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THIS MONTH

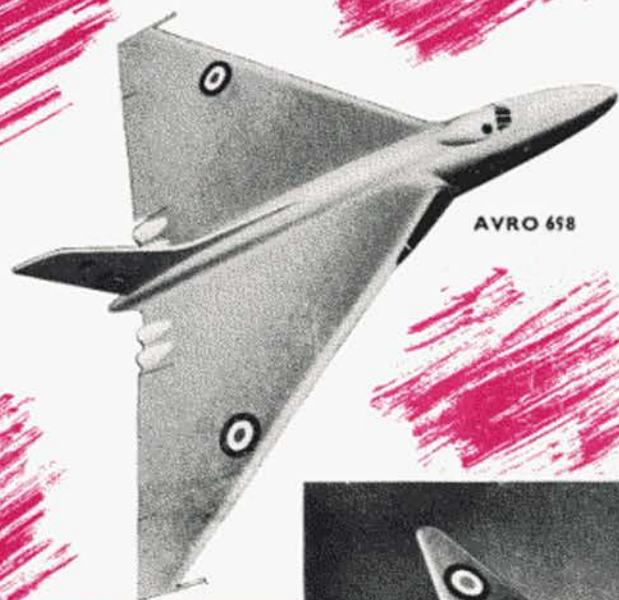
**FREE DATA
SUPPLEMENT**

In this issue

APRIL, 1953

● DETACHABLE DATA SUPPLEMENT ● PLAN OF
'HELIOS'—FARRANCE'S CONTEST WINNING GLIDER
● NEW FACTS ON FANS ● DELTAS ● THE NEW
WAKEFIELD RULES SURVEYED ● WEIGHT REDUCTION

1'6



AVRO 658



AVRO 707a



GLOSTER JAVELIN



TIGER MOTH



MIG-15



AUSTER



GRASSHOPPER

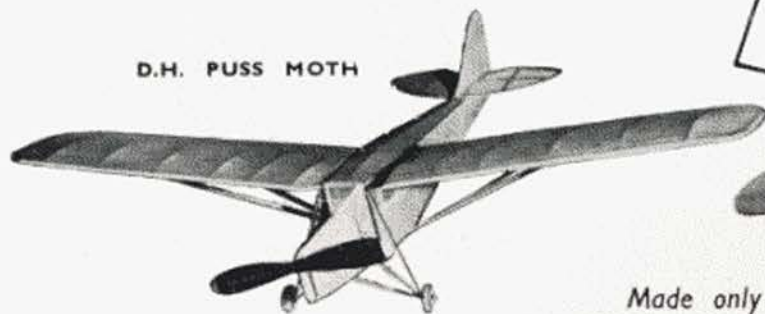
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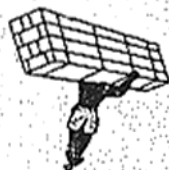
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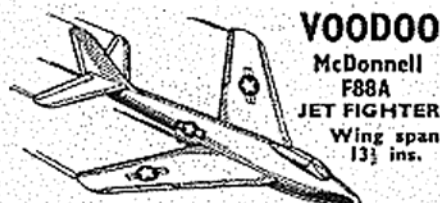



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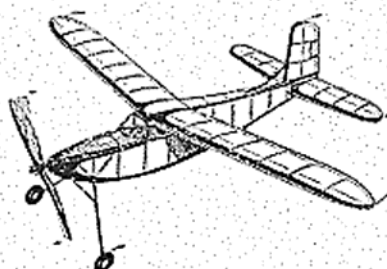
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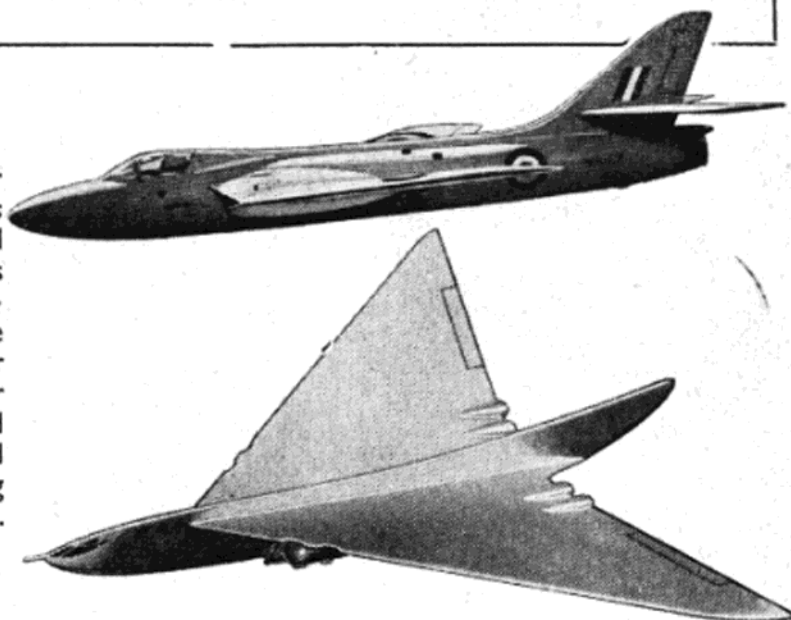
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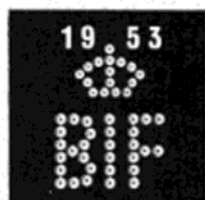
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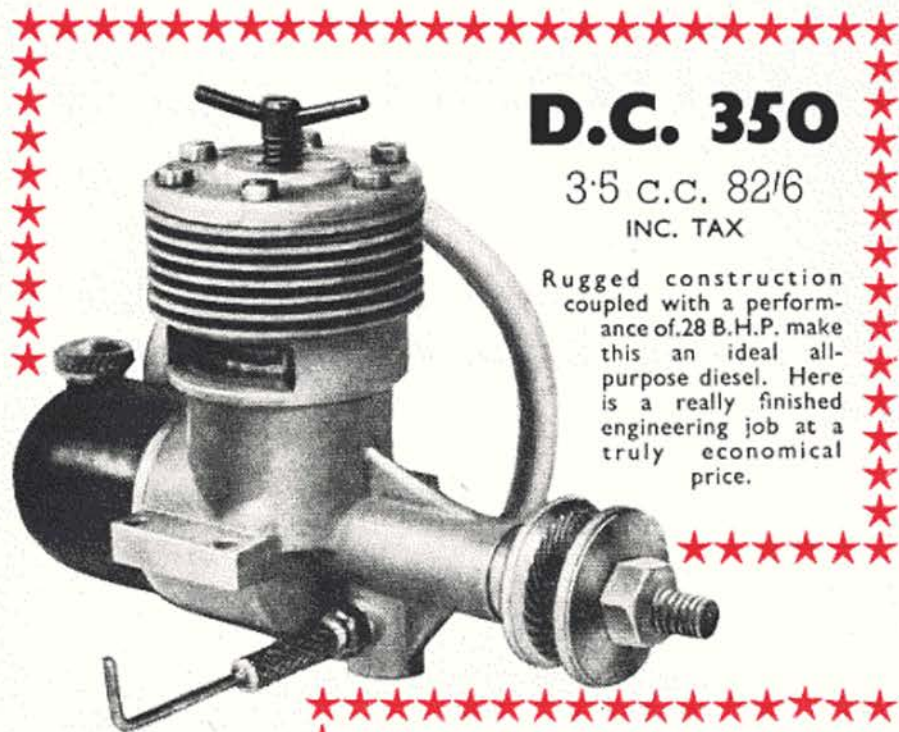
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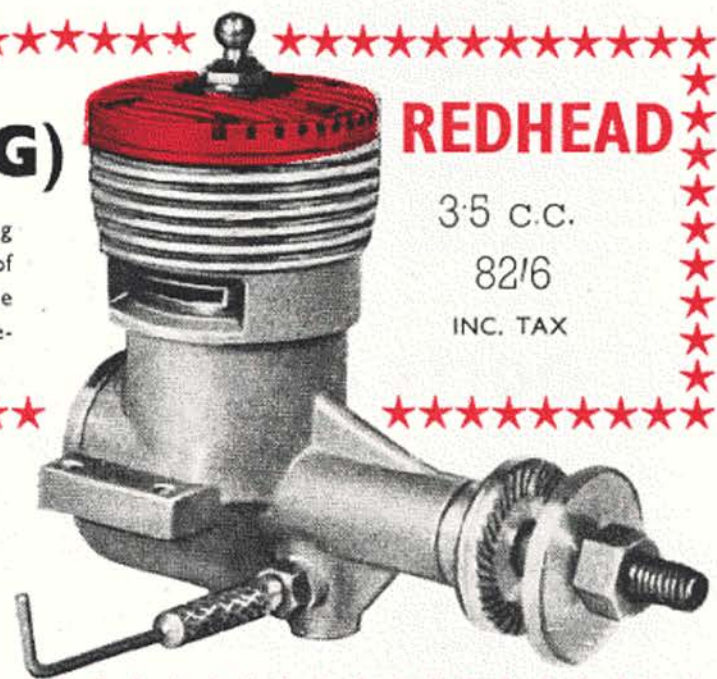
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APRIL, 1953.

Vol. 12, No. 4

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EDITORIAL

The fact that we have occasionally expressed editorial views in "Model Aircraft" which do not coincide with those of the S.M.A.E. seems to have been misunderstood in some quarters. We feel that it may help to clarify the position if we draw the attention of our readers to the fact that although "Model Aircraft" is the official journal of the S.M.A.E. the Society has no control over the editorial policy or business affairs of this publication.

"Model Aircraft" has always been willing to provide the Society with the means of publicising its activities; in addition it has supported the Society financially to the extent of nearly £3,000 since the end of the war. It must be remembered that even if every member of the S.M.A.E. bought "Model Aircraft" each month, they would represent only a very small proportion indeed of our total readership; nevertheless, by devoting space regularly to reporting the Society's activities, we have brought these to the notice of the many thousands of model fliers who are not members of affiliated clubs.

Although "Model Aircraft" is recognised as the official journal of the S.M.A.E. this does not mean that we have to "toe the party line." It always has been our policy to express our views on matters of general interest in a frank and unbiased manner, and we shall continue to do so in the future. If being the official journal involved any restriction on our Editorial freedom, we would not hesitate to propose to the S.M.A.E. that we should discontinue the use of this title.

In conclusion, we would like to make it quite clear that relations between the Society and the publishers of "Model Aircraft" have always been, and still are, most cordial. The Society itself is, of course, fully conversant with the position which we have outlined above. By publishing this statement we trust that we make the position clear for those who were unaware of the facts.

Cover Story

Roger Clarke, seen on our cover this month, must enjoy athletics, for although a keen R/C flier himself, he is frequently seen launching other fliers' radio models. In this case the model is Sid Allen's, and it was photographed on the occasion of winning the Rip-max Trophy at Fairlop last autumn.



THE JOURNAL OF THE SOCIETY OF MODEL AERONAUTICAL ENGINEERS

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19-20 NOEL STREET, LONDON, W.1. Telephone: GERrard 8811 Annual Subscription 20s. 0d. post paid.

Here and There

COMMENTS ON CURRENT TOPICS

THE END OF FAIRLOP

After many months of uncertainty as to what was to be the fate of Fairlop Aerodrome, Essex, the end has at last come as far as model fliers are concerned. The area has been turned back to the farm land from which it was originally converted, and, in fact, the greater part of it has already been ploughed up. So—London Area fliers have finally lost the aerodrome which has been the centre of their activities since model aviation got on its feet at the end of the war, and as there is nowhere in the whole area which is anywhere near as suitable for contest flying, the situation for the 1953 season is decidedly difficult. As we go to press the London Area is planning to hold some contests at Chobham Common, in Surrey, but even this is by no means readily accessible to most London fliers. A black outlook!

PUZZLE CORNER

Our Plans Department recently received a letter with a Leeds postmark, containing a postal order and a slip of paper saying just "M.A. 54 Mewgull, 2/9." That is all; not a word more. Now we should be glad to supply this reader with his plan—if we only knew where to send it—so if he will write again, this time enclosing his name and address, we will dispatch it immediately.

Incidentally this is not the first time a letter like this has reached us, and it gives us a problem of what to do with the ownerless postal orders! We would therefore remind senders of anything valuable, or for that matter anyone writing to us, to be sure to enclose their name and address. At least it saves us having to print paragraphs like this one!

THE MODEL AIRCRAFT SUPPLEMENTS

In this issue, on the centre pages, we are publishing the first of a series of special leaflets. These will appear from time to time and summarise data and other useful information of interest to the various fields of model aviation. The first, for example, deals with rubber motors, with notes on how to make up and treat motors for lasting performance, and also data on all sizes of rubber strip of use to all designers from the beginner to expert stage.

It is intended that these leaflets be detached from the main book and folded up to form a handy,

eight-page booklet. To do this, separate the four centre pages carefully, fold as in the journal and then fold together again along the dotted line indicated on the first page. Cutting along the top dotted line will then enable all the pages of the booklet to be opened up properly. If you want to make a really permanent job of the booklet, staple or sew the separate leaves together.

Various aspects of our hobby and sport will be dealt with in turn. In the meantime, if you have any particular subject which you think would form a useful "booklet," please let us know. The main idea of the booklet is to be useful and handy in size.

JUST FOR A CHANGE

Also in this issue we are publishing the first of a series of articles by Ron Warring on experimental model projects. These articles represent the results of practical tests and investigations made with unorthodox model layouts and for his first subject he has chosen the delta wing layout. The series of model tests described give prospective delta wing designers some idea of the best proportions to adopt in the design of such models—and also outline some of the snags, and cures, which may be encountered. One experimental model, in this case, is a Jetex-powered delta designed to "optimum" proportions on the results of these tests.

Further articles in the series will take other unconventional layouts and ideas—perhaps some you have never even heard of—and aim at developing a model design of each type which can very well form the basis for further interesting experiments.

A DATE FOR THE "M.E.X."

Looking ahead on our fixtures calendar, we find we can fill in another important date—that of the 1953 *Model Engineer* Exhibition. This great annual show will be held this year from August 19th-29th, and as usual model aviation will be well represented. Further details of the exhibition, particularly about the competitions with their valuable awards, will be made on these pages in following issues.

AND A NEW DATE FOR CONTROLINERS

As we go to press, we learn that the World Control-line Championships which were to be held at the end of March, are now to take place on June 6th-7th, at Milan, in Italy. It has therefore been decided to change the date of the eliminating

contests to select the British team. These will now be run on April 26th, at a venue as yet undecided.

However, would-be world champions are advised to enter without delay. At the time of writing we understand from the S.M.A.E. Competition Secretary that only four entries for the eliminators have so far been received!

WATCH OUT!

The A.M.A. (the American equivalent of the S.M.A.E.) recently published its schedule of 1953 contest rules, and a most significant change appears under the "towline glider" heading. All former classes in this category are discontinued, and in their place are two classes only: one for models with a maximum area of 350 sq. in. and minimum weight of 10 oz.; the other for models to the Nordic A2 specification—the first time this formula has featured in official American contests.

Another significant event is the appearance of the first American engine really designed for power models to the "International" formula—the O.K. Cub .14 (2.49 c.c.).

The significance of these two events is that the United States will soon be entering teams in all three F/F categories of world championship contest flying. As far as the Americans themselves are concerned this is likely to result in an entirely new attitude to modelling among the keen contest fliers: they will become "international" minded. As far as we are concerned, it will mean that our power and A2 teams will be meeting competition from the U.S. for the first time—and if their Wakefield record is anything to go by, it will be substantial competition.

THE NEW "M.E."

We make no apology for once again drawing the attention of our readers to the rejuvenation of our companion magazine—*The Model Engineer*. This long-established publication, a firm favourite of model builders the world over, has recently undergone a "face-lift" and now has a striking cover in two colours, while the contents are more attractively presented. With even more in its pages than before, but still at its old price of 9d. weekly, *The Model Engineer* will be enjoyed by anyone who builds models, and particularly by those interested in such matters as power units or R/C. If you would like a free sample copy, write to the Circulation Manager, Percival Marshall & Co. Ltd., 19-20, Noel Street, London, W.1.

CUT PRICE GEARS

The new Wakefield rules, coming into force in 1954, and therefore being effective in September of this year when the first of the 1954 Eliminators are to be held, badly hits the traders who, with the hope of only limited reward at best, have struggled to produce commercial gear blanks at reasonable prices. With only 2.8 oz. of rubber permitted in the 1954 Wakefield, gears are "out." So now we need some clever designer to utilise gears in another type of model—or else there are likely to be an awful lot of Wakefield size gears going into the scrap bin!

TALKING POINT

It is generally agreed that having the Wakefield, F.N.A. Cup and International Power events in one meeting at Cranfield this year will be the highlight of the British contest season.

However, this is viewed with some misgiving by one of our leading Wakefield fliers who writes to us as follows:—

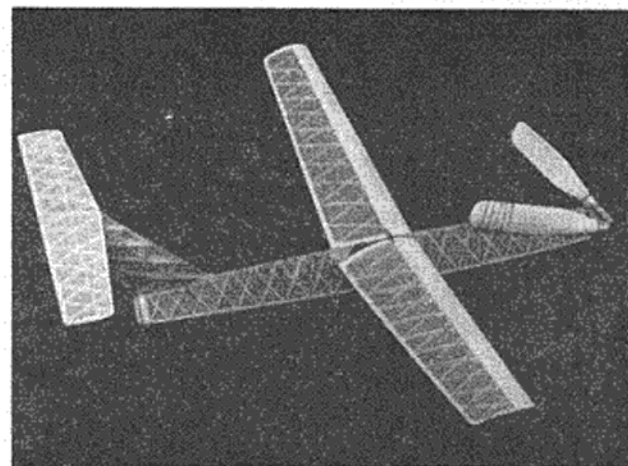
"If Sweden did not want to run the Wakefield this year, it would have been better to have run it in any other country other than our own. We should have earned the right to run the Wakefield here—by winning it abroad; France, Italy or Holland would all have been better venues. As it is, with a change in rules coming up in 1954, some countries may feel that we have 'pulled a fast one'—getting the Cup back to fly in our weather in daytime conditions and then eliminating the designs which have been so successful for the past three years—the Scandinavian return-gear designs. What I hope these countries will realise is that the British Wakefield modellers (or a good many, at least) are just as incensed at having the rules changed without the slightest say in the matter themselves as many other of the world's Wakefield fliers must be!"

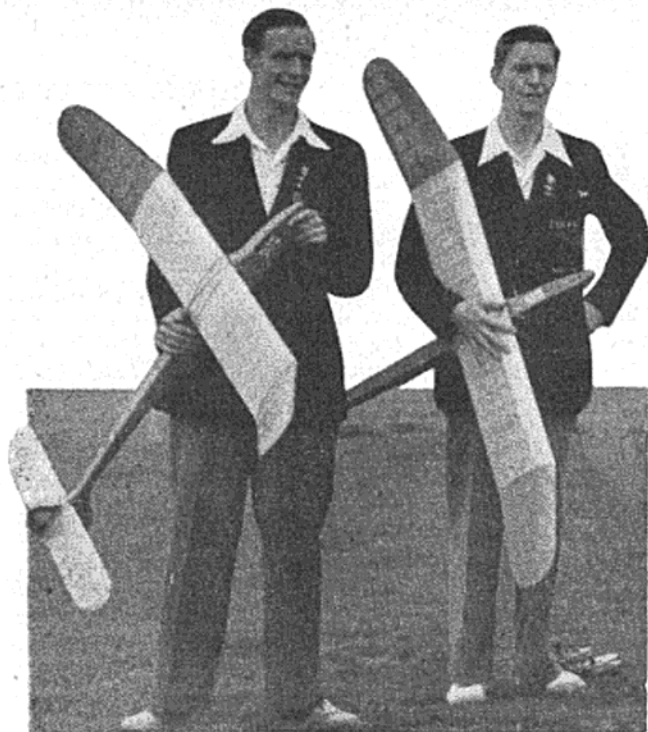
Whilst we may not entirely agree with the views expressed by our correspondent we can see that there is a possibility that the situation may be misunderstood by foreign Wakefield enthusiasts.

THE "THING"

One might well be excused for mistaking the photograph for a semi-scale model of a jet fighter rather than a contest Wakefield. Actually it is Ron Warring's 1953 Wakefield carrying to a logical (or illogical!) conclusion two theories: (i) The way to increase duration is to increase rubber weight; (ii) To produce a five min. model in all conditions, a nine min. "still air" model is required.

Based on Ron's '52 diamond Wakefield layout, the new model is designed around 11 oz. of rubber (equivalent to 56 or 64 strands of $\frac{1}{4}$ in. strip, maximum turns 3,600). Total weight is in the neighbourhood of 15 oz. The duration of the power run is 6 min., so that normally the model would d/t whilst still under power each time. A free-wheeling large-diameter propeller is fitted—the freewheel used only for ease of winding.





The designer (left) with his brother Ernest and two examples of this fine model.

DEVELOPED mainly as the West Yorks club glider, the *Helios* has been kept as simple as possible. In fact several have been built and flown successfully by junior members.

This model has proved itself stable in the strongest winds, both in flight and on the line during the 1952 flying season, while still maintaining a still air average of approximately 3 min. 45 sec. There is nothing very unusual about the design. It is a simple orthodox model and has proved that such a model, built and flown correctly, can give a good account of itself.

Building

The fuselage is built in the usual way, one half on top of the other. Using soft $\frac{3}{16}$ in. sq. for longerons and uprights— $\frac{3}{16}$ in. \times $\frac{3}{32}$ in. for the diagonals aft of the wing. After the two halves have been joined, the keel is fitted into place. This is first made up from two pieces of $\frac{3}{32}$ in. hard sheet, with the rail for the towhook first bolted into place as shown.

Fit the main spar and the $\frac{1}{2}$ in. \times $\frac{3}{8}$ in. hard balsa L.E. making sure the main spar is flush with the front of the ribs. The outer panels are built in the same way as the main wing with the spar and T.E. tapered towards the tip. Leave the spars, etc., $\frac{1}{2}$ in. overlong to allow for trimming. The tips are made from three laminations of $\frac{1}{32}$ in. \times $\frac{1}{2}$ in. When the three wing panels get to this stage, they are joined together and the dihedral built in. Trim the spars on the outer panels to give 6 in. dihedral under each tip, butt-join them to the main wing. Next, cement in the $\frac{1}{16}$ in. ply dihedral braces and the $\frac{1}{8}$ in. sheet gussets. Cement rib B to rib C and cover this panel with $\frac{1}{32}$ in. sheet to give the wing a flat underside here to fit on the fuselage, fill in with $\frac{1}{16}$ in. sheet on either side of rib C for $\frac{1}{2}$ in. to assist in covering.

Helios

A contest-winning A-2 Glider

BY W. FARRANCE

Sheet from the L.E. to the main spar with medium $\frac{1}{32}$ in. sheet and sheet the centre section immediately above the fuselage. Cement a piece of $\frac{1}{32}$ in. ply on the T.E. where the rubber bands will fit. The wing should now be ready for sanding.

Tail

The only part of the elevator that needs any explanation is the main spar. This is built as an I-section and partly made before pinning down. Make the $\frac{1}{8}$ in. upright part first, notching it for the ribs; cement this to the flat piece of $\frac{1}{32}$ in., pin this, the T.E. and $\frac{1}{8}$ in. \times $\frac{1}{2}$ in. spar to the plan and add ribs. Now cement on the top piece of $\frac{1}{32}$ in. to complete the spar. Next add the L.E. and riblets and sheet the centre section top and bottom after the laminated tips have been built on in the same way as the wings. Build the fin flat on the plan from $\frac{3}{32}$ in. sheet, cut out the trim tab and hinge with pins pushed through the fin. The fin is cemented in to the slot left in the elevator after covering.

Covering and Trimming

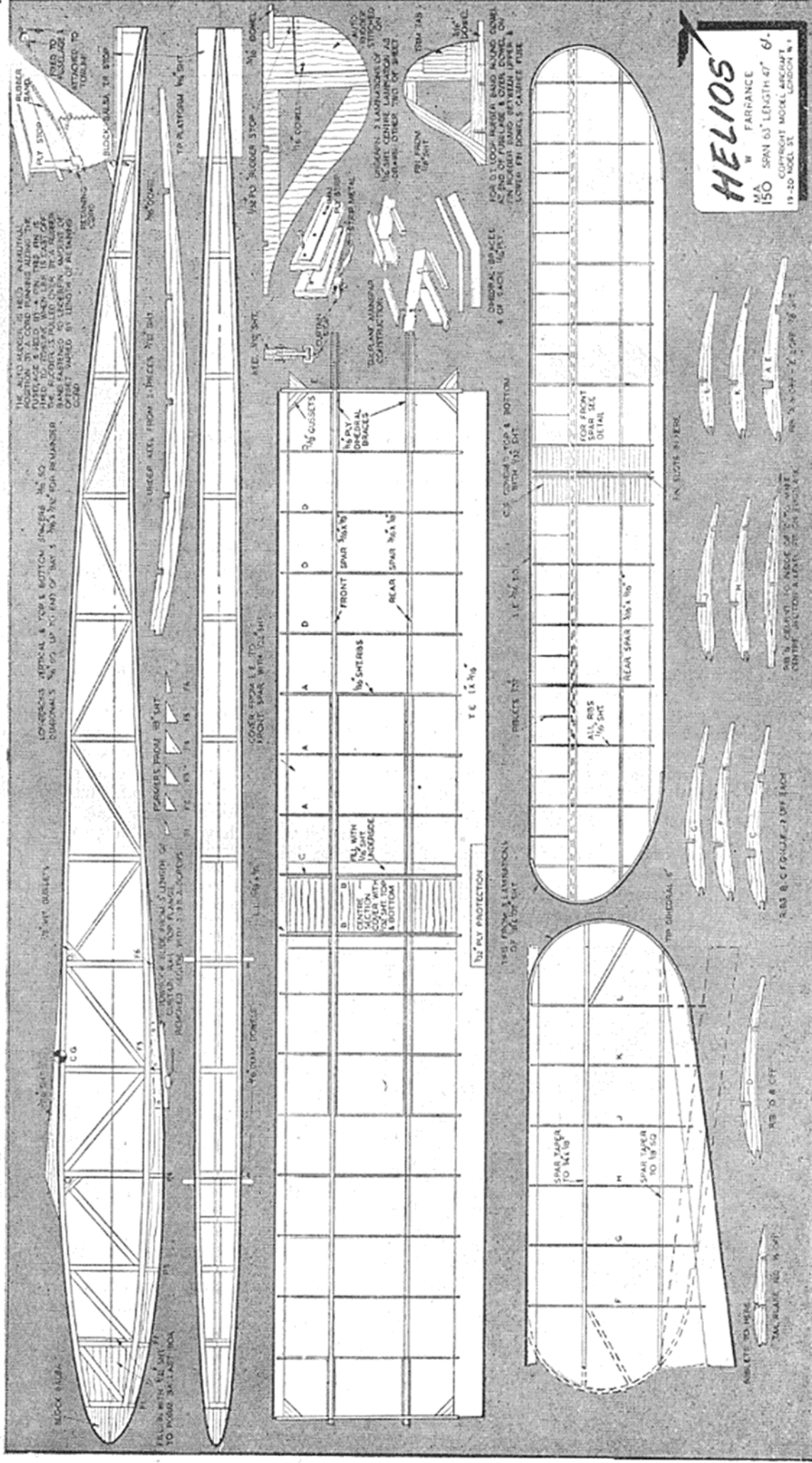
The wings and fuselage are covered with heavy rag tissue, the elevator with lightweight. Give the wings one coat of glider dope, the fuselage two coats and the elevator one coat thinned down 50-50. After covering, fix up the auto-rudder and tip-up tail; assemble the model, cementing on the tailplane platform whilst lining up. Fill the weight box until the c.g. is in the position shown. All trimming is now done on the wing and trim tab. Hand launch until a straight stalling glide is obtained, packing up the leading edge $\frac{1}{32}$ in. at a time until this is achieved.

The model is now ready to try on the line. Fix the towhook $\frac{1}{2}$ in. forward of the c.g. and move it $\frac{1}{16}$ in. at a time until a dead straight fast tow is obtained. If the model swings from side to side, move the hook back, if it goes to one side without any sign of swinging back, try opposite trim tab. If this doesn't work, move the hook forward; with a bit of care and patience you will be able to get a straight overhead tow.

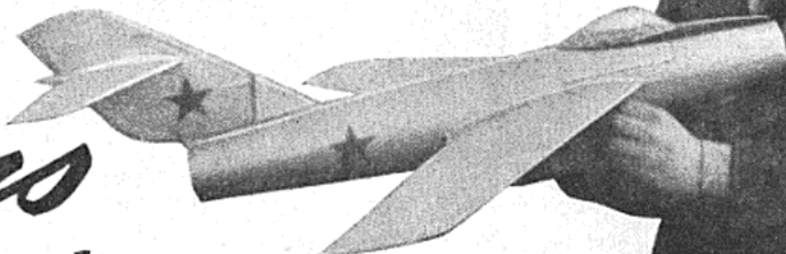
The model has usually been trimmed for a left hand turn. Use the full length of line and a short D/T when trimming, then, if the model gets into any difficulties, the D/T will bring it down safely. If the model doesn't stall on the turn, pack up the L.E. until a slight stalling turn results, then smooth out the stall by removing the last piece of $\frac{1}{32}$ in. or adding a little weight to the nose.

Contest Honours

1951. British Hand-launch Record (4 min. 39 sec.)
 1951. 1st place in Wakefield M.A.C. Rally.
 1952. 7th place in Pilcher Cup.
 1952. 1st and 4th places in S.M.A.E. Cup.
 1952. 1st, 2nd and 3rd in N. Area Glider Contest.
 1952. 1st in "Aeromodeller" A-2 Contest.
 1952. 2nd in Butlin Rally Glider Contest.



New Facts on Fans by M. M. Gates



P. E. Norman with his second 36 in. span MiG-15 model. Powered by an Elfin 1.8 it weighs 22 oz. and has a very realistic performance.

THE possibilities of ducted fans for propelling scale jet planes have only become widely known in this country during the past year or so, and already wide interest is being shown. The first kitted design has been built in numbers all over the country, in many cases attracting newcomers to model flying. Certainly the jet has a fascination quite different from other types, and in fact the problems of designing and constructing a ducted fan model approach very closely to those of full size high speed aircraft. It is thought that many enthusiasts will wish to extend their range of jets by designing their own models. With only a very limited amount of information available from the few articles published on ducted fans, additional design notes may be of some assistance.

In view of the low propulsive efficiency of the ducted fan some readers may still believe them incapable of producing a scale jet performance. That this is not so has been demonstrated by P. E.

Norman's MiG-15, and probably now by other scale enthusiasts. It seems very unlikely that a fan could ever compare with a propeller on a basis of efficiency, but that does not prevent it being invaluable for scale jets. As a general rule a high power/weight ratio should be aimed at, which means building the model as small as possible around the engine to be used. The resultant high wing loading gives high flying speeds, but is by no means excessive. Modellers intending to build very large jet models would do well to remember that although they may achieve higher speeds than smaller models, scale speeds will generally be lower. For example: a 22 in. span Hunter flying at 20 m.p.h. has a scale speed of 360 m.p.h. For a similar scale speed a 55 in. span model would have to fly at 50 m.p.h., which takes some doing!

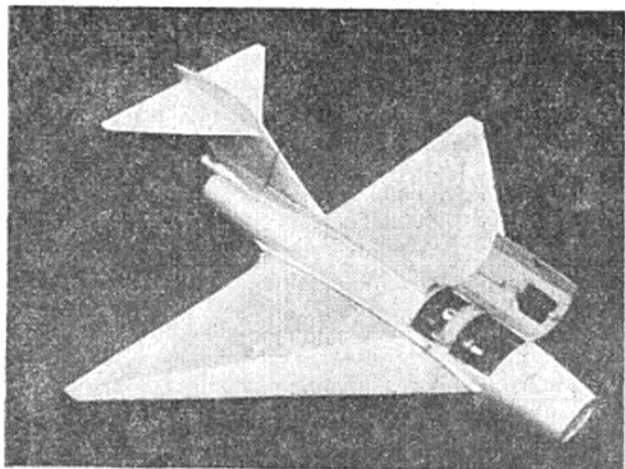
Fan Design

The ducted fan is really only a small propeller with some added resistance provided by the duct. Just as propellers require to be as large as possible for best efficiency, so ducts require to be of large diameter. But large ducts mean large models, heavy models and a poor performance. The result is that a compromise must be made, based on experiment. Experience to date appears to indicate that five or six-bladed fans are satisfactory with a pitch angle at the blade tips of approximately 30 deg. The fan diameter should then be made as small as possible without causing overspeeding. This diameter can be calculated for any engine

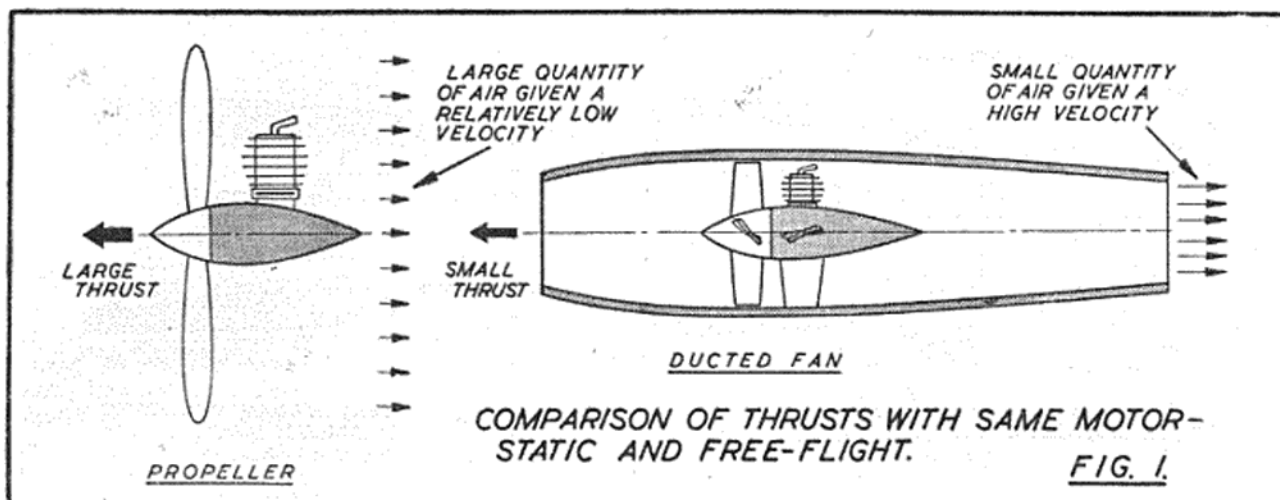
from the formula $D \text{ (inches)} = 1665 \sqrt[5]{\frac{BHP}{N^3}}$

where N = engine r.p.m.

This gives diameters for various engines as shown in Table I. For any new designs of fan the value of the constant 1665 can be adjusted to suit, or a multiplication factor found for the given diameters. For example, if a ten-bladed fan used on an Allbon Dart requires a 2½ in. diameter instead of the 3 in. given,



Another P. E. Norman creation, a 36 in. Boulton Paul BP120, Elfin 2.49 powered. It is seen here without its final trimmings, access hatch open.



then for a similar fan made for any other engine the tabulated diameter should be reduced in the ratio $2\frac{1}{2} : 3$, that is 0.833. In practice, though, the variation is unlikely to be as great as this. The formula shows that engines which are best for free flight propellers may not be best for fans. With a propeller, a slow speed engine gives more thrust than a high speed engine of the same power, since it can drive a larger propeller. In the case of the fan, thrusts are unlikely to be much different, whereas the faster engine needs a smaller fan—hence a lighter fuselage. Result: more revs—smaller model—higher speed. The diameter formula assumes geometrical similarity of fans and airflow conditions, which will be closely maintained except where proportions of intakes and jet pipes are varied, when pitch changes will be required anyway.

In designing the fan itself, it is very important to achieve as nearly as possible a constant geometric pitch from root to tip of the blades, as on propellers. This means that the blade angle *decreases* from root to tip (say from 90 deg. to 30 deg. measured from the plane of rotation). It will be noticed that fans cut and bent from sheet metal do not conform to this ideal (their blade angles *increase*, from 0 deg. to 30 deg.) so considerable improvements in fan efficiency may be expected. The effectively flat disc formed by the centre of the sheet metal fan can clearly cause considerable drag, if not actually reversing the direction of airflow behind it. It would appear that the ideal fan would be made from a plastic moulding, which requires large scale production to be economical. Let us hope that such fans will shortly become available. Meanwhile the next best arrangement is to fit individual blades into a turned hub.

Even with the small engines used to date, fan blade failures have not been uncommon. With more powerful engines in use, tip speeds will be higher and vibration more severe. The result will be more broken blades unless some steps are taken to make stronger fans. Blade stresses being caused mainly by centrifugal force the best material will have a low density, and high strength. For a good strength/weight ratio "Kite" brand tufnol seems hard to

beat, being better than alloy steel, far lighter and, of course, easier to cut and file. A thick blade root, and thin tip places the material where it is most needed.

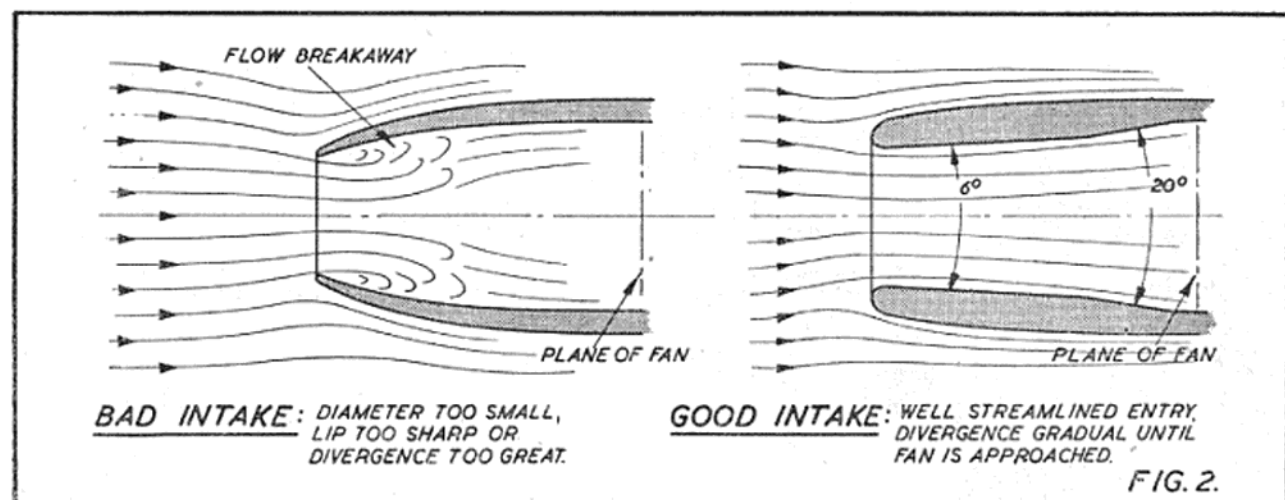
In cases where side intakes necessitate a position of the fan near or behind the aircraft e.g. a pusher installation is worth consideration for getting the c.g. forward without using nose ballast. There should be no power loss if the thrust is taken on the prop washer, and not on the crankpin or connecting rod big end as happens on some engines. Providing the cylinder head is in the airstream, cooling is not materially affected by placing it before the fan.

Energy Losses

To obtain the maximum thrust from a ducted fan we must first appreciate the energy losses suffered by the airflow in its passage through the duct. The air flows through the duct at about three times the models flying speed, which means the drag of any object such as a fuel tank is *nine* times as great as if it were out in the breeze! So do not kid yourself that the model need only be streamlined where it shows! Having seen that considerable losses can be caused by the usual drag-producing objects, let us now consider the other sources of inefficiency.

Friction with the duct walls—this is least if the air velocity is slow, which indicates a large duct diameter. A short duct is also to be desired, of circular cross-section, with smoothly shaped walls, but wall friction does not seem to account for a very large loss of thrust.

Flow breakaway and turbulence which often occurs where the area of the duct is *increasing*, so duct divergence should never be great. A 10 deg. inclusive angle is often quoted as a maximum, but even this is probably excessive for model work. This loss is most likely to occur in the intake and since it can be quite considerable it is worth while taking care in designing and building the intake. Fig. 2 shows the points to watch. It is interesting to note that when the Meteor 8 intakes were cut back to increase the minimum diameter from 21.44 in. to 26.12 in. the thrust at 100 m.p.h. was increased by



200 lb. and sea level rate of climb increased by 1,000 ft. per min. Available experience seems to show that an intake area of half the fan area is just about adequate, which means a diameter of about 0.7 of the fan. This is not usually far from scale—the trend is towards bigger intakes for full-size aircraft these days—and a small increase in area is not very noticeable. Wing root and side intakes should not be ruled out altogether, although they are more difficult to construct than nose intakes, and rather less efficient. By the way, the nose intake of the first British jet, the Gloster E.28/39 has not been beaten since for intake efficiency. Its value of 99 per cent. easily surpasses the 80-95 per cent. values of more modern types like the *Vampire*, *Attacker*, etc.

Slipstream Rotation. This represents energy wasted in producing an unwanted torque. Do not be misled by statements that ducted fans are torqueless, and so require no flow straighteners. If ducts are to produce no torque reaction they must contain flow straighteners; probably the engine mounting performs this function in a rather inefficient manner. Well designed straightener vanes will cut out torque and increase thrust. Placed just behind the fan, their leading edges should be cambered to meet the twisting airflow, trailing edges being approximately axial. The vanes can also be used to stiffen up the engine mount, the vibration of which can otherwise cause a considerable loss of revs.

The "Jet." Yes, the thrust producing jet itself represents wasted energy if the air comes out faster than it need, as it must with a small diameter tailpipe. On the other hand, if the nozzle is too large the efflux is very little faster than the air flowing past the model, so again thrust is small. On scale models, the nozzle is most likely to be on the small side, so from the thrust point of view make it as large as you can: something like "reheat" size.

The Fan. Most of the fan losses are produced in a similar way to wing drag, so aerofoil sections should be similar, perhaps with rather more camber; say 6 to 12 per cent. of blade chord to absorb more power within a given diameter. Remember that blades can stall as well as wings, the result being a

loss of revs and thrust. The stall will occur whenever the airflow is sufficiently obstructed, for instance by very small intake or outlet areas. Put your hand over the tailpipe of a ducted fan, and see how the revs drop. Fan losses are also increased by using low "aspect ratio" blades, large tip clearances and insufficient twist.

Design Procedure

The first step in the design is to decide on the engine to be used. Easy pulley starting will be required, with a high power/weight ratio, maximum power occurring at high speed. For sizes above 2.5 c.c. at any rate, the glowplug engine is clearly superior to even the ball-bearing diesel. In the smaller sizes there is little to choose between glowplug and diesel. The other decision to be made at the start is the aircraft to be modelled. One with a large circular fuselage, large intakes and big jet pipe is to be preferred. Models have flown well with the standard 35 deg. sweepback and 2 deg. to 3 deg. washout to prevent tip-stall. The "dihedral effect" of the sweepback contributes largely to the model's lateral stability. Whether unswept "jets," and in particular low wing types can be flown satisfactorily is not yet known—perhaps pendulum controls will be necessary. To show the method of determining the optimum size of model for most realistic performance, two sample calculations are given.

Elfin 1.49 powered Hawker "Hunter"

The minimum fan diameter is calculated by the formula given on page 160; the result for the Elfin 1.49 is shown in Table I as 3 in. Allowing $\frac{3}{16}$ in. all round for the fuselage structure, the fuselage outside diameter comes to $4\frac{1}{8}$ in. The ratio of wing span to fuselage diameter is a useful factor to work out, scaling the dimensions from drawings. In the case of the *Hunter* the ratio is 8.13, so our minimum wingspan is $4\frac{1}{8} \times 8.13 = 33.5$ in. (approximately 1 in. to 1 ft. scale). Weight of motor and fan = $2.7 + 1 = 3.7$ oz. which we will call *C*, the constant weight. The fan weight used here is a rough estimate

of 1 oz. In practice a more accurate value will be known. The best formula for determining the air frame weight, here called A , of a power model is to assume it to be proportional to the wing span squared and to the square root of the constant weight mentioned above.

That is $A = k s^2 \sqrt{C}$ where s = wing span.

k is a constant—call it the airframe weight coefficient—which can be determined by weighing earlier, similar models of any other size. For the Veron LA-17, k was 0.0058, and for P. E. Norman's MiG-15 and BP120, k was 0.0064, so we can take 0.006 as a fairly average value, increasing it when we want to build more heavily or where the design makes increased weight inevitable. In our case the Hunter has a very long fuselage for its wingspan, so we will increase k by 10 per cent., that is to 0.0066. Units used are ounces and inches.

$$\begin{aligned} \text{Total weight of model} &= A + C = k s^2 \sqrt{C} + C \\ &= 0.0066 \times 33.5^2 \times \sqrt{3.7} + 3.7 \\ &= 14.22 + 3.7 = 17.92 \text{ oz.} \end{aligned}$$

Assuming the Elfin 1.49 gives 0.14 b.h.p. the models power/weight ratio is $\frac{0.14 \times 16}{17.92} = 0.125$ b.h.p./lb.

With an area of 403 sq. in., the wing loading is $\frac{17.92 \times 144}{403} = 6.4$ oz. per sq. ft. based on gross area.

It cannot be said that a model will have sufficient thrust to fly if it exceeds a certain power/weight ratio—a high wing loading means a high minimum

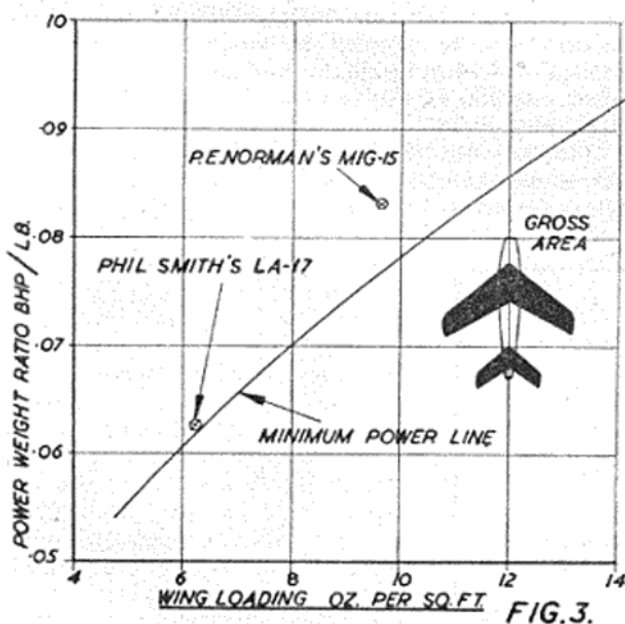
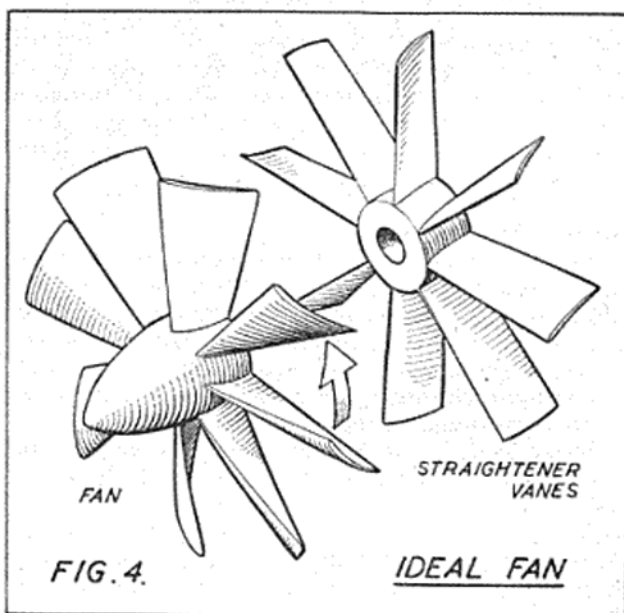


FIG. 3.

TABLE I

Engine	Fan Dia. (in.)	Engine	Fan Dia. (in.)
Dart 0.5	3	E.D. Bee	33
Mills 0.75	31	E.D. 2.46	41
Elfin 1.49	31	Elfin 2.49	41
Elfin 1.8	31	Amco 3.5	41



flying speed and so more power is required. The amount of power must be increased as shown by the curve for minimum power, Fig. 3, which assumes a constant efficiency of the propulsive system. Looking against 6.4 oz./sq. ft. on the graph, the minimum power is shown to be 0.0624 b.h.p./lb. Our Hunter with 0.125 b.h.p./lb. has twice the minimum power required, ample to allow for any increased losses caused by wing root intakes; or we could increase the model's size. Our second example shows a design based on obtaining adequate area from a scale intake.

Amco 3.5 powered Gloster E.28/39 (first British jet aircraft)

On the E.28/39, which can be seen in the Science Museum, the fuselage diameter is very large compared with the intake and jet pipe, making a double-skin fuselage construction necessary. The minimum fan diameter, from Table I is 41 in. With intake area half the fan area, intake diameter must be $4.625/1.414 = 3.27$ in.

Wing span is 12.62 times intake diameter, or 41.2 in. Taking the weight of motor and fan as 5½ oz., $C = 5.5$. The fuselage being large, we will take the large value for airframe weight factor, i.e., 0.0066.

$$\begin{aligned} \text{Total weight of model} &= A + C = k s^2 \sqrt{C} + C \\ &= 0.0066 \times 41.2^2 \times \sqrt{5.5} + 5.5 \\ &= 26.3 + 5.5 = 31.8 \text{ oz.} \end{aligned}$$

Assuming a b.h.p. of 0.28, the models power/weight ratio comes to $\frac{0.28 \times 16}{31.8} = 0.141$ b.h.p./lb. Wing and tailplane gross areas are found to total 424 sq. in. giving a loading of $\frac{31.8 \times 144}{424} = 10.8$ oz./sq. ft.

Minimum power for this loading is 0.082/1 b.h.p./lb. so again power is seen to be ample.

Such a model would surely be a most rewarding sight in flight, its green and brown camouflage

contrasting with prototype yellow undersides. Many readers will know that the prototype was at one time fitted with two extra "finlets" on the tailplane, so it should be possible to obtain good lateral stability without departing from scale. The large side area provided by the fuselage itself should contribute towards good stability.

Future Developments

With the development of scale jet models proceeding so rapidly it is tempting to try to peer into the future by considering ideas which may bring further improvements. Development of the existing ducted fan types (both axial and centrifugal) to give still better flight performances must soon become slow unless some wind tunnel tests can be carried out. Perhaps the L.S.A.R.A. will oblige, for ducted fan radio models appear feasible with a little more development. For modellers who like something requiring more skill than usual, the twin-jet such as the Gloster *Javelin* is an appealing project. With the thrust lines closely spaced, trimming should be far easier than a propeller twin. By adjusting wide-thrust vanes in the tailpipes it should be comparatively simple to fly such a model on either engine, or both.

When speed is desired at the expense of the glide it would be possible to fit two engines and fans in series into one duct—thus fitting twice the power into a given size of airframe. Because of the high wing loading which is likely to result, such an arrangement is more likely to be suited to C/L scale models, than to F/F work. To simulate reheat, or afterburning would be interesting, and this could evidently be obtained by fitting a Jetex unit in the duct behind the motor. Would the duct have a beneficial effect on the Jetex, like the thrust augments tube?

Noise

The sound of a ducted fan model is rather different from a propeller-driven type, and as such gives a fairly "scalish" effect, not unlike a V1 flying bomb. Whilst the exhaust crackle is muffled by the fuselage

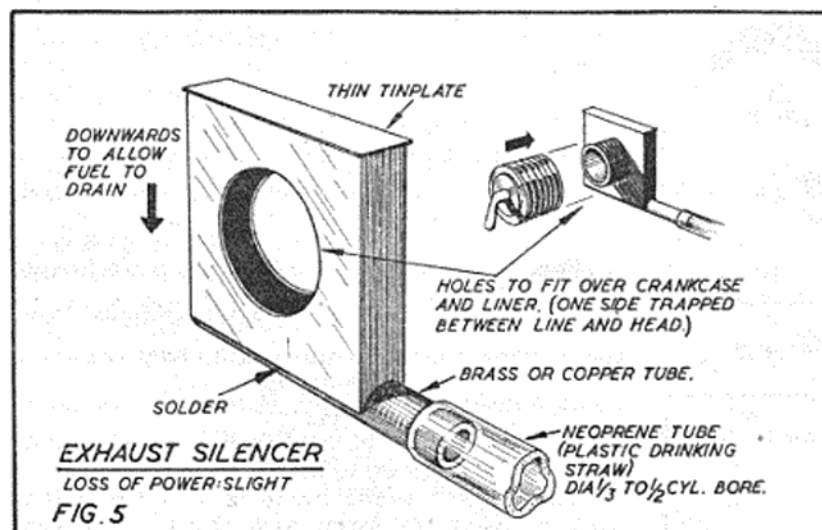
walls, the fuselage itself acts as a resonating sounding board. For modellers who want to quieten their models down to imitate the real thing more closely, it is suggested that the engine mounting should include some layers of rubber to absorb vibration—perhaps hard rubber washers on the bolts would suffice—and that a simple yet effective exhaust silencer be fitted, as shown in Fig. 5. The high pitched scream resulting from high revs also contributes to realism, but doubtless also to engine wear!

Flying

The most common fault which can occur on the first flights with a ducted fan is that it does not climb. There can be many reasons behind this lack of airworthiness, which may still be apparent after following the advice given in the earlier part of this article. It usually looks as though the engine lacks power, but if the model is designed to the rules given, this will not be the case. The most frequent source of trouble is a c.g. placed too far back, giving a lack of longitudinal stability. A model so trimmed will show a long flat glide when carefully launched (alas, too good to be true), or if launched a little upwards, will stall and drop a wing violently, or sit on its tail. Under power it will again try to sit on its tail. With the c.g. moved farther forward it is necessary to reduce tail incidence, often to the point of having an apparently large negative angle. This angle can be made more moderate when swept wings are used, by giving the wings 4 deg. or 5 deg. washout, at the same time reducing wing dropping tendencies, or by increasing tailplane area.

Trimmed for a good glide, and to give a nose-dropping stall the model may still stall under power, calling for downthrust. "Downthrust" and "side-thrust" can be applied by small horizontal and vertical vanes just inside the tailpipe, and these are in effect essential for satisfactory trimming of the power flight and glide.

Trouble with the fan itself will be evident before the model actually takes to the air, by poor revs when the access hatch is closed down. This may be due to a combination of three effects: intake too small; fan diameter and pitch too large. Once the model is complete it is hardly practical to alter the fan diameter but its pitch can be reduced to bring r.p.m. up to the maximum power condition. A well designed model should now fly satisfactorily, but if thrust is still insufficient the last resorts are to increase pitch again and open up extra intakes—nose-wheel wells, windscreens, etc.—or fit a more powerful engine. Such measures should prove unnecessary; fast flights should be easily obtained, so let us look forward to large numbers of fast scale jets of all types—there is a very large and continuously growing variety of prototypes to choose from.



MODEL
AIRCRAFT

ENGINE TESTS

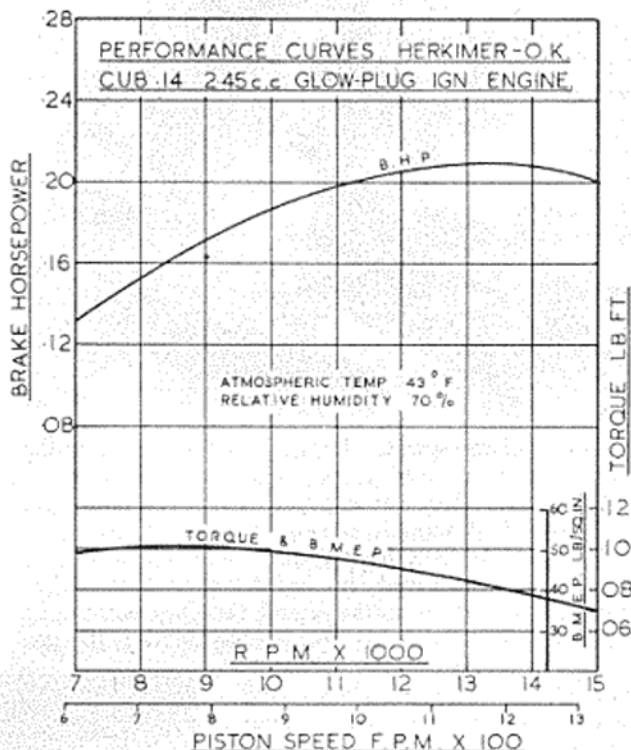
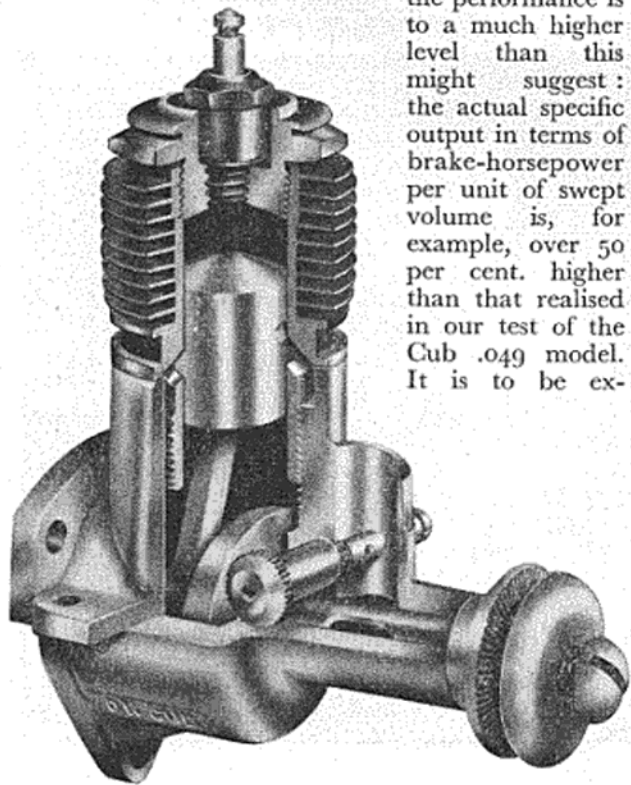
No. 46. The O.K. Cub .14

THE Herkimer O.K. Cub .14 is of especial interest to Britons and to European enthusiasts in general, in that it is the first and, so far, the only American engine which is to the F.A.I. 2.5 c.c. capacity limit for International F/F competition. Until now, the .099 cu. in. (1.6 c.c.) class has been the nearest available capacity in the U.S.A.

Of .149 cu. in. swept volume, the equivalent metric measurement is actually 2.456 c.c. The reason for not taking the utmost advantage of the 2.5 c.c. F.A.I. limit is possibly due to the manufacturers' anticipation of a .15 cu. in. class being eventually recognised by the American A.M.A., should this intermediate capacity prove as popular in the U.S.A. as it has in Europe. Thus, by keeping the swept volume just below .150 cu. in., the widest appeal is likely to be ensured.

The Cub .14 is similar in design to the other, smaller, Cub engines, which have been sold in very large numbers during recent years. In consequence the accent is on light weight and compact design. However, as previously reported in MODEL AIRCRAFT,

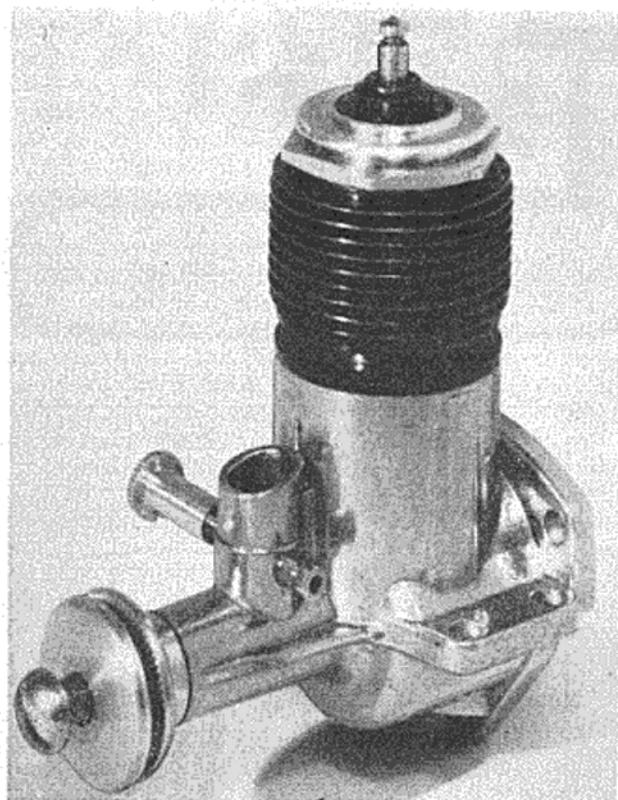
the performance is to a much higher level than this might suggest: the actual specific output in terms of brake-horsepower per unit of swept volume is, for example, over 50 per cent. higher than that realised in our test of the Cub .049 model. It is to be ex-



pected that a higher specific output would be obtained with a substantial increase in cylinder size—this is in accordance with our findings on small glowplug motors—but the power obtained with the Cub .14 is even better than one might reasonably expect. To draw a graphic comparison; it is almost five times as great as that of the smaller engine, for only three times the capacity.

Moreover, when it is considered that the engine weighs only 1½ oz. more than the .049 cu. in. model, this performance becomes even more noteworthy and it is worth pointing out here that the Cub .14 does, in fact, possess just about the highest power/weight ratio of any 2.5 c.c. engine currently available or, for that matter, of any engine up to 2.5 c.c. yet built.

As regards the general design and construction of the engine, this follows the popular circumferential port, shaft valve layout, the cylinder porting being, of course, the patented system employed on all Cub engines and originated by Charles Brebeck, president of the Herkimer Tool & Model Works Inc. A moderately low stroke/bore ratio is employed, contributing to compact design, low weight and



moderate piston speed. The crankshaft which, unlike many diesels of similar size, has a counterbalanced web, features a square rotary-valve intake port. As with other Cub models, the standards of construction and finish are to a high order. The Cubs are, of course, manufactured by most up-to-date large-volume production methods and the die-casting and machining are excellent. A pleasing detail is the use of copper gaskets at the cylinder/crankcase, cylinder-head and crankcase-cover joints. Four gaskets are provided under the head, which suggests, for those who so desire, a possible source of simple tuning for optimum performance on different fuels and over different speed ranges.

The Cub .14, it will be noted, is provided with both beam lugs for normal centre-line beam mounting, and a rear flange for bulkhead mounting.

Specification

Type: Single-cylinder, air-cooled, two-stroke cycle, glowplug ignition. Shaft type rotary valve induction. Patented circumferential exhaust and transfer porting with conical crown piston.

Swept volume: 2.456 c.c. (.1499 cu. in.).

Bore: 0.600 in. Stroke: 0.530 in.

Stroke/Bore ratio: 0.883 : 1.

Compression ratio: Not disclosed.

Weight: 2.75 oz.

General structural data: Die-cast aluminium alloy crankcase and main bearing with screw-in rear cover having tapered flange seating on copper gasket. Steel cylinder, fully machined with integral fins, ground and honed and screwed into crankcase. Lightweight steel piston with fully floating gudgeon-pin positively located in piston and forged connecting-rod. Hardened and ground counterbalanced crankshaft with square valve port, running in plain bearing and with splined end for prop driver. Separate airscrew attachment screw. Machined aluminium alloy cylinder-head screwed into cylinder and seating on same with four copper gaskets. Spray-bar type needle-valve assembly. Three point radial and standard beam mounting lugs.

Test Engine Data

Total time logged: 1 hour.

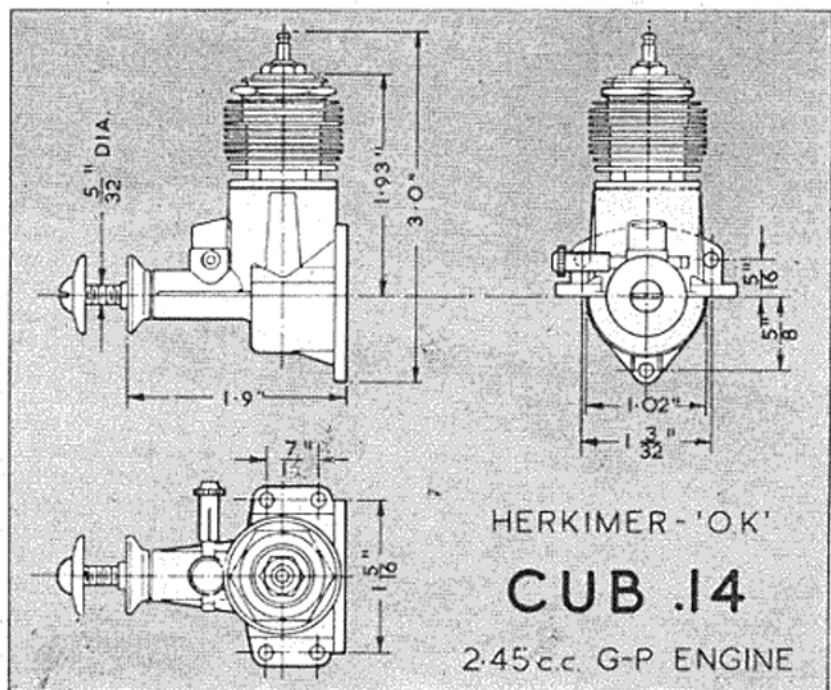
Ignition equipment used: "O.K." short reach glowplug. 1.6 volts used to start.

Fuel used: 45 per cent. blending methanol, 30 per cent. B.D.H. nitromethane, 25 per cent. Castrol "M."

Performance

Even Europeans, used, mainly, to handling diesels, would be hard put to finding the slightest reason for complaint with the Cub .14. Starting is very easy: merely a matter of a single choked preliminary flick of the prop, when the engine is warm, leaving the needle-valve at its running setting. From dead cold, a prime through the exhaust is required or, alternatively, the engine can be temporarily inverted and flicked over to induce a rich charge into the

(Continued on page 169)





Barry Haisman "holds"
for a fellow club member

WEIGHT REDUCTION

By Barry Haisman

REDUCING the weight of the airframe while yet retaining sufficient strength is a problem common to designers of full-sized aircraft as well as to model designers. The former have to design aircraft that will fulfil the dimensional, performance, and load-carrying requirements of the specifications they are working to, and hence they must continually be on guard against overweight in any part of the airframe. The model designer knows that, up to a point, the lighter his model the better will be its glide, and therefore the longer its duration.

This is nowhere more important than in the present Wakefield class model, the lightest of all the international competition models, which to have any chance at all against the Europeans must carry, at the very least, 5 oz. of rubber, but still not exceed 8½ oz. all-up. While it may be argued and occasionally demonstrated that a 10 oz. Wakefield glides as well as the lighter job, the uncomfortable fact remains that the heavier model hits harder and is more prone to damage. It is interesting in this connection to note that a carefully built lightweight of about 30 in. span is relatively indestructible—it "bounces" on impact. It would thus appear to be better, for reasons of durability, to keep the Wakefield as near the minimum weight as possible.

These notes are concerned chiefly with the Wakefield model, because only in that class has any great advance been made in structural design. The other classes of models have not been subject for long enough to the discipline of a fixed set of rules; the power situation is still neither settled nor satisfactory.

However, apart from this, it is not so necessary to pare away fractions of an ounce on power and glider models; the English diesel motor is a remarkably powerful device, providing, when handled intelligently, an ample power reserve for overcoming small aerodynamic inefficiencies, while to a Nordic

glider at the top of the line an ounce or two either way hardly matters.

Some people, in fact, claim that the heavier glider possesses a highly useful quality known as penetration, while others say that as the lighter job flies slower it can be made to fly safely in smaller circles and so improve the chances of catching and holding lift at low altitudes (forgetting, perhaps, that the model, lacking human powers of discernment, may equally well remain in a volume of sinking air). It is clear that within reasonable limits the glider is relatively uncritical as regards its flying weight. But where and how that weight is disposed does appear to be of some importance.

It is well known that no one has the slightest difficulty in building a Nordic to the minimum weight, in fact most of them weigh under 10 oz. They are then ballasted about the c.g. to bring them up to 14½ oz. It is generally far better to do this than to build-in all the weight. In particular, the temptation to add spars and sheeting to the wing should be resisted, as heavy wings are notoriously bad on all classes of models, being conducive to gross instability.

A most striking example of this may be found with chuck gliders where, if the wing is overweight proportional to the rest of the model, no amount of playing about with fin area, c.g. or dihedral will make the model roll out into level, circling flight at the top of the zoom. It may seem to fly well from a normal hand-launch, but having a heavy wing it will never flick out of steep banks or the inverted position as such a model ought to do.

Reverting to Nordics, it would therefore seem wise, for reason of stability, to make the wings as light as possible, and to resist the temptation to build-in weight here; building-in of weight is permissible only in the forebody of the fuselage, which is almost the same as adding ballast.

So for reasons of stability the gliding enthusiast should take weight reduction seriously, aiming to remove weight from the outer panels of the wings and from the after fuselage and tail group, and concentrate it about the c.g. Gunic appears to have had this in mind when designing the 1952 winner.

The essence of the problem for the power modeller lies in increasing the strength/weight ratio. High flying speeds mean that very slight warps and tiny changes in angular settings can bring about disaster.

Structures are needed that will hold their settings in all conditions, without being inflexible; a too-rigid framework can shatter under only a light shock.

A once common method of lightening a model consisted of drilling and punching holes all over the airframe, sometimes with fearful results. If, after such treatment, the model was still strong enough then the indication was that the lightened parts were too heavy in the first place, and should be redesigned. The fault of this method is that it exposes too much unsupported end-grain; its application is limited, and must be used with discretion.

Safe and effective weight reduction is achieved only by careful planning, and unflagging attention to weight economy throughout every single step in construction. It is ever fatal to seek consolation from the thought, "It would be a good thing to have a bit of extra strength there, anyway," when for practical purposes it just isn't needed. Effective weight reduction may be said to be more the result of an attitude of mind than of any single process in design or construction.

It is now generally agreed that most effective weight reduction is achieved by careful selection of wood, given, of course, a sound airframe design to work to. Modern methods of design and construction are no secret; in fact, with a few exceptions, expert competitors are very willing to discuss and exhibit their models. But knowing how to select balsa wood of the right size and consistency is something that is arrived at only after long experience.

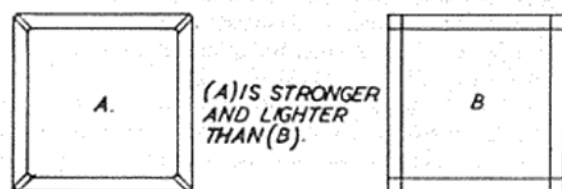


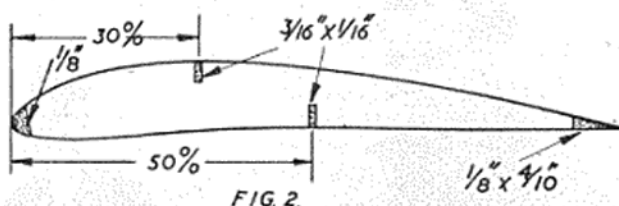
FIG. 1.

Even the experienced modeller often finds that after carefully choosing his wood at the model shop, he can further "select" when he spreads his wood out on the work board.

Wakefield fuselages employing $\frac{3}{16}$ in. \times $\frac{1}{16}$ in., or even $\frac{1}{8}$ in. \times $\frac{1}{16}$ in. longerons set diagonally produce a lighter job of adequate strength. Spacers of firm $\frac{1}{8}$ in. \times $\frac{1}{16}$ in. are required, though $\frac{1}{32}$ in. \times $\frac{1}{8}$ in. spacers have been used; it depends upon whatever reserve of strength is required. (Fig. 1.)

Nordic fuselages are often sheet covered, but there must be a slight advantage in using tissue covering which, being lighter, helps to centralise the weight. In addition, tissue is easier to apply and repair, and simpler to render smooth and waterproof.

To achieve strength with lightness in wing structures the disposition of spars and ribs relative to one another is of first importance. No single member should be so strong that it does the work of others. The material should be disposed as far away from the chord line as possible, the simple arrangement illustrated being quite satisfactory for Wakefield models. (Fig. 2.) Wing ribs are usually cut from



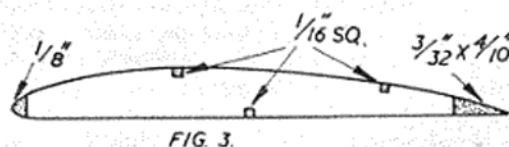
too-hard stock—quite soft $\frac{1}{32}$ in. is adequate provided the ribs are well "anchored" to the covering. Trailing edges, it is worth remembering, merely hold the ribs in position and give an edge to stick the covering to, contributing little to the strength and rigidity of the wings. In this connection, the writer knew one old-time modeller, a highly skilled engineer by profession, who used thread for trailing edges, giving the wings, when doped, the scalloped appearance of the early aeroplanes; the leading edge and mainspar gave full rigidity. Provided the ribs are not pitched too far apart most wings today could have their trailing edges much reduced in size.

Any wing framework will warp if carelessly assembled and covered. There should be no tension between any of the members while the structure is at rest; the forcing of spars and ribs into position is fatal. Covering must be applied evenly.

Built-in fins are now common on nearly all classes of models, and their several advantages outweigh the slight risk of damage; they are certainly lighter—and one upper fin is always lighter than an upper and under fin of equal area.

A heavy tailplane on a Wakefield is almost disastrous, and bad on any model. A tailplane with the spars arranged as shown and soft $\frac{1}{32}$ in. ribs about $1\frac{1}{2}$ in. apart should weigh less than $\frac{1}{4}$ oz. (Fig. 3.) The upper surface should be only lightly doped; occasional slackening of the tailplane tissue has, in the writer's experience, no measurable effect on performance. The only conceivable rigging arrangement where it might matter is when the c.g. is very far aft; such models are too sensitive to air temperature, humidity and uneven knotting of the rubber in Wakefields, to be very practical under English conditions.

While the present silly rule re three-point take-off obtains, some sort of undercarriage is inevitable. A twin-leg undercarriage, no matter how carefully made, is too heavy and too drag-producing for the modern model, and various means, some honest, others of doubtful moral intent, have been used to get round it. Disliking auxiliary fins and pendant skids the writer builds about 8 deg. of anhedral into the tailplane to provide two positive points of support at the rear. The third and forward point is made by a light balsa back-retracting leg, which is raked forward in the extended position. (This scheme has been

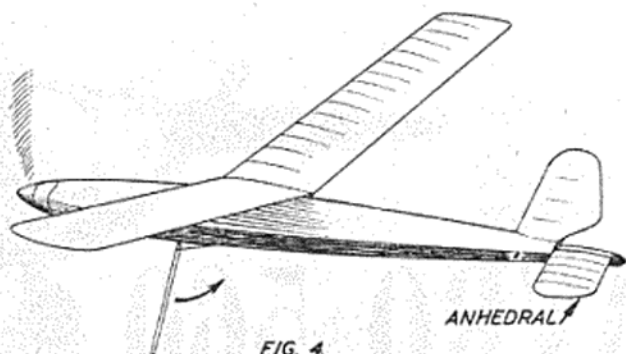


used on a free-wheeling propeller model for a year ; the propeller is still in excellent condition.) The whole arrangement has proved economical and efficient. (Fig. 4.) Whether the 80 grammes of rubber required by the 1954 rules would be enough to pull a mono-leg model off the ground every time is another matter ; we hope the rule will be amended to specify a wheeled undercarriage, or scrapped in favour of hand launch.

A free-wheeling propeller must be fairly rigid ; if not, it is too easily snapped on impact. It would therefore seem unwise to go far below 1 oz. for the complete unit. A flexible featherer or folder, on the other hand, needs little strength in the blades, only enough to withstand the shrinkage of filler or covering tissue, and can safely be reduced in weight to $\frac{3}{4}$ oz. or less. This is most important with a folder, as c.g. shift on folding is a direct function of blade weight.

One-fifth to one-third of the weight of a Wakefield (without rubber) is taken up by the covering, and it is not often realised that safe economies in weight can be made here. Photo paste, tissue cement, gloy or banana oil are widely used for sticking tissue to the framework, but for lightest and cleanest results ordinary dope is unbeatable. Its one disadvantage is that only small areas can be dealt with at a time due to its rapid drying and absorption, though this should produce a neater and more evenly stressed covering due to the enforced slower rate of working.

Bad finishing adds weight, the whole subject of finishing being one that should repay systematic investigation from the point of view of weight. Generally, covering materials with a high absorbency should be avoided where weight is critical.



Dope should be used sparingly, three or four thin coats being better than one thick one. Banana oil is heavy and should be used little, if at all. A good finish is one that is smooth and airtight, and not necessarily glossy, the tissue pores all filled in and the 'umps and 'ollers natural to wood made even with sandpaper and filler. "Exhibition bullshine" dazzles and often influences judges ; it more often prejudices flight performance. A model can be made attractive without adding weight at all, or very little, by leaving no wood exposed, by using contrasting tissues for covering, and by the judicious use of piping (tissue strips or coloured dope) and transfers. Restraint is all-important.

The trend of the foregoing applies to all models. The addict regards models as expendable ; the enthusiast appreciates the importance of a high strength/weight ratio, which allows him to handle his models confidently and fly them with pleasure over a long period.



Engine Tests

(Continued from page 166)

combustion chamber after sucking-in three or four times. On the test engine the critical needle setting was six turns open, varying fractionally according to load.

The Cub was tested over an 8,000 r.p.m. speed range, taking 7,000 r.p.m. as the starting point. There is little reason for loading a glowplug engine down to speeds lower than this : indeed, it is inadvisable to do so in view of the limitations on ignition range imposed by this form of ignition.

Over this entire range of speeds the Cub ran perfectly, with a clean exhaust and a clear note without trace, at any speed, of the background "crackle" which spells incomplete combustion. Such flexibility is very good and can be attributed to sound basic designing, as well as to intelligent matching of compression-ratio, fuel and plug characteristics.

The maximum torque reached by the Cub .14 on the reaction dynamometer was equivalent to a b.m.e.p. bettering 50 lb./sq. in. This is higher than we have been accustomed to expect in glowplug

engines in the lower capacity groups. It is reached at between 8,000 and 9,000 r.p.m., beyond which the torque falls off slowly but evenly all the way to 15,000 r.p.m. This results in an unusually flat power curve, having its peak at 13/14,000 r.p.m., and in which there is relatively small variations in output over a wide range of speeds. The maximum b.h.p. recorded was .21 and it is worth mentioning that, if it is desired to run the engine at the peak to take advantage of this, the Cub is perfectly happy when loaded for such speeds. It is still easy to start and runs smoothly and evenly and without sign of stress.

Compared with diesels of the same capacity, the Cub runs more smoothly and there is no loss of power as normal running temperature is reached.

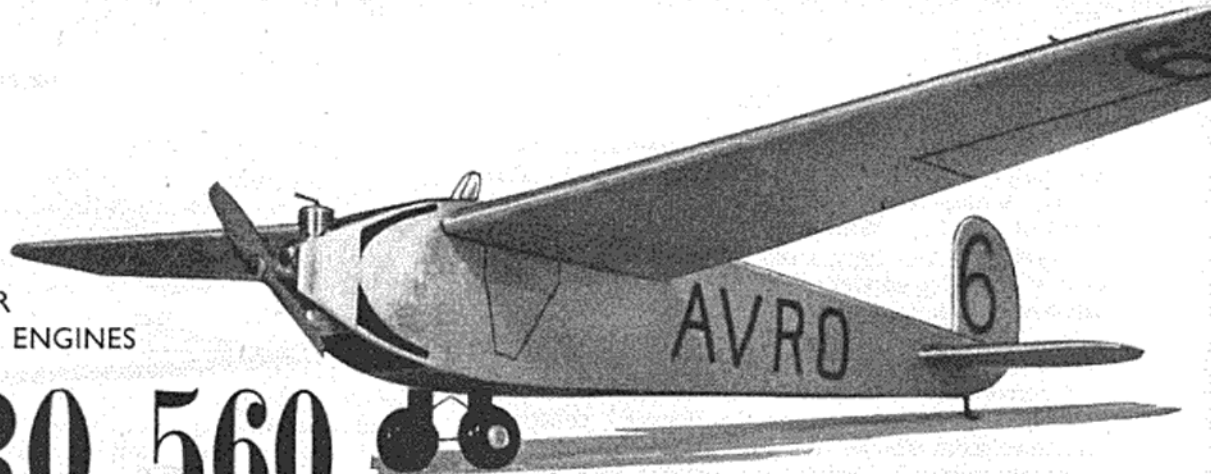
In conclusion, it is worth remembering that this engine is no heavier than the average 1.5 c.c. diesel, while its useful output is 40-50 per cent. higher than the best examples of the latter. It is interesting to contemplate the improvement in performance which could result installing (for unrestricted contests) a Cub .14 in a 1.5 c.c. class power-duration model.

Power/Weight Ratio (as tested) : 1.22 b.h.p./lb.
Power/Displacement Ratio (as tested) : 85.6 b.h.p./litre.

A FLYING
SCALE
MODEL FOR
POINT-FIVE ENGINES

AVRO 560

LIGHT AEROPLANE... by P. M. H. Lewis



THE Avro 560 was produced in the early 1920s to compete in the Lympne light aircraft trials and was flown by the late S./Ldr. Bert Hinkler, who was one of the most prominent pilots of the time. The span of the machine was 36 ft. and the engine fitted was the 698 c.c. Blackburn Vee-Twin. The span of the model is 3 ft. 6 in., and any of the .5 c.c. engines available may be fitted.

Fuselage

Select hard $\frac{1}{8}$ in. sq. balsa for the longerons and build two side frames on the plan in the usual way. Fill in the last bay at the tail with $\frac{1}{8}$ in. sheet, at the same time cutting the opening for the tailplane. When dry, remove the side frames from the board, separate carefully and, after joining at the tail, cement in the cross pieces. Cut the undercarriage former from $\frac{1}{16}$ in. ply and sew and glue to it the 18 s.w.g. wire undercarriage frame. Fix the former in place in the fuselage and reinforce where shown with $\frac{1}{8}$ in. sheet gussets. Fill in the fuselage at the wing root with $\frac{1}{8}$ in. sheet and make and fit the box to take the wing fixing tongues. It is advisable to cover the wing box with silk doped on to add strength. The rolled paper tubes for the wing bands are also cemented in place. The tailskid is shaped and bound in position. The paper tube holding the rudder bamboo fitting is glued in two halves above and below the tailplane mount as shown on the plan. Fit the four $\frac{3}{32}$ in. sq. stringers to the centre of the sides and the top and bottom of the fuselage and then cover the entire fuselage, from the leading edge of the wing to the sternpost, with $\frac{1}{32}$ in. sheet to form an octagonal section. The cockpit edging is cemented to the top deck. The hardwood engine bearers are screwed and glued to the $\frac{1}{16}$ in. ply former to suit the .5 c.c. engine to be used. Solder the axle to the undercarriage together with the cross bracing wire and the metal sheet fairings.

Wing

The wing is made in two halves and secured with a tongue and box fitting. The leading and trailing edges are pinned down to the plan with the two $\frac{1}{8}$ in. sq. hard lower spars. Cut the ribs from $\frac{1}{16}$ in. sheet and cement in place. When dry, add the upper spars and the $\frac{1}{8}$ in. sheet wingtips. Insert the $\frac{1}{16}$ in. sheet ply wing tongues in the slots cut in ribs W1 and W2, sandwiched above and below with $\frac{1}{16}$ in. sheet

balsa for a tight fit in the fuselage box. Sew and cement the rubber retaining hooks of 20 s.w.g. wire to the leading and trailing edges and cover the top and bottom of the wing roots with soft $\frac{1}{16}$ in. sheet.

Tail

Make the tailplane directly as shown on the plan. The $\frac{1}{8}$ in. square leading edge is pinned down and the rest of the outline cut from $\frac{3}{32}$ in. sheet with the grain running in the direction indicated. The $\frac{1}{16}$ in. sheet ribs are added after fitting the $\frac{1}{8}$ in. sq. spar and the centre section of the tailplane is covered above and below with $\frac{1}{32}$ in. sheet for strength. $\frac{3}{32}$ in. \times $\frac{1}{16}$ in. corner braces and $\frac{1}{16}$ in. sheet gussets complete the structure. The rudder is made in the same manner as the tailplane and is held in place by the bamboo peg fitting into the paper tube at the rear of the fuselage. The rudder is adjusted by selecting the position required in the ply insert on the top of the fuselage. A pin bound and glued to the leading edge of the rudder engages in the holes in the ply insert.

Covering

The fuselage and flying surfaces are covered with medium weight tissue, water sprayed and given two coats of clear dope and two of silver dope. The celluloid wheels are fitted to the axle and retained by two soldered washers. The semi-circular metal nose panels and the cowl panels in front of them are cut from silver foil and glued in place as shown on the plan. The top decking of the fuselage to the trailing edge of the wing and the underneath of the fuselage to the undercarriage are painted black as are the sides of the bay above and below the above-mentioned semi-circular nose panels. The windshield is cut from celluloid and cemented in its slot in front of the cockpit. Aileron and elevator hinge lines are drawn in with Indian ink. The name "AVRO" on the fuselage sides and the numeral 6 on each side of the rudder and above and below each wing tip are painted on in black.

Flying

Test glide over long grass and adjust by altering the tailplane incidence and by adding weight to the nose until a satisfactory glide is obtained. Power flights may now be made with the normal adjustments to sidethrust and the rudder until the desired flight pattern is reached.

Your First Controliner



THE wide acceptance of the C/L model by younger aeromodelers has contributed largely to its popularity during the last few years. It is undoubtedly true that most budding power modellers begin by building a C/L model, rather than by constructing a F/F power type.

For the aeromodelist building a power model for the first time, the C/L model does have a number of advantages when compared with F/F types. It is generally simpler to construct and, when built, is more robust than a F/F model and thus better fitted to withstand inexperienced handling.

It is not necessarily more "crashproof," since its speed is considerably greater than that of the F/F power model but, usually, it is quicker and easier to repair and will remain airworthy longer since its flying qualities are less likely to be impaired.

Another advantage of the C/L model is that it needs only a relatively small space for flying—unlike the F/F model, which can really only be enjoyed to the full when flown on a large open space, such as a full size aerodrome.

Although a certain amount of skill is needed to successfully fly a C/L model, this is, with patience, quite easily acquired, while the success of the model itself is much less dependent on constructional perfection than is the F/F type.

This is not to say that there is any room for carelessness, or shoddy workmanship, in the C/L model—it is in our own interests to always strive to make the best possible job of any model we undertake—but slight errors which may creep into the construction are sometimes admissible in a general purpose C/L model, whereas they might have disastrous results if allowed to remain on a F/F machine.

This, of course, is due to the fact that the flight of a C/L model is, to a large extent, stabilised by outside forces, such as the centrifugal force acting upon it due to its tethered circular flight path, and the

longitudinal control afforded by the movable elevators.

The F/F model, on the other hand, maintains stable flight by means of a relatively complicated pattern of trim adjustments to delicately balance one force against another and any slight disturbance of any of these forces may seriously threaten the safety of the model, since, once in the air, it is no longer within the power of the modeller to control the model.

Following on last month's article, in which we described the starting and general handling of a small diesel, we are, therefore, dealing this month with a simple control-liner for our first power model.

The model we have chosen is the *Jasco Trojan*. This model is exceptionally easy to build and even if you are new to this series of articles and have not followed the earlier section dealing with glider construction, or have never previously constructed a model aeroplane, the *Trojan* can still be recommended to you.

This model is stated to be suitable for all engines of between .5 c.c. and 1.5 c.c. However, in view of the power of modern 1.5 c.c. engines, we would hesitate to recommend the fitting of any such engine before some practice in flying has been obtained, since such a power unit is bound to make the *Trojan* rather fast, and high speeds, naturally, allow the beginner only a small margin for mistakes.

One of the .5 c.c. engines currently available could be used, but, in general, these are a little more critical to starting and handling technique than the .75-1.3 c.c. engines mentioned last month, and we are therefore featuring the Mills 75 motor for the purpose of this article.

The *Trojan* has a wingspan of 18 in. and is of solid all-balsa construction. The kit contains all necessary parts, including screws, nuts and washers, but excluding the fuel tank. At 10s. 6d., it would appear to be rather more expensive than one might expect,



but it must be remembered that this is a "pre-fabricated" type kit, in which certain parts are supplied in a semi-finished state and this, naturally, results in increased cost over the normal type of kit that contains only bare materials.

The model is of the "profile" fuselage type. That is to say, the fuselage is not built up, but is simply cut from thick sheet balsa wood to a side view outline shape, the engine being side-mounted. The wing and tail surfaces are likewise of sheet balsa so that, combined with the fact that the basic parts are ready cut to shape, the model can be built up very quickly and easily.

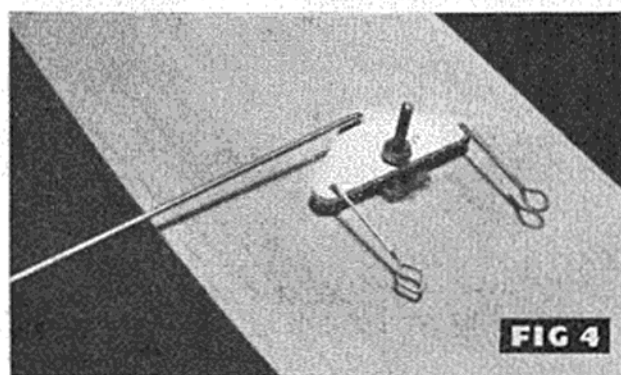
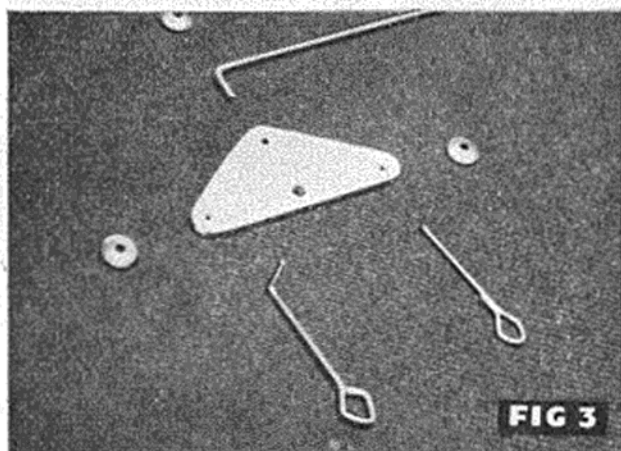
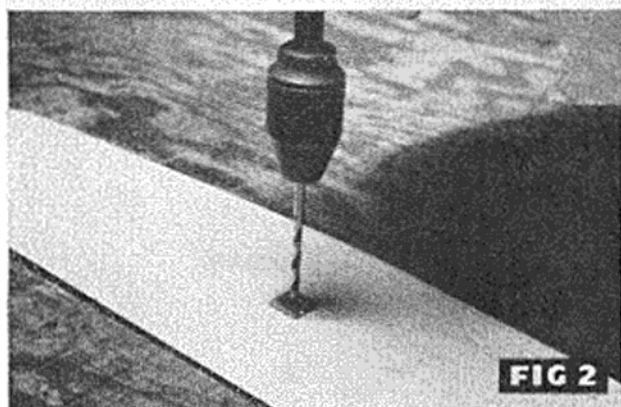
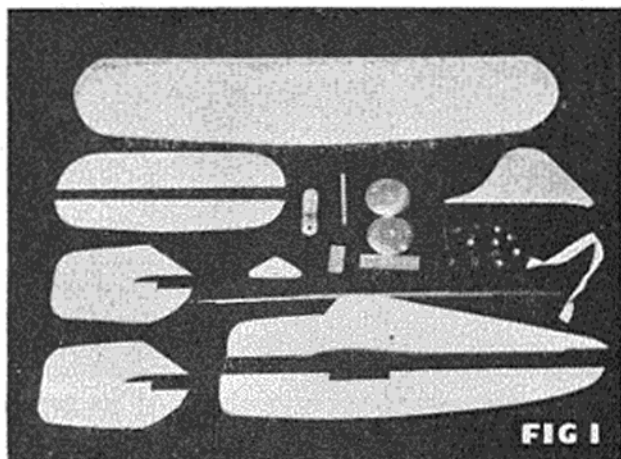
Construction is started with the wing. This is already cut to the appropriate planform, but needs to be shaped to the required section. This can easily be accomplished with coarse and fine sandpaper blocks. Lay the wing on a flat surface and carefully taper down the trailing edge, taking off the bulk of the material with the rough sandpaper block. Do not attempt to reduce the trailing-edge thickness below about $\frac{1}{16}$ in. Shape up the leading-edge in the same manner and taper down the tips also. Work only on the top surface of the wing: the undersurface is left quite flat.

Now smooth off with fine paper until the wing section resembles that given on the plan. If you are not sure of your "eye" for this, use a cardboard template.

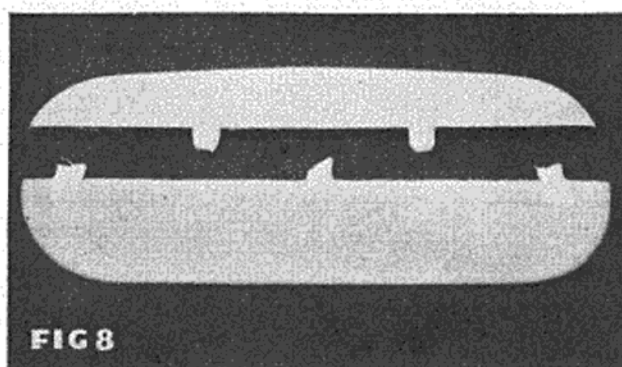
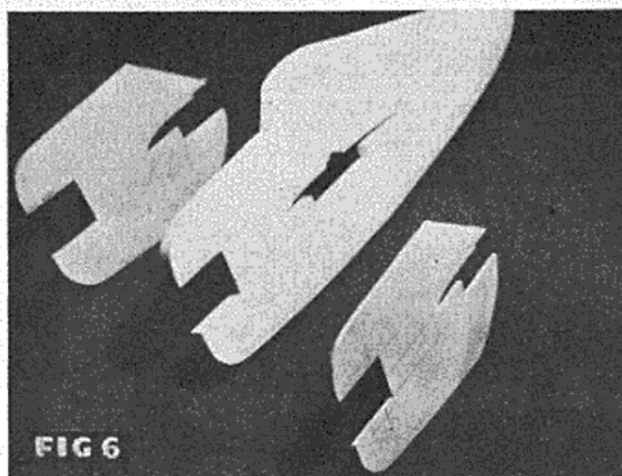
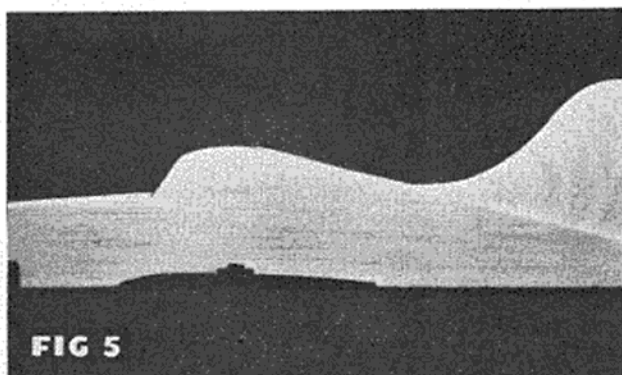
Next, find the centre of the wingspan and draw a line across the chord, top and bottom, at right angles to the leading edge. Mark off, on this, the bellcrank pivot point. Take the short piece of thin plywood supplied in the kit, cut in half to give two pieces approximately $\frac{1}{2}$ in. sq. and mark the centre of each. These pieces of ply are used to reinforce the bellcrank pivot fitting. Pre-cement both pieces and the area around the pivot marked on the wing, top and bottom. When dry, cement the ply squares in position, driving a pin through the pivot location to hold them firmly. Allow plenty of time to dry, then remove pin and drill through with a 6 B.A. clearance drill. (Fig. 2.)

Assemble the bellcrank parts, bending the pushrod and lead-out wires and soldering cup washers in position to retain them to the bellcrank. It is, however, recommended that about $1\frac{1}{2}$ in. of 20 s.w.g. wire is retained for the elevator horn, rather than the 1 in. specified on the plans. It will not matter if the lead-out wires are a little shorter in consequence. (Fig. 3.)

Fit the 6 B.A. screw through the wing from the top, clamp up firmly and apply cement liberally around the nut. Fit the bellcrank and second nut, leaving sufficient clearance for free movement of the bellcrank. It is a good idea to apply some cement to the



1. The Trojan kit contains many semi-finished parts.
2. Drilling the centre-section for the bellcrank pivot screw.
3. Parts of the bellcrank ready for assembly and soldering.
4. The complete bellcrank assembly fitted to the wing.



threads when fitting the second nut. This will prevent it from loosening and possibly causing the bellcrank to bind. (Fig. 4.)

Add the plywood line-guide to the left wing-tip, first drilling two $\frac{1}{16}$ in. diameter holes $1\frac{1}{2}$ in. apart. Make sure that this line guide is positioned so that the control-lines, when fitted, will lie parallel with the leading-edge of the wing or raked slightly backward. If the lines are raked forward, there will be a tendency to steer the model towards the centre of the circle, with consequent loss of control.

Carefully slot the top of the fuselage about $\frac{1}{8}$ in. and insert the plywood fin, cementing firmly. Now shape the upper fuselage section to accommodate the wing centre-section, including the top ply reinforcement and screw head. (Fig. 5.)

Temporarily tack the top and bottom together and cut out the slot in the nose for the engine crankcase. For the Mills 75 engine, this will need to be approximately $\frac{3}{8}$ in. wide and 1 in. long. Cut the two plywood nose reinforcement pieces in the same manner. (Fig. 6.)

Pre-cementing all joints, the two halves of the fuselage may now be joined together with the wing between them (Fig. 7) and the ply nose pieces added. Insert pins diagonally to hold the upper and lower fuselage sections together and clamp the nose section firmly while drying.

Smooth the tailplane and elevator with fine glass-paper but do not attempt to thin down the elevator trailing edge too much. Simply rounding off the blunt edges is sufficient. Tape is supplied in the kit for hinges, but we are inclined to recommend the substitution of a thinner and more flexible material as it is essential, especially in a model of this size, to have the controls as free as possible. If available, silk is to be preferred. (Fig. 8.) Also, it is worth while adding an extra hinge at each tip. Bend the elevator horn to shape and secure with tape and plenty of cement.

Insert the tailplane in the slot in the tail of the fuselage after pre-cementing. Bend the end of the pushrod at right-angles, so that it is of the correct length to neutralise the elevator when the bellcrank is centralised, cut off surplus wire, insert through elevator horn and solder cup washer in position.

Drill the fuselage for the undercarriage dowels and insert them with cement. Bend the undercarriage carefully, using, if possible, a bench vice so that the various angles may be judged properly. Secure the wheels with cup washers soldered on. (Fig. 10.)

The recommended fuel tank is a metal, team-racer type of 15 c.c. capacity. An aluminium strap and two woodscrews are supplied for securing the tank

5. Shape the fuselage to accommodate the wing centre-section, and add the ply fin.

6. The fuselage and ply side pieces are cut to fit the engine crankcase.

7. The wing centre is sandwiched between upper and lower halves of the fuselage.

8. The tailplane and elevator are connected with fabric hinges.

to the fuselage. The tank should be so arranged that the delivery pipe is towards the *outside* of the circle (i.e., to the starboard, or right-hand side of the model when looking forward). However, do not fit the tank until after the model has been doped and finished.

Now go over the entire model with fine glasspaper and sand down smooth. The edges of the fuselage may first be rounded off with a coarser grade paper. Next give the model a couple of coats of clear dope, rubbing down lightly between each.

If preferred, the model may be covered with lightweight "Modelspan" tissue, which will avoid the necessity of grain-filling as well as making the model somewhat stronger and more serviceable.

If the finish is to be brushed directly on to the wood, we would recommend, first, an application of grain filler or "sanding sealer." A home-made filler can be mixed by adding french chalk or talcum powder to clear dope, as described earlier in this series.

For colouring your *Trojan* it is recommended that a bright colour be used, since this will stand out more clearly against a dark background, such as trees, etc. Yellow, red or silver are favoured.

A cellulose colour dope should, of course, be employed, and it will generally be necessary to dilute the dope somewhat with cellulose thinners. Use a soft brush. By this means—thin dope and a soft brush—you will be sure of getting an even finish, free from ugly brush marks.

When building any C/L model, there are one or two points which are worth bearing in mind.

Firstly, one of the most essential aids to the success of a control-liner is a freely working control system. Therefore make sure that the bellcrank (sometimes called "control-plate" incidentally) and linkage, is really free. A tight, or stuck, control linkage is often the cause of an unnecessary crash simply because if, as when the model is climbing overhead, the line tensions lessens, the controls are too stiff to respond to the reduced line tension.

Secondly, make sure that the undercarriage wheels do not cause the model to swing inward on take-off due to the axles being out of alignment.

Thirdly, make sure that the bell crank is really securely fixed and that the component on which it is mounted is equally well secured to the model. There is quite a considerable pull exerted on these parts during flight.

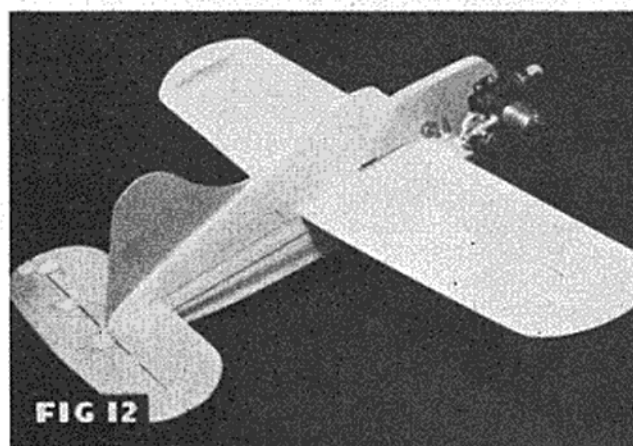
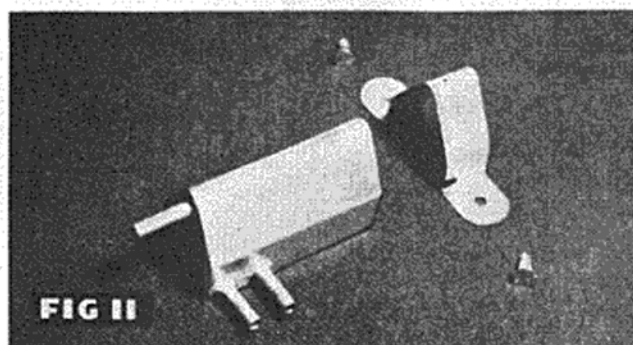
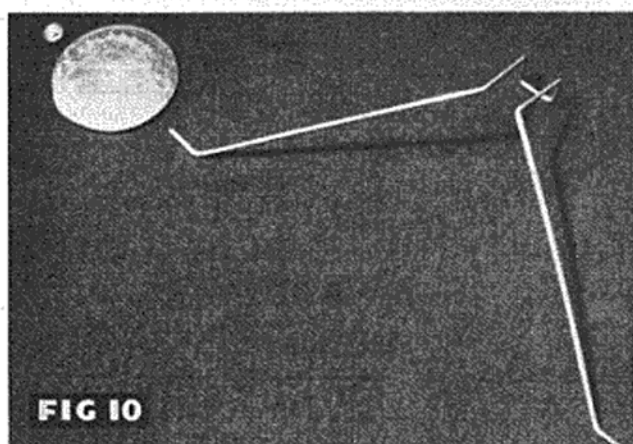
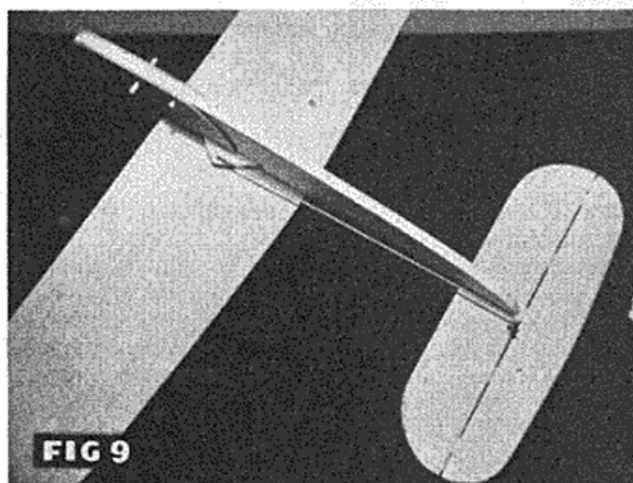
Also worth bearing in mind is the fact that should any part of the control system come adrift in flight, all control will be lost and a crash will be almost certain to follow. Therefore, make sure that all your soldered joints are made with a clean, hot iron and, preferably, with an effective flux such as "Baker's Fluid."

9. Showing the complete control assembly after adding the tailplane and elevator.

10. Undercarriage wire is bent to shape as shown and wheels retained by cup washers soldered to the axles.

11. 15 c.c. "team-racer" tank showing metal strap shaped to fit.

12. The assembled *Trojan*, with Mills 75 engine in position, and ready for painting.



[illegible]

The first of a new series of features on unusual or experimental models

THE very real interest in the delta wing layout displayed by full size aircraft designers of recent years prompted the idea of investigating deltas from the model standpoint. A lot of nonsensical claims have been made as to the advantages of the delta wing layout which have tended to obscure the *real* advantages and the model designer contemplating

▶ **BY RON WARRING**

a delta wing model has, so far, had very little to guide him, other than the fact that full size "deltas" do fly remarkably well.

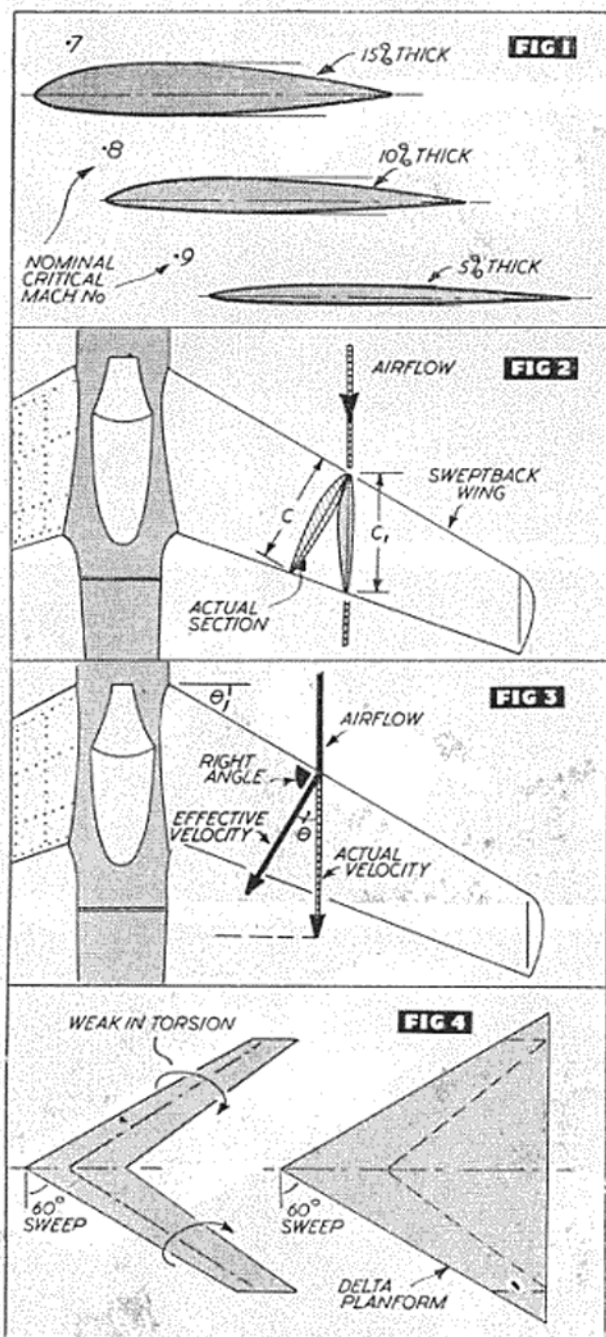
Accordingly a series of test models employing different degrees of sweepback were built and flown, as simple gliders, to try to get some useful data on the behaviour of different planforms and establish useful design information for modellers. The original idea was to conduct these tests with simple "flat plate" models and produce a Jetex powered model of "optimum" proportions. The next proposed step was a rubber powered model, which was actually to be a two-thirds (geometric) scale Wakefield to investigate the torque effects of a large propeller diameter and sound the possibility of this design for contest work, using multi-gearred motors. For reasons which will be clear later, however, this project was abandoned.

Before dealing with the model tests, it would be as well to explain the main reason for adopting a delta wing layout in full size design. As an aircraft approaches sonic speed the airflow over the wings tends to reach a critical condition, producing severe buffeting which may either make the machine uncontrollable or even lead to structural failure. Speeds of such high values are expressed in terms of a decimal fraction of the speed of sound and called the Mach number. Thus a Mach number of .8 represents $.8 \times$ the speed of sound, and so on. For a given wing section there is usually a limiting Mach number, representing the practical "top speed" for that wing.

In very general terms, the critical Mach number can be increased, i.e., the top speed pushed up, by reducing the thickness of the section. Varying the profile of the section also has similar effects, but we need not complicate the problem by taking this into account. All we need to appreciate is that the thinner the section (i.e., the smaller the thickness : chord ratio), the higher the critical Mach number (Fig. 1.)

Now there is a limit to how thin a wing can be made and still be strong enough. Again we can ignore the fact that thin wings may become practical, machined and ground from solid steel, or with the bending loads relieved by slinging dead weights along the wing (e.g., jet engines in nacelles). With orthodox construction it is difficult to make a wing with a root chord much thinner than about 8 to 9 per cent. and still have it strong enough.

However, if such a wing is sweptback in planform, the net effect is a virtual reduction in the thickness : chord ratio (Fig. 2). The section presented to the airflow has the same actual thickness but a longer apparent chord, so the thickness : chord ratio is less.



The greater the angle of sweepback the more pronounced the effect.

There is another theoretical method of assessing the value of sweepback at high Mach numbers. This assumes that the critical airflow velocity is perpendicular to the leading edge. The actual airflow is not "bent," of course, but it is this component velocity perpendicular to the leading edge which is the important criterion. It now follows that the critical airflow speed over the wing is the actual airspeed multiplied by the cosine of the angle of sweepback (Fig. 3).

Since the cosine of a real angle is always less than 1, this means that, by using sweepback, we can push the actual speed of the aircraft up without the wing reaching its critical Mach number. For example, with a sweepback of, say, 30 degrees, and a limiting Mach number for the wing section of .8, the actual flying speed of the aircraft can reach Mach .8 + $\cos. 30 \text{ deg.} = .925$ before the wing reaches its critical Mach number of .8.

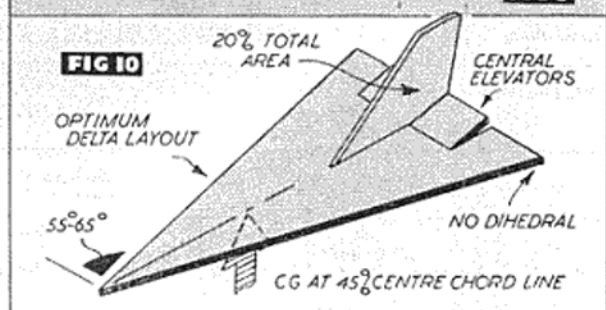
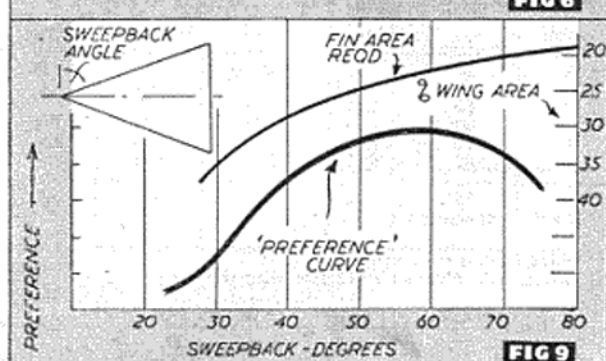
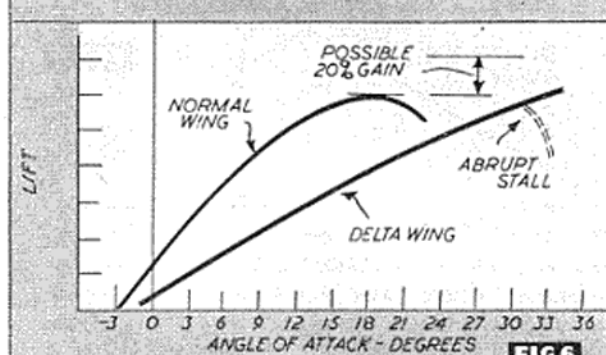
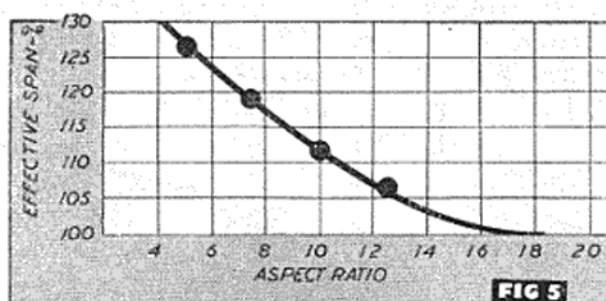
The greater the angle of sweepback, the greater the difference that can be realised between the actual flying speed of the aircraft and the critical Mach number possible with that particular wing section. The main trouble is that, with increasing angles of sweepback, it becomes more and more difficult to produce a wing design which will not twist or distort. Hence the logical solution to join the tips of the severely swept wings to make a much more rigid structure—and produce the delta wing layout. (Fig. 4.)

That, in simple terms, is the main reason why the delta layout has been developed for full size aircraft. It is essentially a practical solution to wing strength and, of course, also enables the designer to start thinning down the wing section again on account of the rigidity and strength of a basic "triangle."

Now the aerodynamics of a delta wing differs from what orthodox theory would predict. Normally, introducing sweepback in a wing results in a loss of maximum lift of about 5 per cent. for every 10 deg. of sweepback and an increase in induced drag due to the lowering of the aspect ratio (since a swept wing of comparable area and chord must always "lose" span). Below an aspect ratio of about 1.5, however, standard theory no longer holds true. For one thing the effective span is greater than the actual geometric span, with values somewhat of the order shown in Fig. 5. Also, with a delta shape in particular, the stalling angle is considerably increased and, although the lift generated at moderate angles is much lower, the ultimate maximum lift may be higher—Fig. 6.

One other effect of sweepback needs to be taken into account before we discuss the results of our model tests. That is, sweepback is effective as a "dihedral angle" in the sense that a swept wing requires less dihedral for stability than a wing without sweepback. As a rough and ready rule, 10 deg. of (leading edge) sweepback is usually considered to be equivalent to 1 deg. of dihedral.

Now we come to our test models. These were all constructed from $\frac{1}{16}$ in. sheet balsa of reasonably



consistent density so that "structure weight" was appreciably constant throughout. The use of a "flat plate" aerofoil should, if anything, be flattering to stability, if not performance. A reasonable area was also chosen for the test models (33 sq. in.), and all models were made of the same area. Layouts are detailed in Fig. 7 and Table I. Note that a "control" model was built with orthodox wing and tailplane of the same total area again, balanced at 50 per cent. chord, to compare, directly, "delta" performance with orthodox performance in the same size range and with the same (flat plate) aerofoils.

The proportions of a delta wing are determined from simple formulas related to the leading criteria

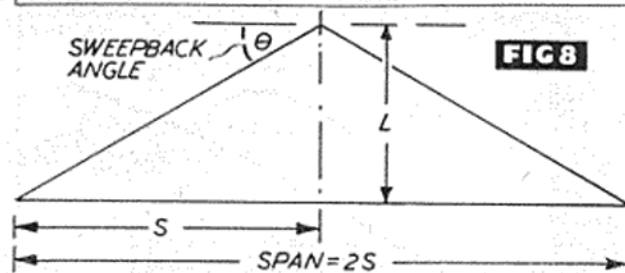
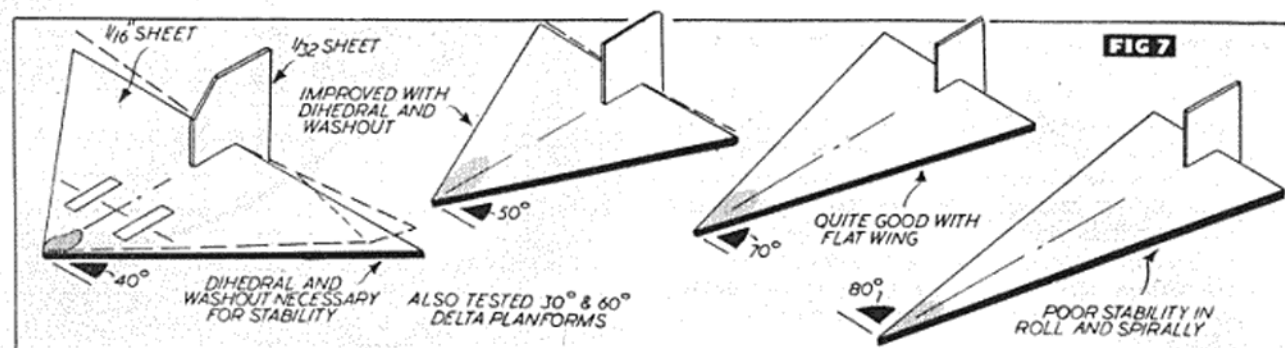


TABLE I. MODEL DATA. ALL MODELS' AREA = 33 sq. in.

Model	Sweepback Angle (θ)°	tan θ	S² = Area / tan θ	S (in.)	L (in.) = S tan θ
Control	—	—	—	12 (wing)†	1.5‡
A	30	.52	66.1	8.12	4.06
B	40	.70	47	6.86	4.8
C	50	1.19	27.5	5.25	6.3
D	60	1.73	18.8	4.34	7.5
E	70	2.75	12.0	3.46	9.5
F	80	5.67	5.9	2.42	13.75
Paper Dart*	75 (approx.)	—	—	—	10.0

*Folded from quarto paper.

†9 sq. in. tail. Moment arm 2.5 × wing chord.

TABLE IA. ASPECT RATIO OF TEST MODELS

	Control	A	B	C	D	E	F
Aspect ratio	6	9.85	8.3	6.36	5.25	4.2	2.94

$$\text{Aspect ratio} = \frac{45^2}{33} = .125^2$$

TABLE II. C.G. POSITION FOR OPTIMUM TRIM

Model	Sweep (°)	Unwarped Wing		With "Elevator" Effect	
		C.G. posn. (in.)	C.G. posn. % CL Chord	C.G. posn. (in.)	C.G. posn. % CL Chord
Control	—	1	50	—	—
A	30	—	—	—	—
B	40	—	—	2.5	52
C	50	3.5	56	3.15	50
D	60	4.2	56	3.4	45
E	70	5.3	56	—	—
F	80	8.4	61	—	—
Paper Dart	75	5	50	—	—

TABLE III. OPTIMUM FIN AREA

Fin Area	Control	A	B	C	D	E	F
sq. in. ...	2.5	—	11	98	8	6	6
% Wing ...	7.5*	—	33	27	24	21	18

*% Total area.

shown in Fig. 8. The appropriate formulas are:—

$$\text{Area} = SL$$

$$= S^2 \tan \theta$$

$$L = S \tan \theta = \sqrt{\frac{\text{Area}}{\tan \theta}}$$

$$\text{Span} = 2S = 2 \frac{L}{\tan \theta} = \frac{2 \times \text{Area}}{L}$$

The test range included models of the same total area with sweepback angles varying from 30 to 80 deg. by 10 deg. steps.

The first part of the experiment consisted of trimming the delta models for smooth, stable flight in "dead" air (i.e., indoors) by adding the necessary nose weight to balance. All wings were left perfectly flat. With the exception of the 30 deg. sweepback model, all the deltas had satisfactory stability with no dihedral angle.

The models were then retrimmed in "live" air—outdoor, calm air—and an attempt made in each case to produce a model with satisfactory stability, both by adding dihedral, where necessary, and adjusting the fin area (Table III) but still keeping the wings flat, i.e., unwarped. At this stage the 30 deg. delta was abandoned as impracticable to trim without resorting to severe washout on the trailing edge towards each tip. The 40 deg. delta required about 3 deg. of dihedral for satisfactory stability and the 50 deg. delta about 1½ deg. All the others were stable enough without dihedral. The "control" model, incidentally, needed a minimum of 6 deg. dihedral for what was considered satisfactory stability. By direct comparison, therefore, the theory of 10 deg. sweep = 1 deg. of dihedral seemed to hold pretty true. More reserve stability could, however, usefully have been employed, given in the case of the orthodox "control" model by increasing the dihedral to about 9 to 10 deg., for example.

Main point of interest at this stage was the extreme sensitivity of the flat (i.e., unwarped) deltas to longitudinal trim. A slight change in c.g. position was sufficient to change the flight pattern from a dive to a stall. The stall itself was also interesting. It was certainly vicious, as theory predicts. In the case of the deltas with no dihedral, a vicious stall often meant the model recovering in a dive past the vertical when the models pulled out in the inverted position and flew like this until the next stall. An unwarped delta wing with no dihedral and a flat plate aerofoil is, of

Maximum turns

This table shows the greatest number of turns-per-inch allowable with any particular motor.

Number of Strands	Uncorded Motors				Corded Motors			
	1/8 x 1/30	3/16 x 1/30	1/4 x 1/24	1/4 x 1/30	1/8 x 1/30	3/16 x 1/30	1/4 x 1/24	1/4 x 1/30
2	100	90	73	70	66	51	48	44
4	73	57	53	52	50	44	42	40
6	58	49	46	44	42	38	36	34
8	49	42	40	39	35	34	32	30
10	42	38	35	33	29	31	30	28
12	40	34	33	31	26	29	28	26
14	36	32	30	29	23	27	26	24
16	34	31	29	27	22	26	25	20
18	33	30	28	25	—	24	24	—
20	32	29	26	22	—	22	—	—
22	31	28	23	—	—	22	—	—
24	29	26	—	—	—	24	—	—

The above figures must be regarded as approximate since the "turns capacity" of a rubber motor depends on the age and condition of the rubber, and also the quality of the rubber. Commercial rubber strip is seldom of unvarying quality throughout even a single skein.

To compute approximate maximum turns for any motor, multiply the figure given by the above table by the length of the motor. The length is the "natural" length before breaking in the rubber. In the case of made up, broken in motors, the "natural" length is equal to 0.9 times the actual made up length.



Rubber Motors

The rubber motor has, rightly, been called the "heart of your model." Without a doubt the rubber motor, and the propeller, have more effect on the potential performance of a model than any other part of the design. A good motor and propeller can turn an indifferent design into a good one, but the best of "aerodynamic" designs will have a poor performance without a good rubber motor.

Rubber flying is no longer inexpensive. The price of rubber has risen considerably and the modern contest rubber model (almost invariably to Wakefield specification) may employ up to 6 oz. of rubber in a motor at a cost of several shillings. It is only logical, therefore, to treat rubber motors properly to get the best possible use out of them.

The days when modellers used two, or even three motors per contest—and then threw them away—are gone. One motor may have to last for several contests and some, indeed, go through a whole season. Maximum "life" can only be realised if the motor is properly lubricated and serviced and never wound beyond about 80 per cent. maximum turns. It is better to carry a little extra rubber weight so that you can get the required performance without using full turns than to have to wind the model right up "to the limit" each time.

Servicing a motor means, largely, keeping it clean and free from dirt and grit and stored away from sunlight or excessive heat. Adequate lubrication reduces the friction between strands during winding and unwinding. Any "dry spots" in the motor are prone to early failure due to chafing.

A good commercial lubricant made from soft soap is excellent. This should be of the type which should not dry out when a single application of lubricant will last for months. Excessive lubrication is not necessary. All that happens is that the bulk of the lubricant is thrown off the motor when it unwinds to collect inside the fuselage. Castor oil is another good lubricant, but not quite as good as soft soap.

Broken strands can be repaired by knotting together and binding the knots with wool. It is nearly impossible to tie a permanent knot in well lubricated rubber without some sort of binding around the knot. The fact that a strand does break is not necessarily an indication that the rubber is no good. Some otherwise excellent strip contains faults and cuts which lead to early breakage of individual strands. If these faults are found and repaired the motor may have an exceptionally long life.

Old motors or spare lengths of rubber can be made up into short "test" motors to determine breaking turns per inch. Practise winding, too, in order to find the technique best suited to avoid bunching and to get on "contest turns" with the minimum of discomfort to both winder and assistant.

FOLD ON THIS LINE

Making up

Average weight of grey rubber strip

WEIGHT IN OZS.

	Unlubricated						Lubricated					
	1/8 x 1/30	3/16 x 1/30	3/16 x 1/24	1/4 x 1/30	1/4 x 1/24	1/8 x 1/30	3/16 x 1/30	3/16 x 1/24	1/4 x 1/30	1/4 x 1/24		
Per in.0023	.0035	.0093	.0046	.0058	.0024	.0037	.0046	.0399	.0061		
Per ft.0278	.0918	.0520	.0556	.0695	.0292	0.440	.0596	.0584	.0730		
Per yard ...	1/12	1/8	5/32	1/6	5/24	1/10	5/32	1/6	1/5	1/4		
Per 10 yards	7/8	1 1/4	1 9/16	1 2/3	2	1	1 5/16	1 5/8	1 3/4	2 1/8		
Per 12 yards	1	1 1/2	1 7/8	2	2 1/2	1 1/16	1 5/8	2	2 1/8	2 5/8		
Per 24 yards	2	3	3 3/4	4	5	2 1/8	3 3/16	4	4 1/4	5 1/4		

in.	6902	4608	3672	3456	2772	6480	4320	3420	3240	2592
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lb. weight	576	384	306	288	231	540	360	285	270	216
Per yard	192	128	102	96	77	180	120	95	90	72

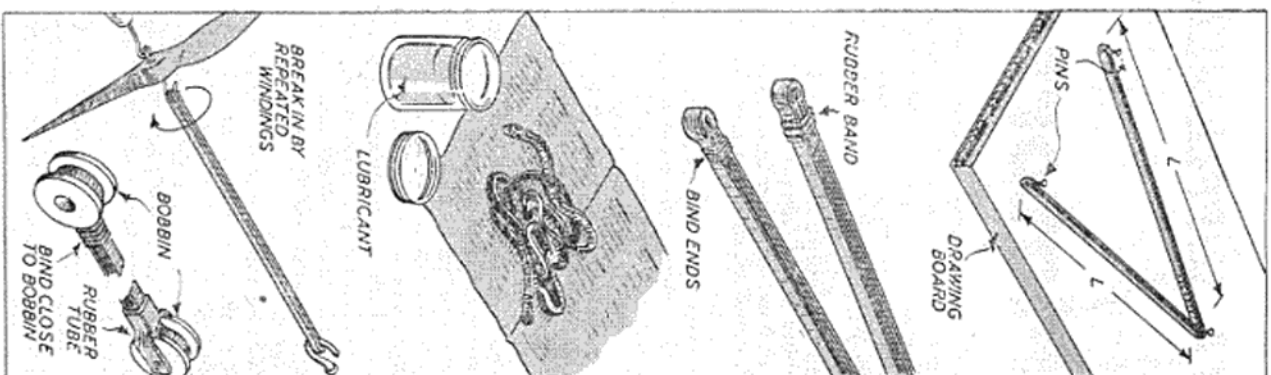
These tables are based on average samples of grey rubber strip. Variations in density may occur from batch to batch of any one manufacturer's product. It is not unknown for the density of a given sample to vary from end to end of a skein.

Rubber is sold both by length and by weight. The above table gives a guide as to the relationship between length and weight for average strip.

Rubber which has been lubricated weighs roughly 5 per cent. more than unlubricated strip. Lubricant in excess of this amount is not retained by the rubber but thrown off during winding and unwinding.

Selection of rubber

Good rubber strip has a fresh, springy feel. Rubber strip is generally covered with french chalk after manufacture which is readily shaken off or wiped off with a damp finger to examine a short length. It should be possible, with good rubber, to grasp a length of an inch or so between the thumb and forefinger of each hand and alternately pull hard to full extension and allow to go slack again, alternately, up to fifty times, as a minimum, before the test length breaks. Another good test is to see how far you can stretch a short, marked length. If the rubber stretches more than about seven or eight times its normal length, it is probably too "soft" to make a useful motor. Ragged, uneven edges to the strip; non-uniform thickness or width; poor, uneven "ribbing"; or visible defects in the strip are all possible causes of early failure. Good strip is uniform in texture and physical dimensions. Localised defects can, if necessary, be cut out and the two ends tied in making up the motor.



Rubber weight

the motor

Dunlop

WAKEFIELD MOTOR DATA
RUBBER (1/4 in. x 1/24 in.) WEIGHTS (Oz.)

	1 in.	10 in.	1 ft.	1 yard	12 yards
Unlubricated ...	0.0055	0.055	0.06	0.20	2.4
Lubricated ...	0.006	0.058	0.07	0.21	2.52

MOTOR LENGTHS FOR GIVEN WEIGHT OF UNLUBRICATED RUBBER (In.)

Weight of Rubber Used	No. of strands in motor							
	10	12	13	14	15	16	18	
3½ oz.	63	52½	48½	45	42	39½	35	
4 oz.	72	60	55½	51½	48	45	40	
4½ oz.	76½	64	59	55	51	48	42½	
4¾ oz.	81	67½	62½	58	54	50½	45	
5 oz.	90	75	69	64½	60	56	50	
5½ oz.	99	82½	76	71	66	62	55	

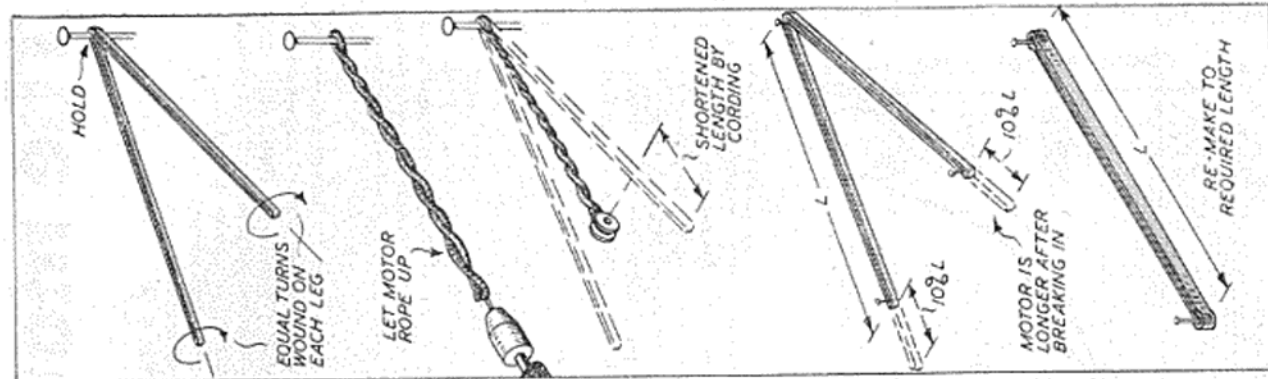
Pirelli

RUBBER (6 x .8 mm.) WEIGHTS (Oz.)

	1 in.	10 in.	1 ft.	1 yard	12 yards
Unlubricated ...	0.006	0.061	0.073	0.22	2.64
Lubricated ...	0.0064	0.064	0.077	0.23	2.77

MOTOR LENGTHS FOR GIVEN WEIGHT OF UNLUBRICATED RUBBER (In.)

Weight of Rubber Used	No. of Strands in Motor							
	10	12	13	14	15	16	18	
3½ oz.	57	48	44	41	38	36	32	
3¾ oz.	61½	51	47	44	41	38½	34	
4 oz.	65½	54½	50½	47	43½	41	36½	
4¼ oz.	69½	58	53½	50	46½	43½	38½	
4½ oz.	73½	61½	56½	52½	49	46	41	
5 oz.	82	68	63	58½	55	51½	45½	
5½ oz.	90	75	69	64	60	56	50	
6 oz.	98	81½	75½	70	65	61	54½	



The weight of rubber required for duration flying means that a single skein motor is invariably longer than the distance between motor hooks in the fuselage (except where a very long fuselage is used). To take up this slack when the motor is unwound, and thus ensure a consistent glide trim, motors are "tensioned." This can be done by mechanical means or, more conveniently by "roping" or "cording."

There are many ways of "roping" or pre-tensioning a motor, but only one method will be described. This is the system in almost universal use.

The lubricated, broken-in motor is laid out in two equal legs with one half the number of strands required in each leg. (The number of strands in the final number must, therefore, be an even number.) Holding the mid point of apex of the "V," wind about 40 to 70 turns on each "leg," in the same direction as the motor is usually wound. Bring the two ends together and, fitting them to a winder hook or propeller shaft, allow the two legs to unwind again when they will rope up or "cord," as shown. Bind the ends with rubber bands. It will be found that the motor has shortened its length considerably and will naturally assume this shortened length, without slack, after each unwinding.

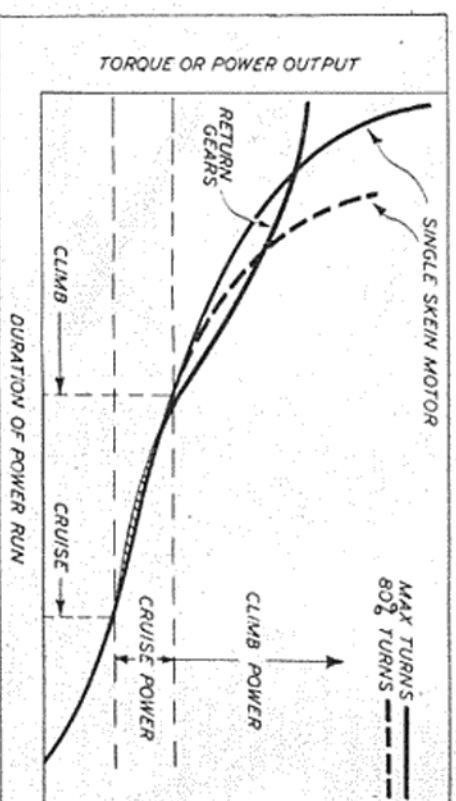
Motors arranged taut between hooks (as in long fuselage Wakefields and geared models) need re-making to length after breaking in, since rubber develops a permanent stretch of about 10 per cent. after breaking in. Re-measure and tie the ends in the same way as making up the motor initially. In making up new motors for such models, lay out the initial length a little more than 10 per cent. shorter than the final length.

The motor in use

The power given out by a wound rubber motor is continually varying, from a maximum when first released to a minimum as the last turn unwinds. A typical power output curve or torque curve, plotted against the time of the power run, is shown in the diagram. Tests have shown that a curve or propeller r.p.m. plotted against time takes a very similar form, so that since the thrust generated is directly related to the torque of the motor (or propeller r.p.m.) we have, in effect, three stages in the power output of a rubber motor.

For the first part of the power run, excess thrust is available to climb the model. Motor power, and thus thrust, soon falls to a more nearly constant level, when the excess power available is smaller and cruises, rather than climbs the model, although height may still continue to be gained. At the latter end of the power run the power falls below the minimum necessary to sustain level flight and so the model begins to lose height, even though the propeller may still be turning under the action of the rubber motor.

A properly selected motor gives useful power over nearly the whole of the power run. A good, high pitch propeller makes full use of the "cruise power," possibly at the expense of some loss of efficiency at the beginning of the power run. A low pitch propeller is generally more efficient at the beginning of the power run and less efficient in the region where cruise power is developed. The designer generally has to compromise between the two requirements.



Climb power and cruise power may both be increased, and "wasted" power at the end of the run decreased, by increasing the cross section of the motor. This, however, produced a very high initial torque which may be difficult to control. In other words, the model may be tricky to trim under full turns.

It is an interesting fact that, with a single skein motor, winding to less than full turns (say 80 per cent. maximum turns) still produces a similar high initial torque, as shown by the dotted curve, although the duration of power run will, of course, be less. Using less than maximum turns, then, is not necessarily a "cure" for a model which is difficult to trim under full power.

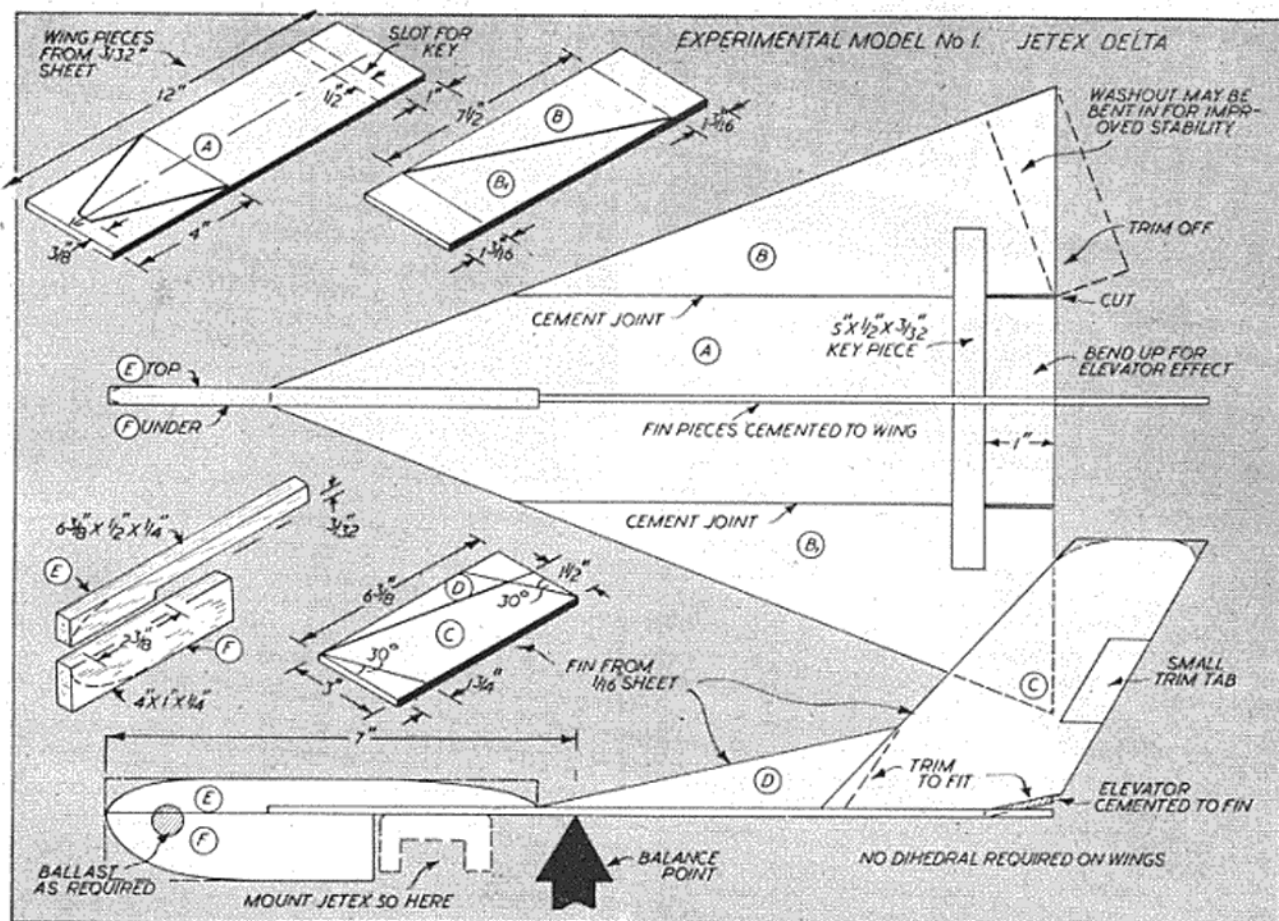
With the motor split into two parts, using a return gear system, the torque or power output curve is rather different. Initial torque is generally lower, and more sustained, for the same cross section of rubber. Geared motors, in other words, do not have that same initial burst of power associated with single skein motors. Winding a return-gear motor to less than maximum turns generally produces a correspondingly lower initial torque.

To prolong the life of a rubber motor it is generally advisable not to exceed about 80 per cent. maximum turns on winding. Good rubber can be wound to this figure a large number of times without deteriorating. If wound to near maximum turns each time, there is usually a permanent loss of power after some three or four windings and the motor begins to break up, strand by strand.

Corded motors should preferably be uncorded after use and the skeins unwound before storing away. If left corded the rubber becomes twisted or deformed, which may lead to strands breaking. Contrary to popular belief, motors may be corded the day before a contest and left in this state without harm. A preliminary wind up, putting on about half turns and allowing the motor to unwind, is good practice before attempting full winds on a motor which has been left corded.

After a day's flying, motors should be inspected for cut or partially broken strands, drawing the length of rubber through the fingers. Make any repairs necessary by knotting and bind the knots with wool to prevent slipping. Store motors in a glass jar in a cool, dark place. Never expose rubber to sunlight or extreme heat.

Good rubber strip can take far more abuse than most people imagine. It is not necessary to clean a motor by washing after use, for example, unless the motor has been dropped on to the ground and has picked up grit or dirt. However, the life of a motor is prolonged by taking sensible precautions, such as never over-winding, periodically checking for broken strands, relubricating as necessary and keeping free from dirt, etc. A lubricated motor is quite sticky and grit or hard particles touching it will adhere and be ground into the strip, cutting the strands, on the next winding.



course, the same inverted as upright—and the model had no means of differentiating between the two positions.

As regards c.g. position, theory tells us that this should be at the centre point of the mid-chord on a delta planform, this being the theoretical centre of pressure of a triangular planform aerofoil (and also the reason a folded paper dart requires no nose weight). The models, as checked, trimmed out with c.g. positions as summarised in Table II. Theoretically the c.p. position is independent of the actual planform for any delta shape. This would appear to hold true with the test models, except that the practical balance point worked out farther aft (57.5 per cent., average), possibly due to the relative inefficiency of the front part of the triangle as an aerofoil.

None of the models was particularly attractive as a project for "safe" flying. Compared with the "control" model they flew very much faster and appeared very lacking in spiral stability. The reserve of longitudinal stability, also, was certainly not as high as could be desired. It was most difficult to trim the models to fly nose-up and thus operate at a higher lift coefficient for low speed flight, still leaving the wings unwarped.

The next step was to take the 40, 50 and 60 deg. deltas and warp the tips up to give an elevator effect. The result, in each case, was most beneficial. The c.g., of course, had to be moved forward to com-

pensate (Table II), but the models could now be trimmed to fly at higher angles of attack, slower (but still faster than the control model) and more safely. The 70 and 80 deg. deltas proved just a little critical on actual washout values to take full advantage of this method of trimming.

The conclusions reached by these tests, to summarise the various data established, are that the delta wing layout is apparently not at all suited to model work. By that is meant that the delta planform offers no particular advantage over orthodox layouts and introduces a lot of disadvantages from the stability and trim angle. It certainly does not appear to be a layout worth considering from the duration point of view. Despite a higher stalling angle it seems most difficult to get a higher lift coefficient from a model delta, with the result that a model delta of the same total area as an orthodox machine must, inherently, fly faster, probably requiring more power and certainly having a higher sinking speed. To get a comparable sinking speed you would almost certainly need a proportionately larger delta area (by as much as 50 per cent., possibly) and then almost certainly more power to fly it.

The 30 deg. delta was little different from an ordinary "tailless" model, with its attendant stability troubles. The 40 deg. delta was not much better, and certainly requires a considerable degree of washout on the trailing edge to stabilise it. The

(Continued on page 184)

OVER THE COUNTER

Co-partners of the original Atwood Manufacturing Company of America have recently gone their separate ways. Bill Atwood, 20 years a manufacturer in the model aircraft trade, is now operating Atwood Motors. His former partner Bob Holland has taken over manufacturing rights of the original Wasp and is continuing production of that model under the name Holland Engineering Company.

Atwood Motors are also producing an (apparently) identical model (the Atwood .049), together with limited numbers of Triumph 49's and 51's.

Atwood Motors, incidentally, are the first of the American firms to import post-war Japanese motors on any scale. The model they are currently running is the OS "29."

* * *

The model on our front cover this month, which is being launched by Roger Clarke, was built by the well-known West Essex R/C exponent Sid Allen. It is powered by an E.D. 2.46 and uses Venner accumulators for the low tension power supply for the radio. Sid Allen makes the interesting point that in spite of the initial outlay on accumulators he saves enormously in the course of a year, for to keep his model in the same state of reliability would cost a fortune in batteries. He also regards the use of Venner accumulators as a form of insurance because, as his models are worth about £20 each in flying trim, to have a really reliable low tension source, considerably minimises the risk of having a fly away.

That the accumulators are extremely successful for supplying power over a long period, is supported by the fact two New Zealanders, Frank Bethwaite and Les Wright, have recently broken a world record for a duration flight by keeping an R/C model airborne and under control for 1 hour 9.4 sec. The low tension battery used for this flight was a 5 amp. Venner ultra-lightweight silver-zinc accumulator.

* * *

Wolf Electric Tools Ltd. announce that Wolf Solderguns and soldering irons will in future be fitted with a patent wire stripper for stripping plastic covered wires. The stripper is conveniently fitted to the barrel of the tool in a position for correct working temperature.

It can be used on all sizes of plastic insulated wires—single or stranded—without damage to the internal wire or stranded conductors. This innovation will be of great assistance to the operator as the stripping can be done with ease and simplicity.

The attachment is not suitable for stripping rubber insulation.



J. E. COOKE

396, WATERLOO ROAD, HANLEY,
STOKE-ON-TRENT, STAFFS.

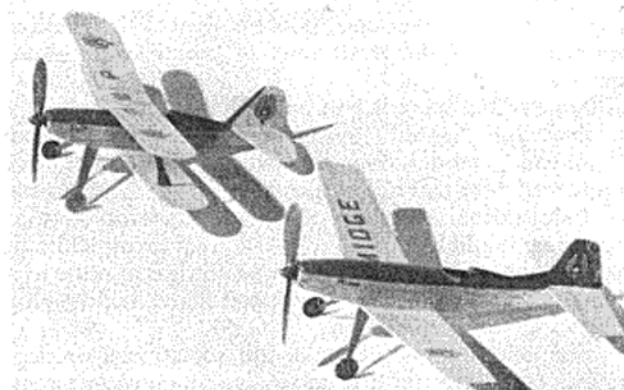
During the summer of 1950, Mr. Cooke took over an existing concern, and in the last three years has built up a considerable business in the model and allied trades. His shop carries a large and comprehensive stock of model aircraft supplies.

Mr. Cooke is a keen member of the Five Towns Model Flying Club, and he is particularly interested in the control-line section.

A semi-scale de Havilland *Comet* all-plastic model is being produced by Cascelloid Ltd. for "kite" flying, utilising rotating wings. This intriguing method of obtaining lift has attracted quite a bit of attention. Certainly these "Revojet" models, as they are called, do perform, although they are essentially tethered "kites" and not free-flying models. The aerofoil section on the new model has been modified for greater efficiency.

* * *

Shades of the electric r.t.p. model—Messrs. Childs and Smith are now manufacturing a r.t.p. helicopter with three-speed bushbutton and joystick control. The model is mounted on the end of a rigid arm, counterbalanced, and pivoted to a small pylon. The arm is driven by a small electric motor, whilst remote controls govern the speed of rotation and inclination of the arm (i.e., height of the model).



The Frog "Pup" and "Midge"; two of the junior semi-scale kits reviewed on the facing page.

OVER THE COUNTER ——— KIT REVIEW

The Frog Vandiver II and the Junior Series

When C/L flying was still in its infancy in this country a semi-scale commercial model appeared which, with a low powered engine, astounded many of the experts of the time by proving to be fully aerobatic and, at the same time, a machine almost completely free from vices. That model was the *Vandiver* which, even on a Frog "100," would perform consecutive loops, eights and so on with the best of them. Yet it was essentially a docile machine. It would, for example, "fly itself" inverted and was rugged enough to take a lot of punishment in inexperienced hands and still come up for more.

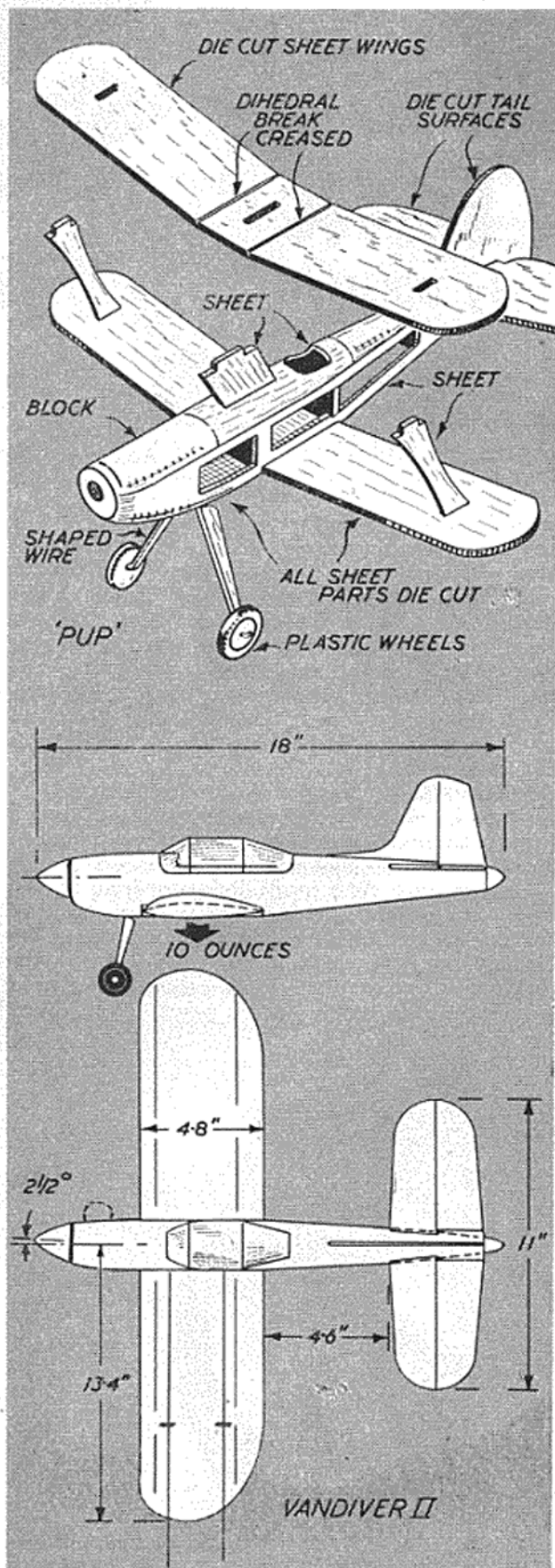
Its modern successor is the *Vandiver II*—a completely new design retaining all the good features of its forerunner but with faster response and more "modern" design ideas. It is a model which still has to be built—not slapped together in a hurry. But the Frog kit is wonderfully complete, crammed full of pre-shaped and pre-formed parts, including a stunt tank, plastic spinner, complete "hardware," etc. Few kits in a similar price bracket begin to complete in this respect.

The *Vandiver II* is fully aerobatic on a Frog "150" engine and one of its main attractions should be its semi-scale appearance (with fixed instead of drop-out undercarriage this time). It could be a contest model, although its main appeal will undoubtedly be to the sports flier.

The other new Frog kits we had to examine were a selection from the Frog Junior series of semi-scale rubber powered designs. Prefabrication is very complete in these low price kits. All sheet parts are die cut, undercarriage wire bent to shape and the propeller assembly in plastic complete. Essentially all that you have to do is to stick the bits together and carve and sand the cowling blocks to shape. On some of the models a limited amount of tissue covering is necessary.

The one fact that impressed, apart from having all the "cutting out" work done, was that these models are extremely well designed. They are not, in fact, quite as simple models as may at first appear, which may be a possible failing if these kits are turned over to youngsters to tackle unaided. But we could not help appreciating the fact that the "easy way" of making rounded fairings employed in so many low priced kits by cutting from stiff paper was ignored and curved sheet and shaped block took its place. These are, in fact, designs which will satisfy even the most critical of modellers.

We built and flight tested two—the *Pup* and *Midge*. Both flew straight off without resort to any trimming and showed no particular vices to trap the unwary. Performance is not outstanding, of course, but these are not duration machines. But we found that we could manage 15 to 20 sec. flights with comparative ease.



Model Talk

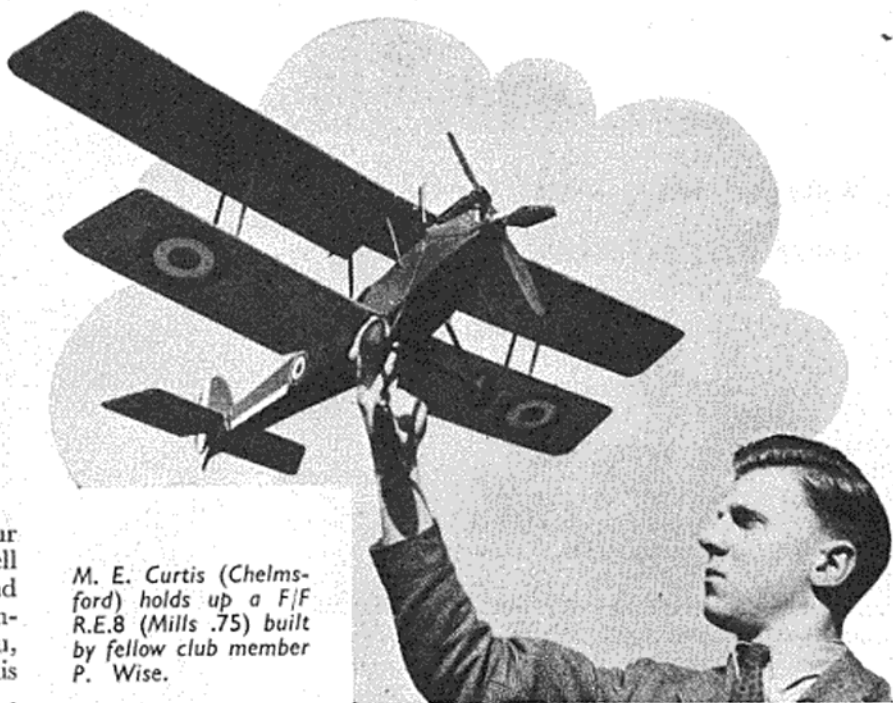
By Bill Dean

● ONCE AGAIN we stretch out our dope stained fingers for the well worn "Model Talk" folder and sort through readers' letters, random jottings and what have you, for some news to lead off this month's notes. Let's see . . .

here's a lengthy screed from Monty Tyrrell, one of the big names in Australian C/L circles. Monty was National Senior Stunt Champ in '51 and '52—and also does well for himself in speed and team racing events. He sent over a copy of the new "Acromodeller's Rules Handbook," which he compiled jointly with Alan King (three times member of Aussie Wakefield teams) and Robert Rose (secretary of the Victoria M.A.A.).

Monty tells us that the Australian contest rules position has been far from satisfactory for several years now, since each State had its own ideas on the subject and no hard and fast rules existed for the whole country. As a result, delegates from all the States got together at the 1951-52 Nationals and drafted contest rules to cover the period up to January, 1954, at which time they will come up for revision. The result is this recently published handbook of 24 tightly packed pages, which covers

M. E. Curtis (Chelmsford) holds up a F/F R.E.8 (Mills .75) built by fellow club member P. Wise.



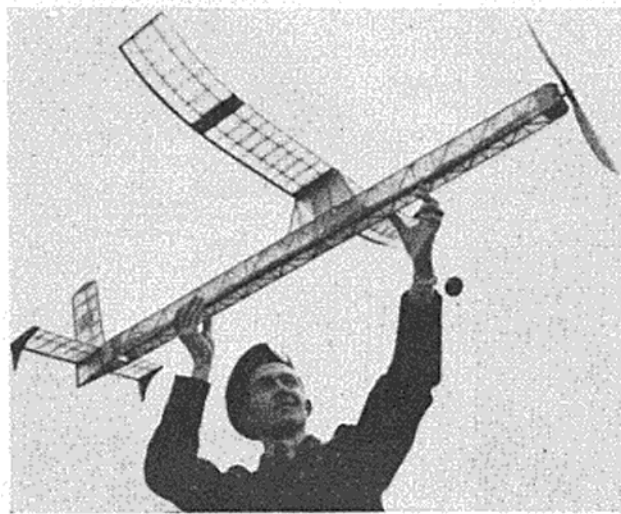
everything from indoor model events to the layout of T/R flying areas. We note that all contest entries (except scale) must carry the owner's State registration number on the wings or fuselage—a procedure that we might well adopt in this country.

Indoor rubber events are "open" and contestants are allowed to use a different model for each of the three rounds if they wish—the best flight being the scoring time. No restrictions are placed on the design of chuck gliders or Jetex models—any size motor (one fuel charge) being eligible in the case of the latter type.

F/F scale embraces power, Jetex, rubber and glider—with models being judged for fidelity to scale and workmanship. A total of 25 points may be awarded, with an extra 15 thrown in for each additional power-plant. The emphasis is on the Concours aspect since models have only to take off and climb to an altitude of 3 ft. to qualify. C/L scale is judged on a similar basis, but here competitors have to execute two laps of level flight, a gentle climb and dive and a good landing. Additional points can be won by operating retractable undercarriages, flaps, bomb doors, throttle control, engine cut-off, etc. Rules are also given in the C/L section for payload events!

Power plants are split into the same seven classes as our own, for speed flying—including the open jet class. F/F power contests are divided into three engine groups—Class 1, Class 2 and 3 combined, Class 4—the latter covering anything over 3.5 c.c. R.o.g. is the general rule, but in Class 1, hand launch is optional. F/F models must weigh a minimum of 8 oz. per c.c. of engine capacity and scoring is on a ratio basis.

Rules are given in the handbook for F/F power "scramble"—an event that would liven up some of our own meetings no end, as Adrian Bryant pointed out when he was here last year. Briefly, the idea is to log as much time in the air as possible, during the space of one hour. No restrictions are placed on motor run, but the maximum flight duration is



Cpl. L. Vesley, of R.A.F. Halton, and the sixth version of his "Energia" Wakefield design. Note elliptical.

pegged at 2 min. All flights have to be r.o.g.—from the same point each time—and spare flying surfaces and airscrews may be fitted in the event of breakages. Each entrant is allowed one helper for starting and chasing purposes.

Other rules are basically similar to our own—Class "A" team racers for instance, featuring 75 sq. in. minimum wing area (ours is 70) and a tank size of not more than 16.4 c.c. (ours is 15). The R/C scoring schedule is nothing if not complete, including as it does—consecutive rolls, inverted flight, inverted spin, outside loop, balloon bursting and sky-writing (two letters minimum!). Just wait 'till Jim Walker hears about all this—he'll have his multi-channel job loaded up in the Cadillac before your can say "Fireball"!

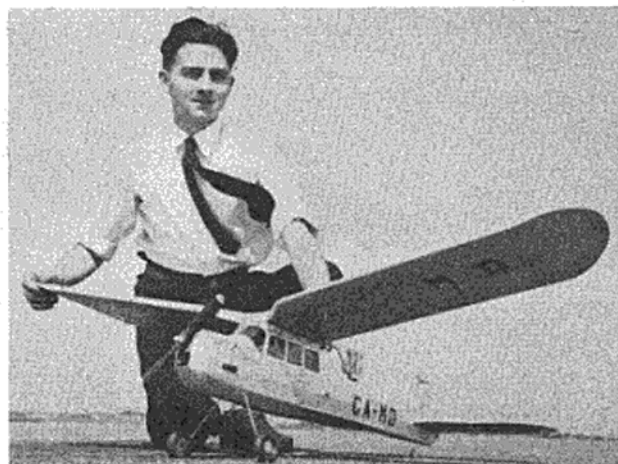


● SOLID SCALES are once again firm favourites with modellers and more and more of these non-flying replicas are finding their way into the annual club exhibitions and displays. One club entirely devoted to the building of "solids" is the Reading Solid Model Society, which was founded some five years ago. Brian Webb, secretary of the club, sent along a copy of their annual *Skywatcher* publication and told us that six of their members exhibited models at the last *Model Engineer* show. We also learned that C. B. Maycock—who handles the popular "M.A." "Prototypes Worth Modelling" feature each month—is an active member of the club.

Starting with four founder members in 1948, the R.S.M.S. has steadily increased in size until it can now claim no less than 82 members, who keep in touch with each other through the medium of a monthly newsletter. Membership is not confined to local residents—in fact, the club's most prolific builder is Peter Gray, who lives at Luton. During 1952, the club put on five displays in connection with the showing of aviation films at local cinemas. Visits were made by club members to the Keil Kraft kit factory in London and the Farnborough Air Display.

A register is now being compiled of all the models made by club members, in order that displays may be planned at short notice and representative selections of different types easily made. Of the 160 models so far registered, 47 are jet types and 42 are biplanes. Lone examples include the *Sunderland*, a *Spitfire* floatplane, a *Cierva C-30*, a *Horsa* and a *Kirby Cadet*. Kit manufacturers may be interested to learn that the most popular types are the *Spitfire* (10), *Delta* (10), *Hunter* (9), *Hurricane* (5), *Swift* (5), *Mig-15*, *Sabre* and *F.W.190* (4 of each) and *Supermarine 508* (3).

For those who go in for statistics, Mr. Webb offers the information that the total weight of all these models equals 30 lb. and if they were placed wing-tip to wing-tip, they would stretch for 80 ft. or more. Finally, if all the club members were to despatch their models to Reading for an exhibition, the total mileage covered would be 4,260 miles. For which statement, we have absolutely no hesitation in taking



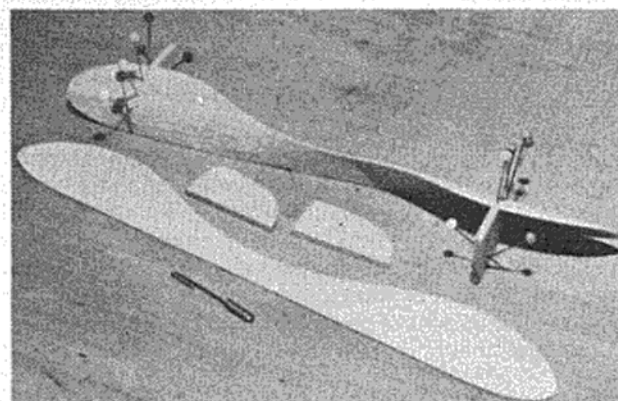
P. E. Daish, of Hendon, and his very first power model—a well built, Allbon Javelin powered "Sportwagon."

Mr. Webb's word!



● FRIENDS, DO you like to spend a cosy evening in the kitchen? You do! Well, here is a recipe for "Baked Prop," a delicacy to appeal to the fickle palette of any duration minded modeller who hates carving airscrews. If your rubber jobs fly all soggy because of underdone props, try our favourite dish for an appetising airscrew *a la* "Model Talk."

Take one piece of well seasoned 1/32 in. sheet (8 in. x 1 in.), cut a prop blank to the shape shown in the photograph and boil for 10 minutes. Take out of the saucepan, wipe off the surplus moisture (get a load of that aroma—mmmmmmhhhhhh!) and pin to a piece of ply, holding the camber of each blade in place with pieces of 1/8 in. sheet. Now pop into the oven on a low gas until it is quite dry, then unpin from the ply. The result—"Baked Prop," done to a turn. Fit a 20 gauge shaft and install in your small slabsider or stick model.



A simple method of making small airscrews from sheet balsa. See text for full recipe and instructions!



J./T. F. J. Royle (Wellsbourne Mountford) and his original 1 c.c. diesel powered 42 in. span Nieuport (F/F).

Well, we must be off now, as we have an urgent appointment with our psychiatrist—about a little micro-film model that will sit on our shoulder. Brush it off as we may, it always comes back sooner or later. Yes, there it is again. Help!

Deltas (Continued from page 179)

50 deg. delta is a more attractive proposition, if you are determined to build a "delta," the 60 deg. model probably the best of the lot. The 70 deg. model suffers from its relatively small span and the 80 deg. delta is even worse off in this respect. A preference scale could be summarised as in Fig. 9.

Building a delta within the "optimum" range, best practice would appear to be to rig the completed model with the c.g. no farther aft than 45 per cent. of the centre chord and use elevator flaps, possible combined with a fixed washout, on the trailing edge of the wing. These flaps, being located inboard, would not have such a critical effect on spiral stability as tip elevators—and the spiral stability properties of deltas appear poor enough without aggravating them. The total area of the delta would also be boosted by up to 50 per cent. above the total area you would select for a conventional model of the same general "specification." The lack of span, too, means that a torque-free power unit should be the best proposition for a delta, e.g., a Jetex unit, although there is no reason why, choosing the

● COMMENTING ON the fact that American participation is needed at the annual F.A.I. international meetings, to give them true "World Championship" status, Pete Chinn ventured the opinion in a recent American magazine article "... present Wakefield models are not everybody's meat, and far from every Englishman being minutely concerned with keeping Wakefield flying on top and tipping up his nose at all other flying, a far larger proportion would like to see other events—F/F power, glider, C/L and R/C—developed to have similar status."

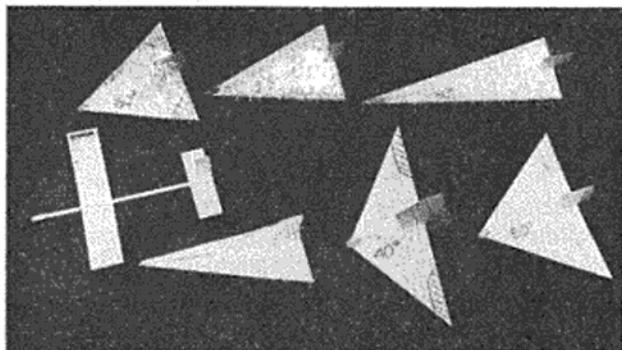
All those in favour...? Just as we thought—practically unanimous except for those characters over there in the corner—the ones with rubber lubricant stains all down their ties!

★ ★ ★

In Brief...

Here is an SOS from the Editor of *Ikarus*, the German model journal. He is looking for a British correspondent to contribute occasional articles on aeromodelling. Interested? If so, write to Edgar Dollazahl, Verlag Klasing & Co., Berlin, W.35, Schoeneberger Ufer 59, for further details. ... Modern definition of an aero-modelling line shooter: Someone who sticks an address label and a tip-up tailplane on a ducted fan model!

largest span available within the "optimum" range, a propeller driven model should not be successful, provided only moderate torque values were involved. If you are interested in delta models, then you could do a lot worse than duplicate the range of test models described and repeat some of the experiments. You may quite well discover new, important factors to help you with your final design project.



The test deltas shown with the control model of the same total area and a paper dart folded from quarto size paper.

Talking of Design...

You should read RON WARRING'S book on
Power Duration Models

Price 6s., from your Model Shop or the Publishers, Percival Marshall & Co., 19-20, Noel St., London, W.1.

Packed with valuable information on the design and construction of power duration models, this 108-page illustrated book contains a detailed analysis of over 150 successful designs.

Topical Twists

Stag Gag

One fog-bound visitor to a model club dinner writes of encountering the "murky stuff" en route.

Rather premature, I should say. At the average club dinner the "murky stuff" is usually encountered some time later—when the after-dinner speakers get cracking.

Fans Across the Sea

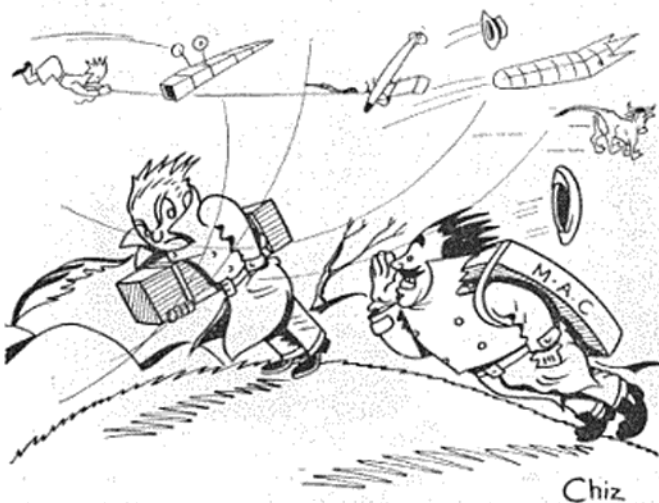
A two-way exchange of ideas on helicopters and autogiro models—by what might be termed "fan mail"—has given birth to a formation known as the "International Helicopter Society."

Now, without wishing to appear, like Don Quixote, to be tilting at windmills, I should think that normal horizontal flight is difficult enough without making any "vane" attempts at the vertical. But, seemingly, this youthful group enjoys doing things the hard way. Or, so I would gather from its choice of such a ponderous title as the "International Helicopter Society" when the simpler and more obvious "Rotary Club" so readily suggests itself.

Muscling In

Spoilsports. That's what they are, altering the Wakefield rules just when I was about to embark on the biggest money-making racket since the first few sticks of balsa wood were offered for sale in a coloured carton. The idea—and a devilishly ingenious one I might say—was to get in on the "muscles by post" racket on the assumption that rubber motors would become heavier and heavier, and the winding up of same tougher and tougher. But now, with the limitation of rubber weight, the whole thing has been a waste of effort, even to the magnificent advertising campaign. And what an advertising campaign! To give you some idea, imagine a full page illustrated spread on the inside cover of your favourite model mag.

First picture: The 6 stone weakling is struggling to get a mere 200 turns on his motor, while in the background



Chiz

"I said, 'Isn't it nice to have SPRING with us once more'!"

the strong arm boys are smugly flexing their mighty sinews in the 1,000 plus region.

Second picture: Despondent weakling happens on the "muscles by post" advert in his model mag.

Third picture: Former weakling is now happily preparing a mighty rubber motor, which for sheer knotty bulginess is only surpassed by his own newly acquired biceps.

Final picture: Former weakling now triumphantly cradling the Wakefield pot in one huge arm, while the other supports his $\frac{1}{2}$ oz. airframe/ $\frac{7}{8}$ oz. motor Wakefield job.

Some idea, eh? One snag, though. It's customary to have an adoring girl featured in the episode. Trouble was, I couldn't find one: they were all far too busy posing with Bill Dean's models.

While the rubber boys are laying aside their chest expanders the glider lads can also relax. Those early morning workouts on the local running track will not be so necessary now that the towline length has been so drastically reduced.

This means that to secure a place in the A2 team in the future will involve less physical effort. Unless, of course, the team selection idea takes root—in which case you'll need even more pull.

A "Fin"icky Business

Reading through an article on fin shapes recently, I felt a warm glow of fellow feeling for that perky little chap who props himself on the tail of the model with such an air of individual detachment. Formulae, graphs, slide rules, and the rest of the back room torture apparatus, which cramp and pinion all the other less fortunate model parts into precise mathematical shapes, cannot get so much as a thumbscrew hold on our jaunty little friend: he's much too elusive a character.

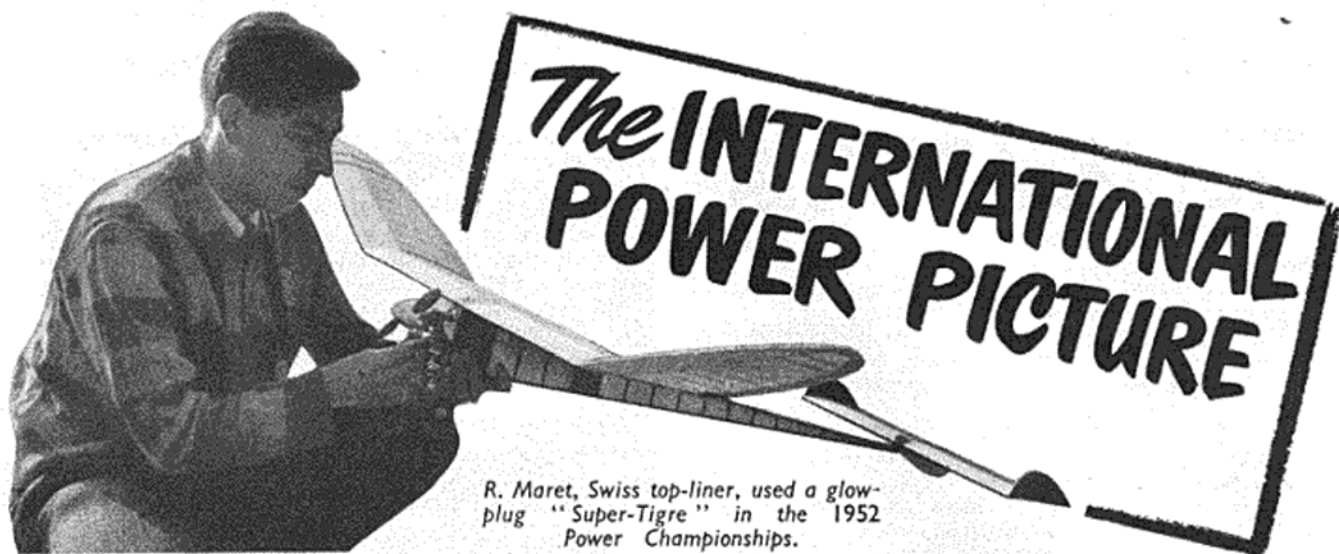
And how versatile, too! He's as much at home balancing delicately on top of the tail as he is hanging precariously underneath it, and, when in flippant mood, he can even fragment his saucy little self for general distribution over the whole tailplane region. Moreover, in performing such acrobatics, he can assume any whimsical shape or stance he chooses, from prim erectness to rakish audacity, without so much as a by your leave to the despairing back room boys.

Possibly the only grievance I have against my jaunty little friend is that, at times, he carries his individualism just a bit too far. For example, wrecking a perfectly good Wakefield by a sudden and capricious squiggle of his airy flanks. Or, perhaps, getting up to all those impish pranks on the end of a towline. Why, not even the sternest remonstrances from Ron Warring himself seem to have any effect.

For this next one I must beg forgiveness from both my readers (myself and the bloke with the blue pencil). But having read that a certain club, in using a local council ground, is subject to a stiff fine for flying after 2 p.m. on Sundays, I just cannot restrain myself from saying that it would make a nice change to have a fine Sunday afternoon's flying.

(Flash: The bloke with the blue pencil has now demanded danger money!)

Pylonius



R. Maret, Swiss top-liner, used a glow-plug "Super-Tigre" in the 1952 Power Championships.

INTEREST in the F.A.I. world power championship class F/F model, the so-called "International" class, is very much more widespread than hitherto. Some response to efforts to interest our friends on the other side of the Atlantic is now definitely being felt, if one may judge from the editorial attention being given to the subject in their model journals, and the advent of the Herkimer Cub .14 International class engine will undoubtedly help in this direction.

In Continental Europe, of course, the type is now well established, while, in Britain, it appears to be emerging as the most popular power-duration type.

At this time, therefore, it seems opportune to review the International class model and trends of design, both national and foreign. In particular, there is a case for examining the types of engine available to the various competing countries. The power unit is the most important part of an international model, for it is upon the performance of the motor and its utilisation, that the potential performance of the model depends and to a greater extent than anything else. This is a fact which will become increasingly evident in future championships, especially if the rules should be altered so as to tighten model specifications and tie down model size more closely, as in the case of international rubber (Wakefield) and glider (A2).

ACCENT ON POWER By P. G. F. CHINN

It has been the writer's good fortune to try out examples of the 2.5 c.c. class engine from no less than eight different countries—all of which, incidentally, are approximately contemporary with one another, being the latest types available at the time of writing.

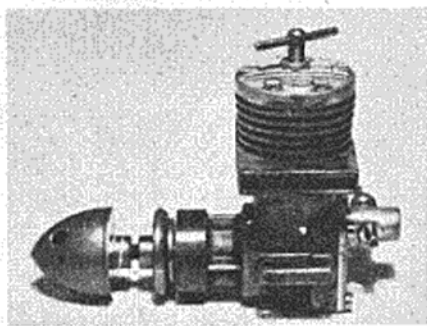
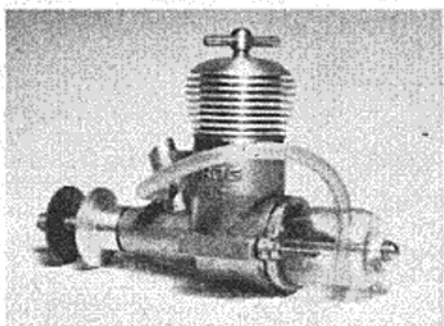
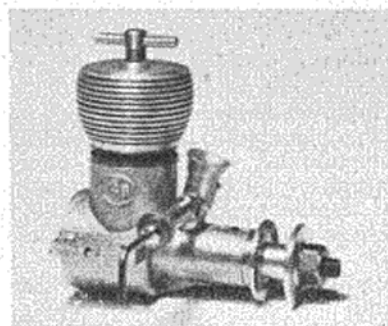
Ignoring, for the moment, British units, they have included two glow-plug models and two 1.5 c.c. engines, the remainder being 2.5 c.c. diesels. In each case, too, the engine, or engines, sampled were of a type acknowledged to be thoroughly representative

of the country concerned and were, in several instances, of a type used by leading contestants in the 1952 World Power Championships held in Switzerland in September last. We had, for example, the "Super-Tigre" G.20 from

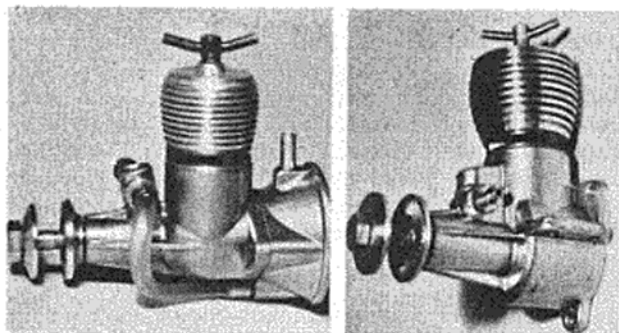
Italy, Holland's Veenhoven "Typhoon" and the "Webra" from Germany, each of which placed well up in the final results.

One of the most interesting is, undoubtedly, the glow-plug Super-Tigre. We first made acquaintance with this make in Italy several years ago when it was built by the *Officina Sperimentale Apparecchi & Motori* ("OSAM") in Bologna. Nowadays, this firm puts out another marque under the "OSAM" name and the Super-Tigre engines are built by *Micromeccanica Saturno*.

The test model Super-Tigre was one of the very



Gt. Britain. Three contenders for International honours: The Elfin 1.49 (left), 1952 winner and a top performer in the 1.5 class. The low-priced Frog 150 (centre) which brings International competition within the reach of almost everyone. Another leading challenger in the International class is the E.D. 2.46 Racer (right) fitted with ball-race crankshaft bearings.



Two diesels from Australia: On the left, the new Sabre 150 with its exceedingly neat radial mount, and on the right, its companion model, the Sabre 250 Mk. II—both well-finished, high performance engines.

latest G.20S models, having a new finned cylinder-head and revised piston and combustion chamber design, with a 10:1 compression-ratio. Actually, the Super-Tigre is assembled in two different models, a "Sport" version, having a single ball journal bearing on the crankshaft and an 8.5:1 compression-ratio, and a "Speed" version, having twin ball bearings and the 10:1 compression as already mentioned.

The Super-Tigre G.20S is a shaft-valve engine but in most other respects its design is more in accordance with disc-valve type racing engine practice. It has, for example, in addition to a ball-bearing main shaft, generous exhaust ports in a 180-deg. layout and a large volume transfer passage, together with an aluminium alloy piston having two compression rings. Construction, too, follows current racing engine design, there being a nickel-iron liner in a pressure cast cylinder/crankcase block and the main bearing housing being a separate casting, making a metal-to-metal joint with the crankcase to which it is secured with four machine screws.

Super-Tigres are, undoubtedly, highly regarded on the Continent and the Italian team were not the only competitors using them in the power championships. The engine is beautifully turned out: the die casting is really excellent—far superior to that generally to be seen on Continental products and better, too, than many British engines.

So far as the performance of the G.20-Speed model is concerned, this is definitely of the "top end" variety, which is aimed at C/L work, notably speed models. At the last championships, the Italians were reputed to be running their Tigres on tiny props at around 13,000 r.p.m. and it does seem likely that the gain in b.h.p., which allowing the engine to run near to its peak will give, is largely nullified by loss of prop efficiency. On the other hand, the Tigre is obviously well adapted to receive the ministrations of the diligent engine tuner and it is not beyond the bounds of possibility to raise the torque at the lower end in order to permit the use of a larger prop without excessive loss of power.

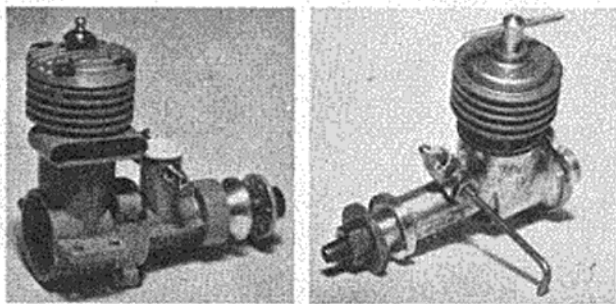
In marked contrast to the Super-Tigre is the Norwegian David-Andersen engine, which was dealt with in "M.A." "Engine Test" No. 36 (June, 1952). This engine is a good example of

high performance in the lower speed bracket and, up to 9,000 r.p.m., our test example actually showed a power output which was well above average and at least equal to that reached by any other 2.5 c.c. production engine. Properly used, this motor should be capable of pulling an international model aloft as rapidly as almost any other 2.5 c.c. motor. Due to its quite outstanding medium speed torque, it is possible to use a really effective prop and our tests would seem to indicate that a good 10 x 5 is the best choice. On such a prop, a good example of the David-Andersen 2.46 will run at around its peak speed of just over 9,000 r.p.m.

This is another well built and well finished unit and although, at nearly 6 oz., it is substantially heavier than the previously mentioned Italian engine, this is not of great importance for an international model, since an all-up weight of nearly 18 oz. will, in any case, be required to meet the rules, leaving 12 oz. for the airframe, etc., which is adequate.

In the 1952 championships, Germany took sixth and seventh places in the individual scores and second place in the team aggregates. The engine used by their top team men was the Berlin made 2.46 c.c. Webra. This motor has already been covered quite fully in MODEL AIRCRAFT, including a report in the February issue, but it is possible that an improved Webra may be available in time for the 1953 contest. This will, if the manufacturers decide to go into production, take one of two forms. Either it will be a new, ball-bearing, racing type unit, with porting arrangements similar to their recently introduced 1.5 c.c. model, or will take the form of an improved version of the existing 2.46 model, having a new cylinder and piston with somewhat different porting and timing arrangements. Factory prototypes of these two models have indicated improvements in peak power output amounting to 27 per cent. and 18 per cent., respectively, over the existing standard production model.

While an Australian team is unlikely, at present, to be seen at the Championships, it is not improbable that Australian or New Zealand built models may be received for proxy flying—especially as the 1953 contest will be held in Britain. Two Australian built motors may be seen: the Sabre 250, which we featured in the January "Engine Test" and the more recent "Sabre 150" model which is available



Italy (left): The very latest version of the ball-bearing Super-Tigre G20 glow-plug motor with finned head and high compression. Germany (right): The new Webra 1.5 which offers high performance in this class.

for anyone who prefers a 1.5 c.c. engine and the lighter and smaller type international model which it permits.

The Sabre 150 is a very neat little diesel, its appearance reminiscent of the American Wasp .049. It has, for example, the same design of crankcase and conical tank type mounting with the feed from a point at the bottom. It is an ideal layout for duration model installation and our thanks are due to Jack Dunkerton, president of the Model Aeronautical Association of New South Wales, and to Gordon Burford, the manufacturer, for sending along one of the first two prototypes for comment and test. We found the engine easy to handle and of good performance (the bore and stroke, incidentally, are the same as those of the Elfin 1.49) and we feel that, in these two models, the 150 and 250, Australia has products worthy of her entry into international competition. Both engines are very soundly constructed and well finished.

Among Continental 2.5 c.c. diesels, one of the best performers is the Typhoon from Amsterdam. One of these engines was, of course, featured in last month's "Engine Test" and little further comment, therefore, is called for here. It is a compact engine of somewhat above average peak output and well suited to power-duration work and to the International class in particular.

Rather surprisingly, perhaps, France is less endowed with suitable 2.5 c.c. engines than most other countries and is much less well off in this respect than Britain, Italy or Germany. In fact, it appears that the only motor to meet current requirements adequately, which has reached the market in any numbers, is the 2.5 c.c. Météore, now being put out by the well-known Paris firm of *Moteurs Micron*.

This is a conventional shaft-valve annular-ported engine, like most other 2.5 c.c. competition diesels, and has a bore and stroke of 15 mm. x 14 mm. It is a radial-mount model and features the unusual needle-valve design common to all current Micron models.

American's sole representative, thus far, in the 2.5

c.c. class, is the 2.45 c.c. Cub. 14. This engine is very much lighter in weight than any other 2.5 c.c. model available, but, although this results in a commendably high power-to-weight ratio, it is not, unfortunately, a characteristic of any great significance to the class of model we are reviewing. Nevertheless, the actual power available, while developed at high revolutions, is consistent with accepted standards for this class. Further details of this engine are given in the test report appearing in this issue of *MODEL AIRCRAFT*.

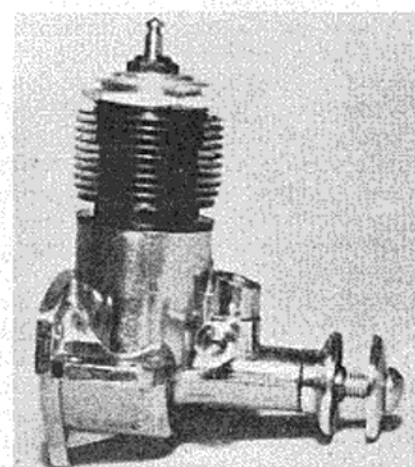
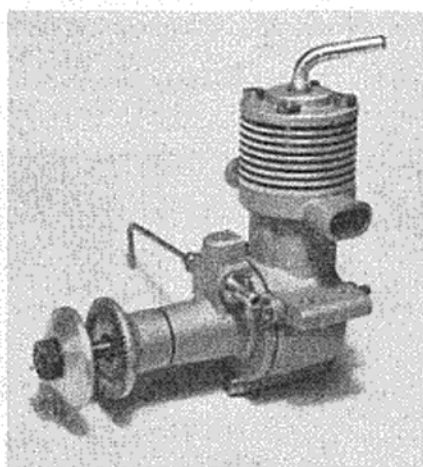
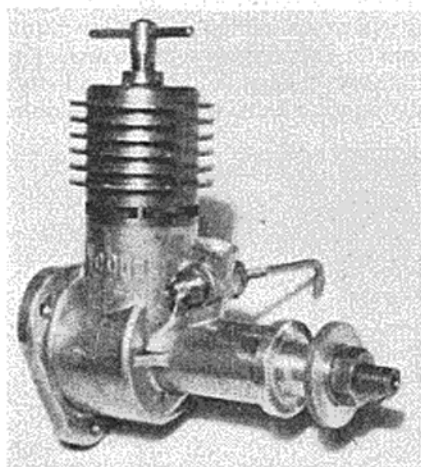
The only alternatives for international aspirants in the United States (so far as their own engines are concerned) would be a .099 (1.6 c.c.) engine, such as the Arden .099, Cub .099 or McCoy "9," or a rebuilt high performance .19 cu. in. model, such as the K. & B. Torpedo 19, sleeved and, possibly, de-stroked, to bring it down to 2.5 c.c. The latter is obviously not a solution that is likely to be widely attempted (although, perhaps, offering greatest promise if tackled expertly) but the .099's, using 11½ oz. models of up to 410 sq. in. total area, are not, we feel, the best answer, so that the Cub .14 still seems to be the obvious American choice at the moment.

Now for our own position, which, happily, is a strong one.

So far as the 1.5 c.c. class is concerned, highest performance is shared by the British Elfin 1.49 and the German Webra 1.5, while in the 2.5 c.c. category, we have available three engines which, for the type of performance we are seeking, are virtually unsurpassed. These are the E.D. 2.46, the Elfin 2.49 (notably the 1949 radial mount model) and the latest Oliver Tiger.

The latter engine is not well known to the acromodeller and it should be explained that this is, nevertheless, a well proven make, having acquired, over the past three or four years and several models, an enviable reputation among model racing car enthusiasts. The model currently available to aircraft enthusiasts is a single shaft version of J. A. Oliver's

(Continued on page 197)



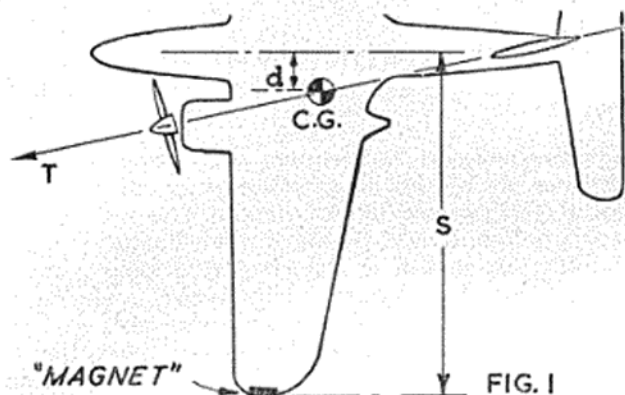
Some further 2.5 units. Left: **Germany.** The popular Webra 2.46. An improved model may be appearing shortly. Centre: **Norway.** The David-Andersen which, despite a slightly vintage appearance, has an excellent performance. Right: **America.** The O.K. Cub 1.4 model, America's sole representative and one of the few glow-plug units in the International class

Letters to the Editor

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters

TAPLIN'S TWINS

DEAR SIR,—Col. Taplin has suggested that according to Mr. Campbell's theory a twin-engined model would fly on one engine if its c.g. was moved over to lie on the thrust-line of that engine, as in Fig. 1. He appears to be doubtful, so I presume he has not tested this arrangement in flight. In case he has found moving the c.g. such a distance to be difficult, I should like to suggest how it can be done. Obviously the c.g. has to be attracted to one side, so we must place a "centre of gravity magnet" on that side. A "c.g. magnet," in contrast to a common magnet, has its greatest effect when farthest from the c.g. upon which it acts, and I have found lead to be the best material for the magnet.

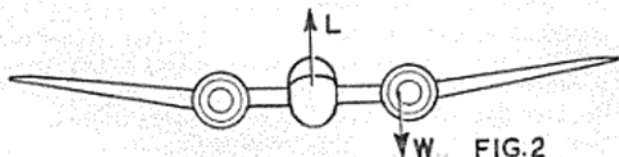


The c.g., which is the point at which the mass of the model can be considered to be concentrated, obviously has inertia, so a light model will have its c.g. attracted most easily. Placing the magnet at the wingtip, the volume of magnet required (V cu. in.) will clearly depend on the semi-span (s in.), the lateral distance from the centre line to the thrust line (d in.), the weight W lb. of the model and the "coefficient of c.g. attraction" of the magnet, k . This is .41 for lead, and .36 for rolled up balsa cement tubes.

$$\text{Then } V = \frac{dW}{sk}$$

This theory I have conceived myself, Col. Taplin, and when I put it into practice, I found it worked!

Mr. Campbell omitted to remind Col. Taplin in his letter that for straight flights, forces and moments in all directions must be balanced. Whilst there is now no yawing moment, there is a large rolling moment (Fig. 2).

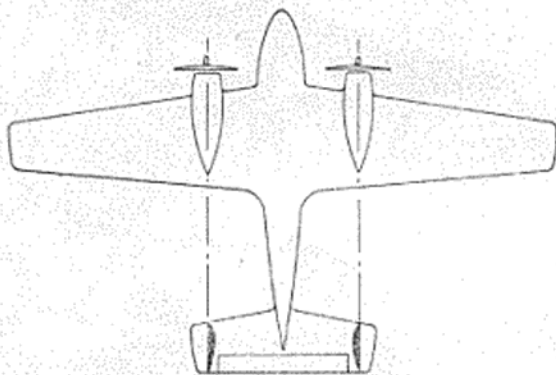


To set a propeller at 90 deg. sidethrust would seem to be of doubtful value, since no thrust component is left for forward flight. Or has Col. Taplin invented a plane which can fly sideways?

Tadworth, Surrey.

Yours faithfully,
M. M. GATES.

DEAR SIR,—I wonder if Colonel Taplin is familiar with Mr. Igor Sikorsky's patent twin fin arrangement on full size multi-motored ships?



It will be seen from the sketch that the two fins on the ends of the tailplane have an airfoil section, the lift or force of which are exactly opposed to each other and towards the centre line of the ship. These fins are each in the slip stream of its respective propeller and as long as the slip streams are equal, the turning moments are neutralised. However, should the thrust of one propeller and consequently the slipstream, be greater than the other, the turning moment of the greater thrust would be neutralised by the equal and opposite turning moment of the fin in the greater slip stream.

Mr. Sikorsky was one of the pioneers in the development of multi-motored aircraft and I believe he claimed that his ships, using these compensating fins could fly with one engine operating (in a two-engined aircraft) with little or no discomfort to the pilot.

New Jersey, U.S.A.

Yours faithfully,
GEORGE TAYLOR.

TOWLINE STABILITY

DEAR SIR,—I have read with interest your article on "Towline Stability," and I should like to submit an idea of my own.

Stability on tow depends on the correcting factor. The larger this factor, the more sudden the return to a normal flight path. When it is very large, the model corrects any veering tendency so violently that it swings right over to the opposite side. It corrects itself again, swings over, and so on, *ad infinitum*, until it is either cast or crashed. When a model sideslips on tow, it is because its c.f. is too small. Thus it will be seen that each form of instability requires a different cure, and that stability is a half-way house between them. To increase c.f., move tow-hook forward, move c.g. back, increase fin area, or reduce dihedral. To reduce c.f., vice versa.

This is not merely theory. I once had a lightweight glider, with three tow-hooks. On the front hook, it weaved, on the back hook, it sideslipped, but on the middle hook, it went up overhead in any weather. I have also had similar, though not quite so marked, experiences with other models.

Derby.

Yours faithfully,
P. L. ROE.

Prototypes Worth Modelling



By
C. B. Maycock

No. 31
The **ARMSTRONG-WHITWORTH**
F.K.3

THIS aircraft has a lot to recommend it for a flying scale model. It has pronounced dihedral (4 deg.), a rugged undercarriage with that prop-saving device the forward skid, and a cowling sufficiently deep to bury a diesel motor. More important than these however is the long moment arm and generous tail surfaces which should all add up to a very successful model.

The Armstrong Whitworth F.K.3 was designed by Frederick Koolhoven in 1915 and produced in 1916. It was known to the R.F.C. as the "little ack" to differentiate from the later F.K.8 or "big ack." Ack incidentally was "signalese" for "A." The "little ack" shared the unenviable job of spotting for the guns with the B.E.2.C. Later it was relegated to training duties. The pilot sat in front, and the observer had a swivel mounting for a single machine gun. The wings were the usual wooden construction, fabric covered. They were of equal span and chord with 14 ribs per wing. The spruce interplane struts were bright (i.e., varnished) with the end fittings and bracing wires black. The fuselage was built up with

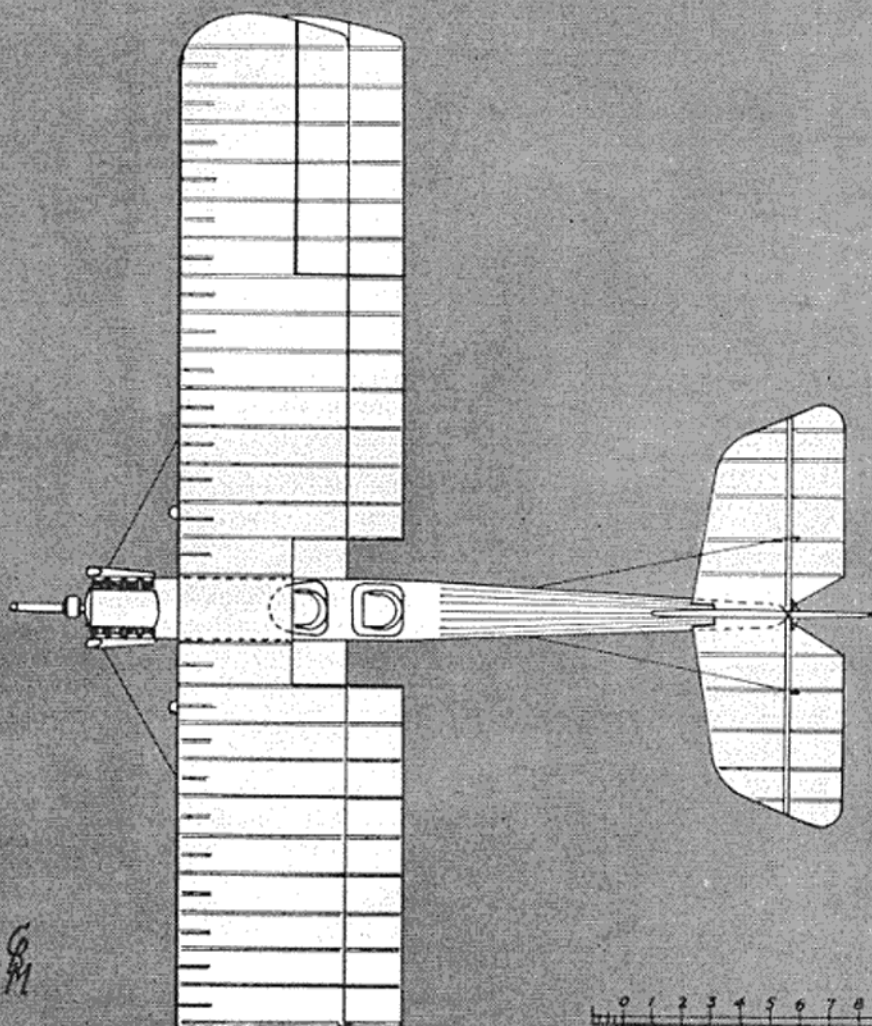
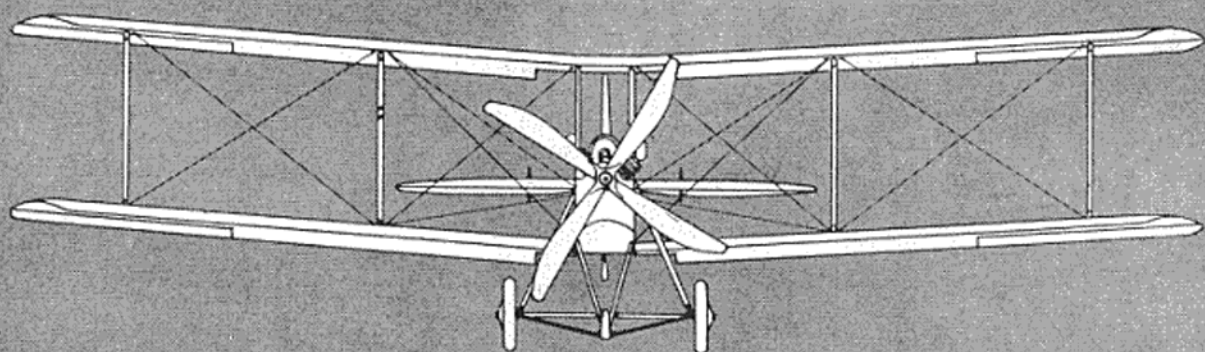
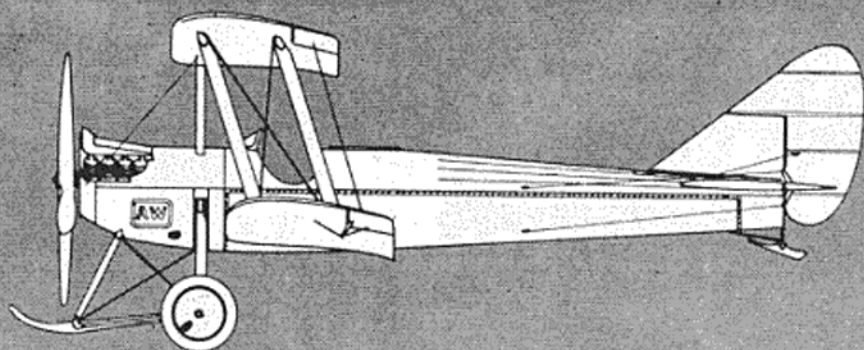
wooden longerons and formers, with stringers to the decking aft of the observer's cockpit. Except for metal cowling it was fabric covered. The power plant was a 90 h.p. R.A.F. (Royal Aircraft Factory) eight-cylinder air-cooled, in line, motor, driving a four-bladed wooden airscrew (laminated mahogany, highly polished). The cylinders were arranged in two banks of four, set at 90 deg. to each other, that is 45 deg. either side of the vertical centre line. The metal panels either side of the nose had the letters AW pressed out and were enclosed in a square panel also embossed.

The undercarriage had the axle in two halves hinged to the central skid. The landing shocks were transmitted by two compression struts, the upper ends of which slid up and down spring loaded slide-rods in the fuselage. The central skid was carried on two vee struts in tandem. A track rod from the root fitting of the front pair ran back to the wheel hub fitting. The colour scheme was dark khaki-green for all upper and vertical surfaces. The cowling and the metal panelling at the nose were dark grey. Serial number was in white along the base of the fin. Wheel centres were of aluminium doped canvas covering wire spokes. Red, white and blue rudder stripes were carried, red at the trailing edge. Under-surfaces were clear doped (cream colour) and the roundels beneath each wing tip extended to within 1 in. of the leading and trailing edges. The same applied to the roundels on the upper surfaces and fuselage flat sides except that these were outlined in a thin line of white. The main dimensions were as follows: Span, 40 ft.; chord, 5 ft. 8 in.; gap, 5 ft. 11 in.; stagger, 1 ft. 11 in.; dihedral, 4 deg.; incidence $2\frac{1}{4}$ deg. top, $1\frac{1}{2}$ deg. bottom.; weight, 1,900 lb.; speed at 1,000 ft. was 85 m.p.h. Landing speed, 38 m.p.h. Duration $3\frac{1}{2}$ hours. Climb to 10,000 ft. in 23 min.



An F.K.3 in France during the 1914-18 war.

ARMSTRONG WHITWORTH F.K.3



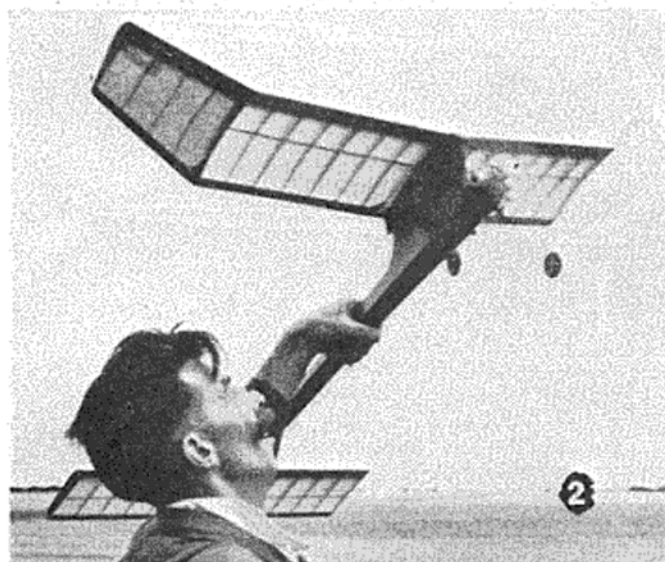
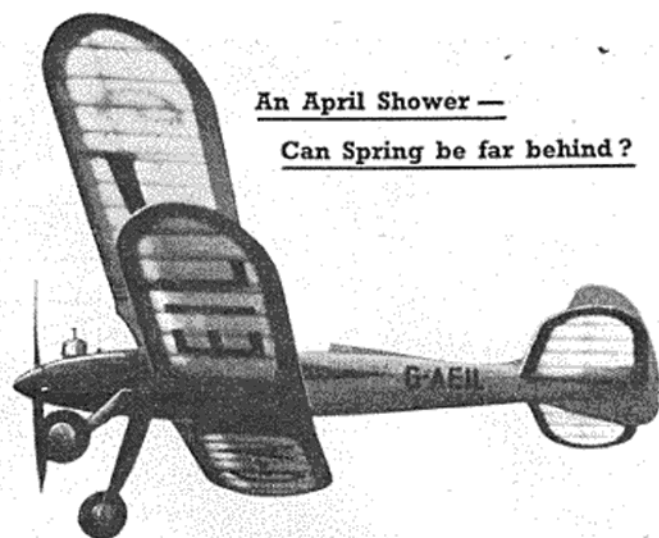
GM

SCALE OF FEET.
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PHOTONEWS

An April Shower —

Can Spring be far behind?



WELL—April Shower, Spring Collection—we felt we had to call it *something*. After all, it is a special occasion—a shining new season, fresh with promise of records (and models) unbreakable, of blue skies and golden sunshine . . . who knows? —we may even get a day like that!

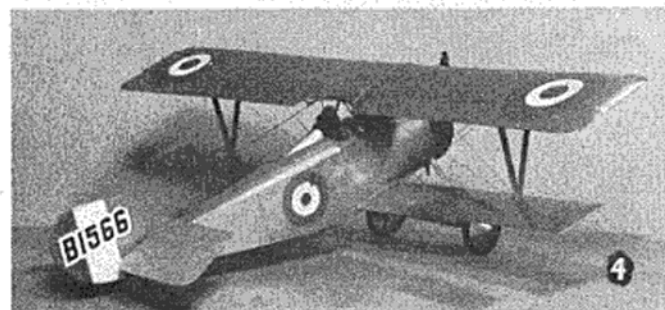
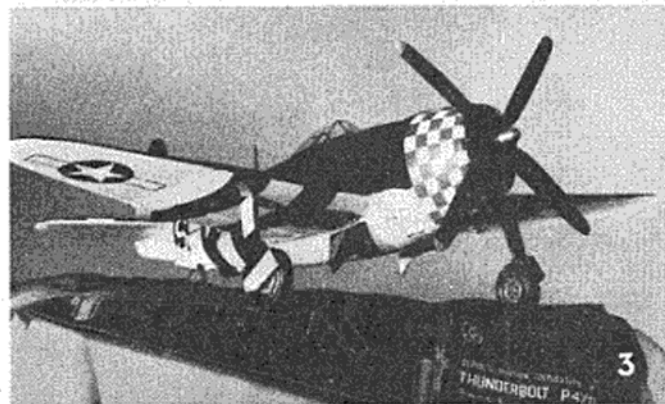
Our first model this month won a Highly Commended diploma at last year's "Model Engineer" Exhibition. It was built and photographed by M. B. Rees of Dartford, Kent, and is a beautifully finished Frog *Firefly* powered by an E.D. Bee. Coloured cream and red, this 36 in. span semi-scale biplane certainly looks well in the air.

No. 2 depicts bewhiskered Ralph Hewlett secretary of the Lowestoft Club, launching his Elfin 1.49-powered *Little Aud* and was photographed by J. Genlloud.

One might expect that our star model, the *Thunderbolt* in No. 3, was just a super-detailed solid, but it is in fact a stunt C/L model. It was built to a scale of 1 in. to 1 ft. by Arthur Wild, an Australian enthusiast, and won the C/L scale event at the 6th Australian Nationals held at Bendigo. It took over a year to complete, and powered by a Fox "59" weighs 5½ lb. Incidentally, Arthur Wild also took the excellent photograph.

The prototype of No. 4, the *Nieuport 17c*, is not popular choice, but W. Hitching of Middlesbrough has produced a fine flying scale model of it, and as it is now entering its fourth flying season there cannot be much wrong with its flying capabilities. The power unit is a Mills Mk I, now in its sixth year of service, and we are assured that it is now running better than ever! The model is numbered to represent "Billy" Bishop's machine, and the "pilot" is even provided with a leather flying jacket with fur collar, and even glazed goggles.

Johnny Gorham of Ipswich must be one of the most prolific builders of models in the country; his output—mainly of Wakefields—is enormous. In No. 5 we see his 1953 Wakefield design, but no doubt there will be any number of sister models built before the contest. It is built to survive the English "trials" and comes out at 9 oz. with 5½ oz. of rubber. New features are the free-wheel/folding propeller, retractable undercarriage, larger fin and higher aspect ratio flying surfaces. The wing is mounted on a small platform and is braced to the side longerons with wire. The photograph is by A. Longstaffe.



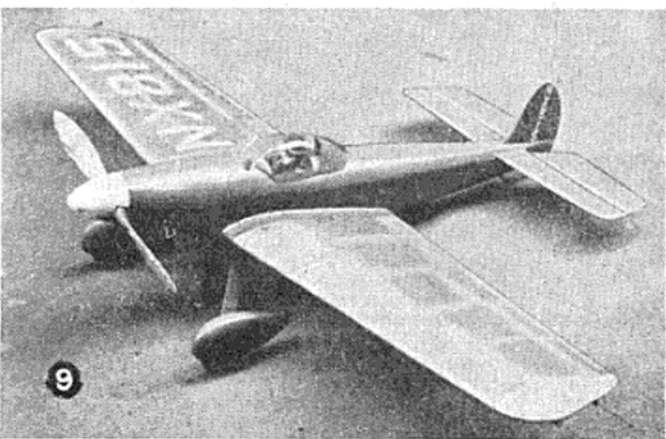
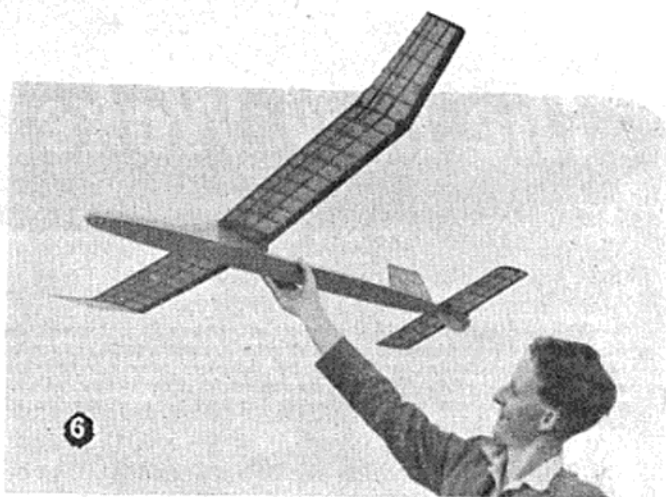
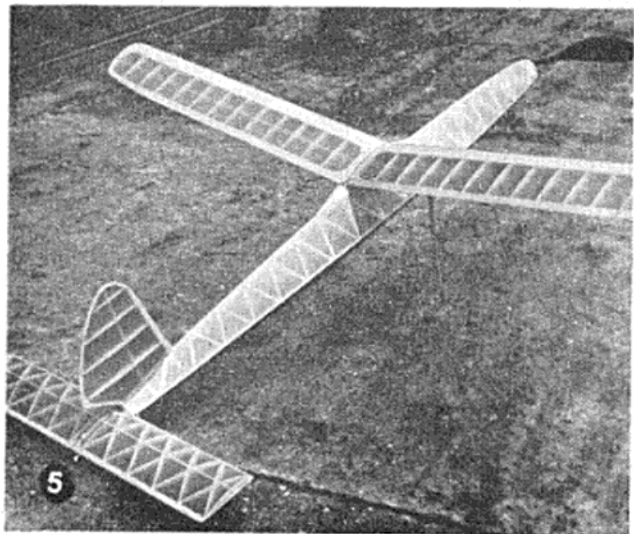
Cpl. Woodrow of R.A.F. Aston Down took Photo. No. 6 of J./T. D. Barker with a much modified version of the popular Mercury Marauder. The entire fuselage has been covered with $\frac{1}{16}$ -in. sheet giving much greater rigidity, while the wings are now in two halves, joined by 14-s.w.g. dowels in brass tubing. The two underfins have been omitted and a single underfin with auto-rudder has been installed, giving improved towline stability. The model gained second place in last year's Maintenance Command A2 glider event.

One of the prettiest free-flight semi-scale models we have seen for some time appears in No. 7 and was photographed by Kenneth Farmer of Bristol. This one was built by Brian Macey of Trowbridge, who certainly seems to have included a considerable degree of detail. The design seems to have been influenced largely by the Fairchild Argus—a particularly good-looking aircraft in the high-wing and cabin category. It seems rather a pity that it is not used more as a prototype for flying scale models.

J. B. Stewart of the Salisbury M.A.C. keeps us posted at frequent intervals of activities in his club, and sent us Photograph No. 8 of another popular kit model—the E.D. Radio Queen. This model was built by fellow club-member R. Snook, and powered by an E.D. 3.46, will be controlled (it is hoped) by E.D. Mk. III radio equipment. With all new radio models, the first flights are a little nerve-racking, so we wish Mr. Snook the best of luck!

Lastly, we have in No. 9 a very attractive little C/L model built by J. Swift of Sheffield. It is designed very much in the team racer pattern, but is in fact a fully aerobatic stunt model. Powered by a Frog "150," it has a wing span of 24 in. and appears to be very well finished. We particularly like the pilot-filled cockpit and the wheel spats—details that most builders of stunt models regard as unnecessary or "too much trouble."

Well, there is our collection for this month. We still want to see your pictures in MODEL AIRCRAFT, so shake the moth-balls out of the box Brownie and get cracking! We should be in for a really good summer after the shocking winter we've had, so there is no excuse. Make the pictures really newsy and interesting, and please send, if you can, half-plate glossy prints.



The new Wakefield rules

Surveyed by Ken Rutter

"The limitation of the weight of rubber (lubricated) on models to 'Championship of the World' formula to 80 grammes (2.82 oz.) maximum proposed by Belgium was carried for application in 1954. To facilitate control, the weight of the airframe complete with rubber is limited to a minimum of 230 grammes (8.113 oz.)."

At the time of writing the new rules have yet to be ratified but it seems unlikely that they will be thrown out at this stage. From conversations we have had with other Wakefield addicts the change seems to be popular. Certainly most aeromodellers are conservative where rules are concerned, and like changes to be made as infrequently as possible; but it was recognised by a large body of opinion that some change was necessary and this way of cutting potential performance seems as good as any. We shall be better able to say whether it is a good idea or not in five years time or so, but in the meantime we are faced with what amounts to a completely different design problem than applied under the old rules—and, it might be added, a more difficult one.

First, performance will definitely be reduced under the new rules. The effect this will have on the performance of individual modellers remains to be seen. Most of the experts in recent years have tended to rely more and more on sheer weight of rubber for performance. Changes in the design of the airframe have more often than not been merely intended to reduce weight so that more rubber could be carried. People who have proceeded along these lines are brought to a sudden stop in no uncertain fashion by the new rules. There are however other designers who have kept the rubber weight down to reasonable proportions and still managed to retain good performance, so it can be done.

Generally the new rules mean that performance will be cut by about 1 to 1½ min. So far we have not heard of any proposal by the F.A.I. to reduce the maximum flight time from its present level of 5 min., and this raises an interesting point. If the average performance without thermals of a good old-type Wakefield was 3½ min., the effect of one thermal in a three-flight contest would be an increase of 1½ min.

over 10½—say about 15 per cent. increase. The effect of the same thermal under the new rules will be to increase the three-flight aggregate from 7½ to 10 min., which is about a 33 per cent. increase. In other words, thermals under the new rules are more than twice as useful as under the old.

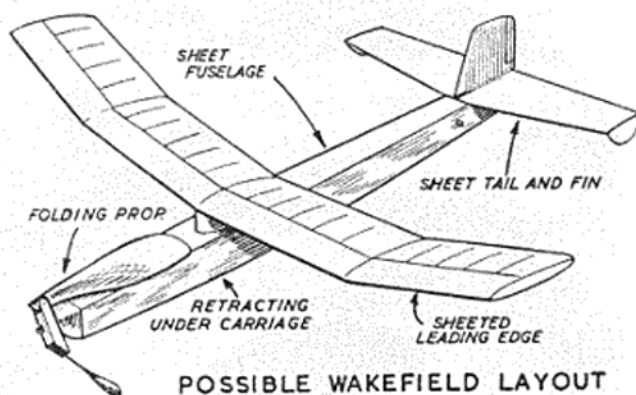
Nobody wants to cut out the luck element altogether, but it seems advisable for the maximum flight time to be reduced to 3½ or 4 min. if we are not to see people climbing to the top of the rubber contest averages more by luck than by judgment.

Leaving the question of performance for a moment, we find that the new rules cause the greatest changes in the field of constructional design. Now the rubber content is fixed at 2.82 oz. and the minimum all-up weight at 8.113 oz. Previously we designed a model to be as light as possible, consistent with what we considered to be adequate strength, so there was no downward limit to weight. If a model by some freak of chance turned out lighter than we expected, we cheerfully added another 2 or 3 in. to the already awe-inspiring hunk of liquorice and were thereby able to twist a few more turns on, if we had the strength.

Now, however, there are very close weight limits, both upwards and downwards. If we make the Wakefield too heavy, considering the small motor, it will be at a much greater disadvantage than an overweight model was under the old rules. If it comes out too light we are forced to add dead weight to make it comply with the specification. Allowing for the inaccuracies inherent in area scales we can round off the rule figures (you would never think it was an English contest, would you?) and regard them as 2½ oz. motor maximum and 8½ oz. all-up minimum. This makes the airframe 5½ oz., plus or minus about 1/10 oz.

Designing to an exact weight is a new experience for Wakefield exponents; probably the best stratagem would be for us to have a word or two with our friends of the A2 cult, who have been doing it for some time.

The most obvious thing about a 5½ oz. airframe is that it should work out appreciably stronger than the old types were. The jibe often levelled at us that Wakefields were just paper bags full of rubber was not entirely unjustified, and in recent years many modellers have abandoned Wakefield operation simply because they did not like making flimsy models. This flimsiness caused great care to be taken in design and construction and a lot of time to be spent in making repairs and substitutes, all of which made it next to impossible for the Wakefield flier to devote time to any other branch of the hobby. Now it ought to be possible to make Wakefields as robust as power jobs and A2s, and we can look forward to a



resurgence of interest on these grounds alone.

Reverting to performance, it is clear that the previous emphasis on lightness-at-any-cost will now be transferred to finding means of refining the flight characteristics and we can expect airframe design in the aerodynamic sense to undergo improvements. As already mentioned, thermals will play a big part in future contests, and with thermals it is a case of the lower the fewer. Consequently we shall undoubtedly see a lot of research on propellers with the object of getting the models up among the risers. Rate of climb will probably become the main thing and long motor runs will not pay off.

Motor arrangements appear to be pretty well confined to 12, 14, or 16 strands. With the 12 strand, $\frac{1}{4}$ in. \times $\frac{1}{24}$ in. motor the length will be about $41\frac{1}{2}$ in., and the permissible turns about 800. We predict that this will become the most popular motor, probably with propeller pitches of 20 in. to 24 in., giving a smart climb of about 30 to 50 seconds' duration. Below about 800 turns possible, motor runs give such a wide variation in power output that trimming becomes difficult; for this reason 14 and 16 strand arrangements, giving maximums of about 650 and 500 turns respectively are unlikely to be widely adopted.

Unless somebody discovers a way of getting something for nothing by means of gears, we cannot see much future for them under the new rules. Return gears at any rate seem to have had their day.

Once having got the model to climb to a reasonable height it will be necessary more than ever to see that this height is lost as slowly as possible. Drag-producing features like two-leg undercarriages,

rubber-band-encumbered wing fixings, bumps on the fuselage and so on can no longer be tolerated. And much as we like freewheeling propellers it looks very much as though they will shortly become quite rare. The weight allowed for the airframe will at any rate allow more use to be made of gadgetry, and no doubt methods will be found of eliminating the present disadvantages of folding and feathering propellers.

With the new freedom of constructional design we can expect to see great changes in the methods employed. There seems to be a current desire among aeromodellers generally to spend less and less time on construction and more and more on flying. This has led to the increasing use of short cuts and quicker, simpler systems of construction. The tendency will undoubtedly have its effect on new-rule Wakefields, and there will probably be all-sheet tails and fins and possibly even wings. Fuselages also will probably come to be sheet-covered, particularly as there will now be no need to make them longer than about 34 in. to 36 in. overall.

We said at the start that the problem of design had been made more difficult by the new rules. That is only natural because now we're trying something different from anything we have had to do before. Designing for a really high performance is always difficult in any class of modelling, but in the new Wakefield specification we have at least the chance to make a robust serviceable model which should be if anything easier to trim than previous Wakefields have been. So start designing, and let us see how long it will be before we get so good that they have to change the rules again!

ACCENT on POWER

Continued from page 188

highly successful twin-shaft direct-drive model car unit and is of the shaft-valve type with circumferential porting on the lines of the Brebeck system. The actual capacity is 2.43 c.c., derived from a .550 in. \times 625 in. bore and stroke, which gives a somewhat above average stroke/bore ratio.

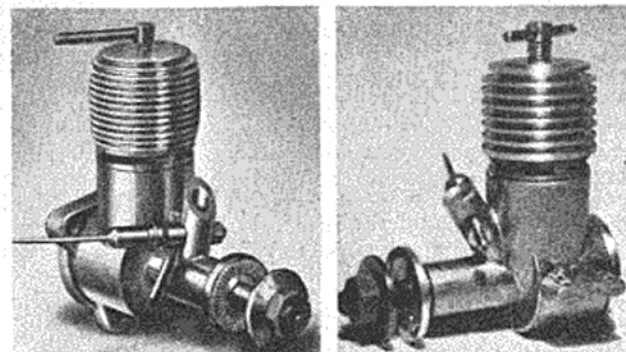
The Oliver is equipped with twin ball bearings and is essentially a hand made unit, owing much of its performance to the perfect fitting of component parts and to stiff construction. It weighs slightly over 6 oz. and is a relatively expensive engine, but is obviously of interest to all serious competition enthusiasts.

Unfortunately, the business of trying to pick an engine of the best possible performance is not without some hazard. This is on account of the fact that the vast majority of mass produced model engines show considerable variation in output between picked production examples. It is necessary to bear this in mind when considering the respective merits of different models, for comparison between single examples may even appear to contradict previous information, to the detriment of one type, or advantage of another.

We do feel, however, that, in the case of the E.D. 2.46 and 1949 Elfin, it is safe to say that the

average example of either of these two models is more than comparable with overseas products of the same capacity, and we would mention further that picked "good" examples of these two models have recorded the two highest performances (particularly as related to F/F speeds) of numerous tests of 2.5 c.c. engines—excluding the previously mentioned Oliver model.

In next month's article it is proposed to examine a little more closely the capabilities of the engines here described, as applied to international models.



France (left): The Meteore follows orthodox modern design practice. Holland (right): The popular and well-proven 2.5 c.c. Typhoon diesel.

Northern Notes



Officials of the Northern Area in deliberation at a recent committee meeting. Left to right: P. Stringer, secretary; Ron Calvert, chairman; Don Gordon, comp. sec.; Chas. Exley, asst. comp. sec.

★ I HAVE, during the course of a very varied life, been a member of various clubs and associations, societies and sects, ranging from the Band of Hope to the Society for the Protection and Care of Indigent Chorus Girls; but never have I known a society with so many members apparently intent upon the destruction of their association as the Society of Model Aeronautical Engineers. The latest idea of these types is the sabotage of the earnest (and shall I say painful) efforts to put the financial affairs upon a really firm basis, and whilst they sit with their tongue in their cheeks, ostensibly applauding the recent affiliation fee increase, in reality they are working out, by every subversive method they can devise, ways and means of avoiding the payment of these necessary fees by as many of their fellow club members as possible. If they are allowed to get away with it, organised model flying in this country will cease to exist. Thank Heavens, there are still some people left with at least a little common sense, people who realise that their efforts, which are directed to the building up of a strong society, will eventually bring to them untold benefits and all the advantages of a strong and healthy organisation.

★ AT LEAST one club in the North has worked out an idea for placing affiliation upon an individual basis; to my mind, the only way in which every flier can be relied upon to pay his whack. The idea, which was mulled over by the Northern Area Committee, and put forward to the council is briefly: the affiliation period shall begin just before the start of the comp season; each club shall declare and pay the fee for all the members then on the books, receiving the same number of affiliation cards which are filled in with the holders' names; members joining after the commencement of the affiliation year pay a proportionate fee for their card. Thus every club member pays either a year's, or part year's fee, every affiliated member can produce his card, and best of all, it catches the bloke who joins a club only for the

comp season, and who never figures upon the list of members affiliated by the said club. I would go one further than this, and suggest that at area meetings, where presumably competitors would be asked to produce their cards, that someone be stationed at the entrance gates of the 'drome with powers to restrict entry to card holders only. I am sure that the 'drome authorities would be only too willing to co-operate since present airfield agreements are between the appropriate Ministry and society members only.

★ A FAT lot of interest a good many clubs took in the recent Competition Questionnaire seemingly, since your council is constantly being requested to effect alterations to the already fixed competition programme. One such request brought up recently was the scrubbing of all de-centralised events and since this was a matter which could have been decided by the almost ignored postal ballot, quite wisely it has been left until the next comp questionnaire. Now I see the dear old London Area has again popped up with the suggestion that the three minute rule introduced this season, be altered back to five minutes. "Ye Gods and little tow-lines," not so long ago they were all crying "keep 'em in the airfield," and now, before one single solitary flight has been made they want to be back as they were. Their council delegate must have the patience of Job and a manner more diplomatic than Tony.

★ A WELCOME addition to the Northern Area is the Redcar Club, who will strengthen up the membership of the north-eastern corner of the Broad Acres. I hear tell that, although small, they are more than keen, and already arrangements are being made for some three-cornered meetings and contests between them and their near neighbours, Stockton and Darlington. Fliers in the vicinity who may be interested should contact Chas. Skinner of the Redcar Model Shop for more details. I

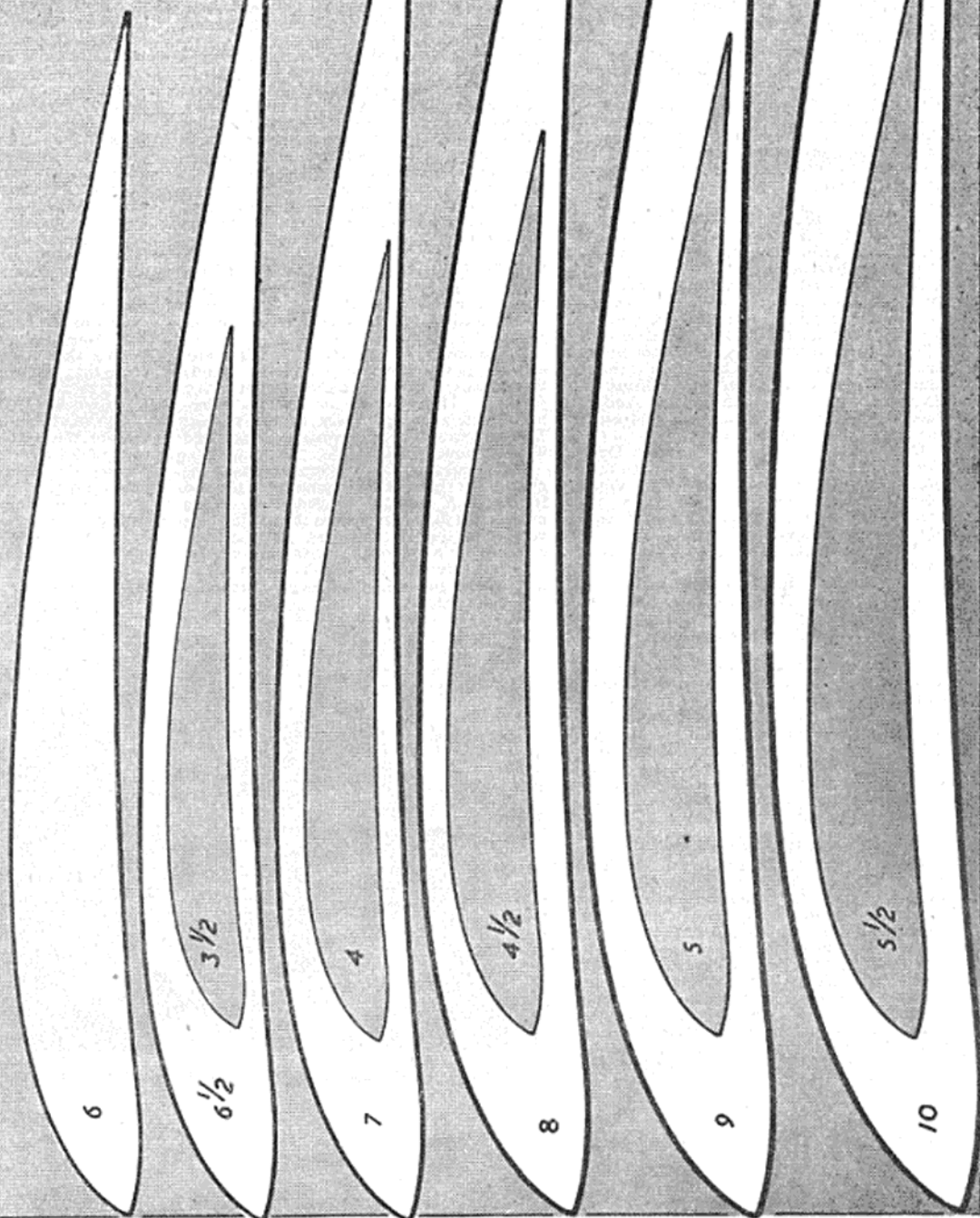
hear too that the secretaryship of the North Eastern Area has passed into the (willing or otherwise) hands of R. F. Sanderson of 2, Tumulus Ave., Newcastle on Tyne, 6. Again, interested parties in the North East should contact Sandy for details of area meets, bun-fights, beer-ups and what-have-you.

★ FROM THE North West comes the news that the new rules, although generally welcome, mean nothing at all if the major comps of the year are to be run under a five minute maximum; it merely puts a premium on thermal grabbing. Again, the splitting up of the Team Trials into a two-separate-weekend affair is none too popular (I thought this would cause a rumpus somewhere) on the very logical grounds of expense. The council's fears that three-hundred entries could not be coped with in one day are a little out of date in light of the enormous number of competitors handled at Sherburn, Woodford, Langley and the like; seems like a short course in the organisation department is badly needed somewhere. A point in this connection was well put at a recent N.A. meeting when it was said that the society always passes over an immense number of really skilled fliers, and gives out privileged jobs to an army of dead-heads, photographers and the like. It is quite true that there are quite a number who spend most of their spare time helping to run the affairs of the society, but when a big do comes off they are shoved behind the ropes with two or three thousand others, whilst the flying area is littered with officious types and their friends, who only come from under the stones when there is any glory to be found. The N.A. are so sore upon this point that they have asked that all stewards, timekeepers and such like for the International meeting at August, be recruited from experts in the various areas, and already at least twelve blokes with some idea have volunteered to pay their own exes to do such a job.

ISACSON 53009

There are a whole range of Isacson zerofoil sections, many of which have been widely used by Scandinavian modellers. The one we have chosen is on the thick side, allowing ample spar depth to be incorporated and being well suited to medium size models of around F.A.I. wing loading. It should be suitable for duration models of all types—rubber, glider and power. The nose radius can actually be more rounded than shown, if preferred. The nominal nose radius is 0.8 per cent. chord, but the use of a more pointed nose often has beneficial effects on the stall characteristics of a model aerofoil.

STATION	0	2.5	5	10	20	30	40	50	60	70	80	90	100
UPPER	0	3.4	5.1	7.3	9.0	9.6	9.2	8.5	7.2	5.8	4.1	2.2	0.2
LOWER	0	-1.6	-1.8	-1.6	.1	.6	.7	.7	.7	.6	.2	.1	0



NEWS

From the S.M.A.E. and the CLUBS

SOUTH-EASTERN AREA

This must, of necessity, be brief as the season has as yet not got into its stride. First I must make it known that the proposed venue for our area competitions is at present under water and it would be unkind in the extreme to pursue the farmer in question as to the possibility of using his ground; he is by nature a very co-operative man in normal circumstances!

The area competition secretary is at present trying to obtain alternative accommodation and all clubs will be notified as soon as arrangements are in hand, meanwhile it is hoped that all members will bear with the area executive and continue to pursue their building programme, etc., to enable the meetings to proceed with the best co-operative spirit.

WEST OF SCOTLAND AREA

The West of Scotland A.G.M. was held on January 18th, 1953, in the S.A.S. Club-rooms, Auchenhavie.

John MacArthur (S.A.S.) is chairman again for this year but he has also agreed to be minute secretary at some meetings to help out secretary Bill Jardine (Kilmarnock). Bill has been secretary since the Area began and I don't think we could have done without him. Bill, however, is finding it difficult to do two jobs at once—run an area, and a garden. He had a hint from his wife when she bought him a greenhouse.

Due to health reasons treasurer Dave Forrester (S.A.S.) has to pack up. We take time here to thank him for past work done. Some clubs still owe him monies but off-hand he says we have about £45 in balance—not bad for a two year old Area.

Danny Mitchell, of Prestwick, is taking over from Dave.

The members agreed unanimously that comp. secretary Bill Meehan (Glasgow M.A.C.) had got to remain for another season. He has done too much good work to let him go.

He has got some fantastic method for deciding the champion club by percentage of entries, total times and—oh, I don't understand it. Anyway, by his calculations, Barnstormers are champions for last year.

Bill said our competition entries are increasing and hoped our entries and times would improve this year. We have a U.K. Challenge match to win, and possibly the Area championships.

NORTH WESTERN AREA

The 160 entrants of the North Western Area experienced in full a real Winter Rally on February 8th. Early indications of light snow gave way to a heavy snow storm in the second and third rounds. Despite this there was a queue in evidence waiting to fly all day, totalling 79 in the F/F classes.

First round flights were considered to be an accurate estimate of performance, dynamic soaring, or slight lift, contributing to the only 3 min. maximum made by Mike Thomas flying his stick type Nordic. It should be noted that 200 ft. lines were used in this contest, and therefore a fair estimate of

performance would be 1 min. 50 sec. to 2 min. 26 sec. based upon present day glider performance. Very few competitors produced new designs, the majority flying well tried favourites, e.g., *Quickie*, *Maurauder*, although the trend to smaller tailplane area was noted. Tom Smith (Blackpool) flew a large lightweight with phenomenal glide, and Mr. Gosling his *Arctic Tern* in perfect surroundings.

Rubber presented the main interest; here it was noted that a consistent performance of over 2 min. is possible. H. O'Donnell flew a well-tried Wakefield fitted with feathering prop. Brother John with similar machine and single bladed featherer, claims a consistent 2 min. 40 sec. He was unfortunate to break a motor. The difficulty of processing was overcome by enforcing a "spot check," this worked very well and there seems to be no evidence of any underhand work.

SOUTH BRISTOL MODEL AERO CLUB

First report is that of the Western Area rally. The South Bristol M.A.C. did very well indeed in this rally held on our home ground "Ladgate Bottom."

In the power, Johnny Down was first with an own designed pylon job (1.49). Andy Wilson was second in the glider event with a *Quickie*. Harry Middleton made a comeback with a second place in the rubber. The most exciting event as many expected was the team race Class A.

In the final were four starters; all got off the ground but that was the beginning of the end for two. A mass of tangled lines, falling models and flying timber was the result of the very first lap! However, two models emerged by a miracle. It was however, a very fast race after all, with T. Smith taking first place and M. Chittenden coming a very close second.

BLACKPOOL AND FYLDE M.A.S.

Competition flying started early for the Society this year at the N.W. Area Winter Rally held at Tilstock on February 8th. On arrival we found that snow was falling and that visibility was very poor. It was evident that models were sinking very quickly or else going o.o.s. in about 1 min. 30 sec. As the day wore on a stiff breeze sprung up and times dropped considerably. By this time most people had stopped flying due to models going off trim unaccountably. Mike Thomas returned a time of 4 min. 51 sec. in the glider event which was very creditable for the conditions.

Recently the Society participated in a successful hobbies exhibition. Although the space allotted was rather small it was found possible to put in it a large number of models, including two 8 ft. span models one of which was an R/C *Falcon* and a beautiful range of solids by S. Newton. After many years of trying we now have obtained a room for club meetings. It has been generously loaned by the Blackpool and Fylde Gliding Club and meetings will be held on alternate Mondays starting on Monday, February 9th. Anyone who is interested is welcome to attend.

WORKSHOP AEROMODELLERS

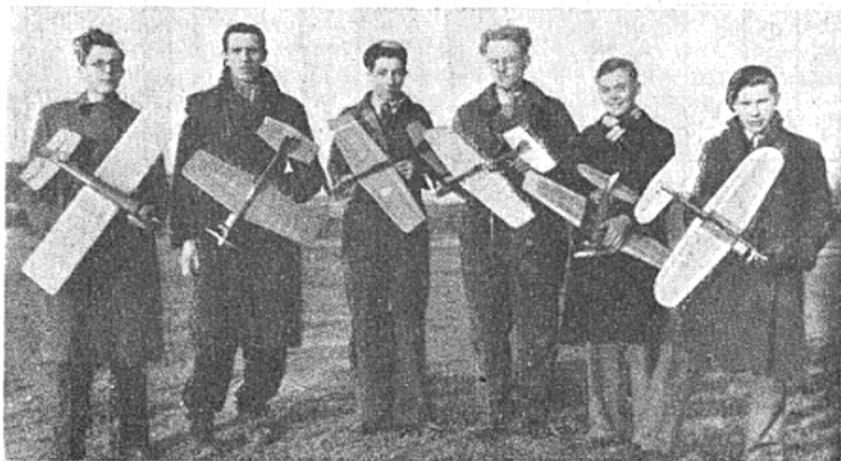
The club is holding a general exhibition on March 28th and 29th, in the Congregational Hall, Bridge Street, Workshop. All types of models will be on show, and modellers living within a reasonable distance will find it worth their while to get to it.

Combat flying is the craze at the moment, Frog 150s being standardised for this purpose. Inevitably, the bright boys have got to work, and each week sees a slight gain in speed. It has been definitely established that speed is more important than manoeuvrability in combat. The more proficient have got to the stage where they can chase each other around loops, waiting for the other to give way—takes some doing, the lines cross with each loop and it takes some cool thinking to avoid a tangle! Inverted flight comes in too, and it is quite a sight to see Pete Russell scraping his fin on the deck, hoping that Alfie Brammer won't dare to come that low to get at his streamer!

WAVERTREE M.F.C.

This has been one of the most busy winter seasons this club has had, what with team race rallies and inter club contests between Merseyside clubs we have had plenty of practice ready for the coming official contest programme. This has already paid dividends, when at the North West Area Winter Rally, John Stanley won the glider event in what can only be described as an Arctic blizzard.

As gliders are now the most popular models, the club is holding a junior A2 contest every three months with a trophy



A group of members of the Workshop Club with their combat models.

each time. If your club is having trouble getting the younger members out on the flying field of a Sunday, get them started on A/2s.

Team racing men in the club have been busy lately in designing new models, Syd Rymill now has one down to 14 in. wide and weighing 11 oz. with a 2.46 E.D. and as most people will tell you who attended the winter rally "it moves."

CHEADLE & D.M.A.S.

The club attended the N.W. Winter Rally in some force on February 8th, but the effective number of fliers dropped to around six as a result of the blizzard—snow and windy conditions, with poor visibility. The only place obtained went to Charlie Gardiner with a second in power. His stick pylon lightweight (Elfin 149) flew well on a "safe" 7-ish sec. power run, reaching upper visibility limit. We noted that one prominent N.W. flier—of another club—went o.o.s. upwards inside the power allowance! Guess who? Brian Faulkner apparently placed fourth in glider, the top Nordic place, with the top three placers being other clubs' big jobs, with the advantage of better visibility.

The club's approach to the F.A.I./S.M.A.E. mixup reached panic level on the Sunday with the publication of the new comp. programme. Many sober vows "to give rubber—and especially Wakefields—a rest" went for a Burton with the Farrow Shield so early in the season. As, last year, the only four available rubber men managed a 30 min. aggregate to place sixth in the final results, a fair number of our usual "yard-bird" (36 in. span) lightweights—with the trend towards longer runs—are being rushed off.

A competition will be run over the course of the year between the top four "civvy boys" and the top four R.A.F. lads (we now have six), top six aggregates per man to count.

SOLIHULL CLUB NEWS

During the winter months, Mitchell Bishop's new 1.49 pylon job has been thoroughly tested and really has the fastest climb seen for some time. Maurice Hanson who has built one of these has had great



Ron Calvert, chairman of the Northern Area, presenting the trophy for the club Rubber Champion to Bert Wheeler, Hon. Sec. of the Huddersfield M.A.C.

★
"A REPORT
indeed — all
they want is a
four-line
SYNOPSIS!"
★



success and the model is to be put forward as a standard club design. Before the comps. start the majority of the club should have a replica. A new junior who has joined our ranks, is showing promise with the club A2 and consistently puts up good flights. We have been fortunate in having one or two rather fine Sundays and full use was made of the good conditions. George Fulwell is at present testing a diamond fuselage pylon job with a very thin airfoil of his own design and gives a good account of itself. On the glider side, J. Rogers is modifying last year's A2 and has a fine straight dihedral job which seems to be well suited to "dead air" conditions. Reg Averill brought out his "old faithful" which still goes well and he talks of using the same design for this year but having a higher aspect ratio. The club would like to request any organisers of rallies, etc., to let us know in good time as last year we did not attend all comps. through lack of knowing when and where they were to be held. So please let us know!

BRENTWOOD AND DISTRICT M.E.S.

The aeromodelling section is now going great guns and they have a very full programme for 1953. A R/C glider is being built as a club effort, and the following programme has been arranged for the next few months:—

March 27th. Round the pole competition.
April 10th. Hints and tips.
April 24th. Quiz.

A large outdoor flying programme is also being arranged for the summer months. We have our own club room at "Primrose Hill" Brentwood, and aeromodelling nights are every Friday at 8 p.m. New members are welcome and details can be obtained from the Hon. Secretary at 8, Elmway, Westwood Avenue, Brentwood, Essex.

BRADFORD M.A.C.

Following universal custom at this time of year, members of the Bradford M.A.C. are busy developing and building new models for the coming season. In the power field, there is little to suggest that any great change is likely, as the *San-de-Hogan* design seems to have been adopted as the club's standard model, following its successes last year; but Arthur Collinson has produced a scaled-down edition, built to F.A.I. specification and powered by an Elfin 2.49 modified to radial mounting. Silvio has also built one, and first tests have proved very satisfactory—though I understand he has since written it off!

Ron Calvert is working on a new glider, and if this is better than the one he flew last season, it will be very good indeed; whilst Mr. Miller, senior, is busy with a "hush-hush" Wakefield conforming to the recently

announced new rules. This latter embodies a diamond fuselage of novel construction and geodetic flying surfaces to maintain strength with the minimum of weight.

In conclusion, it must be admitted that that die-hard Wakefield exponent, Norman Lees himself, has been seen recently flying a power model again, powered by an Arden .099. I believe he looks round furtively to see if anybody is watching before unloading it from the car!

WEST YORKS M.A.S.

When you hear someone screaming for contests without rules, ignore him! We've had some! This year we decided the fewer rules the better for our club contest. Chaos! So, finally we drew up a set of rules and everything ran smoothly. Geoff (It's another boy!) Illingworth beat all the Nordics with his power entry whilst Brian Farrance won the junior cup with his club Nordic. How the Ferrance's sort out their Nordics beats me, but they seem to do it. On the whole the club has had a good year with a place in the Nordic team, a couple of national trophies and the Northern Area K.O. Cup to quote a few. All this when the A.G.M. reveals that in a couple of years we should be a minus quantity if membership keeps falling at this rate.

From time to time we hear of the benefits obtained in the way of flying grounds, by convincing the public that ours is a good and useful hobby, but so long as the modellers of this district continue to "freelance" we are handicapped. By joining a club you obtain benefits of representation both with the S.M.A.E. and outside bodies. You will also get to all the contests you read about but rarely, if ever, visit. Subs have had to be raised because of the increase in S.M.A.E. affiliation fees, but even so few clubs have such a low rate at 5s. per quarter for seniors, and 2s. 6d. for juniors. If you cannot afford the 6s. or so it usually costs to visit the contest the treasurer will even take it at a 1s. a week! So what are you all waiting for? Meetings held at Victoria Central School, Dewsbury (near the baths) on alternate Tuesday evenings. Date of next one can be obtained at the Model Shop, Daisy Hill.

The new committee join all members in wishing modellers everywhere a good season's flying. We'll be seeing you.

CHESTER M.F.C.

The annual dinner and prizegiving held on January 31st was a most enjoyable function attended by 69 members and friends. (How nice to see the chaps dressed up once in a while.)

Among those present were Mr. R. F. L. Gosling, Mr. and Mrs. J. G. Efflaender, Mr. and Mrs. Platt (North Wirral) and P.

Ridgeway, who journeyed from South Wales for the occasion.

Mrs. R. W. Milton presented the trophies for the past season's competitions and thanks to our President (Mr. R. W. Milton) each received an S.M.A.E. tie.

C. Filtness: Dowry Championship Cup, Chidley Cup (Wakefield) and Reynolds Trophy Class B.T.R.

M. Heath: Junior Championship, Junior Glider Cup.

K. Modern: Glider Chalice.

F. Wilde: Parbo Cup (open rubber).

W. Dawson: Jarvis' Cup (r.t.p.).

J. William: Milton Trophy (C/L stunt).

F. Dodd: Hammond Power Cup.

A. Knight: Junior Rubber.

Mrs. M. Filtness, Ladies Trophy.

A ventriloquist and a conjurer provided entertainment at intervals during dancing.

CHINGFORD M.F.C.

Fairlop has been visited every weekend the weather has been favourable. Scale twin-engined jobs have made their bow, there are two on the drawing board. One is a 40 in. Tiger powered by two Frog 500s, the model is going to be a super detailed speed model. The other is a 45 in. Miles Gemini with two Elfin 2.49s. We are hoping to stunt this.

A lot of interest is being shown in a pusher-canard which was aired at Fairlop recently. It was not very successful, but the idea is being developed and this prototype is being modified. A brand new Fox 35 has been acquired by one of the lads so we hope to see a really hot stunt model before long take off on its first lap. "A" team racers are still top of the popularity poll with stunt C/L types a close second. No type of model is left on the shelf, there being a sprinkling of interested boys for all types. Now the contest season is here the club is hoping to enter more contests and get in print more often.

BARNESLEY & DISTRICT M.A.C.

The club has recently decided to follow the example of the Huddersfield Club, and scrap all existing club records, new ones to remain in existence over a period of five years. This was a much-needed reform, as many of the records had been set up by persons who are no longer members of the club. Also, records are being introduced to cover the team racing enthusiasts in the club.

The members decided to hold some of the club events during the winter, when the weather is more favourable for flying! Two of these have now been held, first a scramble, in which each entrant was allowed 30 min. in which to get as much flying time as possible. This produced some fine cross-country work, with much bellows-to-mend amongst the more elderly competitors, the eventual winner being J. Wharam, with

7 min. 10 sec., a fine effort. More recently the Class "A" team-race was flown in a snowstorm, producing nine entrants, and the setting up of the first club team race record by the ultimate winner W. Lavery, with a speed of 46.5 m.p.h. over the five miles, and 52.5 m.p.h. in the final.

WINCHESTER M.A.S.

Sailplane contest on January 18th. We tried out the 150 ft. tow line for this event and it proved to be good. It was a very windy day and apart from anything else the short line limited the distance covered and saved our legs. Flights of almost 2 min. were frequent and something over 3 min. should be possible in decent conditions (without thermals). As usual in these competitions the same three were out in front scrapping: a bad flight each from Ray Lewis and Bill Childs enabled Peter Ivory to get away with it. Times were pretty close and with a little more consistency the result would have been in doubt right up to the finish.

Small model night on February 4th. Another crazy night this, enjoyed by all. To describe it is impossible except to say that the air was full of models, noise and bobs roaring up and down. Ray Lewis' Meteor 8 was perhaps the best model there with Ken Andrew's Javelin close up. I wonder if Glosters know how well a Javelin will fly—upside down? The balloon bursting session was both funny and dangerous, particularly the attempts at the F/F balloons. The competition secretary thinks he should have a model for starting that off. Talk about a dart league!—which reminds me that I should have removed the pin from the nose of my Meteor before giving it to the small boy from next door, oh dear! Derek Aslett and Len Nicholson seemed to be taking some fair sized risks in doing the judging.

CHINGFORD M.F.C.

Indoor r.t.p. speed Jetex has made an appearance with everything from "50" to "350" jobs rotating on 10 ft. lines. Cover is always taken with this type of flying, especially since the "350" motor came adrift at the beginning of a flight and chased everybody round the hall!

A film show of club activities was shown at a club night and a great time was had by the audience in recalling the attempts of our pet R/C man making controlled flights.

GRAVESEND AEROMODELLING CLUB

Suffering from the old club complaint of loss of ground, activities during the past few months have been centered around team racing with the boys keeping well up to the mark in both A and B with the 1953 contests in view.

We continued to run our very successful team race league during the winter 1952, and

much experience has been gained whilst adding another attraction in the prize list. These leagues, a 1953 one has recently been started, adhere strictly to the S.M.A.E. rules, the most popular motors being E.D. 2.46 and an occasional Elfin 2.49. With this winter experience the 1953 contest season is eagerly awaited.

F/F is mostly confined to power ratio and glider work, although at the Blackheath Gala they were harassed by winch trouble, which resulted in the use of 100-ft. line which was just no good.

Alec Holland has had a good 1952 season winning the Gluck Trophy for general proficiency: the Bailey Trophy for the longest official time of 1952; the C/L speed shield, the C/L stunt and most team race events. The remaining events went to Colin Turk who won the power ratio, M. Tolhurst the glider contest and Don Sargent the power precision shield.

HUDDERSFIELD D.M.A.C.

The Concours d'Elegance held by the Huddersfield D.M.A.C. on January 17th was a huge success. Parents and friends were invited and a pleasant evening was had by all.

The standard of workmanship was extremely high, and Messrs. R. Calvert and T. London had some difficulty in deciding which were the best models. However, the final results were:

Senior: J. S. Gay with a blue Prestwick Pioneer.

Junior: G. Ellis with a very nice Tiger Moth, which would not have looked out of place in the senior section.

Several Jetex 50 speed jobs are being flown and although the maximum speed so far attained is only in the region of 55 m.p.h. this is much too fast for accurate hand timing. One 2.00 powered job has flown but the speed is still on the secret list. (We can't count fast enough!) However, after seeing it fly, several members have increased their life insurance!

LOUGHBOROUGH COLLEGE M.A.C.

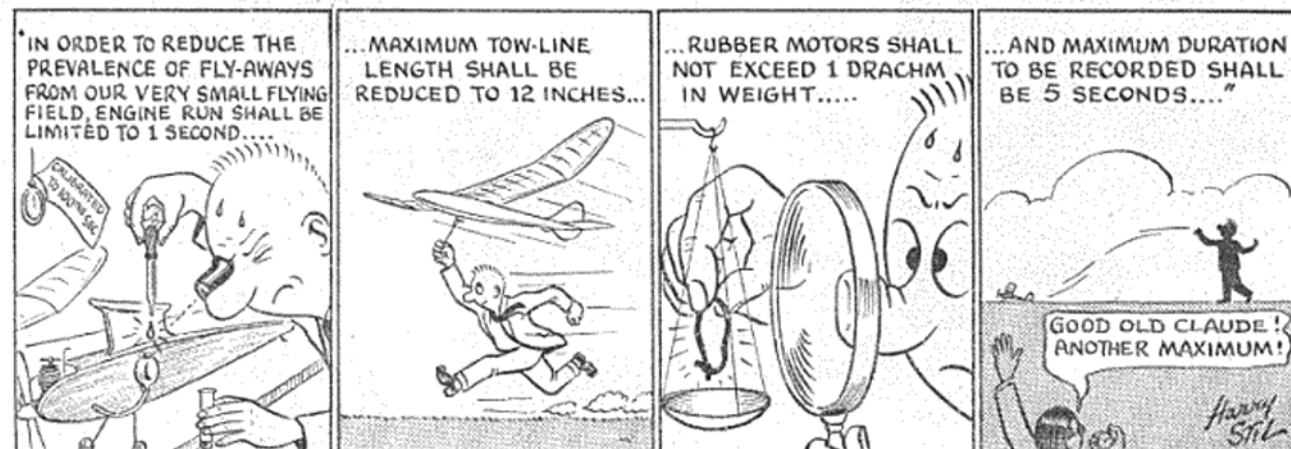
The club has been strengthened this year by the addition of several contest minded members. Building and flying has gone on continually throughout the winter months and a variety of new designs have appeared. The main interest has been centred on the production of still air A2s, and good results have been obtained with Czepa-type stick models. Max Byrd has made a successful balsa tube fuselage using a broomstick as a former.

Since Stan Wade left for the R.A.F. Dave Sugden has been our only Wakefield enthusiast, and his normal length fuselage models have been flying very consistently.

A competition was held recently to try out the proposed new rules. A 50 metre line for gliders and 10 sec. engine run for power

CLUELESS CLUB RULES, 1953

By Harry Stil



were allowed and a 3 min. maximum was imposed. The winner was Max Byrd with a total of 7 min. 03 sec. for three flights, including one maximum. The flying was remarkably consistent the average of the 15 flights made being exactly 2 min. although several flights were dethermalised short of the maximum.

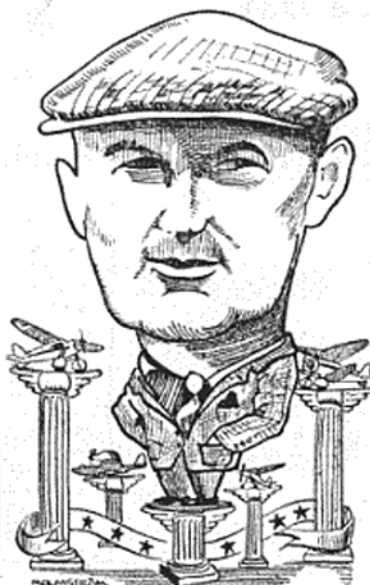
A Myford lathe is now in use in our clubroom and several members are making their own engines and carrying out modifications on existing models.

FORESTERS (NOTTINGHAM) M.F.C.

The Foresters recently elected Messrs. Trapp, Ward, and Hibbs on to a social committee; its chief function being organisation of the annual dinner and dance. They are also arranging fortnightly socials at the Eagle Flying Clubhouse, Tollerton.

Geoff Pike has at last finished his super R/C job using his patented actuator to work independent proportional rudder, steerable tailwheel and engine control. This is all worked with a little joy-stick on the transmitter. The model is 8 ft. span, 13 lb. orthodox shoulder-wing design based on his *Shrimp*. The power has naturally had to be increased however, and instead of the *Shrimp's* Kemp 2 c.c., an Anderson Spitfire is prominent with its two speed contact breaker. The first flight was most impressive; the model was taxied along the peri-track, the throttle opened, and away roared the *Skyflirt* on its maiden flight. After a few circuits, it was landed back along the runway and taxied up to Geoff standing at the transmitter. It was the nearest thing to full-size yet witnessed, and promises great things.

AEROBODS OF NOTE



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Chelmsford M.A.C. E. G. W. SUMMERFIELD, "Elmdene," Joe's Lane, Downham, near Billericay, Essex.

West Yorks M.A.S. C. WESTERBY, 7, Trinity Place, Ashworth Road, Dewsbury, Yorks.

Inverness & Dist. S.M.E. C. J. CRESSWELL, 43, St. Valery Avenue, Inverness.

Whitefield M.A.C. J. O'DONNELL, 2, Park Road, Pendleton, Salford 6, Lancs.

S. Birmingham M.F.C. V. GEORGE, 61, Masshouse Lane, Kings Norton, Birmingham.

Hastings Dist. Aeromodellers. E. TAYLOR, Gas House Cottages, Catsfield, Battle, Sussex.

Blackheath M.F.C. K. CHURCHILL, 9, Dairsie Road, Eltham, London, S.E.9.

Hull Pegasus M.F.C. G. R. GOODING, 112, James Reckitt Avenue, Garden Village, Hull, E. Yorks.

West Middlesex M.F.C. J. C. PLANK, 38, Chandos Avenue, Ealing, London, W.5.

Cambridge M.A.C. P. HOSKISON, 4, Hale Street, Cambridge.

Kingston & Dist. M.A.C. (formerly Thames Valley M.A.C.) P. T. TAYLOR, 31, Eastbury Road, Kingston-on-Thames, Surrey.

Southdown Aeromodellers. W. SLAUGHTER, 14, Church Road, Burgess Hill, Sussex.

Southampton M.A.C. B. G. PIERCE, 104, Shaftsbury Avenue, Portswood, Southampton.

New Milton M.A.C. F. W. C. SIVIER, 1, New Inn Cottages, Batmansley, near Lymington, Hants.



CONTEST CALENDAR

Mar. 22nd	Area. S.M.A.E. CUP. Int. A2 Eliminator. *FARROW SHIELD. Team Rubber. *WOMEN'S CUP. Unr. Rubber and Glider. "FLIGHT" CUP. Unr. Rubber. Decentralised.	Aug. 2nd	WORLD CHAMPIONSHIPS. Cranfield, Beds.
April 5th	HAMLEY TROPHY. Unr. Power. Decentralised.	" 3rd	WAKEFIELD CUP. F.N.A. CUP. POWER CHAMPIONSHIPS.
" 19th	Area. *WESTON CUP. Wakefield Eliminator. *ASTRAL TROPHY. Int. Power Eliminator.	" 15th	WORLD C/L CHAMPIONSHIPS. Speed/ Stunt. Trento, Italy.
May 3rd	Centralised. INT. A2 TRIALS. "AEROMODELLER" R/C TROPHY.	" 21st-23rd	WORLD A2 GLIDER CHAMPS. Yugoslavia. Radlett, Herts.
" 10th	Decentralised. LADY SHELLEY CUP. Tailless Models. JETEX CUP.	" 23rd	All Britain Rally. Int. Jetex Contest.
" 24th	BRITISH NATIONALS. Centralised.	" 30th	Centralised. AREA CHAMPIONSHIPS. Rubber/Glider/ Power.
" 25th	THURSTON CUP. Glider. "MODEL AIRCRAFT" TROPHY. Unr. Rubber. "GOLD" TROPHY. C/L Stunt. SPEED TROPHY. C/L Speed. S.M.A.E. TROPHY. Radio Control. SIR JOHN SHELLEY CUP. Unr. Power. TEAM RACE TROPHY. Class A and B. PAA-LOAD TROPHY.	Sept. 5th-6th	IRISH NATIONALS, Dublin.
June 7th	Centralised. WAKEFIELD TRIALS. POWER TRIALS.	" 6th	YORKSHIRE EVENING NEWS Rally. Sherburn. Int. R/C Contest. Glider/Power. Brussels.
" 21st	Decentralised. KEIL TROPHY. Unr. Power. FROG JUNIOR CUP. Unr. Rubber/Glider.	" 13th	Area. GUTTERIDGE TROPHY. 1954 Wakefield Eliminator.
" 28th	Slope Soaring Contest. Clwyd Hills, North Wales.	" 20th	*"MODEL ENGINEER" CUP. Team Glider.
July 3rd-6th	Int. C/L Stunt and Speed. Knokke, Belgium.	" 27th	International Team Race. Holland.
" 5th	Centralised. SUPER SCALE TROPHY. Scale Power. BOWDEN TROPHY. Precision Power.	Oct. 11th	Area. *K. & M.A.A. Cup. 1954 A2 Eliminator. HALFAX TROPHY. 1954 Power Eliminator.
" 12th	Northern Heights Gala Day. Langley.	" 17th	Ireland. U.K. CHALLENGE MATCH. Rubber/Power/ Glider.
" 19th	Decentralised. C.M.A. CUP. Unr. Glider. FROG SENIOR CUP. 1.5 c.c. Power. Int. Tailless Glider Contest. Bremen, Germany.	" 20th	Madrid, Spain. International Meeting. Glider, Power, C/L.
" 26th	Int. Radio Control Contest. Southend.	" 18th	Centralised. DAVIES TROPHIES. Team Race A and B. RIPMAX TROPHY. Radio Control. C/L SPEED.

S.M.A.E. CONTESTS IN CAPITALS

*Indicates Plugge Cup Events.

THE "MODEL AIRCRAFT" CONTEST CALENDAR will again be featured in our Club News section during the coming season. Now that the S.M.A.E. Contest Programme has been announced we strongly advise clubs who intend to organise rallies to decide upon the dates of these without delay. Early publication of the dates of these events in the Contest Calendar will avoid them clashing with other fixtures.

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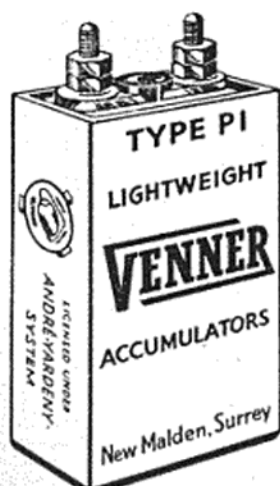
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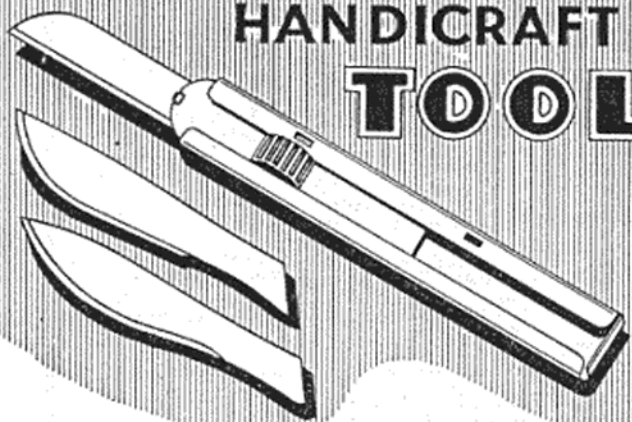
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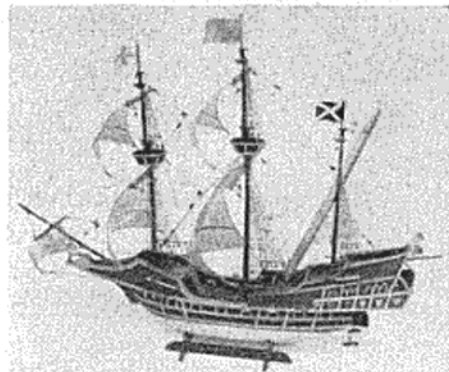


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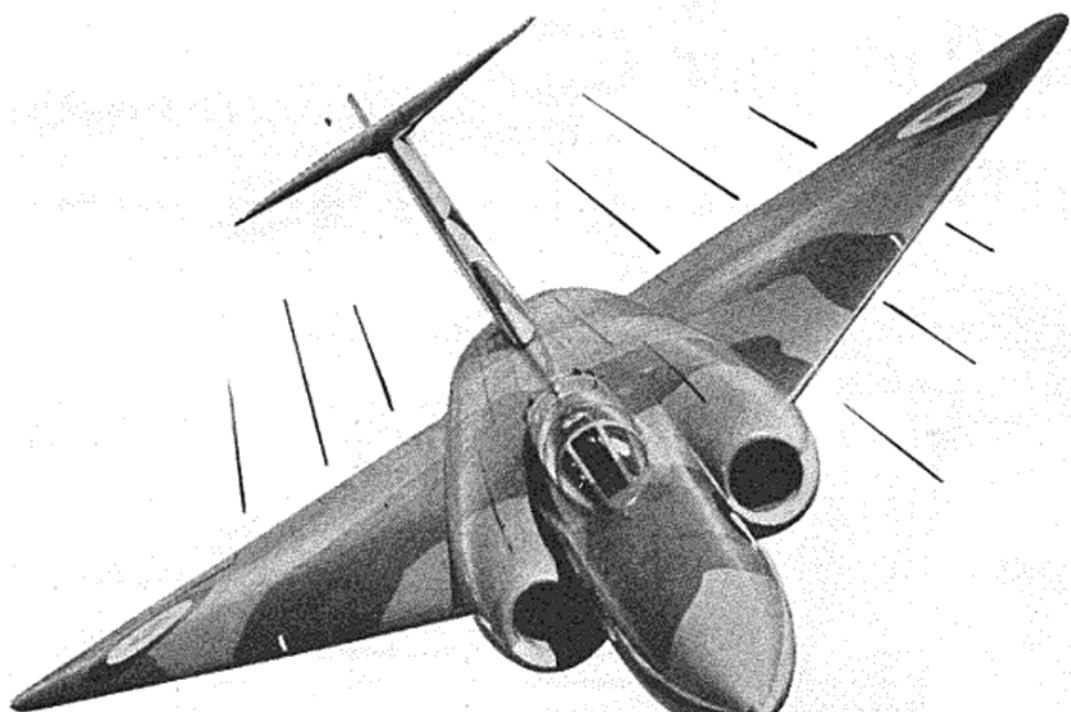
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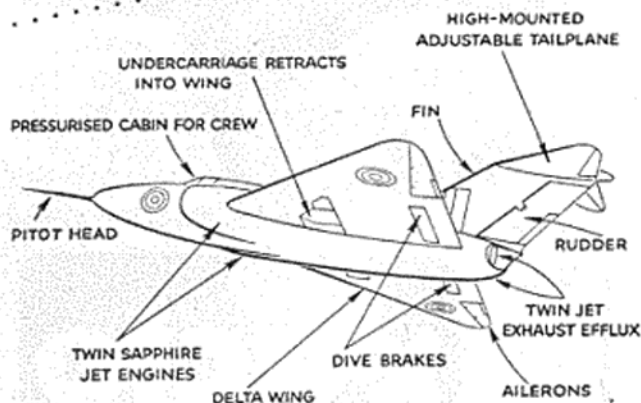
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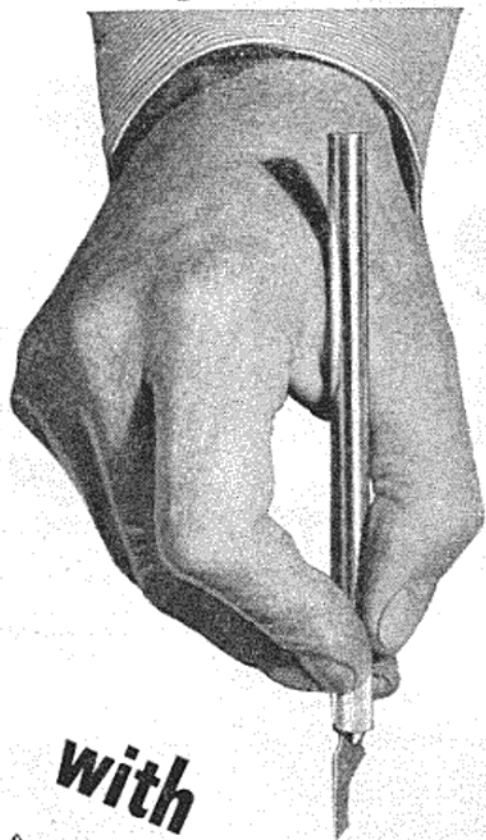
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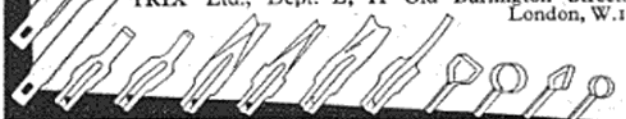
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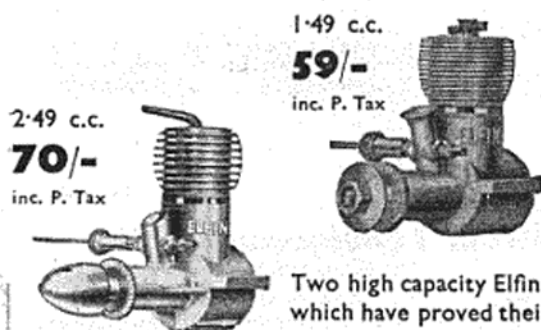
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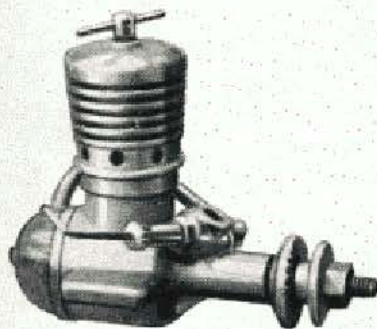
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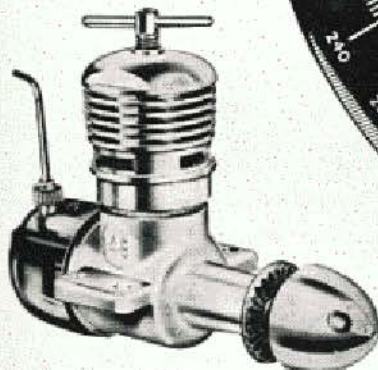


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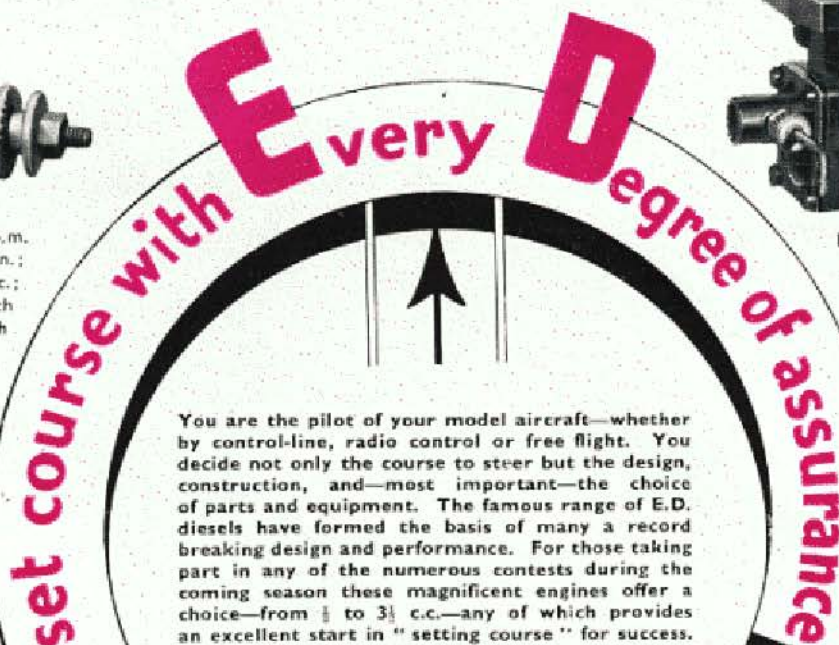


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