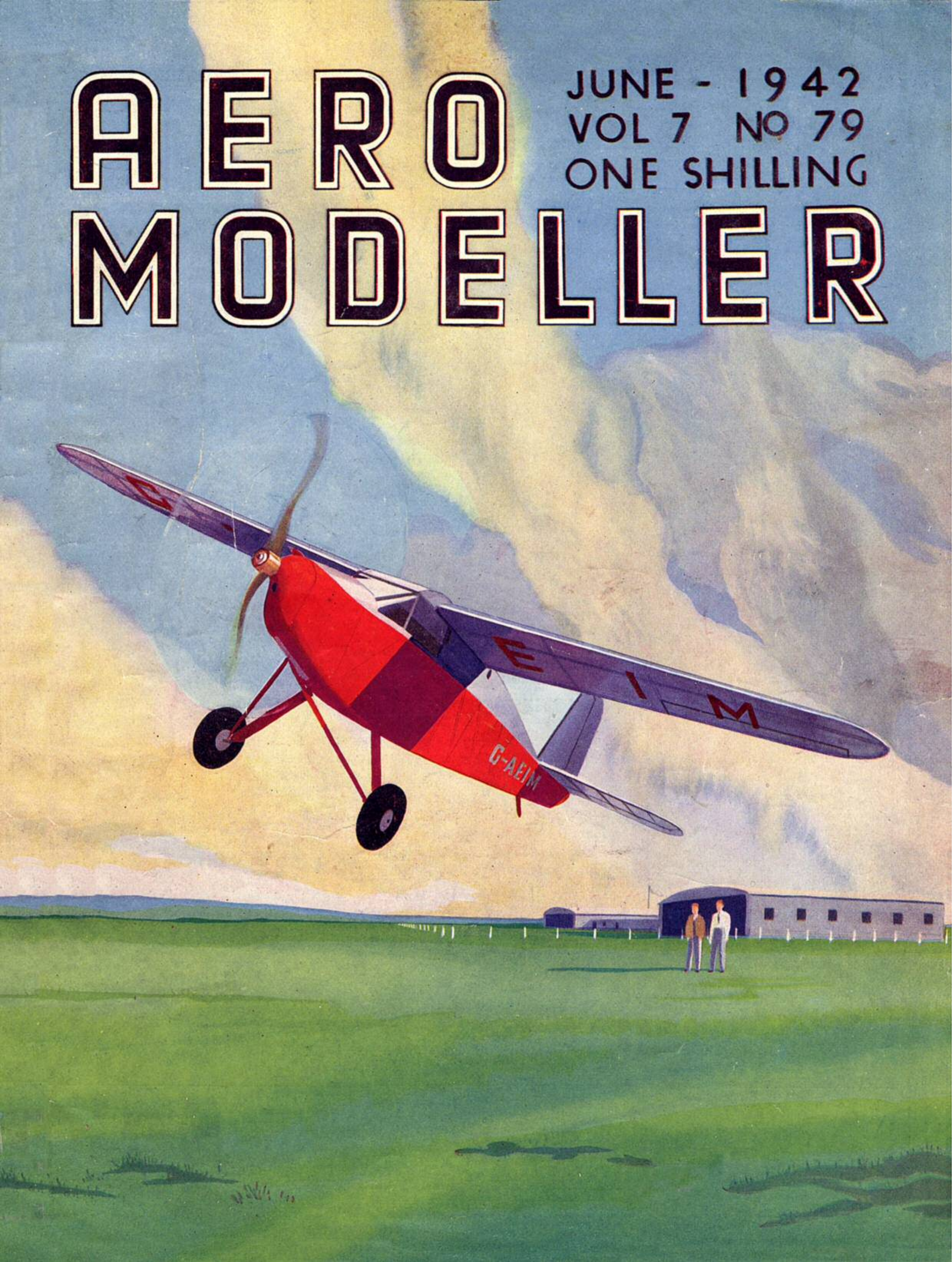
AERO MODELLER

JUNE - 1942
VOL 7 No 79
ONE SHILLING




SKYROVA
HALIFAX · LIBERATOR
BOEING FORTRESS
MANCHESTER · STIRLING
Skyrova kits enable you to build solid scale models of these famous bomber aircraft, and include semi-finished wood fuselage, wings, tailplane, cement, engine nacelles or cowls as required, propellers, coloured transfer insignias and squadron markings, and a very clear plan with perspective drawings and full directions for building.
3/-
Average span 8¾ inches.
MODEL
AIRCRAFT

BEAUFIGHTER 7/11

The Model of Outstanding Performance

C.M.A. I PRICE 7/11

POSTAGE EXTRA

26½ in. Wing Span. Weight 1¾ ozs. Average duration 90 seconds, best flight to date 2½ hours.

SUPER ENDURANCE MODEL

KIT CONTAINS all ribs ready cut, propeller, tissue, cement, dope, rubber lubricant, best quality balsa, fully detailed blue print, etc. etc.

MESSERSCHMITT ME.110 6/11

INSIGNIA Water slide transfers of British and foreign aircraft markings in wide range of sizes.

CAMOUFLAGE DOPES All correct colours in matt finish for British and foreign planes.

MODEL AIRCRAFT TRADE ASSOCIATION

FIRST of a NEW SERIES INTERNATIONAL FIGHTERS

NOW READY.—P.Z.L.-P.24, FOKKER G.1 DOUGLAS D.B.7 (Boston)

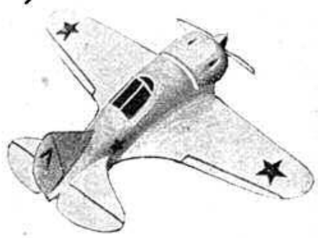
5/3 8/11 8/3

CAPRONI RE. 2000 6/-

SUPER MODEL KITS, SCALE ½ in. 1 ft.

S.E.5.	4/11	WESTLAND LYSANDER	6/-
PFALZ D.12	4/11	CURTISS P.37	6/3
MESSERSCHMITT B.F. 109	4/11	BELL AIRACOBRA ...	6/3
MORANE SAULNIER 405	5/3	BOULTON PAUL DEFIANT	6/9
SUPERMARINE SPITFIRE	5/3	BLACKBURN SKUA ..	6/9
HAWKER HURRICANE..	5/3	BREWSTER BUFFALO ..	6/9
RATA I-16	5/3	BRISTOL BLENHEIM ..	6/11
BRISTOL FIGHTER ..	5/3	MESSERSCHMITT ME. 110	6/11
FAIREY BATTLE	5/6	BEAUFIGHTER	7/11
D. H. DRAGONFLY ..	5/6	LOCKHEED P.38	8/9
CAPRONI RE. 2000	6/-		

POSTAGE EXTRA



RATA I-16 5/3

CHINGFORD MODEL AERODROME

155 STATION ROAD, CHINGFORD, LONDON, E.4 Telephone: SILVERTHORNE 1052

WHOLESALE ONLY

MAKING THE YOUNG AIR-MINDED

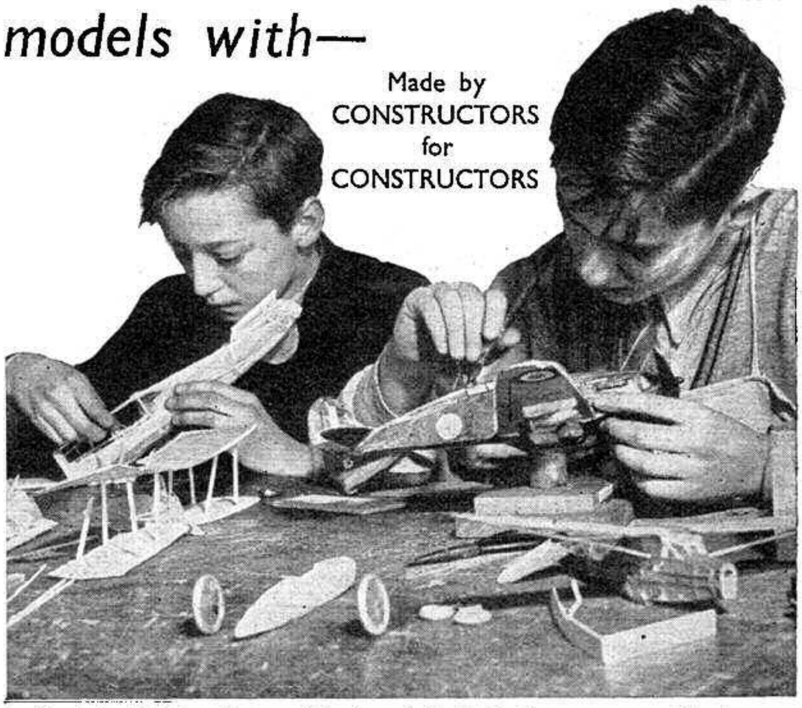
MODEL AIRCRAFT TRADE ASSOCIATION

. . . building better models with—

JOY-PLANE products

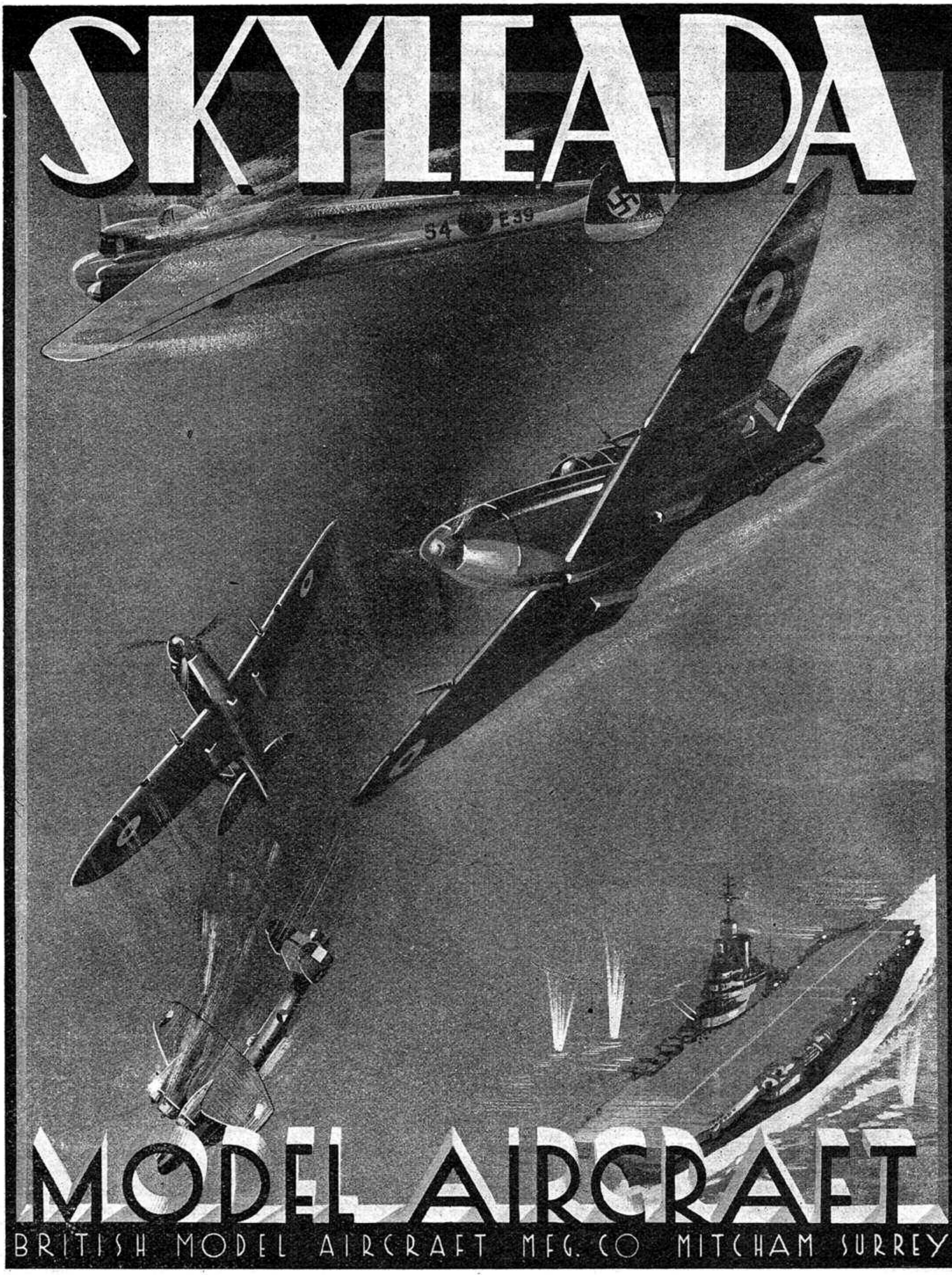
Made by CONSTRUCTORS for CONSTRUCTORS

JOY PLANE BALSA CEMENT ..	4d., 7½d., 1/3
LUMINOUS PAINT — "New Discovery" Brand Bottles, 7½d. Outfits containing Base Coat and Top Coat	1/8, 2/10
JOY PLANE RUBBER LUBRICANT ..	6d., 9d.
JOY PLANE WING DOPE (clear) ..	7½d., 1/2
JOY PLANE WATERPROOF DOPE ..	8d.
JOY PLANE FIELD CEMENT	7½d.
JOY PLANE SILVER & GOLD DOPE ..	9d., 1/3
JOY PLANE BANANA OIL (1) Thick ..	7½d., 1/2
JOY PLANE BANANA OIL (2) Thin ..	7½d., 1/2
JOY PLANE BALSA WOOD GRAIN FILLER.	Jars 8½d.
JOY PLANE COLOURED MODEL DOPES (Opaque colours), including Camouflage Glossy and Matt, black, white, brown, green, grey, pale blue.	4½d., 8½d. 1/3
JOY PLANE TISSUE PASTE..	5d., 9d.
JOY PLANE PLASTIC BALSA WOOD ..	7½d.



In Air Cadet Training Centres, Schools and Hospitals the young men of to-day are becoming more and more Air-minded. Models are being constructed with Joy-Plane Products.

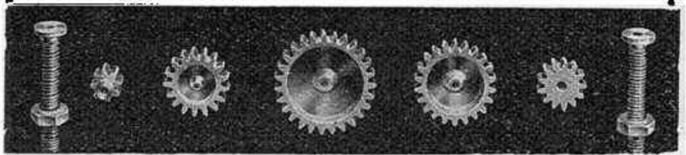
THE TURNBRIDGE MANUFACTURING & SUPPLY Co., Ltd., 52a/62a, Longley Road, London, S.W.17


SKYLEADA
S4 E39
MODEL AIRCRAFT
BRITISH MODEL AIRCRAFT MFG. CO MITCHAM SURREY


MODEL SKYROVA AIRCRAFT
COMPLETE 3/- KIT
SOLID SCALE CONSTRUCTION KITS—
MANCHESTER LIBERATOR
HALIFAX STIRLING &
BOEING FORTRESS
OBTAINABLE FROM YOUR LOCAL DEALER—

GEARS

16 g.	1/4 in.	1/2 in.	3/4 in.	5/8 in.	3/8 in.	16 g.



6d.	7d.	9d.	11d.	10d.	8d.	6d.

Postage extra. No C.O.D.

Cup Washers, 16 g. and 18 g. 4d. per doz.

Bushes 3/8 in. long. All gears drilled 16 s.w.g.

To meet the demand for a range of accurate, precision cut gearwheels, we have secured stocks of brass gears in all the above sizes. To avoid heavy loading stripping the teeth, the thickness is 1/8 in., but undue weight has been avoided by recessing the larger sizes. All gears mesh with each other and any combination of step up and reduction gearing can be built up from this range with the certainty of obtaining smooth and easy running.

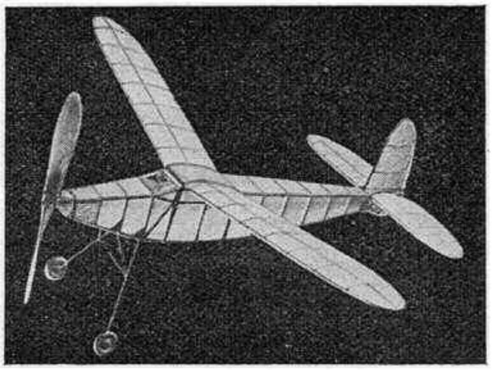
For best results accurate bushes must also be used, and these we can offer drilled to suit 16 s.w.g. shafts.

PLEASE NOTE.—We are unable to undertake the design or construction of gear units, and, while we are always pleased to answer queries, they MUST be accompanied by a stamped addressed envelope.

SUPER SCALE KITS

UPPINGHAM, RUTLAND

BUILD "BRISTOL" BALSAWOOD MODELS



THE "LINNET" KIT

8/6

COMPLETE

Postage 7d. extra.

COMPLETE RANGE OF

"BRISTOL SIMPLEX" KITS

The **BRISTOL PUP**, 21 in. Span, High wing monoplane ..	KIT 5/-
The **BRITISH R.O.G. BIPLANE RECORD HOLDER**, 1937. A 34 in. Cabin plane	KIT 14/6
The **LINNET**, 31 in. Span, High wing monoplane	KIT 8/6
The **BRISTOL** Junior Endurance Model, 18 in. Span ..	KIT 4/-
The **SIMPLEX** Club Model. A 36" Span, High wing monoplane	KIT 10/6
The **SETTER**, 36 in. Span, Low wing monoplane	KIT 12/6

When ordering, please include 7d. extra to cover part cost of postage and packing.

BRISTOL MODEL AERO SUPPLIES
Best Materials And Service

"The Model Airport," 51, Colston St., Bristol 1

Please enclose stamped addressed envelope with any enquiries.

TO

Solid Model Enthusiasts

Send Stamped Addressed Envelope for LIST of WHEELS, CELLULOID COCKPIT COVERS, INSIGNIAS, PAINTS, BANANA OILS, Etc., Etc.

THE MODEL SHOP

2 COLLEGE ROAD, BARRAS BRIDGE
NEWCASTLE-ON-TYNE

M.S.S. OFFER
THE FOUR ACES
FOR
FLYING MODEL "ACES"

M.S.S. "LYNX"

M. S. S. COMPLETE KITS

"LYNX"	40½ in. Span	18/6
"LYNX CUB"	30 in. Span	12/6
"PANDA"	38 in. Span	16/-
"GREYHOUND"	22 in. Span	6/-

All above, postage 7d. extra

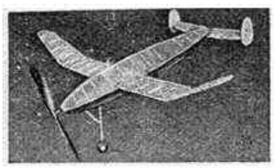
ALL BEST MAKES OF KITS STOCKED

"SKYLEADA" "SKYROVA" "KEILKRAFT" "TOWER" "BRITANNIA" "ASTRAL," Etc.

2½d. stamp for complete lists

New "Balsa" substitute woods and all materials in plenty. The best of everything for flying and solid enthusiasts.

Always obtainable at M.S.S.



M.S.S "PANDA"

MODEL SUPPLY STORES

17 Brazennose St., MANCHESTER 2

Also at 6 Kirkhams Bury Old Rd., Prestwich, Lancs.

ATTACK THE PROBLEM IN A PRACTICAL WAY

AIR CADETS, AIR SCOUTS and all classes of Aeronautical Students, you can study the theory and practice of mechanical flight in a fascinating way if you build and fly a PREMIER PEDIGREE MODEL

The "NORTHERN ARROW" was designed by the 1939 Northern Heights Gala Champion, Mr. Ivor Hall, who won the trophy offered by "The Aero-Modeller" for the championship.

Here is the latest tribute to his ability as a designer :—

Dear Sir, *Oxon., 30–4–42*

I wish to congratulate you for producing such a fine kit as the Northern Arrow at the modest price of 18/6

I found plenty of all materials in the kit and was very pleased with the smart and robust plane which it built.

I tested my Northern Arrow on the 29–3–42, and very little trimming was needed before she was clocking 1½ mins. consistently. I then put 700 turns on the motor, and the plane climbed rapidly and disappeared into a cloud after 7 mins., 1½ secs., this setting up a new H.L. record for the Witney & District M.A.C. The model came into sight again after approx. 1 min., still very high. After being in the air for well over 10 mins., the machine made a perfect landing a mile away from launching point.

Again congratulating you, *Yours truly, F. Humphris.*

Thank you, Mr. Humphris, for making such a sound job of it.

THE NORTHERN ARROW 18/6

Proved Average Duration 2½ minutes R.O.G.
Includes 16" dia. Duration Airscrew.
Blue print only 3/4 Post paid.

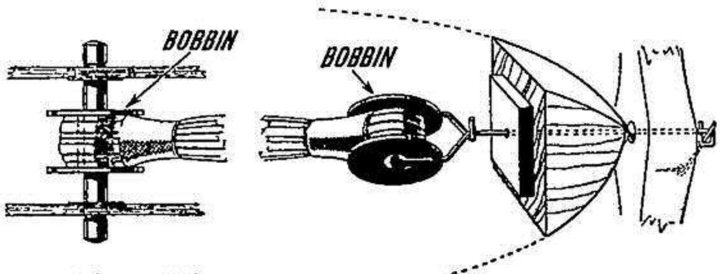
Fully described in "Models for Flying" by Rippon & Sparey.

Span 40" Length 33½"
Weight 4½ ozs.

NURSE YOUR RUBBER!

NO RUBBER WILL BE WASTED, or cut on the hooks, or creep over the hooks and shafts, or bunch in the fuselage, or rattle and be unstable—if you adopt our

PREMIER "RUN-TRUE" BOBBINS



PLAN VIEW of REAR FIXING

"BABY" SIZE for 1/32", 1/16", 1/8" wide Elastic Motors,	1½d. each.	Shafts	20 SWG.	1½d. each.
"MINOR" " " 1/8", 3/16" " " "	2d. "	"	18 "	2d. "
"MAJOR" " " 3/16", 1/4" " " "	2d. "	"	18 or 16 "	2d. "
"STANDARD" POWERFUL 1/4" " " "	2½d. "	"	18 or 16 "	2½d. "
"LITTLE GIANTS" " 1/4" " " "	3d. "	"	16 "	2½d. "

PREMIER "RUN-TRUE" BOBBINS are featured and specified by many well-known designers. Among famous users of "RUN-TRUE" Bobbins may be numbered Dick Korda, Bob Copland, Frank Zaic, Ivor Hall and many others.

SEND FOR WAR-TIME PRICE LIST, 3d. POST PAID.

PREMIER AEROMODEL SUPPLIES,
2a Hornsey Rise, LONDON, N.19.
PHONE: ARC 2376

SLICK

MODEL AIRCRAFT PRODUCTS

A FIRST-CLASS MATERIAL—FOR A FIRST-CLASS JOB
Approved by all the Leading Model Constructors.

NEW SELLING PRICES

Manufacturers to the Trade only.

CLEAR FABRIC DOPE for wings (has extraordinary tightening properties) in 7½d. and 1/2 size tins

COLOURED DOPE for wings and fuselage in 7½d. and 1/2 size tins

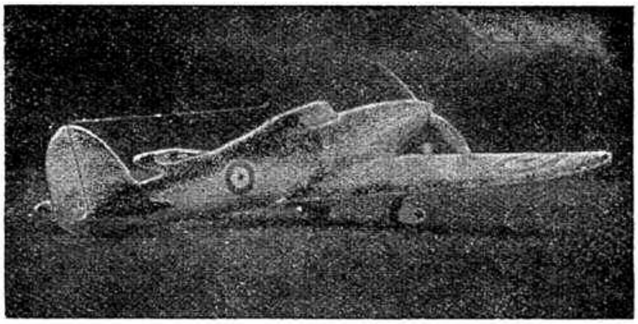
SILVER DOPE, in 7½d. and 1/2 size tins

CAMOUFLAGE DOPE, brown and green, in 7½d. size tins

BALSA PLASTIC WOOD, in 7½d. and 1/2 size tubes

Thoroughly Tested

Highly Recommended



HIGH-GLOSS WATERPROOF FINISHING DOPE
in 7½d. and 1/2 size bottles

SPECIAL QUOTATIONS TO BULK BUYERS
also
MANUFACTURERS OF SMALL SIZES FOR USE IN KIT PACKS

Write and ask for full particulars and best Export terms

Liberal discount to the Trade.

BANANA OIL No. 1, thick, in 7½d. and 1/2 size bottles

BANANA OIL No. 2, thin, in 7½d. and 1/2 size bottles

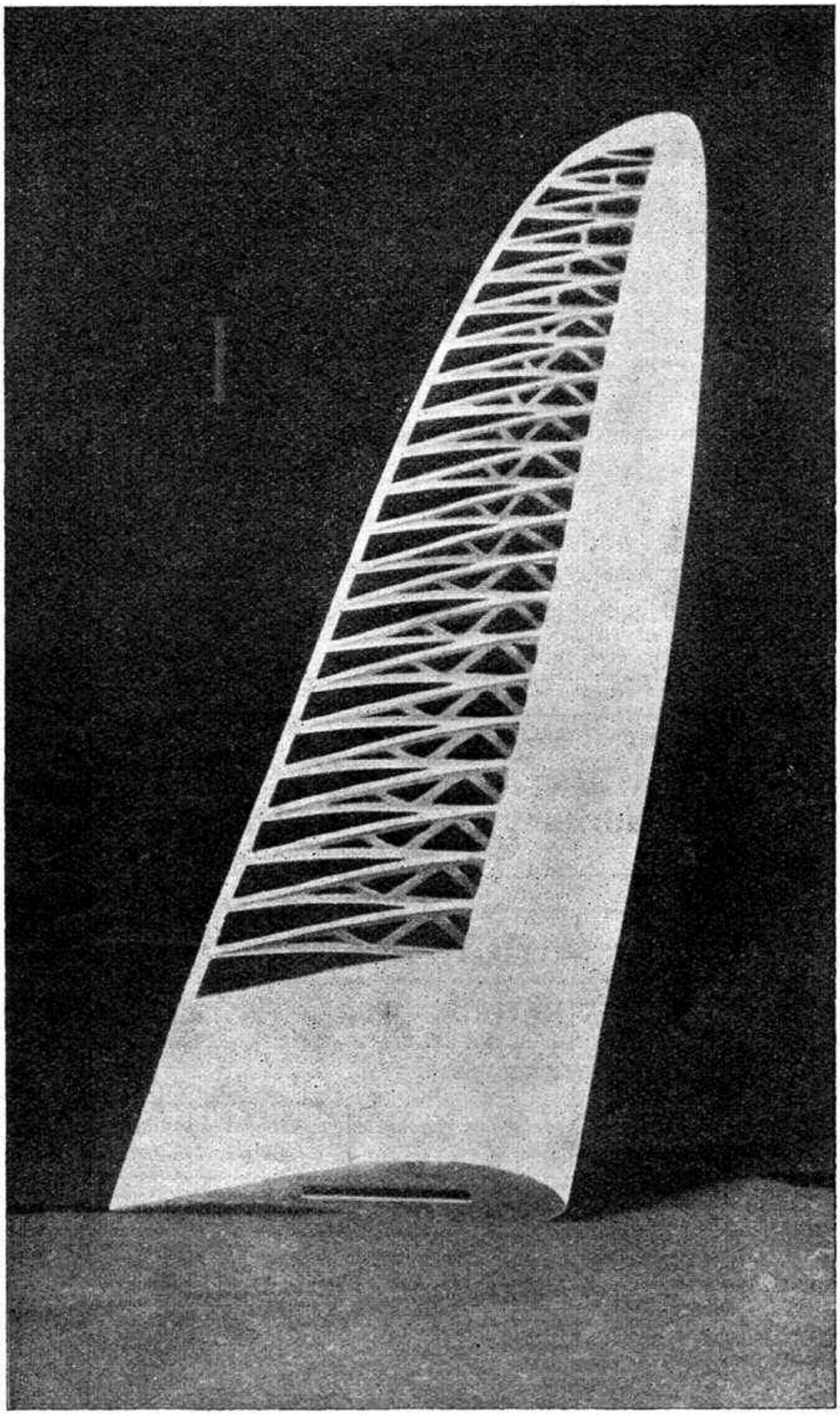
BALSA WOOD CEMENT (both ordinary and field drying) in 4d. and 7½d. size tubes

RUBBER LUBRICANT, in 4d. and 7½d. size tubes

SPECIAL ADHESIVE PASTE, in large 4d. tubes

MATA
MODEL AIRCRAFT TRADE ASSOCIATION

Manufactured by :— **SLICK BRANDS LTD.,** Waddon, Croydon, SURREY



NO BALSA IN THIS WING!

An excellent example of a well-designed glider wing panel by L. G. Temple, in which all hard-wood construction is employed, even to the sheet covering.

The semi-span is 40.375 ins., and area 75 sq. ins. Weight 5.6 ounces uncovered and 6.75 ounces covered with heavy silk, with four coats of dope and two of varnish. Following full-size construction this wing is amazingly strong and has a shear value of 6,800 lbs. per sq. inch. The section is Gottingen 535.

CONTENTS OF THIS ISSUE

THE AERO MODELLER

Established in 1936

(INCORPORATING "THE MODEL AEROPLANE CONSTRUCTOR")

(Proprietors : Model Aeronautical Press, Ltd.)

THE MODEL AERONAUTICAL JOURNAL OF THE BRITISH EMPIRE

Managing Editor : D. A. Russell, A.M.I.Mech.E. *Editor :* C. S. Rushbrooke

Vol. VII - No. 79 JUNE, 1942

ALLEN HOUSE, NEWARKE ST., LEICESTER

EDITORIAL

FEATURED on our front cover this month is " Jackdaw II," a 1/12 scale semi-scale two-three seater 'plane weighing 5½–6 ounces. Wing area is 1 square foot, and flights up to 2 minutes duration may be obtained *without* the aid of thermals.

This 'plane has been designed and constructed by Mr. C. R. Moore, with a view to placing in the hands of aero-modellers a scale type of model of good performance, built entirely *without* balsa. The model has a geared up motor, driving a hardwood airscrew.

Full-size scale plans, of which a 2/5 reduction appears on pages 256–7 of this issue, are available price 2s. post free, through the Aero-Modeller Plans Service.

Particulars of an interesting competition in connection with " Jackdaw II," together with full building instructions, are on page 246–7.

American Aero-modellers go to War.

A fair amount of news has recently reached us of American activities in the world of aero-modelling, and in our next issue we shall present a summary showing what has been achieved since that country joined the United Nations. For the moment we will only say that the news is *good*, and that the American Powers-That-Be have been quick to realise the value of aero-modelling in the training of the youth of the country, and to make use of the ability and knowledge stored in the hands and minds of many hundreds of thousands of American aero-modellers.

Would that we could record the same spirit in all parts of *this* country ! Alas, we still become aware of black spots. Such a one, apparently, is the town of Bury. From the Hon. Sec. of the M.A.C. for that Town and District, we hear that the Club has received little assistance from the Director of Education, who, so the Hon. Sec. says, described aero-modelling as " playing with toys," and advised the members to spend their time more usefully ! ! !

Apparently the Club has to pay the corporation a rent of 5s. per week (from weekly funds of 7s. per week), for the use of a clubroom, seemingly so small that " as it would not accommodate the local A.T.C. for a lecture," the Club was regarded as not capable of helping the A.T.C.

Space prevents our commenting in greater detail on this regrettable state of affairs, other than to offer to pay the return travelling expenses of the said Director of Education to visit the Eastbourne Youth Centre, and there see the work being carried out by the organisers who have the full support of the Corporation and Education Authorities.

The " Whirlwind."

We would remind readers that all 1/72 scale plans appearing in The Aero-Modeller are available in loose-leaf form through the " Plans Service," price 6d. each ; or 3s. per dozen (assorted), in each case post free.

Thus readers who wish to retain intact their copies of The Aero-Modeller may obtain the plans separately. We have anticipated a large demand for plans of the Whirlwind, and have good stocks of plans ready for immediate despatch.

Subscriptions.

As a number of readers appear to have difficulty in obtaining copies of The Aero-Modeller when residing in " out-of-the-way-parts," we would remind them that a subscription of 15s., prepaid, enables them to have their copies sent direct from the printers each month. The 15s. includes postage, and the Double Xmas Number, and covers 12 consecutive issues, and may be started at any time.

Miniature Accumulators.

Considerable interest has of late been shown in miniature accumulators, and publication in the April issue of our summary on the position has called forth the undernoted letter from our contributor of " Petrol Topics," Dr. J. F. P. Forster.

In regard to the first paragraph of the Dr.'s letter, we feel bound to point out that we are *not* possessed of the powers of television, and cannot reasonably be expected to know who does actually make the many hundreds of gadgets which are from time to time placed before us.

The summary we published was based on the knowledge available to us, and had Dr. Forster mentioned, in one of the several articles we have published under his name, the man who had built his accumulators, we should certainly have referred to the originator once again.

D. A. R.

Dear Sir,

Whoever wrote the unsigned article headed " Small Accumulators " in the April issue of The Aero Modeller appears to be under a misapprehension or blatantly ignores the credit due to the real maker and designer of Lt.-Col. Bowden's miniature accumulators illustrated therein.

In justice to the maker, who, though a very busy man, made time and went to much trouble to produce an experimental accumulator of the weight and dimensions specified by me, I feel bound to beg a little of your valuable space to put on record the actual facts of the case which led up to the later unspillable models, so misleadingly represented in the article as being " some designs of Lt.-Col. Bowden's."

Col. Bowden's own subsequent article in the May issue certainly goes some of the way towards correcting any impression that these accumulators were of his own design, but in omitting any mention of the actual maker, he unfortunately gives me perhaps more credit than I deserve !

The first model, based on my own crude efforts, and filled with liquid acid, was designed upright, chiefly because this shape fitted the battery recess in my Flying-Boats, on which I had had troubles with dry batteries becoming damp. This model proved that the idea was definitely practicable, and best of all, would stand up to " flash charging " direct from a 6 volt booster, and was commented on and illustrated in " Petrol Topics," October, 1940.

As a result of the excellent *electrical* results obtained, I then badgered my friend, Mr. Brian Kille, Radio and Electrical Engineer, of Minehead, to produce an improved flat version, to be packed with glass wool, or otherwise made unspillable. Having decided that jelly electrolyte would not allow of my unorthodox "flash charging," he thereupon produced the 4½ oz. model and at the same time very kindly made me a present of an even smaller replica weighing only 2½ ozs., both of which proved entirely unspillable, and as an added precaution against gassing spray seeping round the sides, and damage to the terminals and inter-cell connections, he sank the top below the level of the sides, leaving a safety well to catch any acid if it did escape, though in practice it does not.

I was so pleased with these models that I ordered an extra one and gave it to Lt.-Col. Bowden; on seeing my 2½ oz. baby, he was sufficiently impressed promptly to tackle my long-suffering friend, Mr. Kille, and persuade him to make another for himself, and his article shows that he is as satisfied as I with these miniatures in action.

I should be most grateful if, in justice to Mr. Kille, you would find space to publish this letter in the June Aero Modeller.

I am, Sir,
Yours faithfully,
JOHN F. P. FORSTER.

We don't know whether Falconry is an art taught officially in the A.T.C., but anyway, this seemed an appropriate photograph to face the article commencing on the opposite page. The photo was taken at the London Zoo.

MICROFILM and its attendant difficulties has also appeared in Hungary and they have developed a new form of frame for lifting this elusive substance off water. This frame consists of two short lengths of wood connected together by strips of silk or similar material. This forms in effect a frame with flexible sides. It is placed on the prepared microfilm in the conventional manner and the excess film turned over it. The film is then raised from the water by lifting one of the wood pieces upwards—the silk sides are thus pulled gently off the surface of the water with but little strain upon the film itself.

BROKEN propellors form quite a fair part of the petrol modellers "junk box" and one ingenious American has reported a novel use for them—they make admirable shoe-horns!

ARGENTINE modellers are experimenting with an air turbine as a source of motive power for model aeroplanes. Apparently the scheme consists of blowing a stream of air out from the rear of the fuselage, giving in effect a form of rocket propulsion. Similar schemes were being considered in this country prior to the war but no outstanding results have as yet been achieved.

THE Baltimore Aero-Craftsmen boast a complete model airport with wind sock, weather vane and anemometer to measure wind direction and strength as well as a loudspeaker system for controlling the crowds and advising fliers of competitions and whereabouts of lost models. This latter unit is housed in a "control tower."

THE dihedralled tailplane with no vertical fin at one time achieved a certain amount of popularity and was even used on some full-size types, notably the Stanley sailplane. One American modeller has recently re-introduced this feature on a new machine in which the tailplane is given a large *negative* dihedral angle. The same principles as before apply as regard stability but the two tips of the inverted tail unit form skids for take off purposes and thus go well with a monowheel undercarriage. The arrangement does not *look* stable although apparently the model has flown well.

LIGHTWEIGHT dry cells are available in America for the petrol enthusiast. The smallest of these is suitable for the class A engines and weighs only ½ ounce. A complete range is available covering all classes of engines and all are characterised by a considerable saving in weight over the normal flash lamp batteries usually employed.

A CONTINENTAL authority advised the use of from one to four degrees washout on a tapered wing and from nought to three degrees washout on a wing that has tapered outboard panels as covering all stability problems, particularly in the case of gliders. This effect, of course, will be more pronounced on wings of high aspect ratio.

AIRFOIL sections used by the Continental fliers are usually chosen from Clark Y, R.A.F. 32, M-6. or N.A.C.A. 6412 with the Gottingen sections preferred for gliders.

The first, second, and fourth named sections are fully described in "Airfoil Sections for the Aero-modeller," by R. H. Warring, price 2s. Gottingen 387, 398, 413, 426, 436, 532, and 602, are also fully described in this book, which may be obtained from any model shop or bookseller, or direct from the publishers at Allen House, Newarke Street, Leicester, price 2s. 2d. post free.

THE solution to the transport problem of models has been solved by one American aero-modeller who has fitted a model hangar to the roof of his car. This is quite realistic in appearance—if not in position!—and every provision is made for the safety of its contents. The whole is mounted on soft rubber pads to minimise vibration.

THE marathon flier who absolutely refused to lose his model! He was chasing it across country when it flew over a river so he removed his trousers and shoes and swam across after it. He then continued the chase across a cornfield clad only in his underwear and a shirt!

IN recognition of the importance of the youth of America with regard to the country's future the Air Youth of America recently announced the award of scholarships at the Boeing School of Aeronautics for a number of successful aero-modellers. In this way they hope to pick from amongst the thousands of model builders a number of enthusiasts who, with a technical training, will provide the backbone of the future aviation industry.

BIRDS

THE MODEL AIRCRAFT

By
F. W. LANE

The adjacent photograph shows a gannet in flight. Ample stability is afforded in this attitude by the generous dihedral angle.

Photo by courtesy of Royal Aeronautical Soc

"There is no doubt that bird flight has in the past acted as a great stimulant. Almost without exception, the early pioneers have paid tributes to the knowledge they have gained in this way." J. L. Nayler, F.R.Ae.S., Secretary of the Aeronautical Research Committee.

"At the beginning of his association with aeronautics, Handley-Page believed that designers must follow the principles of bird flight. He believed that inherent stability must be obtained by designing aeroplane wings to resemble those of a bird." Quotation from "Wonders of World Aviation" (1938).

FROM the above quotations it will be evident that the study of bird flight has long been recognised as having an important bearing upon aeronautics and aeroplane design and performance. This is not surprising when it is realised that birds have had millions of years of flying-time experience in comparison with which man has been flying for but a few ticks of the astronomical clock.

Bird flight has been studied from several aspects: by the scientific ornithologist, keen to probe the mechanism of the "way of a bird in the air"; by the amateur naturalist, enthralled by the sheer beauty of living wings cleaving the sky; by the nature photographer and cinematographer, intrigued by the difficulties and lured on by the rewards of capturing for permanent record the flying technique of birds; and by the aeronautical scientist who seeks to apply to man's comparatively clumsy attempts to fly, the lessons he may learn from some of the flying masterpieces of Nature. The results obtained by all four types of investigators are necessary for a full understanding of bird flight and its relation to aeronautical science.

One of the methods used by a German worker to study bird flight more closely and carefully than was possible by other means will, I think, be of special interest to aero-modellers. He made models which simulated the beating wings of birds and which took off and flew in a similar manner to birds. The motive power was supplied by rubber. By adjustments to the model it was possible to alter at will the amplitude of the beat, the warping of the surface along the span, distribution of forces during the phase of a beat and the adjustment of the ratio of forces between the up and down stroke.

These models of flying birds could easily be started from ground level and climb at an angle of over forty-five degrees. Many of the models even hovered temporarily in one spot. The models varied in span between a few inches to over six feet. They flew from twenty to sixty seconds, the power flight being followed by a glide.

It might be thought at first glance that the fact of aeroplanes using a propeller to drive them through the air while birds use flapping wings largely renders valueless analogies between the two. But a moment's reflection will show that such is not the case. Quite a number of soaring and gliding birds seldom flap their wings at all, and many other birds keep their wings stationary for periods during flight. And with all birds the wings act not only as a propeller to give the bird forward thrust but as supporting surfaces as well.

The maker of the model writes: "A differential gear prevents the lessening tension of the rubber motor in the course of the wing-beat from affecting the motion of flight; the wing-beats can be carried out, as we desire, with force that remains constant, or that increases or lessens, either suddenly or gradually." Perhaps an even more ambitious model was that of a dragonfly with its four wings. Strangely enough, however, the German worker did not find such a model difficult to make. He writes: "It is much easier to reproduce dragonfly flight than bird flight by means of models. The relatively slow frequency of beat of the models which we have hitherto built (span not less than 30 cm.) obviously requires, as an additional compensating moment (sic), the adoption of a tail plane. This turning moment can be very much lessened by giving the wing a marked sweepback. In this case, stable flight is quite possible (if the beat frequency is not too low) even without an additional surface, as with the dragonfly itself."

Incidentally, it is of interest to note that the wings of practically all flying birds do actually take on, in greater or less degree, the action of a propeller. It is quite wrong to imagine that all birds (and insects, too) merely beat their wings up and down like a pair of cabbage leaves flapped from either side of their stalk. High-speed photographs and films have clearly demonstrated that the action is something like that of a figure 8 or, to use another analogy, the wings act somewhat similarly to the oars used by a man in rowing a boat.

A formation of Fairey Battles of the Belgian Army Air Force. Compare this photograph with the one opposite of a gaggle of geese in flight.

Photo by courtesy of "Flight."

In a pigeon, for example, the wings come well in front of the head to "collect" air and then they throw it off behind. Judging from the results achieved by the use of an apparatus in France, it appears that the wings of the faster-flying birds utilize air drawn not only from the sides but also from other directions. The apparatus consisted of a glass tunnel into which jets of tobacco smoke had been introduced, and cinematograph apparatus which would record the movement of the smoke in various directions. It would be interesting to compare the air-flow round the blades of a propeller with that round the wings of a bird. I shouldn't be surprised if the bird's wing was much more efficient from an aerodynamic point of view.

In passing, there appears to be an unusual parallel between a propeller and certain birds' wings in the ease with which both are damaged when they strike an object. In the case of propellers this is, of course, well-known. According to Major C. E. Radclyffe, falcons, swallows and swifts (all first-class flyers with high aspect-ratio wings) break or damage their wings if they strike a twig or, as has happened occasionally, if they collide with a trout rod!

A well-known student of aeronautics, who is also very keen on the study of bird flight as applied to aeroplanes, has told me he thought birds would be even more efficient flyers than they are if they did actually use propellers instead of wings as a propulsive force. Such a belief finds support from the fact that the humming-bird, which has the greatest control in the air, beats its wings, more than any other bird, in a manner allied to the action of a propeller.

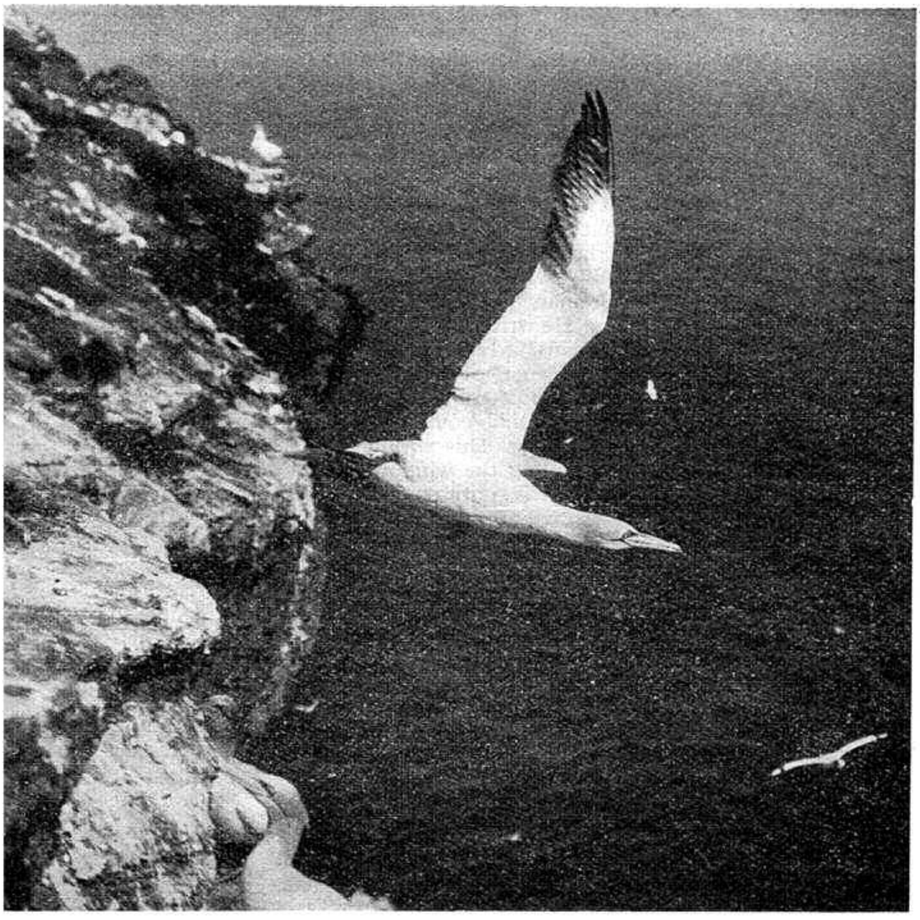
High-speed cinematograph films of humming-birds in flight have been taken at the rate of 500 pictures per second with an exposure-time for each one of 1/100,000th of a second. When these films have been projected on the screen, thereby "slowing down" the action of the birds' wings and thus enabling them to be studied in detail, it was found that on each downward or backward stroke the wings turn completely over so that they are actually upside down.

It has been suggested that this remarkable twisting of the wing may be like the action of a variable pitch propeller and may explain how the humming-bird can fly backwards. Does it also throw a light on that other aerodynamical miracle which the humming-bird is able to perform—sideways flight?

Before dealing in detail with the wing shape and structure of birds let us look at the material with which the wing is made. The framework is composed of the cellular bones which all flying birds possess. This structure effects the compromise between the desired ends of lightness and strength. Such bones are hard but have hollow shafts and are not filled with marrow but with a kind of sponge bone. Where strength is especially needed bones are fused together.

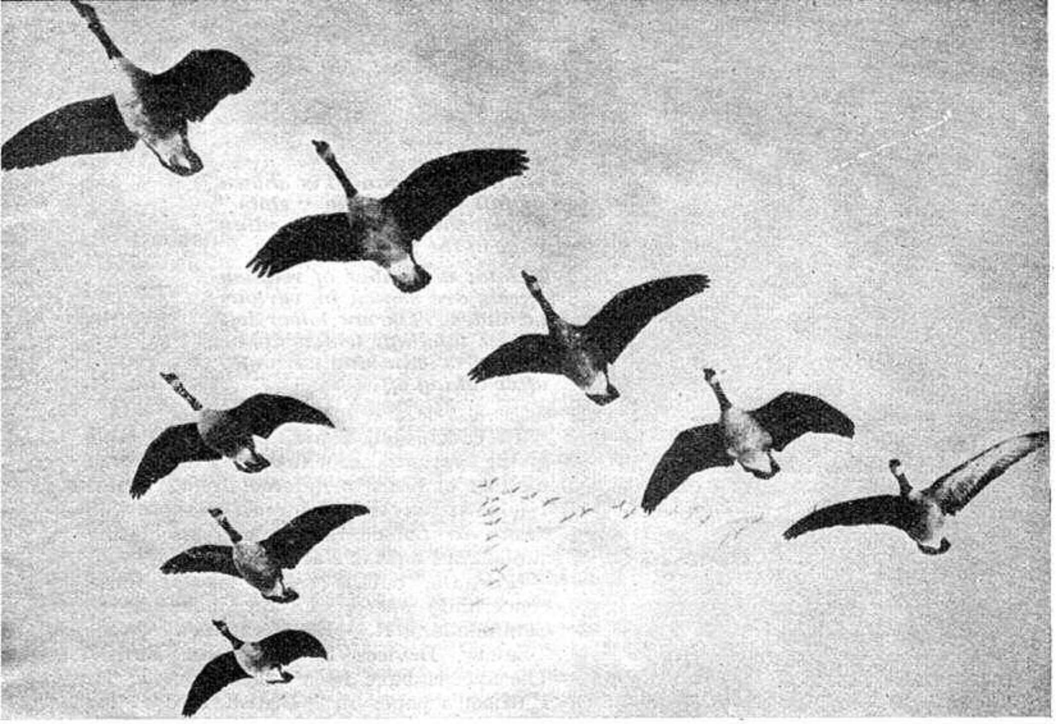
Writing of the wing of a bird, J. L. Nayler, the Secretary of the Aeronautical Research Committee says: "The strongest and lightest known covering is provided by the feathers." A bird's feather is certainly a wonderful structure. The following description is taken from Gordon Aymar's fine book, "Bird Flight," a book which I commend to all who wish to study further the subject of flight in Nature.

"The perfect adaptation of a feather to its function is easy to demonstrate. Examine one of the primaries of a pigeon, for example. It can be bent double on its shaft—elasticity sufficient to withstand the average blows to which it may be subjected and to flex with air pressure to avoid creating unfavourable eddies. Its lightness is proverbial. Its shaft is curved to fit into the pattern of the whole wing with a subtlety only possible in something which Nature has grown. If it is held between the fingers and swung through the air edge-wise its resistance is



Another shot of a gannet, this time just after taking off. The feathered slots at the wing tips are closed in this case.

Photo by courtesy of Royal Aeronautical Society.



Geese flying in "Vic" formation. Note the almost perfect positioning of each bird. Since they have flown like this from time immemorial it can be said that once again man has mimicked nature.

Photo by courtesy of Royal Aeronautical Society.

the wing of an aeroplane. The swiftest flying birds have wings which are beautifully adapted for mastery of the air. Streamlined, with a high aspect ratio and with little camber, they are ideal for swift movement through air.

The strong bony keel near the front margin of the wing causes it, during the downward stroke, to "feather" itself and cut the air edge-on. The air is thus glanced in the required direction. The tail, too, plays its part in aerial manœuvres. In fact in some birds it appears to play the part of Fowler flaps. This is particularly the case in that marvellous flyer, the frigate bird.

Perfect muscular control (it has been estimated that a goose has 12,000 muscles to control the action of its feathers alone !) enables a bird to raise, lower, spread or alter the shape of its tail. It is used both as a balancer and rudder, aids in the difficult process of hovering and helps to tail off the air-stream.

Dead birds with their wings stretched out have been tested in wind tunnels. It has been found that their maximum lift-over-drag ratio is of the order of four or five to one, which is very much lower than that of an aeroplane. Figures of greater efficiency have, however, been quoted. Idrac, for example, made careful observations off the West coast of Africa when birds were just able to glide without flapping. He estimated a L/D of as much as seventeen to one.

Some experiments in Russia have demonstrated that birds' wings are enormously strong. Wings were put in a vice and weights attached to the ends of them until they were destroyed. When a wing of a white grouse was thus tested it was found that "the maximum skin stress at section where failure occurred was calculated to be approximately 6,000 kilos/cm^2, which approaches the value for mild steel." The load factor for failure in ordinary flight of other birds' wings was found to be between eleven and thirteen and in

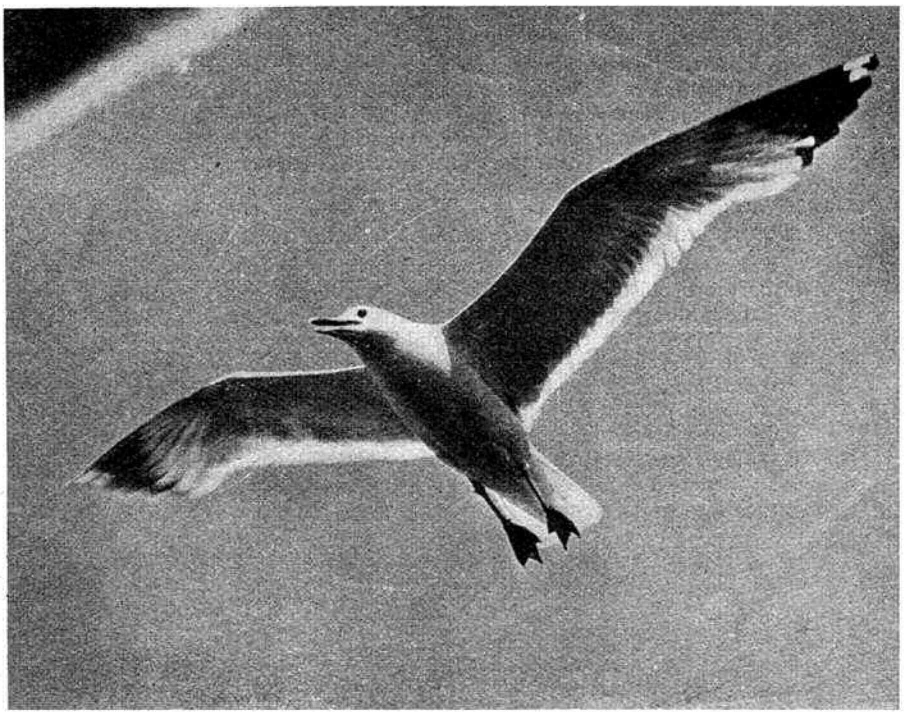
inconsiderable; if it is rotated so that its flat vane faces the direction of motion its parachute-like character seems out of all proportion to its size. The forward or cutting side of its web is narrow like a well-trimmed jib; the side aft of the shaft is broad and might well serve as a pattern for a Marconi main sail. Its barbs are the ideal battens to keep the sail at perfect fit. Separate the barbs on any part of the web except at the base, where they become downy, and they part reluctantly; smooth them together with a single stroke and they adhere again as though they had never been parted. They are the perfect instruments to extract the maximum resistance from a medium as thin as air."

In addition to acting as a covering of the wing some birds' feathers play other parts as well. The late Commander Graham published in "The Journal of the Royal Aeronautical Society" several years ago, a paper in which he investigated the part played by special feathers and feathery down on the leading and trailing edges and upper wing surfaces of owls. He considered that these play an all-important part in the silent flight of these owls. Commander Graham was interested in the application of this natural silencer device in some form or another to aeroplanes. He thought it possible to deaden the racket made by a modern aeroplane by a somewhat similar device to that in an owl's wing applied to the propeller.

Some feathers appear to help directly in the flight of a bird. There is an elastic ligament which, when the wing is straightened for flight, causes the great flight feathers to spread like a fan and thus be immediately "ready for action." The long primary feathers attached to the "hand" of the wing are of value in lateral steering and are prominent in insect-catching birds such as swallows and swifts. The inner secondary feathers are of importance for the down stroke of the wing as they trap the air and considerably increase the lift of the wing.

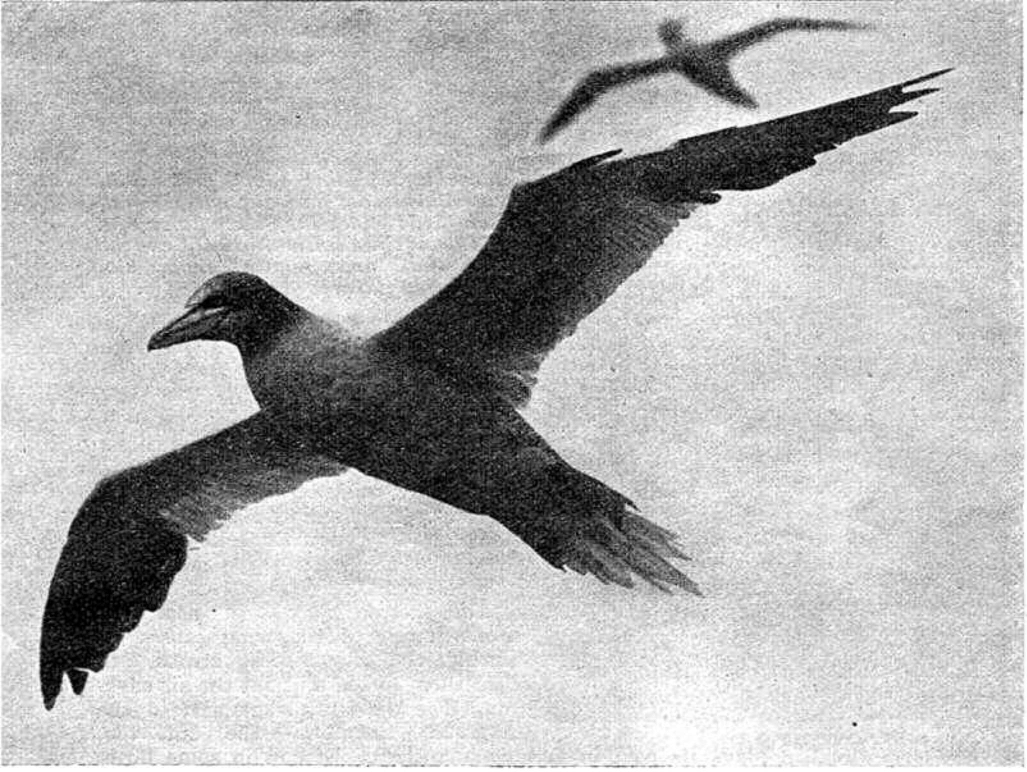
In the slotted wing-tip which many birds possess practically the whole of the feathers act by themselves like little wings of a very high aspect ratio. This gives the bird the double advantage of saving wing-tip air spill and weight; for a wing that could compete with the extreme twisting that an unslotted wing (e.g. of a partridge) would require to be very strong and therefore heavy.

In conversation a short time ago with the chief designer of one of our famous aircraft manufacturing companies, he spoke enviously of the wonderful structure of a bird's wing when compared to



A fine shot of a Californian gull with "flaps and undercarriage down." In this attitude the wings are exerting nearly their maximum lifting force.

Photo by courtesy of U.S. Bureau of Biological Survey.



On the left a gannet is shown in full flight. The "slots" are apparent on the leading edge of the left outer wing.

Below: a number of reddish egrets are shown in various attitudes. The one lower left is just landing, whilst above it one is climbing strongly after taking off.

In conclusion, I am appending a table giving various aeronautical details for a number of birds of different flying types. I hope it may be of interest to those who desire to pursue further this fascinating subject of Flight in Nature.

(For the details below, except those concerning speed, I am indebted to Commander R. R. Graham's paper "Safety Devices in Wings of Birds." The speeds have been taken from T. H. Harrison's paper in "British Birds" for September, 1931, and my own book "Nature Parade." The latter book contains speeds for some 60 species of birds.)

Name	*Weight (ounces)*	*Wing loading (pounds per sq. ft.)*	*Aspect ratio*	*No. of Wing-tip slots*	*Speed (m.p.h.)*
Goldfinch	.44	.36	2.35	3	26
House sparrow	1	.58	2.30	3	33
Song thrush	2.31	.77	2.46	3	30
Starling	2.50	.75	2.90	2	30
Golden plover	3.00	1.18	3.60	—	70
Snipe	4.00	1.23	3.78	—	65
Little owl	6.00	1.02	2.40	4	40
Jay	6.00	1.03	1.90	7	—
Partridge	12.00	2.00	2.33	6	53
Teal	13.00	1.96	3.60	1	68
Grouse	23.00	2.23	2.67	5	60
Pheasant	38.00	2.40	1.70	8	60
Heron	40.00	.92	3.00	3	35
Griffon vulture	260.00	1.85	2.72	8	90 ?

one case, with the wing half closed, the figure was eight.

The shape and structure of birds' wings varies with their habitats and modes of life. Take three examples from a study of the leading edges of birds' wings. In ducks, which are fast flyers, the edge appears to have a biconvex section, such as is used in high-speed aeroplanes, and the edges are about twice as thick in section as the rear webs directly behind them. The leading-edge of the wing of the short-eared owl has a comb-like appearance, which, as I have pointed out, acts probably as a silencer and enables the owl to swoop—" on silent wings "—on its prey. The wing of the griffon vulture has a leading edge which is much more curved down than many other birds. This probably has some relation to the high lift value required by that bird when soaring at low air-speeds.

The eleven-feet long by nine-inches-wide wings of an albatross, together with its "pneumatic" body in which nearly every bone is filled with air-sacs, make it the most efficient soarer in the world. But such a wing, while admirable for use in the Roaring Forties and other regions where there is always a wind to enable the bird to rise, would be useless almost anywhere else.

Most birds which live among trees or underbush have, of necessity, short, rounded wings. This is a bad shape for flight but Nature has helped to compensate the owners of such wings by giving them "thrust slots." They act in a similar manner to the slots in the wing of an aeroplane.

Whenever bird flight in relation to aeroplanes is mentioned, I always think of the Handley-Page slotted wing. The history of this device may be remembered. In the pioneer days of human flight many valuable lives were lost because of the air-eddies which formed over the wings at large angles of incidence. The slotted wing, by trapping part of the air-stream and causing it to flow over the upper surface of the wing in such a way as to smooth out the eddies, did much to make flying safer.

But if only those pioneer airmen had studied the wings of birds more closely they would have discovered that in the so-called alula or bastard wing, birds have had this same safety device from time immemorial! It is composed of one main feather overlaid for strength and thickness with one or two smaller feathers. It has nerves and a surprising number of muscles, when its small size is considered, of its own. These muscles act in a similar manner to the springs of the Handley-Page slotted wing and steady the alula in the closed or open position.

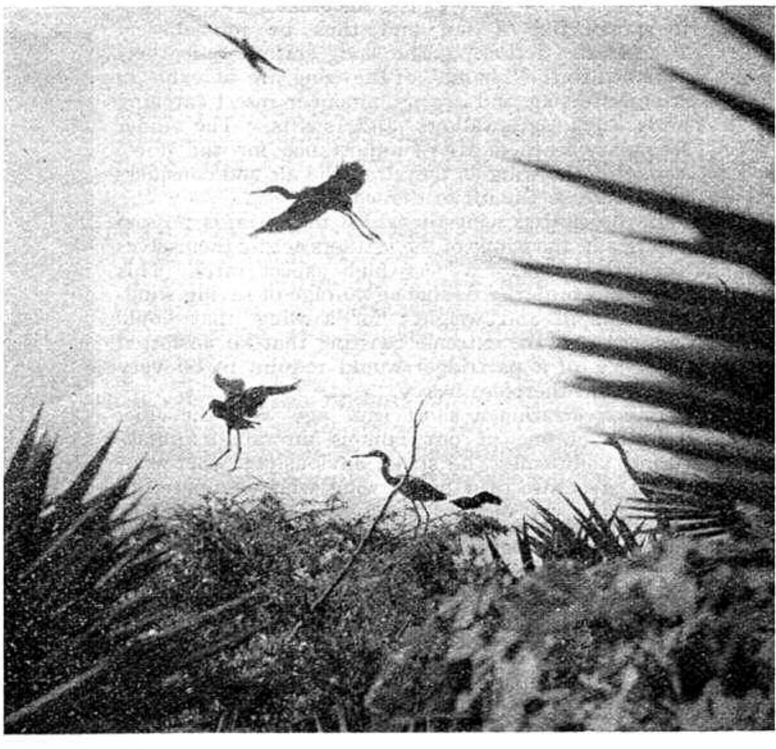
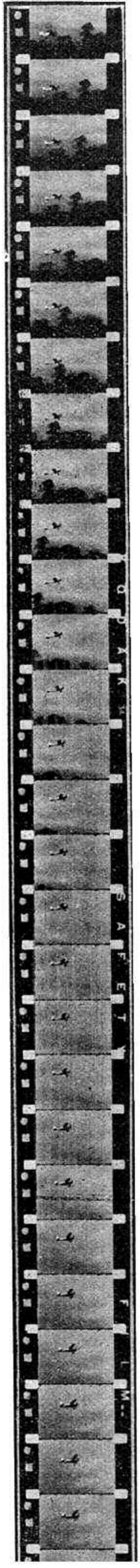


Photo by courtesy of U.S. Bureau of Biological Survey.

The JACK

By C. Rupert



NOTE.—Two layers of $\frac{1}{32}$" sheet can be used in place of $\frac{1}{16}$" sheet throughout.

Materials.

Spruce, particularly silver spruce, is excellent material except for steam bending, when birch is rather better. Birch can be used throughout, but the sections in the wing spar should be reduced as the wood is somewhat heavier, $\frac{1}{16} \times \frac{1}{16}$ in. can be used instead of $\frac{1}{8} \times \frac{1}{16}$ in. and diagonal bracing added from rib E to C. Again, the T.E. can be cut to $\frac{1}{8}$ in. wide. The new P.S.S. wood, advertised in this journal, is ideal for the job.

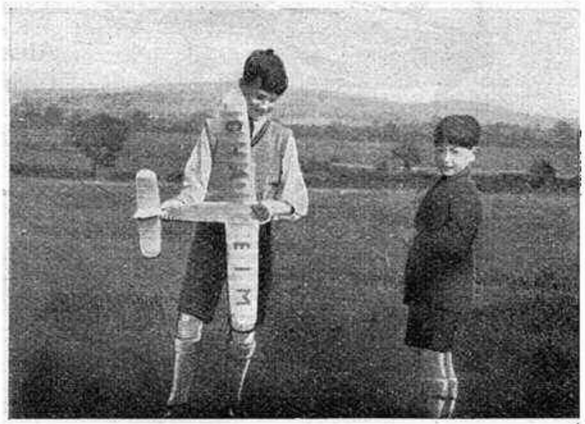
Veneer of about 1/64 in. is obtainable at most model shops, but if you can't get it, wood "spills," procurable at most tobacconists, are satisfactory, providing the straight grained ones are chosen for ribs. The leading edge can be covered with these spills end to end or, if preferred, the covering can be abolished and riblets added made, as the wing ribs, of two-ply $1/64 \times \frac{1}{8}$ in. When using 1/64 in. sheet as covering it is wise to banana oil as soon as set to prevent damp wrinkling the surface. Stringers may be used in place of the sheeting above and below the nose. Durofix or similar cement should be used in place of balsa cement and all joints should be left *undisturbed until thoroughly set*, which is usually several hours.

The Fuselage.

Steam bend the longerons to shape and build as usual. Join tail end, fit jigs, steam bend sides to meet nose former and proceed as usual. The former X is two or three layers of 1/64 in. sheet wrapped round a cardboard template similar to the wing tip, cemented together and bound till dry.

Undercarriage.

Build up of bamboo or birch and wire as usual. Shock is absorbed by two rubber bands passing from the front hook over the front U.C. legs and back again. A single rubber band, acting in opposition, acts as a damper. Celluloid wheels can be used, but better wheels can be made by cutting a 3 in. disc of thick cardboard, putting a bolt through the centre and screwing a nut tight behind ; this bolt can be put in the chuck of a twist drill brace, which can be held in a vice horizontally and used as a lathe. Cast a block of candle wax about $\frac{1}{4} \times 2\frac{1}{8}$ in. diam. on the disc and with a penknife turn to the shape of half a wheel. Remove from brace and with dental plastic (3 oz. is enough), make a mould over the wax and leave for several days to dry hard. Put the whole thing in a cool oven and melt the wax, allowing it to soak into the plaster. Cut circles of newspaper about 3 in. diam., soak the first with water only and press carefully into the mould with the fingers. Next, paste thoroughly both sides with "Gripfix" or flour paste and press on top. Five thicknesses should be enough, the last four being pasted very thoroughly. Allow to set and then remove. Thick celluloid discs, $\frac{1}{2}$ in. diam., are cemented inside and out over the axle holes and drilled, forming a hard bush. Paint the inside to protect from damp and join two halves round the rim by a strip of $\frac{1}{2}$ in. gummed paper and paint thoroughly all over and that is your wheel.



An essential feature of the Aeromodeller Plans Service is the flight testing of models. Here are Michael and Timothy Russell, with the original "Jackdaw,"

LIST OF

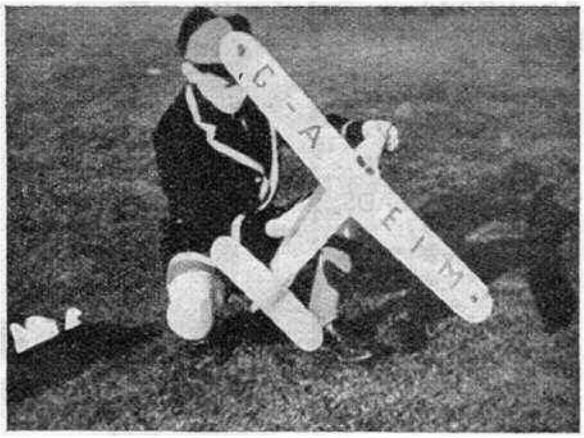
	Lengths.	*Size.*	*Materials.*
Fuselage.			
Longerons	4	$\frac{1}{16}$" × $\frac{1}{16}$"	Spruce or Basswood.
Side bracing	4	$\frac{1}{16}$" × $\frac{1}{16}$"	" "
Top and bottom bracing	4	$\frac{1}{16}$" × $\frac{1}{16}$"	" "
Reinforcement	$\frac{1}{2}$	2" × $\frac{1}{32}$"	Sheet Whitewood or $\frac{1}{16}$" Balsa.
Keel / Former Y	$\frac{1}{2}$	2" × $\frac{1}{32}$"	" "
Nose-former	–	3" × 2" × $\frac{1}{16}$"	3-ply or 3 layers $\frac{1}{32}$" sheet.
Cowling	1	2" × $\frac{1}{64}$"	Sheet Whitewood or $\frac{1}{32}$" sheet Balsa.
Wing.			
Spar	2	$\frac{1}{8}$" × $\frac{1}{16}$"	Spruce or Bass or Whitewood.
TE	1	$\frac{1}{16}$" × $\frac{1}{16}$"	" "
LE and wing tip	2	$\frac{1}{16}$" × $\frac{1}{16}$"	Birch or Basswood.
Ribs—Base	2	$\frac{1}{16}$" × $\frac{1}{16}$"	Spruce or Bass or Whitewood.
Camber	1	2" × $\frac{1}{64}$"	Sheet Whitewood or $\frac{1}{32}$" Balsa.
LE capping	$\frac{1}{2}$	2" × $\frac{1}{64}$"	" "
Centre section and riblets	$\frac{1}{2}$	2" × $\frac{1}{32}$"	Sheet Whitewood or $\frac{1}{16}$" Balsa.
Bracing	2	$\frac{1}{16}$" × $\frac{1}{16}$"	Spruce or Whitewood or Bass.
Tail Plane.			
Outline	1	$\frac{1}{16}$" × $\frac{1}{16}$"	Birch or Basswood.
Ribs	$\frac{1}{2}$	$\frac{1}{64}$" × 2"	Sheet Whitewood or $\frac{1}{32}$" Balsa.
Spar	–	12" × $\frac{1}{16}$" × $\frac{1}{16}$"	Or 2 layers $\frac{1}{32}$" sheet.

★ A GRAND COMPETITION

£5 5s. 0d. cash prize for the longest R.O.G. flight by a "Jackdaw II" built from Aeromodeller Plans Service Plans. Flights must be witnessed and certified by the owner and three witnesses: two of these witnesses must be over 25 years. Flights must be made before Sept. 31st, 1942, and claims received at the Aeromodeller Offices by Oct. 5th, 1942.

DAW II

Moore, A.R.C.A.



shown also in the " cuts " from a film taken during tests. This model has regularly clocked flights of 1¾ to 2 minutes duration <u>without</u> the aid of thermals.

MATERIALS.

Rudder.	*Lengths.*	*Size.*	*Materials.*
Outline } Kingport }	1	$\frac{1}{16}$" × $\frac{1}{16}$"	Birch or Basswood.
Ribs	½	2" × $\frac{1}{32}$"	Sheet Whitewood or $\frac{1}{32}$" Balsa.
Undercarriage.			
Legs	2	3" × ¼" × ¼"	Bamboo or Birch.
Torque rods	2	5" × ⅛" × $\frac{1}{16}$"	" "
Stub axles } Main hinge }	–	12" × 18 s.w.g.	Piano wire.
Sundry pieces	–	12" × 20 s.w.g.	" "
Fairing	Scraps of Balsa or notepaper.		
1 pair	2" diameter wheels.		
Tail Skid	–	2" × ⅛" × $\frac{1}{16}$"	Bamboo.
Nose Block and Gear Box.			
	1	2" × $\frac{3}{16}$" × ⅞"	Cedar or Whitewood or laminated cigar box.
	1	3" × ⅜" × 1¼"	" "
	2	½" × 16 s.w.g.	Screwed bushes.
	1	½" × 16 s.w.g.	Push in bush or tube.
	1	3" × 16 s.w.g.	Piano wire shaft.
	1	4" × 16 s.w.g.	" " "
	1	¼" gear	
	1	½" gear	
	2 Run-free Bobbins.		

Covering.
Fuselage—Mikasa tissue or heavy top tissue.
Wings—Medium tissue.
Tail and Fin—Lightweight tissue.
Dope.
Banana oil 'throughout'.
Silver dope.
One coloured dope to taste.
Rubber.

8–10 strands	¼" × $\frac{1}{30}$" × 20"
or 12–16 strands	¼" × $\frac{1}{30}$" × 20"
or 24–30 strands	⅛" × $\frac{1}{30}$" × 20"

The Wing.

Make a cardboard template for the tip, cutting out the centre as shown on plan, take the $\frac{1}{16} \times \frac{1}{16}$ in. L.E., stick on to the template at the T.E. with gummed paper so that one diagonal of the wood is in the horizontal plane. Steam bend round and bind with cotton. The template is left in place till thoroughly dry. The single spar is built up. There are five complete ribs A, B, C, D and E and five open ribs between. Pin down and cement the $\frac{1}{16} \times \frac{1}{16}$ in. rib bases and the T.E. Cement the completed spar in place. Cut and cement the five nose ribs in place and add L.E. In the upper notch in the nose rib lay the ***temporary*** $\frac{1}{16} \times \frac{1}{16}$ in. jig spar and then cement the cardboard jig rear spar in place.

Take a bundle of $1/64 \times \frac{1}{2} \times 6$ in. and steam bend to a rough camber. Cement at 5, 4, 3, 2 and 1 at the L.E. on the " packing blocks " and at the T.E. Make sure that the strip fits FLAT on the L.E. and pin in place, when set cement a second 1/64 in. strip on top of the first and leave to set hard. *Remove the $\frac{1}{16} \times \frac{1}{16}$ in. temporary spar* and put the ribs E, D, C, B and A in place in the same way as 5, 4, 3, 2 and 1. When set remove cardboard jig spar, add 1/64-in. sheet at L.E. and complete wing as usual.

Tail Unit.

The outlines of both fin and tail are steam bent round cardboard templates and put under pressure to dry. The fin is cemented to the tailplane and the whole is held in place by two bamboo pegs at the L.E. and one tiny rubber band at the T.E.

The Gear Box.

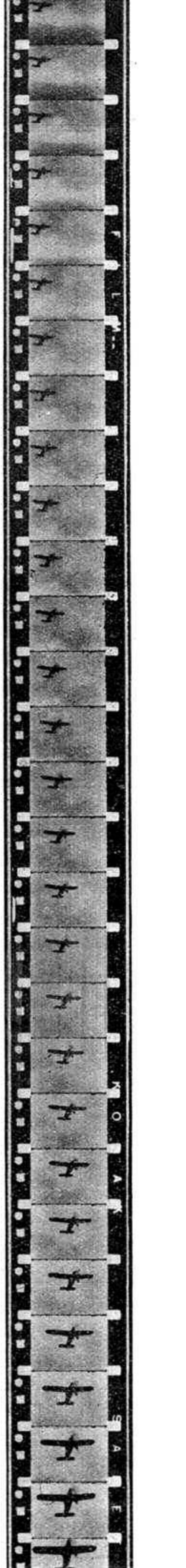
A ratio of 2 to 1 was used on the original, but anything between 2 and 3 to 1 is quite satisfactory. Soldering is stupidly simple if the following care is taken. Clean everything with sandpaper or a file, fill the gear teeth with dope, bind copper fuse wire behind gears, round the winding loop and in front of the driving plate. Fit paper washers wherever there is fear of solder sticking. The main shaft has ⅛ in. forward travel allowing gears to run out of mesh to form free wheel.

Covering.

The fuselage is covered with Mikasa tissue, wings with medium tissue and tail with lightweight tissue. The whole is given a coat of banana oil. The original was red and silver doped, with red letters on the wings and silver on the fuselage.

Rigging.

Assemble as usual. Fit the rubber which is 8–10 strands of $\frac{1}{4} \times 1/30 \times 20$ in., pre-wound until just slack enough to allow main shaft to work. Take a lump of " Plasticine " out with you and add lumps to nose or tail until a perfect glide is achieved. Find the exact balance of the machine and mark it. Remove " Plasticine " and by either lengthening or shortening the " tail shackle wire " trim the balance.



for ALL AEROMODELLERS!!!

£2 2s. 0d. for the best photograph of the uncovered model.

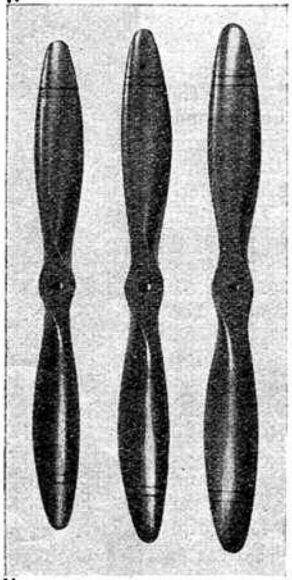
£2 2s. 0d. for the best photograph of the covered model posed *against a suitable background.*

£2 2s. 0d. for the best photograph of the model in flight.

No photographs can be returned. Winning photographs become property of the Aeromodeller.
All photographs must be received at the Aeromodeller Offices by October 5th, 1942.

ATLAS MOTORS

ANNOUNCE IMMEDIATE DELIVERIES (WHILST PRESENT STOCKS LAST) OF ALL ITEMS HERE ADVERTISED



RED ENAMELLED AIRSCREWS
12″ 12½″ 13″
DIAMETER
4/6 4/9 5/-
PLUS POSTAGE AND PACKING 6d. EXTRA

CHAMPION TYPE V-2
¼″
32 THREADS
5/-
EACH
PLUS POSTAGE AND PACKING
6d. EXTRA

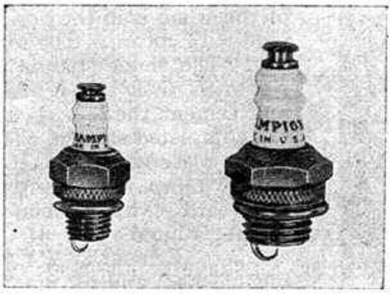
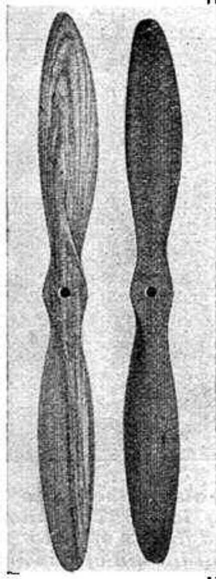


PHOTO SHOWS ACTUAL SIZE OF PLUGS

CHAMPION TYPE V
⅜″
24 THREADS
5/-
EACH
PLUS POSTAGE AND PACKING
6d. EXTRA



PLAIN WOOD AIRSCREWS
13½″ 14″
DIAMETER
5/3 5/6
PLUS POSTAGE AND PACKING 6d. EXTRA

SPECIALISTS IN ALL TYPES OF ACCESSORIES FOR

PETROL 'PLANES

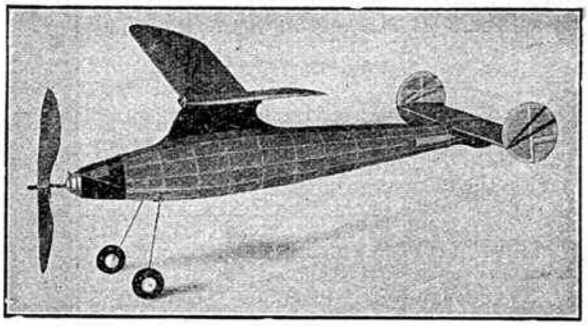
POSTAGE ON EACH OF THE UNDERNOTED—3d. PER ITEM

'DROME ENGINE MOUNTS **4/6** PLUG SPANNERS **1/6**
CONDENSERS **1/6** 6″ LENGTHS PETROL TUBE **1/-**
SAMPLE TINS S.A.E. (BABY CYCLONE) OIL .. **1/-**

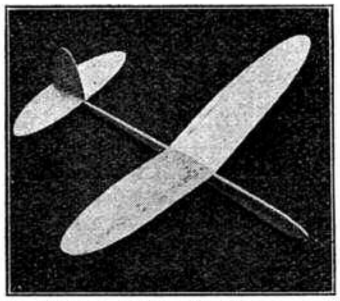
CASH WITH ALL ORDERS TO

B.C.M./B.A.B.C.Y. LONDON

"VICTOR" Wing span 31″ **13/1** *Post Free.*



THE "GNAT"
16″ SOLID "BALSA" GLIDER



Price **2/6** *Post Free.*
Wholesale Supplied.

" WINSTON "
" Premier of the Skies "
Wakefield type, span 50″.
19/9 *Post Free.*
6 mins. 28 secs. O.S., Whitefield Model Aero Co. Sat. April 18th.
Plans and printed sheet.
3/6 *Post Free.*

" NIPPY "
30″ span, 24″ length.
Average duration 80-120 seconds.
8/7 *Post Free.*
Plans and printed sheet.
2/3 *Post Free.*

KITS FROM **2/-** IN STOCK.

" MAYBIRD "
27″ span, 24″ length
7/4 *Post Free.*
Plans and printed sheet of " MAYBIRD "
2/– *Post Free.*

ALL ACCESSORIES STOCKED INCLUDING BALSA SUBSTITUTE, 3 BLADED STAMPED CELLULOID PROPS FOR SOLIDS, ALSO CABINS AND TURRETS.

Send 3d. for Catalogue, fully illustrated.

ELITE *Model Airplane Supplies,* **14, Bury New Road, MANCHESTER 8**

"PETROL TOPICS" By Dr. J. F. P. Forster

These two photographs show a K.G.S. built by J. Heathcote of Pendlebury, Lancs. . . It is powered by an inverted Ohlsson "23" which, with a wing loading of only 6½ ozs. per square foot, gives the model a terrific climb.

HAVING felt that "Petrol Topics" was beginning to contain too many of my own opinions, and also due to the falling off in correspondence suitable for discussion in this feature, it seemed to me better to shut up altogether than talk nonsense. The long periods of "hibernation" resulting from this decision, however, have not entirely discouraged correspondents, and from time to time letters still come in, not always very helpful towards the composition of another instalment, but almost all without exception, beseeching me to continue to "dish out" something of interest to "Petroleers." I should like very much to thank all those who have written, and for the kind remarks passed by several of them concerning my small efforts to keep interest in petrol models alive with this feature. I'm afraid these are now hardly deserved in view of the last few months' absence of "Topics" from these pages, but at all events, here is the "gen" on a few of the letters received.

Two letters concerning engine design require comment :— The first was a demand from a schoolboy, G. B. Ducker, of Bubwith, Yorks., for the complete general layout of a 3 c.c. petrol engine, from which he hoped to get out scale plans for making his own engine in the school workshops, "as ready-made ones are such a large price and hardly procurable." I do not feel that this could reasonably be answered in a feature of this sort, even if I felt qualified to do so myself. The Editor made it quite clear when I started "Petrol Topics" that queries could only be dealt with through this feature, and although I have frequently made exceptions by writing personally to many correspondents (including this one) I really do not feel that I can be expected to act as a sort of free "Plans Service." If a man is still at the stage of being ignorant of the general layout of even a single make of engine, I think it might be as well for him first of all to take the trouble to look at an engine for himself. Any Petroleer would surely have no objection to allowing anyone interested to give one of his engines a "once over," and even a demonstration run.

From this most youthful and inexperienced correspondent, I turn now to a letter from one of our earliest and most experienced. The writer, who still wishes to remain anonymous, but who is a dental surgeon by profession (and in my opinion, an expert radio and mechanical engineer by inclination !) is that same correspondent to whom I referred in the June, 1940 (p. 369), instalment of "Topics" as "running before most of us are even crawling," and who, before the war, had already flown two radio-controlled machines, the last one very successfully using as power a ¾ h.p. American Mercury engine. For those interested in the Radio Control, he used a single valve receiver of the R.K.52 type, the transmitter being a 10 watt Crystal controlled "set-up" fitted with a miniature joy-stick and throttle lever. This arrangement was really very satisfactory from all accounts, and although he did not give details of his selector, presumably this was of the reed type. At all events he had three controls, each requiring at least two positions, these being rudder, elevators, and throttle. The throttle, by the way, *was*, in fact, a throttle, which he fitted specially to the Mercury Engine and did not work on the "advance and retard" of the ignition.

On an engine of this capacity, a throttle works perfectly satisfactorily, but readers may recall my own experiments with a throttle fitted to an Ohlsson "23," and how I came to the conclusion that these small engines are a little too touchy to respond satisfactorily. The real reason for this is, I think, that the "draught" through the induction pipe is really not sufficient on these small engines for a throttle to make much difference until very nearly closed altogether when the engine, instead of slowing down, simply stops suddenly.

Returning to our friend's Control mechanism : on his pre-war model, these were operated by "00" gauge electric motors fitted with a specially made reduction gear. All this, apart from being very weighty, especially including the batteries necessary for their operation, resulted in a fair time lag and lack of "positiveness" in his controls, and the all up weight of his plane, which was streamlined, and had the appearance very much of a "Cavalier," was some 15 lbs., the span being 9½ ft. and the area being somewhere around 9½ sq. ft. Pretty hefty wing loading ! !

A propos of my mention some months ago of experiments with a dentist's flexible drive, with a view to twin screw operation from a single engine mounted amidships in the fuselage, he now writes telling us of his intention, after the war, to build such a machine (probably a Wellington Scale Model) but instead of using the flexible cable drive he intends to use the bevel gears of a dental right-angle hand piece, and he considers that these will prove strong enough to stand up to his ¾ h.p. engine driving contra rotating airscrews.

Instead of the multiple electric motors for the control mechanism, he now proposes to use hydraulic controls. These are to be worked by a piston and plunger arrangement, the degree of movement being controlled by the length of time the fluid is allowed to pass into each control tube. The tubing is to consist of stainless steel hypodermic needle tubing (obtainable in 3 ft. lengths) which should be extremely light, and pressure will be obtained from a small gear pump, operated from the cross shaft to the airscrew gears.

The whole idea sounds thrilling and ingenious, and he considers it should save at least 1 lb. in weight over the old motor control, and also be very much more positive in action.

His second letter brings us back to engine design, with which these comments started. He asks for my ideas on the "ideal engine" and sets forth his own, after enumerating all the snags most noticeable on engines produced commercially up to the outbreak of war.

His own suggestions so nearly coincided with my own that I feel justified in taking up space in Petrol Topics with what for once, are not my own ideas *only* !

His chief snags are :—

(*a*) Difficulty of starting (more apparent in some makes than others), reason unknown. I suggest that some of this is due to the very poor induction draught induced at the slow revs. obtainable by hand starting particularly if the induction

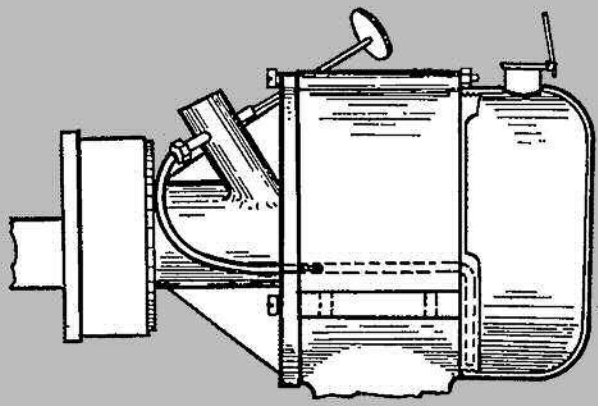


FIG. 1.

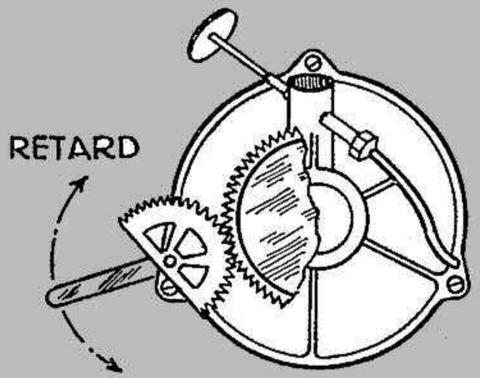


FIG. 2.

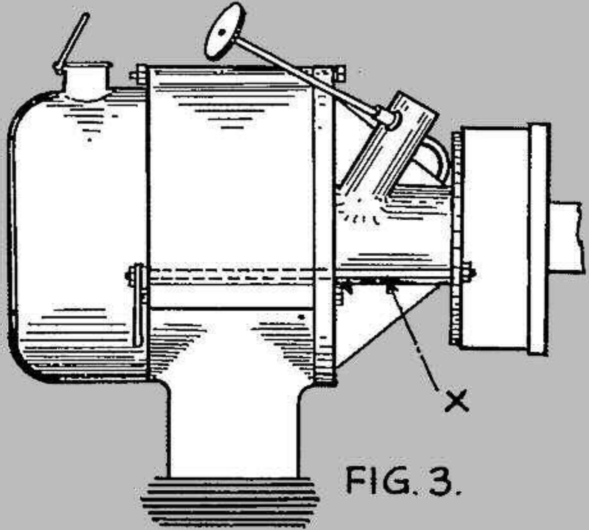


FIG. 3.

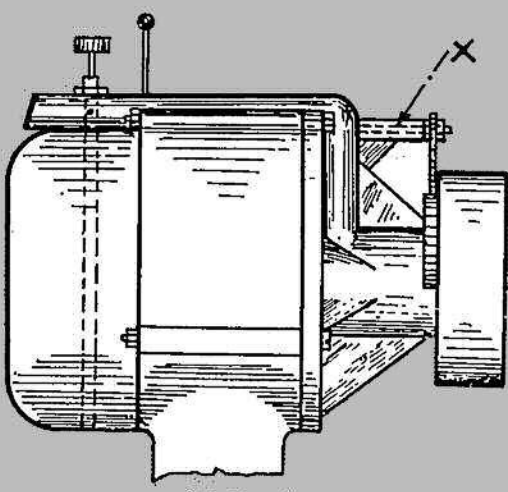


FIG. 4.

pipe is of too large a diameter. Many of the smaller sizes might start more easily if the diameter were smaller at the point where the mixing valve crosses the induction pipe!

(*b*) Dirty contact-breakers due to their close proximity to the shaft. "O.K. when new, but as soon as main bearing wears a little, oil pours on to points." My own answer to this is to use miniature accumulators for flying, and the points will operate completely immersed in oil!

(*c*) Aluminium pistons with rings unsatisfactory.

(*d*) No drain plug to the crankcase on upright engines. My answer is use engines inverted.

(*e*) Most engines designed entirely for upright running.

(*f*) Omission of ball thrust on crankshaft.

(*g*) Lack of proper piping facilities for exhaust.

(*h*) Lack of rigidity between jet and tank.

(*i*) Placing of coil and condenser "any-old-where."

To these I would add :—

(*k*) Vulnerability of tanks suspended from induction pipes, and the theoretical objection to the "direct induction" system altogether, as opposed to the rotary valve system. With the latter, a full crankcase of charge is obtainable at top dead centre, whereas with direct induction, except at very high revs., allowing for "suction lag," there is a tendency for blow back down the induction pipe, with consequent difficulty in starting or running slowly, and probably loss of maximum possible power. Also, more cylinder ports are required, weakening the cylinder.

As against this, his suggestions for the ideal engine include :—

(1) 6 c.c. capacity.
(2) Tapered shaft as on Ohlsson "23," with thrust-race and brass shims for taking up wear.
(3) Rotary valve induction as on Cyclone.
(4) Elimination of "dangling" petrol tanks; tank either to be separate from engine or integral with back of crankcase.
(5) Engine to be inverted.
(6) Plain steel piston lapped to liner.
(7) Piston to be made on the "double diameter" principle as on Dunelt motor cycle engine.
(8) Location of all controls on top of crankcase away from airscrew.
(9) With tank integral with back of crankcase, petrol feed pipe to consist of hole drilled forward through side of crankcase.

With all the above suggestions for the ideal engine, I personally agree, and I would also add my own preference for engines in which the crankshaft bearing and front cover-plate are detachable rather than those on which the rear cover-plate is detachable. The most vulnerable part of all engines is the crankshaft bearing housing, which becomes distorted even before a crankshaft becomes bent. If this cannot be straightened, and is part of the crankcase proper, a whole new replacement crankcase may be necessary, and with the prevailing tendency to incorporate the lower half of the cylinder (into which a sleeve is shrunk) in the crankcase casting, together with the transfer passage, an accident causing serious distortion of the bearing may cost a complete new engine.

This correspondent and I seem agreed that the ideal engine incorporates in one engine the best features of the American Cyclone or British Wasp, with those of the Ohlsson family of engines, and such an engine has still to make its appearance on the market.

In the accompanying rough sketches, I have tried to depict the main lay-out of such an engine. It will be noted that the needle-valve and ignition controls are both brought back to the top and right side of the crankcase. The lugs on the sides of the crankcase, through which the long engine assembly bolts pass on an Ohlsson "23," are cast thicker than at present. Two additional holes are drilled through these above the bolt hole. The one on the left side of the engine forms the petrol feed pipe from the tank at the rear, while the one on the right forms a bearing for the spindle of the remote ignition control, which carries a semi-circular gear engaging with a similar gear on the rear of the timer assembly. (Figs. 1, 2 and 3).

In view of the length of unsupported spindle, as depicted in Fig. 3 (X) of a starboard elevation, it might be better to carry this through a hole along the top of the crankcase, and to give it extra support by passing it through an extra projection cast integral with one side of the induction pipe and web, as in Fig. 4 (X).

A simpler solution to the petrol feed, dispensing with the long pipe, might be to cast a long induction pipe passing back along the top of the crankcase and petrol tank. The forward part would be cast integral with the front cover-plate passing vertically up the front face with a right angle bend to meet the corresponding rear portion. Of course it is not essential to have this rear portion cast integral with the crankcase, but if it were, better vapourisation of fuel would result from its becoming hot (Fig. 4). Actually, it would be drilled through a solid lug, along with the bolt hole, and spindle-bearing on either side.

Details of tank fixing have been omitted for clarity, but it might be rather attractive, in a commercially made model, to have this of transparent material. It could either thread into a lip cast round the rear face of the crankcase, or simpler still have a bayonet attachment, being secured by a quarter turn. The hole through which the needle valve passes would be drilled straight through the top of the tank and induction pipe, and the needle-valve, when in position, would prevent the tank rotating and becoming detached. A snap filler-cap (omitted for clarity) would lie to one side of the induction pipe.

It will be noticed that this arrangement groups the three essential accessibles, the needle, timer control and filler-cap all close together with the end of the induction pipe, which must be choked with a finger (or otherwise) for starting. Such an engine as this in smooth die castings, fitted with tapered crankshaft and thrust-race, does, I believe, come very close to the Petroleer's dream. Your candid opinions are earnestly requested, for if there is sufficient demand for a certain type of engine after the war, we ought, through the columns of THE AERO-MODELLER, to be able to tempt some enterprising maker to give us what *we* want, and not what he thinks we ought to have.

These suggestions, together with any others forthcoming from correspondents, will perhaps do something to satisfy another writer, Mr. J. R. C. Fearon, of Eastcote, Middlesex, who asks for articles on engine design.

The photos of the K.G.S. (to which he has added an H) are sent in by J. Heathcote, of Pendlebury, Lancs., who gives a glowing account of this well known record hunter. He has kept his wing-loading down to 6½ oz./sq. ft. with his Ohlsson " 23," and it climbs at about 45 degrees. Readers may recall another good photo of a similar model made by H. C. Flello in the September, 1940, AERO-MODELLER, and it is interesting to note the improved appearance, when cowled, of Heathcote's inverted Ohlsson compared with Flello's upright version. On the other hand, the front view of K.G.S.H. shows admirably the snags of inverting an Ohlsson when mounted on lugs with large supporting webs obstructing access to the induction pipe for choking, and to the petrol filler cap, and I would draw the attention of those interested to the photo and my remarks on the radial mounting of inverted Ohlssons which headed the last instalment of " Topics " in the Christmas, 1941, issue. The three versions make an interesting comparison.

Space prevents my dealing with more letters, but " Topics " is not finished. I already have some interesting material in hand for another instalment, including a really *hot* undercarriage and layout, generally, of a radio-controlled scale type pusher from A. J. Cope, of Westbury-on-Trym.

"THE STABILITY BABY"

HERE IS AN INTRIGUING, YET EASY-TO-BUILD MODEL. REDUCED SCALE PLANS ARE ON THE NEXT TWO PAGES, WHILST FULL SIZE SCALE PLANS MAY BE OBTAINED THROUGH THE AERO-MODELLER PLANS SERVICE PRICE 2/- POST FREE

Designed by—— ——W. A. DEAN

THE plan covers all the building details but in case these are not quite clear to the reader the components are dealt with individually in the following paragraphs.

Fuselage.

This is made on a jig, *i.e.* a length of straight hardwood, as shown in the sketch. The jig and the middle of the formers can then be withdrawn when the fuselage is assembled as is usual with this form of construction. The twelve stringers are first of all cemented to the tail and then bent forwards and cemented to each individual former. Elastic bands may be used at this stage to keep them in place. When these have set the jig may be removed and the undercarriage, tail fittings and sheet fillings can be cemented in place. Small strips of tissue will have to be used for covering as it is of circular cross section.

Wing.

This is of " sparless " construction and is made in the conventional manner. The tips are of sheet balsa blending into the leading and trailing edges with a small ⅛ in. by 1/16 in. spar fitted as shown in the plan to give greater strength at this point. 1/16 in. sheet fillets give a certain amount of rigidity to the centre section and also help to hold the dihedral angle. No undercamber is used and so the covering is simplified as the tissue need not be stuck to every rib.

Tail Assembly.

Join the two halves of the tailplane and cement to the fin. The triangular piece is then cemented in place and the whole assembly can then be mounted on the fuselage. All that then remains is to cement the underfin in place, noting the little bamboo inset which prevents wear on that component.

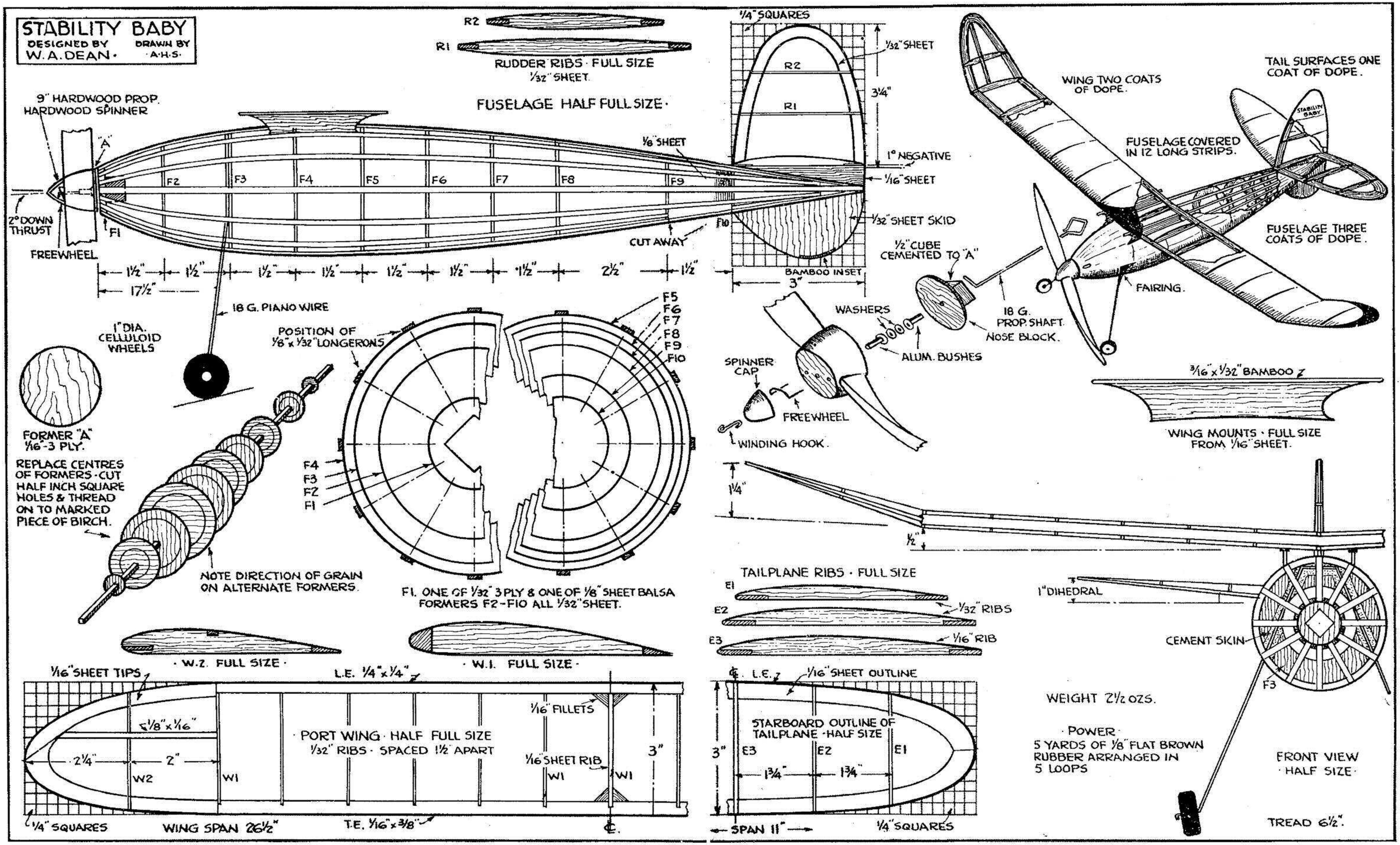
Wing Mount.

The wing mount should then be cemented to the top of the fuselage in the exact position as shown on the plan. The wing itself is held on by two elastic bands passing over it and looped over pins pushed into the mount at each end. The elastic bands are cemented to the rear pins so that the wing flies off at any sharp contact and thus minimises the risk of breakage

Trimming and Flying.

Complete with elastic the model should be slightly nose heavy when balanced by the wing tips. The wing may be shifted slightly or a small weight added if this is not so. A number of test glides should then be carried out until the correct trim is obtained after which hand-launched flights on 250 turns may be attempted. If everything is in order increase the number of turns to 800, which is about the limit, by gradual stages, making sure that the model is trimmed to fly in circles opposing the torque, for this is quite considerable.

The comparatively large amount of rubber employed gives a really sensational climb and makes the model leap right off the ground, so it is essential that the trim be correct for flights on full turns or otherwise a serious crack-up may result. With reasonable care, however, many hundreds of flights may be made with this model without the necessity of any major repair. If the fuselage is sheet covered with 1/32 in. balsa and then sanded down slightly it should be practically crash-proof, although the performance will then suffer on account of the increased weight.


STABILITY BABY
DESIGNED BY W. A. DEAN.
DRAWN BY A.H.S.
R2
R1
RUDDER RIBS · FULL SIZE
1/32" SHEET.
FUSELAGE HALF FULL SIZE.
1/4" SQUARES
1/32" SHEET
R2
R1
3¼"
1° NEGATIVE
1/16" SHEET
1/32" SHEET SKID
BAMBOO INSET
3"
9" HARDWOOD PROP.
HARDWOOD SPINNER
"A"
1/8" SHEET
F2
F3
F4
F5
F6
F7
F8
F9
F10
2° DOWN THRUST
F1
FREEWHEEL
CUT AWAY
1½"
1½"
1½"
1½"
1½"
1½"
1½"
2½"
1½"
17½"
WING TWO COATS OF DOPE.
TAIL SURFACES ONE COAT OF DOPE.
STABILITY BABY
FUSELAGE COVERED IN 12 LONG STRIPS.
FUSELAGE THREE COATS OF DOPE.
FAIRING.
½" CUBE CEMENTED TO "A"
18 G. PROP. SHAFT.
NOSE BLOCK.
WASHERS
ALUM. BUSHES
SPINNER CAP
FREEWHEEL
WINDING HOOK.
18 G. PIANO WIRE
1" DIA. CELLULOID WHEELS
FORMER "A" 1/16" 3 PLY.
POSITION OF 1/8" x 1/32" LONGERONS
F5
F6
F7
F8
F9
F10
F4
F3
F2
F1
REPLACE CENTRES OF FORMERS · CUT HALF INCH SQUARE HOLES & THREAD ON TO MARKED PIECE OF BIRCH.
NOTE DIRECTION OF GRAIN ON ALTERNATE FORMERS.
F1. ONE OF 1/32" 3 PLY & ONE OF 1/8" SHEET BALSA
FORMERS F2-F10 ALL 1/32" SHEET.
3/16" x 1/32" BAMBOO
WING MOUNTS · FULL SIZE FROM 1/16" SHEET.
1¼"
½"
TAILPLANE RIBS · FULL SIZE
E1
E2
E3
1/32" RIBS
1/16" RIB
1" DIHEDRAL
CEMENT SKIN
F3
· W.2. FULL SIZE ·
· W.1. FULL SIZE ·
1/16" SHEET TIPS
L.E. 1/4" x 1/4"
1/8" x 1/16"
1/16" FILLETS
PORT WING · HALF FULL SIZE
1/32" RIBS · SPACED 1½" APART
1/16" SHEET RIB
3"
2¼"
2"
W2
W1
W1
W1
1/4" SQUARES
WING SPAN 26½"
T.E. 1/16" x 3/8"
℄
℄ L.E.
1/16" SHEET OUTLINE
STARBOARD OUTLINE OF TAILPLANE · HALF SIZE
3"
E3
E2
E1
1¾"
1¾"
SPAN 11"
1/4" SQUARES
WEIGHT 2½ OZS.
· POWER ·
5 YARDS OF 1/8" FLAT BROWN RUBBER ARRANGED IN 5 LOOPS
FRONT VIEW · HALF SIZE ·
TREAD 6½".

TECHNICAL TOPICS

By R. H. WARRING

THIS month I would like to start our discussion by clearing up an error which occurred in my "Glider" article in the April issue of THE AERO-MODELLER. It concerns the method laid down for finding the angle of incidence of the wing for minimum sinking speed of the whole machine. In the text I most carefully explained that this was *not* the incidence that gave the best L/D ratio, i.e. the best gliding angle, but the graph, diagram 5, illustrating this point unfortunately was one showing the method for finding L/D max. and not $L^{1.5}/D$ max. as it should have been. Actually $Cl^{1.5}$ should have been plotted against Cd and not Cl against Cd, this point being explained in last month's Editorial, and Mr. L. G. Temple picked me up on this, quite rightly. It would also appear that this method is not generally accepted for finding the incidence for minimum sinking speed in full size practice—more accurate results are obtained by plotting $Cl^{1.5}/Cd$ against Cl and working from the maximum point of the graph.

Mr. Temple is an authority on low speed aerodynamics so his views are most welcome and below is given his method which is quite similar to that shown in diagram 4 of the article in question but far more detailed.

He also raises the point of correct model values for the fuselage Drag/Wing Area coefficient. Now very little low speed data is available on the drag of the "non-lifting" components at model speeds and the generalised figures that I quoted were actually based on full size sailplane figures and are far too low for model work (right again, Mr. Temple!). Since the article was written (about eighteen months ago when I had very little scope for wide reference), some more figures have come to hand by diligent search through past issues of THE AERO-MODELLER and the technical books of the Harborough range. It would appear that C_{df} for model gliders ranges from ·015 to ·03 and for rubber-powered models from ·025 to ·070. These figures should not be accepted as final—they require careful checking by low-speed wind tunnel tests when this is possible.

Now for Mr. Temple's method of finding the correct incidence for minimum sinking speed which should, once and for all, solve that maltreated question of wing incidences.

"A source of error is the fact that graphs and data used for full size sailplane designing are nearly always marked Kl, Kd, etc., and not Cl, Cd, etc., as graphs used for models are marked. And Kl is the same as Cl/2, etc., i.e. the 'K' coefficients are exactly one-half the corresponding 'C' coefficients. The first point then is to be sure that you are using the correct coefficients and not mixing them up. The procedure is then as follows:—

(i) Convert all values of Kl, Kd and the value of K_{df} (which can only be an approximation unless one possesses a wind tunnel), into the more normal notation Cl, Cd and C_{df} for model use by *doubling* the 'K' values.

(ii) Correct these values of Cl and Cd for low Reynolds Number work.

(iii) Using the corrected (low R.N.) figures make your aspect ratio corrections to determine the new angles of incidence at which each value of Cl occurs for the aspect ratio you are using.

(iv) Add your approximate value of C_{df} to each value of Cd in your table of figures.

(v) Using Cl and the *total* values of Cd and C_{df}, as obtained in step (iv), calculate the values of Cl/C_{dt} for the whole machine.

(vi) Plot two graphs (or two curves on one piece of graph paper), to give (*a*) a curve of Cl against incidence, using the figures obtained from step (iii), and (*b*) a curve of $Cl^{1.5}/C_{dt}$ against Cl, so that by finding the value of Cl corresponding to the minimum sinking speed (i.e. the maximum point of the curve), we can plot this value on the first curve and find, very accurately indeed, the exact angle to use. One graph only, of $Cl^{1.5}/C_{dt}$, against angles of incidence may be used but it does not give as accurate results as a rule."

Thank you, Mr. Temple, and I hope that this discussion has cleared up any points or difficulties that the reader may have experienced on the subject. This method, of course, can be used equally well to find the incidence for the flattest gliding angle by plotting Cl/Cd against Cl in curve (*b*) and has much to recommend it as being extremely accurate once the correct coefficients are known.

Whilst on the subject of gliders it would be as well to discuss another query raised by a reader as to the effect of the *weight* of a model on its gliding ratio. The slope of the glide path is equal to the ratio of the total drag to the total lift, i.e. the tangent of the gliding angle is equal to Dtotal/L = Cdt/Cl. Thus for a given 'plane the gliding angle is independent of the weight provided that the trim is unaltered. Hence, if the all up weight of our model is increased, with the above proviso, the gliding *angle* remains the same as before but the *velocity* of the glide must be increased to generate more lift to support the extra weight.

Since $L = W \cos\theta$, where θ is the gliding angle,

and $L = Cl\,\rho/_2\, SV^2$

we find that

$$\frac{V_1}{V_2} = \sqrt{\frac{W_1}{W_2}}$$

where the suffixes 1 and 2 denote different conditions of weight for the same model under the same trim.

Or, for scaling up model performance to full size performance, ignoring scale effect for the moment,

$$\frac{V\ \text{model}}{V\ \text{full size}} = \sqrt{\frac{Wm\ Sf}{Wf\ Sm}}$$ where m and f denote model and full size conditions respectively.

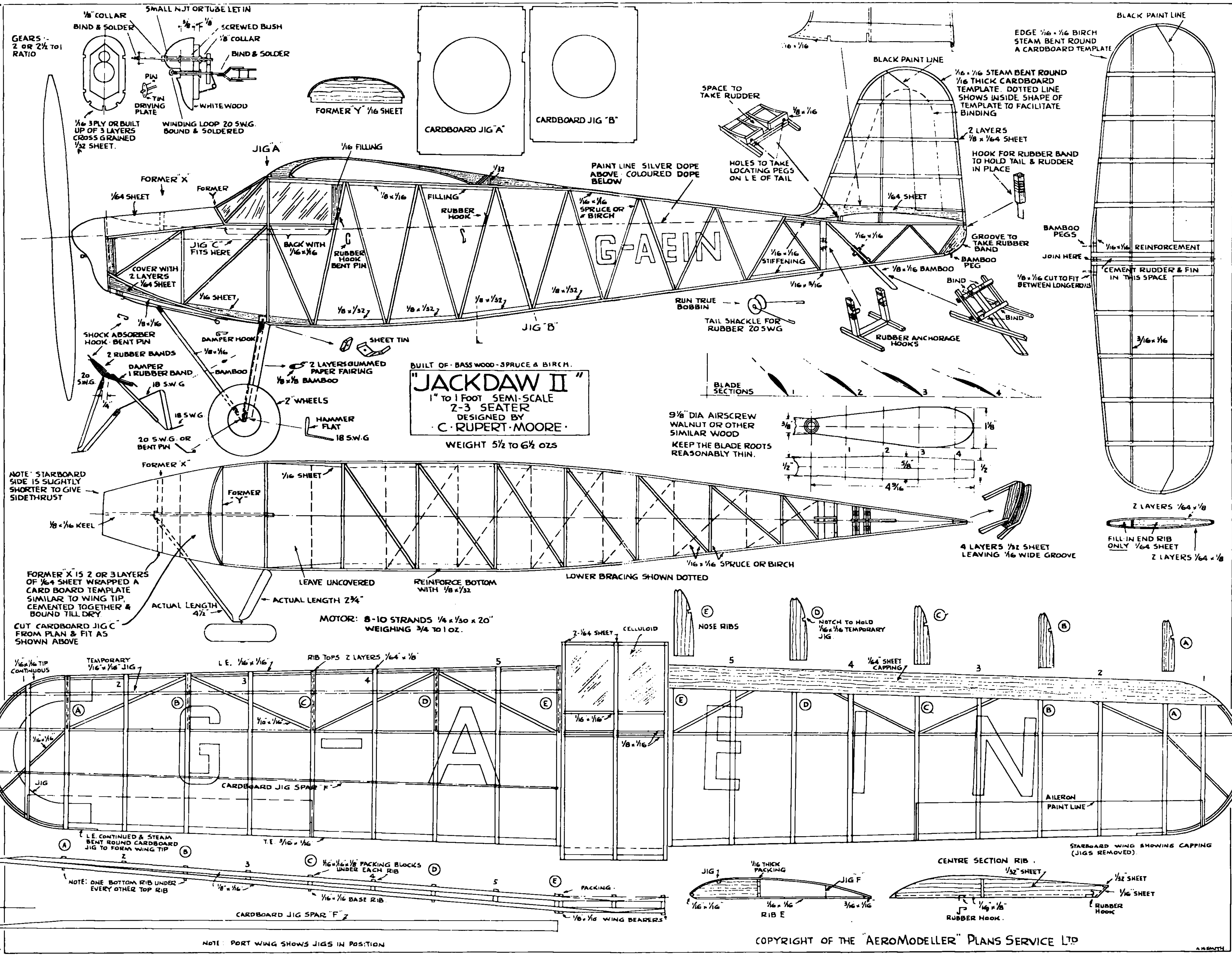
$$= \sqrt{\frac{\text{Model wing loading}}{\text{Full size wing loading}}}$$

Both machines being identical in form as stated above.

The sinking speed, Vs, equals $V \sin\theta$, where V is the gliding velocity along the flight path. This increase in weight will naturally lead to an increase in the sinking speed. That is, although the machine has the same gliding angle, when more heavily loaded it is gliding faster and thus its sinking speed is greater, and *vice versa*. The ratio of the two sinking speeds will equal the square root of the ratio of the two weights as in the case of the gliding velocity.


FROG
SCALE
MODEL
AIRCRAFT
FROG
TRADE MARK
REGD.
MADE IN ENGLAND BY INTERNATIONAL MODEL AIRCRAFT LTD
For the Sole Concessionaires: LINES BROTHERS LTD., TRI-ANG WORKS, MORDEN ROAD, MERTON, LONDON, S.W.19. ENG.

£5 s. 5 d. 0 CASH PRIZE FOR THE BEST FLIGHT ★



£6 s. 6 d. 0 CASH PRIZES FOR THE BEST PHOTOS ★

GADGET REVIEW

By M. R. Knight

Illustrated by

C. Rupert Moore, A.R.C.A.

HAVING just walked into a brick wall and thereby crash-landed in someone's front garden when returning from an operational trip in the blackout (not an S.M.A.E. dinner, by the way), the importance of a well-sprung undercarriage has been brought home with some force. Hence the unusually high proportion of ideas for new types of landing-gear in this month's Gadget Review.

The first is for freelance flying models, and has been sent by Mr. G. W. Meredith, of Ruthin, North Wales. It is quite simple and straightforward, and it would not be surprising to learn that it is already being used in one form or another by other modellers. In Fig. 1 it is shown as applied to a fuselage of circular cross-section, but it is equally suited to a "slabsider." As will be seen the wire from the undercarriage legs first passes through two short horizontally mounted brass tubes—which, by the way, need to be *very* firmly secured to the bulkhead—and then turned upwards to form an anchorage for the rubber shock-absorber and a stop which by contacting the upper part of the bulkhead prevents the undercarriage from swinging too far forward. The shock-absorber can take the form of a stout rubber-band, or a length of elastic cord, and its rear end is attached to a hook further back in the top of the fuselage. It secures the return of the undercarriage to its normal position after it has moved rearwards on the model touching down. The shock to the bulkhead would be reduced if small pieces of rubber strip were cemented to those parts that the wire strikes. It would also be advisable to reinforce the rear of the bulkhead with stout balsa strips.

As shown the undercarriage legs consist of extensions of the wire inside the fuselage, with balsa fairings. As an alternative, bamboo legs could be used, in which case the ends of the wire should be doubled and very securely lashed to the tops of the struts, as shown.

The sender does not indicate any particular size of wire, but one would suggest 16 gauge for a Wakefield size model, 18 gauge for a "Flight" Cup type (144 sq. in. of wing, and a min. weight of 5 oz.), and 20 gauge for small light models. The one drawback of such an undercarriage is that it is not removable from the fuselage. But if some provision was made for access to the rear shock-absorber anchorage so that the rubber-band could be slipped, then when the rubber motor was removed the struts would fold flat beneath the model.

Lance-Cpl. T. C. Watson, of the Royal Engineers, sends a photograph of an excellent semi-scale flying model, broadly resembling a Spitfire, which he has designed, built and flown. The immediate interest is that the difficult problem of securing a realistic and well-sprung wing undercarriage has been tackled with considerable success. The model weighs 11 oz. and flies at about 18 miles an hour, so the landing strains are far from negligible. As the designer puts it, the undercarriage has to be strong or it would not stand up to the work it has to do.

Ash or birch can be used for the legs, which plug into sockets of 1/16 in. hard balsa sheet, well gussetted by triangular chunks of the same material and sundry bracing pieces (Fig. 2). The part of each leg which slips into the socket has shoulders of hard balsa which ensure a tight fit and can be replaced quite easily when worn. These struts can, of course, be removed for packing the model.

The sender does not say whether or not the wing is detachable, but as the undercarriage sockets are fixed into the centre-section there would appear to be no reason why the outer panels should not plug into the centre part.

Mr. G. S. Lewis, of Rupert Street, London, W.1, writes that

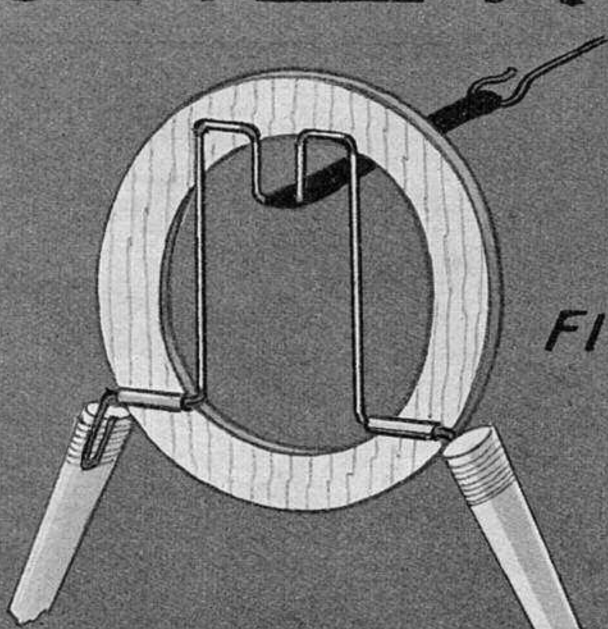


FIG. 1.

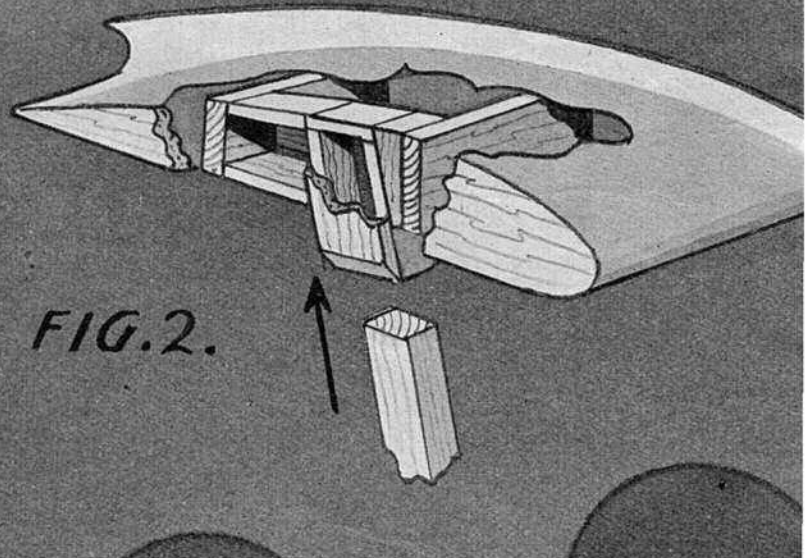


FIG. 2.

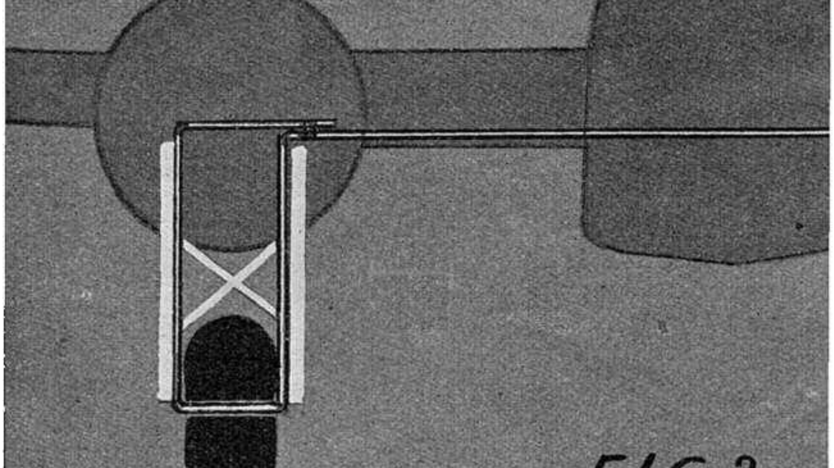


FIG. 3.

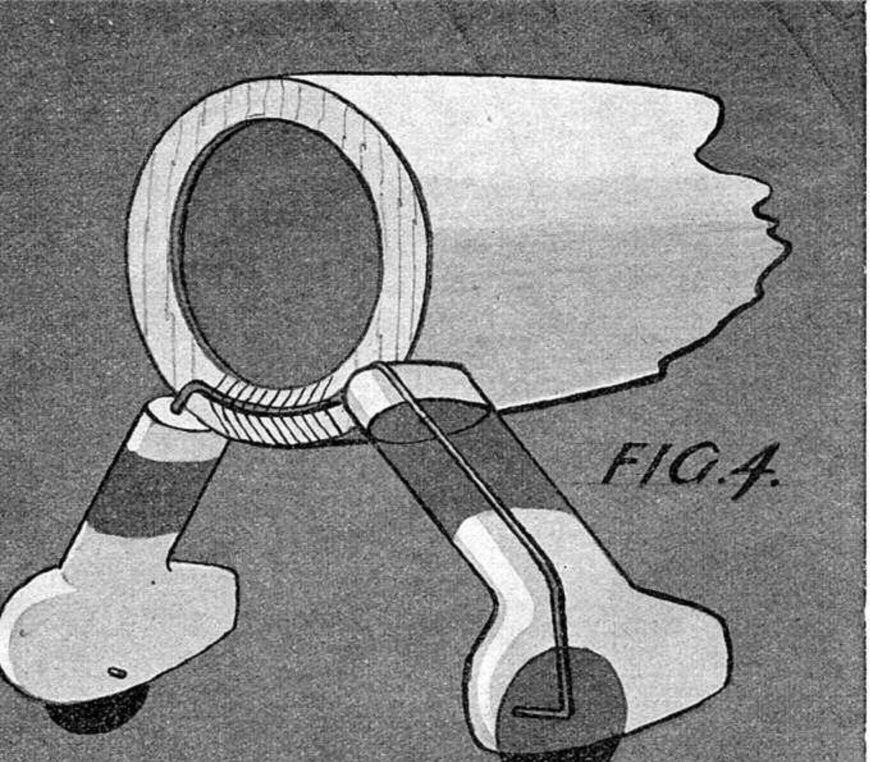


FIG. 4.

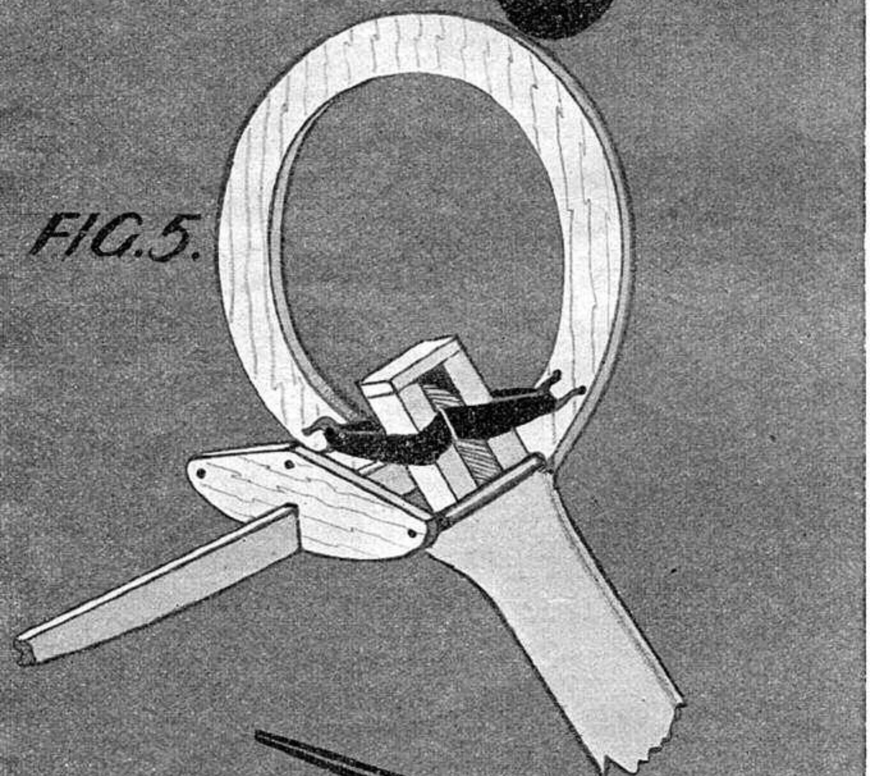


FIG. 5.

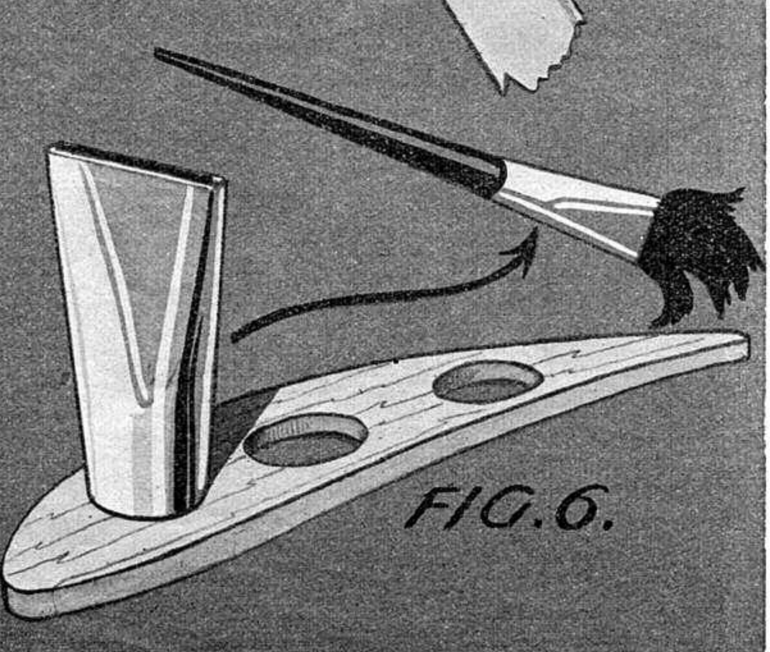


FIG. 6.

he has constructed Mr. H. J Towner's flying scale Bristol Blenheim, and has evolved for it a modified undercarriage which he suggests is no less effective than the original but a trifle more "scalish." Fig. 3 shows how the wire supporting each wheel is continued to form a rectangle and its end soldered to the horizontal wire passing through the fuselage. Balsa dowels and crosspieces are cemented to each leg.

The same correspondent forwards an idea for incorporating adequate springing in a faired and spatted undercarriage of the Lysander type. Fig. 4 depicts how both wheels are carried by a single wire which is relied upon for the springing. A section of the balsa fairing on each leg is cut away and replaced by a covering of thin rubber from a toy balloon. This allows the wire to bend under the shock of landing, and the rubber moves back into position with the wire. In cases where the gap is considerable, one or two balsa formers could be cemented to the wire to keep the rubber from sagging in an unsightly manner.

The advantage of this particular form of undercarriage is that while satisfactorily realistic it allows that rearward flexing which is so convenient with a model which, owing to its pilotless condition, tends to fly into the ground instead of levelling for a "three-pointer."

Another method of imparting springing to single-strut undercarriages suitable for scale models, devised by Mr. Joseph Lines, of Radford, Coventry, is shown in Fig. 5. Each leg is formed from hardwood (say bamboo or birch) in such a manner that the upper part enclosed within the fuselage consists of two separate pieces around which rubber tensioners are slipped. A bridge-piece prevents the tensioners slipping out of place. As will be seen, one tensioner runs outward to the outer edge of the bulkhead, while the other runs inward to the inner edge. The strut is pivoted by means of a brass tube as shown. When landing it splays outwards against the pull of one tensioner, and the other returns it to the normal position.

Though there is no rearward movement, this undercarriage has nevertheless proved satisfactory so far. The lateral springing renders it very suitable for the rear unit of a tricycle undercarriage.

Mr. T. W. Kemp, of Cardiff, describes a simple gadget for making lightening holes in balsa ribs, which is formed from a pensioned-off dope brush (see Fig. 6). When the last hairs have come out on that neatly covered wing, the circular portion of the metal ferrule which formerly held them together is sharpened to form a cutting ring. The holes are formed in the ribs by turning the ring to and fro. Mr. Kemp encloses a sample rib showing two sizes of hole neatly cut by gadgets formed from two different sizes of brush.

In the last Gadget Review two methods of plotting ellipses for bulkheads were described. One was the "trammel" method, the other made use of a circular pattern and a beam of light. Here is yet another accepted method which has been sent in by two readers quite independently of one another. They are Mr. H. P. Scott, of Abergavenny, and Master D. Ross, of Broadwell, Glos.

The method is as follows. First the width and depth of the ellipse are decided upon. Then draw a vertical line corresponding in size to the major axis (see Fig. 7). A horizontal line is drawn, representing the minor axis, bisecting the first line at right angles. With a pair of compasses step out the distance from the centre to the end of the major axis, *i.e.* one half the major axis, and with the point of the compasses on one end of the minor axis an arc of a circle is drawn which cuts the major axis in two places as shown.

Pins are driven into these three points and a piece of thread or strong cotton tied around the bases of the pins to form a triangle. The pin is then removed from the minor axis extremity, and, with a finely pointed pencil held vertical, the thread is stretched out as shown. Keeping the thread taut the pencil is moved round from top to bottom of the sketch. Thus you will have obtained one half of the ellipse, and the other half can be obtained by slipping the pencil within the opposite side of the thread and working around as before. If the pencil is not held upright or is blunt it will jump the thread.

An ingenious idea for a crash-proof airscrew has been received from Mr. W. Parkin, of Cottingley Yorks. It is shown in Fig. 8. Each blade is hinged a short distance from the centre, as in the manner of a folding airscrew, and at the bottom is securely cemented half of a press stud. The corresponding half is fixed to the airscrew-boss.

The motor having been wound and the freewheel engaged, the blades are snapped into the extended position. If, when landing, one of them hits an obstruction the press stud tends to unfasten, thus allowing the blade to fold. Large press studs can be given additional security by slipping fine tacks or pieces of pins through the holes. Alternatively, the studs can be sewn to a piece of silk, and the latter glued into place. The halves of the studs should not grip too tightly, but the hinges and wire blade stops must be very firm.

Mr. Robert Finlayson, of Stirling, Scotland, sends details of a non-slip winder-hook which has proved effective and reliable. The hook consists of a 4 in. or 5 in. nail with the business end filed to a taper, as in Fig. 9. This part is bent to form the hook. The head of the nail rests behind the jaws of the chuck, and when the latter are tightened, is prevented from slipping out during the process of winding the rubber motor.

Thanks largely to the pioneer work of Mr. C. A. Rippon and Mr. C. Rupert Moore the twin-engined model is no longer a day dream. Mr. Rippon introduced the flexible drive used to such good effect by Mr. Towner and Mr. Moore invented and patented his "Moore Drive" (shortly to be released, *Ed.*). Mr. H. E. White must not be forgotten for his earlier work on twin flying boats using elongated nacelles.

Various means of driving the twin airscrews have been employed by these and other designers, and here in Fig. 10 is an idea sent by Mr. R. Watson, of Stafford. It will turn a drive through any angle between 45 degrees and 135 degrees. Basically it consists of a brass wheel with six projecting prongs which is mounted on the airscrew-shaft. A similar wheel, to which the rubber motor is attached, is mounted at such an angle to it that the prongs of each engage. Thus the rubber skeins of a twin motor model can run at any convenient angle from the airscrew-shaft in each wing nacelle through the centre-section of the wing and into the fuselage.

Without knowing how much testing this particular gear has received, or the measure of success which it may have achieved, the idea is here described for its intrinsic interest, and to serve as a pointer for experimentation by modellers capable of this class of work. Further details from the sender and news concerning other people's efforts along the same line will be welcomed.

Mr. Watson offers the following constructional hints. The pronged wheel consists of a circle of 1/16 in. brass with 20 gauge piano wire projections. A hole is made with a sharp nail in the centre of a ½ in. square of brass and a circle 5/16 in. in diameter is described with a pair of dividers. The brass is then filed down to the required diameter, and the centre hole is drilled. The slots for the prongs are very carefully spaced, and as carefully cut with a fine hacksaw, the free running of the gear depending in large measure upon the accuracy achieved. Next the six prongs are cut from 20 gauge steel wire, soldered into their slots, and the wheel soldered to the shaft. It should be tested to ensure that it turns truly. If well made it should prove light and dependable.

The two gears to be engaged should be fitted into a small gearbox formed from 1/32 in. brass sheet.

In conclusion, two simple constructional aids from Mr. D. J. Dickson, of Bexleyheath. Fig. 11 shows a template and scriber for shaping a stout leading edge for a wing of constant chord. It is cut from three-ply or sheet brass, and when rubbed along a roughly shaped spar will soon produce an even edge that will only need smoothing with fine glasspaper.

Fig. 12 depicts how a length of window curtain "railway" can be used as a holder for wood strip which is to be converted into a triangular-sectioned trailing edge. It helps to keep the razor blade from slipping and the glasspaper block from biting too deeply, and provided that the rail *is* straight and free from kinks, also serves as a straight edge.

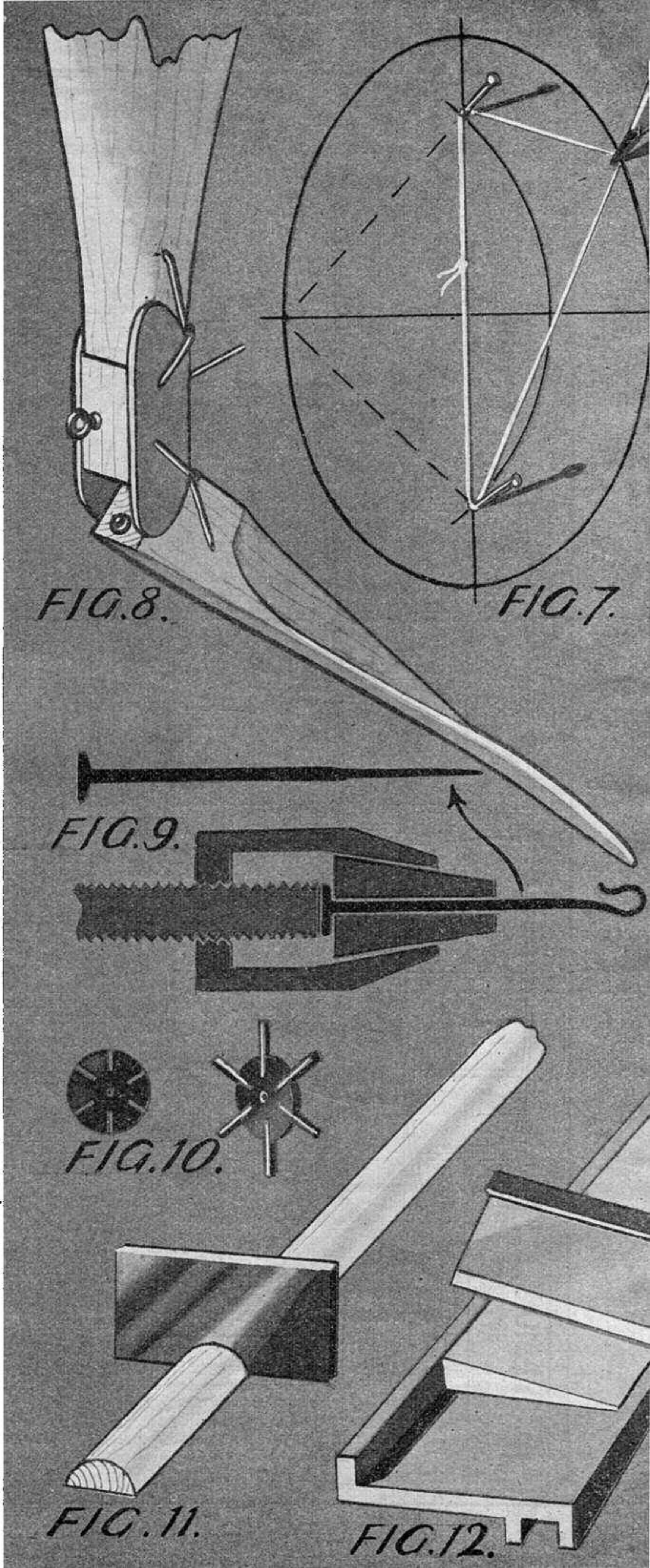
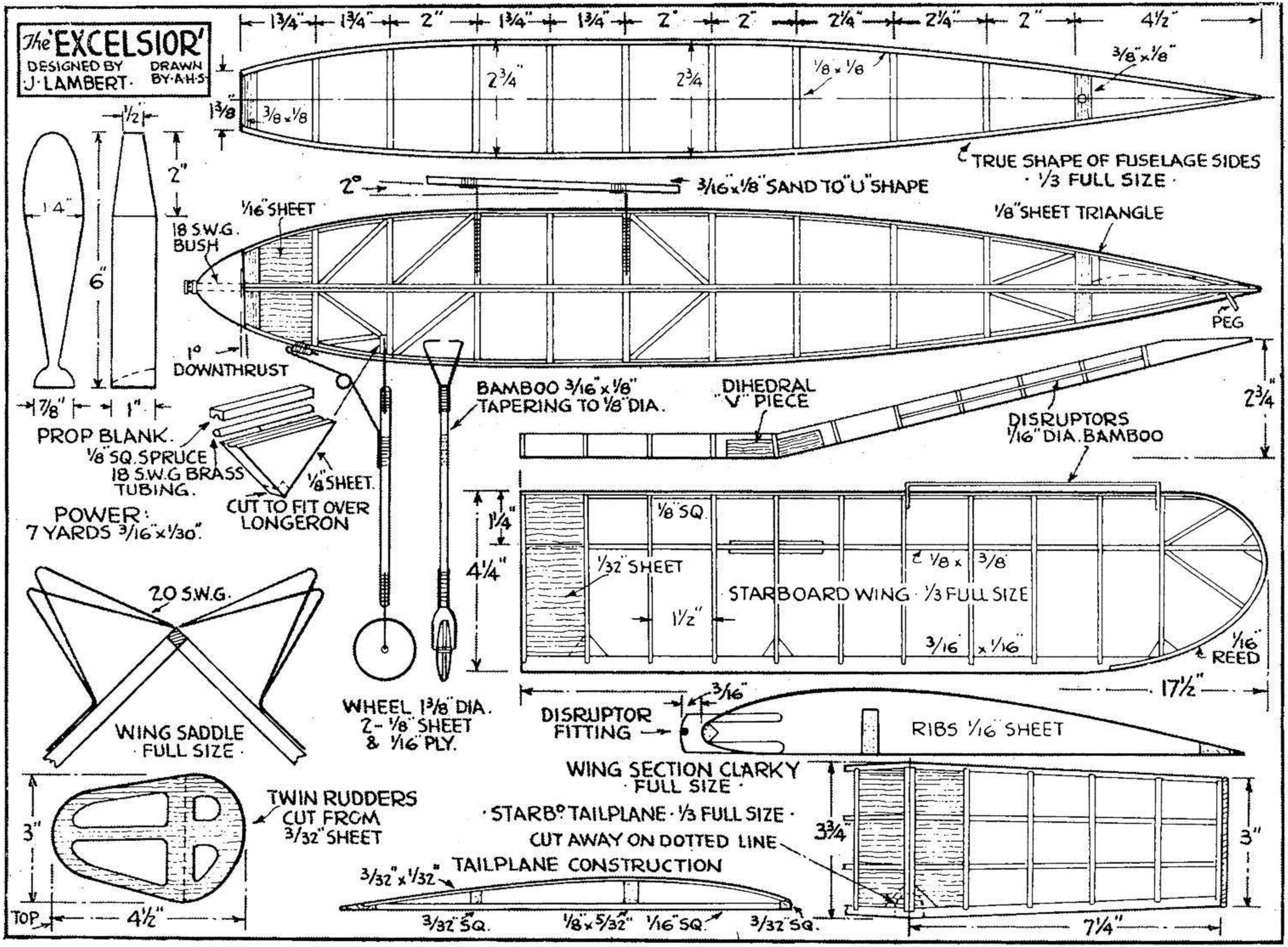


FIG. 8. FIG. 7. FIG. 9. FIG. 10. FIG. 11. FIG. 12.

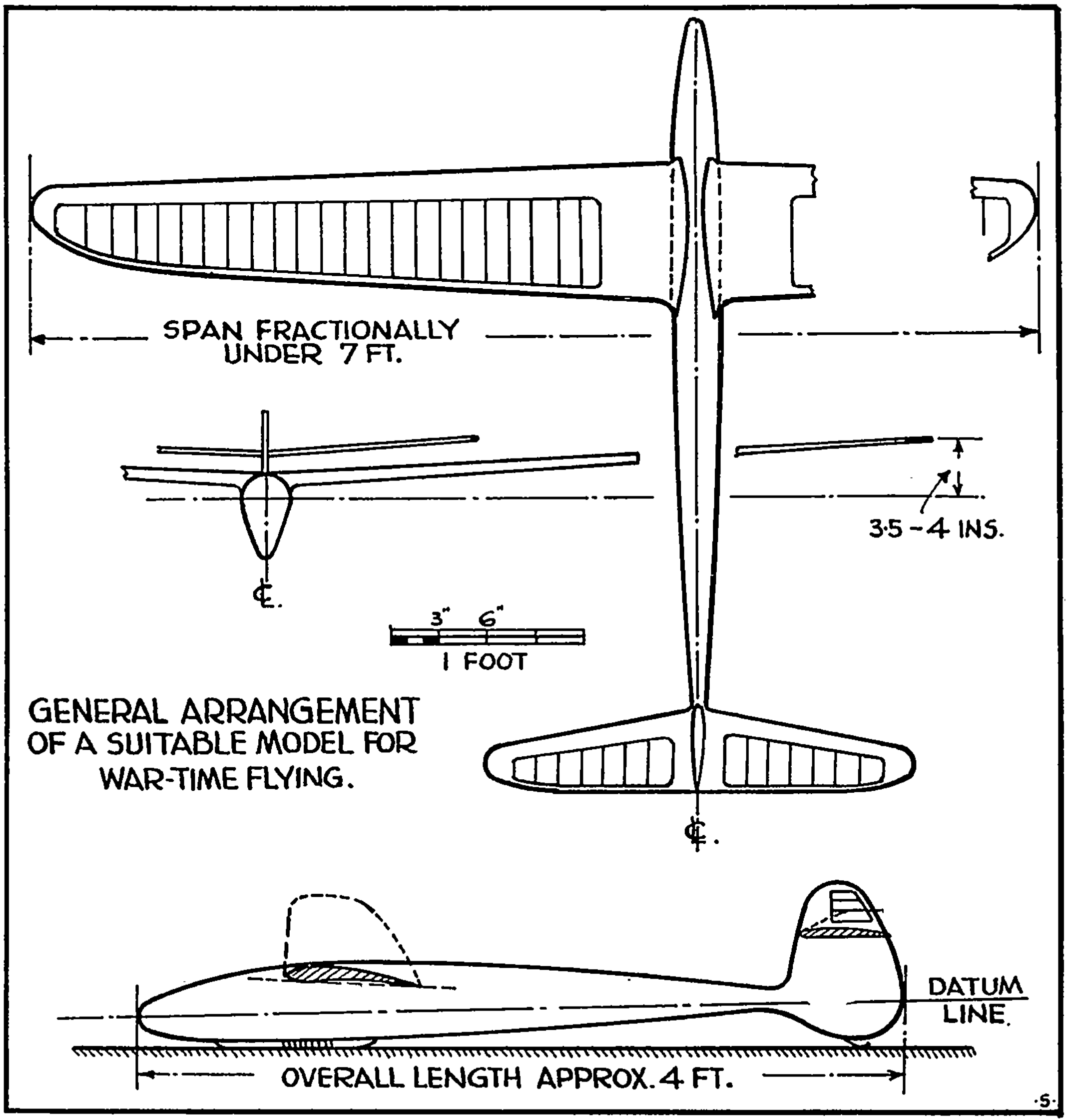

The 'EXCELSIOR'
DESIGNED BY J. LAMBERT.
DRAWN BY A.H.S.
1¾" 1¾" 2" 1¾" 1¾" 2" 2" 2¼" 2¼" 2" 4½"
2¾"
2¾
⅛ x ⅛
⅜" x ⅛"
1⅜
⅜ x ⅛
TRUE SHAPE OF FUSELAGE SIDES · ⅓ FULL SIZE ·
½"
2"
1·4"
6"
7/8"
1"
PROP BLANK.
2°
3/16"x⅛" SAND TO "U" SHAPE
1/16" SHEET
18 S.W.G. BUSH
⅛" SHEET TRIANGLE
PEG
1° DOWNTHRUST
⅛" SQ. SPRUCE
18 S.W.G BRASS TUBING.
⅛" SHEET.
CUT TO FIT OVER LONGERON
POWER: 7 YARDS 3/16"x1/30".
BAMBOO 3/16"x⅛" TAPERING TO ⅛" DIA.
DIHEDRAL "V" PIECE
DISRUPTORS 1/16" DIA. BAMBOO
2¾"
1¼"
4¼"
⅛" SQ.
1/32" SHEET
⅛ x ⅜
STARBOARD WING · ⅓ FULL SIZE
1½"
3/16 x 1/16"
1/16" REED
17½"
20 S.W.G.
WING SADDLE · FULL SIZE ·
WHEEL 1⅜" DIA. 2 - ⅛" SHEET & 1/16" PLY.
3/16"
DISRUPTOR FITTING
RIBS 1/16" SHEET
WING SECTION CLARK Y · FULL SIZE ·
· STARB° TAILPLANE · ⅓ FULL SIZE ·
CUT AWAY ON DOTTED LINE
TAILPLANE CONSTRUCTION
3/32" x 1/32"
3/32" SQ.
⅛" x 5/32"
1/16" SQ.
3/32" SQ.
3¾"
3"
7¼"
TWIN RUDDERS CUT FROM 3/32" SHEET
3"
TOP
4½"

SAILPLANES

PART—III

By

LEOFRIC GEORGE TEMPLE



In this final article of the series I propose to describe the layout and construction of model sailplane wings; it is a subject which should be given plenty of thought, as a badly designed wing upsets the whole performance of the aircraft. We must realise that the wing ought to be not only efficient aerodynamically, but stable as well, not only efficient in flight but amply strong too. I have already discussed what points to look for in choosing an airfoil, so now I shall describe the merits of the different plan forms available, and explain how lateral stability is obtained.

First, the designer has to choose between three plan forms — constant chord, tapered, and elliptical. The constant chord wing is usually adopted because it is very simple to build — it can be made in far less time than the other types, but has its disadvantages : it is not so strong as the tapered and elliptical types, and the weight is evenly distributed along the half-span, which means that the tips are too heavy. Tapered and elliptical wings, on the other hand, can be made very strong at the roots and the tips kept light, which is what we do need. Since a sailplane carries a large proportion of its total weight in the wings, this is a point to watch, as undue weight at the tip will mean the machine tends to sideslip and spin after a steep banked turn.

Apart from structural and weight problems, the constant chord is easy to deal with ; this is due to the fact that the tips of such a wing stall after the centre portion, whereas on a tapered wing the tips stall first, and the greater the degree of taper, the earlier will be this stall. We need a wing in which the whole span at least tends to stall together, so it would seem that the constant chord wing is our logical choice, nevertheless there are quite simple means by which we can ensure that even a highly tapered wing will stall last at the tips.

We can obtain this result by four methods : first, we can set the last few ribs at a smaller positive angle of incidence (known as washout) ; second, we can alter the section so that the last ribs are of airfoil section that stalls very late ; third, it is easy to build a gradual washout into the wing so that the incidence decreases evenly from the root out to the tip ; fourth, we can use slots.

In actual practice it is difficult to say which is the best method, and the first three have been well tried out in models ; tip washout seems to be the most popular in this country, while the Germans had excellent results with the change of section at the tips. I think a gradual washout is really the best of these three styles. I do not believe slots have been used previously on sailplanes, but I see no reason why the Bowden-designed slot should not be as successful on them as it is on the big petrol machines. I have adjustable tip slots on my 1941 model and they do not coarsen the gliding angle, but it is almost impossible to stall or spin this machine. It is an idea which may appeal to the serious research workers.

So far I have not said a lot about the elliptical wing. I have purposely left it until last, because, although in theory it is more efficient than any other shape, it is very difficult to build. Each rib has to be drawn out separately and the spar is not easy to make, because it tapers elliptically too. If we decide to sheet in the nose portion of the wing, this is a job to try the patience of a Job. However, a well designed elliptical wing is hard to beat.

A wing tapering from say, 8 or 9 in. at the root to about 5½ in., and with about 2 degrees less incidence at the tips than at the root, would be very good for a span of approximately seven feet, and is not hard to build.

Dihedral is necessary on all models, to obtain inherent lateral stability, but a sailplane needs less than a powered aircraft, and as a general rule 1 to 1½ in. per foot of half-span is quite satisfactory. Tip dihedral and polyhedral give tremendous stability but should not be overdone, or the machine will rock from side to side in flight ; and a gull wing is seldom any good and must at all costs be avoided. It was, in the opinion of the majority of design experts, a passing phase only. If you use polyhedral, a good plan is to raise the outer third of the wing, and use only a matter of 2 or 3 degrees on the inner portion and about 15 or 20 degrees on the outer, or tip portion.

Calculate the incidence carefully from power factor curves drawn for the airfoil you intend to use, and do not merely say " everyone else uses 5 degrees positive, so I am going to, too." That is certainly not design, but it *is* stagnation.

A sailplane wing consists of the main spar (or spars), the ribs, the leading and trailing edges, and the tips. The construction may be all balsa, but I shall describe in some detail wings made of other more durable timbers.

An all-balsa wing is very simple to build, as the ribs can all be cut from sheet and filed to shape between two templates of metal or hardwood—if the wing tapers, then templates cut to the size of the largest and smallest ribs will do. For a constant chord wing the ribs can be cut directly from the template.

The spars may be arranged at the point of maximum depth of the rib, and if spars of fairly large size are employed, say $\frac{3}{16}$ in. square for the top and $\frac{3}{8} \times \frac{3}{16}$ in. (greatest dimension vertical) for the lower spar, a strong wing results. Leading and trailing edges of $\frac{1}{4}$ in. square and $\frac{1}{2} \times \frac{1}{8}$ in. balsa, and a sheeting of $\frac{1}{32}$ in balsa from both top and bottom spar to the L.E., make quite a sturdy structure. The ribs can be made of $\frac{1}{16}$ in. or $\frac{3}{32}$ in. sheet, and the tips either built up of laminations of sheet or built from reed cane. A full-depth spar of $\frac{3}{16}$ in. balsa is also satisfactory. I do not advocate the use of multi-spar wings.

Since the majority of readers have had experience of building wings of balsa, I will not go into the subject in detail but will pass on to a description of non-balsa wings

In building a wing entirely without balsa, we have got to follow very closely the design and construction of the full-size thing ; and for lightness I advise a box or girder spar, built-up ribs, a hollow trailing edge, and a box nose. The spar for a seven-foot wing may be made with a top flange of $\frac{1}{8}$ in. square spruce, a bottom flange of $\frac{1}{8}$ in. square birch, and .8 mm. plywood webs. The ribs would be sheets of .8 mm. ply cut to shape and lightened, with $\frac{1}{16}$ in. square spruce outline and cross-braces ; trailing edges are easy to build from two narrow strips of 1 mm. ply, and the whole leading edge is formed with a sheet of .8 mm. ply. The tips are of reed cane.

The following description will, with the aid of the drawings in figs 1 to 3, make quite clear how such a wing is built.

The plywood rib blanks are filed to shape between templates, just as we shape the balsa ribs in a conventional wing ; the outlines are glued on and the lightening holes cut out. Do not forget the little stiffeners at the leading edge, nor those at the point where the rib slots are cut out. These stiffeners are needed on both sides where the ribs come, but all the rest of the braces are on one side only. Next, the spar flanges are glued into the slots in the ribs, the latter being held in position on a board to ensure accuracy during this operation. When this structure of ribs and spar flanges is dry, ply webs are cut to fit exactly between the ribs and are glued in place. For lightness, these webs may be on one side only, but it pays to use front and rear webs and form a complete box spar. A girder spar, in which diagonals are glued between each rib, is also very good, but not so strong as the box type.

The trailing edge is made of two strips of ply about $\frac{3}{8}$ in. wide, one fixed to the underside of all the ribs, one to the top, and glued together at the rear to form a hollow triangle. This is very strong indeed. I have devised a new form of leading edge made of .8 mm. ply and eliminating any true L.E. It is formed thus : cut a sheet of ply wide enough to extend from the top of the main spar right round the noses of the ribs to the bottom of the spar, steam it for a little while, and glue and pin it in place. It will form a hollow box which is immensely strong and resists torsion. If desired, this nose portion may be put on in short sheets, but make sure that where two sections join, there is plenty of " land," for if they merely join on a rib they will open up under stress. It is best to put half-ribs where a joint occurs, one on each side of the main rib, making them a little smaller than the other ribs. A small strip of ply is then wrapped round the rib and the two half-ribs, making a small box which gives a solid foundation on which to make the joint in the main sheet.

Tips can be made of cane, steamed to shape and braced to the spar and the torsion-box, $\frac{1}{8}$ in. being suitable.

For all glued joints in hardwood construction, use a casein or fish glue, never on any account try to manage with cellulose cement.

Before covering a single-spar wing it is a good plan to stiffen the ribs between the spar and trailing edge with $\frac{1}{4}$ in. wide strips of silk running from root to tip, top and bottom, and looped round each rib. When doped, these tapes add to the rigidity of the wing and keep the fabric from sagging too much. Covering should be bamboo paper or silk, applied damp and doped with two or three coats of full-strength " glider dope " —model dope is not much use, and produces saggy wings.

I realise that there is a great deal I have left out in these short articles, so anyone wishing to write to me, c/o the Editor, will be answered to the best of my ability.

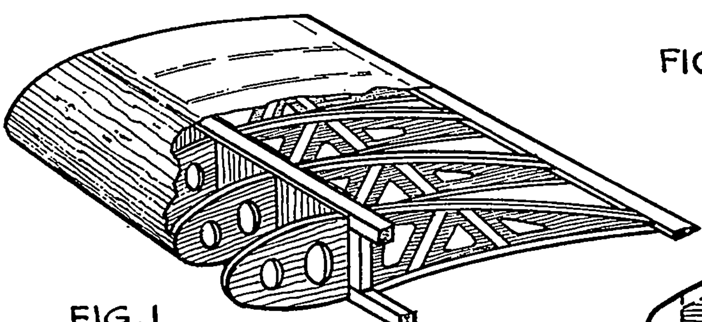
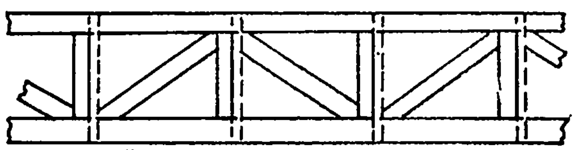


FIG. 1.

CONSTRUCTION OF WING FROM SPRUCE AND BIRCH PLYWOOD NOTE BOX SPAR AND HOLLOW TORSION-BOX AT THE L.E.

FIG. 2.



"N" GIRDER SPAR.
DOTTED LINES SHOW RIB POSITIONS

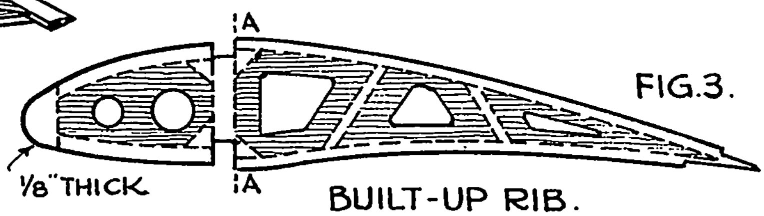
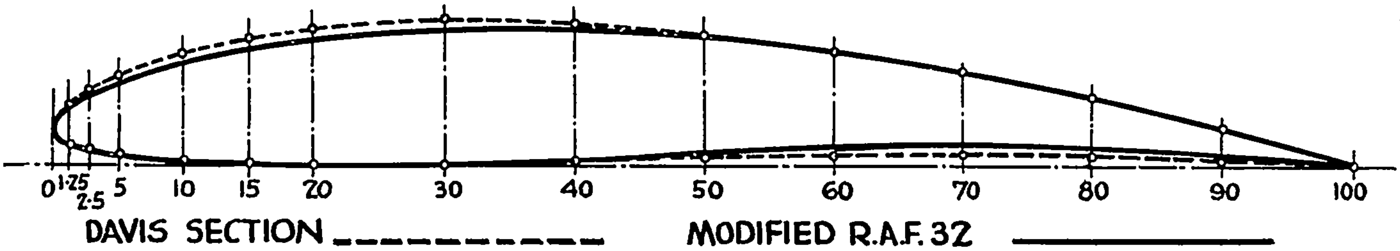


FIG. 3.

BUILT-UP RIB.
STIFFENERS FOR^D OF A-A = 1/8" SQ.
" AFT " " = 1/16" SQ.
RIB WEB = ·8 m.m.

·S·

THE R.A.F. 32 AIRFOIL MODIFIED by ·R·H·WARRING·



In this article R. H. Warring gives a detailed account of four of the R.A.F. series of airfoils so well known to the aeromodeller and draws some very interesting conclusions from the comparison of a modified form of the R.A.F. 32 with the famous Davis section. A table of ordinates for the modified R.A.F. 32 is given below.

Station	0	1·25	2·5	5	10	15	20	30	40	50	60	70	80	90	95	100
Upper surface ..	2·54	4·45	5·22	6·27	7·78	8·82	9·54	10·38	10·48	9·97	8·35	7·28	5·25	2·88	1·58	·10
Lower surface ..	2·54	1·57	1·20	·53	·24	·06	0·00	·24	·56	·88	1·17	1·28	1·17	·74	·42	·10

BEFORE we discuss the merits and evolution of the R.A.F. 32 airfoil, let us just examine the essentials required for any section. The most obvious of these is good lift, with small drag resulting, i.e. a high L/D ratio for flight angles and also a high value of C_L maximum (maximum lift coefficient). Actually a circular arc airfoil of camber y, at zero incidence, gives a theoretical value $C_L = 4\pi y$ for smooth flow, with a resulting drag approximately equal to the skin friction of a flat plate. Thin sections developed from this also show good L/D ratios and small drag coefficients, but unfortunately their use is limited because the resulting wing structure must be very weak. To accommodate wing spars of sufficient size to give a reasonable factor of safety the section has to be thickened with an increase in the drag coefficient, although the lift coefficient is at the same time increased and, by careful design, the efficiency of the section as a whole kept pretty high.

One measure for comparison of different airfoils is to calculate C_L max./C_D min. for each, and classify the types according to the greatness of the ratio obtained.

A flat plate or circular arc section is very inefficient at angles of incidence much above zero, due to the early break away of the air and consequent irregular flow. In order to obviate this a symmetrical fairing is placed around these elementary airfoils and the result is, as we can easily see, a "streamlined" section in place of the flat plate, and a similar "streamlined" section for the circular arc, but now, with the centre line curved, giving an under-camber.

The L/D ratio of a symmetrical section (straight centre line) is surprisingly good, and shows at once the relative inefficiency of the flat plate. The other section, developed by fairing the circular arc airfoil, has been considerably modified and turned into hundreds of different sections, all with the object of ensuring a minimum amount of irregular airflow over the range of usefulness of the section concerned.

This is by no means the only way of designing an airfoil, however, as there are several empirical methods available which also predict the characteristics of the airfoil so designed. The Joukowski streamlined sections are of this type, and they have been shown by experimental tests to give very little drag. These sections, however, lead to a trailing edge of infinite thinness, and consequently require modifying for practical application. Joukowski wing sections are obtained by modification of the transformation equation, and again experiment has verified the excellence of such types. In practice the experimental lift is usually less than the theoretical lift, as the former calculations usually neglect frictional effects and at around C_L maximum theory and practice differ widely.

Another deciding factor in our choice of airfoil is the position and movement of the centre of pressure or point of application of the resultant aerodynamic forces. It is well known that all cambered airfoils have an unstable centre of pressure movement, that is, as the angle of attack increases, the C.P. moves *forward*, tending to *increase* the angle of attack still more, and so on up to the critical point. If a model wing alone is launched horizontally it will stall, dive, stall again until it reaches the floor, and thus the necessity of a tailplane is seen to damp out this unstable movement. A flat plate on the other hand possesses a *stable* centre of pressure movement, which means that the centre of pressure moves *back* with increased incidence, thus introducing a righting couple. For this reason a piece of paper weighted at one end so that the C.P. coincides with the C.G., will glide straight when launched unless it meets an air disturbance, which changes its path, causing side-slipping, etc.

However we have seen that a cambered section is far more efficient, and some method of minimising the C.P. travel must be found. For model work this is usually taken care of by the tailplane, for this is always on the large side in any case. A series of experiments were carried out many years ago in

TABLE I

Airfoil.	C_L/C_D max.
Eiffel 400 ..	20·8
Clark Y ..	18·8
Gottingen 436	18·5
Clark Y-15 ..	18·4
R.A.F. 15 ..	18·4
U.S.A. 35B ..	18·1
R.A.F. 32 ..	17·9
U.S.A. 27 ..	17·7
Gottingen 387	16·2
U.S.A. 35A ..	15·1

TABLE II

Airfoil.	C_L max.
U.S.A. 35A ..	1·470
Gottingen 387	1·431
U.S.A. 27 ..	1·351
R.A.F. 32 ..	1·312
U.S.A. 35B ..	1·301
Eiffel 431 ..	1·290
Clark Y-15 ..	1·260
Clark Y ..	1·239
Gottingen 436	1·204
R.A.F. 31 ..	1·051
R.A.F. 15 ..	1·017
R.A.F. 30 ..	·82

TABLE III

Airfoil.	C_D min.
R.A.F. 31 ..	·0109
R.A.F. 15 ..	·0123
R.A.F. 31 ..	·0130
Clark Y ..	·0153
Gottingen 436	·0165
Clark Y-15 ..	·0168
R.A.F. 32 ..	·0185
U.S.A. 35B ..	·0185
U.S.A. 27 ..	·0220
Gottingen 387	·0237
U.S.A. 35A ..	·0302

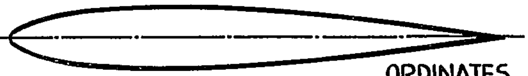
TABLE IV

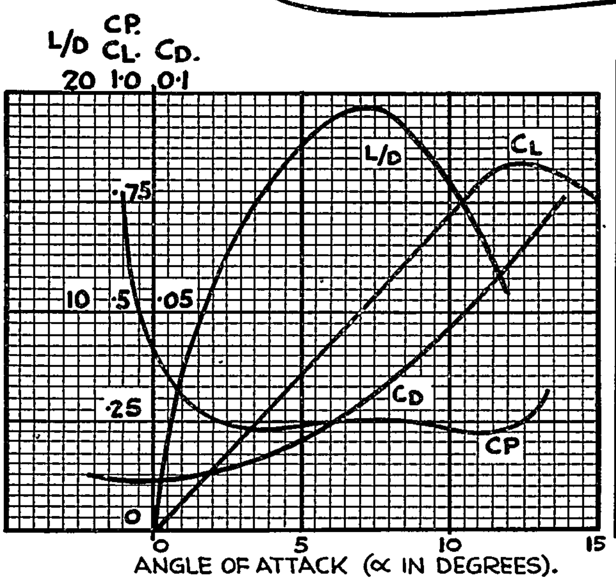
Airfoil	C_L max. / C_D min.
R.A.F. 15 ..	82·7
Clark Y ..	80·9
R.A.F. 31 ..	80·85
R.A.F. 30 ..	75·23
Clark Y-15 ..	75·0
Gottingen 436	73·0
R.A.F. 32. ..	70·9
U.S.A. 35B ..	70·3
U.S.A. 27 ..	61·4
Gottingen 387	60·4

TABLE V

Airfoil.	$C_L^{1.5}/C_D$ max.
U.S.A. 35B ..	14·66
U.S.A. 27 ..	14·25
Clark Y ..	14·25
Clark Y-15 ..	14·20
R.A.F. 15 ..	13·89
Gottingen 387	13·71
R.A.F. 30 ..	13·52
U.S.A. 35A ..	13·45

R.A.F. 30
R.N. 252,000.





ORDINATES % CHORD.

DIST FROM L.E.	UPPER & LOWER
0	0
1·25	1·80
2·5	2·48
5	3·46
10	4·68
15	5·44
20	5·94
25	6·20
30	6·32
35	6·30
40	6·20
45	6·00
50	5·66
55	5·26
60	4·78
65	4·28
70	3·70
75	3·12
80	2·50
85	1·90
90	1·30
95	·70
100	0

order to find a section giving a very small C.P. movement, and it was found that by turning the trailing edge upwards *reflexing* it was called, this aim was achieved. Unfortunately the other characteristics of the airfoil suffered, particularly the lift and, although this method achieved some popularity at the time, it has now been almost universally abandoned in favour of choosing a section of normal form with a moderate travel and getting stability by other means (e.g. slots, although slots are primarily used for prolonging the lift curve).

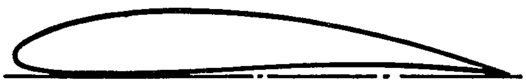
We will now collect together all the criteria necessary for a complete comparison of various airfoil sections, and see briefly how they are used.

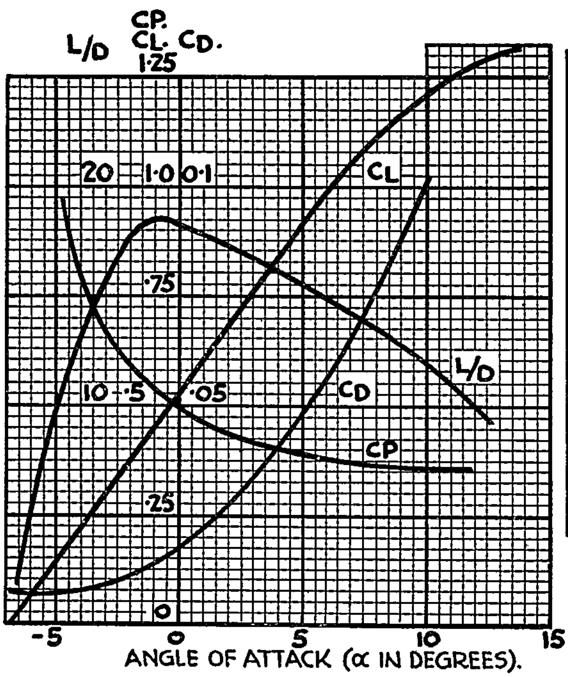
CL max. is the criterion for either :—

(*a*) Minimum speed with given wing loading, or

(*b*) Wing loading for a given minimum speed.

R.A.F. 32
R.N. 252,000





ORDINATES % CHORD.

DIST. FROM L.E.	UPPER	LOWER
0	3·42	3·42
1·25	5·56	1·96
2·5	6·52	1·50
5	7·84	·88
7·5	8·83	·50
10	9·72	·30
15	11·02	·08
20	11·92	·00
30	12·98	·30
40	13·10	·70
50	12·46	1·10
60	11·06	1·46
70	9·10	1·60
80	6·56	1·46
90	3·60	·92
95	1·96	·52
100	·12	·12

·AHS·

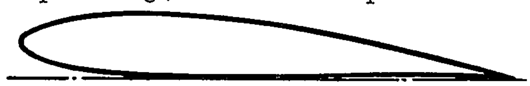
CL/CD max. gives the greatest weight carried for a given thrust, flattest glide (*not* slowest sinking speed), and maximum range.

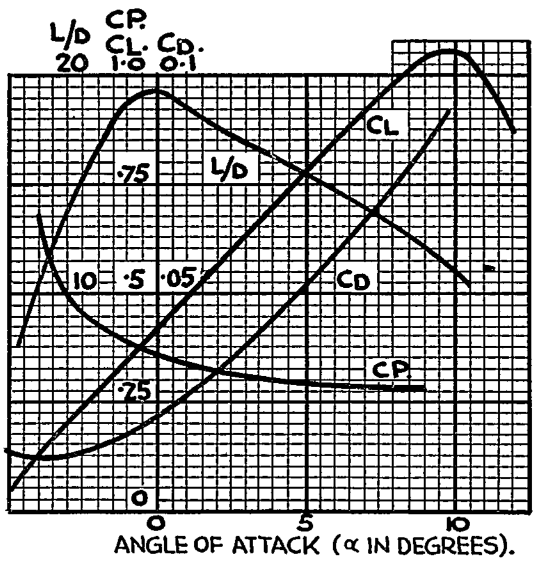
Power factor $C_L^{1·5}/C_D$ is a criterion for minimum sinking speed, ceiling, climb and duration. The higher this value the greater any of these, and also the lower the power required to maintain flight.

It is also useful to calculate the L/D ratio for various lift coefficients, these data giving criteria for speed and climb. Putting the cart before the horse (we haven't mentioned the R.A.F. 32 airfoil yet), the following tables set out these various criteria, the airfoils being arranged in order of merit. Since it is hard to obtain sufficient data for various airfoils tested at the same Reynolds Number, their absolute accuracy is not guaranteed but, as presented, are for tests at a R.N. of roundabout 190,000, corresponding to a 6 in. chord at approximately 60 feet per second. Where data was not available at this R.N. a graphical correction was applied.

The series, R.A.F. 30–33 were designed in about 1923 with the object of obtaining good thick airfoils with high maximum lift (CL max.) and high efficiency. Up to that time the R.A.F. 15 was one of the most popular sections in use, but, owing to its thinness, it was really only suited for biplanes or braced monoplane wings, hence this development.

R.A.F. 31
R.N. 252,000.





ORDINATES % CHORD.

DIST FROM L.E.	UPPER	LOWER
0	7·18	7·18
1·25	8·88	5·36
2·5	9·70	4·72
5	10·70	3·74
10	11·84	2·58
15	12·52	1·72
20	13·00	1·14
25	13·20	·72
30	13·14	·44
35	12·90	·26
40	12·48	·12
45	12·00	·04
50	11·42	·02
55	10·64	·06
60	9·80	·10
65	8·80	·16
70	7·74	·22
75	6·60	·30
80	5·40	·32
85	4·18	·32
90	2·92	·24
95	1·62	·14
100	·12	·12

The basic airfoil was the R.A.F. 30—a symmetrical section about a straight centre line. It is actually a Joukowski section* calculated from a generalised transformation formula of that type. The actual method used is too mathematical to describe here, and for those interested R. and M. 911, by H. Glauert, gives its derivation.

From this section two more were obtained by arching the centre line. The R.A.F. 31 was given a camber of ·02 with the object of obtaining minimum profile drag at high speed, and the R.A.F. 32 a camber of ·05 to give minimum profile drag at low speed. The resulting sections and their characteristics are illustrated in the accompanying diagrams.

These two latter sections yielded particularly good results, but the centre of pressure travel of the R.A.F. 32 was rather large, and so a still further section, the R.A.F. 33 was introduced with a reflex trailing edge to give more favourable "stability" characteristics. This had the same camber (0·5) as the R.A.F. 32, but the C.P. is approximately constant over flight range. However, its other characteristics show a falling off compared with the other two, particularly as regards CL max. and L/D max.

* *For those interested in aerofoil design it should be noted that the last 1 per cent. of the transformed section was cut off to avoid an infinitely thin trailing edge, and the contours in this region modified to suit.*

In all of these sections the most noticeable change due to scale effect is an increase in minimum drag, with reduction of Reynolds Number—i.e. as the test more nearly approached model practice. Since the R.A.F. 32 is otherwise quite an excellent section for our job, some means of reducing this effect is to be welcomed.

Probably everyone has used this section at one time or another, particularly for Wakefield models, but several advantages are to be gained by modifying it for low speed work. If we thin the section down by taking 80 per cent. of the ordinates and plotting a new section we get one that still retains a high lift coefficient, both at flight angles and the critical point, with quite a considerable reduction in drag. Mr. R. N. Bullock was one of the first to use such a section on a Wakefield model and the excellence of his results is a good recommendation. Even though the section is thinned down there is still ample room for spars suitable for a model wing, particularly that type of construction employing large leading and trailing edges with no intermediate spars.

Of recent years the Eiffel sections have been widely used on Wakefield, tending to supersede the R.A.F. 32 in its normal and modified form, but in the absence of accurate low speed wind tunnel data it is impossible to give a definite ruling. I have found by comparison of what little data I have on these Eiffel sections that of the three, Eiffel 400, Eiffel 431, and R.A.F. 32, that the latter comes a definite third, especially on the high aspect ratio wings of the modern duration machine, but the thin trailing edges of the French sections often lead to constructional difficulties and too many builders nullify the slightly greater efficiency by poor wing shapes. This point is also definitely against any modification by thinning down as in the R.A.F. 32.

The modified R.A.F. 32, however, has shown up well in flight tests and some recent research with it has produced some extremely interesting results. But in the absence of any wind tunnel tests, these results are only qualitative.

Readers are probably familiar with the famed Davis section, claimed by the Americans as " revolutionary " and highly efficient. This latter section is derived mathematically from two basic formulæ which are, unfortunately, far too complicate for the average reader to comprehend. Actually a whole series of airfoils can be designed from these two formulæ but with different thickness to chord ratios. The first Davis wings, it will be remembered, were characterised by a high aspect ratio and a thin section as in the Consolidated models Nos. 31 and 32, the latter being more familiarly known in this country as the " Liberator." Recently news has leaked out of a projected fighter design fitted with a Davis wing, the Manta, a model of which has been tested in a wind tunnel and a full scale mock-up constructed. The wing, unlike the original Davis, is quite thick.

To revert to the original Davis section. Using the basic formulæ a profile with a thickness to chord ratio of 11·25 per cent. was plotted as probably being suited for model work. Having completed this it was thought that a comparison of this profile with that of the modified R.A.F. 32 would be of interest. The Davis is plotted about the geometric chord whereas the R.A.F. 32 is plotted about the " lower tangent " chord and so the first thing to do was to plot the modified R.A.F. 32 and then draw in its geometric chord, i.e. a line passing through the trailing edge and the centre of curvature of the leading edge. The Davis section was then plotted about this geometric chord with the result shown at the beginning of this article.

Quite an amazing similarity is apparent, in fact the ordinates of the two sections coincide at a great number of points. The upper surface of the Davis is slightly more convex forward of 40 per cent. of the chord but rearwards of this it is exactly the same. The lower surfaces coincide up to about 30 per cent. of the chord but rearwards of this the modified R.A.F. 32 has slightly more undercamber (about 1·5 per cent. greater).

If, then, the Davis is so highly efficient this would account for the low drag values suspected for the modified R.A.F. 32. At present no wind tunnel results are available to confirm this but careful observation of flight tests appear to justify this point.

However, that is no reason to sit back and feel that at last we have a really efficient model section—there is probably room for great improvement. It would appear, in fact, that a combination of the upper surface of the Davis and the lower surface of the modified R.A.F. 32 would possible be even more efficient although the author has a feeling, which can only be proved or disproved by wind tunnel tests at low speeds, that possibly a more pointed section may give better results at the model end of the aerodynamic scale. Until more knowledge is forthcoming on this point, though, I can confidently recommend this compound section for all classes of rubber-driven competition models except the particularly low speed types and heavy models in general.

Such a section has a sufficient depth to allow for wing spars of adequate size, resulting in a strong structure, but a rib spacing of one inch should be adopted to prevent distortion of the section by the covering sagging between the ribs. Except on high aspect ratio wings there should be no need to wash-out the tips and, properly constructed, it should give reasonably low drag values coupled with a good lift. A table of ordinates of this section which, justified or not, I have called the " C.W.1," is given on this page and its profile can be seen from a study of the heading sketch to this article.

For indoor models with single surfaced wings the upper surface ordinates of this compound section should give excellent results. A point that a good many builders overlook in these types is that *a thick section is not essential* and is even detrimental to performance. A section with a moderate amount of camber gives better results for, even at extremely low speeds, drag is still important and the power reserve is extremely small. The upper surface of the Marquardt S-2, which corresponds to the McBride B-7 indoor airfoil, has a camber of only 8·3 per cent. of the chord and up to now this section has probably given the most consistent results. This is no reason, however, for not trying other sections.

Finally, to conclude this article, a few notes on wing construction would not appear to be amiss. Too many builders spoil an otherwise excellent design by lack of attention to the finer points of building, especially in regard to the shape of the leading and trailing edges.

Perhaps the most usual error is in the *attitude* of the trailing edge. In the majority of sections used by the aero-modeller this is not perfectly flat but usually inclined at an angle with the front edge slightly higher than the rear edge. In other words the front of the trailing edge must be packed up by inserting little slivers of balsa, usually about 1/32 in. thick, between it and the plan when building. In other words do not spoil your theoretical work by faulty construction.

Actually the difference between a good and an excellent section might not be very noticeable on a model, but it is these little things that count in producing a first class competition machine. Those of you who choose R.A.F. 32 every time, " because it is the usual section for a Wakefield," might do well to bear in mind that this section is nearly twenty years old and a lot of experimental work has been carried out since then. If you can get data on various sections, *tested at the same Reynolds Number* (i.e. the same aerodynamic scale), compare them all by the means suggested in the above paragraphs before deciding which to employ on your model.

Table of ordinates for C.W.1 :—

Station	0	1·25	2·5	5	10	15	20	30	40	50	60	70	80	90	95	100
Upper surface ..	2·54	4·49	5·46	6·64	8·32	9·49	10·29	11·03	10·68	9·97	8·85	7·28	5·25	2·88	1·58	·10
Lower surface ..	2·54	1·57	1·20	·53	·24	·06	·00	·24	·56	·88	1·17	1·28	1·17	·74	·42	·10

NOTE.—This section is plotted about the " lower tangent " chord.

MY NEW WAKEFIELD BY ROBERT JAMIESON

WHEN the first rumour that Jamieson had a new Wakefield " on the stocks " trickled out, a wave of surmise and speculation swept through every aero-modelling club room in the country. Everywhere that " substitute-sufferers " and " dope-diluters " gather, small groups would get together to discuss and argue about this, the really big event of the aero-modelling year. Would Jamieson slab or stream ? Would he retract or fold ? Would he poly or twin ? These, and a dozen other questions, were hotly disputed wherever the brotherhood gathered from Lands End to John o' Groats.

Such an interest in our work is, of course, quite natural when one remembers that nearly all the major improvements and refinements now in everyday use in our Wakefields were first introduced by Jamieson. The retracting undercart and the folding airscrew for instance are only two of the innovations emanating from our workshop, though subsequent pioneers have, it must be admitted, greatly improved upon our first efforts. Nevertheless, the idea was ours. The first retractable undercarts, for instance, were crude affairs, and all of the " delayed-action " type ; that is, the undercart did not fold up until the machine struck the ground.

Our first folding propellers were also developed in conjunction with our landing gear, our problem being to develop an airscrew that would fold up out of harms' way voluntarily, without being forcibly collapsed on coming in contact with Mother Earth. We gaze with pride on the subsequent development of our first crude ideas, " from such small beginnings . . ."

But to our muttons. In the ordinary course of events, the new Jamieson model would not be seen until, guarded by cordons of police, and snapped from every angle by batteries of press cameras, it made its proud debut at the take-off board for the Wakefield trials. But things being as they are, we feel it our duty not to withhold the result of our researches, but to pass on our findings to our contemporaries.

To the wondering, the anxious, and the eager-for-news, we hasten to come to the crux of the matter and inform all and sundry, quite simply, that our new model is based on Macgillicuddy's formula. Now then, you fat man at the back ! Quiet please ! I know exactly what you are going to say. You are going to reveal your abysmal ignorance by shouting " Macgillicuddy ! Whose 'E ? Never 'eard of 'im ! "

Well, maybe you haven't, but that's nothing to be proud of, for who of us, among the old guard of our hobby, does not bare his head at the mention of the old Maestro's name, or has not burned the midnight oil poring over the wisdom in his epic book " Models for Maniacs, Morons and Mongols."

Starting therefore with his Empiric Formula for blending thrust line with C.G.

Stated thus :— $\sqrt{\frac{LMS \times ARP}{LRAM + 13s.\ 4\frac{1}{2}d.}}$

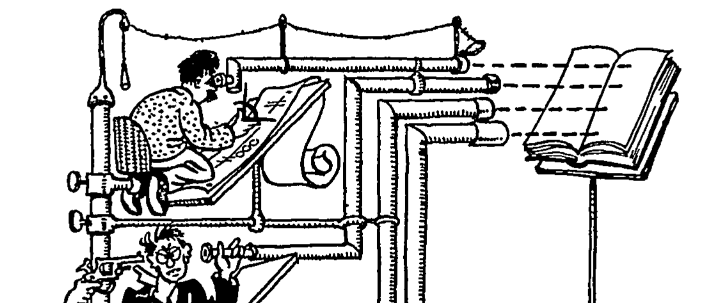
Where L = Length, M = Mass in slugs, S = Span, ARP = Area round propeller, and LRAM = Length of rubber allowed (for) motor and 13s. 4½d. = The french-polisher's charge for renovating the top of the dining-room table after we had spilt cement over it.

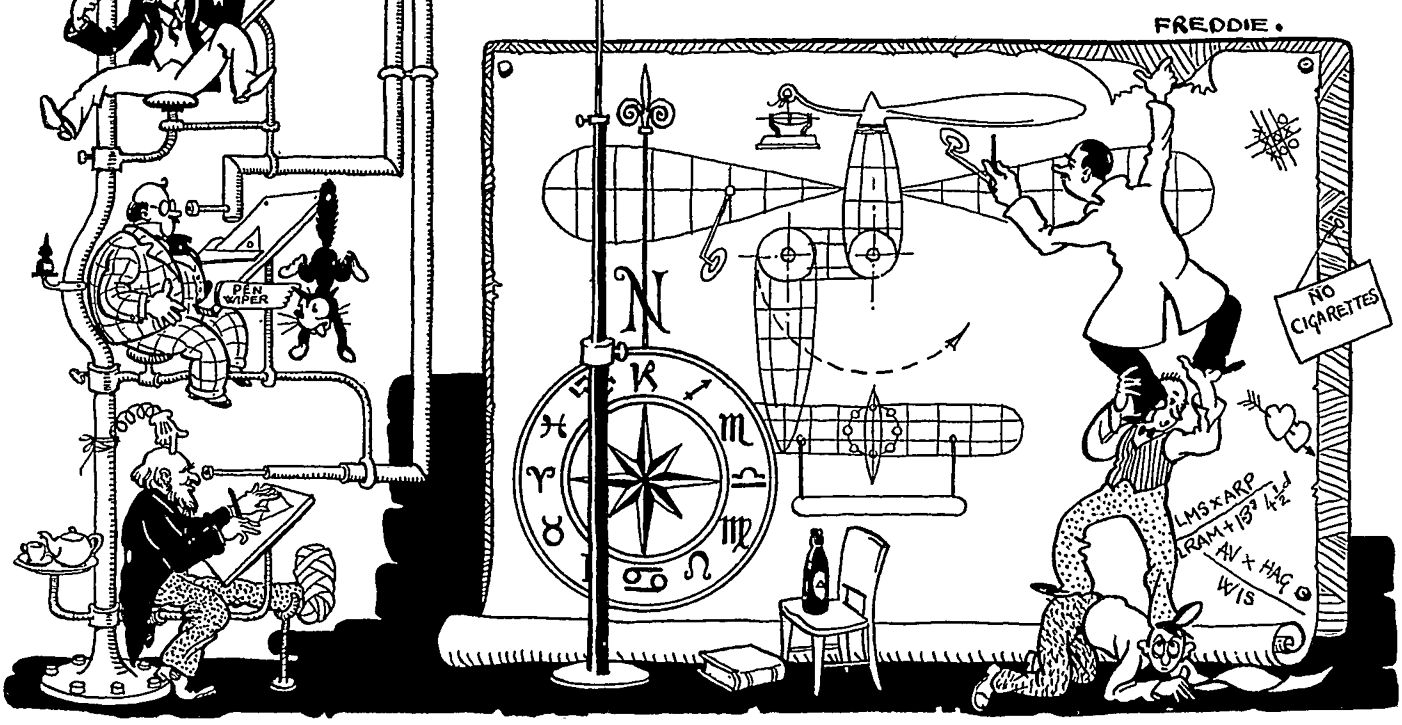
We see at once that the ideal fuselage shape is an ovidly rectangular polypatogon, the thrust line of which will meet the C.G. athwart its greatest cross-section and always at the least possible distance from its smallest curve.

" But," you will object, " that will mean that the thrust line is moving about." " Well, what do you expect it to do ? Dance the Conga ? "

McGillicuddy, in his treatise, " Aerodynamics for Infants and Imbeciles " (Chap. 5), pointed out that that was the mistake that most designers make when they imagine the thrust line to be static and constant. I quote him verbatim—" As the twig is bent the tree inclines," " similarly as the propeller revolves the rubber wallops about. We must therefore in our designs think not of what we hope won't happen, but of what we are afraid will happen." Hence the assumption of a moving thrust line.

Here, of course, the conventionally-minded throw up their hands in horror and ask " What about stalling ? " " Well, what about it ? " Indeed, given the right attitude of mind it can be easily overcome with a little thought. Two methods suggest themselves.





Firstly—Intimidation :—Pounce suddenly on the model, draw your gat from your shoulder-holster and snarl " Quit stallin', sucker," in your best G-man manner. This is effective in most cases.

The second method, and the one which we intend to adopt, is simply to fair up the nose of the machine with sheet lead, this will have the effect of keeping the nose down whatever the circumstances.

Passing now to the wing ; it is obvious that with the paralatic ligature of the fuselage passing so far above the centre of positive alacrity, a wing of rather unusual wing section and plan form will be required to overcome any tendency to amblic yawing. The section we are using therefore is Modified Macgillicuddy 123. While some may have turned down this section in the past on account of its low points value, and tendency to curl its camber in hot weather, its admittedly high Drift and Brag co-efficient (particularly noticeable on Leap Years and Tuesdays) more than justifies its selection.

The plan form of the wing is, as we have stated, rather unusual. The largest section being at the extreme tip and tapering sharply to the root, where it comes almost to a point. Thus we kill two birds with one stone, that old bugbear of the past, that slimy fifth columnist, the tip vortice, gives one look at the broad tip and gives up immediately, baffled and disgusted. Used to slipping round the slim tips of a highly tapered wing, the broad tip section knocks him for the count at once, while at the other end, Root Interference, owing to the wing tapering to a sharp point where attached to the fuselage, simply never has a chance, there being nothing to interfere with.

Admittedly, of course, the vega of vitaminic vibration of such a plan form is high, but, after all, as Stalin said to Hitler, " You can't have everything."

Passing now to the calculated air speed of our model we come to a serious snag. Air speed (provided pitch is known) can be simply calculated by the following formula :—

$$\frac{AV \times HAG}{WIS}$$

Where AV = Asthmatic verbosity.
HAG = Height above ground (when launched).
WIS = Weight in Slugs (Snails will do if slugs are not available).

That is, of course, assuming the model goes into a vertical dive immediately it is launched.

" But, what about Propeller Pitch," you now ask. Most designers are quite nonchalant about this most important point, they say—" Pitch = dia. plus ¼ "—and leave it at that. As if the pitch of any propeller can ever be accurately ascertained. For as Macgillicuddy says (Models for Maniacs, etc.), " Surely the pitch of any propeller is not a matter of mathematics, but one of physical strength and degree of exasperation. No-one can forecast how far any aero-modeller can pitch his propeller, without of course being there to measure the distance at the time."

The next question to be settled is that of the Rig, chief point of which is the angle of incidence, method of finding which is as follows :—Inscribe a circle whose area is the same as the greatest fuselage cross-section, around its outer periphery inscribe the twelve signs of the Zodiac in their proper segments. Now insert the height above sea level (taken at sunrise, if measured at any other time, allowance must be made for the state of the tide) at the base of the circle and draw a line N.N.E. from the selected spot until you come to the edge of the paper. Now draw another line through Cancer the Crab and Taurus the Bull, continue this line to infinity or to the nearest shop that has cigarettes in stock, whichever is the lesser distance. Fifty per cent. of the Tangental cosine where the two lines meet will give the required angle of incidence.

Much the same result can, of course, be obtained by bunging a chunk of balsa or other suitable material under the leading edge of the wing to prop it up a little higher than the trailing edge. But this method is not favoured by the elite as it makes the whole darn thing look too simple.

Coming now to the rear, we are faced with rather unusual Fin and Stabiliser problems, for it must now be obvious (to those who have followed us thus far, and are still in their right minds), that a wing whose flight graph shows such steep curve on the descent (practically vertical in all cases); that a really efficient Stabiliser and Fin assembly must be evolved if successful results are to be forthcoming.

And here we proudly present the Surprise of this year's model. Our new Ball-bearing, Gimbal-swung, self-trimming, fully-automatic, Auto-compensating (patt. applied for) Tail-Unit.

Revolutionary as the idea may sound, we are confident that before long it will be widely adopted. Think of the advantages ! Model starts stalling, tail flicks down to correct it, model tries a dive, tail immediately yells " No you don't " and starts counter-blitz in the opposite direction. Fit and Forget, no more wrecked models ! Boys, it's colossal !

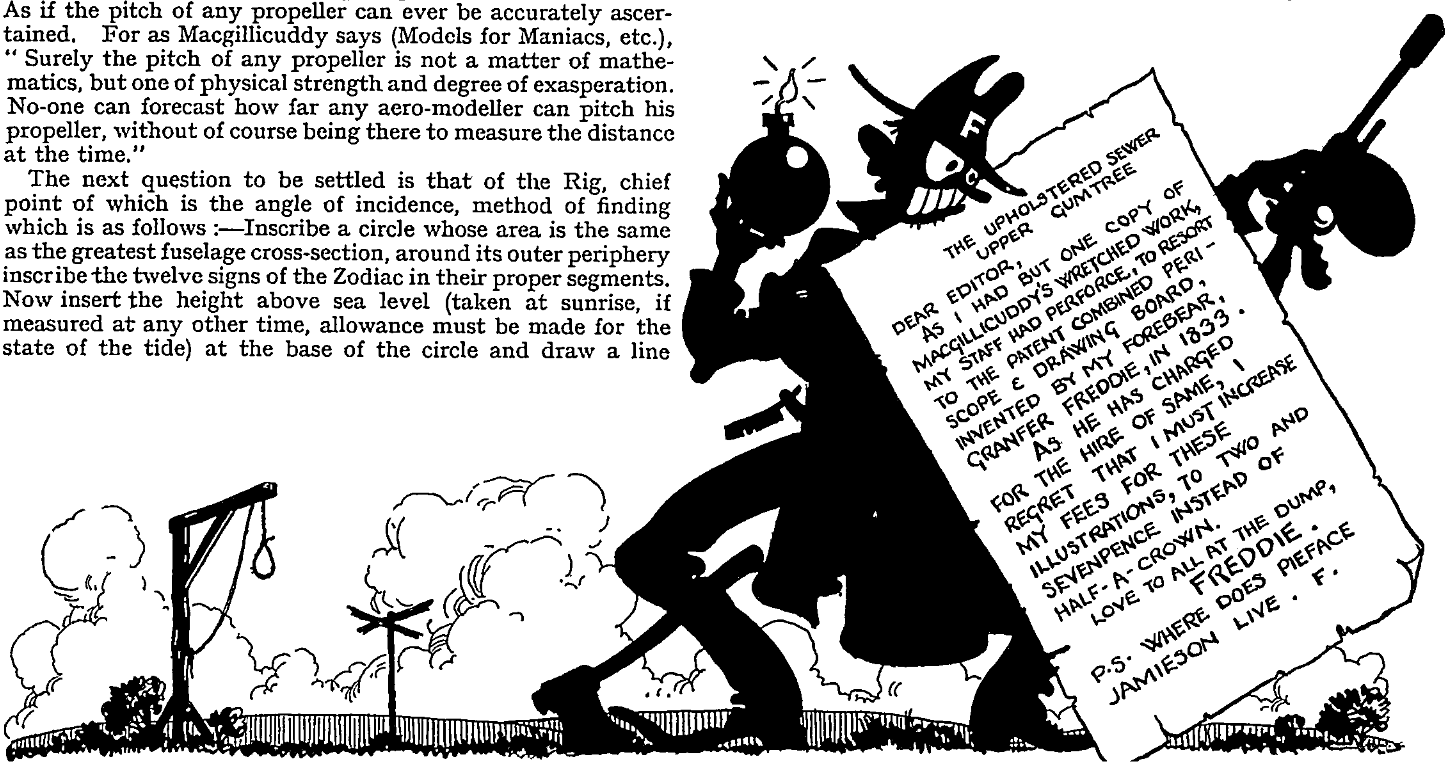
How does it work ?

Well, er—eh—we just haven't got it perfected. yet, but operations are proceeding and we hope to issue a communique shortly. We are confidently anticipating a successful outcome of our researches on this problem, with the aid of Old Moore's Almanac, the Ministry of Agriculture's guide to Fat Stock Breeders and Macgillicuddy's book " Cheery Theory for Wings and Things."

If you have read thus far, well, it just shows how little some folks have to do with their time. If you have taken it all in, then your hair will only require the addition of a few straws to obtain for you a permanent lease of the best private suite in the local nut house.

In conclusion—if you really wish to build a Wakefield, send to THE AERO-MODELLER Plans Service and get one of their plans or buy a decent kit. Either way you will save yourself a helluva lot of trouble.

ROBERT JAMIESON.



To whom it may concern . . .
in re-
"Aircraft of the Fighting Powers"

Price (post free) 13/6

Volume I contains full particulars of prototype, development and military use of 87 British, French, American, German, Italian, Dutch, Belgian and Polish aircraft used in 1940. Each is depicted by a large photograph which is accompanied by full particulars of engine(s), dimensions, specifications and identification markings. In addition there are 87 three-view 1/72 scale plans, ideal for recognition tests and for the use of solid scale model builders. The book contains close on 300 pages, is printed on art paper, cloth bound in stiff boards.

Compiled by
H. J. COOPER
and
O. G. THETFORD
Edited by
D. A. RUSSELL,
A.M.I.Mech.E.

Volume II contains particulars of prototype, development and military use of 88 British, American, German, Italian, Canadian, Australian, Grecian, Jugoslavian, Iraquian, and Russian aircraft used in 1941. Each is depicted by a large photograph, which is accompanied by full particulars of engine(s), dimensions, specifications and indentification markings. In addition there are 88 three view 1/72 scale plans, ideal for recognition tests and for the use of solid scale model builders. The book contains close on 300 pages, is printed on art paper, cloth bound in stiff boards.

Price (post free) 13/6

HERE IS THE POSITION

In regard to Volume I, our binders have at last caught up with the order book, and we now have several thousand copies in stock. Owing to the huge demand for copies of Volume II no further work will be carried out on Volume I for the time being, and therefore orders should be placed immediately so as to secure delivery before the present stock is exhausted. Orders may be placed with any model shop, newsagent or bookseller; or direct with the publishers.

★ ★ ★ ★

In regard to Volume II, the slow rate of delivery is controlled entirely by the Binders, many of whose operatives have been called-up, resulting in a reduced output which cannot catch up with incoming orders. The "waiting list" of orders is being dealt with in strict rotation, and as rapidly as conditions permit. By placing YOUR order NOW, YOU will reduce to a minimum the time you must wait for YOUR copy.

Meanwhile, to "ease the situation," plans and photographs of all aircraft described in Volume II have been printed on separate sheets, and are now available. Full particulars are printed on the back inside cover page of this issue.

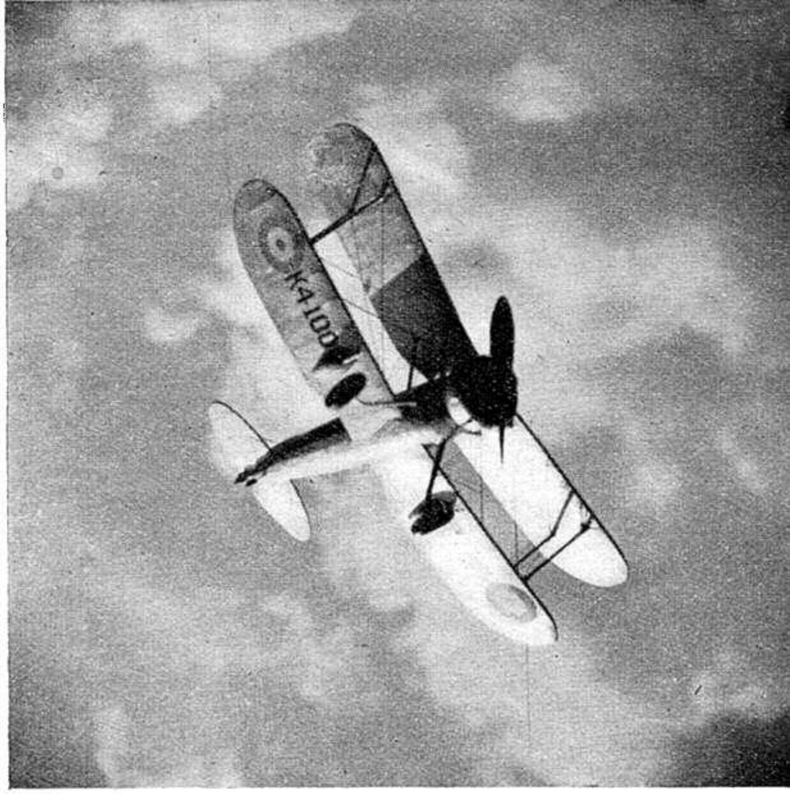
★ ★ ★ ★

Just as Volume I is representative of 87 aircraft flown in 1940, so is Volume II representative of 88 aircraft flown in 1941. Volume III is now in active preparation, and will, of course, be representative of aircraft used by the Fighting Powers in 1942.

★ ★ ★ ★

There is no question of late volumes being "more up-to-date" than earlier ones. Each is representative of the aircraft flown in a particular year, and the complete set of volumes will be necessary to form a complete record of all the aircraft used by the Fighting Powers in this present war.

Harborough Publishing Co. Ltd., Allen House, Newarke Street, Leicester



A ½" scale "Gladiator" built by Cadet J. J. Chambers of Oxford. A fine piece of modelling, well photographed.

MONTHLY MEMORANDA

No. 4 of Series

"EXEUNT THE GLADIATORS"

Owing to Mr. Thetford being on sick leave this article is contributed by Mr. H. J. COOPER

After such splendid service with the Royal Air Force, Gloster Gladiator fighters have at last quitted the amphitheatre of war with as fine a record of versatility and reliability as any aeroplane holds. Many still remain in service on training and communicatory duties, and appear frequently in this country as pleasant diversions from the monotony of monoplane wings.

The full story of their exploits in Norway and the Middle-Eastern deserts, which are probably more glamorous and glorious because of the obsolescence of the Gladiator, will be told some day, but here it is proposed to deal briefly with the history of Gladiator markings since the type's introduction five years ago.

Gladiators first appeared in squadron service with the Royal Air Force in the early summer of 1937, being developed from the F.7/30 (K 5200) of 1935, from which it differed only in minor details. Initial deliveries were issued to No. 3 (Fighter) Squadron, then stationed at Kenley, and others followed quickly to both long-existent and newly-formed squadrons. At this time the camouflage system did not apply to fighting aircraft, and the Glads were flown resplendent in the simple aluminium colouring which had served for so long. No. 3 Squadron's individual marking was modified when the new equipment was received. When the squadron flew Woodcocks, Gamecocks and Bulldogs, the marking consisted of a broad green band painted along each side of the fuselage from the motor to the rudder and along the upper surfaces of the upper wing, between the roundels. On the Gladiators the marking was a green streamlined shape rounded in front and tapering to a point, rather like an elongated D/F ring fairing on a modern bomber. This was painted on the fuselage beginning at the cockpit and extending almost to the tailplane, being broken by the roundel. The marking was not usually carried on both upper planes, being seen mostly on the upper starboard plane, with its nose towards the centre-section.

At this period roundels were tri-colour and no tail markings were carried. The latter had been abandoned in 1934 because the weight of the paint upset the balance of the rudder. (At least, that was the official reason, but there was no objection to the colours being *painted* out.) Early in 1940 identification problems necessitated the revival of tail markings and they were then painted on the fin.

The first production batch of Gladiators was allotted the serial numbers K 6129 to K 6150, and they were supplied to Nos. 3 and 56 and to the newly-formed 72 (Fighter) Squadrons. No. 56 Squadron's marking consisted of red and white dicing, but though when this squadron flew Gauntlets all machines carried the marking, only a few Glads were so coloured.

Two red bands with a blue band between them were painted on the Gladiators of No. 72 Squadron. On the fuselage aft of the roundel the bands tapered to a point.

Other squadrons which received the Gladiator were Nos. 17, 33, 54, 65, 73, 80, 87 and 602 (City of Glasgow). A later batch of Gladiators was numbered from K 7902 to K 8055 and were issued to Nos. 33, 56, 65, 73 and 87 Squadrons.

The marking of No. 54 Squadron was a broad yellow band; No. 87 Squadron's mark was a narrow black band across which was a green wavy line.

Gladiators were the last fighters to carry squadron markings.

In the autumn of 1937 a new scheme for the colouring of the undersurfaces of fighters came into operation. This was the system of painting the lower starboard wing black underneath, with the port wing white, and Glads were the first types to appear so coloured. Usually the roundel was omitted from the black wing, but was often seen in this position with either red, white and blue or red and blue circles. Under the white wing the roundel, though not always carried, was of three colours, as they were above and on the fuselage.

Many minor camouflage and marking variations were introduced soon after the black and white wings became common, and some Glads were painted with the tailplanes black and white as well, and sometimes with the fuselage (which had formerly been silver) also half black and half white. The under surface of the upper plane was usually left silver, but was sometimes all black. Prior to the introduction of black and white wing markings, serial numbers were carried below the wings, but these were later discontinued. Roundels on wings and fuselage appeared in a number of varying forms.

No. 33 (Fighter) Squadron (which was formed as a Bomber Squadron, and was the first to receive the Hawker Hart, in 1930), was equipped with the Gladiator and stationed at Ismailia, in Egypt. One squadron in the Middle East carried the squadron letters SO, aircraft O being numbered L 7620. These Glads were entirely silver-doped, with light grey code letters.

Just before the outbreak of war the camouflage scheme extended to the fighters, and Gladiators appeared with green and brown on sides and upper surfaces. One Glad squadron (which, incidentally, is now equipped with the Whirlwind), carried the code letters HE on the fuselage. The under surfaces were first coloured black and white, but this was later changed to duck-egg blue and then to light grey as subsequent schemes were introduced. Training Gladiators are now camouflaged green and brown above and are yellow underneath. Roundels, now standard on all types, are red and blue above the wings, red, white and blue underneath, and red, white, blue and yellow on the fuselage. Fin markings are red, white and blue vertical stripes in the form of a rectangle 2 ft. wide by 2 ft. 4 in. high.

Squadron Code-Letters

Squadron code letters and serial numbers apply as under :—

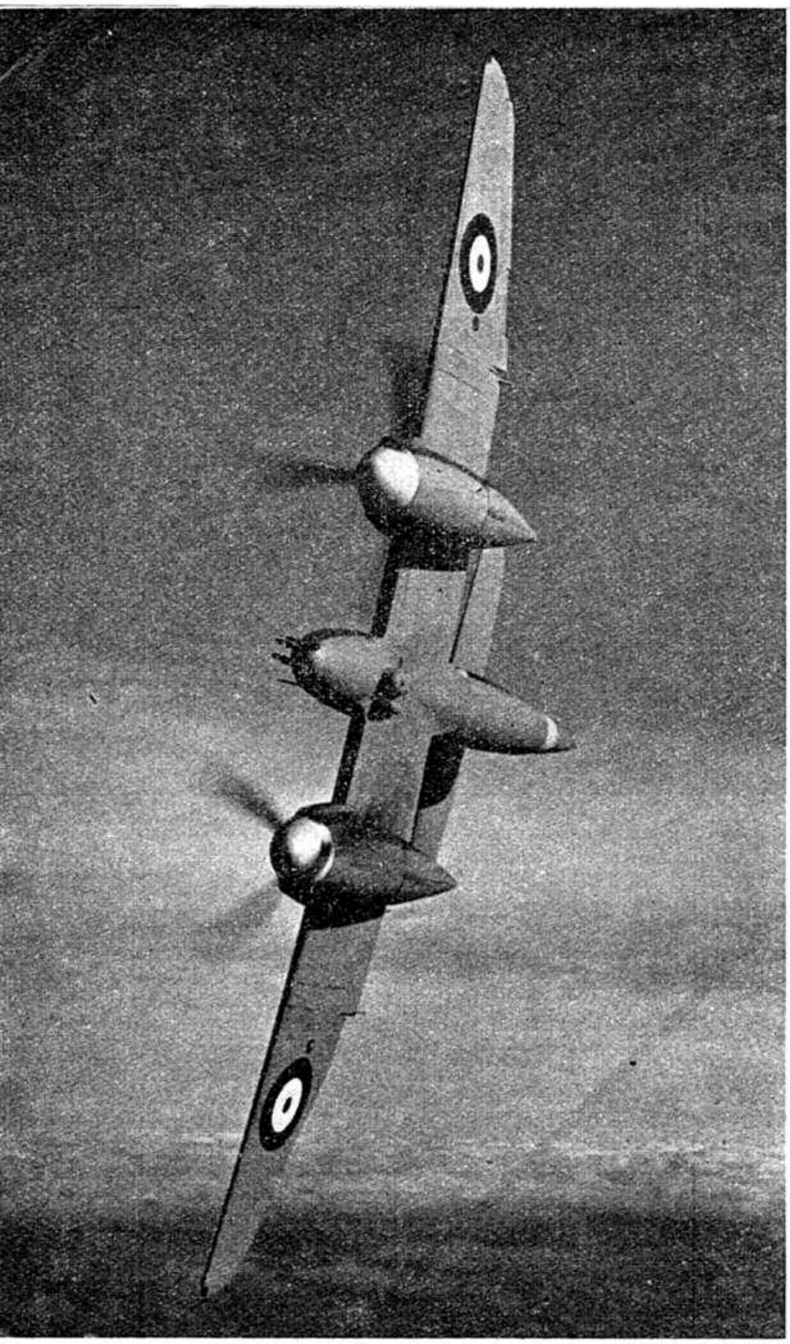
Spitfire V : ZD; ZF; KH.
Hurricane IIc : QO. (Machine R, Z 3894; P, Z 3086; T, Z 3092.)
Hurricane-Bomber : AE. (Machine W, BE 485.)
Whitley V : EY. (Machine W, T 4131.)
Wellington II : BU; PH; EP. (Machine R, W 5461.)
Catalina I : AX. (Machine W, AJ 159.)
Beaufighter I : (day fighter): WR. (Machine F, R 4639.)
Tomahawk II : RU. (Machine V, AK 185.)
Boston III : OM; MQ.

H. J. C.

FIGHTING AIRCRAFT OF THE PRESENT WAR—XVIII

By H. J. COOPER

THE WESTLAND "WHIRLWIND" I



THE Whirlwind I, Westland's two-motor single-seat fighter, has been in squadron service with the Fighter Command of the Royal Air Force for about two years. It was designed as long ago as 1935 to an Air Ministry specification numbered F.37/35, and was flying some months before the outbreak of war, though it is only in the past weeks that information regarding it has been released.

In June, 1940, a few initial deliveries were issued to a squadron then flying short-nosed Blenheim fighters, and saw a little active service, but the squadron later received the Beaufighter as its standard equipment. Several squadrons are now in service, and the Whirlwind has been used for escorting bombers over the Channel in daylight sweeps. Their heavy armament of four 20-mm. Hispano cannons mounted in the nose and their high top-speed make them particularly suitable for low-flying attacks against shipping. The maximum speed of the Whirlwind as quoted on the British official silhouettes which have been published in German aeronautical journals is 358 m.p.h. at 16,350 ft., but from observation of the Whirlwind in flight it is apparent that its top speed is much greater—probably well in excess of 400 m.p.h.

Constructional details of the Whirlwind have not as yet been released, but it is evidently of all-metal construction and is covered entirely with a stressed skin. The low wing is of high aspect-ratio and the outer sections are sharply tapered. The tailplane is mounted high above the fuselage and is neatly faired with a cylindrical fairing, which is a modification to the original design. The tail-unit and the two large low slung motors projecting well forward of the wing and nose make the Whirlwind incomparable from a recognition point of view with any other type in the air. A slight positive incidence to the motors give the monoplane a noticeable tail-up sit.

The undercarriage consists of two units which swing upwards and backwards into the motor nacelles, and they are enclosed perfectly by twin doors. The tail-wheel retracts similarly. Fowler-type flaps are fitted to the trailing-edge between the ailerons and fuselage, and a portion of the motor nacelle fixed to the flap moves down when the flaps are lowered. Handley-Page slots are fitted to the outer wing sections.

Officially the Whirlwind is powered with two fully-supercharged Rolls Royce Peregrine 12-cylinder Vee motors, each developing 885 h.p. and fitted with 10 ft. De Havilland constant-speed airscrews. Radiators for the motors are contained in the leading-edge of the wing centre-section—an unusual feature.

The pilot is accommodated in a transparent cupola above the wings which slides backwards for access. The front portion is fixed. A retractable step is fixed on the port side of fuselage.

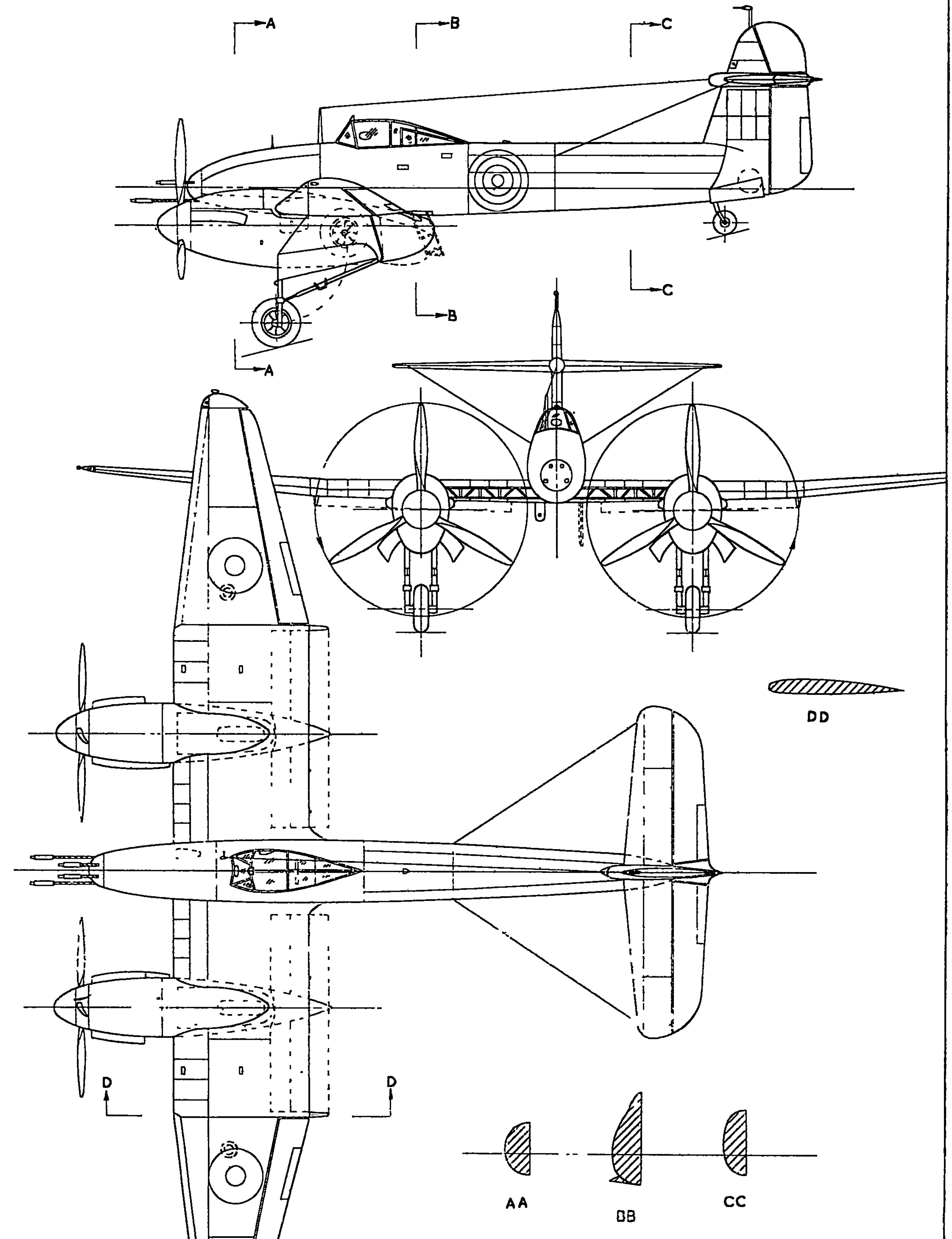
Whirlwinds in service are now camouflaged with two shades of grey on the upper surfaces and are light grey underneath. One squadron carries the code letters HE. Aircraft R has the number P 6991, which is painted in black ahead of the duck-egg blue band round the fuselage immediately in front of the fin. Aircraft V is numbered P 6969.

Main dimensions of the Whirlwind are: span, 45 ft.; length of fuselage, 30 ft.; length over motors, 31 ft. 6 in.; length over cannons, 32 ft. 5 in.; height, 10 ft. 10 in.; tailplane span, 14 ft. 8 in.; maximum wing chord, 6 ft. 5 in.

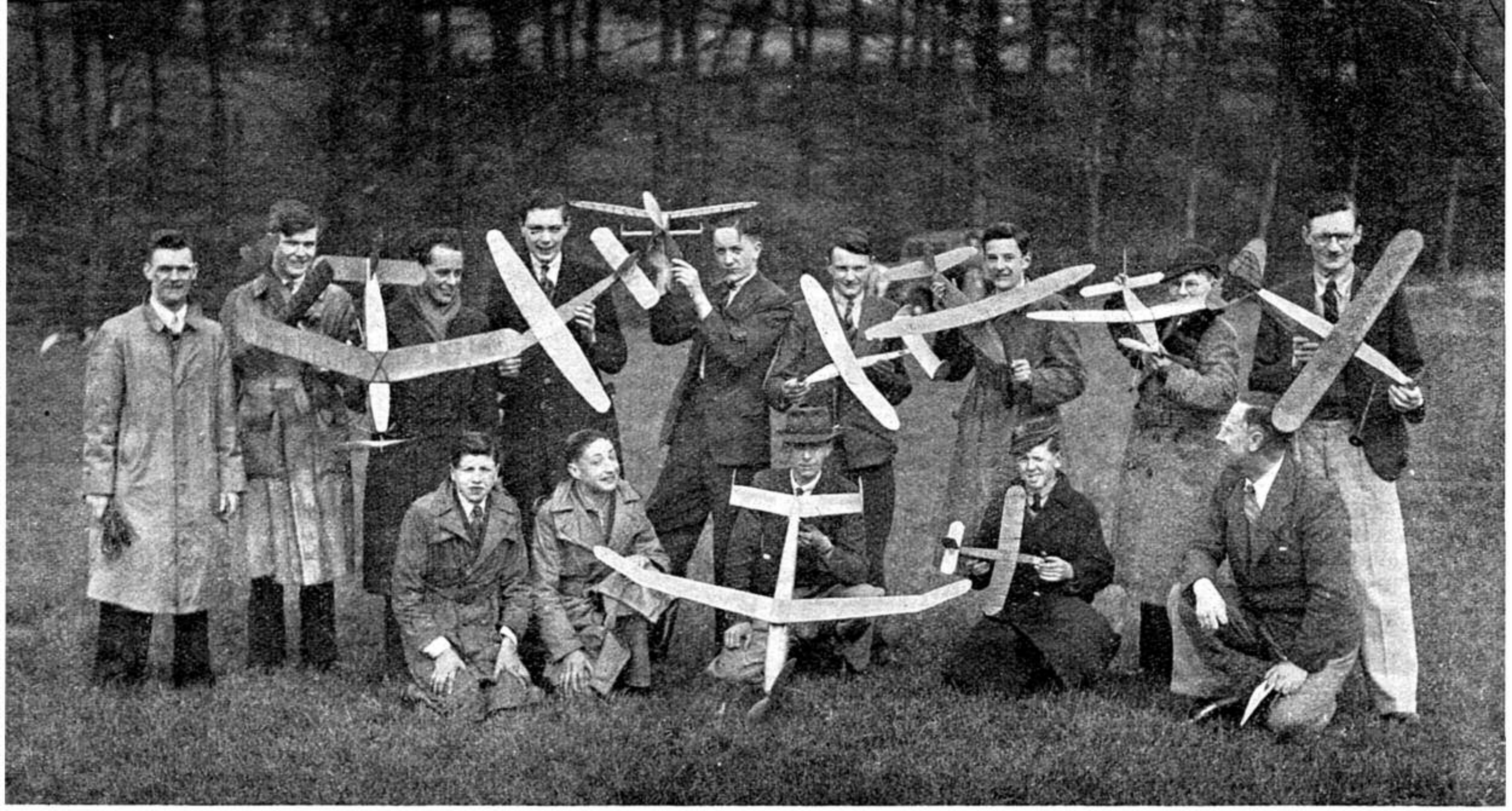
A sum of Two Guineas will be paid for the best photograph of the best model made from the accompanying general arrangement drawing, received at THE AERO-MODELLER offices not later than 31st July, 1942. Entries must not be smaller than post-card size and should be clearly marked with the name and address of the entrant on the back.

Next month: The Fairchild 24W.

Photos by courtesy of "Flight."



WESTLAND "WHIRLWIND I"



CLUB NEWS *By* THE "CLUBMAN"

I NOTE from the latest issue of the S.M.A.E. Journal that the whole question of affiliation fees is to come under review. For those of our readers who are not conversant with the changes that took place subsequent to the happenings of September, 1939, I would remind them that in order to assist Clubs, as far as possible, the Council agreed to reduce the affiliation fee to a figure of one guinea per club per annum. A little later it was agreed that in special cases where a Club had been badly hit financially, owing to various exigencies connected with the "general upheaval," a special reduced fee would be considered. This system worked very well, and undoubtedly helped a great number of Clubs in the very trying period immediately following the outbreak of war.

Unfortunately it is becoming increasingly evident that some Clubs are applying for special consideration when they are undoubtedly in a position to carry on under almost normal conditions. Likewise, some Clubs who were granted special concessions have since greatly expanded their membership, but are still wishing to continue at the reduced fee.

Obviously this is not fair to the remainder of the Clubs, and I am pleased to see that some notice is now to be taken of this rather invidious position. I expect to see a number of suggestions put forward and modifications transpire at the next Delegates' meeting to be held on the 3rd May.

If you will excuse my speaking like a Dutch Uncle for a few moments, I would point out that in my experience far too many Clubs are prepared to plead poverty when such a condition does not exist, and I am afraid that in most instances this is due purely to a lack of proper control of club finance.

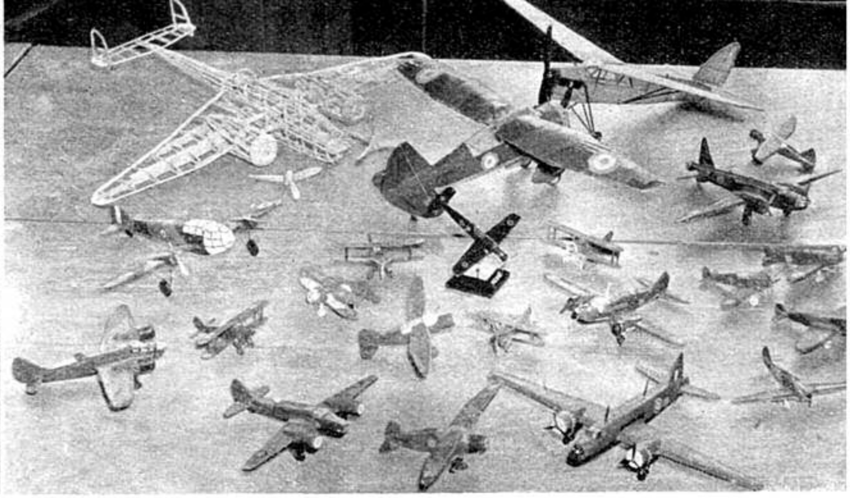
This brings up again my old argument that anything that it is too easy or too cheap to belong to does not retain its value, and I heartily disagree with purely nominal membership fees. Granted, the majority of members belonging to aero-modelling clubs are on the junior side, with a fairly limited amount of pocket money (although there seems to be far more spending money about at the moment than there has been for a number of years); even so I consider it ridiculous for any Club to attempt to run a properly conducted group with such membership fees as 1s. for seniors and 6d. for juniors. For any club to operate with any degree of system it must have a certain amount of finance, and where membership fees are of such an absurdly low standard the membership has to be huge before any reasonable amount of finance can be relied on for proper development.

My own opinion (of course, all these statements are purely my own opinion but based on a very wide experience), shows that a good average subscription is either 10s. or half a guinea per annum for seniors, and 5s. per annum for juniors. This works out at just over 2d. per week for the older chaps, and just over a 1d. per week for the youngsters. I contend that this would not break anybody, and I am certain (and experience here proves my point), that where a lad has paid say a bob for a year's membership, he does not bother himself so much as he does when he has laid out the far greater sum (to him) of 5s. Simultaneously the members who pay higher rates automatically benefit from the higher finance available to the Club as a whole, and their facilities are invariably much better than those of the "bob a year" man.

I understand the Editor is to put forward a number of suggestions to the S.M.A.E. incorporating much of what I have said, but obviously I cannot go into this now, as I write before the Delegate meeting has been held. More of this anon!

I have just received a number of American aero-modelling publications, the majority of these dealing primarily with the entry of America into the war. As in our own case, this has naturally brought in its train a general upheaval of the hobby, but (and I wonder if they have learned anything from our own difficulties), they seem to have jumped straight into an enormous programme, with Government assistance, and much activity at the present moment is being directed to the building of solid models for recognition purposes. Materials, designs, instructions (and instructors) are being provided at schools all over the States, and, with the solicited assistance of the many hundreds of clubs operating in America, models are being turned out wholesale for distribution to the various Services, and will greatly assist in general observation and recognition. The American Government has called on the model aeroplane builders for 500,000 aircraft models for training purposes, and this task is being tackled with an energy typically "Amurican."

Mr. Albert L. Lewis, who has served in recent years as Executive Director of the A.M.A. (Academy of Model



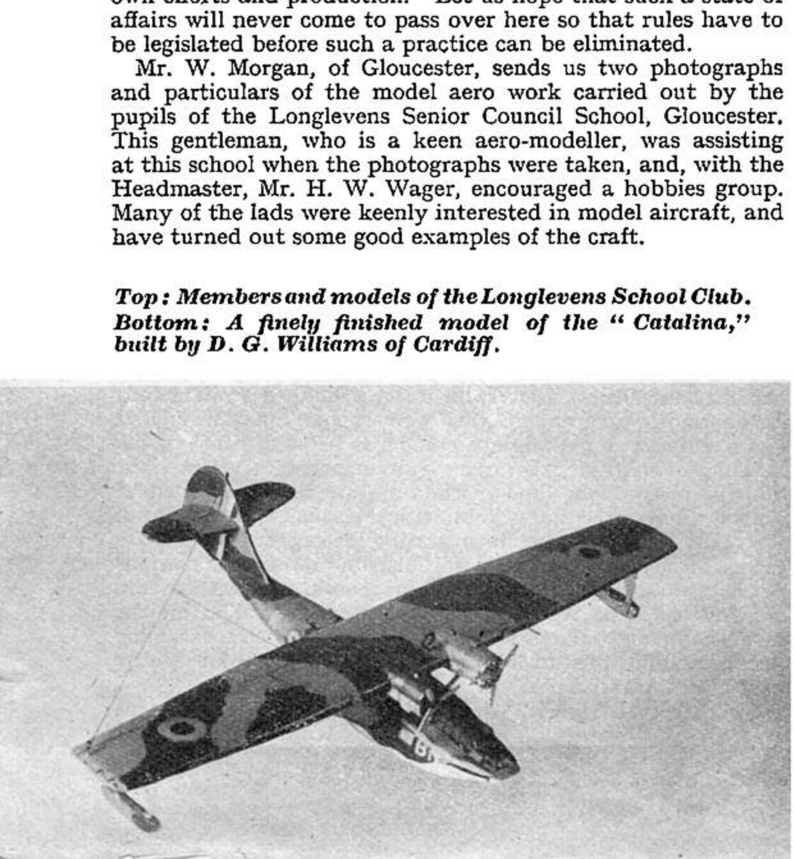
Aeronautics), has been appointed Acting Director of the Air Youth Division by the Air Youth Board. It is pleasing to note that an active aero-modeller has received a commission for his services, and the contrast is very sharp when viewed against what usually happens in such cases! Unfortunately, what happens far too often? A person is appointed to a position far removed from his usual activities, and we find such anomalies as butchers in charge of building, and stock-brokers directing aircraft production, all of which might lead somewhere in due course but seems to be a very haphazard procedure!

The revision of gas model rules in the States is still creating a great deal of controversy, and quoting from "Air Trails" (April, 1942), I see that Frank Zaic's idea is to limit each contestant to one model per event. This would put it up to the individual to keep his ship under control (at least he would be careful not to lose it before the third official flight). With only one model allowed (and less chance of losing it), there would be less of the mass-production complex and more care and attention given to careful workmanship. I think you will all heartily agree with the above sentiments.

A prevalent practice in American competitions seems to be the borrowing of either complete models or components, and there is a lot of argument going on at the moment as to whether this should be eliminated in future or otherwise. Personally, I hold very strong views on this subject, as in my opinion it ceases to be a competition when a man can borrow another chaps model, engine, or other component, and continue in a contest against chaps who are relying solely upon their own efforts and production. Let us hope that such a state of affairs will never come to pass over here so that rules have to be legislated before such a practice can be eliminated.

Mr. W. Morgan, of Gloucester, sends us two photographs and particulars of the model aero work carried out by the pupils of the Longlevens Senior Council School, Gloucester. This gentleman, who is a keen aero-modeller, was assisting at this school when the photographs were taken, and, with the Headmaster, Mr. H. W. Wager, encouraged a hobbies group. Many of the lads were keenly interested in model aircraft, and have turned out some good examples of the craft.

Top: Members and models of the Longlevens School Club. Bottom: A finely finished model of the "Catalina," built by D. G. Williams of Cardiff.



Owing to limitations in supplies of balsa and other difficulties, specific instruction in aero-model building has not been given and we are assured that the models shown have been made by the lads, all of whom are under 14 years of age, entirely without guidance. Naturally there are many obvious errors in workmanship but the results indicated in the group of finished and part finished models are very creditable indeed.

No doubt the boys have gained considerable help from their normal handicraft lessons and it is refreshing to find that, even in these very trying times, the Council schools try to keep up to date in the ever increasing variety and scope of activities which modern scientific developments necessitate.

The HALIFAX M.A.C., like many more, have lost their usual flying ground for the duration, but are hoping to carry on, using the municipal playing fields. As these are some 1,100 feet above sea level, they will have to battle some with the breezes (which believe me, are somewhat strong up that way at the best of times!). Dennis Lees started the ball rolling with a flyaway of 8 : 30—and unfortunately lost the model. It was only the second time this model had been out, and was a beautifully streamlined Wakefield.

W. Gordon, of the PERTH (A.T.C.) M.A.C., has raised the club record to 1 : 40, at the same time carrying off both events at the second club meeting. Full results were :—

2 ft. span Class	W. Gordon	165	secs. Agg of 3.
	J. Crow	120	,, ,, ,,
	C. MacQueen	110	,, ,, ,,
Open Class	W. Gordon	150	,, ,, ,,
	G. Stuart	145	,, ,, ,,
	V. Stoddart	115	,, ,, ,,

After nearly twelve months' silence, word comes from the SUDBURY HEIGHTS M.F.C., and I am pleased to hear they are still flying, though naturally suffering from the current club disease—loss of members to other requirements! A fair season was enjoyed last year, and a number of records broken, the list at present being :—

6 : 17	R.O.G.	W. Bayse.
4 : 28	H.L.	J. Fenwick.
1 : 23	R.T.P.	W. Collins.
1 : 50	T.L. Glider	W. Collins.

The UPPER STRATTON M.A.C. put on a fine exhibition in aid of the R.A.F. Benevolent Fund, over 150 models being on show. Pole flying was continuous throughout the show, and the sum of £9 was forwarded to the Fund. Nice work.

Poor weather has prevented the LEICESTER M.A.C. taking full advantage of their new ground at Scraptoft. This, however, has not damped their enthusiasm, and Frank Davies has already put up the club record to 7 : 10.

Comps. have started in many districts, and one of the first to report is that held by the ASHTON AND D.M.A.C. A. Wood made one flight of 5 : 48 to win the event (Open H.L.), N. Hayes placing second with a best flight of 2 : 26.5, and A. Fitzjohn third with 1 : 24. Hayes has been setting up some good times with his sailplane, 2 : 38 being clocked off a 100 ft. towline. During Easter Week an exhibition was held in a local schoolroom, and the National Air Raid Distress Fund benefited by £12.

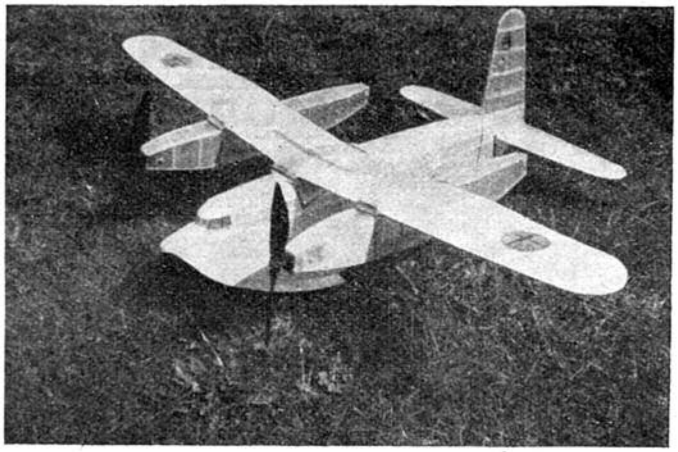
The RIPON M.F.C. started the season with four crack-ups, and a meeting with the Harrogate Club almost blown out of existence! Nine 'planes from Ripon competed against twelve from Harrogate, and only three remained intact at the end of the day. (What happened—weren't those three taken out of the boxes ?) An S.O.S. is sent out for a Mr. Bartholomew of, I believe, Northern Heights. As this chappie is constantly moving around the country, it is not possible to contact him through his own club, and if he reads this, he is asked to get in touch with the Ripon secretary.

The new secretary of the ANDOVER M.A.C. (see secretarial amendments), is anxious to enrol more senior members in order to outweigh the preponderance of juniors ! ! Boyoboy—you should just see me with kids . . . I'm a wow. One word from me and they do just . . . yes, you're right, just as they like !

R.T.P. flying wound up the winter session of the CHELMSFORD M.A.C., and once again Mr. Foden carried off the honours, setting up a consistent average of a minute. A number of unusual designs are making their appearance for the summer season (if any !), among them being a radical type of biplane, with the lower wing on top of the fuselage, and the upper component carried on four struts. This flies quite well I am told, but pancakes in rather than glides. Another interesting project is Foden's tailless, folding prop. job, of which more anon.

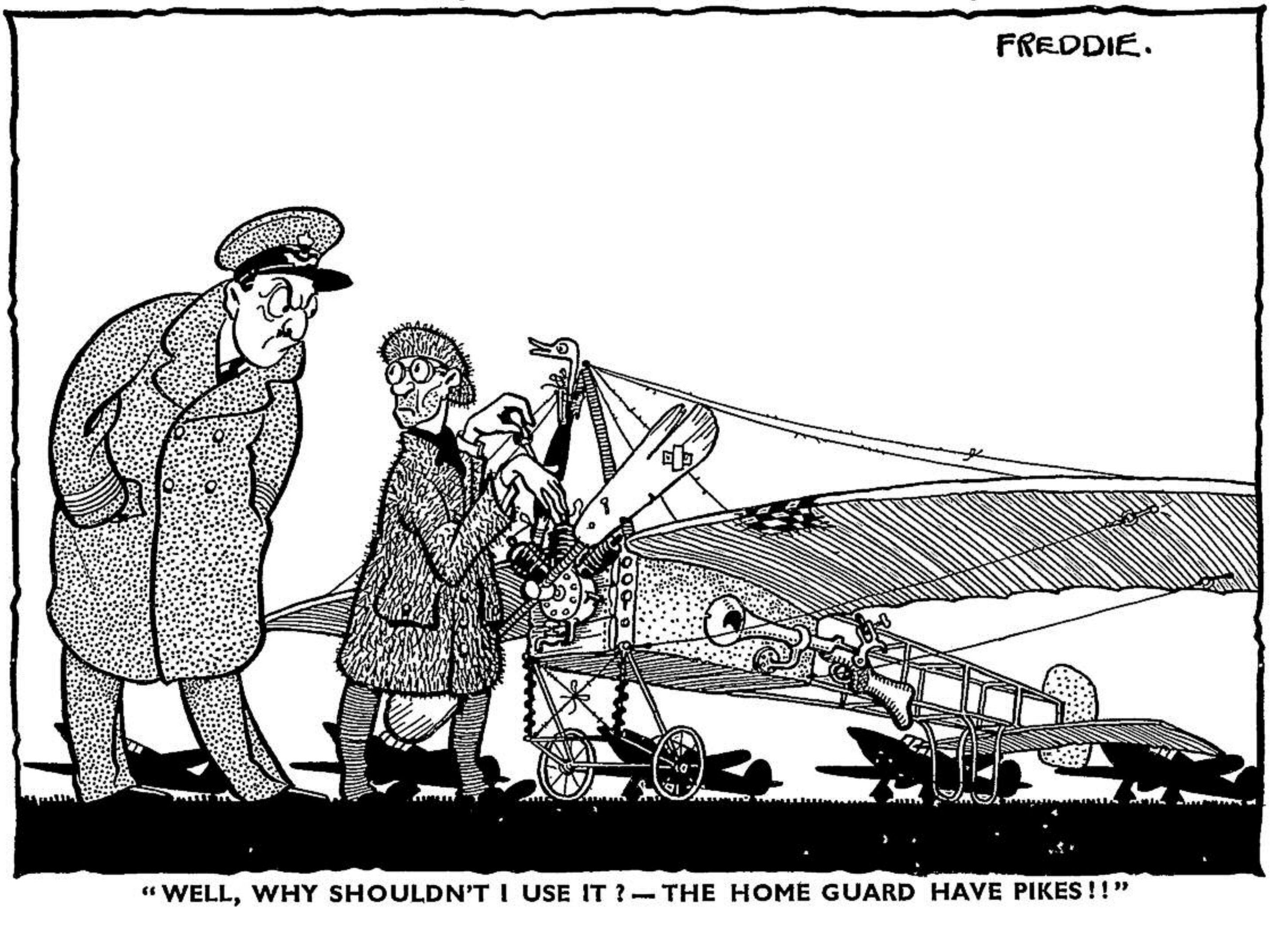
The WHITEFIELD M.F.C. has now been elected to affiliation, and is setting out its stall for the national comps. R. Smallman has already made one o.o.s flight of 6 : 30 on half turns—though full credit is given to the helpful thermal who had much to say in the matter ! ! A real honest-to-goodness "bitsa," consisting of a slab fuselage, wing from an old duration model, "Diasphere" tailplane, and "Clipper" fin, had the teremity to break the over 150 sq. in. class record three times in one day. Club records at the moment are :—

Under 100 sq. in.	H.L.	1 : 36.5	C. Hargreaves.
100—150 sq. in.	H.L.	2 : 21.1	J. Donaldson.
do.	R.O.G.	1 : 39	J. Donaldson.
Over 150 sq. in.	H.L.	4 : 37.4	K. Allison.
do.	R.O.G.	1 : 14.7	J. Donaldson.
Wakefield Class	R.O.G.	1 : 33	N. Crooke.
Glider, tow launch		1 : 23	K. Allison.
R.T.P.		1 : 10	J. Donaldson.



John Carpenter of Sidcup wins a prize of 10/6 with this photo of his "G.B.2. Flying Boat" constructed from A.M. plans.

An exhibition was held at Walthamstow from March 21st—28th, in which the WALTHAMSTOW M.A.S. played a prominent part. The competition section was divided into five classes for both senior and juniors. The collection centre raised £1,400 in National Savings Certificates.



"WELL, WHY SHOULDN'T I USE IT ? — THE HOME GUARD HAVE PIKES ! !"

The LANCASTER M.A.S. has a change of secretary, Mr. R. Pavey now being the " mug." Flying now takes place on the Bolton-le-Sands foreshore, and it is hoped to repeat at least one of last year's interesting comps., namely the Horner War Model Cup. In this event, no balsa may be used in the construction, and last year's winner, Mr. J. P. Swindlehurst, used birch, cane, ply, and tissue covering. The record for this type of model is held by Mr. Pavey with a flight of 1 : 02.2.

Members of the PHAROS M.A.C. are going strong, two competitions already being completed, results being :—

Open Duration	J. P. Buckeridge	Total	3 : 05
	K. C. Jenkins	,,	2 : 10
	P. Willmott	,,	1 : 40
Juniors	K. C. Jenkins	,,	4 : 03
	J. Riley	,,	3 : 06
	A. G. Lowe	,,	2 : 49

Buckeridge later broke his own club record with a flight of 14 : 07 o.o.s, with a 30 in. span model finished in red, white and blue. Any news of this model will be welcomed. Throughout the past season, two members have shown considerable improvement—Jenkins, best senior and tree climber, and J. Riley, who has placed well in all contests.

News from a new club comes from the VALE (Nottingham) A.C., which commenced operations last Christmas. A number of models are under construction, and at present records are held by H. Bradley, 1 : 35 H.L., and E. Schofield, 1 : 20 R.O.G. The flying field is just off Wallaton Vale, on the west side of Wollaton Park, and prospective members are asked to contact the secretary at the field (Sunday afternoons), or write to his address at 58, Joughborough Road, West Bridgeford, Nottingham. (Name by the way is T. McGrath.)

P. Albericci, of the LEEDS M.F.C., was presented with a cup, being the junior with the highest number of points during last season, while H. E. Vauvelle won the Anderton Cup for seniors. This club starts its season with a " record setting day," and evidently conduct both seasonal and permanent lists.

Good entries were received for the first comp. of the season at the COLERAINE AND D.M.A.C., and resulted in a win for R. J. Troy flying a " Gutteridge Winner," to a score of 338 points. H. J. Molloy (Air Cadet) clocked 317 points, and A. C. Tosh 220 ditto's. Molloy also bagged the honours in the R.T.P. events staged through the winter.

The BRADFORD M.A.C. were able to hold a club dinner (lucky stiffs) and the usual presentation of cups, etc., was a highlight of the evening. Mr. H. S. C. Vaughan made the presentations, and both he and Len Stott had a real task in judging the many fine models on show. Messrs. Whitaker and Scarth carried of the prizes in this section.

St. Patrick's Day saw the official opening of the flying season of the DUBLIN M.F.C., the two comp. results being :—

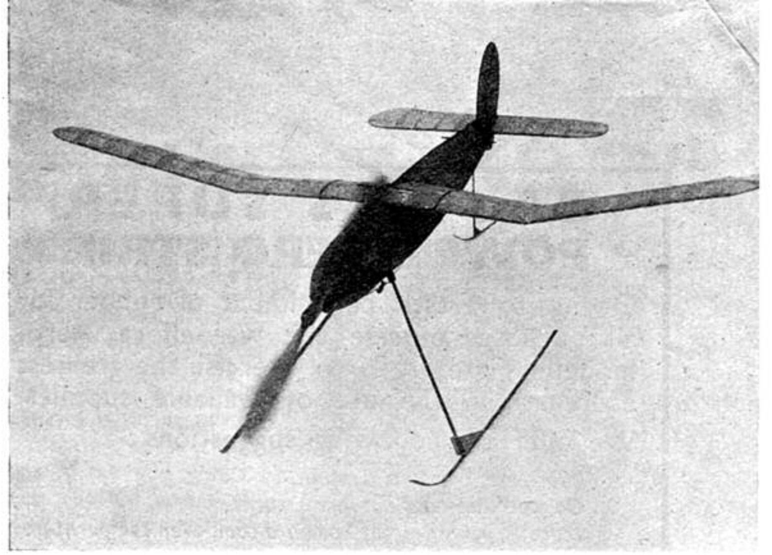
Open	Dr. Charles (Ulster)	Av.	2 : 05.3
	B. Brazier (Dublin)	,,	1 : 13
	J. Jones (Dublin)	,,	1 : 02.1
Class D	J. Jones (Dublin)	,,	40.1
	T. D'Arcy (I.M.A.C.)	,,	38.0
	J. Pollard (Dublin)	,,	18.9

The latter event is peculiar to the D.M.F.C., specifications being : wing area, 144 sq. in. ; rubber, 1 oz. ; total weight, 6 oz. This is, of course, similar to the Flight Cup rules, with an extra ounce tacked on to the total weight. Obviously, a model must be well designed to do well in this event. During the contests both Charles and Brazier made flyaways, the former with a flip of 5 minutes, and the latter 3 : 09.

Most interesting is the news of petrol flying still taking place in Ireland, eight models alone in the D.M.F.C. being well and truly aired. Flights up to five minutes are clocked up in the Dublin mountains, and I can see Dr Forster making tracks for the Emerald Isles on his next vacation !

In preparation for the new season, when glider flying will be in greater prominence than ever before, F. Gray, of the BLACKHEATH M.F.C., has constructed a new winch incorporating a clever device. A worm drive will guide the line backwards and forwards to ensure an even winding on the reel.

Mr. Hills, of the CROYDON AND D.M.A.C. has raised the club heavyweight record to 4 : 54.6, and has consistently clocked 2 minutes without thermals. " Mick " Farthing lost his stick job after 2 : 10 o.o.s. Flying now takes place on Epsom Downs, as . . . well, sheep have babies you know, and the usual ground has received its full quota of hop-skip-and-jumpers !



Another prize winner is C. V. Handforth of Bromsgrove, who built this " Diasphere "—and fitted skis for cold weather work.

By the way, did you hear of the club who turned out in full force, trimmed their models—and then found that nobody had brought a stopwatch ! ! ! As Tommy Handley would say, " cor, burn my braces with a blowlamp ! "

The following three chaps wish to form clubs in their districts, and welcome enquiries from enthusiasts in due course :—

D. H. Collison, " Tarkwa," Plantation Road, Amersham.
B. Platt, 52, Caroline Street, Longton; Stoke on Trent.
I. Robinson, 8, Cemetery Road, Smethwick.

A few more " sales " items to hand this month. B. Young, of 34, Hardy Street, Maidstone, has a Bunch " Scorpion Major " and Mighty Midget engine for sale ; G. E. Taylor, 28, Ward Street, Penistone, has two Veron " Eagles," a Veron " Hawk," Club " Super Duration," Air Cadet and a " Maybird " for sale ; and R. V. Worth, of 17, Clinton Road, Barnstaple, wishes to dispose of a " Syncro Special." (Being a Home Guard officer, he might consider a swop for a nice revolver or automatic ! !)

Whoops, nearly forgot . . . our heading photograph this month shows some members of the Crook M.A.C., who staged a series of comps. during their local War Weapons Week. Nice show of models, boys—but look at them thar trees ! (No, Willie, they are not a photographer's backcloth—they're the real thing.)

Well, that's all for now lads, so . . . tata for now, and, Don't Forget the Stopwatch—Don't Forget the Stopwatch.

The CLUBMAN.

Secretarial Changes.

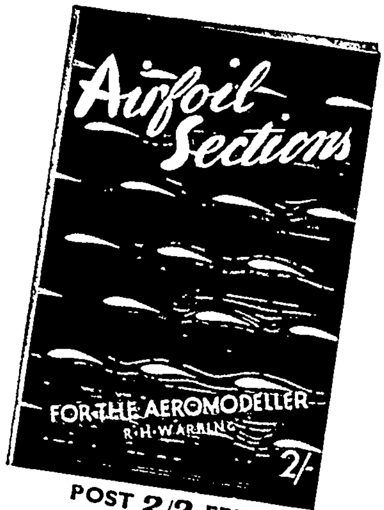
STEWARTON M.A.C.
T. H. Skeoch, 10, Gilmour Street, Stewarton.
NORTHERN HEIGHTS M.F.C.
S. Ryde, 59, Exeter Road, Southgate, N.14.
HEYWOOD M.A.C.
C. Watson, 38, Unity Street, Broadfield, Heywood.

A number of clubs are still sending their monthly reports too late for early publication, and it again becomes necessary for me to repeat that reports must reach the Aeromodeller Offices *not later than the 20th of the month preceding publication.* In simple language, a report for inclusion in the August issue must be in our hands by June 20th at the very latest. Please bear this in mind, as no exceptions can be made, and it's too late to grouse after we have gone to Press.

All matters concerning the S.M.A.E. should be directed to the Secretary : Mr. A. G. Bell, 70, Nelson Road, Hornsey, London.

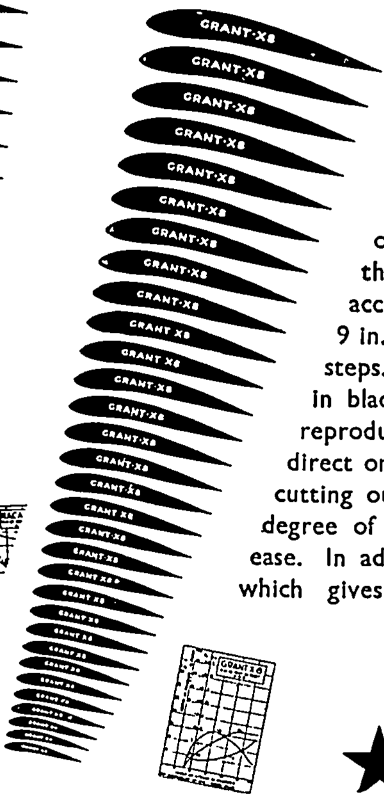
TWO STAR FEATURES FOR THE AEROMODELLER!!

"HARBOROUGH" SCORES AGAIN!!



POST 2/2 FREE

A completely revised and enlarged edition of the Aeromodeller's standard text-book on the subject of AIRFOILS. Six chapters of text explain simply and clearly the basic principles of wing theory, and deal also with the more practical aspects, such as the actual plotting of sections from tables of ordinates and the layout of tapered wings. The list of 36 airfoil sections has been revised and now includes the Grant X-8 and the Eiffel 431. Data on each of the 36 sections named below is given, together with an accurate drawing of the profile to a chord of 7 ins. on a 1% grid, which enables a section to be drawn out to any other chord dimension. There are now 64 pages in this book which, in addition to the foregoing, includes a page of useful formulæ and a table of low speed characteristics of many American-tested airfoils. Size of book is $5\frac{1}{2} \times 8\frac{1}{2}$ ins.—a handy pocket size—with stiff card cover in full colours.



COPIES OF THIS BOOK AND ANY OF THE 36 SHEETS OF AIRFOILS MAY BE OBTAINED FROM ANY MODEL SHOP OR DIRECT FROM THE PUBLISHERS ★

Complementary to AIRFOIL SECTIONS are sheets of each of the 36 airfoils dealt with in the book. Each sheet gives 31 accurate profiles, ranging from 9 in. chord to 3 in. chord by 1/5 in. steps. The sections are printed in black on thin white paper, as per reproductions at side, and may be pasted direct on to balsa sheet, or thin ply for cutting out as templates. Wings of any degree of taper may thus be built with ease. In addition, each sheet has a graph which gives the chief characteristics of the section from zero lift to the stalling angle. Size of each sheet is 30 × 10 in.

Price 6d. Each Post Free

★

ACTUAL SIZE OF SHEETS IS 30 × 10 ins. EACH SHEET CONTAINS 31 SECTIONS. THE LARGEST IS 9 in. CHORD, THE SMALLEST IS 3 in. CHORD. SECTIONS STEP UP IN SIZE BY 1/5 INCH.

SPECIAL OFFER

The Complete Set of 36 Sheets

Post 15/- Free

SHEETS OF THE UNDER NOTED AIRFOIL SECTIONS, FULLY DEALT WITH IN THE BOOK, PRICE 6d. EACH POST FREE

R.A.F. 15	S/1
R.A.F. 19	S/2
R.A.F. 30	S/3
R.A.F. 31	S/4
R.A.F. 32	S/5
R.A.F. 33	S/6
CLARK Y	S/7
CLARK Y-H	S/8
N.A.C.A. 97	S/9
N.A.C.A. 98	S/10
N.A.C.A. 4309	S/11
N.A.C.A. 4409	S/12
N.A.C.A. 4412	S/13
N.A.C.A. 4415	S/14
N.A.C.A. 6409	S/15
N.A.C.A. 6412	S/16
N.A.C.A. 6512	S/17
N.A.C.A. 6712	S/18
U.S.A. 5	S/19
U.S.A. 27	S/20
U.S.A. 35 B	S/21
EIFFEL 400	S/22
EIFFEL 431	S/23
GRANT X-8	S/24
GOTTINGEN 387	S/25
GOTTINGEN 398	S/26
GOTTINGEN 413	S/27
GOTTINGEN 426	S/28
GOTTINGEN 436	S/29
GOTTINGEN 532	S/30
GOTTINGEN 602	S/31
SIKORSKY GS-1	S/32
N.22	S/33
N.60	S/34
C.72	S/35
MARQUARDT S-2	S/36

When ordering these sheets please quote reference number only—thus for R.A.F. 32 state simply '—sheet(s) S/5.'

HARBOROUGH PUBLG: CO: LTD: ALLEN HOUSE, NEWARKE ST., LEICESTER

Made and printed in Great Britain by Alabaster, Passmore & Sons, Ltd., London and Maidstone, for the Proprietors and Publishers, The Model Aeronautical Press Ltd., Allen House, Newarke Street, Leicester. Trade Distributors: Horace Marshall and Son Ltd., Temple House, Tallis Street, London, E.C.4—C1601. Sole agents for Australia and New Zealand: Gordon and Gotch (Australasia) Ltd. Registered at the G.P.O. for transmission by Canadian Magazine Post.