AERO MODELLER

XMAS DOUBLE NUMBER VOL 6.—Nº 61

1/6

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Written by a member of The Aero-Modeller staff, this book will be of great assistance to those thousands of aero-modellers who this winter will be constructing solid scale models of military aircraft now in use in the second great war of the twentieth century. There are close on 100 pages in this book, which is illustrated by a considerable number of photographs and over 50 sketches specially drawn by another well-known aero-modeller, C. Rupert Moore, A.R.C.A. In additon, there are 1/72 scale plans, together with full building instructions, for the Supermarine "Spitfire," the Hawker "Hurricane," and the Boulton-Paul "Defiant."
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Airfoils. Airfoils and Fuselages for Monoplanes and Biplanes. Drag. Control Surfaces. Aircraft Performance. Airscrew Design. Airscrew Performance. Rubber Motors. Testing Power-driven Airscrews. Wind-tunnel Testing. Wing Construction. Fuselage Construction. Landing Chassis, Tyres and Wheels. The Mounting of Engines and Accessories. Engine Testing and Tuning. Flying the Model.

The ideal book for the petrol 'plane enthusiast. The book is printed on fine art paper, thread sewn, and is bound in full cloth with stiff covers. Size 8½ in. by 5½ in. Over 250 pages. The dust cover is in full colours.

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THE AERO-MODELLER

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NEWARKE STREET, LEICESTER, ENGLAND

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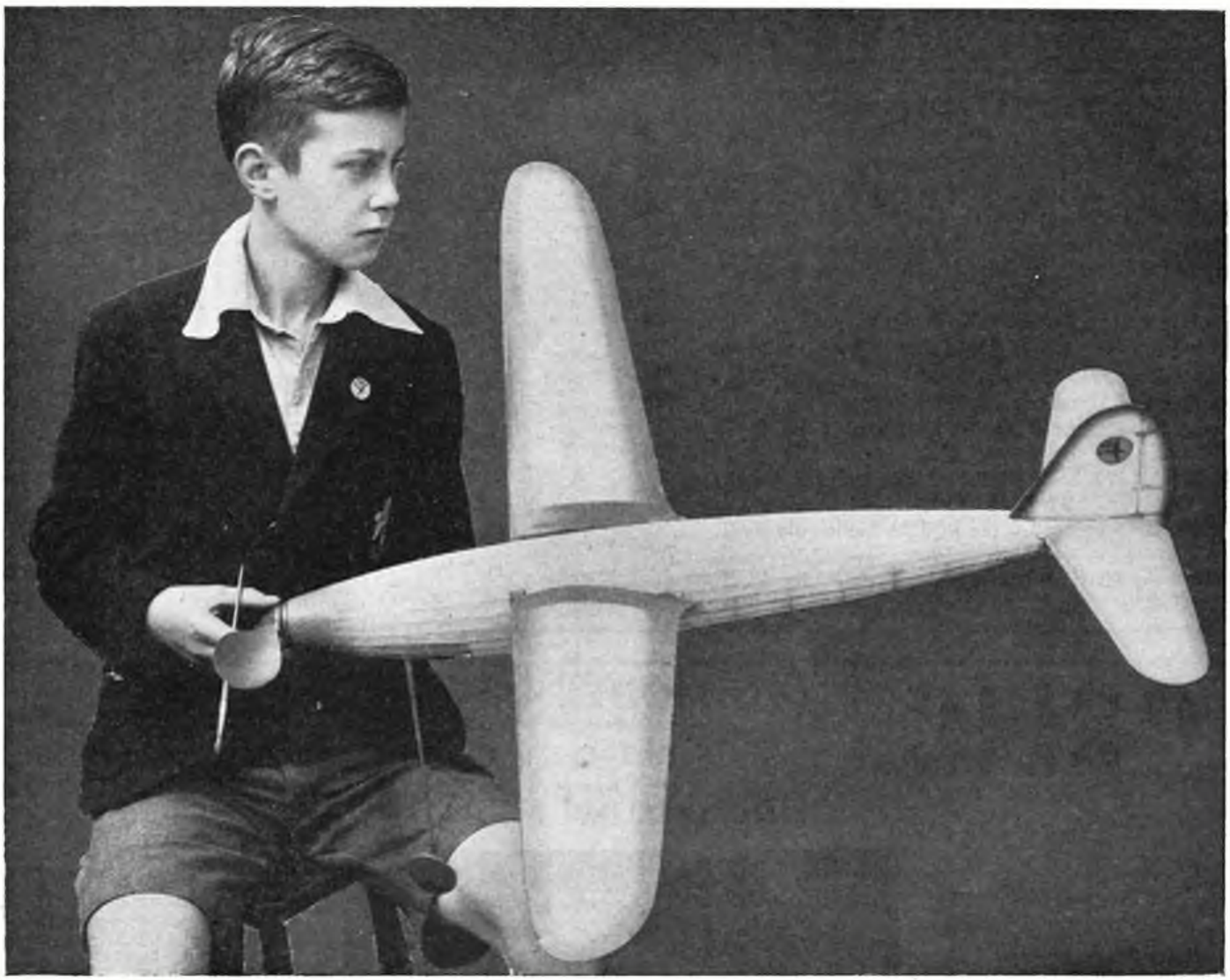
MASTER P. F. PEEKS . . .



. . . Winner of £3 3s. first prize, offered in the competition announced in the May, 1940, issue of THE AERO-MODELLER, *for the best built replica of "Copland's 1940 Wakefield Model," building instructions for which were published in the April issue, and of which a full-size set of plans may be obtained from* THE AERO-MODELLER *offices, price 1/3 each, post free.*

The AERO MODELLER
INCORPORATING "THE MODEL AEROPLANE CONSTRUCTOR"

DECEMBER - 1940
Vol. VI. - No. 61

Tel. Leicester 65322

Editorial

WHEN we wrote the Editorial for the Christmas, 1939, issue of this journal—some eight to ten weeks after war had been declared—we were able to record that "Peace (relatively speaking) was still with us." A whole year has gone by since we wrote those words, and, alas! we cannot now say that "Peace (relatively speaking) is still with us" . . . for many unexpected things have happened . . . the face of most of Europe has been changed. . . Despite these events, it is in no spirit of solemnness that we write this Editorial in the early part of November, 1940. Folk there were who said that our hobby would be killed, due to lack of balsa supplies. . . . Folk there were who said that aero-modelling could not be carried on under war-time conditions . . . we suppose there will always be folk who are pessimists.

True, we have been unable to hold the big international rallies which were becoming such important events in the model aircraft world. Meetings at the Albert Hall have had to be suspended (note how we refuse to use the word "cancelled"), and true, there has been a certain restriction in the supply of balsa, whilst just recently the Air Ministry have instituted a ban on the flying of petrol 'planes and very large model aircraft. For all that has happened, just how much has it affected our hobby? So far as we can judge, very little. We hear of many aero-modellers who have turned their attention to the study of full-size aircraft and the construction of models of them, whilst others have turned to work of a more original and even experimental nature.

Aircraft of the Fighting Powers.

On pages 692-3 we give full particulars of the most ambitious publication yet offered by the Harborough Publishing Company Limited. That it will be an instantaneous success goes without saying, in view of the large sales achieved by Mr Pollitt's "Scale Plans of Military Aircraft"; since the new book far surpasses it. There are eighty-six aircraft described in this book, each with a photograph and full description and history of development; whilst there are forty-one single-page plans, forty double-page plans, and five three-page plans.

We understand from the publishers that copies will be available on December 15th, but that early reservation is advised to ensure delivery straight from the printers as soon as copies are ready.

Xmas Greetings.

Of course, we should have started this Editorial with some such expression as "A Happy Christmas to all our Readers," but somehow our sense of reality has overcome our imagination! Writing this Editorial in the north of London, with the sun shining and our winter pants still in the airing cupboard, we just cannot conjure up a picture of snowy scenes and Christmas trees! However, our cover artist, Mr. Rupert Moore, has risen to the occasion, and we hope that his design will meet with our readers' approval.

Before any of them rush into print and criticise Mr. Moore for depicting a petrol 'plane . . . when the flying of such is now prohibited . . . we would explain that the suggestion, and therefore the responsibility, is ours, and that we especially asked Mr. Moore to give us a really *peace-time* picture for our cover. (We must admit that the packages carried by several of the persons look suspiciously like gas mask cases, but on behalf of Mr. Moore we must claim "artist's licence" and stoutly assert that the family were out for the day and had brought their lunch with them!)

The Price of "The Aero-Modeller."

In the early summer, when we increased the price from 7d. to 8d., we expressed the hope—in fact it was nearly an assurance—that there would be no need for a further increase. But recent developments have compelled us to make a survey of the position.

Firstly, wages in the printing industry have received another increase, and just recently the price of paper has again been raised, and now it is very nearly *double* the pre-war figure.

Secondly, there has been the question of the size of our editorial and office staff.

As we have already stated, the circulation of THE AERO-MODELLER has been steadily increasing during the past year, and it is no exaggeration to say that we now receive ten times as many letters of enquiry as we did a year ago. The result of this is that we have had to consider whether to keep the journal at 8d. and take out a few pages to meet the increase in wages and paper charges, and deal as best we could with the increased number of enquiries; or whether we should increase the price to 9d. and from the increased revenue maintain the journal at practically its pre-war size, and augment our staff to enable us to cope more efficiently with the great increase in letters we receive from readers.

We have decided that the latter course was the correct one . . . that it was best not only to continue our standard but

endeavour to improve on it, feeling that readers would prefer to pay 9d. for the journal and our service as efficient as possible, rather than 8d. and have less satisfactory value for their money. We submit that a study of this present issue will show that there is no shortage of first-class material of interest to readers of all types, and that in fact THE AERO-MODELLER *can* " *deliver the goods.*"

And now for some notes on the contents of this issue: Dr. Forster illustrates his article this month with some photographs of two amazing machines, and asks us to say that he has some more " Tip Top Topics " for the coming year.

In regard to Flt./Lieut. Smith's " Flapper," we are asked to issue a word of warning to those enthusiasts who build replicas. If models are flown *indoors*, dogs and cats should be kept *out-of-doors*, and if the models are flown *out-of-doors*, then dogs and cats should be kept *indoors!*

Incidentally, we can see no reason why a model ornithopter should not be eligible for a " R.T.P." competition . . . or for duration attempts! We shall be interested to hear of the performances readers obtain, and offer a prize of one guinea for the best duration put up by January 31st. Readers should send in their entries on a postcard, stating time, hand launch; this to be signed by two independent witnesses, who must add their names and addresses.

Calling All Cadets.

On pages 703-4 we introduce a new feature by Mr. C. A. Rippon, Fellow of the Society of Model Aeronautical Engineers. We understand that there are some twenty thousand Air Cadets in this country, which one would hardly believe in view of the fact that only Mr. Rippon's squadron, No. 85 (Southgate) entered for the trophy which we offered for competition amongst the squadrons. Automatically, therefore, No. 85 Squadron won the trophy, a photograph of which appears above. It stands twelve inches high and is of solid silver. Mr. Rippon commences his feature by a frank and open letter addressed to all squadron leaders, and to ensure that his letter gets to them we are sending each a complimentary copy of this journal. We feel there is some point in the suggestion that certain squadron leaders regard model aircraft as toys, and therefore have not devoted much attention to the training of the youths in their care.

If this is so, we respectfully draw their attention to a letter which Mr. Rippon has received from Squadron-Leader H. W. Woollett, D.S.C., M.C., who is a high official in the organisation and London Area Controller of the Air Defence Cadet Corps. Squadron-Leader Woollett says: " I am very glad to hear you are going to edit two pages monthly in THE AERO-MODELLER for the benefit of the Air Defence Cadet Corps. Having been a pilot myself for eighteen years, and having always taken a great interest in model aircraft, I can say that what you are about to do for the Corps will be welcome by all Cadets alike, and the work is a wonderful training for the brain, hands and eyes, and it will certainly develop enterprise, resource and patience. Although many squadrons have gone ahead with their training in model-making, **as laid down in the Syllabus of Training for the Corps, some squadrons have not started, which is a great pity, for I consider it a subject which is of paramount importance to Air Cadets. I shall watch your articles monthly, and hope that *all* squadrons will do likewise.**"

We have printed the last part of Squadron-Leader Woollett's letter in bold type, because we wish to emphasise the importance attached by Headquarters to the building of model aircraft as a means of consideration to Air Cadets.

Competition for Replicas of Copland's Wakefield Design.

On page 715 we publish the names and addresses of the prize-winners in the competition we organised for the best-built replicas of Copland's Wakefield design, and on the page facing this Editorial we reproduce a photograph of the winner with his model. An examination of this photograph, and one showing his 'plane before being covered, and an appreciation of the fact that Master Peake is fifteen years old, should convince the most doubting of Thomases (or A.D.C.C. Squadron-Leaders) that model aircraft are anything but toys!

The "Aero-Modeller" Plans Service.

On pages 766-7 we give a full list of the plans available through this " Plans Service." It was introduced some four or five months ago, and the fact that we have already sold over two thousand plans indicates how popular is this feature. To extend further its popularity, we are making a special offer, valid until January 31st, 1941, to accept coupons given free with this issue to the value of 1s. 6d. towards the cost of any plans available. These two coupons are printed at the bottom of the back inside cover of this issue and should be carefully saved until required. The coupon for 6d. may be used when purchasing any plan up to 2s. 6d., and the coupon for 1s. may be used when purchasing any plan above 2s. 6d. The two coupons may together be used when purchasing any plan costing more than 7s. 6d.

Xmas Greetings

. . . and so we conclude this Editorial, true to form, by extending to all readers of THE AERO-MODELLER, no matter their location or nationality, " A Happy Christmas."

D. A. R.

WHERE DID THAT ONE GO TO ————?

By D. A. RUSSELL, A.M.I.Mech.E.

FIRSTLY, let us consider the vexed question: for how long can the whistle of a falling bomb be heard before it hits the ground?

From the time the bomb is dropped from the aircraft it is, of course, creating its whistle; and the essential point to ascertain is: over what distance can this whistle be heard?

Let us consider some statements that have recently been made in the Press:—

1. In an article published in the *Daily Mail* on September 19th last, Sir Ian Frazer made the statement that he heard the whistle of a bomb from the time it left the aircraft until it hit the ground.

During the time the bomb dropped, and its whistle was audible, Sir Ian claims that he was able to leave the entrance to his shelter, awaken his wife, instruct her to put her fingers in her mouth, and then himself return and close the door of his shelter—all before the bomb hit the ground quite near to where he was.

2. On page 365 of the issue of *The Aeroplane* for October 4th, the statement is made that:—

> "If it (a bomb) is dropped from about 17,000 feet there is about 25 seconds warning once it accelerates sufficient to be audible. Those 25 seconds are long enough to allow the listener to throw himself down and cover his head."

3. On page 269 of the October 3rd issue of *Flight*, the statement is made:—

> "It should be remembered that a bomb is not heard at the time of its release, but only during the last five seconds of its fall. So, when the 'plane is right over head the bomb may have completed all except the last five seconds of its fall, and been on its way for 26 to 30 seconds quite silently as far as we on the ground are concerned."

Whilst the first two of these statements are in some agreement the third is obviously a direct contradiction, and so we must endeavour to find out which, if either, is correct, before we proceed any further with our investigation.

Before passing on, however, it may be remarked that the time of 25 seconds quoted by *The Aeroplane* as that taken by a bomb falling from a height of 17,000 feet is an under-estimate.

Referring to Air Raid Precaution Handbook No. 5, issued by H.M. Stationery Office, the time of a fall of a bomb may be calculated from the formula $T = \cdot 25\sqrt{H}$

which T = Time of fall in seconds,

and H = The height of the aircraft at the moment of release in feet.

A simple calculation shows that from a height of 17,000 feet the time of fall is a trifle over 33 seconds, and not 25 seconds, as stated.

Reverting to our investigation as to how far off the whistle of a falling bomb may be heard, we note from *Molesworth's Engineering Formulæ*, 31st edition, published in 1940, that on a still day rifle fire may be heard over a distance of 5,300 yards, and a military band 5,200 yards; as near as anything a distance of three miles.

It may be a matter for some argument as to whether the whistle of a falling bomb *is* louder than that of a military band, but my own view is that it is *not*. My own experience, based on listening to at least 100 bombs falling as near as within a radius of a mile of my residence, and many more falling further away (some so far that their whistles "just died away"); is that the maximum time during which one can hear the whistle of a falling bomb, is some 9 to 10 seconds; and as I will show later, a time exceeding 5 seconds will only occur when the bomb passes over the hearer and falls a considerable distance away.

I consider that the statement made by the writer in *Flight* —"that the sound of a falling bomb can be heard only during the last 5 seconds of its fall," is pretty accurate; and that, generally speaking, the bomb then falls within about half-mile of the hearer.

It would seem, therefore, that the claim made by Sir Ian Frazer, and the statement made in the *Aeroplane*, are not borne out by established facts or experience.

Now it is commonly known that the maximum height that the standard barrage balloons are flown is some 6,000 feet. We may fairly assume, therefore, that the German aircraft have had no need to fly above a height of 10,000 feet.

Referring again to A.R.P. Handbook No. 5, 1st edition, it may be noted in Chapter I that, from a height of release of 10,000 feet, the striking velocity of a bomb is given as 800 feet per second, or 550 miles per hour.

At this speed it is nearing its terminal velocity, and we may fairly assume, therefore, that during the time the whistle of a bomb is within earshot (5 seconds) prior to its hitting the ground, its speed is pretty constant at this figure.

At a speed of 550 miles per hour we may calculate that during the last 5 seconds of its fall a bomb travels ·76 mile.

Now, since the sound of the whistle is travelling at 750 miles per hour, it follows that the sound of the whistle over this distance of ·76 mile would be carried in $3\frac{2}{3}$ sec.

Thus, it follows that from the time of the bomb coming into earshot ·76 mile away and its hitting, say, the hearer, $1\frac{1}{3}$ seconds would elapse (i.e. 5 seconds – $3\frac{2}{3}$ sec.).

This would seem to bear out the suggestion one sometimes hears that anyone hit by a bomb has little warning of this coming event!

From this also one can develop the "pointer" that if the whistle of a bomb can be heard for several seconds it will not fall near enough to harm the hearer.

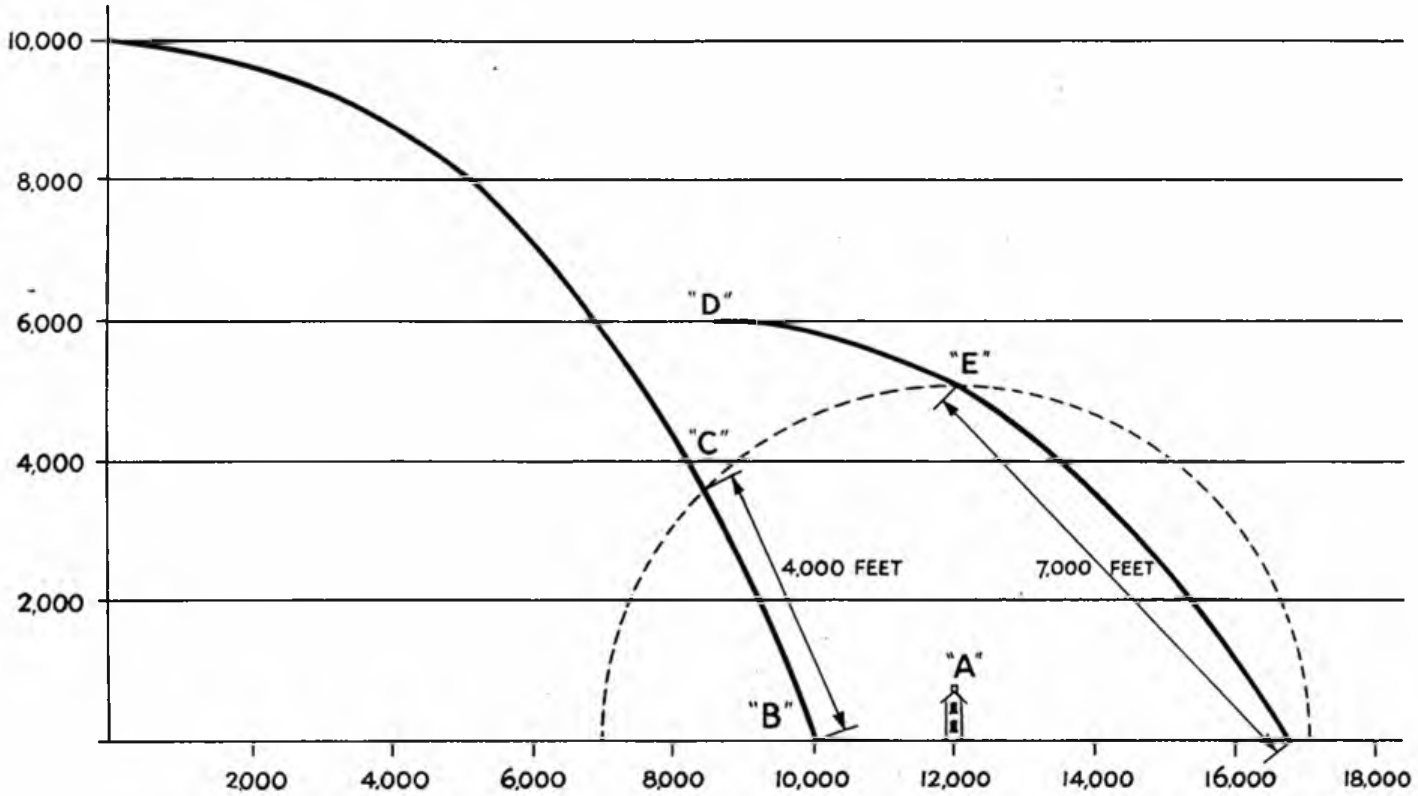
Recently, I have timed the fall of a number of bombs with a stop-watch, my location being in a ground-floor flat in a five-storey building near the top of Highgate Hill.

One night in October I timed a very loud whistle for $3\frac{1}{2}$ seconds. This bomb fell close enough to shake the building (18 in. brick wall on the ground floor), and cause the electric light to swing.

Next day I located where this bomb fell, and found that the site was some half-mile distance from my flat.

Now, as sound travels at the rate of one mile in 5 seconds it follows that the sound of the bomb hitting the ground would travel this half-mile to my ears in $2\frac{1}{2}$ seconds, i.e. I would hear the sound of the hit $2\frac{1}{2}$ seconds after this event actually occurred.

Obviously, also, the sound of the whistle of the falling bomb took a certain period of time to reach my ears, and I was hearing this whistle after the bomb had ceased to generate this noise. In fact, I must have heard the last part of the whistle prior to the "hit" $2\frac{1}{2}$ seconds after this event had actually occurred.



Since the maximum time I could have heard the bomb before the " hit " would be $1\frac{2}{3}$ seconds, the total time of hearing the whistle would be $1\frac{2}{3} + 2\frac{1}{2} - 3$ 5-6 seconds, which compares with my stop-watch figure of $3\frac{1}{2}$ seconds.

Let us now examine the statement, " that the whistle of a bomb can be heard only during the last 5 seconds of its fall " (during which, from a height of 10,000 feet, it will be travelling ·76 mile), and consider the accompanying illustration :—

At " A " is stationed the hearer; and the dotted semi-circular line has been drawn with a radius of 5,000 feet to indicate the " zone of hearing " of the whistle of a falling bomb. (It has been earlier stated that the range would be ·76 mile; but for the benefit of those readers with a more sensitive hearing than the writer's, a " margin " has been allowed, and the range increased to a mile, say, 5,000 feet).

Now, suppose the bomb is released from a height of 10,000 feet and falls at " B."

From information given in the before-mentioned A.R.P. Handbook, the angle of impact will be 19 deg., and since the distance forward that the bomb will travel during its descent to the ground can be quite accurately ascertained, it may be taken that the flight path will be approximately as shown.

Thus, the bomb enters the " zone of hearing " at " C," at a point some 4,000 feet distance from the hearer at " A," and the sound of its whistle will travel this 4,000 feet in approximately 3·7 seconds.

However, suppose the bomb is released at the point "D" from a height of 6,000 feet.

It will then enter the " zone of hearing " at " E." and hit the ground at " F."

The flight path will now be from " E " to " F," a matter of 7,000 feet, i.e. nearly twice as long as in the first instance.

In this latter case, the time during which the whistle of the bomb will be heard, will be increased to 6·5 seconds. It should also be noted that in the first example, as the bomb travels from " C " to " B," it gets appreciably near to the hearer; and thus its " note " will appear to rise (as that of approaching trains or cars); but in the second case the distance between the bomb and the hearer does not vary so much during the period of time that the bomb whistle is within the " zone of hearing."

From this may be deduced the " pointer " that if the " note " and intensity of whistle do not much vary, or rise at a relatively slow rate, the bomb will hit the ground well away from the hearer.

A point which is of interest is that whilst the speed of sound in air is a trifle under 1,100 feet per second (= 1 mile in 5 seconds) the speed of sound in earth is something over 11,000 feet per second, i.e. sound travels about 10 times as fast through earth as through the air.

Again quoting from A.R.P. Handbook No. 5, on page 18, the statement is made that :—

" The impact of the missile causes an intense local pressure over the area of impact preceded by a pressure-pulse or compression-wave, which is transmitted from the target with the velocity of sound in the material."

On page 4 the following sentence may also be noted :—

" Apart from the shock-wave generated in the air, analogous waves are also generated in the earth or other target in or on which the bomb explodes. Similar earth waves can be caused also by the impact of a bomb apart from any effect due to explosion."

This information is worth recording, because it confirms my own experience : that one can feel the dull thud when a bomb hits the ground before one hears the explosion; and by careful timing with a stop-watch it is possible to measure the distance away a bomb has fallen by noting the time which elapses between the feeling of the thud and the hearing of the explosion.

Of course, one's main concern is with bombs and their lethal effects; but falling pieces of exploded anti-aircraft shell may also be lethal, and in view of the fact that very few folk appear to realise that this " debris " can take a relatively long time to fall to the ground, this article may well close with some notes on anti-aircraft shells (British), their bursting, and effects thereof!

Whilst little information has been published on the *speed* of anti-aircraft shells, a fair approximation of the time taken to reach a certain height may be obtained from the formula

$$t = \sqrt{\frac{h}{\frac{1}{2}G}}$$

Where t = time in seconds.
h = height in feet to which the projectile rises.
and G = 32

Thus, for a height of 15,000 feet, the time is calculated to be 30 seconds. For a height of 10,000 feet—at which we have generally supposed E.A. to be flying—the time taken for an anti-aircraft shell in travelling from a gun to bursting (we hope) near to said E.A. will be approximately 25 seconds.

For the " debris " from a bursting anti-aircraft shell to be lethal to an observer on the ground, obviously it must burst over his head. The sound of the bursting will travel over the distance of 10,000 feet back to the observer (at the rate of 1,100 feet per second) in 9 seconds.

How long will the " debris " of a shell take to fall?

According to A.R.P. Handbook No. 5, whilst the terminal velocity of a bomb will be about 1,000 feet per second, that of a 2 lb. incendiary will be only about 400 feet per second.

We must " guess " at what will be the terminal velocity of a jagged piece of anti-aircraft shell; and whilst its ratio of density-to-mass will be greater than that of an incendiary (tending to *increase* its speed), its " drag " will obviously be very much greater also (tending to a *slower* speed), and it would therefore seem reasonable to take the same figure, viz. 400 feet per second, as a fair one for the terminal velocity of a fragment of anti-aircraft shell bursting at a height of about 10,000 feet.

If we apply the formula for time of a falling bomb

$$T = 0{\cdot}25\sqrt{h}$$

we get a time of 25 seconds. However, this assumes a terminal velocity of 800 feet per second when dropped from a height of 10,000 feet, compared with our " guessed " figure of 400 feet per second for the shell fragment, on account of its poorer streamline when compared with that of a bomb. Therefore, whilst certainly we can say that a piece of anti-aircraft shell will take at least 25 seconds to fall to the ground, it is more likely that it would take about 35 seconds in actual fact.

Thus, assuming that an anti-aircraft shell is fused to explode at a height of 10,000 feet, there would elapse 25 seconds between the time when the gun is fired and the shell bursts; and (say) a further 35 seconds before the fragments reach the ground; a total of about 60 seconds.

In conclusion, I would emphasise the *relatively* slow speed of sound in air, viz. 1 mile in 5 seconds.

The full effect of this " slowness " and the need for looking for the E.A. " *ahead of its sound* " is shown in the following example:

Supposing an anti-aircraft gun is fired at an E.A. 10,000 feet above the ground.

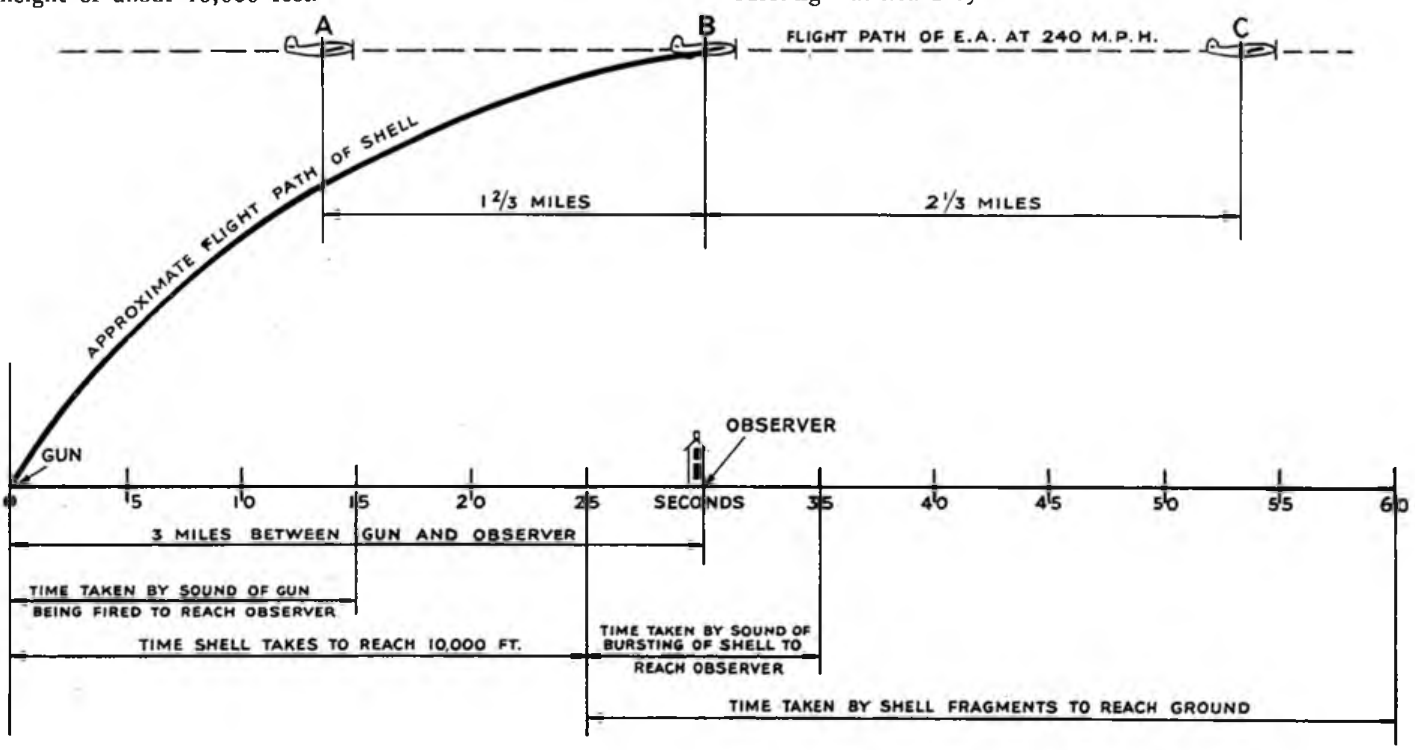
Suppose the gun is 3 miles distance from an observer, and overhead of him is the E.A. at the instant that the shell explodes.

The relative positions will be as shown in the sketch:

Suppose the gun is fired exactly at 11 o'clock, then

(*a*) The sound of the gun being fired will be heard by the observer at 15 seconds past 11 o'clock.
(*b*) The shell will burst at 25 seconds past 11 o'clock.
(*c*) The sound of the shell bursting will be heard by the observer on the ground at 35 seconds past 11 o'clock.
(*d*) The shell splinters will hit the ground 1 minute past 11 o'clock.

That is to say, that from the time the shell leaves the ground approximately one minute elapses before the splinters caused when the shell bursts at a height of 10,000 feet reach the ground; and that these splinters will arrive at the observer nearly half-a-minute after the sound of their bursting was heard by him.

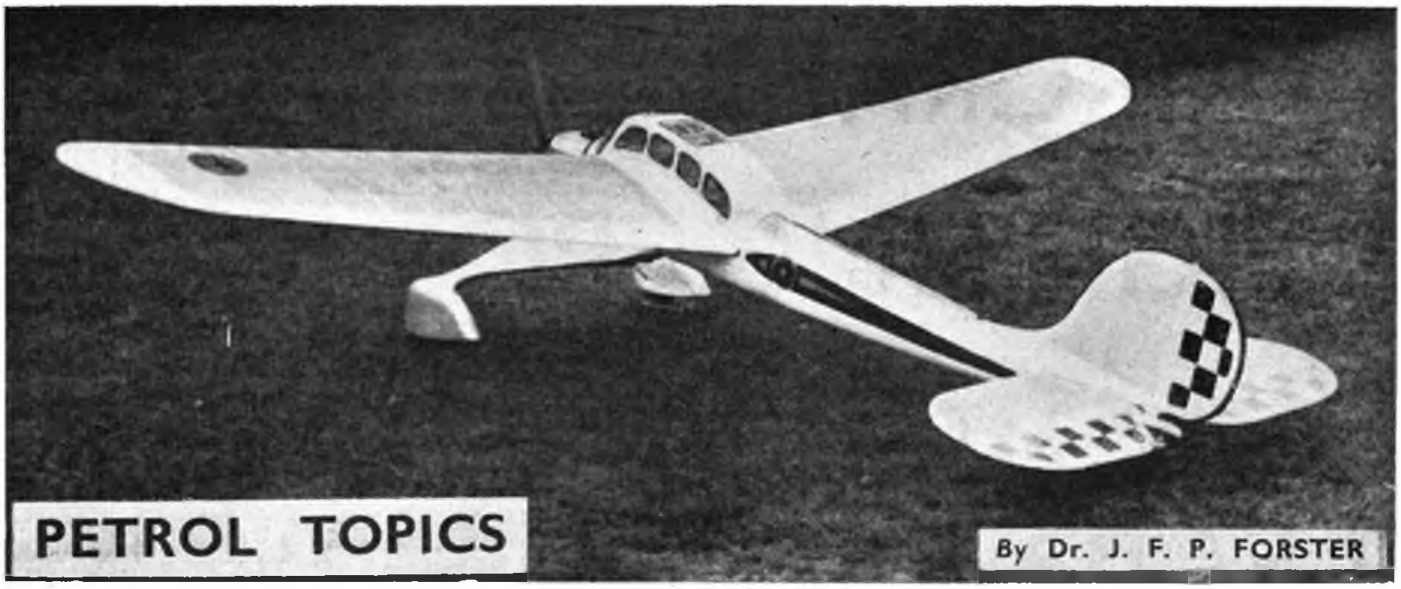


AN APOLOGY

ON BEHALF OF

THE HARBOROUGH PUBLISHING CO. LTD.

We regret that owing to enemy action there have been delays in completing orders for our range of books on Model Aircraft, but would assure our many customers that conditions will shortly return to normal, and all outstanding orders will be dealt with.



PETROL TOPICS

By Dr. J. F. P. FORSTER

MY " venture into journalism," as one sarcastic correspondent called these monthly " yarns," has shaken up my ideas of time. The thing one never gets over is the impossibility of being really quite topical. For anything that finally appears in print must usually have been written from 3—4 weeks previously. Consequently, when the Editor reminded me that he was expecting a " Topics " for the Christmas number, and it is even now, at the time of writing, only the middle of October, I began to wonder whether a bomb hadn't perchance turned his calendar on a month or two! At all events I certainly feel very far from "Christmassy " at the moment.

However, since this instalment is due to appear in the Christmas AERO-MODELLER (which, in common with all other magazines, has the peculiar habit of publishing Christmas numbers about the middle of the Autumn!) (And therefore explains the Editor's haste!—ED.) it behoves me to try and include " a little something " for everybody.

The result will probably be a very mixed bag of topics, including excerpts from correspondence (which, by the way, is still rather scanty), some sketches and ideas of my own, which I hope may give food for thought, and as a special war-time-cum-Christmas concession to those chaps whom I perhaps too disparagingly labelled in the April issue, builders of " Models of Aeroplanes," as opposed to the builders of " Model Aeroplanes," a detailed account of what must be about the most elaborate example of aero-modelling in any shape or form yet published in this country. Under the war-time flying ban I suppose those petroleers who hitherto have been primarily interested in, and got most pleasure from, the practical application of aerodynamics by getting their models to fly consistently, will have to spend more time at their drawing boards and in their workshops, and provided they can continue to bear in mind the practical aspect of our hobby, it may not be such a bad thing for some of them. This certainly goes for myself, for there have been times when I have been so carried away with the urge to fly, and too keep on flying, one or possibly two models, at every available opportunity, that the urge to construct a new one disappears, and even minor or necessary repairs to the models in use seems a waste of time and at once becomes " hard labour."

My mind is carried back to that " first fine careless rapture " experienced while building my first petrol model. I recall the sense of satisfaction derived from every longeron and rib " well and truly laid " into position, and the growing thrill as the model gradually assumed the form of an aeroplane (of sorts!). Since doing so much flying, I realise now that I have come to regard construction less as a real pleasure in itself, and more as a means to an end.

This is not as it should be, and I expect I am not the only one suffering at least occasionally, from this malady. Building models for the sheer love of construction and using one's hands, is the chief motive behind most branches of model engineering, and model aeroplanes, boats, and, to a lesser extent railways, are, I suppose, the most notable exceptions, in so far as they represent modes of transport, and are intrinsically " mobile." To get full satisfaction from them they must perform and actually " do their stuff."

There will, however, always be the man who makes, if not a fetish, at least a wholly satisfying hobby of construction for its own sake. Take for example the man who builds an 8-spar wing: it may be strong; it may even be light; but he knows that he can get a lighter wing, equally strong and probably more resistant to torque, by using a compound box-spar formed by " sheeting in " the leading edge at the top and bottom members of a single main spar. The only possible answer to the question, " Why does he do it? " is that he just likes it. " He's funny that way." The remote (?) possibility of a crack-up and subsequent case of repair evidently doesn't carry sufficient weight to influence his feelings in the matter. Amen, so be it! Far be it from me to deny him his " Lebensraum " ! The point is—he is being inconsistent if he incorporates these sorts of ideas in a petrol model which, above all other models, is a flying model, and one that can " take it." It is surely short-sighted policy to go to the expense of installing a petrol engine in a model incorporating impractical features which render it prone to damage, or are difficult to repair if damage does occur.

This attitude, which may be considered as " eminently practical " (to use the words of C. E. Bowden, describing a model of his own design), has been rigorously maintained in " Petrol Topics," because we must try and avoid the discouragement of youngsters and beginners that has in many cases resulted from serious or repeated damage to first models. An engine costs a whole heap of the average young

modeller's pocket money (and may cost more after the war !), and when one considers the years of hard service and immense amount of pleasure to be got from a good modern engine if reasonably well cared for, it is worth giving some thought to this matter of *avoidable* damage. It is to be hoped, therefore, that although the war-time ban on flying may drive both old hands and newcomers to their work-benches (my correspondence suggests that several newcomers intend to occupy their black-out evenings building their first petrol models), their zest for construction will continue to be tempered with *practical* considerations. To summarise at the end of nearly a year's " Petrol Topics " for the benefit of new readers, the chief propaganda has been for :—

(*a*) Wings built in two halves with *short* locating dowels, the halves held together with elastic bands. The weight of the machine upside down on its wing-tips cannot break short dowels.

(*b*) Detachable tail-surfaces, again located by *short* pegs and held by elastic bands.

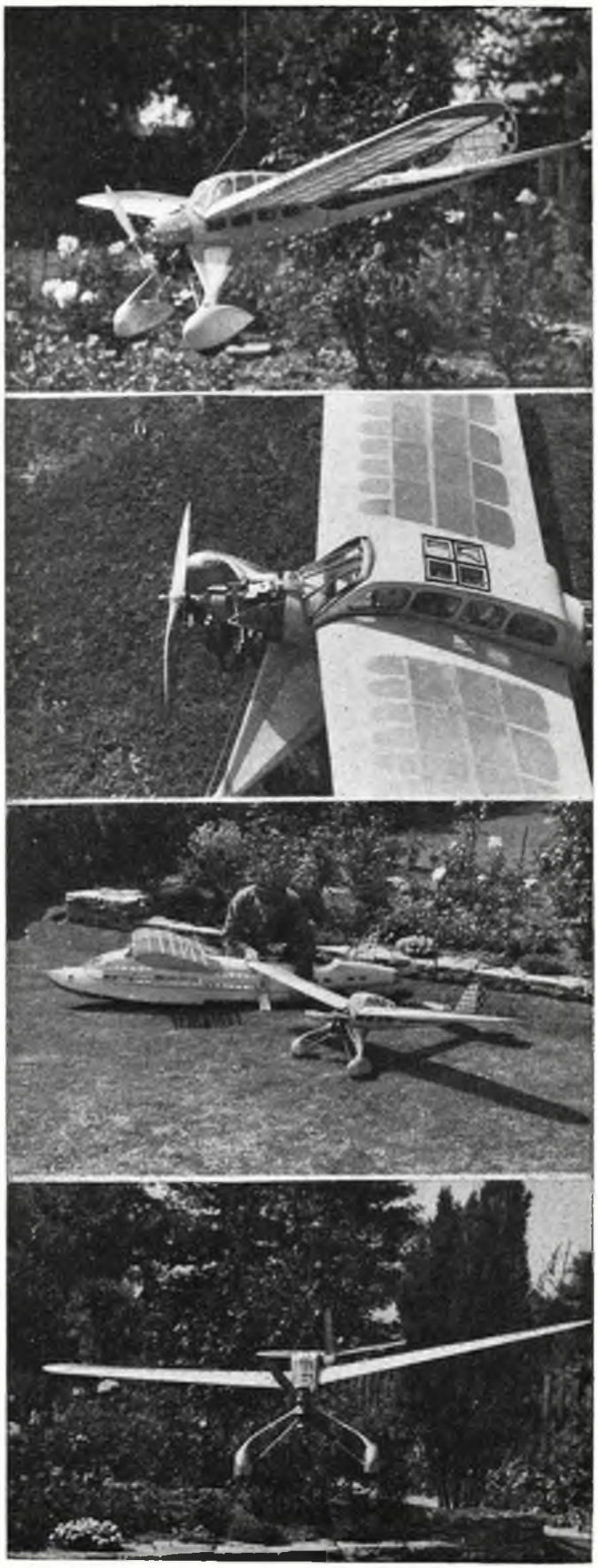
(*c*) Detachable or " knock-off " engine mountings, and

(*d*) Soundly designed undercarts, preferably incorporating at least *some* degree of *backward shock-travel.*

So much for the past. What of the future? W. Anderson, of Harborne, Birmingham, has evidently been looking several years ahead. He has designed, and is building in most elaborate detail, a model of an " Ocean-going air-liner of the future." His excellent photograph gives a good idea of the hull which, apart from the beautiful external workmanship, comprises internally a dining-saloon, furnished with tables and chairs ; a cocktail bar with carpets. etc. Sleeping cabins fitted with bunks, etc. Promenade deck, deck-chairs, lavatories, furnished lounge, luggage compartment, and cockpit fitted with controls. Somewhere in the bowels of this flying palace is housed a miniature *working* radio set ! The compartments are illuminated with 21 lights, and there are to be two navigation lights.

The wing-span is to be 10 ft. 6 in., and he proposes to power her with "twin 10 cc. engines," though how he proposes to synchronise them he doesn't mention. The weight in this form he hopes to come out at approximately 13—14 lb. Fortunately, he threatens to fit the model with radio-control, so presumably he may be able to arrange a separate throttle-control for each engine. Since he has eschewed sponsons he is evidently proposing to use wing-tip floats : he has my sympathy ! They are a proved wash-out with a single-engined flying-boat, but if he's skilful enough at the throttle controls he may one fine day succeed in opening up the starboard engine just at the moment the port float leaves the water or vice versa. There'll be a rough sea if he doesn't ! What worries me is what is going to happen to all his tables and chairs, carpets and cocktail glasses when he instals radio control? The wing-loading, by the way, before fitting R—C, works out at only 1 lb./sq. ft., so he has quite a bit to play with. If I may be allowed two small criticisms they relate to the main step and airfoil. The former appears a long way behind the C.G., and the latter appears to be of streamline section. Rather high speed and low lift, surely? It occurred to me also that a motor-launch might be more appropriate at the entrance door of a flying-boat than those steps !

Yes ! Those steps are, I think, the key to this man's



These photos well illustrate the skill and perseverance of Mr. Anderson. The graceful lines of the petrol 'plane are well brought out in the top and bottom photos.

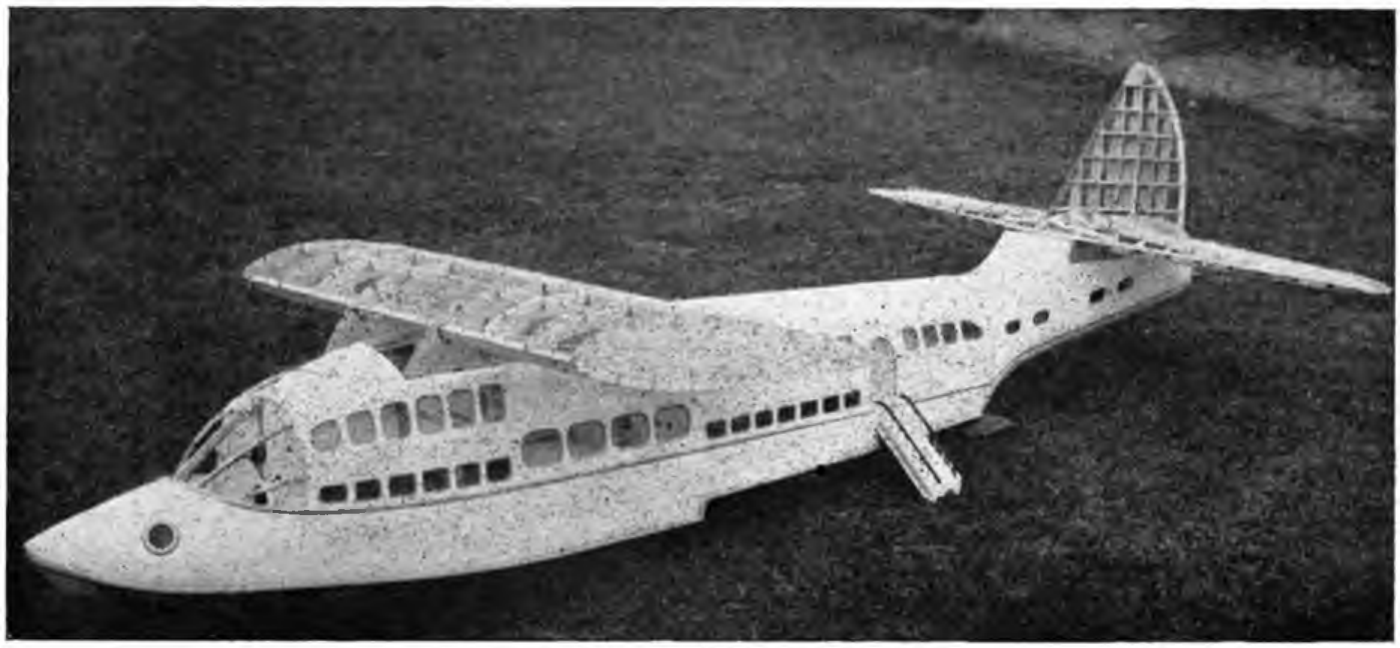
mentality : he is evidently one of those people who are just not happy unless they are making *something*. Apparently it doesn't much matter what it is, and its effect upon the flying characteristics of his finished model simply doesn't register as serious consideration. I know this type well, and never cease to marvel at their patience and ingenuity. I am left to gasp in admiration of their handiwork. I think what differentiates them most of all from the working, or flying-model maker, is that these chaps have never finished ! The flying-modeller looks only for the day when the last spot of paint reluctantly splashed on his model is finally dry and he can hie himself off to a quiet corner of his pet flying fields for those first glides ; the culmination of weeks of thought and perhaps wishful thinking !

The other man, when his model is finally and unalterably completed, must surely face the day of trials with feelings of regret that no longer is there anything left for those hands to do ; dejection and despair are his " portion," while over all must hang a dreadful foreboding ; he must quake with anxiety lest the impending doom should overtake his beloved cocktail-shaker, ruining his best Turkey carpets with gin and angasturas at 2¾d. per cc. ! I suppose after this " lament " readers will not have much doubt as to which category I belong !

Heigh ho ! It takes all sorts to make a world, and every dog has his day. The present time, with flying banned, would seem to provide the " heyday " for the chaps who are amused mostly by building. The others must either become " rubber-ears," construction fiends, or drop out for the duration. The latter would be most deplorable, and to avoid this is the chief reason for the continuance of " Petrol Topics." To keep the interest going, therefore, we shall have to give more consideration to constructional methods and details of finish than has been the case in this hitherto " eminently practical " feature. Good close-up photographs and sketches of the detailed construction or arrangement of accessories are really quite easy to obtain with quite ordinary cameras, and a lot of interest can be got from attempts at this. The results are well worth publishing, and would help to enliven " Petrol Topics " in the months to come. An example of the sort of thing I mean was the snap included in the October issue of the miniature accumulator. I don't pretend to be a photographer, and this was obtained by the simple use of a portrait attachment allowing one to work up to distances of only 18 in.

As a sop to the more practical merchants, I include this month some rough sketches (not to scale) of an undercart I have devised for low-wing petrol models. Originally, it was mounted on the leading edge and main spars, but as can be easily imagined, the result of backward travel and compression of the springs tends to force the front and rear pivots apart, and this has the effect of pulling the L.E. spar forward, and even breaking it. It was, therefore, decided to mount the whole issue on a plate of $\frac{1}{16}$ in. aluminium sheet suitably bent to form hinges fore and aft, and locating plates, which are freely bound and glued to the spars and reinforced with plastic balsa. The plate resists any tendency for the front and rear members to separate, and by far the greater part of the landing shock is converted into an upward thrust on the main spar, with only a slight downward pull on the leading edge. Figs. 2 and 4 show this plate in side elevation, and diagonally from below, respectively, with the locating pieces lettered X, Y and Z in both sketches. Fig. 3 is a front view of the " wirework," while Fig. 1 represents an underneath view of a low-wing model in which this undercart is mounted in the leading edge of the centre-section, built integral with the streamlined and fared fuselage. The wings are built in two halves with the leading edges of the centre section cut away. They are held together with *short* dowels and elastic bands, and held to the fuselage entirely by elastic bands from hooks on the upper surface just forward of the trailing edge fillets, and at their leading edges to corresponding hooks on the fuselage and L.E. of the centre section respectively.

This wing arrangement for low wings is fairly crash-proof, and the fixed centre-section can be built amazingly strong

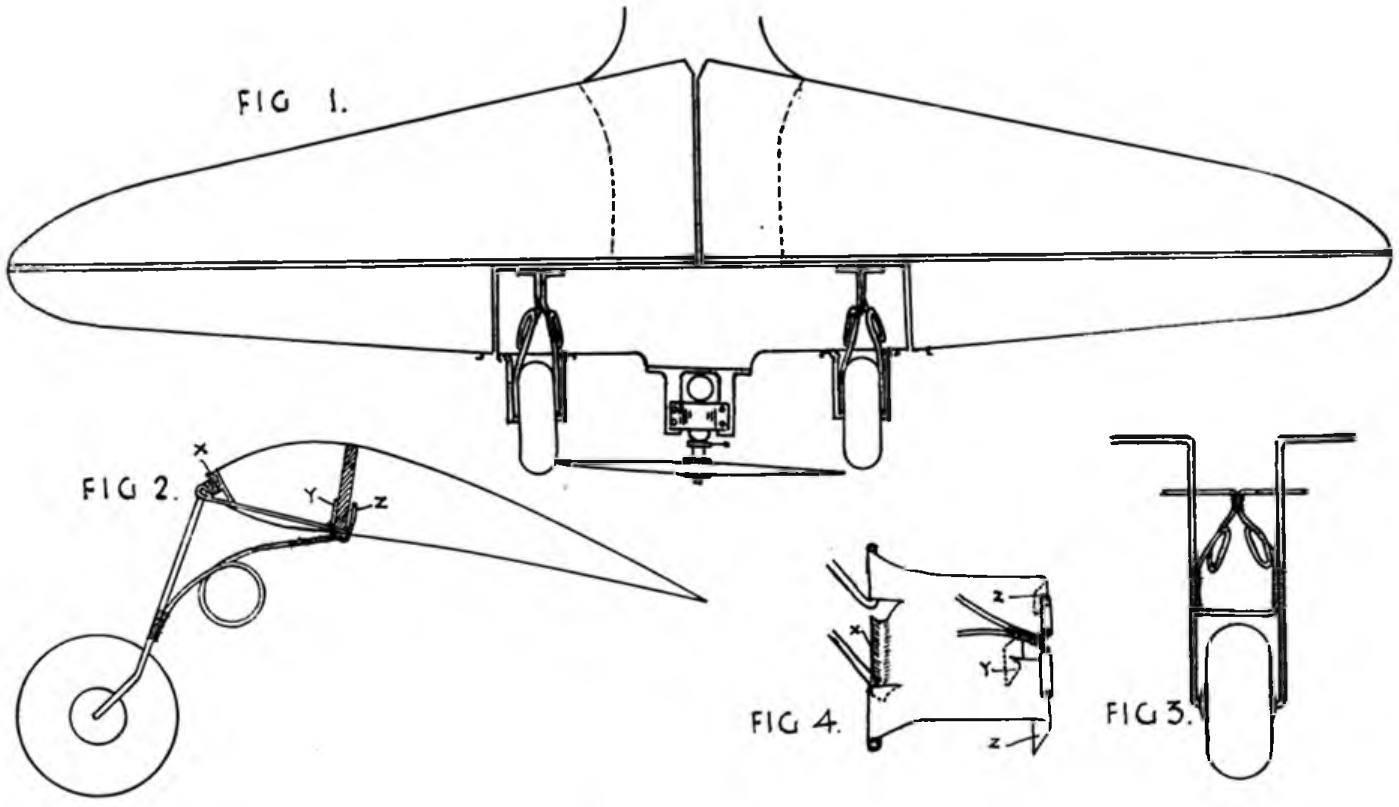


With dining room, tables, chairs, carpets; a cocktail bar; promenade deck, lavatories, and many other features, this model will earn the admiration of many of our readers.

with internal cross-bracing. It has taken some terrific crashes on my own model, which weighs about 2½ lb. The other alternative is, of course, to build the whole of the wings in two halves, and mount this type of undercart actually in the wings, as was described in the little "Low-Wing Freak," photos of which appeared in May "Topics."

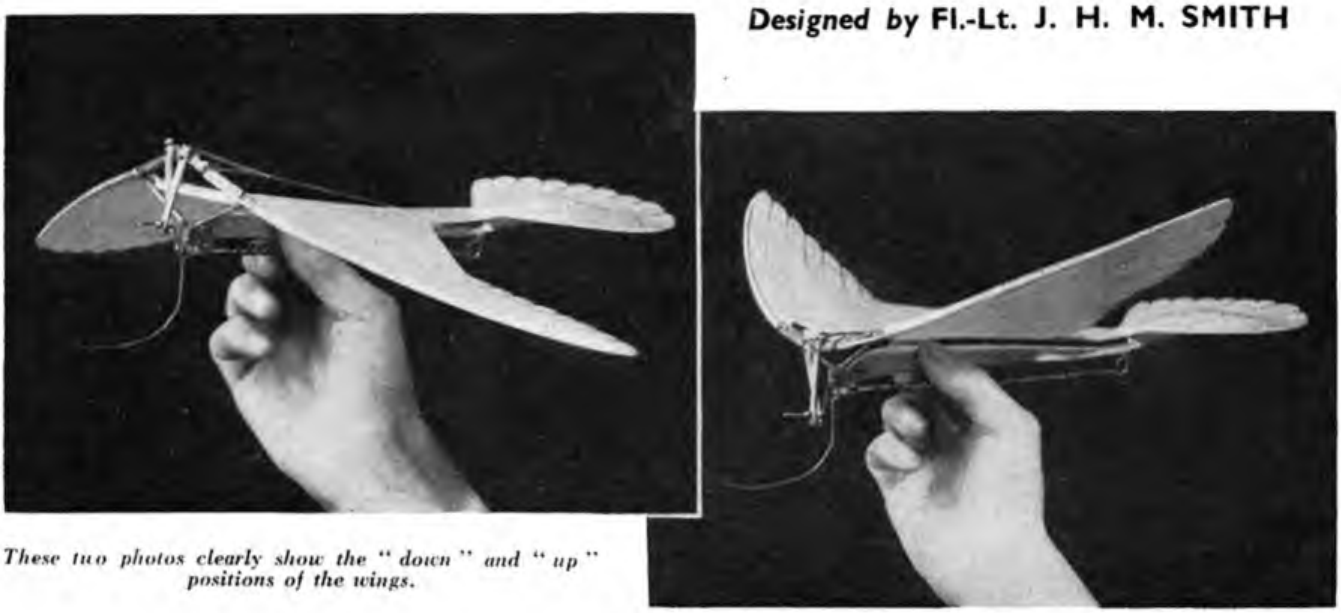
The other photographs of this month are of another of our "super-detail" friend, W. Anderson's creations. I remember seeing this model adorning the window of a well-known model supply shop in Birmingham last time I was up that way, and a very beautiful piece of work it is to be sure. It is a "double-decker" housing a dozen seats, with a most striking chromium-plated cockpit windscreen frame. With an all-up complement of some 15 souls, I take it the 8 cc. Ohlsson is intended to represent some 3,000 h.p. engine of the future. A pity we can't get this little power unit into production in time to deal with Goering's Luftwaffe. The model is a splendid performer, but I remember wondering why it carried its coil and condenser dangling in the oily draught between its legs. Perhaps you can enlighten us, Mr. Anderson: detachability or looks?

Well, chaps, a Merry Christmas! We can't expect any engines from Santa Claus this time, but with all the scrap metal and junk(ers) falling out of the sky at various points of the countryside, there ought not to be any shortage of raw materials for their mass-production after the war.

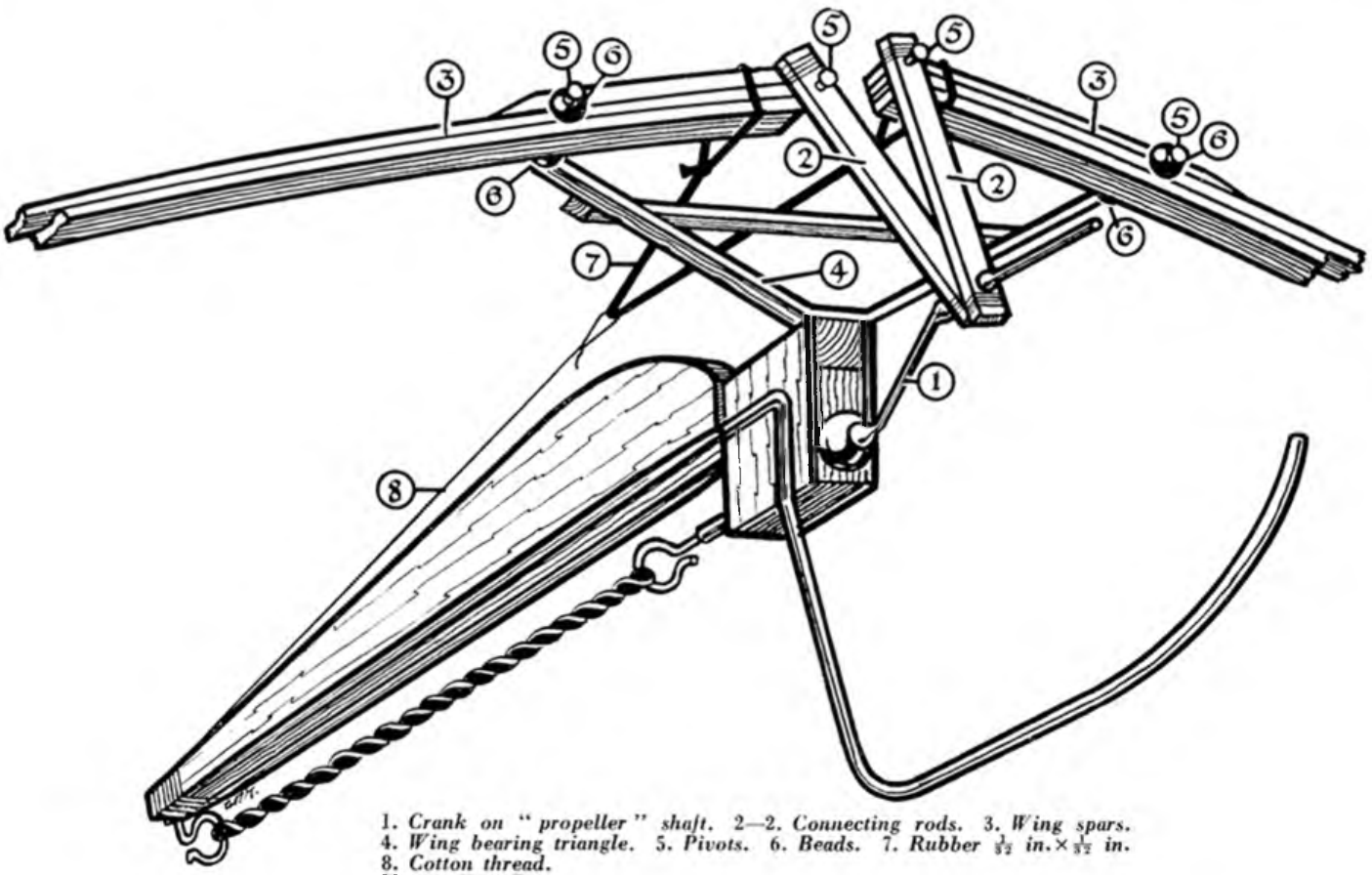


BUILD THIS FINE "FLAPPER" FROM THE COPYRIGHT PLANS PRINTED ON PAGES 700-1

Designed by Fl.-Lt. J. H. M. SMITH

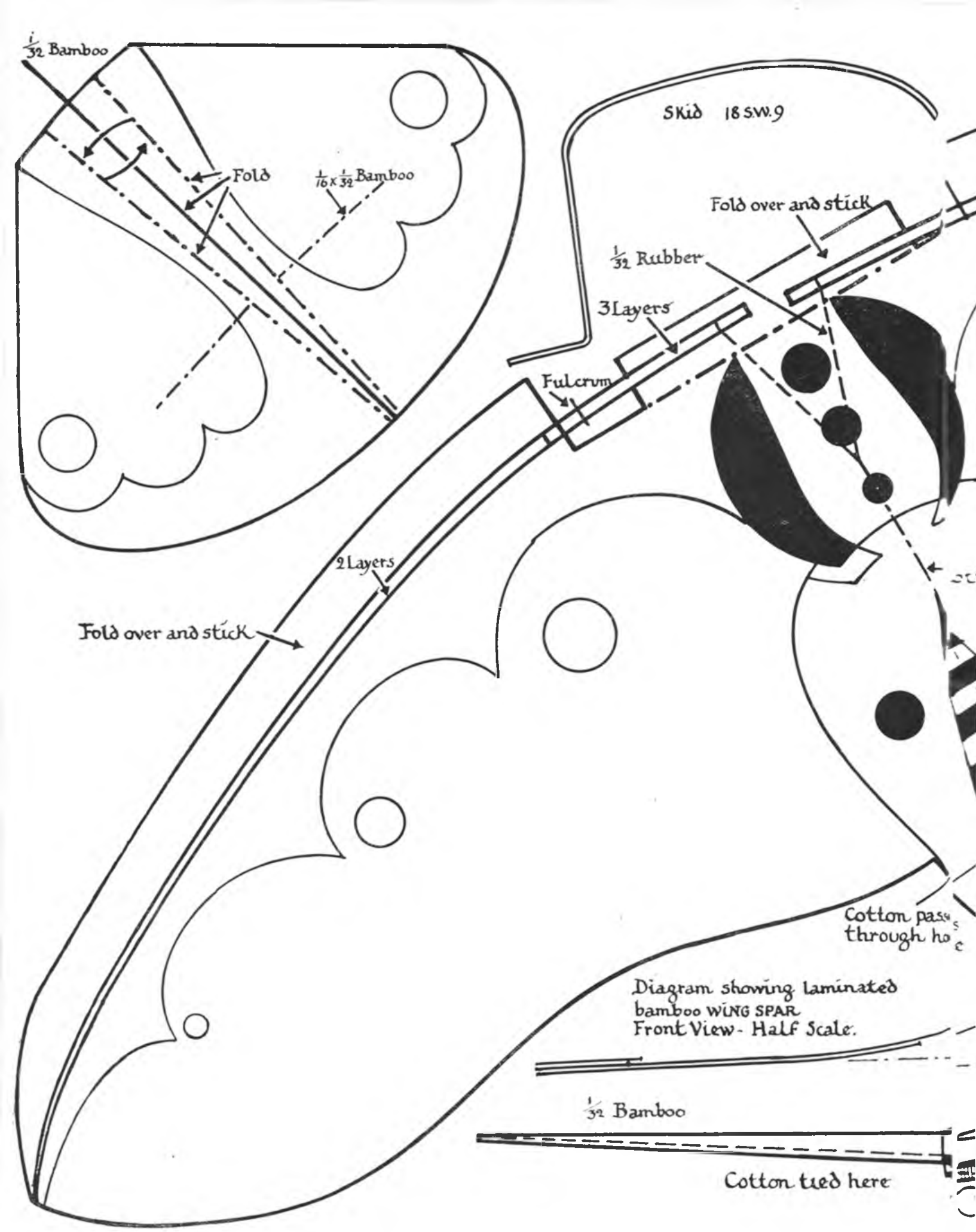


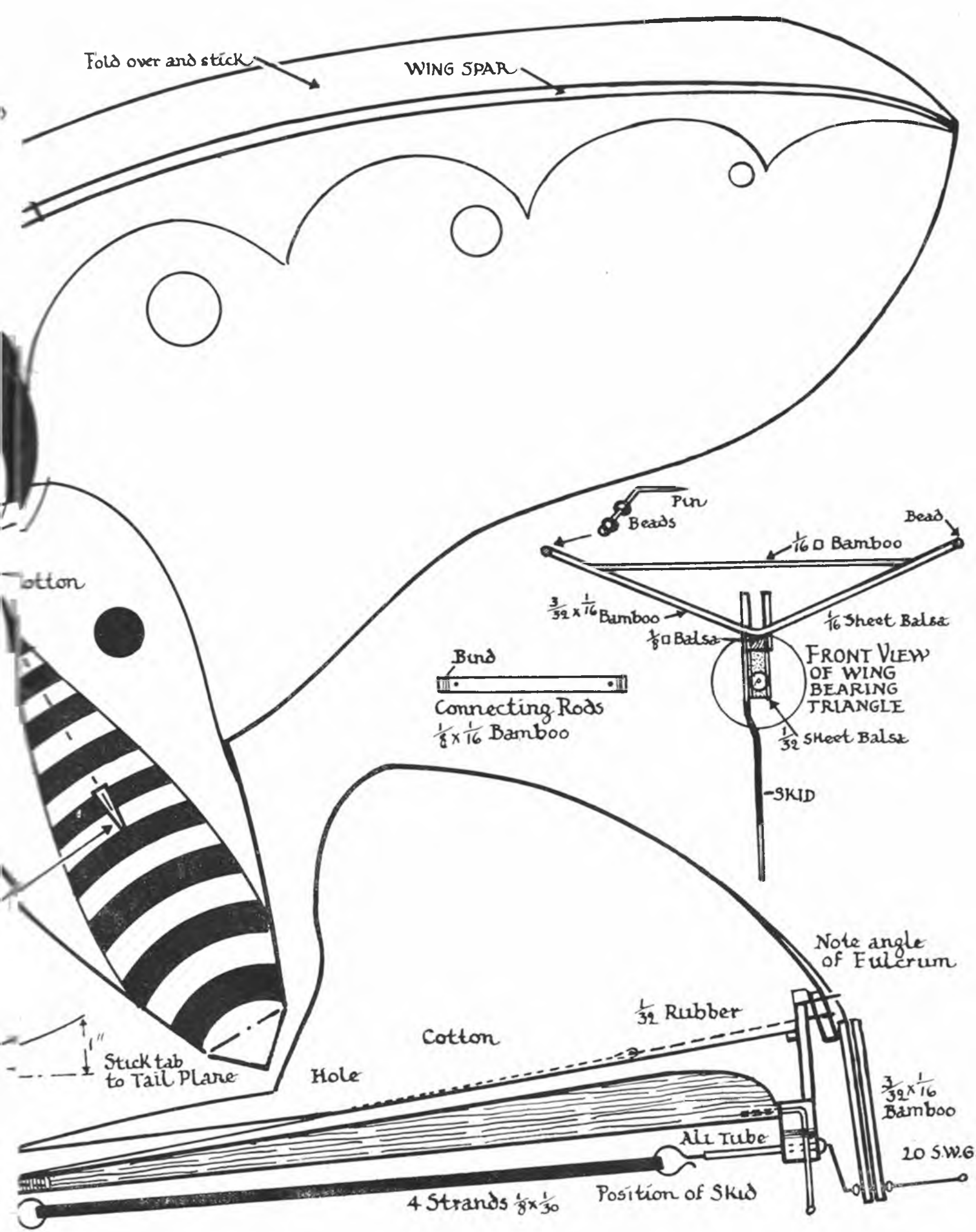
These two photos clearly show the "down" and "up" positions of the wings.



1. *Crank on "propeller" shaft.* 2—2. *Connecting rods.* 3. *Wing spars.* 4. *Wing bearing triangle.* 5. *Pivots.* 6. *Beads.* 7. *Rubber* $\frac{1}{32}$ *in.*×$\frac{1}{32}$ *in.* 8. *Cotton thread.*

NOTE.—*By adjusting the length of cotton* 8, *and so varying the tension on the rubber band* 7, *the speed of flapping may be controlled.*





Calling all Air Cadets.

Introducing a new monthly feature to be conducted by Mr. C. A. Rippon, which commences with an "open letter" to all Squadron Leaders:

GENTLEMEN,

You have all chosen—voluntarily—to devote your spare time and energies to help develop the character and abilities of youths of a receptive age, through the organisation sponsored by the Air League of the British Empire, therefore —I take it—you desire to give the lads the very best training possible in all subjects concerned with air matters. That is the reponsibility you have accepted, and therefore it is to your advantage, and ultimately to the advantage of the cadets themselves, and the whole movement, to foster interest in all subjects. Although it is quite obvious that no cadet can absorb every subject efficiently, nevertheless, every cadet can usually master one subject if he is given the chance to study it sufficiently and is interested enough to do so.

Now I am appealing to you to give your squadrons every chance to study aeronautics through the medium of model 'planes, and more especially *flying* model 'planes, because I know from my own experience of training Air Cadets that it not only gives them a sound foundation of the knowledge of how and why aeroplanes fly, but it also teaches them an understanding of the problems associated with mechanical flight. In the building of their models they learn to do delicate work and cultivate patience, and in the designing and flying of model 'planes they develop enterprise and resource, and should they compete in competitions they will also develop the team spirit and all that is best, in fact true *esprit de corps*.

Now you cannot find any fault with a subject or pastime that has so much to offer, and I feel that you will be doing the right thing if you encourage and make easy the opportunities for organising your model aeroplane sections. I suggest you make contact with your local model flying club members, and invite them to find you an honorary instructor. If you find it difficult, write to the Editor, who will give you the address of your nearest club. I myself shall be glad to give you personal hints as pointers, and I feel sure that you will find it really worth while fostering the model aeroplane section.

Will it convince you if I tell you that 30 per cent of my fellow club members (the Northern Heights M.F.C.) are in the R.A.F. or connected in some way with the aircraft industry, and remind you that such famous designers as G. de Havilland, C. R. Fairey, Sidney Camm (designer of the Hurricane), the late L. Mitchell (designer of the Spitfire), A. V. Roe, and such fine airmen as Air-Commander L. Slatter, one-time leader of the Schneider team, and who led the big massed flight over London at the last Hendon Pageant, and many of our fine airmen and pilots of to-day, *all* found their way to success via a study and appreciation of flying models?

What further evidence do you need to convince you that model aeronautics as a subject has a definite place in the training of the Air Cadets? Difficulties there may be in getting your model aeroplane section going, but nothing worth while is accomplished without difficulties, and, after all—"*Per Ardua ad Astra*"—is the motto of the Service you emulate, so please give my plea your sympathetic consideration.

Yours sincerely,

C. A. RIPPON,

Fellow, Society Model Aeronautical Engineers,

Hon. Instructor, No. 85 Southgate Squadron A.D.C.C.

CO-OPERATION

CADETS, these are your own pages, and by your interest and endeavours they will stand or fall. Let's get together and make them a real live feature, virile and full of pep.

In the past the Air Cadet News was handicapped by the squadrons themselves, only a few taking the trouble to send in news of their members' activities. Now, with my taking over, I want all aero-modelling Air Cadets to send me their own individual news and pictures, and ask their own questions, which I will do my best to answer. When the influx of news gets too large for me to handle, then will be the time to limit reports to squadrons' own edited reports. But let's make a start and see just how many of you do build and fly models. We can make a great success of this page if you co-operate, and, as that great little comedian, Leslie Henson, used to sing, "A little co-operation from you and there's nothing in this world we couldn't do." How true these words are! Co-operation has made the aero-modelling movement what it is to-day. Co-operation in the first place between a few pioneers who got together and decided that if they wanted to make progress they would have to co-operate and pool knowledge and resources; so commenced the club movement. As it grew, so the trade grew with it, and in growing helped the club movement with prizes and encouragement, making it possible ultimately to run great rallies of aero-modellers and international competitions. Yes, co-operation is a keystone to progress, and if you will get your commanding officers, your management

Constructors of R.T.P. "midgets" might take a look at Mr. Galloway, of T.M.A.C., with his 12 ft. 6 in. span rubber driven plane . . .

committees, your local model flying clubs, and your fellow Air Cadets to co-operate, aero-modelling in the A.D.C.C. will become a virile and an honoured pastime and study.

Now let's consider for a moment on what lines we will found our personal co-operation on this page. We can correspond, and air our views, and exchange ideas. We can consider what form we would like next year's AERO-MODELLER Challenge Trophy contest for Air Cadet Squadrons to take, whether it shall be for a special design again, or free-lance design, or flying scale models or kit models, etc., etc.

Maybe a Construction and Finish Contest would help. We can exchange ideas as to the best way to organise our model aeroplane section, and how best to equip and run it. I do hope that officers will not be shy in asking advice or opinions. After all, 30 years' experience, and the experiences of many of my friends, should be of some help to you; and is at your service.

Then we can consider running an Amateur Photographic Contest, a decentralised Pole Flying Contest between squadrons, flying the models in your own drill and assembly halls. Again, perhaps, some of you would like to send in designs to be "vetted."

Hints on organising and running an exhibition may interest some of you, or contacting clubs. And, by the way, clubs, a special word for you: Why not adopt your local squadron and invite interested Air Cadets to become honorary members; it may appear to you that you are giving something for nothing, but my experience is that the useful ones become useful club members too, and pocket money is limited you know. Persuade one of your senior members with sound practical knowledge to take up an honorary instructorship—it's great fun. Of course, there's difficulties—so many people still do not realise the value of the hobby—but they can be converted. Anyway, don't be "top hat" and too dignified; join in my new co-operative movement for the further development of our sport. I have a feeling that most clubs embody this, or a similar rule: That the objects of the ——— M.F.C. are to foster and encourage an interest in matters pertaining to designing, building and flying of model aircraft and air matters in general. Am I right? I thought so.

Clubs, play your part and just go out of your way a little to see what you can do to help Air Cadet Squadrons. Who knows? You may find the potential Wakefield Cup winner among your Air Cadet friends; and even if you don't, at least you will have gained considerable respect and prestige. Well, in these introductory remarks I feel I must have struck a responsive chord somewhere, so just have a chat with your chums and send me some news to start the ball rolling, for once it starts rolling it will gather momentum.

Hum our adopted signature tune—"A little co-operation, etc."

In a recent issue of THE AERO-MODELLER there appeared a picture of No. 85 Squadron's aero-modellers, and I must confess I'm proud of their effort, for as the contest was decentralised you must realise they had no idea as to the competition they were meeting, so that they perforce had to go "all out" to win. This they did under very adverse conditions, but you may imagine their disappointment when they found that no other squadron was enterprising or sporting enough to make their fight worth while. However, the contest is over for this year, and no good can be done by trying to fix the blame on anyone in particular. Let's get down to it together and make next year's contest the real thing, in spite of Hitler, Goering and Co. It will be well to remember that we of the S.M.A.E. are looking to you youngsters to carry on the skill and traditions of pre-war aero-modellers and uphold Great Britain's prestige in the great international contests when peace-time activities are resumed.

Cheerio until next month. Get going on my suggestions. Don't waste time. Lay the foundations for the spring.

. . . whilst "petrol" fans will no doubt recognise "Bunny" Ross starting up this 8 ft. span rubber-driven 'plane!

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Short Story Writing
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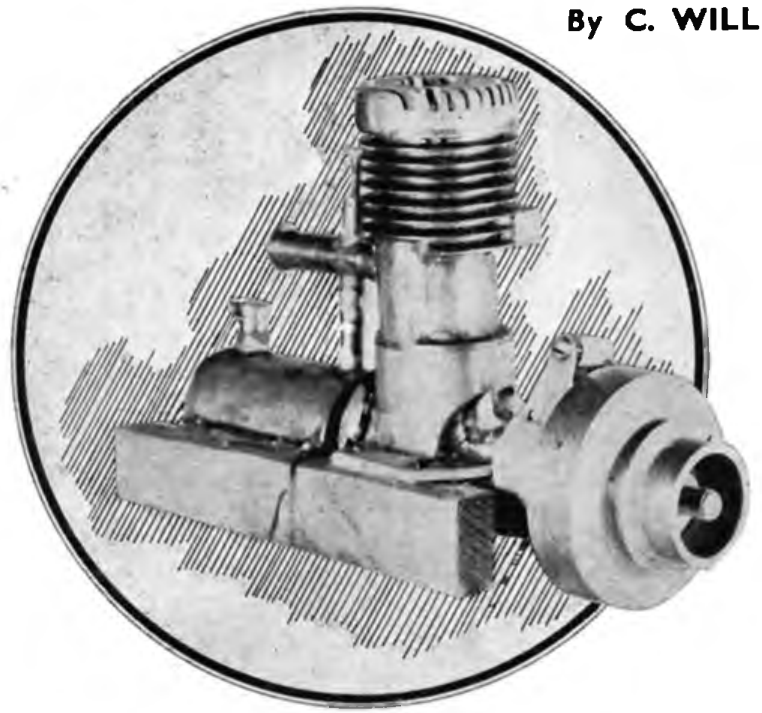
THE MECHANICS OF GAS ENGINES

I.—TESTING HORSE-POWER OF A MOTOR

By C. WILLIAMS



The advancement of gasoline-powered model aviation has been so rapid during the past few years that I hope it may not be amiss for me to introduce to your notice a short summary of "The Mechanics of Gas Engines."

The nature of the work itself is academic and involved, but the writer has attempted to simplify it to the greatest possible degree.

I am indebted to the Research Division of the General Motors Corporation for their valuable assistance and to the Shell Oil Co.

I hope the series may prove of value to some, at least, of those who are interesting themselves in the problems of gas engines.

THE AUTHOR.

ANYONE walking by the workshop in the basement of the Meyers' home late that evening probably would have been surprised to hear the conversation that ran between the two boys who were in there. Bill Lambert and Jim Meyers, buddies-in-arms and a million other things, were once more in their sanctuary discussing matters on model aviation, and by their talk one could see that they were happy.

A peep into the workshop revealed the two boys standing and looking at something clamped in the vice on the top of the work-bench. No wonder their faces reflected the happiness in them! Why, hadn't they saved and scrimped every penny that came their way for the past months? And now the results lay on the work-bench, with them proudly looking at it—a brand new shiny motor for their first gas model, which had just been completed.

Getting back to the confab, Bill was talking. "Ain't she a honey," was all he could say at the moment. "Yeah," said Jim, "ain't she." Both were grinning from ear to ear in excess admiration of the motor. This talking in monosyllables went on for some time, and then the boys settled down for some serious discourse. Bill was toying with the engine for a while during their session of gabbing. He looked up at Jim and said, "Y'know, Jimmy, I wonder how much horse-power this engine actually delivers?"

"I don't understand you," retorted Jim, "the manufacturer says that it is a ¼th h.p. motor."

"That's what they all say," said Bill with a laugh, "but look. Every motor varies; no two motors are alike any more than finger-prints are. The surrounding atmosphere may be different. Gasoline varies in different sections of the country. Pistons vary within few ten-thousandths of an inch. So do rings and crankshaft bearings."

A look of understanding came into Jim's eyes, and Bill summed up what he had said. "You know, we buy horses—but how many did we really buy? And another thing," went on Bill, "if we'd have an instrument or something that'll tell us the horse-power of the motor, we can change the needle valve setting, spark timer setting, and fuel during a test, and find out the setting that'll give us greater power."

"Okay," said Jim, "we'll get together to-morrow night and dope out a way to test the horse-power of our 'put-put.'"

The following night found the two chums together in their workshop.

"Well," said Jim, after they had sat down on a couple of boxes that were pinch-hitting for chairs, "I haven't been able to get any information on how to find the h.p. of the motor. Have better luck?"

Bill said that he had. "Y'remember the guy who taught us mechanics at school?" Jim nodded. "Well, I bumped into him to-day. We got talking, and I told him about our new engine. I said that we were trying to test its h.p." Bill took a piece of paper from his pocket. "Here's the sketch and formula that he gave us. It's pretty simple. I'll explain it to you: Two wooden blocks lined with asbestos are pressed against the fly-wheel of the motor by turning the winged nuts and tightening the bolts, thus applying a friction load to the fly-wheel. The 'brake' arm moves because of the energy absorbed by the brake. This lever carries the pressure to the scales, which are adjusted to balance the load. Get the idea?"

"Looks simple enough," said Jim, "but might there be a more elementary system?"

"Nope. This is the most effective and practical method of finding out what the output or brake horse-power is on a small motor like ours. Cost will be practically nothing,

and results exact. The reading we'll get will give us the correct h.p. our propeller will be getting. All that is necessary to know in order to work out the formula is :

R or the length of the brake lever in units of feet.
N or revolutions per minute of the flywheel.
W or net weight on scales in pounds.

The formula goes like this :

$$\frac{2 \times 3{\cdot}14 \times R^1 \times N \times W \text{ lb.}}{33{,}000} = \text{brake horse-power}$$

I don't think we'll have any trouble there."

" Looks okay to me." said Jim. " c'mon, let's get started."

" By the way," interrupted Bill, " before we start the test we've got to get a ' zero reading.' "

" And what, if I may not appear to be indulging in ignorance, is the ' zero reading?' "

" Well, when we've taken our test, the scales not only register the friction or power they have absorbed from the motor, but the weight of the brake itself. Follow me? "

" Sure," retorted Jim, " but how does the master-mind get this ' zero reading ' ? The way you yap, you'd think that you had Mr. Law-of-Gravity in your power. Come, come, my sweet one," mocked Jim. " I understand the law-of-gravity is still in force."

Bill clenched and unclenched his fists, counting up to ten in twos in double-quick time. " We have a counter-weight on the brake and scales," said Bill, having composed himself. " When the brake blocks are in place on the flywheel, without applying tension to the bolts, the weights are moved until the brake lever is perfectly horizontal. The scale is disconnected from the brake, and the scale arm is set to register zero in the same fashion. The connecting piece is left on the scale and the end weights are moved until the scale is level. Even when testing the brake horse-power of an engine, everything has to be on the ' level,' slug-nutty."

The next day after classes the two brothers in crime met in the corridor and hurried along to get back to the workshop. Not much talk passed between them, but by the gleam in their eyes one could tell that they were anticipating something interesting. When they got home Jim produced the sketch, and they went to work in earnest.

The boys drilled holes in the skids of their motor and used big, hefty bolts to fasten it down to the work-bench top, close by the window. Then they procured two small medium wood pieces too make the brake blocks. Holes drilled in them to take the bolts and arcs cut into them with a coping saw completed them. Jim asked his Dad to get him a strip of asbestos at the hardware store. Another piece of wood was found and was planed down to the correct size of the brake arm. Two bolts with winged nuts had been bought for a nickel apiece.

The brake was assembled and Jim started to hunt around for a scale supporting arm. He found what he was looking for in the wood pile. It was cut to the correct height and screwed to the table. An old metal bracket was found and fastened to the point where the supporting arm and the table met. A short horizontal arm was now needed to fasten the scale on to. Bill hunted through the junk box. A clinking could be heard ; then a cry : the lid was shut, and Bill emerged with a triumphant look on his face. In his hand he held a small shelf metal bracket. " Great things one finds even when rummaging through junk, eh? Didja ever try looking through your grey matter? I bet you'd be surprised ! " he asked, trying out his friend's patience.

Jim didn't answer. He was too busy laying out the scale arm. Notches were cut on the top, numbers marked out and the counterpoise put on. To do this the boys cut off the heads of two bolts, one for the scale and the other for the brake. A weight for the scale was cut in the form of heavy wire solder, weighing two ounces. Jim's Dad returned from the hardware store, and the boys used glue to fasten the asbestos on to the curved sections of the blocks.

Everything finished, the boys decided it was time for chow. Bill was to eat at Jim's home, so that they'd be able to test the motor that evening. Jim's mother was, indeed, surprised to find the two boys silent at the table. It was unusual. They usually talked and argued until they were ready to go at each other with knife and fork.

As soon as they had finished, back they went to the workshop. After the " zero " reading had been taken, Bill put some fuel in the engine's tank and checked the wiring. Jim turned the flywheel over a few times to prime the motor. Bill snapped the switch to start the electric fan going, which was to blow the exhaust fumes towards the window. Jim wrapped the starting cord around the flywheel and told Bill to " switch on." Jim give the cord a yank, and the engine sprang into life with terrific noise. Then he placed the brake into position, not tightening it. The engine was throttled up and Bill moved over to where the scales were. He adjusted the counterweights and motioned to Jim.

Jim tightened the bolts. The brake arm moved dangerously down and the scale arm moved up. Bill moved the scale weights until the scale assumed a horizontal position. The motor had slowed down to a noticeable degree. Just a slight slowing down was all that was needed.

Jim took the R.P.M. indicator from the work-bench drawer and placed the conical end into the funnel-shaped hole at the end of the crankshaft. " 750 revs. per minute," yelled Jim.

" That's fine." shouted back Bill, while he bent over and cut the ignition.

The data they had gathered was written down on a notebook used especially for that purpose, and the brake and other apparatus was put away. The motor wiped clean, the boys went upstairs.

In Jim's room the desk was opened and the boys started to calculate the output of their engine.

In their notebook, wherein all their notes were kept in an orderly fashion, and the formula they set down went like this :

$$\frac{2 \times 3{\cdot}14 \times 3 \text{ ft.} \times 750 \text{ r.p.m.} \times \frac{1}{2} \text{ lb.}}{33{,}000} = {\cdot}21 \text{ b.h.p.}$$

" Little less than $\frac{1}{4}$ horse-power," said Bill. " Not bad."

" Pretty good, I'd say."

Into their notebook went the following data for purposes of future reference :

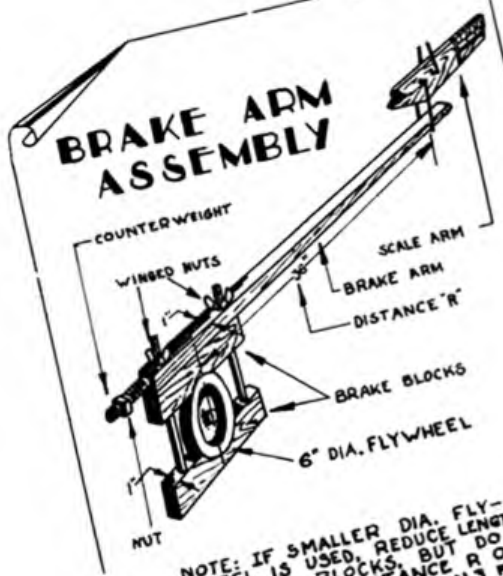
(1) Before testing motor to determine brake horse-power (b.h.p.), engine should be run in for several hours to wear in all parts smoothly. During period of " breaking in " use a flywheel.

(2) B.H.P. is the horse-power that your engine will deliver when installed in 'plane, so use the needle valve setting, spark timer setting, and fuel mixture you intend using when it is installed, during test.

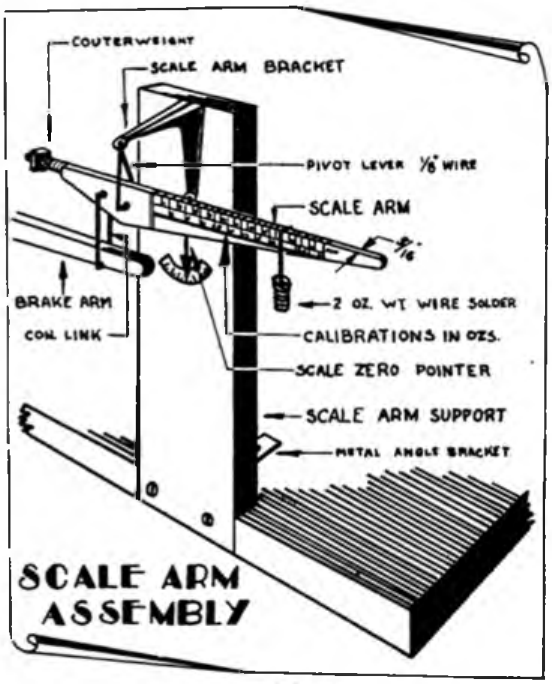
(3) Several readings should be taken during brake test, using different needle valve settings, spark timer settings, and fuel, in order to determine the positions giving greater output.

(4) Should the direction of rotation of the engine under test be opposite to the direction of one shown in illustration, reverse the apparatus.

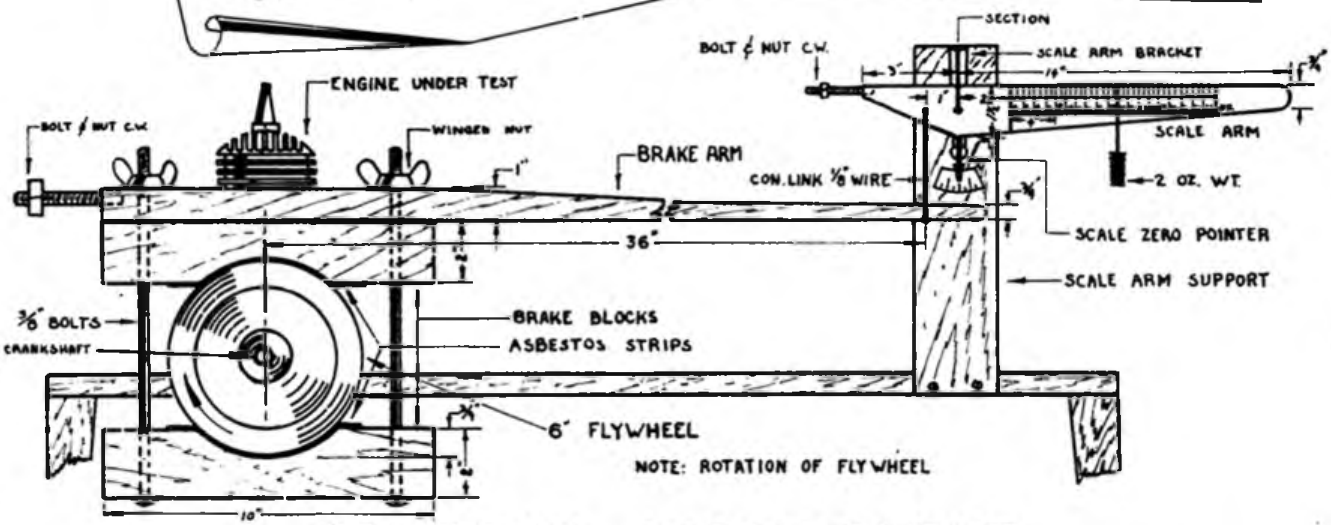
BRAKE ARM ASSEMBLY



NOTE: IF SMALLER DIA. FLY-WHEEL IS USED, REDUCE LENGTH OF BRAKE BLOCKS, BUT DO NOT MAKE DISTANCE R ON BRAKE ARM SHORTER THAN 3 FT.



SCALE ARM ASSEMBLY



GENERAL ARRANGEMENT

OPERATION OF R.P.M. INDICATOR

PRESS TIP OF INDICATOR INTO CONICAL HOLE OF CRANKSHAFT.

BLOCK BRAKE

for

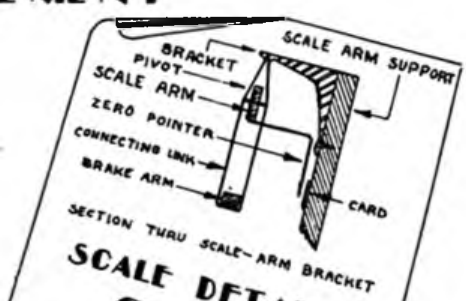
TESTING H.P. OF ENGINE

DETAILS

SCALE:-

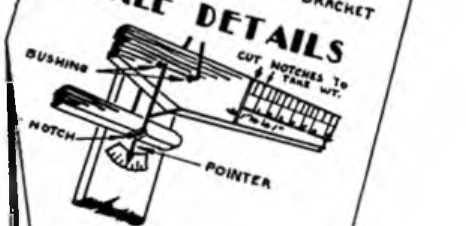
CALIBRATE FROM 0-20 OZS., AT 1" PER OZ. INTERVALS.

DESIGNED & DRAWN BY
C.S. Williams



SECTION THRU SCALE-ARM BRACKET

SCALE DETAILS



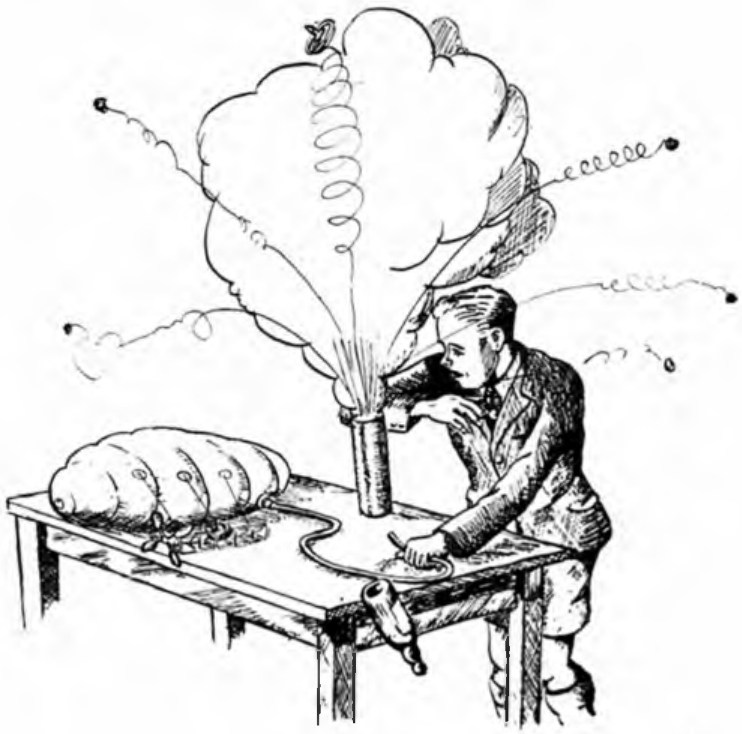
A TRUE, BUT PRETTY "GRIM" STORY

IT was the end of a perfect day, and in the mellow interior of the age-old " Dick Turpin's Kitchen " were gathered together those stout fellows who had put in a long day at the adjacent Fairey Aerodrome, on, I believe, the occasion of one of the Wakefield Trials, and who were enjoying to the full their hard-earned rest and refreshment. As they browsed they exchanged banter and yarns, and the conversation ultimately veered round to how and why people came to take up aero-modelling. Several gave interesting answers to the open question, and many pointed interruptions enlivened the narratives, but as the conversation languished the bereted figure of " The Old Hand " stirred himself in the corner of the oak settle, and remarked, " Well, you've all told your tales of your introduction to aero-modelling, and very interesting, too, but I've heard nothing so queer as the circumstances which surrounded the advent of " Little Arfer " into the fold of aero-modellers, nor as exciting. At this some of the company looked askance, but several rude ejaculations were heard, and one tough nut who had had some, remarked, " Look here, if you think we're here for ' duration ' you had better have another think." " That's all right," retorted he of the beret, but a good tale is always worth the telling, especially a fairy tale, as you blokes ought to know that have arrived home late (or early) after Council meetings, and sprung a good one on the wife! So, in order to create the necessary atmosphere he commenced, " Once upon a time."

Once upon a time there lived in North London—a large tract of country devoid of decent model flying grounds, densely covered with buildings, small boys, dogs, and those despoilers of an aero-modeller's holiday, trees, those sirens of the country side which give it its wonder and charm, but which at the same time are really devils in disguise, with magnetic arms waving in the gentle breeze, to welcome and ensnare the " dream ships " of the unwary aero-modellers—yes, there lived in North London a small boy who, being an only che-ild, was thrown to a large extent upon his own resources, and this inspired in him a fearful and wonderful sense of inquisitiveness which at times proved not only something for his doting parents to boast—" Oh, you've no idea how clever he is " before their friends and relations, but more often than not caused them pain—you know the sort, " It hurts me more than it hurts you." Ugh!—and embarrassment, and it was one of these latter occasions which was prefaced by the incidents which are the background to my fairy tale.

At about the time that the Wright Bros. were just about being heard of certain experimenters in Europe were pushing—or, shall I say, attempting to push?—gasbags around the sky by means of most inadequate internal combustion engines, driving airscrews which appeared to be converted shovels, at least so it seemed from the pictures of them. In this country we had our own specialists in the Spencer Brothers, and although we now are inclined to be facetious at their expense, it must be borne in mind that they *were* brave pioneers and took tremendous risks in their experiments, all honour to their memory. However, at the time in question the Spencer Brothers were hard at work with an airship, trying their best to persuade the ungainly brute to fly to the City of London and circle St. Paul's Cathedral dome, a distance of about seven miles. Those of you who have seen the ground staff tackling a stubborn " barrage balloon " in gusty weather, can well imagine what heroes these men were, who tackled such a job as detailed above in a dirigible airship of such elementary type, underpowered and unmanageable in anything but a dead flat calm!

Well, on the direct route lay " Little Arfer's " home, and the trail rope from the dirigible one day brushed across the roof tops and a tall ash tree in his garden. Until then " Little Arfer " hadn't thought much about flight, only to shoot off his catapult at the cheeky but inoffensive London sparrows, and nothing at all about mechanical and artificial flight, but on this occasion, after his first fright was over at the sight of such an ungainly bird—(he's seen more ungainly ones since—" good night, airman! "—he pestered his unfortunate mother and father with his special brand of " Why does it? " and " How does it? " and " What makes it? " until I feel sure they, like many others, thought " that there flying was the invention of the devil." Nevertheless his small brain worked on the problem of artificial flight, and of airships in particular, and one day the die was cast: *he* would build an airship! Of course, it would have to be



" . . . . up went the lid of the tin within half-an-inch of his nose."

a small one, but if it flew, what matter? At least, he wouldn't get hurt. That's what he thought *then;* later events proved him sadly remiss in his reckoning.

His father, witnessing his sudden air of active mystery, was heard to remark, " That damn boy's at it again," and his mother realised only too well that her time would soon be taken up running round after him, clearing up, and chasing him off to school, at *somewhere* near the right time. Yes, he went to school, but I'm afraid, like the boy portrayed in Shakespeare's " Seven Ages of Man "—only just!

It was a great game evolving the airship; he managed to find a picture in a newspaper, although not up to the standard of the modern photographic art which we take for granted nowadays, and the masterpiece gradually took shape. It was very difficult for him to obtain supplies, and his inherent ingenuity was sorely taxed, there being no balsa wood shops around every corner, as there seems to be to-day, with small crowds of boys and enthusiasts blocking up the pathway and steaming up the tradesman's window with their hot excited breath, and so perforce he had to rely on what could be " scrounged," and for the fuselage or nacelle he purloined the penny cane (happy thought), which of necessity always hung ready for action behind the kitchen door, and splitting it, and his fingers, with his blunt pocket knife, he evolved something resembling the shape he wanted. Pulling one of his Christmas toys (a toy railway locomotive) to pieces, he solved the problem of motive power, and some sort of propeller was made from bent cane, bound to one of the locomotive wheels, and covered with paper. This completed the mechanical side, but the balloon had yet to be made, and this presented the biggest problem of all. He had some knowledge; hazy, admitted, of how a balloon lifted, for his father and a friend had for some years made " fire balloons " at about Guy Fawkes time, and " Little Arfer " had been thrilled when, on being launched, they straightway rose towards the top of the tall tree in the garden, impaled themselves in the top branches, and burnt themselves out. He was always hoping against hope to see the tree burnt up, and he often wishes to-day much the same thing! He couldn't get up trees in those days because he was too small; now he can't because he's too big.

Having managed to get hold of some tissue paper he at length—after pasting the table, the walls, and himself pretty thoroughly—made up the sausage-shaped balloon, and he was content for a while to blow it up like a paper bag, fix the car underneath, and by suspending the whole contraption from a line, get some thrill out of it. But, alas, it wasn't good enough, and soon the idea came into his mind that he must try and get it filled with real gas, for he was " wide " enough to know that it would have a very short life if he attempted to use it as a fire balloon—" they " had told him the real thing was filled with gas—so *his* version had got to be. But how to get the gas? As soon as he so much as hinted of the idea to his parents, he knew he was up against it, and so it went on for several days, until one perfect hot sunny afternoon, when his mother (and I suspect the neighbours), were enjoying a quiet afternoon's nap, the great idea was born, *he would use gas*, but he'd be independent of the domestic supply, he'd make *his own*—that is, the gas would be his own, even if he had to beg, borrow or scrounge the wherewithal to make it!

It so happened that " Little Arfer's " parents had a young man lodger, who was a very keen cyclist, and " Little Arfer " had watched him preparing his acetylene lamp, of course, not without the inevitable " Why does it? " " How does it? " etc., and so he, of course, knew that one had only to saturate the carbide with water, to generate lots of gas, and to him—with the very little knowledge that was dangerous—what did it matter what gas it was, it was all gas? Everyone knew that gas went up, so here was the solution! So with a much more cheering prospect in view he hastened to find ways and means. Having bagged a tall tin of carbide from the lodger's cycle shed, and carried out one or two minor experiments to accustom himself to the *modus operandi*, and to make sure it really was gas—which fact he proved by the simple expedient of setting light to it, standing well back and throwing lighted matches into the smoking tin lid which was his laboratory apparatus, until who-o-o-o-o, up it went!—So far, so good. But how?—and this was the key problem—how was he to get the gas into the balloon? This gave rise to a lot of hard thinking, and nearly got him down, but after awhile he began to see light, and the wonderful idea came to him of utilising a cycle valve for the job; of course, the very thing! He'd often seen Mr. Jones pumping up his tyres, and if you could get air through, well, of course, gas would be easy. So he purloined a " Wood's " valve from the lodger's stock of spare parts, punched a hole (what a tough job for him) in the lid of the carbide tin, fixed up the valve, and heigh presto! There was his champion generator. Now for the great event. He put about an inch of carbide in the bottom of the tin, poured on a little water, banged on the lid, and stood awaiting events, and the supply of gas. But he waited for a few seconds in vain. He bent down, put his ear to the tin, and could hear the brew working s.s.s.s.s.s. z.z.z.z.z.! He was just about to move back when S.S.S. Z.Z.Z. * * * Whiz—bang! Up went the lid of the tin within half-an-inch of his nose, right up, up, up! higher than the roof the house, and then it came down, down, down! Bash! Right in front of him. Was he scared? He was *so scared* he couldn't move; he was dumbstruck! Instantly windows were thrown up, and startled neighbours

poked out their heads. Meanwhile " Little Arfer's " mother, awakened from her beauty sleep, came dashing down, scared out of her wits, instinctively finding her way to where her imp of mischief was slowly coming to, which he did on spotting her with some alacrity, when he realised how things had gone wrong, and he took to his heels, but as there was no back gate he was for it sooner or later. The wonderful airship that had taken so much time and patience to evolve suffered a grievous end, during which mother noted for the first time that the family cane had been embodied in its construction, but that made no difference, and a slipper covers more area anyway, and that was the end of " Little Arfer's " first aerial experiment, and it wasn't until a good many years after that he realised where the catch was, and why the generator blew up.

You see the principle of the " Wood's " type cycle valve is that you can pump air in, but it can't come out. With this little knowledge, which was so dangerous, he hadn't grasped that important point, but that really narrow escape from an early demise has influenced his whole life, for he " always looks behind the car to see if the road is really clear." is kind to animals, never runs after his own model if he can get someone else to do it, and never, for the same reason, climbs a tree; in fact, after that early lesson, he leads a blameless life, and lives happy ever after as your old friend " Rip."

IN QUEST OF DURATION

By BOB RENAUT

THE recent correspondence we have read between Mr. Maxwell and Mr. Jones with regard to the latter's article, "Streamlining and its Bearing on Duration Models." raises some important issues in our efforts to get the maximum duration from our Wakefield models.

Mr. Jones apparently believes that if he takes an unstreamlined machine and streamlines it, then utilises the saving in drag by increasing the angle of incidence of the wing to provide extra lift, he will get:

(*a*) The same low forward speed of the first machine.
(*b*) A higher lift/drag for the whole aircraft.
(*c*) An extremely low sinking speed.

Now if he does this he will merely increase the drag and lift of the wing, which in effect means to substitute a wing of larger area for the same weight. This will obviously have the effect of producing a lighter wing loading, which will give us the desired (*a*), (*b*) and (*c*).

But conversely it will also have the effect of decreasing the power, as the drag is still high and the machine flies slowly.

This is where we stop! Do we really require (*a*) – a very low forward speed? I question it. I believe the majority of us are slipping up on this point.

Recent events show that slow-flying machines are not necessary to get top durations. In fact, I will endeavour to prove that they are a disadvantage.

Mr. Jones's streamlined machine typifies many of the British entries in the last Wakefield contest, which did not do so well when compared with Korda's model. Their performance was of the " gradual climb " type, with fairly long motor run and slowish speed; in fact, similar to Mr. Jones's streamlined model.

Of course, I can hear objections right now that you fly your machine at 3 deg. incidence, but what about that spot of " downward " which always seems necessary? Remember, when your machine is flying under power it flies along the *thrust* line, and adding " downward " forces the wing incidence higher. Haven't you noticed that a machine with a fair amount of " downward " flies with tail down and sloping fuselage at a slow speed? I wonder how many duration fans that disagree with Mr. Jones's article have been doing this and unconsciously flying their wing at 6 deg.?

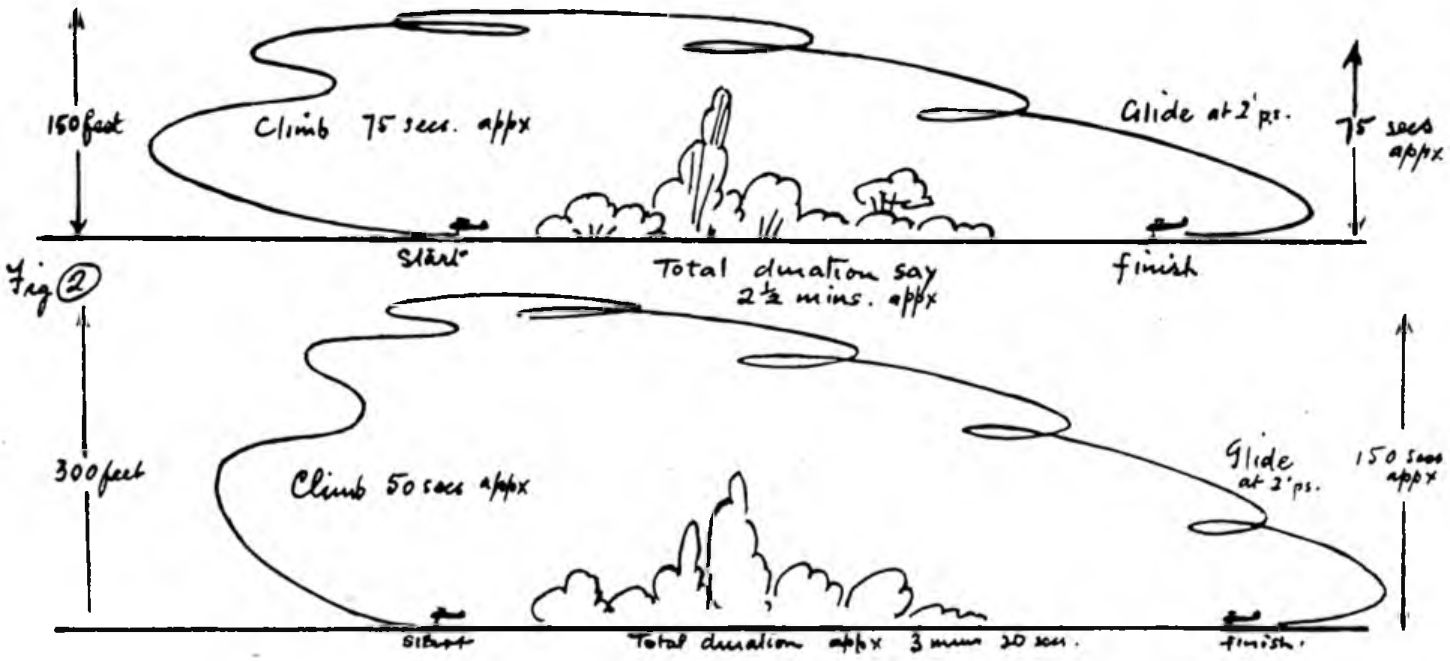
Well, where does this get us? Probably on a motor run of 1,000 turns lasting about 75 sec. our machine climbs gradually to 150 ft. or so and glides down at the rate of, say, 2 ft. per sec. (at the least), making a steady duration of about 2½ min. if no thermal is contacted.

Now we know that the model would have a much better chance of catching a thermal if it had gone higher, no matter how much shorter the motor run, and this is one of the reasons why we failed in America. We did not realise that nine times out of ten there are thermals around every afternoon, *provided you get your machine high enough to reach them!* Here, to my mind, is the crux of the whole matter. Our machines are not built for a sufficiently *fast* climb. We are still clinging to our " safe tactics " of fairly long motor run and gradual climb.

This is where I step in to try to prove to you men that even regardless of thermals the " high-climb-shorter-motor-run " type of machine is what we should aim at for longest duration.

The trouble with our present type is that the model is flying with high lift, high incidence and high drag. This slows up the speed regardless of climb so that it will never reach three or four hundred feet, as the latter half of the climb is practically horizontal, as the power reserve is only just more than equal to the drag. Fig. 1 represents the approximate path of a machine flying in this manner, while Fig. 2 demonstrates how I feel it should be flown, and this I will attempt to explain.

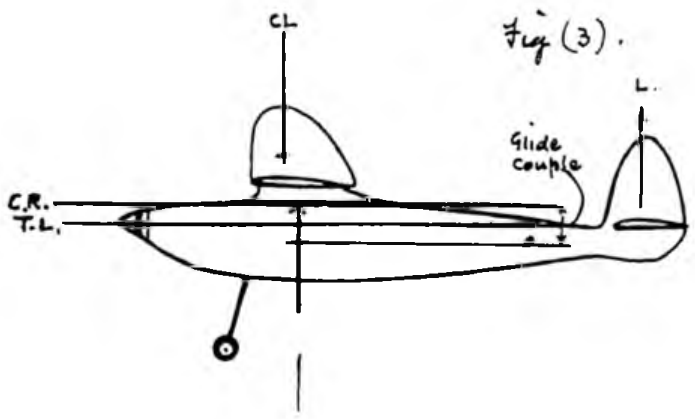
Consider a machine rigged and flown in this manner. For a beginning see Fig. 3.



The thrust line (T.L.) should run through the fuselage line of minimum drag. The wing should be set in relation at the best lift/drag angle, not at a high lift/coefficient angle. The motor should be of high power. Now the machine starts off and we will consider it as it flies.

The Climb.

The fuselage, etc., present the least drag and for *sufficient* lift, so does the wing; therefore the model shoots forward. But you say, " It won't climb so well because the wing angle is low . . ." It will climb a whole heap better and faster if you arrange the centre of resistance about ¾ in. above the thrust line, employ a long tail moment arm and a large area lifting tail set at zero degrees incidence. The combination of these forces with gravity settles the machine at a high angle of climb along which it travels (like a speed model tilted upwards with minimum of drag and just the necessary amount of wing lift). In other words, it makes a bee line for the sky at a high angle, which is just what we want. Now it is hard to get your model to do this and *maintain the climb*, as any warps or wrong rudder adjustment will show up in the speed. If you adjust for a slight spiral you will get a real climb for about 50 sec. at over 1,000 revs. per min. on your propeller. In other words, you will get what Dick Korda got—a terrific climb.



Now the Glide.

After getting to 300 ft. or so, even a mediocre glide with a free-wheeling propeller will get you a good duration, because at that height at least partial thermals support the machine. However, if you can eliminate the vibration, a single-bladed propeller will give you a definitely better climb besides being more suitable for folding to improve the glide.

Now the glide is really where we need a slow-flying and sinking speed and this is how our machine automatically gets it. The centre of gravity is built as low as possible so that its distance from the centre of resistance is as large as possible. Thus when gliding, gravity tends to swing up the nose of the machine and increase the angle of incidence of the wing until the tail pressure settles the angle and the machine glides at an angle somewhere near the least sinking speed.

Referring back to the folding propeller, the model should be adjusted for glide with propeller folded. Then when under power the propeller blade swings forward and tends to nose down. This is counteracted by the previously mentioned pulling up effect we get by the C.R. being the right amount above the thrust line. When the power stops the blade swings back and the model relaxes into the original glide.

Even in calm no-lift conditions I have proved the superiority of this fast climb flying to the old method by making alterations to the same machine. This talk of " paper bags full of rubber " is only nonsense spoken by people who are ignorant of the fact that it is much harder to get a high-powered machine to fly as you want it than to produce the sloppy dawdling flight of a long motor run machine. Let them double their machine's power and see if they can control it. You have to be expert at adjusting and observing to do it.

Judging from pictures I have seen, the points I have mentioned seem to be the embodiment of Korda's model, which has proved itself.

In conclusion, we must admit that as the size of the sky is so great and our models so puny, it seems obvious that we should build these fast climbers powerful enough to get right into the upper air if we want them to soar on the up-currents.

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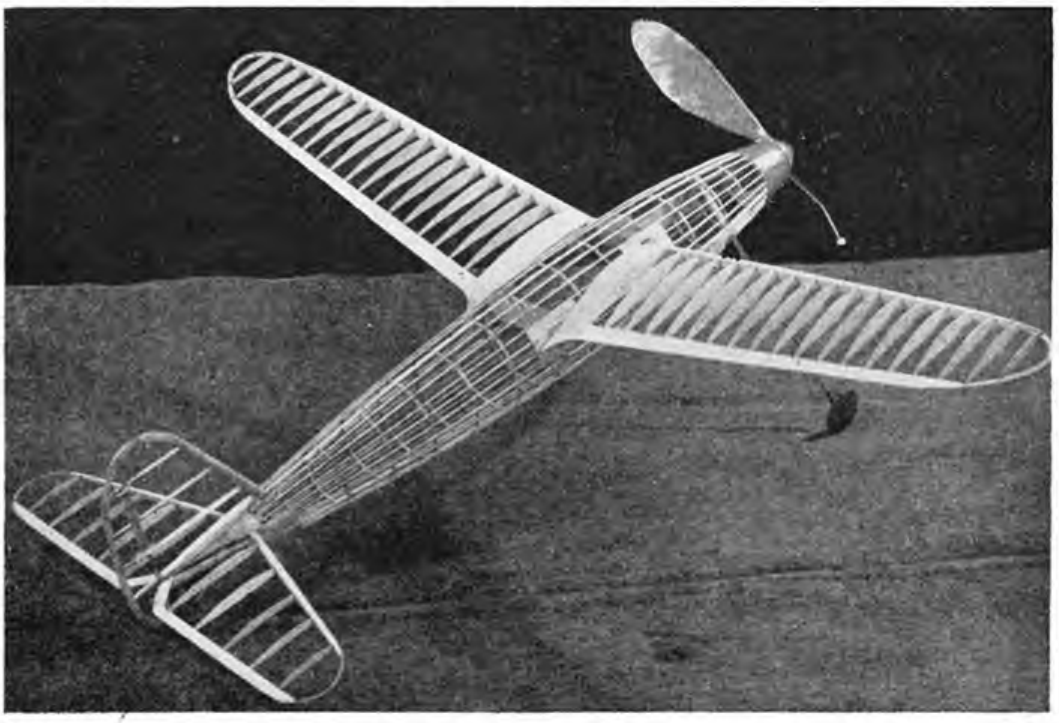

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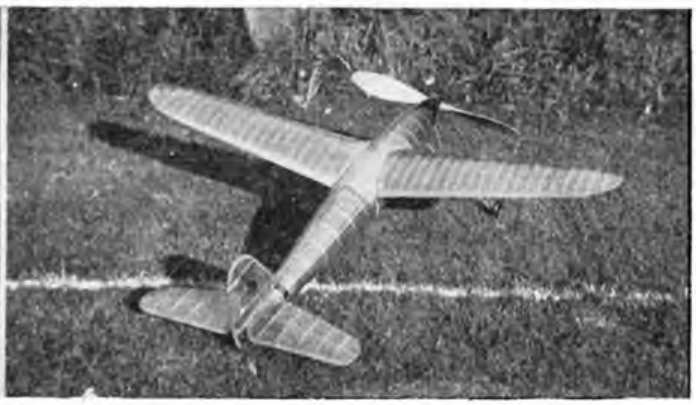
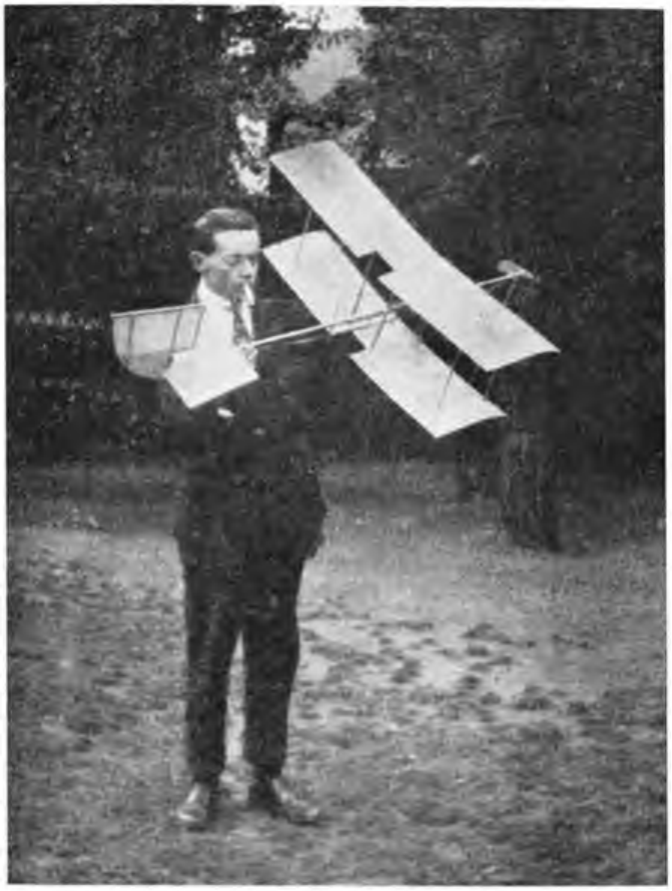


SOME EXPERIENCES



Here is picture 1, taken about 1915, and showing the Author holding one of his early machines. Construction would be mainly of birch or spruce. The wings, though cambered, were covered only on the upper surface. Straining wires of steel kept the main spar rigid.

BY way of introducing myself to the present aero-modellers of this country I thought perhaps, with the acceptance of the Editor, I should give a short account of my work in the field of model aeronautics before I submitted any drawings or designs for interest to readers, so that they would understand that whatever may be accepted of the designs I can offer to this very creditable magazine have behind them experience and experiments of many years.

I have been mostly a lone worker on this subject for thirty years, and it is only during the past ten years that I have matched my 'planes with others, and have found much to my satisfaction that I can at least hold my own against them. I have handed out hundreds of tips and advice to aero-modellers both here and in America, and feel that I can add some interest on this subject by offering tips and advice through the medium of this magazine.

To begin with, as a contrast and for interest I submit a photo of an elastic biplane I designed, built and flew considerably twenty-five years ago; also another, picture No. 2, that was built even earlier and had, for that period, somewhat large proportions for an elastic model; this was also a biplane of 5 ft. span and was the original design of the 'plane shown in picture No. 1. Exactly what year this 'plane was built I forget, having lost most of my records of my earlier stuff, but I can safely say that it would be at least two years earlier, as it was my first tractor model.

I am not going into the construction of these somewhat early 'planes, because there is plenty of information to be had on this subject should anyone desire same. Old history is very nice to read, but in this case I fail to see how anyone could benefit by it, especially to-day, with our powered flying craft of so vastly different design and construction, so it is with this I turn to the modern 'plane.

Picture No. 3 shows a very successful gas model designed in 1936 and still flying up to standard. It was the result of a long series of experiments in this particular field of model aeronautics, and represents a successful all-weather model. It has flown under all conditions the aero-modeller has to encounter in this country, and is now more or less retiring upon its laurels of over 1,000 flights and over 60 hours flying time. It is still a favourite amongst my friends, and even with its non-streamlined and somewhat crude looks holds first place with many.

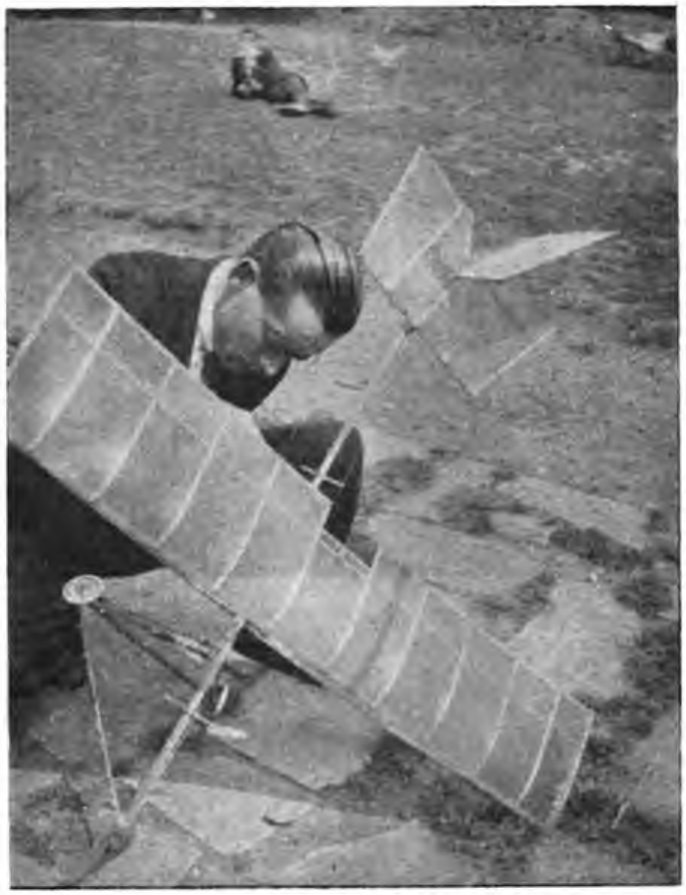
I mentioned this 'plane because it is simple in construction, and while certainly not following my present-day model aerodynamics and not being what I term a " directional flight " model (the term to be made clear later) it is a good all-round performer, and could be termed a beginner's model, that is, a beginner's model as far as gas is concerned —I do not recommend anyone building a gas model without having had previous experience of building, and most decidedly, flying elastic stuff.

Let me stress the word " flying," for knowing how to fly a model, including trimming of course, means equally as much as knowing how to construct. One can build a gas model as their first model if there is someone near who is in the know and can offer advice, etc. I have learned to the full the meaning of the above statement. I had no one with whom I could converse, and very little literature on the subject when I was experimenting with the gas model just north of Calgary in Western Canada in 1927. It was not until 1929 I was able to get the *Model Airplane News* regularly and thereby see for myself what was being done in the States in the line of model aeronautics.

My gas models of those days were unreliable, and only on the calmest days dare I venture out—this does not mean that all present-day gas models can be flown in any weather, because they can't; it depends entirely upon the type of model whether it can be flown in rough weather or not. Should a model be designed for rough weather, in most cases it loses completely certain characteristics that, in my opinion, add charm and delight to the performance of a gas model, a point to be raised later. Those days of gas models in Canada, although days full of aerodynamical troubles, days of excitement, expectation, and in many cases disillusionment, yet so full of a new-found hobby with possibilities ahead surpassing perhaps our wildest dreams, were to me as great as the summer of 1911, when after a long series of experiments under similar conditions I designed and made my first model to successfully fly. It was a Canard biplane.

OF AN "OLD TIMER"

By G. L. STOKES



In picture 2 is shown the author's first tractor 'plane, built about 1913. *The "king post," over which the straining wires passed to keep the centre spar rigid, is shown just behind the trailing edge of the wing.*

The event, too, which I remember only too well, and to my utter amazement and disappointment was only greeted coldly or by a few fitful grins from my family.

Even to-day I have occasion to be amazed at the average man regarding model aircraft, for after the usual preparations prior to a flight I am still asked "if that big thing really flies," or "does it smash itself when it comes down," or even more stupid, "you need a big wind to fly that, don't you?" It really is astounding the few that have ever seen a gas model, let alone one in the air.

Until 1934 I had always conducted my experiments upon well-known facts of simple aerodynamics, finding errors and correcting same during practical experimental flying until I obtained a machine that was reasonably reliable, but also, too, a machine that did to 90 per cent of its time what it liked, and not what its designer wanted it to do; in other words, when once clear of the ground it went where it liked, or perhaps more correctly where it was forced by elements over which it had no control, and this factor I may say still holds for many present-day gas models, so in 1934 I added to my experiments the phrase, "what kind of performance do I desire?"

I shall not go into details at the present time as to how I arrived at the arrangements of forces in my present 'planes that has given them control of directional flight. It can come later if asked for, but I can state what forces should be recognised and kept in mind for final arrangement on the drawing board around which the 'plane is designed.

They are as follow: firstly and most important, the relation of side-pressure occurring on a model on a turn to the centre of gravity; secondly, relation of centre of gravity to centre of pressure of main 'plane.

Thirdly, thrust-line in relation to C.G. and drag-line, then follow several minor points, but all equally important, such as the angle of incidence of main wings and tail, and the centre of pressure of main wing, etc.

At this point several readers will say to themselves, what about dihedral? Well, dihedral is good, a little of it, yes: it helps lateral stability, but if the relation of the side-pressure to the centre of gravity of the model is perfectly arranged, coupled up with properly proportioned twin fins and rudders on the tail, dihedral then becomes a very minor factor and can even be done away with.

I never use more than 3-4½ in. dihedral on a 6 ft. to 7 ft. model. The gas model mentioned above that has had over 1,000 flights, has 4½ in. dihedral for its 6 ft. 2 in. span.

Now to a degree the control of directional flight in a model holds one down to certain designs of construction that are difficult to depart from; it also in certain cases limits the range of weather regarding wind, but it is much better to know what kind of performance your 'plane will give (if designed correctly) before it leaves the drawing board stage, rather than have something, even though it be a good performer, that does what it wants rather than what the designer wishes.

This is the main reason why I long ago gave up elastic. An elastic model is not heavy enough nor fast enough for its size to have those lines of force acting upon it strongly enough so that when they are correctly placed they will give any definite degree of directional flight; instead, after the usual spiral climb the model wanders off in any direction air currents may take it. Now this performance applies to many gas models too, but generally speaking they perform better with regard to directional flight than the elastic model simply because of their extra speed and heavier wing loading giving them more power over air currents, but the lines of force on this particular type of model are very strong compared to the elastic powered 'plane, and are, under their present relationships, acting upon the model to give it non-directional flight other than the usual circles that are the result of the incorrect relationship of these forces.

It is true that if this type of model can be flown with throttled-down engine, thereby reducing its speed, some sort of directional flight may be obtained, but this is only because the slower speed of the model reduces the action of the badly relationed forces. This, too, may be considered a very dangerous practice to obtain a straight flight, because the model is flying near its stalling speed and can easily be placed in one by a gust of wind, the results of which many gas model flyers know only too well.

Picture No. 3 is at left, and shows a petrol 'plane built in 1936, and which has 60 hours' flying-time and over 1,000 flights to its credit. Picture No. 4 is below, and picture No. 5 is the centre one of the group of three on the opposite page.

The reader can understand then from the foregoing that in the gas model we have at our disposal the very material we wish for to enable us to design a model that has a fairly reliable control of directional flight.

Now the question is, what type of 'plane is best for arranging these lines of force?

Since all pressures increase with speed, and the most important force we have to deal with is pressure in relation to C.G., and C.G. equals weight, it can be seen that the type that has the more or less heavy wing loading is the best to arrange for directional flight too; the heavier the 'plane the better it rides wind if properly designed.

Now while this type of model holds every characteristic for design, it has two disadvantages. No. 1 is that owing to the weight and speed of this type of 'plane the lines of force are very strong and need to be very accurately placed to gain efficiency; this is all right with an experienced aero-modeller, but very difficult for the semi-experienced who wishes to design one of his own: secondly, a rather heavy fast model requires a much larger field for flying than a slow light one, and too, it is not pleasing to fly same at a low altitude with a short engine run because the flight is over before it can be fully appreciated. If set at full switch, say 1½ min., its speed being nearly 30-35 m.p.h., its climb fairly fast, its course straight, quite a large field or fields in a line are necessary, and from my knowledge of this country there are so many cases where this is almost impossible; consequently then, this type of 'plane in the case of many aero-modellers must be crossed off if only postage stamp fields are available, or should there be any obstacles in the way where the 'plane is to land, because when on the glide while still directional up to a point, the off-set of the rudders to balance torque comes into play and the model will develop a glide of a very large radius curve to the right; the speed now being much slower and the forces weaker should there be any wind it will now drift in the direction with it, so it is obvious that trouble can arise.

Figs. No. 4 and 5 show this type of model.

The models shown were Ohlsson 10 cc. powered 7 ft. span.

So having discarded what I have found to be the best type of model for directional flight in average weather conditions, owing to the limited size of our flying fields we must turn to the next choice.

Now I have a wonderful flying field some 500 acres, clear of all objects of any kind, and I have so often had to demonstrate models in smaller fields and found, generally speaking, I was " all at sea " so to speak, because of the more or less confined space, and while my models would give an excellent account of themselves on any large field they have suffered in the past to somewhat severe results,

and it was obvious that they were not suited for more or less confined areas, and this applies to many gas models of 6 ft. span or over, so something had to be done about it.

The first thing is what kind of performance is best for the small field? I found it resolved itself into the following: A 'plane with very directional flight control, slow in flight, glide and landings, a 'plane so designed that it can be safely flown at least 2 ft. up from the ground irrespective of engine cutting out at any particular period of its flight, having obtained this it would not matter if the flyer misjudged his time switch and received a cut-out perhaps long before he intended or perhaps when the machine was only a few feet off the ground; in other words, a 'plane so designed that no matter at what period during its flight the engine may cut it would not stall or stall badly enough to cause any misgivings on the part of the flyer. This calls then for a 'plane with a light-wing loading; not overpowered, and constantly flying tail high and no down-thrust;

On the right is picture No. 6, whilst pictures Nos. 7 and 8 are respectively the top and bottom ones of the group of three below. They are all of the 10 ft. 6 in. span, 6 lb. weight, 10 cc. Ohlsson-engined 'plane, which has to date made over 150 successful flights.

the take-off in consequence may be a little long, but when once clear it will rise sufficiently to fly over any normal hedge, and it will be found too that when once in the air it will continue a gradual climb until the engine cuts, and not take a sudden sweep upward when once clear of the field like many gas models do.

It will be easily seen that if we have a model with the performance described above we can safely fly out of one field into another, thus not worrying about one large field.

The next problem I was faced with was the matter of size the 'plane should be. We must have a light-wing loading for this performance; even if only for a safety factor a wing loading of not more than 8 oz. to 9 oz. per square foot. We can obtain this in a 6 ft. span model, but I fear structural strength has to suffer to obtain a 'plane of that span weighing but 3 lb. flying weight; too, the smaller the model the greater is the power weight in proportion to wing area, which is just what we don't want, and so as the 'plane must be as light as possible for its wing area, we cannot expect to fly it under any kind of weather conditions, so why not go the whole limit and design a 'plane giving the exact performance required, which I must say gives unbounded pleasure, and only use same when weather permits? We cannot expect to fly a 'plane of this type, and in the fields it is designed for, at an altitude of say 4 ft. to 5 ft. during a wind and hope to get away with it, but given the necessary space it is far less dangerous and I have found it will take a moderate breeze with safety.

From all this then it seemed to me that size did not matter so long as it gave what was wanted. A large model was undoubtedly the best to design for the purpose, since it was much easier to obtain a light wing loading; too, a large gas model in the normal way always gives us better flying qualities, and so the 'plane shown in Figs. No.. 6, 7 and 8 was designed and built for this purpose. It has a wing span of 10 ft. 6 in. and a weight of 6 lb. ready to fly, with fuel and battery, powered with a 10 cc. Ohlsson engine, which need not be opened out wide should the flyer not desire so. Up to the time of writing it has given 158 flights, with no damage whatever; it has never once performed erratically and has been flown to a considerable altitude on fuel. It has been successfully demonstrated in a field 100 yards long and 90 yards wide surrounded by trees, etc.; in this case it was straight flying from one end to the other despite bad gusts caused by an approaching storm; the average altitude of flights on this occasion was 6 ft.

I have various other types, but for this country I think this is the most suitable, providing the aero-modeller does not mind only flying in respectable weather.

The aerodynamical reasons for directional controlled flight and ground straffing with safety may be given at a later date with the Editor's kind permission.

In the meantime think this over and please remember I am laying no laws down.

A SOLID 1/72 SCALE MODEL of the HEINKEL He. 111 Mk VA LONG RANGE HEAVY BOMBER

By J. H. ELWELL

Photo by J. Simson.

A BOMBER OF BRITAIN.

Above is shown a photograph of the finished model of the Heinkel. The transparent cabin and gun positions are points worthy of note, also the neat doors which enclose the undercarriage when retracted. The large amount of detail in the engine cowlings is clearly shown.

THE Heinkel two-motor long range bomber was adopted by Goering in 1935-36 as the standard heavy bomber of the German Air Force to be. By 1937 the first versions began to appear in quantity, and at that period the 111 was certainly the best bomber in the world, being speedier than our then fastest fighter, the "Fury." Load and speed were the exceptional qualities, but according to modern standards the defensive armament of three machine guns was poor.

The Heinkels depended on speed and evasive action in cloud to escape from our fighters, but the new eight-gun types put even the newer versions of this bomber into the category of "has beens."

The latest Heinkel, the Mk VA (two 1,200 h.p. Junkers Jumo liquid-cooled engines) has a top speed of 274 m.p.h., a disposable load of nearly 15,000 lb. and a maximum range of 2,140 miles. Although many squadrons are now being re-equipped with the new Junkers Ju 88K, the Heinkel He 111 Mk Va is still the most numerous of the bombers of the *Luftwaffe*.

Mr. Cooper's excellent plan shows the very latest type, and any very slight discrepancies between the plan and my model are accounted for by the fact that my model was made to a slightly earlier design and before Mr. Cooper's plan was complete.

The excellent photographs taken by Mr. J. Simson and the sketches make it unnecessary to go fully into the constructional side of the model, and in the space thus saved I intend to describe in some detail two new methods of solving difficult problems—the glazed nose-piece and the retracting undercarriage.

The fuselage is carved from a block of hard balsa wood 1 in. by $1\frac{1}{16}$ in. by 9 in. in the usual manner, using templates in the usual way in the latter stages. The glazed nose *is* included in this process. When sanding the fuselage try wrapping the paper round the block and twirling the fuselage round inside it; in this manner you will turn it rounder than by rubbing up and down with a flat piece of sandpaper.

The wing is cut out of $\frac{1}{8}$ in. sheet balsa, with the wing roots or fillets integral. When the wing is the correct shape as per the plan view a slot should be cut in the centre section to fit a similar slot in the fuselage (see Fig. 1). Make certain that the wing fits accurately at the correct angle of incidence.

Next carve the wing to taper and finally to airfoil shape, using the template AA to ensure accuracy at the roots. The fillets will not prove at all difficult if sandpaper wrapped round a round rod (a pencil will do) is used, and plenty of time is taken over this very important detail.

Before finally sanding, incorporate the dihedral angle by making saw cuts, inserting cement and packing up the tips to the desired angle until dry.

The finished wing should be a smooth silky finish, and the control surfaces, flaps and trimming tabs are scored or cut in the correct positions.

The rudder and elevator are cut out of $\frac{1}{8}$ in. sheet balsa wood.

Fig. 1 shows how an extra piece is left on the bottom of the rudder to fit into the slot cut in the fuselage; this piece and the centre section of the elevator should be cut down to $\frac{1}{32}$ in. flat so that they will fit fairly tightly into

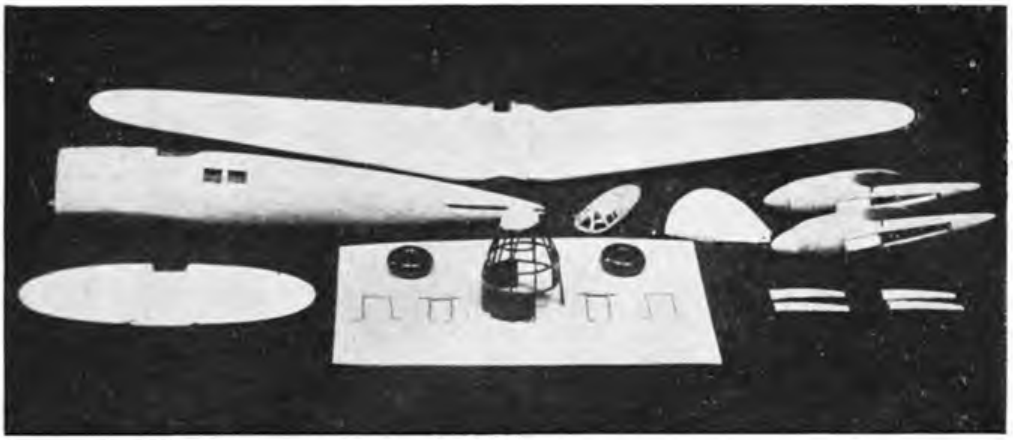


Fig. 1.
Here are shown all the components of the Heinkel ready for assembly. In the centre foreground the framework of the nose-piece is shown, together with the various undercarriage struts.

the saw-cut slots. The rudder and elevator are finished off in exactly the same manner as the wing.

The two small cabin windows at either side of the fuselage should either be stamped or carved out to a depth of approximately $\frac{1}{4}$ in. and painted mat black inside. The top gun pit will also require hollowing out to a depth of $\frac{1}{2}$ in., and a semi-circular ridge is cut to take the celluloid windshield.

To return to the nose of the fuselage, first cut off that portion which contains any glazing, with the possible exception of the two tiny windows at the left-hand side and shown in Fig. 2. Make a neat job of this and be certain to make a square cut. Place the piece cut off carefully on one side; you will require this shortly.

The flat fuselage end is now hollowed to a depth of $\frac{1}{2}$ in., leaving the walls about $\frac{1}{32}$ in. thick and carefully cutting out the two small windows previously mentioned.

The interior of the cockpit may be " mocked up " to suit the individual taste. A short description of mine may be helpful. The hollowed-out portion is painted mat black and a circular card bulkhead is cut to fit inside. A small rectangle about $\frac{3}{16}$ in. wide and $\frac{3}{8}$ in. high is cut out of this, and the bulkhead then cemented in place about $\frac{1}{16}$ in. off the back balsa wall. This gives the impression that the fuselage as seen through the hole in the bulkhead is hollow. A semi-circular piece of card or thin balsa sheet forms a platform upon which two small bucket seats, control column, rudder bar and dashboards are set. Figs. 1 and 2 show how this was done. The cockpit was copied from a photograph of the interior of the actual aircraft.

Fig. 1 shows the nose framework, this being constructed of thin plywood and bamboo. Although many hours of patient work are required, I think readers will agree that the result, when covered with cellophane, as shown in Fig. 4, more than repays one for the time spent. The balsa wood cone stuck on in Fig. 1 was to strengthen the framework whilst sanding smooth, and was later substituted for a celluloid one.

To make the nose like I did, first mark off on the piece of wood, cut off the fuselage the position of all frame members and spaces, and emboss the block to a depth of about 3/64 in. wherever these occur. The next step is to partially hollow out the nose-piece after having split it into four sections. When hollowed out, and the walls are about $\frac{1}{8}$ in. thick, the four parts should be lightly cemented together again. You now possess a semi-hollow balsa nose-piece grooved with lines and spaces.

Grease the outside surfaces and grooves with vaseline to stop the members sticking to the mould. The round frames can either be made of thin string (1/64 in. to $\frac{1}{32}$ in. diameter) soaked well in cement, wrapped round the grooves and cemented at the ends, or alternatively you can cut 1/64 in. circles to the correct diameter out of very thin mm. plywood, split into two semi-circles and recement them in the grooves round the mould. Fig. 1 shows the three pieces of card which are also cemented in place at this stage. The longerons, if we can call them that, are next cut to shape from thin mm. ply or slit bamboo and cemented in place *in* the grooves and *to* the circular members.

When the construction is complete gently separate the four pieces of the balsa mould and prise away from the framework. Clean surplus vaseline from the nose, and sand smooth. Paint inside and out a dark olive green, and also don't forget to paint the interior of the cockpit before cementing the nose in place, which job will be done at a later stage.

Fig. 2. ***A stage during assembly. The wing and tail unit are in position on the fuselage and the motor nacelles are fitted.***

The two engine nacelles are carved from two tiny blocks of hard balsa. Figs. 1 and 3 show how these are hollowed to take the wheels and undercarriage legs.

The rear bottom portion of the nacelle is marked where the doors are when the wheels let down. Fig. 5 shows how the " V " shaped block is removed by making two cuts only with a sharp razor blade. This is extremely important. The top part of the " V " shaped portion removed is used as the two doors. These are shown in Fig. 6, and the remainder of this block should be carefully carved away, leaving the doors about $\frac{1}{32}$ in. thick. The door portion, which should not be split into two yet, will fit beautifully into the nacelle. Fig. 7 shows how the " V " shaped hollow is enlarged until the sides are vertical. Of course this process will have to be repeated with the other nacelle.

It is better to leave the fixing of the hinged doors until the whole model is nearly complete, then hinge both and cut down the centre to form two doors.

Fig. 1 shows the two slots for the front undercarriage legs, which are made, as shown in Fig. 1, of piano wire, with a cross-piece neatly soldered in place at the top.

These front legs are fixed in place before the nacelles are cemented to the wings. They are bedded in plastic hardwood which, in addition to forming a good hard-wearing bearing, allows you to make last-minute adjustments to allow the legs to pack neatly away in the " wells."

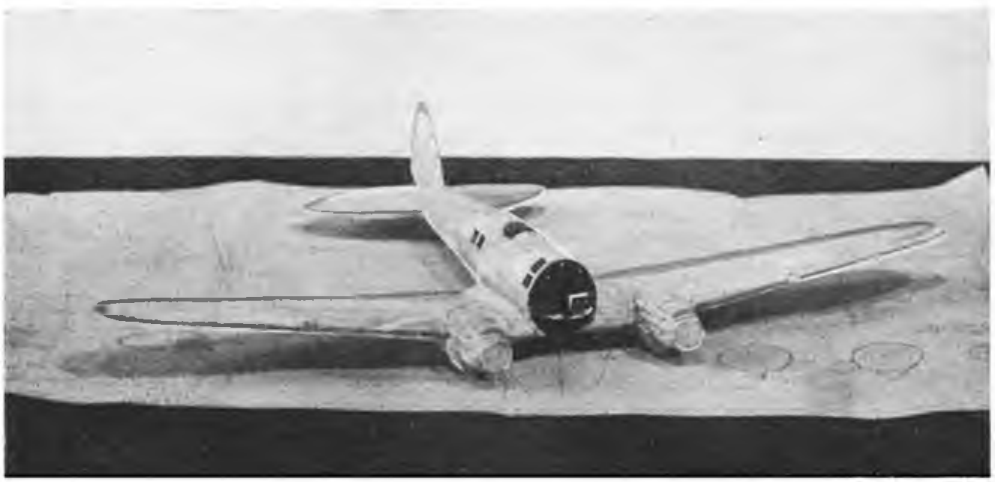
The nacelles are placed in their correct positions on the wings, and the positions of the wells to be cut in the wing surface marked. The nacelles are removed, the wells carved

as deeply and accurately as possible, and the engine nacelles finally cemented in place.

The back legs of the undercarriage are lengths of thin twine cemented firmly to the front legs and the inside of the well. When "out" these string legs look very "solid," but when retracted they fold neatly and take up very little room.

Fig. 2 shows the tiny "S" shaped wire clips which are cemented into grooves cut in the radiator. The clips hold the front leg of the undercarriage rigid when the undercarriage is out, and the grooves in the radiators are easily filled in with plastic wood.

The wheels shown in Figs. 1, 2 and 6 were later removed as rather too large, and a smaller Truscale pair were substituted. These were made by wrapping a length of ¼ in. diameter rubber tubing round a hardwood cone boss. The rubber was successfully joined by a tiny length of wire bent to the correct circle and fitting tightly inside the inner diameter of the tubing. In truth my wheels can be called rubber-tyred.



Before cementing the engine nacelles, wing and tail unit together, as shown in Fig. 2, give all parts several coats of clear cellulose or banana oil, sanding smooth between each coat.

The next step is best shown in Fig. 5, and after this we can carve the underneath gun emplacement to shape, and hollow it out until the walls are 1/64 in. thick. The tiny windows may be then cut carefully out with a sharp-pointed piece of razor blade. Cement in position and complete the rear wing fillets with plastic wood, after which you can punch or carve three more tiny windows at each side immediately above the gun emplacement.

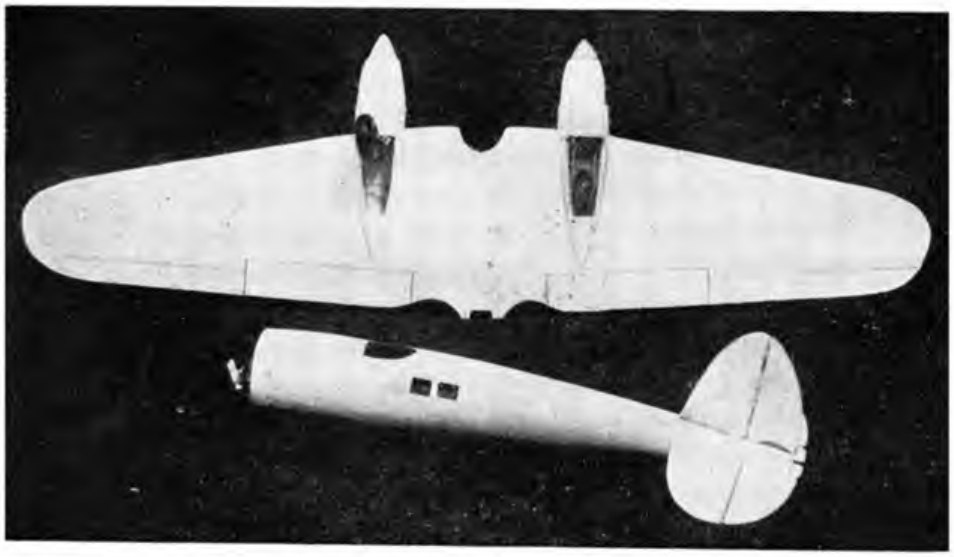
Fig. 6 shows the model with its first coat of colour. I painted my model with poster colours. These may be obtained from any store which sells artists' material in either pots or tubes. They are water-mixed, and thus you will find it necessary to bind each coat of poster colour with a thin coat of clear dope. With the colouring being so thin and easily applied, the results are really excellent. With a pot or tube of each of the primary colours—red, white, blue, yellow and black—you can mix practically any shade you require.

My Heinkel was painted as accurately as present information would allow. Top surfaces dark olive green all over; undersurfaces blue-grey all over. Black and white crosses and swastikas were painted neatly on thin white paper with black poster colour and neatly cut out, leaving the correct amount of white surround. These are fastened in the correct positions with gum before the model is given its final coat of dope and immediately after the last coat of poster colour.

All the cabin windows were covered with separate pieces of cellophane, as were the windows in the fuselage and the underneath gun emplacement. The tail wheel was carved out of solid hardwood and was not retractable. Aerial, mass balance and the handgrips under the rear of the fuselage were made with tiny pieces of wire. The propellers, which are painted black, were constructed from balsa and thin plywood.

Slots were cut in the leading edge, painted black, and with pins pushed well home and painted yellow, represented the landing lights. These, too, were covered with cellophane. Formation lights, too, were pin heads cemented in notches and painted dark red and green.

The machine guns were constructed of tiny pins with the head flattened. Tiny circles of balsa formed the ammunition drum, and the second barrel was a length of thin split bamboo. Carefully painted in black and grey, these looked very well indeed. The several sliding and



On the right is shown the wing fitted with the engines, complete with undercarriage units assembled, one retracted and the other in the "down" position, and in front is shown the fuselage without nose-piece, but with the tail unit in place.

Fig. 4. A further stage in the construction. The nose-piece has been fitted, and there remains only the doors to the undercarriage and the gunner's windscreen to complete the assembly.

hinged escape hatches were represented by tiny frames of thin card covered with cellophane and cemented in the correct places at the nose of the aircraft. The exhaust manifolds, air intake to supercharger and to carburetter were all carved from tiny oddments of balsa.

The frontispiece and Fig. 4 show the model with undercart "down," and I think the final result was definitely worth all the time and energy spent.

In conclusion, I hope that any readers who experience difficulty with this model will write to me, c/o THE AERO-MODELLER, enclosing a stamped addressed envelope. shall be pleased to help them in any way possible.

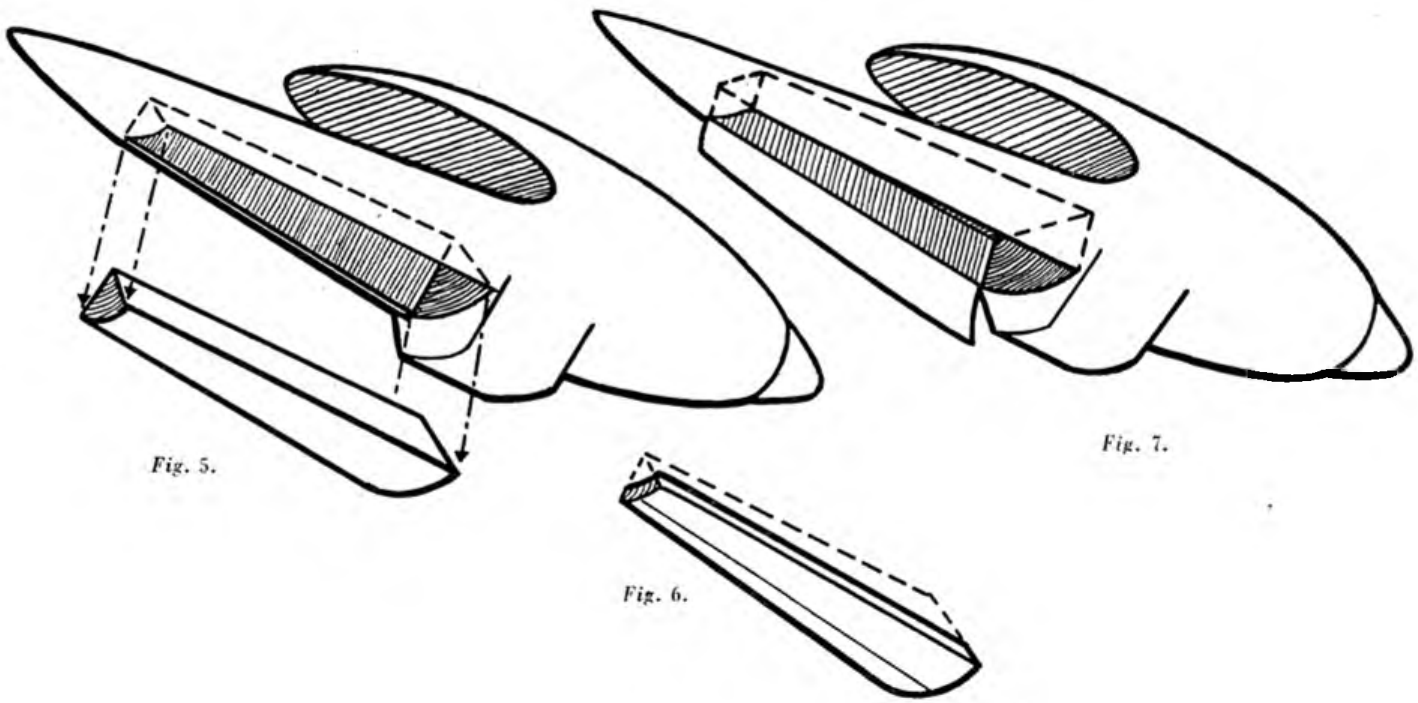
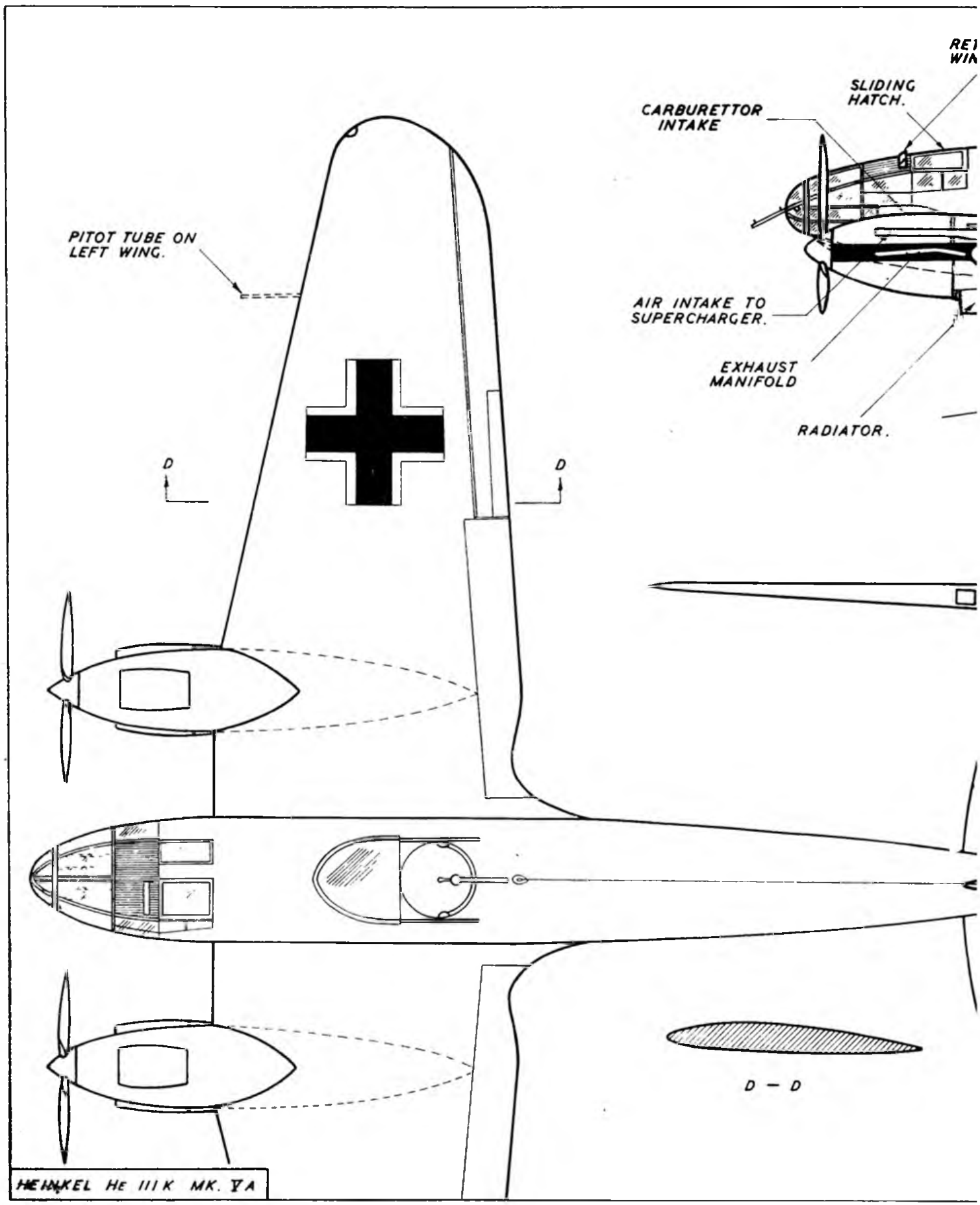


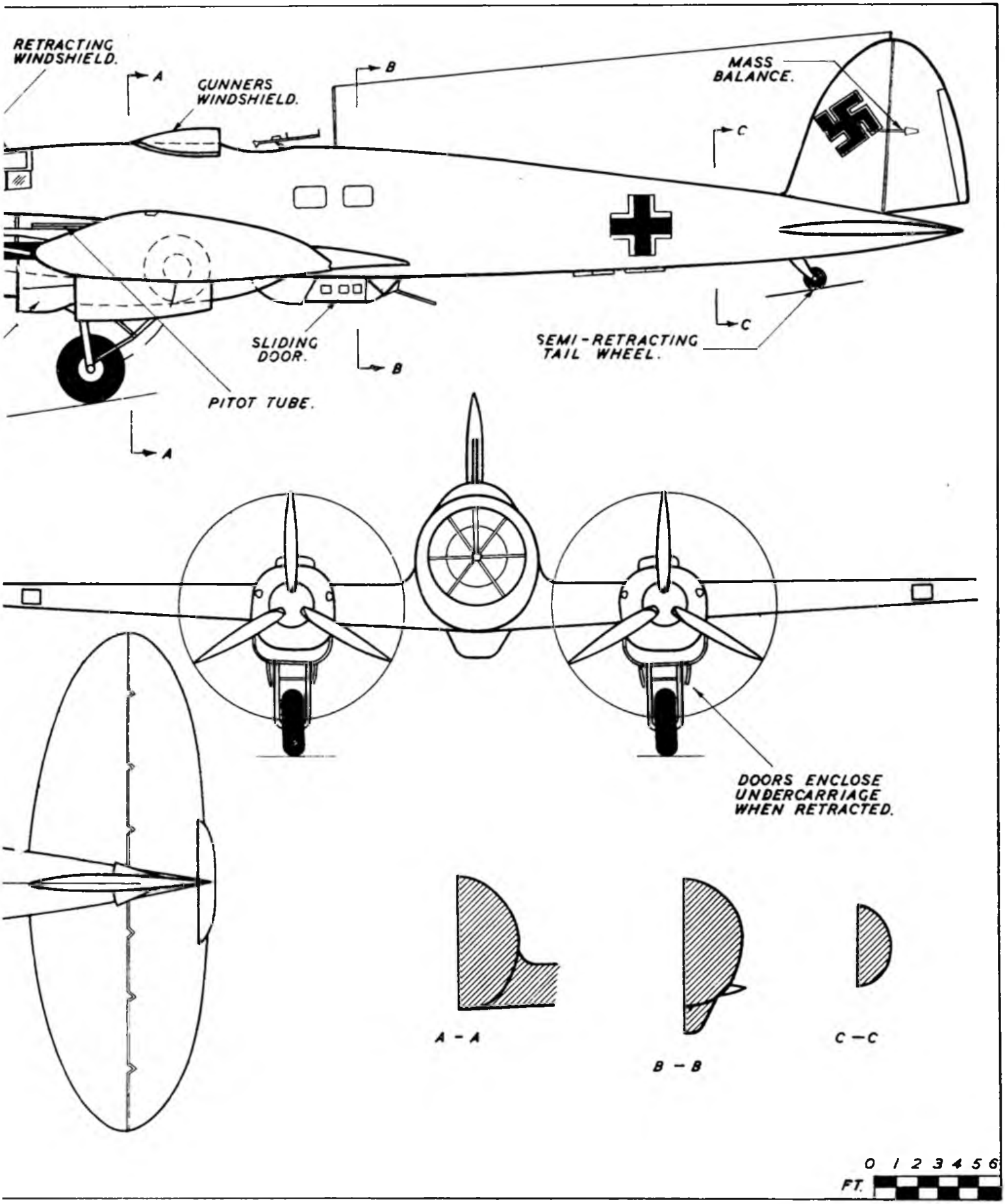
Fig. 5.

Fig. 7.

Fig. 6.

SEE PAGE 682 FOR PARTICULARS OF "SOLID SCALE MODEL AIRCRAFT"—— By J. H. Elwell





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ANSWERING THE CASE FOR THE BIPLANE MODEL

By ONE who has been flying one for the past year

V. C. GRACIE
South Africa

HERE is my personal view on the biplane question: In the past eight years I think that I have only seen five models of this class, two of which can fly to order.

The one belongs to Mr. Lilly, of Worcester (Cape), and is a rubber-powered ship designed by our old acquaintance, G. S. Light (U.S.A.).

The model flies very well, and its duration was found not easy to beat. But here I must stress a point that Mr. Wathew seems somehow to have completely forgotten concerning rubber-power curves.

That difficult first burst causes the real reason for so few rubber-powered biplanes; i.e. the torque is not as easily overcome with the short stubby wings as on the monoplane, where the centre of pressure of each wing will be found farther away from the C.G.

I may here add that on the Wakefield class model I defy anyone to fly a biplane on the present motors used on the monoplanes. Why?

The other model is a gas model designed, or shall we say gradually evolved, over a period of eighteen months, by myself.

She now flies quite respectably when the old Cyclone manages to keep up its revolutions, but the job weighs 4 lb., which really is a bit brickish! However, she is to have a new twin-plug super Cyclone (if it gets here), and this will put the power side in order.

Up to the present I think the highest she has been is about 150 ft. The longest duration was around 60 sec., and nothing really spectacular has been done except in showing its lightning recoveries when upset by gusts. On one occasion I hand-launched the ship, and accidentally released her with right wing low at 45 degrees, to my horror.

What happened? Well, I never saw anything to beat it. She flew straight for about 20 feet in that position (launched), and then did a lovely left climbing turn; the astonishing part is that she did not lose more than twelve inches height from the launched position!

If that had been a monoplane the right wing would certainly have hit the deck, and the motor would no doubt have been loose at the roots after that.

So here goes for my reasons in building the gas biplane, and maybe the arguments used will start more bipe's hopping around. I would be pleased to her from those enthusiasts, and their theories.

Have we not seen enough high-wing monoplanes yet? It is about time that some of us investigated the possibilities of the gas biplane!

Firstly, it breaks away from the usual thing, and also I believe that it may be proved that concentrated wing area will give greater lift, or shall I say, has less likelihood of spilling as much air as the monoplane does, as that job being slower will lose a little more height in the recovery.

Therefore, a quick recovery will be beneficial?

Naturally, wing loadings assumed to be the same.

The biplane will then be more efficient in *riding* a thermal.

Of course, the monoplane will make up in less drag with its greater wing aspect ratio! Then its glide will be superior—it is so.

How is it that rubber-powered biplanes do not generally make long times—chiefly because they never get high enough—this usually being due to a comparatively short motor length!

But in the gas class this rubber handicap I like to think becomes a positive asset—a short moment arm—quick recovery.

Our present ideas of efficiency are based on full-size data, and in my opinion this factor is of small importance when one's main support is from *below*—that is, rising air—requires concentrated area. Hence the biplane—just what we require?

In fact, to go to the root of it, the parachute *is* the most efficient thermal riding contrivance. (It is manœuvrable). Just think back a little, and you may remember some occasions where pilots on baling out have gone up and not down, as they so sincerely wished to do? Their reports were, of course, put into print!

Now, if we tried to put a motor on to a parachute, just where would we put it?

I think that conventionally the biplane, with its concentrated wing area, fills the need best. However this is merely the trend of my thinking cap, and I'm quite open to criticism, especially on the point of efficiency. But that depends on the view you take!

THE AVRO 504K BIPLANE ———

A 1 in. to 1 ft.—

Readers may care to guess at which of the photographs on this page are of the full-size 'plane and which are of the model built by Mr. Riding! (Solution is on page at the end of the article.)

THE first Avro 504 appeared in 1912, several variations of the original being produced, culminating with the 504K at the end of 1917.

The 504K was intended solely for training, and was equipped with a variety of engines, ranging from the 100 h.p. Monosoupape-Gnome rotary, to the 165 h.p. A.B.C. "Wasp."

After the last war, the Avro Civil Aviation Service was inaugurated with centres all over the country for the purpose of introducing aviation to the public—at one guinea per passenger—but was wound up after operating for only one season, owing to heavy financial losses, although over 30,000 passengers were carried during that time, thus giving employment to a great many ex-R.A.F. personnel. Whereas this project had failed, the Berkshire Aviation Tours Ltd., run on a much more modest scale by two brothers, F. V. and J. V. Holmes, succeeded. They started with one reconditioned 504K in 1919, and at the time of their amalgamation with Northern Air Lines Ltd., in 1931, finished up with a fleet of 15 machines. During the 12 years of their existence many pilots who have now become famous in civil aviation started their careers with this firm, the two most well-known being O. P. Jones and Sir Alan Cobham.

The Avro 504K, with rotary engine, finally disappeared from commercial aviation in 1937, but was succeeded by the 504N, with the 7-cylinder Armstrong-Siddeley "Lynx" engine of 180 h.p., or the 150 h.p. 5-cylinder "Mongoose." The latter variation could carry pilot and three passengers, and was the best machine ever produced for pleasure flying in and out of small fields.

Few people realise the tremendous amount of good work done by the Avro 504K in keeping aviation before the public during the long years of slump after the last war. Many thousands of the British public must have been enticed into the air for the first time by the little band of pilots who knew no other job but flying, and their ground staff, who laboured through the nights, very often in open fields, so that their machines could be airworthy for the following day.

Unrewarded by the powers that be, regarded with suspicion by farmers and landowners, the lot of those who toured the countryside, sometimes singly, and later in organised tours, was very often a hard and thankless one.

The Avro 504K was constructed throughout of wood, with sheet steel fittings. The longerons were of ash and the wing spars, ribs, etc., were of spruce. The fuselage was braced with steel piano wire, tensioned by means of Avro pattern turnbuckles, and was given some resemblance of streamline by stringers running longitudinally down the back and sides. With the exception of the 3-ply fairing round the cockpits, the fuselage was fabric covered.

With the 110 h.p. Le Rhone engine, the 504K had a top speed of 90 m.p.h. at ground level, and 79 m.p.h. at 10,000 feet. The landing speed was in the neighbourhood of 35 m.p.h., and the take-off run anything from 10 to 100 yards! (Depending, of course, on the strength of the wind).

Owing to certain peculiarities of rotary engines, i.e. the fact of having to be run almost at full revolutions all the time, since there was no "tick-over," Avro 504K machines were fitted with what was flnown as a "Blip Switch." This switch was actually in the form of a button recessed into the top of the control-column, which when pressed with the thumb, cut off the ignition, allowing the engine and airscrew (which rotated around the crankshaft) to be carried round by their own momentum. When taxiing or making a gliding

—SCALE MODEL

Built and Designed

By E. J. RIDING

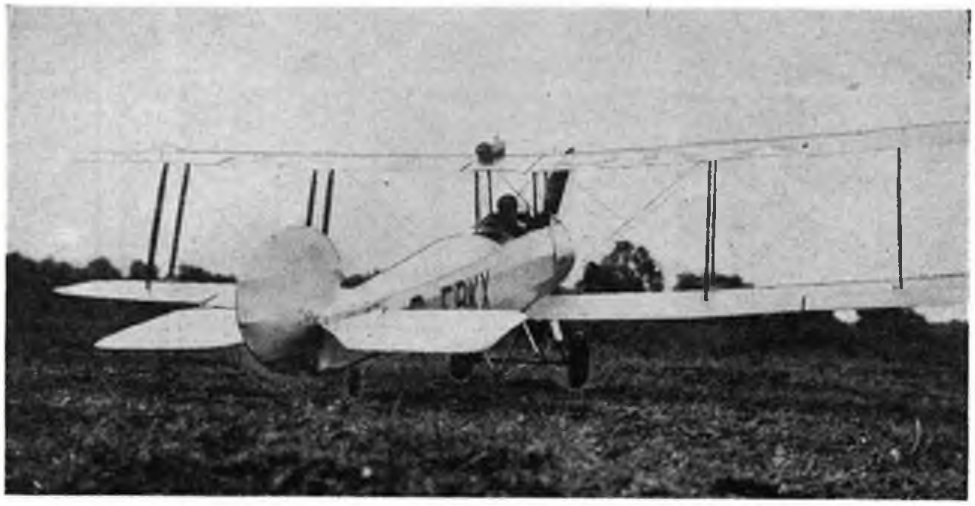
approach preparatory to landing, it was customary to alternately press and release this button. Thus, when the engine was just about to stall the switch was released and it picked up on its own momentum. The advantages of this arrangement are obvious, as the pilot was relieved of the complications involved in using the main ignition switch.

The petrol consumption was 10½ gallons per hour at ground level, and owing to the fact that the engine was a rotary, the oil consumption was round about 1¼ gallons per hour, most of the oil being thrown out over and under the fuselage and the under-surfaces of the wings—the pilot's trousers also came in for a good share. After a good day's flying, one used to peel the mixture of oil, mud and grass off the under-surfaces with a penknife. Incidentally, the oil used had to be vegetable castor oil, for technical reasons too lengthy to go into in a short article! As regards colouring many schemes were in use during the war, the chief one being drab green with clear-doped under surfaces, together with usual R.A.F. tricolours. In civil life, however, practically any colour under the sun was used. Some companies had their own particular colours, i.e. the Cornwall Aviation Company's machines were red all over, with white letters. Northern Air Transport Ltd.'s were silver all over with red struts, letters and decking. The model illustrated is one of North British Aviation Company's buses, and is silver all over with red letters, etc. It is constructed to a scale of one inch to a foot, with spruce longerons and wing spars with balsa ribs. The whole is covered with superfine jap tissue, treated with two coats of clear dope and two of silver. All controls function from the cockpit. The engine is a dummy, built up from balsa, with aluminium induction pipes, etc. The engine cowling is a 22 s.w.g. aluminium spinning. For the convenience of solid scale model builders details of the tail unit, tail skid and undercarriage are given, together with general-arrangement drawings.

Many people have regarded with amusement the large front skid, fitted to prevent nosing over in long grass or ploughed fields.

The latest trend in the design of modern aircraft is the use of the tricycle undercarriage, which is actually a return to the practice of 1912.

Although the model illustrated in the accompanying photographs is "built up," i.e. with longerons, spars, ribs, etc., the following constructive notes refer to a 1/24 solid scale job, as no doubt solid modelling has more appeal for the average scale modeller than the "built-up" method, which in this case involved six weeks' work.



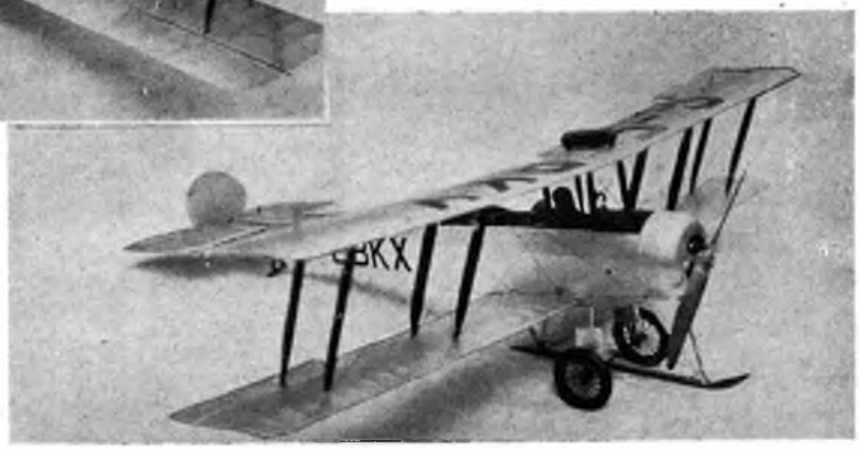
Tens of thousands of persons had their first "five-bob flights" in Avro 504K's such as the one shown in this photograph—that is, of course, if it's a full-size 'plane and not the model!

In building the fuselage, preference is given to the "split construction" method, as it facilitates the incorporation of cockpit details. The fuselage is made from two identical blocks of hard balsa, 11 in. by 1¾ in. by ⅝ in., each marked out as in Fig. 1, although, of course, opposite handed. Surplus wood is cut away, and the cockpit hollowed out and sanded to a smooth finish.

The two sides are then cemented together and allowed to set. As will be seen from the plan view, the fuselage section is circular at the engine bulkhead, gradually tapering to a flat-sided rectangular section with a rounded decking at a position just behind the rear cockpit. After the fuselage has set, the engine plate,

A 36 in. SPAN

These two photographs of the model clearly show how faithfully the full-size 'plane has been copied. The photograph below shows how the "copying" has been carried out, even in regards to the "parts that don't show when the model is finished."



made from ·5 mm. ply, is glued to the front end and the balsa side-fairings glued into position, as shown in the "exploded view," Fig. 4. The circular engine cowling is made from a block of balsa 1¾ in. diameter, and hollowed out to house the rotary engine; the gap in the bottom of the cowl is cut out after fitting to the fuselage.

The engine is built up as shown in Figs. 5 and 6, using a ¾ in. by ½ in. block for the crankcase, and ¼ in. round dowels wound with black thread for the cylinders, nine in number. Induction pipes and push rods can be made from varying thicknesses of aluminium or copper wire and then glued in position. The airscrew is carved from a mahogany block 4¾ in. by ⅜ in. by 1¼ in., given a smooth finish and mounted, together with the engine, on a 16 s.w.g. spindle running freely in the brass tube bearing in the centre of the front bulkhead of the fuselage. The complete unit should revolve freely inside the cowling when the propeller is turned.

The undercarriage legs are made from 20 s.w.g. wire, with balsa blocks representing shock absorber casings, as shown.

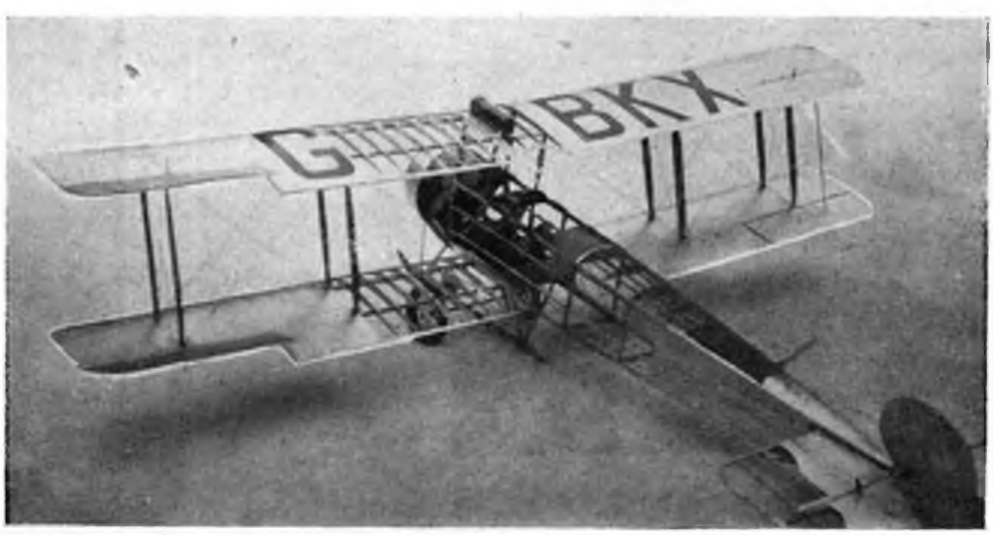
The axle, made from 16 s.w.g. wire, is bound into position between the lower compression legs. Two 1½ in. diameter landing wheels are made from hard balsa, and sanded to the shape shown in the front elevation of the three-view drawing. Note that the conical faces of the wheels face inwards, giving an increased track.

Holes are drilled at six points in the under side of the fuselage to take the two shock legs and the front and rear vee struts supporting the main skid. These three latter items should be made from spruce and glued in position with the rear vee struts at right angles to the fuselage datum line.

The centre section is next cut to size from ¼ in. plank balsa, sanded to the correct aerofoil shape and mounted over the front cockpit on four spruce struts, ⅛ in. by $\frac{1}{32}$ in., remembering that the rear pair are shorter than the front ones, to allow for the incidence angle of 4 deg. Bracing wires are represented by black thread. Note that the space between the rear pair of centre section struts is left free of wires to facilitate entrance and exit for the pilot. To counteract this the bracing is duplicated in the front bay. Cockpit details are now added—windscreen, dashboard (in front cockpit only, if civil) and three bucket seats. Note that in the civil version two seats are fitted in an enlarged rear cockpit.

The tail-plane is fitted into a slot cut in the end of the fuselage, and the rudder glued into position afterwards.

The tail skid is free to swivel and is built up as shown.



"SOLID" MODEL OF THE AVRO 504 K

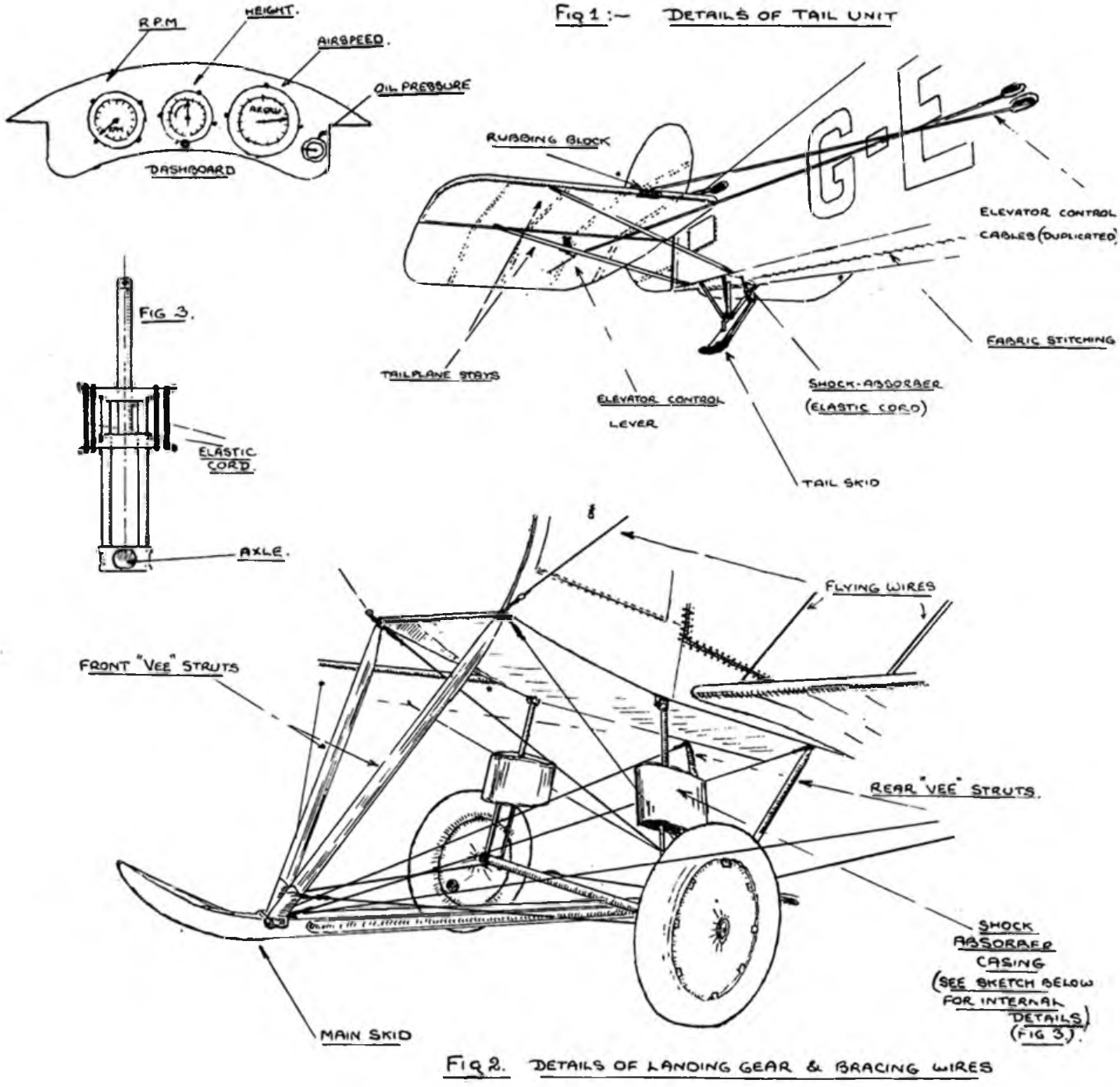


Fig 2. DETAILS OF LANDING GEAR & BRACING WIRES

Finally, the wings are cut to size from ¼ in. balsa plank and sanded to the correct aerofoil shape They can be either "boxed up" before attachment to the fuselage, or cemented into position by means of dowel pins to the centre section and fuselage, adding the interplane struts later Note that owing to the wing section the *rear* interplane struts are slightly longer than the front ones, and also the *inner* pairs have a greater chord than the other pairs. Bracing is done with black thread, all wires being shown in the accompanying plan and sketches. Note also that the flying wires are duplicated and the landing wires single.

Now, as regards final finish, one cannot emphasise too often the fact that finishing and colouring definitely *makes* the model. In this case each component should be alternately clear doped and sanded with fine grade sandpaper until a really good finish is obtained before assembly. Details of colouring have already been given in the description of the original machine, although some additional notes on the subject would not be out of place.

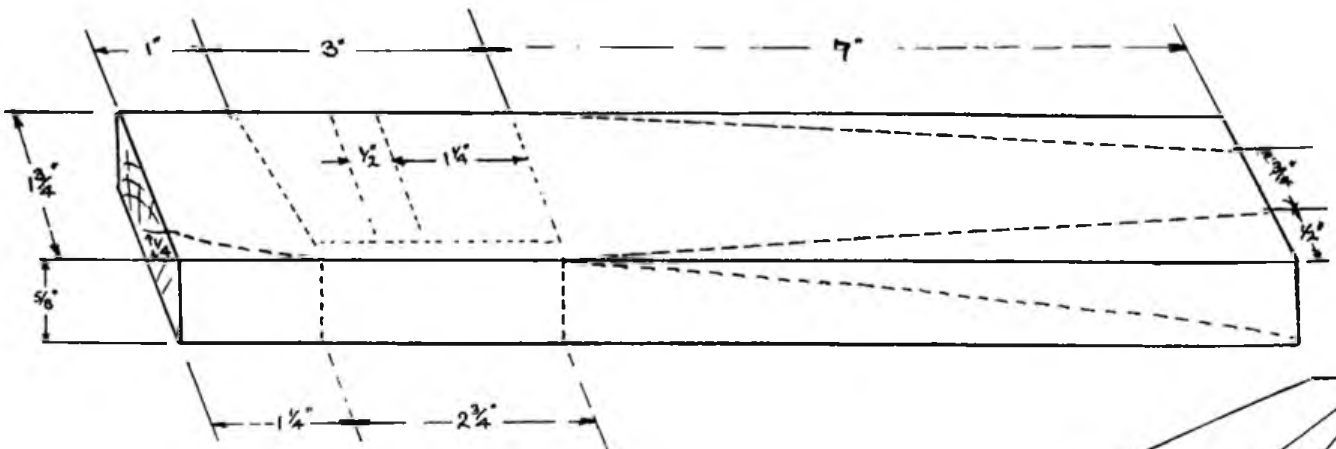
An attractive colour scheme would resemble that at one

THE AVRO 504K —— DID YOU GUESS?

. . . the photograph at the top of page 730 is of the full-size 'plane. All the other photographs illustrating the article are of the model. Incidentally, Mr. Riding took all the photographs, and readers will no doubt agree that he is to be congratulated on his skill as a photographer as well as a model-builder.

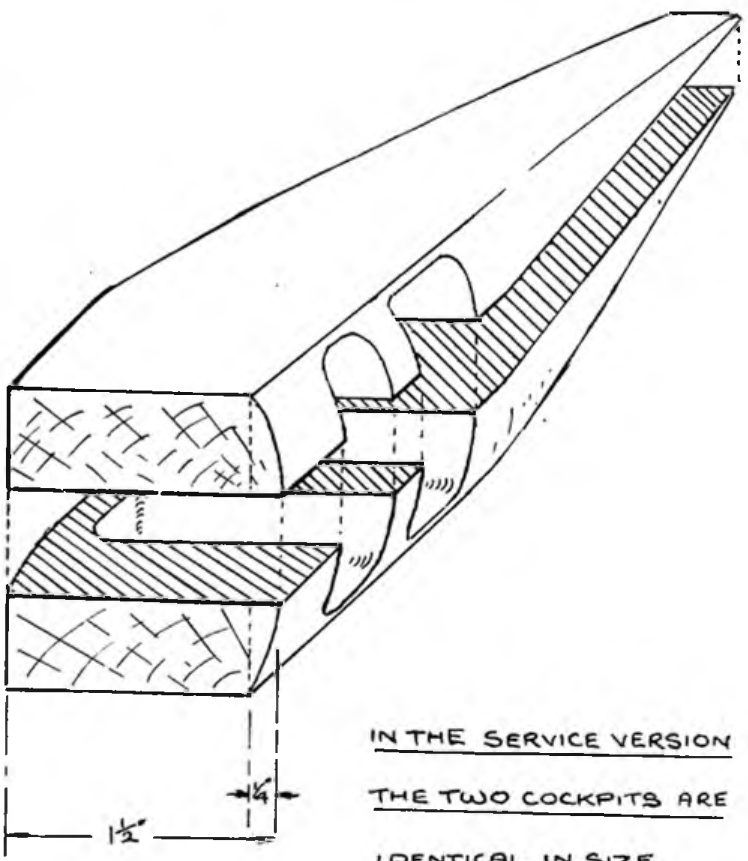
time used on the machine, shown in the photograph of the actual aircraft. In this case the fuselage was turquoise blue with dark blue nose and letters. The wings and tail-plane were silver, and the rudder dark blue with gold stripes. Interplane struts, etc., were also dark blue, but clear varnish, both for these and the undercarriage skid, gives a very good effect. The registration letters in this case were G.EASF, painted on the top and bottom surfaces of the wings and along the fuselage sides, as shown on the general arrangement drawing.

It may be of interest to many readers who have flown in this particular machine to know that it was first registered in 1919, and was finally broken up in 1937, an abnormal lifetime for a commercial aeroplane, although, of course, nothing remained of the original machine—a not unusual occurrence in joy-riding craft, as in the annual certificate of airworthiness overhaul an entire new set of main-planes, or rear end of fuselage, may have to be fitted, not to mention replacements due to damage or wear and tear



THE FUSELAGE IS MADE FROM TWO BLOCKS OF HARD BALSA, (Fig 1) GLUED TOGETHER LONGI-TUDINALLY AS SHOWN IN Fig 2.

TYPICAL WING SECTION. (FULL SIZE.)



THE TWO COCKPITS ARE HOLLOWED OUT BEFORE GLUEING THE SIDES TOGETHER.

IN THE SERVICE VERSION THE TWO COCKPITS ARE IDENTICAL IN SIZE.

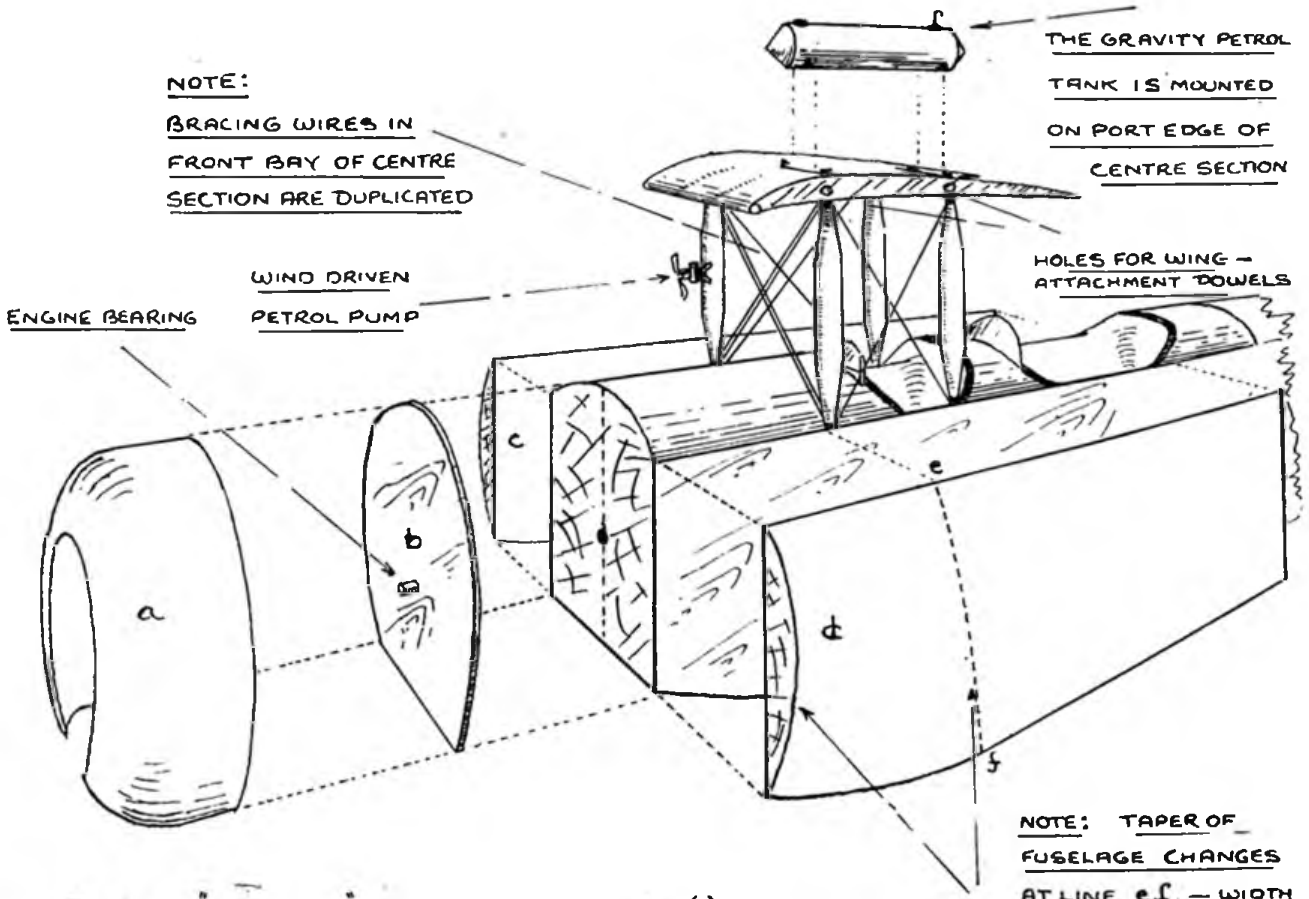


Fig 4 "EXPLODED" VIEW OF ENGINE COWLING (a), FRONT BULKHEAD, (b) & SIDE FAIRINGS, (c & d).

NOTE: TAPER OF FUSELAGE CHANGES AT LINE e.f. — WIDTH AT ARROW HEADS CAN BE ASCERTAINED FROM GENERAL ARRANGEMENT DRAWING.

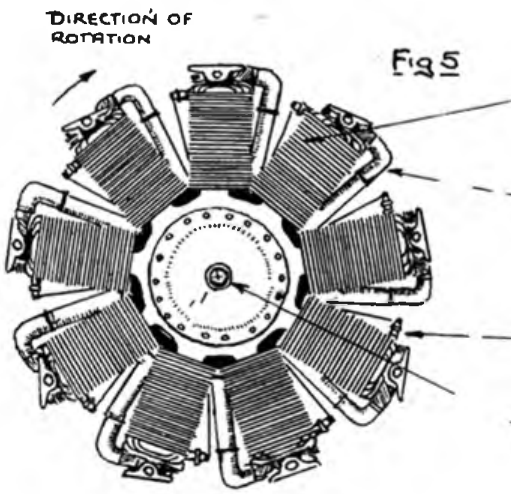


Fig 5

ENGINE.
LE RHÔNE 110 H.P. TYPE J
(FRONT VIEW.)

CYLINDERS MADE FROM BALSA DOWELS WOUND WITH BLACK THREAD.

INDUCTION PIPES FROM 10 S.W.G. ALUMINIUM OR COPPER WIRE

ONE SPARKING PLUG PER CYLINDER

16 S.W.G. PIANO WIRE PROP-SHAFT. PROTRUDING 1/2" IN FRONT OF CRANK-CASE (TO TAKE PROP BOSS) & 3/4" BEHIND, FORMING CRANKSHAFT. ENGINE IS THEN MOUNTED IN FUSELAGE BY FITTING CRANKSHAFT THROUGH BEARING IN BULKHEAD "D".

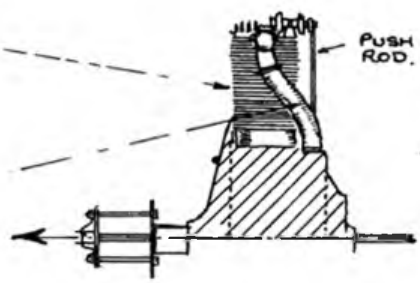


Fig 6 SIDE VIEW.

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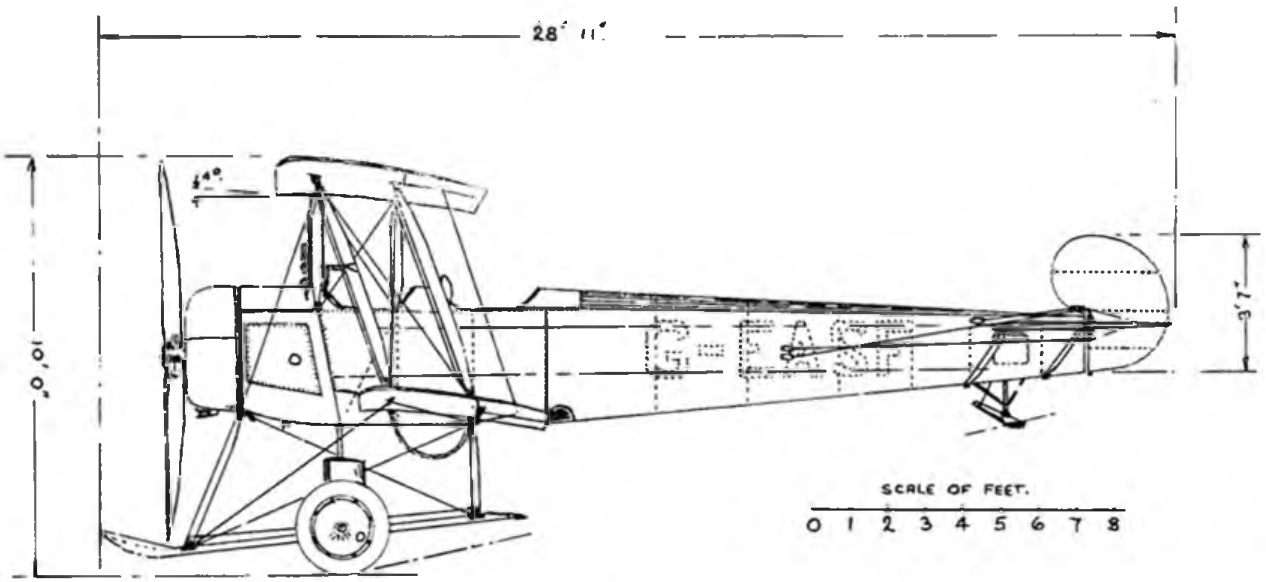
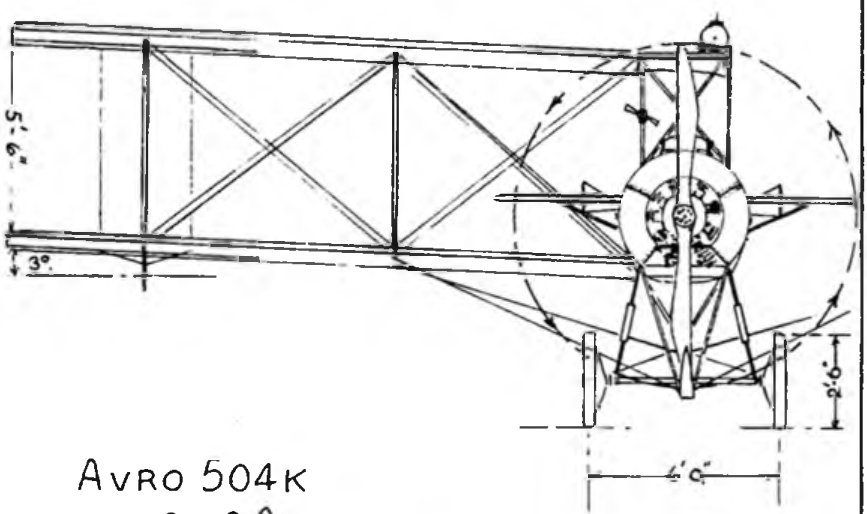
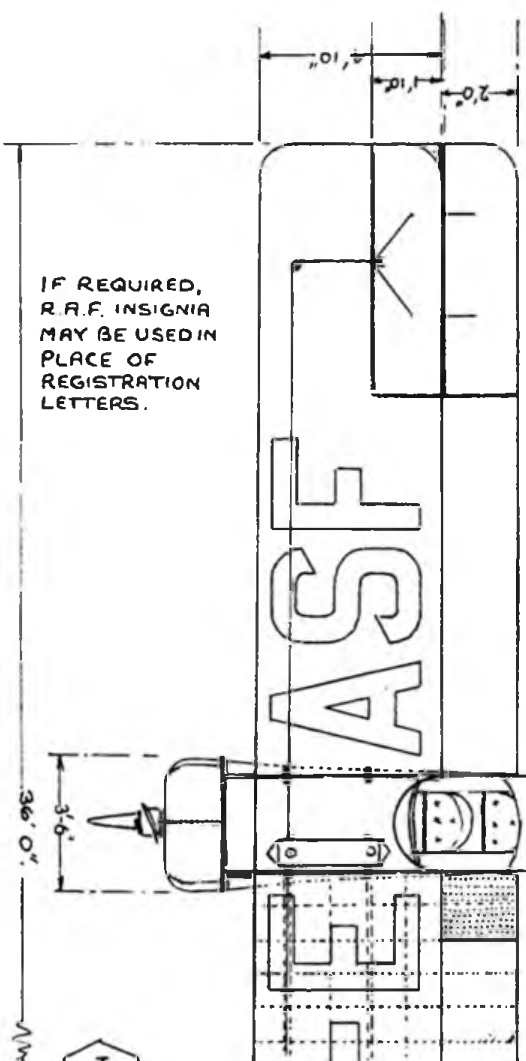
E.J.R 1940.







IF REQUIRED, R.A.F. INSIGNIA MAY BE USED IN PLACE OF REGISTRATION LETTERS.

AVRO 504K

110. H.P. LE RHÔNE

MAX SPAN.	36' 0".
LENGTH.	28' 11".
MAX. HEIGHT.	10' 0".
CHORD.	4' 10".
GAP.	5' 6".
TRACK	6' 0"

E.J.R 1940

COLOUR:- ALUMINIUM ALL OVER, DARK BLUE RUDDER, STRUTS, DECKING, WHEELS, & LETTERS.

AERODYNAMIC FORMULA (2)

By A. H. SMITH

THE first article in this series described the arrangement of fundamental and derived units which led up to the formation of the formulas for lift and drag.

These were given as

$$\text{Lift} \quad (L) = C_L \tfrac{1}{2} pSV^2 \quad (4)$$

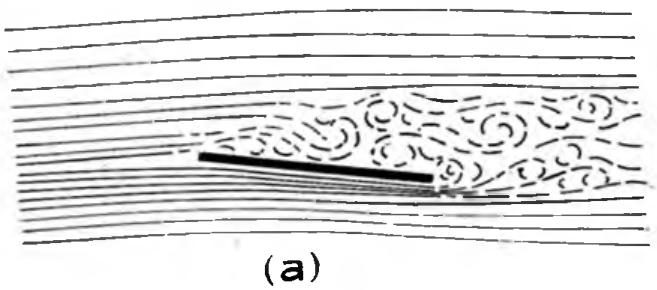
$$\text{and Drag } (D) = C_D \tfrac{1}{2} pSV^2 \quad (5).$$

So far we have only considered the flat plate as an airfoil, and early aerodynamic experiment soon found that by curving the plate it was possible to increase the lift; also, by increasing the thickness an appreciable reduction in drag was obtained. The effect of this on the airflow is shown in Fig. 2.

In the ase of the flat plate (*a*) the airflow is broken up, due to the formation of eddies thus causing a large resistance or drag; at (*b*) a good airfoil shape is shown, and the airflow tends to follow the outline and form lamina or thin layers which are termed streamlines, the aim being to reduce the eddy resistance to a minimum.

Viscosity.

Now all theory of flow over an airfoil must consider the nature of the medium through which it is moving, and its



(a)

basis is the idea of a "circulation," or *flow round* the airfoil. If this were made in a perfect fluid, that is, one free from viscosity or stickiness, it would be possible to calculate the speed and direction of flow at all points.

Although we cannot feel or grasp air, we know that it has viscosity, or the tendency of one layer of air to move with the layer next to it, and this property may be regarded as analogous to friction between solids.

When a streamline body such as an airfoil is moving in the air, the effects of viscosity are greater near the surface, and the greatest effect is confined to a thin layer just above the surface. This flow is thinner at the nose or leading edge and thicker towards the rear, roughly proportional to the square root of the distance from the leading edge.

This layer is called the "Boundary Layer," and is defined as "that depth of the airflow adjacent to the airfoil in which the velocity is not uniform," and from a formula developed by Van der Hegge Zijnen the thickness in feet

$$T = 4{\cdot}5\sqrt{\frac{KL}{V}} \quad (6),$$

where K = ·00016, being the kinematic viscosity of air.

L = Distance from leading edge in feet.

V = Airspeed in feet per second.

It will be seen from Fig. 2 (*b*) that the streamlines diverge at the nose of the airfoil and are increased in velocity with a decrease in pressure. As they move over the airfoil near the thickest part the pressure increases and the slower moving boundary layer tends to pile up and deflect the streamlines from a laminar flow to one of turbulence or disturbed motion.

Due to this turbulence the break-up of airflow results in an increase of drag, and usually occurs at a Reynolds number of about 3,000. The Reynolds number, of the thickness of the boundary layer is given as being equal to

$$\frac{TV}{K} \quad (7).$$

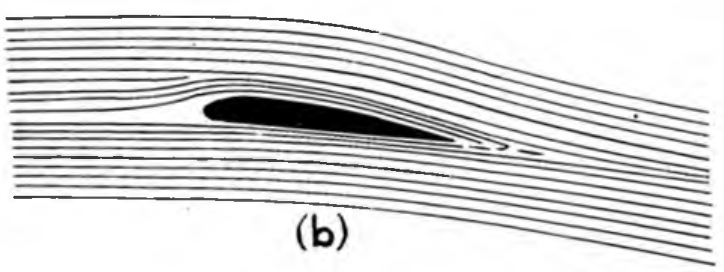
The Reynolds Number.

As wind tunnel experiments cannot be carried out under the same conditions as full scale flight, our reaction formula $R = \tfrac{1}{2} pSV^2$ is not strictly correct, and for model experiments a more accurate formula is given as

$$R = \tfrac{1}{2} pSV^2 \times f\left(\frac{pvl}{u}\right)$$

where l is a convenient linear dimension and u is the coefficient of fluid viscosity.

As the value of u is independent of pressure and temperature for standard density (at ·002378 slugs per cubic



(b)

foot), we may write v for u/p where v is the coefficient of kinematic viscosity.

The expression then becomes

$$R = \tfrac{1}{2} pSV^2 \times f\left(\frac{vl}{v}\right)$$

the value $\frac{vl}{v}$ being called the Reynolds number. So far, we know that lift and drag are expressed in coefficient form and experimental results for their values are usually given in the form of a graph for each particular airfoil shape. When use is made of this data care should be taken to see that the data is corrected to the approximate Reynolds number required. For instance, a Reynolds number of 1×10^7 represents a wing chord of 7 ft. at a velocity of 150 m.p.h., whereas a model of 6 in. chord at 20 ft. per second would have a Reynolds number of only about 66,000. As most airfoil data contained in the reports and memoranda of the Aeronautical Research Committee and the N.A.C.A. reports are given for Reynolds numbers of around 3,000,000, it is recommended that readers study the article by Arnold Wathew in THE AERO-MODELLER for November, 1938, or as presented by S. B. Stubbs in his "Design of Wakefield Models," where graphs corrected for low speed are given for the airfoils R.A.F. 32, Clark Y and N.A.C.A. 6412.

The Lift Curve.

A study of any graph of airfoil characteristics will show how the lift and drag alter as the angle of attack is increased, and it will be seen that with most cambered airfoils there is a definite lift coefficient at an angle of 0°. A flat plate or purely symmetrical airfoil will give no lift when there is no angle of attack and is termed " non-lifting."

Next, for most airfoils the lift curve is practically a straight line between 0° and 10° or 12°; beyond this the line increases slightly and then falls again, forming a curved " peak " with a maximum point between 15° and 20°. This maximum point is known as the " stalling angle " of the airfoil, and is hardly affected by the speed.

If we remember that it is the streamline or steady flow conforming to the shape of the airfoil at low angles of attack which make flight possible, it will be seen that when the airfoil reaches its critical or stalling angle the flow becomes turbulent and breaks away and the airfoil " stalls."

The Drag Curve.

This curve, which gives values of the drag coefficient C_D is usually at a minimum at about $-4°$ to $-2°$, and increases roughly as a parabolic curve, becoming greater in value as the critical angle is approached.

The Lift/Drag Curve.

The third curve on the graph is the curve of L/D, and as we require a good lift value with low drag this curve will show at what angle of attack we can obtain the best lift in comparison to the drag or the best lift/drag ratio.

From our formulas (4) and (5) it will be seen that

$$\frac{L}{D} = \frac{C_L \frac{1}{2} \rho S V^2}{C_D \frac{1}{2} \rho S V^2} = \frac{C_L}{C_D}$$

so that the most efficient angle of attack for our airfoil corresponds to L/D max.

STILL MORE DEFINITIONS

C. A. HAWKES

THE two previous sets of " Definitions," in addition to enlightening many woefully ignorant model builders, also brought about the resignation of the secretary's wife from the committee of a certain model aeroplane club. It is with the hope of such highly desirable results continuing that a further set has been compiled.

Aspect-ratio.—The difference between the actual and calculated durations of a model.

Autogiro.—A model which can descend vertically.

Bamboo tissue.—An inferior grade of wallpaper used for covering heavy models.

Birch and silk onstruction. A technical term often used in ancient times to describe a model aeroplane. Is still occasionally heard in remote parts of the country.

Cabin-windows.—Usually appear in the fuselage after a few flights.

Dope-brush.—A brush specially made so that a bristle comes out at every stroke.

Flying scale model.—See " Autogiro."

Fuselage-jig.—The temporary structure on which a streamlined fuselage is constructed. There are two types —(*a*) Those which collapse prematurely. (*b*) Those which cannot be removed from the completed fuselage.

Gap.—The distance between the wings of a biplane. Does *not* mean the difference between the assets and liabilities of the club.

Jap-tissue.—Used to cover the framework of the 'plane to provide a firm support for N.G.A. and club transfers.

Lady members.—Are generally believed to join model aeroplane clubs to find out for themselves just exactly what variety of secret wickedness must necessarily take place in order to attract so many men.

Microfilm models, flying of. The adult version of a childish game—that of blowing soap-sud bubbles and floating them in the air.

Ornithopter.—A model with wing-flutter in an advanced stage.

O.S.—Means " out-of-sight," and is often written after the time of a flight. Usually taken to mean that the model crashed so hard that it buried itself.

Pterodactyl.—A model incorporating the aerodynamical lay-out of a Manx cat.

Solder.—A form of ballast affixed in little lumps (or large lumps) to the wire parts of a 'plane.

Stagger.—A term referring to the wing arrangement on biplanes. Nothing whatsoever to do with the finish of the club dinner.

Twin-rudders.—Are usually hurriedly fitted to an "own-design" 'plane in order to prove that it could not possibly have been copied from the well-known kit-model that resembles it very closely.

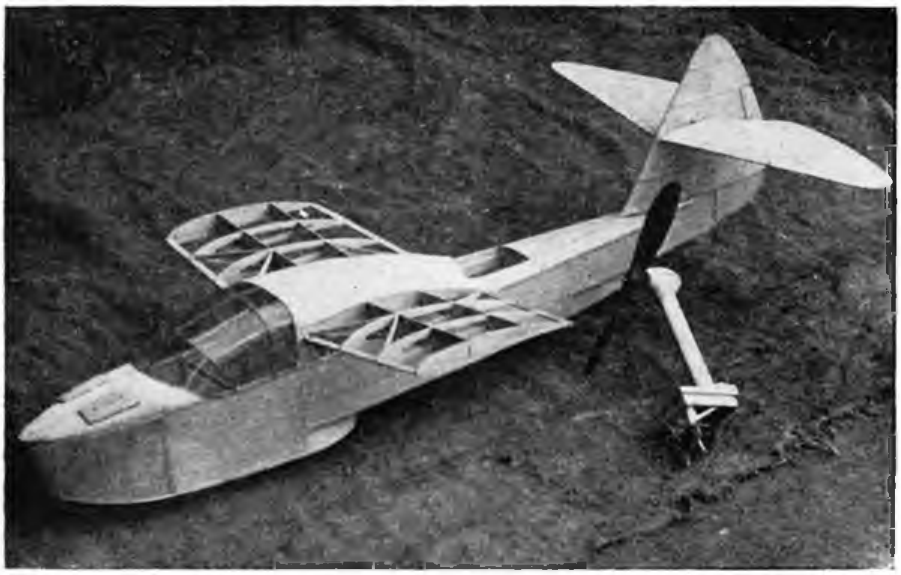
THE SPENCER LARSEN AMPHIBIAN.—*Continued from opposite page.*

A further refinement would be a pointer added to the cam moving over a scale on the fin, and would almost give a micrometer adjustment.

The transmission has stood up to full turns of two ten-strand motors $\frac{1}{4}$ in. thick rubber, although indications appear to show that with an $11\frac{1}{2}$ in. diameter propeller it will have to be geared up to get that initial burst to unstick the craft from the water.

This will call for a lot more experimenting, and so for a war-time diversion in between times it is making a very interesting proposition.

THE SPENCER LARSEN AMPHIBIAN



By H. J. TOWNER

We are pleased to announce that we have secured the copyright in Mr. Towner's design for this model, and plans will shortly be available via "THE AERO-MODELLER Plans Service."

IN choosing the Spencer Larsen Amphibian as a prototype from which to build a flying scale model, the author's main reason was that here was something so very different and so full of possible difficulties, and yet so full of detail that it would require real designing to achieve anything like results.

Throughout the whole design and building I have borne in mind the possibility of incorporating a petrol motor at some future date, and although the job is by no means complete the details so far might be of interest to the modellers, and perhaps help to solve some of their knotty problems.

Here let me state before going further that although I have termed the model a flying scale model, yet I must confess that in some respects I have had to deviate somewhat in order to achieve results, and so I propose to give the reader some idea of the reasons why alterations have been made.

The actual full-size craft is a two-seater side by side job, which gives it a very wide beam and hence a lot of frontal area. This in turn means a lot of drag, and consequently the centre of resistance of the model would be well below the thrust line, which in this case is very high. Consequently the job would tend to nose down with full power, and might be difficult to R.O.W., R.O.G., or even to climb at all.

Considering this, the overall width has been somewhat reduced, although no doubt the larger planing surface of the original would have helped stability on the water.

Then we come to the steps, and here the original main step is well aft of the centre of gravity, where I originally built it. However, on reading Col. C. E. Bowden's advice in the December, 1939, issue of THE AERO-MODELLER, stating that the best position for take-off was just ahead of the centre of gravity, I decided to alter the model in this respect, and consequently reconstructed the hull to bring the main step farther forward.

The next snag was the position of the floats. This had to be determined by trial, so the hull was floated in the family bath (much ribald laughter from a certain member of the B.D.M.A.C.), and weighed down to its calculated finished all up weight of 22 oz. Its fore and aft position on the water appeared about right, but the floats would not reach the water, as it was not possible to scale down the weight as well as the dimensions of the prototype, thus giving a different "plimsol" line.

This called for a lot of wangling to get the floats or pontoons to not only float, but at the same time to act as ground wheels when lowered, and still to keep the correct alignment of the model, both on the ground and on the water.

These then are the chief variations from true scale. Now for the actual design of the various components.

The propeller drive was not difficult, as can be seen from the sketch. The chief point in this type of drive is not to have too sharp a bend in the flexible drive, hence the reason for two steel fine mesh gears in the head, while a central bearing in the lower flexible drive takes out any "whip" that might otherwise occur.

The column itself is balsa built in two halves, and likewise the head, to enable assembly of the drive. The whole fitting is a push fit in the hatch, so that it can be easily withdrawn for inspection, and also stretch-winding.

The drawing of the nose-wheel may seem complicated, but it is very sturdy, with plenty of weight in the right place, and is so designed that the wheel assembly will retract almost vertically without describing an arc, and so tucks away nicely.

I had toyed with the idea of a parallel link motion, but could not afford the head room.

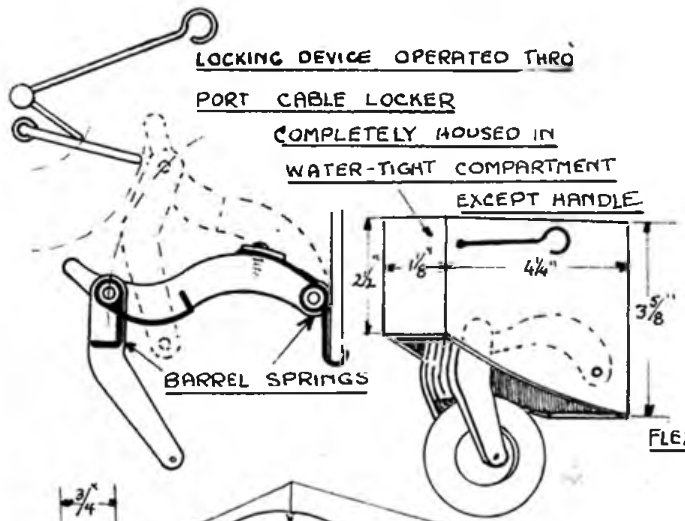
The wheel forks and link gear are all made of hard $\frac{3}{32}$ in. 3-ply built up, glued and dowelled together, and slide up and down in a watertight compartment. The retraction is manually operated, and is held in the "up" position by a pawl which can be depressed by opening the port anchor chain locker and depressing a suitable small lever.

The pontoons are built on a framework and planked with balsa, the steel wire fixing in the nose, giving a nice resiliency for a rough landing. Although these pontoons are a bit heavier than I should have liked a certain amount of weight here probably will not be amiss.

The wing panels are detachable, with vertical dowels, and the wing tips are also made separately and attached with shear pins to relieve the strain of the main dowels.

The system of adjustment of the tail surfaces, using a cam rolling in a suitable box, makes a very definite form of adjustment and stays put.

(*Concluded a foot of opposite page*).



DRAWINGS NOT TO SCALE

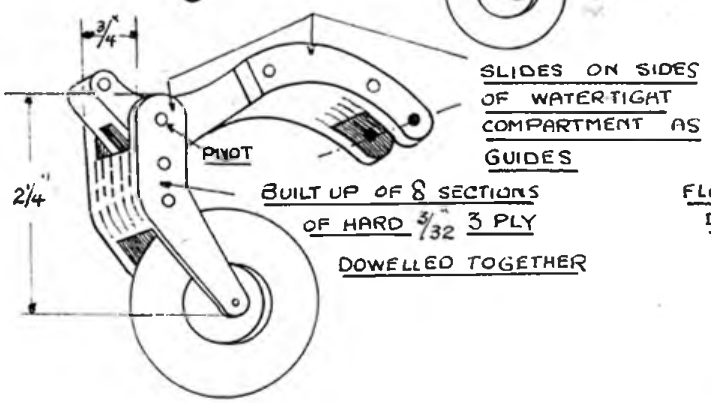
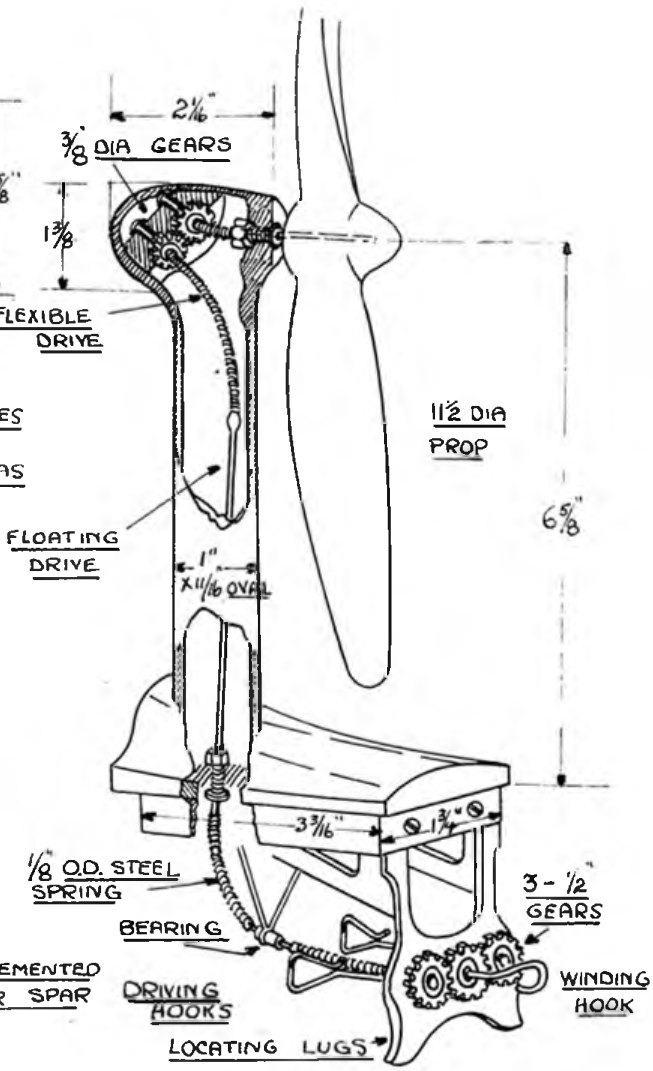
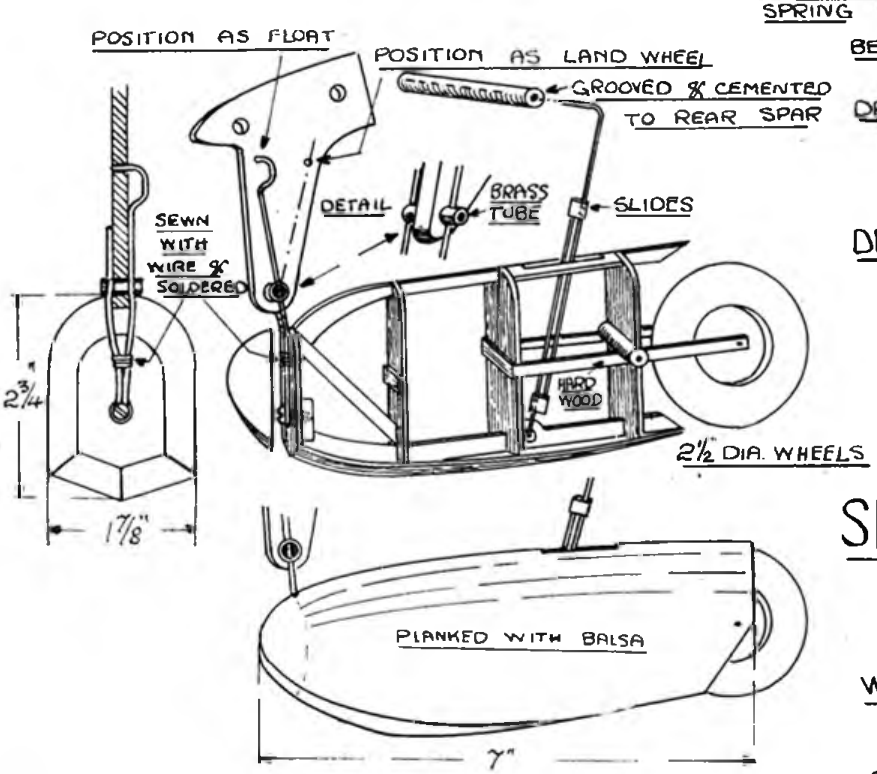


DIAGRAM OF NOSE WHEEL
GIVES VERTICAL MOTION



DETAIL OF PROPELLER
DRIVE

COMPLETE UNIT PRESS FIT
IN HATCH & DETACHABLE
FOR STRETCH WINDING ETC



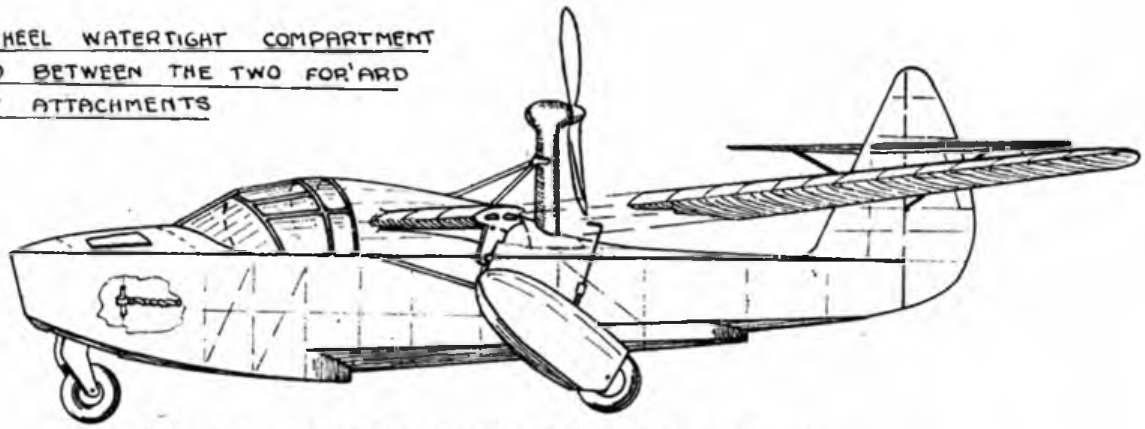
SPENCER-LARSEN
AMPHIBIAN

WING SPAN 68" — 400 ° INS

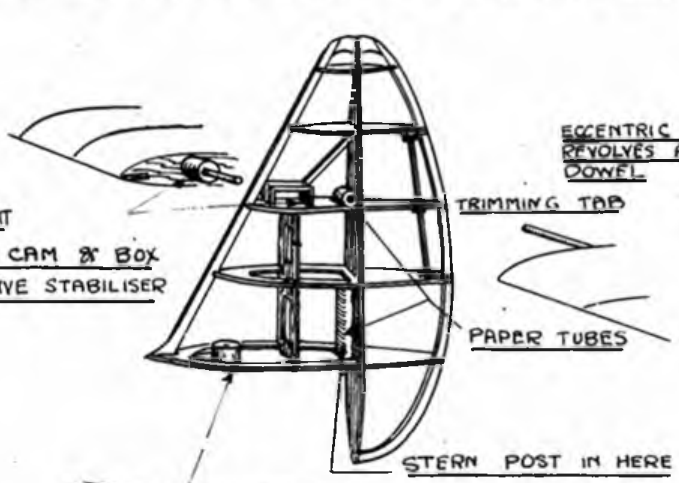
40" OVERALL LENGTH

22OZS ALL UP WEIGHT—WING LOAD 7.6

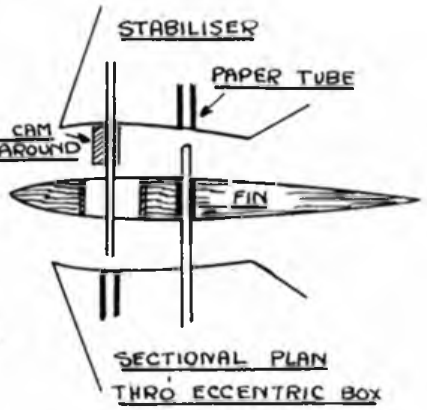
NOSE WHEEL WATERTIGHT COMPARTMENT HOUSED BETWEEN THE TWO FOR'ARD MOTOR ATTACHMENTS



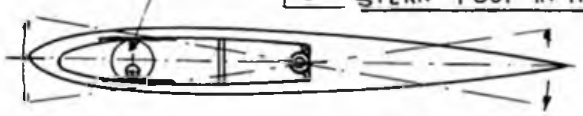
SIDE VIEW AS LAND PLANE WITH WING CUT AWAY



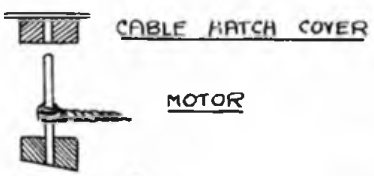
DETAIL OF TAIL UNIT SHEWING ECCENTRIC CAM & BOX WHICH GIVES POSITIVE STABILISER ADJUSTMENT



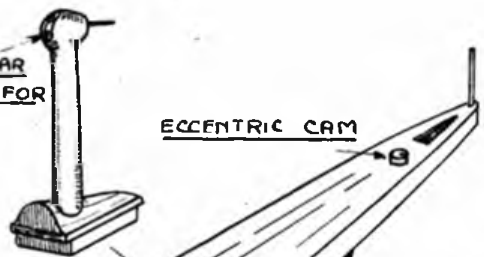
SECTIONAL PLAN THRO' ECCENTRIC BOX



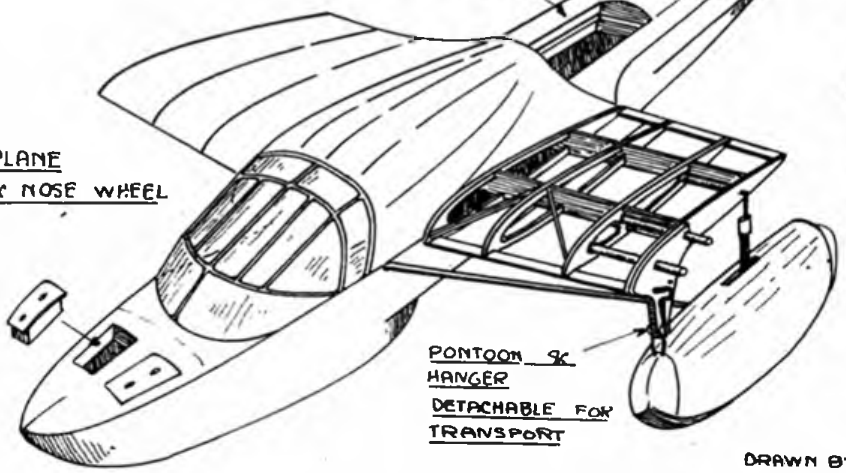
DETAIL OF FIN ADJUSTMENT WITH ECCENTRIC CAM FITTED TO TOP OF HULL & OPERATING IN BOTTOM RIB OF FIN

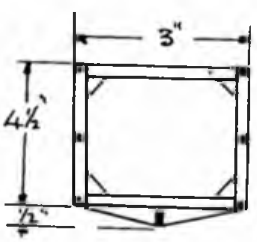


DETAIL OF FOR'ARD MOTOR ATTACHMENT
2 OFF



MODEL AS SEAPLANE WITH PONTOONS & NOSE WHEEL RETRACTED





TYPICAL FORMER
¼ × 1/16 BALSA

DRAWN BY HJ TOWNER
1940

"LET'S TAKE A CHANCE"——Says Lt.-Col. H. J. Parham

IT is nearly always a pity to take anything in this life too seriously, and this applies to one's hobbies as to other things. There are few more depressing sights than those games players who have concentrated on one game till they are supreme at it, and who sooner or later are made miserable because someone comes along and puts them in a " back seat."

Therefore, at all costs let us take our aero-modelling lightheartedly. As with gliding, it is primarily an *amusement* and should not be spoilt by being made into a movement or linked with Youth (with a big y).

But to one outsider, who merely dabbles feebly in the game, it seems that a great deal of fun is being missed by the devotees of the hobby owing to their lack of daring. The conquest of the air is still an infinitely new thing; we are only just beginning to learn how to fly, and we still fall about all over the place as a result of not being better at it.

Now it's no use kidding ourselves that more than one-half per cent of aero-modellers are going to bring about changes in the design of man-carrying aircraft directly as a result of their model work, so here again we are mercifully relieved from making our hobby into a cause, crusade or what not. *But* there is nothing whatever to stop us trying the most outrageous experiments on the off-chance of making a model do what no one else's has succeeded in doing; and the cost of failure is a bit of time spent (not wasted because we will have learnt something for next time) and a few bits of material scrapped.

Dr. Roxbee Cox in the last Wilbur Wright lecture, entitled " Looking Forward," mentioned as subjects for research and development such intriguing items as helicopters, rotaplanes, tail-less, all-wing and other types of 'planes, increase of lift, prevention of stalling, etc. Now, what a lot of fun one could have by playing with a few of these ideas instead of making conventional aeroplanes; and then there are also the ornithopters (which seem to be coming along nicely, thanks to one or two venturesome aero-modellers). Let's go wild a moment.

What about helicopters? Anyone who has ever flown in a jumping autogiro knows that he has experienced something so remarkable that he comes down feeling no one else has ever flown before. But that's only a transition stage to flight with fully power-driven moving wings. So why not model helicopters? And since a single rotor seems simpler and more efficient, what about the problem of overcoming torque reaction? What would happen if a rotor flapped its wings and so got its rotational speed that way without torque reaction (or was driven round by a pair of auxiliary flapping wings sprouting from the hub)? Anyone who saw Herr Lippisch's lecture and film of the new smoke tunnel will have realised that there is a lot more in flapping wings than meets the eye.

And has anyone tried Mr. Granville Bradshaw's idea that you would get horizontal flight in a glider by flapping—not the wings, but the fuselage; by lifting it up and down under the wing (have you ever read how an overloaded light seaplane was repeatedly taken off, when all other methods failed, by the crew of two standing up when she got up on the step and then sitting down suddenly and in unison, the momentary decrease in weight allowing the floats to unstick) —so what about *that* one?

Now, what about " canard " or tail-first models? Nearly all the pre-war (pre Great War I mean!) models were canards and flew not too badly; but we have lost the art. Would not a canard petrol model be great fun and nice and cheap to maintain because it would have its engine and propeller beautifully protected by being behind the crash instead of in front of it? And they land beautifully on a skid—I have tried. *But* they are the devil to keep under control longitudinally. Now, way back in 1912 or so, a chap wrote to *Flight* saying he had put a floating elevator on a canard model (what we would call a "mass-balanced airfoil hinged at its C.P.") and that its stability was far better than with a fixed elevator. And has not Mr. Handley Page got a patent for a tail-less design with a similar type of control ahead of the main plane? Has anyone tried that one?

To return to power-driven moving wings. What about that bumble bee they put in the low-pressure chamber at the R.A.E. and which took off (with its wing loading which is fantastically high for a bird or insect) at a pressure equivalent to a height of 40,000 ft.? Any model bumble bees about?

Back to fixed wings again. There is a school of thought which says, sensibly enough, that someone ought to fit a normal aeroplane wtih an ultra-slotted wing of comparable dimensions in place of its normal wing just to see if the darned thing *did* make the pilot's job any easier at take-off and landing. If it did, they argue, then it would be worth while tackling the purely mechanical problem of making that wing shut up into a high-speed one. How many really fully slotted models (particularly petrol ones) are sculling around? They are great fun, incidentally, and their minute wings, which seem incapable of supporting them, can be made incredibly strong and rigid.

And again we are all going to be very poor shortly and materials hard to come by; who has thought out the *simplest* type of petrol model? Perhaps it ought to be a hand-launched skid landing type, for which case could not we fix it up with a kind of " feeler " below the fuselage (like a lobster's feeler), which on touching the ground released a catch which hinged back the engine and pushed forward a skid (through what would have been the airscrew disc if it had not been folded back horizontally). Quite mad you will say (but what about the Carden Baynes auxiliary-engined sailplane; it did something like that). And then there is rocket propulsion—and model aeroplanes driven by flapping wings (do you remembker Laurence Hargreaves, of Australia, in 1897 or thereabouts, and Herr Lippisch's models similarly driven?).

I maintain that just as this war will be won by unconventional ideas and by taking chances so the *real* fun of model-making can be extracted by taking chances. And (and here I will make a concession to those who feel they have a cause, crusade or movement to further) we shall perhaps bring into the aircraft industry chaps who are not entirely convinced that we have learnt to fly yet. When that has happened we ourselves (or our children or grandchildren) will be nearer getting a flying machine to flop about in for fun without that horrid feeling that every minute you are flying 6d. or 1s. slips out of your pocket in expenses. No, I am *not* a Scotsman, but I *was* a private owner.

P. C. RYDE *talks about* —— "THIS FLYING BUSINESS"

I SUPPOSE it would have been more correct to write about " This Model Business," but to me the sound of the word " model " is particularly loathsome. It has, amongst other things, the power to convert me from a normally placid person into a being capable of the depths of homicidal tendencies. The reason is, I believe, perhaps misguidedly, that an aircraft is an aircraft whether the span is 40 in. or 40 ft. The principle which keeps both in the air is the same; the construction of the smaller machine is the same, allowing for adaptation on the grounds of size—and with petrol jobs the motive power is the same—so why not the name? Let it be understood here and now that I am concerned only with the term " model " as applied to flying non-scale aircraft: scale models of existing full-sized machines, solid or flying—call them models by all means—but out of respect for one's own design and the unexpectedness (in many cases) of its performance let us adopt the principle of calling a spade a spade, and cease referring to our jobs as " models."

Admittedly, I would hesitate to describe my first flying apparatus as either an aircraft or a model. It consisted of two oblong pieces of heavy cardboard, one smaller than the other, attached to a piece of cane, the smaller piece at one end and the larger piece somewhere about a third of the way from the other. There was no rudder, no under-carriage, and the propeller, by reason of its bad balance, very nearly solved the problem of perpetual motion. As far as I remember there was no dihedral angle either, and yet the great thing was—it flew. My one regret is that I have not got it in my possession now. It would have been amusing to contrast it with some of my later jobs. As a matter of fact, I sold it for the same price as I paid for it—five cigarette cards. The procedure for flying went something like this: First of all I would cast around for as many ordinary elastic bands as possible, and if they were not long enough to reach from propeller to tail hook I used to knot two together. Having replaced as many of the bands as had broken when the turns were piled on, the contraption was then hurled into the air and left to do its best—or worst. Usually the worst was a head-on collision with a wardrobe or a wall, and sometimes, on very rare occasions, the ceiling. All this took place in my bedroom, the " powers-that-be " not really being appreciative of flying activities in close proximity to either themselves or to sundry ornaments which might not stand up to the onslaught. I only flew the thing in the open once, and afterwards I had to renew the main plane, using the bottom of a shoe box for the job.

That was my first. Some years elapsed before I contracted " flying fever " again, although I made numerous solids, both of my own design and from various prototypes. It was the first issue of THE AERO-MODELLER that inspired me to build R.2.

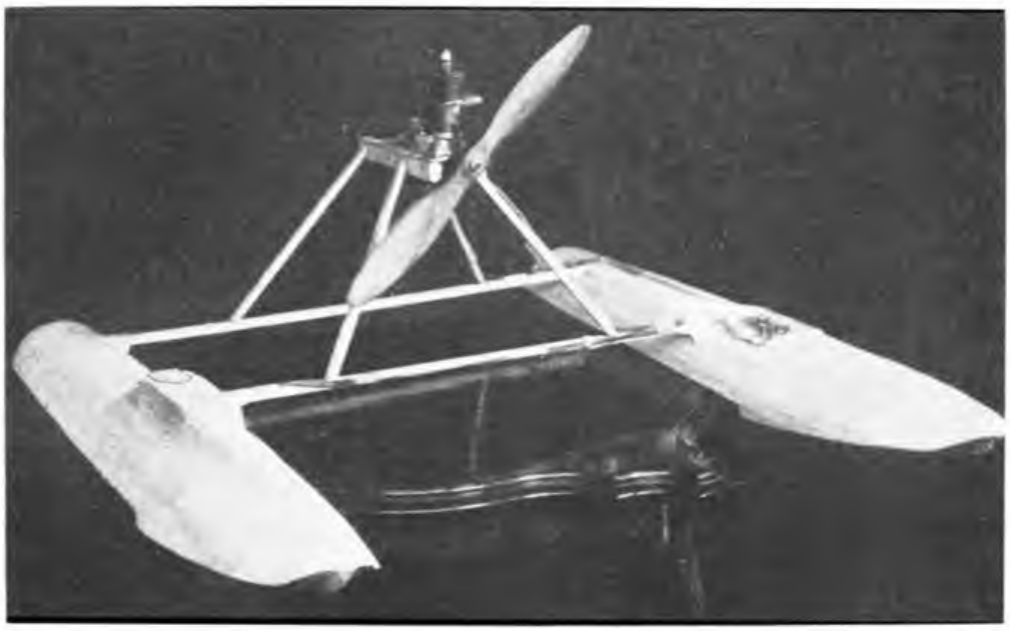
Now I consider that old R.2 was my masterpiece. She was a glider of some 30 in. span, based on the plans of the " Eagle " printed in that original issue of THE AERO-MODELLER. In those days my income was decidedly limited, so I set about building this glider from materials which I scrounged from the coal sheds of friendly neighbours. I say friendly, because it was about this time that I made myself unpopular with an air rifle. When I finally began construction there was a heap of junk on my work-bench (the bedroom window sill) which I fondly imagined I could transform into a cup-winning glider. There were half a dozen canes, several odd pieces of plywood, an assortment of wheels, cotton, glue and an old sheet, later to be used to cover the finished framework. Oh yes! And a 7 lb. tin of hard gloss paint to add the finishing touches.

Again I was phenomenally lucky. By means of the simple expedient of locking my bedroom door I concealed the fact that I was maltreating the paintwork of the window sill until the great work was completed. I was very proud of the finished article. It was all-red, picked out in silver, and I had applied two coats of paint from the 7 lb. tin, thinking in my innocence that dope was merely a fad of the designer of the " Eagle," and that paint would serve the same purpose. I marched up to the top of the hill from whence operations were to be conducted and launched R.2 into the teeth of the toughest gale we had that winter. The wind caught her, held her, and then raced her away twisting and turning, longerons cracking and wings fluttering for a distance of about a quarter of a mile and then . . . dropped poor old R.2 right in the middle of the concrete foundation of a semi-built house.

Needless to say, repair work of any description was out of the question, and for some time R.2 was used as a target for air-rifle practice, a use to which she seemed better suited than gliding. Then one night I conceived the bright idea of giving her a decent burial. Several portions of her anatomy were soaked in petrol, and the whole lot set on fire and heaved out of the window. It must have been the hot air, for she travelled the length of the lawn before crashing in flames. Next morning when I went to examine the wreckage I found only a few pieces of blackened wire, some charred fragments of cane and the hub of one wheel.

Such were the early days. I have built many aircraft since then, some successful and some just plain failures, but none of them have given me quite the same thrill both in building and flying (or not flying) as my old R.2, except, perhaps, my latest effort, a 4 ft. petrol bus, which is still in the designing stage at present. It is my first experiment with petrol, and as I know next to nothing about petrol engines I am anticipating a fairly lively time before I finish. There is a reason for constructing a petrol 'plane in face of the Air Ministry ban that will presumably postpone the flying of it until after the war. I could not make up my mind whether to build a rubber or a gas job until I saw the Air Ministry ban in the daily paper, and then out of cussedness I suppose I decided that R.21 would be powered by petrol, which means that on the day the Air Ministry ban is lifted if anyone sees a small petrol job performing undreamed-of evolutions and they are not near enough to read the name and address or the markings, they will know that it is R.21 on her maiden flight, and that somewhere at hand fervent prayers are being offered for a perfect three-point landing. Even if it does not fly, I shall be able to fit the engine to something else and use what is left for repairs, etc. I once made a glider, using as the wing the tail-plane of a large rubber-driven aircraft which refused to fly, and the times I have used the same pair of wheels on more than one job are countless. Anyway, whether R.21 flies or not I shall have had some fun building her, and I think you will agree that half the fun of this flying business lies in the hours spent in the workshop.

A PETROL ENGINE-DRIVEN HYDROPLANE



By
T. FARNWORTH, Jun.

Evidence that petrol 'plane enthusiasts have no intention of letting the present ban on the flying of petrol 'planes curtail their interest in their engines is forthcoming from many sources. Here is a further example of how "fun and games" may be had at very little trouble and expense!

START by cutting out the formers for the two floats, which are identical apart from the fact that one houses the timer and the other the batteries. All formers are made of $\frac{1}{8}$ in. balsa, except numbers 6 and 9, which are made from $\frac{1}{8}$ in. three-ply, and are not hollowed out, as each bay will then be watertight. Each former is then notched to take the $\frac{1}{4}$ in. by $\frac{1}{8}$ in. balsa backbone. The floats are built upside down by first pinning the backbone on to the plan and cementing the formers on to it. The bottom is then planked with $\frac{1}{16}$ in. by $\frac{1}{4}$ in. medium balsa, using plenty of cement to join each plank. The two floats are then joined by two lengths of $\frac{3}{8}$ in. by $\frac{1}{4}$ in. spruce screwed to the three-ply formers 6 and 9, using $\frac{3}{8}$ in. screws.

When this has been done the top and sides are then planked, leaving a space for the batteries and timer in the two floats, and the two nose-pieces are then carved out of hard balsa and cemented on to formers No. 1. The two rudders can now be cut out. These are made of $\frac{1}{8}$ in. three-ply, or better still, aluminium sheet which can be bent for a turn when desired. The battery box is made from $\frac{1}{8}$ in. sheet balsa, one end of the floor being cemented to the top of former No. 5a and the other end to former 6. The sides can then be cemented in place at the correct distance apart. It can be seen that the battery box extends above the top of the floats, and is streamlined off by means of pieces of $\frac{1}{8}$ in. square balsa and covered with $\frac{1}{32}$ in. sheet. The top is hinged, with a piece of 18 gauge wire firmly cemented to it, and pivoting in a piece of tubing.

As different modellers use different types of timers, I will not endeavour to describe the installation, but I would like to say that I make my own timers out of small old clocks, from which I have extracted everything in the train after the escapement wheel. I put a blob of solder on one of the teeth just large enough to allow the wheel to miss the "works." This slows down the mechanism enough for the job in hand. I then solder a piece of 16 gauge wire on the winding handle after the clock has been bolted to a suitable piece of three-ply. The wire is used as an arm to knock off the contacts which are fixed to the three-ply face. This is a very easy timer to make and is quite efficient really. I have made three of these so far; the first has lasted over three years and has never let me down so far.

The next thing to do is to cover both floats with bamboo paper and dope them three or four times, and then give them two coats of banana oil.

The uprights for the engine are made from $\frac{3}{8}$ in. by $\frac{1}{4}$ in. spruce, and are cut off at the required angles and lengths. These are screwed to the cross-pieces and engine bearers, and the joints liberally glued with Durofix, which is waterproof. The engine bearers used are the ones provided with the engine when purchased.

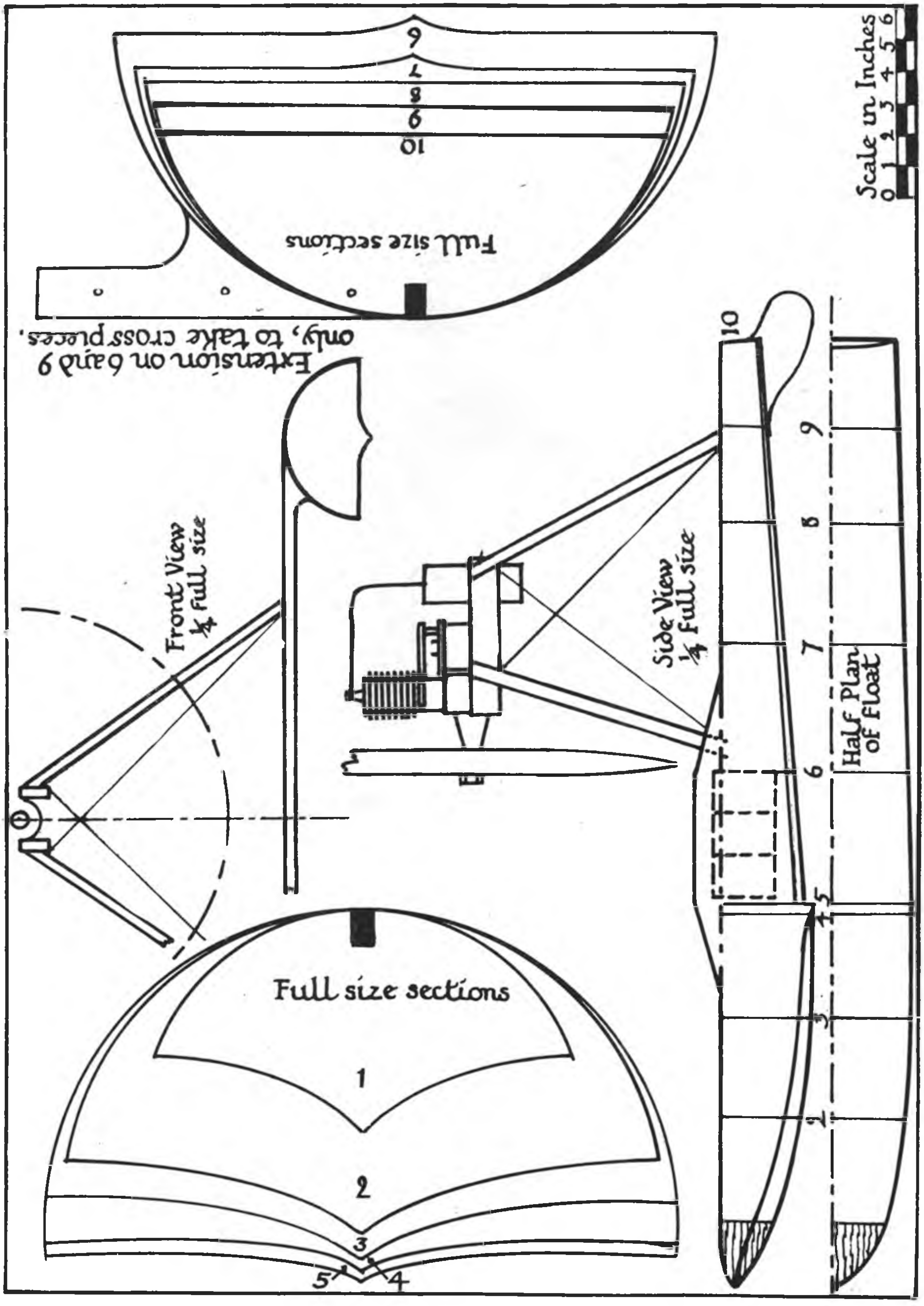
Four bracing wires are needed, and these go inside the four uprights from corner to corner. I use 20 gauge piano wire anchored at the ends by small screws and stretched as tightly as possible, and are soldered where they cross. I find this mount is strong enough for the Brown, although some people may say that it is rather flimsy.

The coil and condenser are both mounted on the engine bearers, and it will be noted that I use large batteries—three $2\frac{1}{4}$ in. by $1\frac{1}{4}$ in. diameter 1·5 volt batteries in series. By using these it enables one to start the engine while the hydroplane is resting on the water, which is rather handy if one is in a boat, although I do use a booster if I am warming it up or if I am on land.

I forgot to add that as the batteries are rather heavy the floats must be balanced, else the model will go in circles.

There is no chance of the model overturing even in rough weather, when there are considerable waves, as the floats are wide apart and are rather oversize, though this does not seem to be a disadvantage.

I have not experimented with round-the-pole runs yet, as the lake I use is not very wide, but long straight runs seem to provide me with plenty of thrills, especially on a choppy day. I have put the step well forward of the C.G., as the thrust line is high, and it seems to get out to the step after 2-3 sec. run, but after that what acceleration!



DESIGNS FOR THE SCALE MODEL BUILDER—XI

By PETER GARROD CHINN

AS a departure from the high-powered military aircraft with which we have dealt in this series during the past few months, I am describing in this article a few British and foreign light military trainers. Aircraft of this type are among the best designs for flying-scale models, since they are essentially machines with low-wing loadings.

Probably the most popular training aircraft with model builders in this country at the present time is the Miles "Magister." The Magister, built by Messrs. Phillips and Powis, is in service with the R.A.F. in considerable numbers and, with the D.H. "Tiger Moth," forms our standard *ab initio* trainer.

The prototype Magister was built in 1937, and was the first monoplane trainer to be accepted for the R.A.F. It is, of course, a cantilever low-wing monoplane with dual-control open cockpits and, like the Miles Master advanced trainer, also built by Phillips and Powis (and described in last month's AERO-MODELLER) is constructed of wood with magnesium alloy castings. The fuselage has spruce longerons and a stressed plywood covering. The wings are also plywood covered, and are built up on two box spars. The tail-unit is fabric-covered.

The Magister's undercart is of the fixed type, and is mounted to the centre-section. The wheels are fitted with brakes, and each is attached with a light alloy fork to a Lockheed leg. Fairings are fitted around each strut and spats cover the wheels.

A 130 h.p. de Havilland "Gipsy Major I" 4-cylinder air-cooled in-line motor provides the power. Driving a fixed-pitch wooden airscrew, it gives the Magister a top speed of 142 m.p.h. at 1,000 feet. Cruising speed is 124 m.p.h., and landing speed 45 m.p.h. Initial rate of climb is 850 feet per minute, and service ceiling 18,000 feet. Range is given as 380 miles.

The Magister has a wing span of 33 ft. 10 in., and a length of 25 ft. 3 in. Wing area is 176 square feet. Empty the machine weighs 1,260 lb. Gross weight is 1,825 lb.

The other standard R.A.F. primary trainer in production, the de Havilland Tiger Moth, is a considerably older design. First produced in 1931, the Tiger Moth has been in service with the R.A.F. for a number of years, and is also being built at the de Havilland Company's factories in Australia, New Zealand, and Canada.

The Tiger Moth is a single-bay equal-span biplane of steel tube, wood and fabric construction. Like the Magister it has a 130 h.p. Gipsy Major motor, giving a maximum speed of 109 m.p.h. at 1,000 feet, and a cruising speed of 93 m.p.h. at the same altitude. Initial rate of climb is 673 feet per minute, and service ceiling 13,600 feet. (These figures vary slightly with different versions).

Dimensions of the Tiger Moth are: Span, 29 ft. 4 in.; length, 23 ft. 11 in.; and height, 8 ft. 9 in. Wing area is 239 square feet. Empty weight is 1,115 lb., and gross weight 1,825 lb. Wing-loading is thus very low—less than 8 lb./sq. ft.

The Tiger Moth is almost identical with the "Queen Bee" radio-controlled target biplane, which was used for anti-aircraft and naval gunnery practice. The Queen Bee, however, probably has a slightly better performance.

For primary training, Germany uses the small Bucker "Jungmann." This machine has a span of only 24 ft. 3 in. and weighs less than 1,500 lb. loaded. It is powered by the Hirth H.M.506 motor, developing 100 h.p., which gives it top speed of 115 m.p.h. Cruising speed is given as 106 m.p.h., ceiling 14,000 feet, and range 400 miles.

Unlike this country, Germany also employs single-seater "fighter" trainers as a second step from the *ab initio* trainer. These include the Bucker "Jungmeister" and Focke-Wulf "Stosser."

The little "Jungmeister," spanning only 21 ft. 7 in., is probably the smallest military trainer in the world. It weighs only 1,290 lb. loaded. Being powered with a 160 h.p. Bramo motor, however, its performance is fairly good, being capable of a cruising speed of 125 m.p.h., a top speed of 134 m.p.h., and a ceiling of 20,000 feet.

The F.W. "Stosser" is a more powerful type, being powered with an Argus motor of 240 h.p. The Stosser has a span of 34 ft. 5 in., and weighs 2,200 lb. loaded. It has a maximum speed of 172 m.p.h.

The United States, like Britain, uses only 2-seater primary trainers. The American equivalent of our Miles Magister is the Ryan STM.

Practically identical with the popular Ryan S-T private-owner's machine, the STM is an open cockpit, externally braced low-wing monoplane, fitted with either a 125 h.p. Menasco C4 or a 150 h.p. Menasco C4S motor.

The fuselage is an all-metal monocoque structure, the cockpits being arranged in tandem and fitted with dual controls, as in the Magister. The wing has the NACA 2412 section, and consists of spruce spars, metal ribs, and an aluminium alloy covered leading-edge, the rest of the surface being fabric-covered. Trailing-edge flaps are fitted and are manually operated.

Span of the STM is 29 ft. 11 in.; length is 21 ft. 5½ in.; height, 6 ft. 11 in.; and wing area, 124 sq. ft. Empty weight of the C4 powered version is 1,081 lb., and of the C4S version, 1,083 lb. Gross weight is 1,600 lb., giving a wing-loading of approximately 12·9 lb. per sq. ft.

The Menasco motors are 4-cylinder air-cooled units like the Gipsy Major, and drive Sensenich fixed-pitch wooden propellers. With the C4 125 h.p. motor the maximum speed is 126 m.p.h., and cruising speed 122 m.p.h. With the slightly more powerful C4S, top speed is increased to 142 m.p.h., and cruising speed to 128 m.p.h. Other performance figures for the 125 h.p. version are: Rate of climb, 800 feet per minute; service ceiling, 16,000 feet; and range, 366 miles. With the 150 h.p. motor rate of climb is increased too 975 feet per minute, service ceiling to 18,600 feet, and range decreased to 326 miles.

Another recent and efficient American military trainer is the Harlow PC-5. This machine is powered with a 145 h.p. Warner "Super-Scarab" motor and, unlike other primary trainers, has a retractable landing-gear.

The wings of the Harlow are full-cantilever, and have the NACA 23,012 series of airfoil section. They are entirely constructed of metal, having an Alclad metal skin riveted to the ribs and stringers. Flaps are fitted, and are of the perforated split trailing-edge type, electrically operated. The fuselage is also of metal construction, and has enclosed cabin-type cockpits, entrance to which is by doors, one to each seat. Excellent vision all round is provided. The under-carriage, when retracted, is fully enclosed in the centre-

section, and is electrically operated. Standard equipment includes navigation and landing lights, radio-receiver and starter, as well as a full complement of instruments.

The 145 h.p. Warner is a radial air-cooled motor, and is enclosed in a full cowling, which blends into the streamlines of the fuselage. Either a fixed-pitch wooden airscrew or an electrically-controlled variable-pitch propeller may be fitted.

The fact that the Harlow is fitted with a retractable undercart and controllable-pitch airscrew, as well as wing-flaps, does not make it unsuitable as a primary trainer. The machine is so designed that the landing-gear may be locked in the extended position, airscrew controls set for fixed-pitch operation and wing-flaps fully closed. The speed is then reduced by about 30 m.p.h., making the machine quite suitably for the raw student. It is claimed that the PC-5 materially reduces the time required to train military pilots, since, after passing through the primary stage, instruction can be given, on the same machine, in the use of retractable landing-gear, variable-pitch propeller and wing-flaps, thus preparing the pilot for the operation of more advanced military types.

The Harlow PC-5 is a little larger than most other primary trainers, spanning 35 ft. 9¾ in., and weighing 2,279 lb. loaded. Wing-loading, however, is kept low, 12·31 lb. per sq. ft. being the actual figure. Other specifications are as follow: Length, 23 ft. 4 in.; height, 7 ft. 8 in.; wing area, 185 sq. ft. Maximum speed is high, 170 m.p.h., and landing-speed low, 45 m.p.h. Rate of climb is given as 850 feet per minute, and service ceiling 16,500 feet. Cruising range is very good: 600 miles, with a cruising speed of 160 m.p.h.

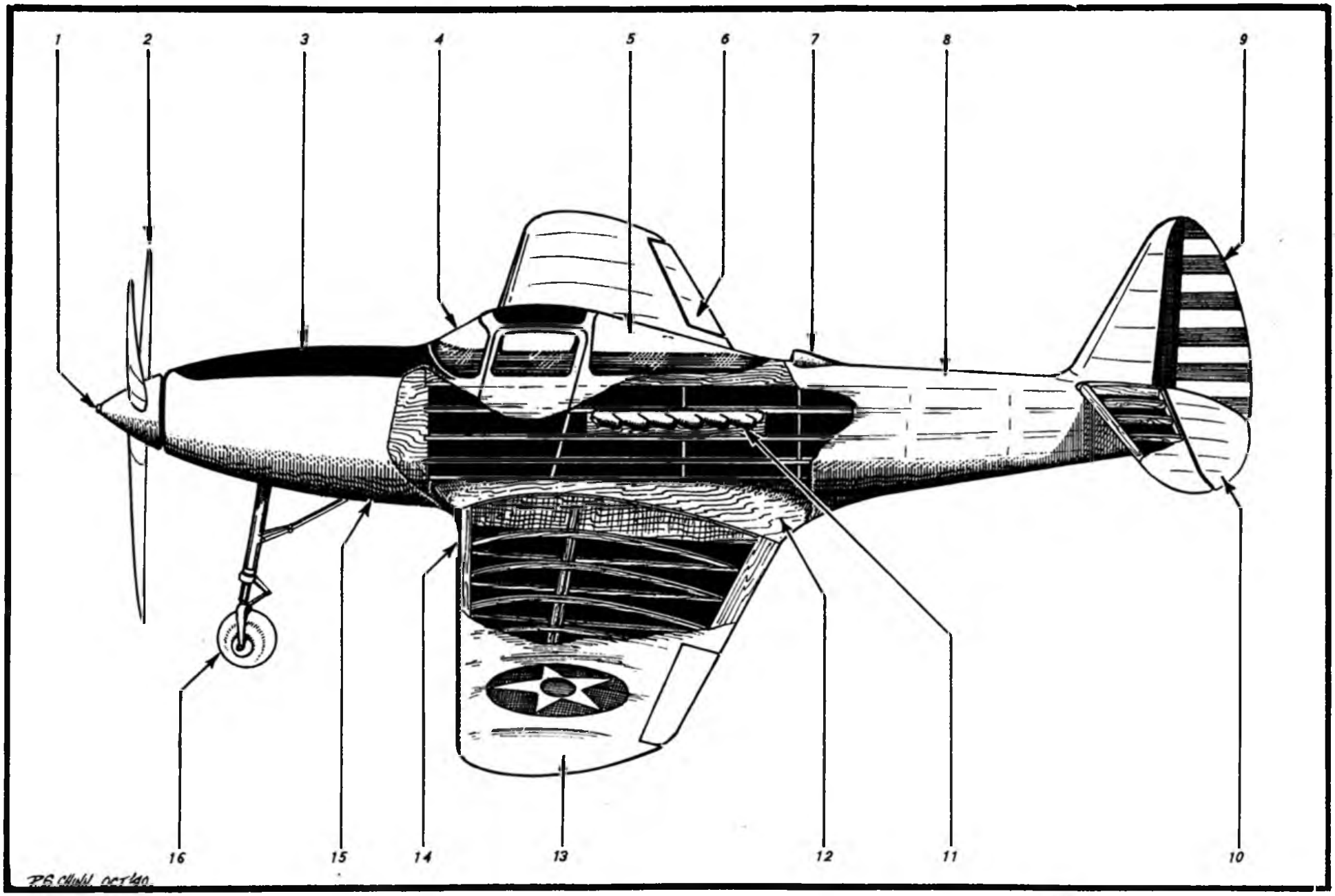
Since we have not dealt with an American machine in the "cutaway model" series since last April, I have chosen one for this month's drawing. It is the Bell "Airacobra" fighter (or P.39, to give it its U.S. Army designation), described in the June AERO-MODELLER.

This machine is also being delivered for service with the R.A.F., and has a high performance, maximum speed being 400 m.p.h. or more, with a ceiling of over 36,000 feet and a range exceeding 1,000 miles. It is equipped with a powerful armament, which includes a 37 mm. calibre shell-gun mounted to fire through the propeller boss. This gun is accommodated in the nose of the machine, the Allison motor being placed behind the pilot, and driving the Curtiss constant-speed airscrew through an extension shaft. To add further to its unconventional design, the Airacobra has a retractable tricycle undercart, the nose-wheel retracting into the fuselage beneath the extension-shaft and shell-gun. The Airacobra is said to be nice to fly and very manœuvrable, due to the moderate wing-loading (28·3 lb./sq. ft.), and positioning of the main weight of the machine near the centre of gravity.

A few months ago a Navy version of the P.39 was brought out. This machine, called the "Airabonita," is intended for service on aircraft-carriers, and is equipped with a conventional undercart and arrester-gear.

With its smooth lines and fairly generous wing area, the Airacobra should make an attractive and well-performing model. The tail-moment is rather short, but this can be compensated to a considerable extent by enlarging the stabiliser area. For a serious flying model a scale of at least ¾ in. to the foot is recommended. This will give a model of 22⅔ in. span.

Kindly mention THE AERO-MODELLER when replying to advertisers.



1. Dummy shell-gun muzzle.*
2. Scale propeller.
3. Black anti-glare panel.
4. Celluloid windshield.
5. Celluloid rear-view panel.
6. Flaps.
7. Dummy air-intake.
8. Fuselage structure: formers and stringers, tissue covering.
9. U.S. Army stripes on rudder.
10. Movable elevator.*
11. Dummy exhaust manifold.
12. Wing fillet carved from soft balsa.
13. Wing structure: built-up ribs, bo-spars with tissue covering.
14. Dummy intake to wing radiators.
15. Sheet balsa covered nose-section.
16. Nose-wheel.

* Denotes optional.

SOME NOTES ON WING INCIDENCE

By E. J. POWDRILL

NOW that we have been able, by means of wind-tunnel tests, to obtain an estimate of the lift and drag of the various components of a model aeroplane, we may consider how we can apply these results so as to obtain the best performance from a given model. The model considered in this article will be a streamlined Wakefield; and, since the mechanics of flight under power are rather complicated, with many factors still undetermined, we will confine our attention to the gliding descent of the model after the power has run out.

The specifications of the model to be treated here are as follow:

Fuselage.

Circular cross-section, maximum cross-sectional area = 13 sq. in. Length 36 in. Single leg, streamlined undercarriage.

Wings.

Area (S), 208 sq. in. Aspect ratio, 9. Section, R.A.F. 32.

Tail-plane.

Area (S'), 62 sq. in. Section, Clark Y.

Rudder.

Area (S''), 20 sq. in. Section, Symmetrical.

Propeller.

Single-bladed, folding. Diameter, approximately 18 in.

Weight.

Two models, weighing 8 oz. and 9 oz. respectively, will be treated.

In the March and July, 1940, issues of THE AERO-MODELLER will be found the results of wind-tunnel tests on the various components of a model. These results can be easily adapted to fit the present case.

The drag of a round fuselage, folding propeller and tail unit at 29·3 ft. per sec. was found to be ·0306 lb.

The combined area of tail-plane and rudder was 47 sq. in., and the section was approximately symmetrical, with $C_D = ·03$ at 0°.

$$\therefore \text{Drag of tail and rudder} = C_D \times \frac{\rho}{2} \times SV^2$$

$$= ·03 \times \frac{·00237}{2} \times \frac{47}{144} \times 29·3^2$$

$$= ·00996 \text{ lb.}$$

$$= ·01 \text{ lb. approx.}$$

Thus, the drag of the fuselage and folding propeller = ·0306 − ·01 = ·0206 lb. Cross-sectional area = 5·5 sq. in.

$$\text{Drag} = K\,A\,V^2$$

$$\therefore K = \frac{\text{Drag}}{A\,V^2} = \frac{·0206}{\frac{5·5}{144} \times 29·3^2}$$

$$K = ·0000628 \text{ lb. per sq. ft. per (f.p.s.)}^2$$

(For meaning of symbols see March, 1940, issue of THE AERO-MODELLER.)

The drag of a single-leg streamlined undercarriage at 29·3 ft. per sec. was ·0075 lb. Then, since it is difficult to estimate the cross-sectional area of an undercarriage, if we let $C = KA$, then

$$\text{Drag} = C\,V^2$$

$$C = \frac{\text{Drag}}{V^2} = \frac{·0075}{29·3^2} = ·0000087 \text{ lb. per (f.p.s.)}^2$$

The cross-sectional area of a Wakefield undercarriage will be about half as much again as this one, so that we can take a value of ·000013 per C in our case. This method may

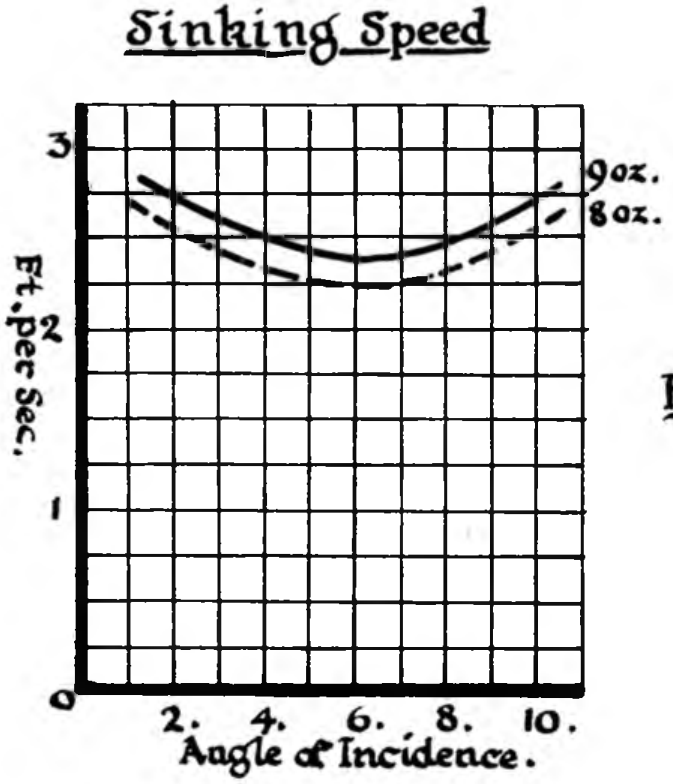
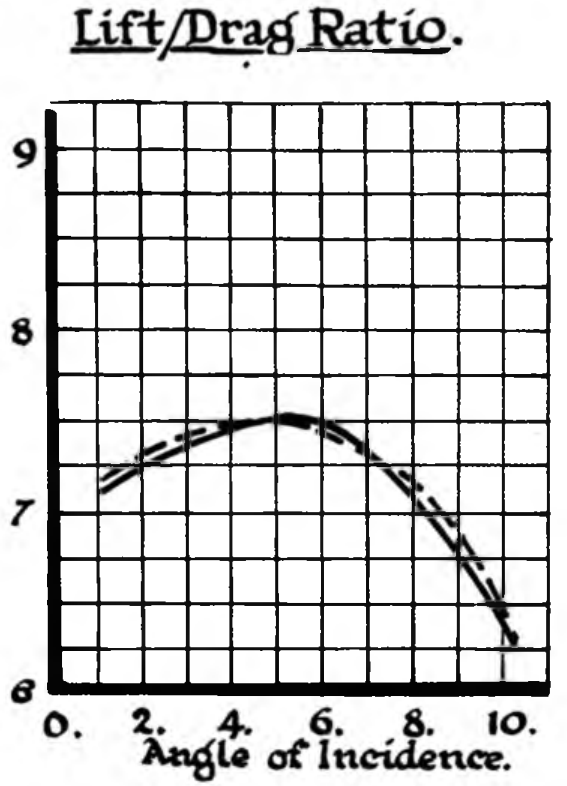


Fig. 1.



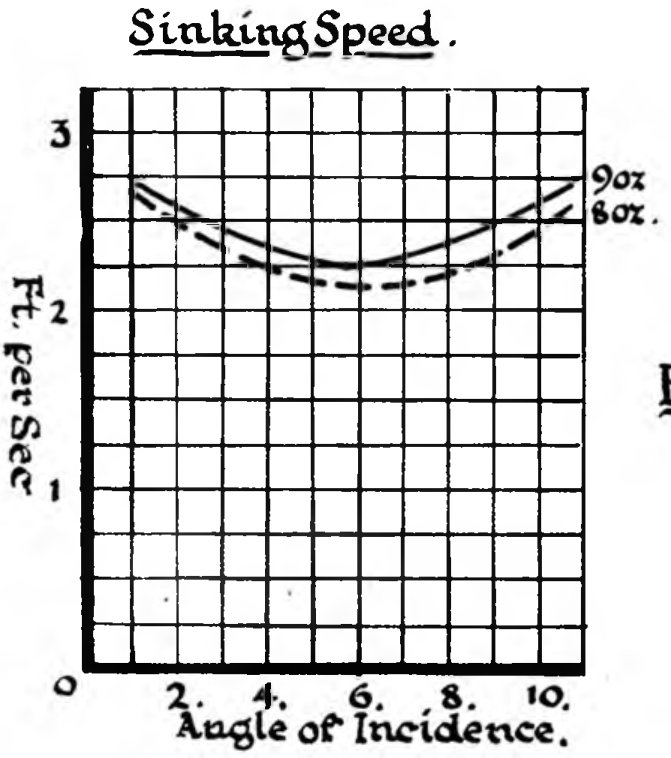
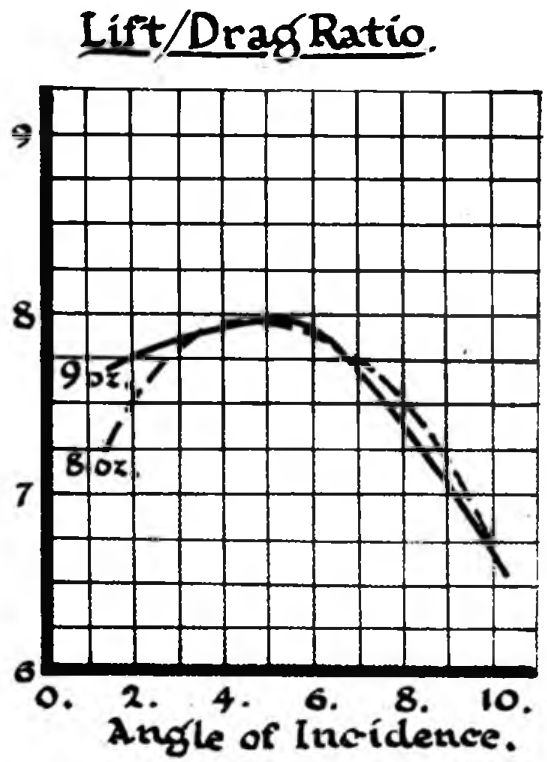


Fig 2.



seem rather approximate, but it will not spoil the result, as the drag of the undercarriage is not very great compared with that of the rest of the model.

The values of the lift and drag coefficient of the wings and tail unit can be used direct, without any adaptation.

Thus we can now calculate the lift and drag of each of the components of the model. It is assumed that the model is trimmed so that its glide path is along the centre-line of the fuselage, in order to minimise the resistance due to the fuselage.

In order to increase the duration of the glide of the model, our aim must be to make it sink downwards through the air at the lowest possible speed. Now, the sinking speed is obtained by dividing the forward speed by the lift/drag ratio for the whole model. We will therefore fix the tail of the model at 0° relative to the centre-line of the fuselage, and consider the effect of any change in the wing incidence on both the forward speed and the lift/drag ratio of the whole model.

The values of the forward speed and lift/drag ratio were calculated from five different values of the wing incidence, but since the calculations are rather tedious, and all essentially similar, they will be given for one value of the incidence, and the rest of the results given in the form of a table :

Wing incidence 2°. Total weight 8 oz.

$C_L = \cdot 75$	$C_L' = \cdot 32$	$C_D'' = \cdot 025$
$C_D = \cdot 062$	$C_D' = \cdot 038$	(Symmetrical)
(R.A.F. 32)	(Clark Y)	

Where C_L, C_D are lift and drag coefficients for wing,
C_L', C_D' are lift and drag coefficients for tail.
C_D'' is drag coefficient of rudder.

Total lift of wings and tail (in lb.) $= C_L \frac{\rho}{2} S V^2 + C_L' \frac{\rho}{2} S' V^2$

$$= \frac{\rho}{2} V^2 \{C_L.S + C_L'.S'\}$$

$$\therefore \frac{8}{16} = \frac{\cdot 00237}{2} V^2 \left\{\frac{208 \times \cdot 75 + 62 \times \cdot 32}{144}\right\}.$$

$$\therefore V^2 = \frac{2 \times 8 \times 144}{16 \times \{208 \times \cdot 75 + 62 \times \cdot 32\}} = 345 \cdot 0$$

$\therefore V = 18 \cdot 6$ ft. per sec.

Total drag of wings, tail and rudder (in lb.)

$$= C_D. \frac{\rho}{2} SV^2 + C_D'. \frac{\rho}{2} S'V^2 + C_D''. \frac{\rho}{2} .S''V^2$$

$$= \frac{\rho}{2}. V^2 \{C_D.S + C_D'.S' + C_D''.S''\}$$

$$= \frac{\cdot 00237}{2} \times 345 \left\{\frac{\cdot 062 \times 208 + \cdot 038 \times 62 + \cdot 025 \times 20}{144}\right\}$$

$\cdot 0448$ lb.

Drag of fuselage and fuded propeller (in lb.) $= K.A.V.^2$

$$= \cdot 0000628 \times \frac{13}{144} \times 345$$

$\cdot 0196$ lb.

Drag of undercarriage (in lb.) $= C\ V^2$

$$= \cdot 000013 \times 345$$
$$= \cdot 00448 \text{ lb.}$$

$\therefore$ Adding together the drag of wings, tail, rudder, fuselage, folded propeller and rudder, we have

Total drag of model in glide $= \cdot 0448 + \cdot 0196 + \cdot 00448$ lb.
$= \cdot 0688$ lb.

Now the total lift of the model is 8 oz. $= \frac{8}{16}$ lb.

$\therefore$ Ratio of lift to drag $= \frac{\text{Lift}}{\text{Drag}} = \frac{8}{16 \times \cdot 0688} = 7 \cdot 28$ (L/D)

But the forward speed is 18·6 ft./sec.

$\therefore$ Sinking speed $= \frac{\text{Forward speed}}{\text{L/D ratio}} = \frac{18 \cdot 6}{7 \cdot 28} = 2 \cdot 55$ ft. per sec.

These caluculations are repeated, using the appropriate values of C_L and C_D for incidences of 4°, 6°, 8°, 10°. The values of C_L', C_D' and C_D'' will remain the same, since the tail incidence is kept fixed at 0°.

The results, when worked out, are as follow :

8 oz. wt.			Drag.			L/D	Sinking speed
Angle of incidence	V^2	V	Wings and tail	Fuselage and prop.	Undercarriage		
		ft./sec.	lb.	lb.	lb.		ft./sec.
2°	345·0	18·60	·0448	·0196	·00448	7·28	2·550
4°	308·0	17·57	·0453	·0175	·00415	7·48	2·345
6°	280·5	16·75	·0476	·0159	·00365	7·45	2·245
8°	268·5	16·40	·0513	·0152	·00350	7·11	2·305
10°	268·5	16·40	·0592	·0152	·00350	6·41	2·555

9 oz. wt.			Drag.			L/D	Sinking speed
Angle of incidence	V^2	V	Wings and tail	Fuselage and prop.	Undercarriage		
		ft./sec.	lb.	lb.	lb.		ft./sec.
2°	387·5	19·70	·0504	·02195	·00504	7·25	2·72
4°	347·0	18·64	·0511	·01977	·00451	7·46	2·50
6°	314·0	17·72	·0532	·01780	·00408	7·48	2·37
8°	302·5	17·40	·0587	·01713	·00393	7·05	2·47
10°	302·5	17·40	·0667	·01713	·00393	6·42	2·71

These results are shown plotted out in Fig. 1.

From these curves we can read off the angle of incidence which gives the lowest sinking speed, and hence the longest duration of the glide from a given height. It will be noticed that the maximum value of the L/D ratio does not occur at the same incidence as the minimum value of the sinking speed, but it is the latter which is the more important for our purpose.

These results may be adapted to suit a model using a free-wheeling propeller if the drag of the propeller is worked out at each incidence (in forward speed) and added on to the total drag when calculating the L/D ratio. Hence new value of the sinking speed can be obtained. The drag on 18 in. diameter free-wheeling propeller may be calculated from the formula

Drag (in lb.) = a V^2 where a = ·000045

In a similar way, they can be adapted to a model with a retracting undercarriage, by omitting the drag of the undercarriage from the total drag in each case. Curves for such a model are shown in Fig. 2.

It is worth noting that it is possible for a 9 oz. model with a retracting undercarriage to have a lower minimum sinking speed than an 8 oz. model with fixed undercarriage!

By constructing similar curves for models with non-folding propellers, the reader may be able to decide for himself whether the extra complications and weight introduced by folding propellers and retracting undercarriages are justified from the point of view of performance.

It may seem to some readers that the whole of this article has been concerned with hair-splitting, since the variations in sinking speed with changing wing incidence are not very marked. But it must be remembered that although a decrease in sinking speed of ·25 ft. per sec. (from 2·5 to 2·25 ft./sec.) only gives an extra 7 sec. in the time of glide from 150 ft. in still air, yet on a day when there were no rising air currents, those 7 sec. would be very valuable.

On a day when there are rising currents, as is usually the case, the difference in sinking speed of ·25 ft./sec. might decide whether a model would go up, in the case of a weak current, to a region of stronger currents, or descend into a region of still weaker currents; thus, an enormous difference in duration could be caused by even a slight change in sinking speed.

In conclusion, it may be stated that the effects of flying the wing of a model at rather high incidence, in this case 6°, have been tried out in practice, and not only is the time of glide definitely increased, but also the characteristics under power seem to be improved, the rate of climb being considerably increased. In the case of a less streamlined model, incidences as high as 8° have been found successful.

A 16 in. SPAN R.T.P. MODEL

By R. H. WARRING

TOWARDS the end of June this year I packed all my competition models into two orange boxes and carefully stowed them away—this in the middle of the competition season! There is quite a simple explanation for this seemingly remarkable phenomenon however; since that day I have been serving in the Royal Corps of Signals, and this article is written in a barrack room "Somewhere in England."

Thinking in terms of extreme lightness and long power run, my first model was a high-wing design, 16 in. span, 12 in. L.O.A. fuselage, 8 in. propeller, 14 in. pitch. Construction was of indoor balsa covered with superfine tissue, which I didn't dare water-spray.

I soon found the error of my ways, for R.T.P. models come in for a fair share of knocks, and in my case everyone fought shy of holding the fuselage whilst I stretch-wound its two strands of $\frac{1}{8}$ in. elastic.

My next endeavour was similar in appearance—fuselage ran 14 in. L.O.A. to allow for an extra length of rubber. The same propeller was used, but the wing was now mounted in a parasol position.

This model was soon trimmed to do 90-120 sec. consistently, but I was aiming higher than that. It always came down with turns on the motor, and in order to cure that (as I thought at the time) I increased the power and tried another propeller with a greater pitch. It was whilst experimenting on these lines that model number two came to a sad end. Owing to the increase in power the initial speed was quite high, and this eventually resulted in the collapse of one wing in flight. Its subsequent gambollings across the floor completed the destruction.

With the results of these two models before me I sat down to design model number three for our forthcoming local competition. I decided to stick to the parasol wing, but to *double surface* it this time to give greater strength without increasing the spar sizes. Tail-plane was given a cambered section and its area increased from 33 per cent to 40 per cent of the main-plane area. The fuselage was completely redesigned, now being of aerfoil shape and L.O.A. 16 in. The new propeller was 10 in. diameter and 15 in. pitch.

Powered with two strands of $\frac{3}{16}$ in. by 1/30 in. rubber, 28 in. long, the very first tests showed that the model was a decided improvement. The breaking point of the elastic is about 2,000 turns, and on 1,500 turns the model gives a consistent 3-3½ min. It should be possible to get 4-4½ min. on full turns, but I experienced difficulty in that the elastic bunched badly at about 1,800 turns, due to its extremely long length, resulting in a pancake after 2¾ min.

Further efforts were cut short by the necessity of completing and test flying my 1940 Wakefield, which model, incidentally, captured the British H.L. record for me with a 26 min. 45·6 sec. flight in June.

Now let me put forward the conclusions I have drawn from two seasons of R.T.P. flying, in the hope that someone may find them of use.

(1) Weight of model not critical, but should obviously be kept at a minimum consistent with fairly robust construction.

(2) Length of elastic approximately twice length of fuselage.

(3) Propeller, large, 9 in. to 10 in. diameter on 16 in. span, proportionately less on larger span, say 14 in. on 24 in. span model.

(4) Wing tips should be *washed out* to zero angle of attack to prevent early stalling and pancake of model.

(5) Model should always fly into ground with turns on the motor, otherwise your propeller is " revving " too rapidly.

(6) Make model circle against torque.

(7) Pay particular attention to the point of attachment of the line, especially for circles of small diameter. The best position I found was on the leading edge by the last wing rib. Otherwise you get an early stall again, while there is still plenty of power left.

If at any part of its flight the wing assumes too high an angle of attack the increase in drag causes a stall because the power reserve is so small when the model is " cruising."

For R.O.G. flights I later fitted a retractable, single-leg undercarriage which worked very successfully. Its principle is unique, and I must thank Mr. Kimpton for suggesting the release " mechanism." The object of retracting the undercarriage was merely to increase the clearance between the model and the floor, and obtain these last few precious circles which mean so many more seconds duration.

I did not increase the power at all, and so with the additional weight and drag the model did quite well to turn in 2 min. 23 sec. R.O.G.

INSTRUCTIONS FOR BUILDING THE MODEL

Fuselage.

Constructed in the normal manner from $\frac{1}{16}$ in. square medium balsa, with the exception of uprights 1, 4, 5 and 7, which are made of $\frac{1}{8}$ in. by $\frac{1}{16}$ in. hard balsa. Upright No. 7 is drilled to take a small bamboo peg which anchors the rubber at the rear end.

Wing Mounting.

The wing mounting consists of two pairs of $\frac{1}{8}$ in. by $\frac{1}{16}$ in. balsa uprights in the position shown on the drawing, cemented in position, so that the front pair are $\frac{1}{4}$ in. higher than the rear pair. Two runners of 1/20 in. square bamboo are cemented along the top.

The fuselage is covered with tissue, water-shrunk and given one thin coat of banana oil.

Wing.

The wing may be built on the drawing. The leading edge is $\frac{1}{16}$ in. square balsa, $\frac{1}{8}$ in. by $\frac{1}{16}$ in. balsa trailing edge. The ribs are cut from $\frac{1}{32}$ in. sheet balsa by means of a template and cemented in position. The wing is cracked at the centre and recemented to give $\frac{1}{2}$ in. dihedral under each tip.

When covering use superfine tissue and cover both surfaces. Water-spray and fix on a dihedral board to dry. Each trailing edge is propped up by two pieces of $\frac{1}{4}$ in. balsa at the tips to give the necessary wash-out and held in this position by weights or other means until the tissue has thoroughly dried.

Tail-plane.

Tail-plane construction is similar, except that it is only single-surfaced and *not* water-sprayed.

Fin.

Simple $\frac{1}{16}$ in. square balsa outline, covered one side with superfine tissue.

Both wing and tail-plane tips are formed by soaking $\frac{1}{16}$ in. square balsa in hot water and then forming to shape.

Propeller.

The propeller is carved from a block of 9 in. by 1 in. by $\frac{3}{4}$ in. soft balsa, shaped as shown in drawing.

Twenty gauge wire is used as a propeller shaft running in a small brass or wooden bush in the $\frac{1}{16}$ in. sheet balsa nose-block. A good bearing is essential to reduce the friction, since only small power is used.

The motor is 4 ft. of $\frac{3}{16}$ in. by 1/30 in. elastic, made with one loop, two strands, 24 in. long. Maximum turns is approximately 2,000 and maximum duration at least 4 min. with the right trim, so go ahead.

Retractable Undercarriage for R.T.P. Model.

The retractable undercarriage may be fitted for R.O.G. work if desired, and is used in conjunction with a tail skid 3 in. long of bamboo, which must be cemented in place.

The retracting unit consists of an easily shaped piece of 20 gauge wire hinged on a piece of 20 gauge aluminium tube which is bound to former 4 on the fuselage. It is thus free to swing forwards or backwards. An axle of 22 gauge wire is bound to the other end and a celluloid or balsa wheel of $\frac{1}{2}$ in. diameter fitted.

The leg is tensioned forwards by a piece of $\frac{1}{32}$ in. square elastic sufficient to pull the leg forward to engage the 22 gauge wire spring catch attached to the underpart of the fuselage. A glance at the diagrams should make this clear.

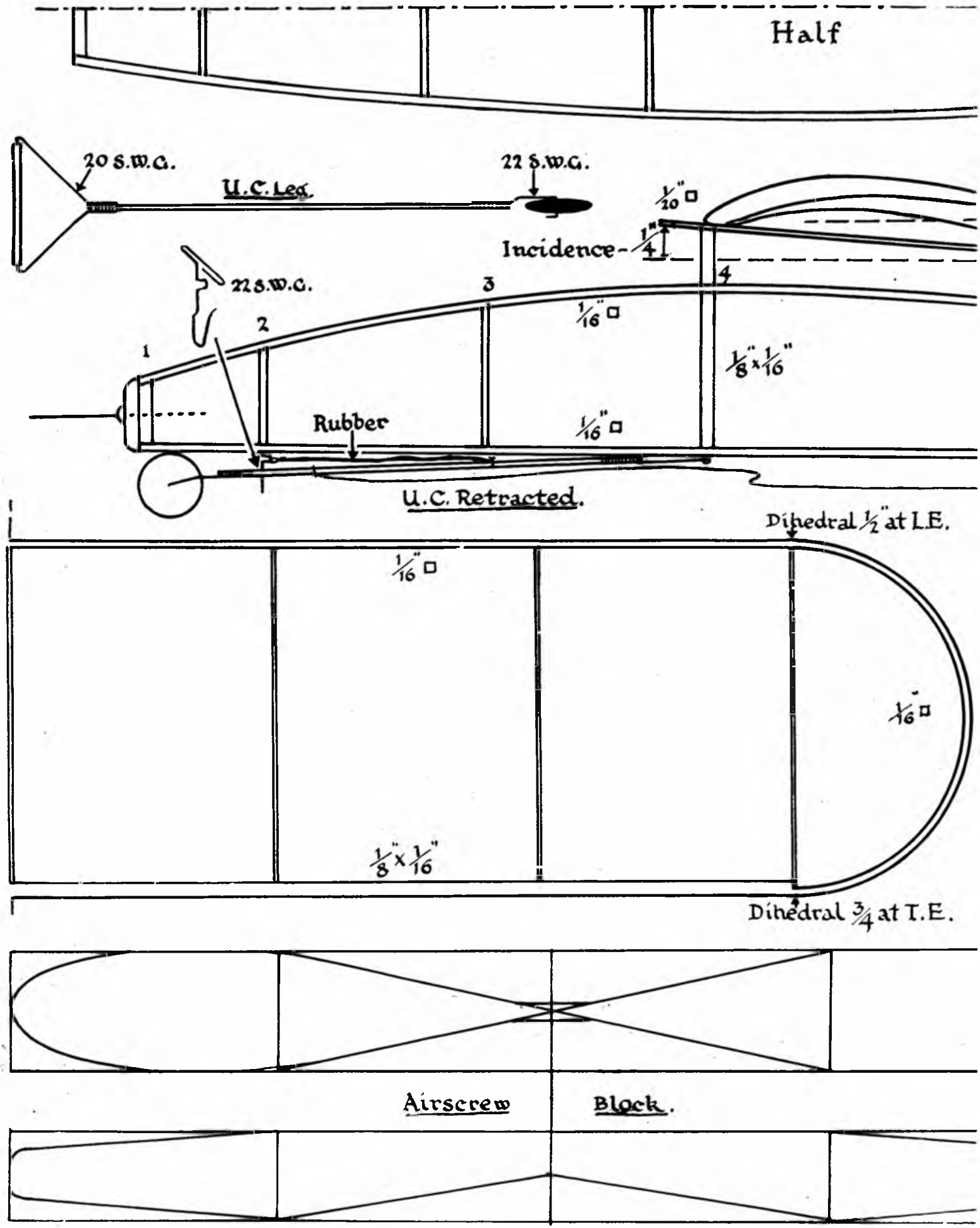
A piece of thread is fastened to the leg and a pin attached to the fore end. This pin presses into a small piece of ordinary eraser or sponge rubber cemented to the rear of the fuselage.

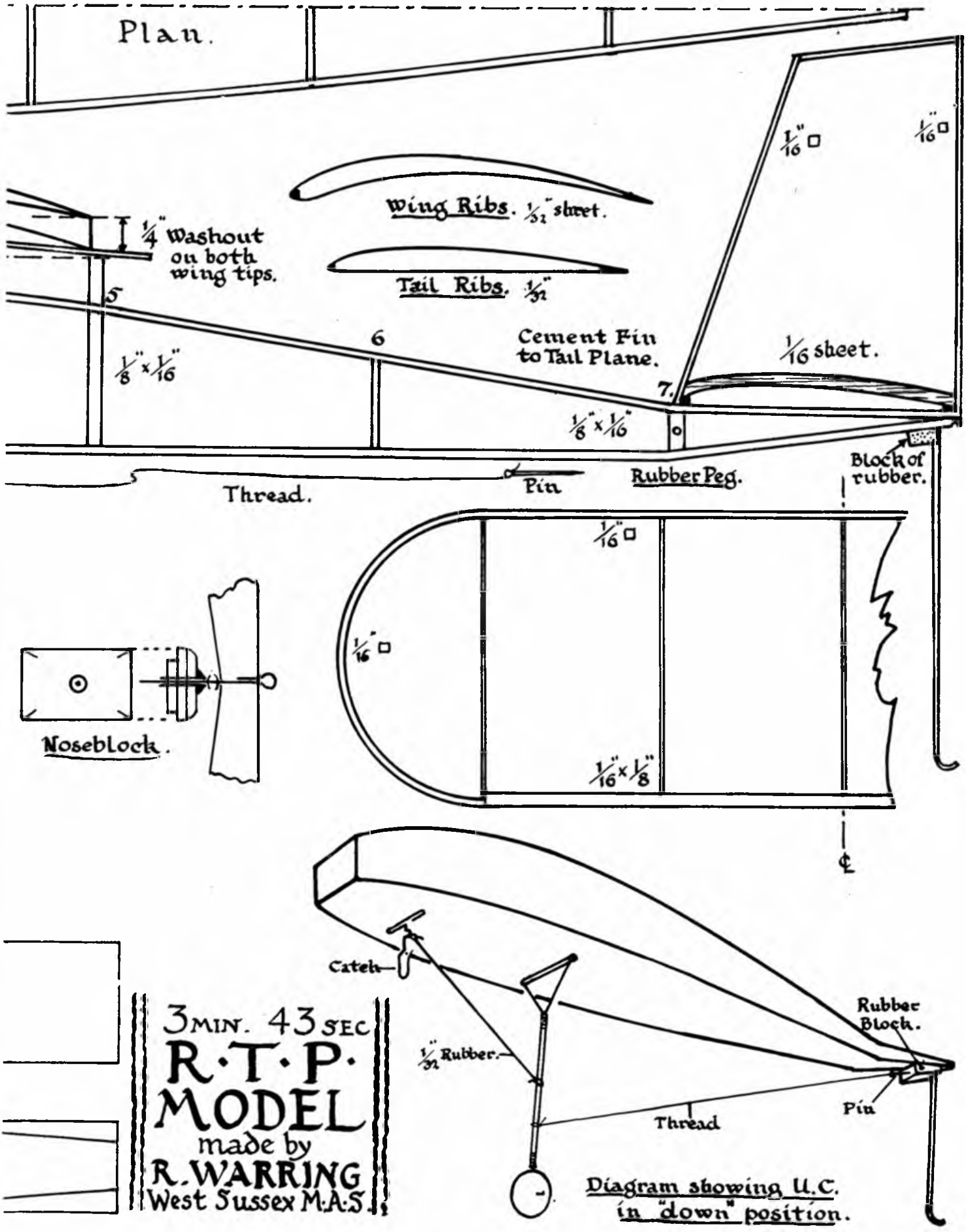
The tension of the elastic pulling forwards is sufficient to pull the pin out of the rubber after a few seconds has elapsed, and this time is adjustable by the amount of rubber used and the distance the pin is inserted.

Whilst on the ground the tension is taken off the thread by pressing lightly on the model. The one wheel and tail-skid are sufficient to keep the model upright when on the line, but a little practice is needed in launching, as the propeller torque may twist the model over as soon as it is released, but my own model, underpowered, made many successful R.O.G. flights.

Of course, this undercarriage is open to vast improvements—it is only a simple experimental type, *but* it works.

The release method—pin pulling through rubber principle—has, I believe, been used as time switches for petrol models. With a little care in choosing the right amount and type of rubber this method could easily be adapted to outdoor models. Indeed I was adapting one of my Littlehampton " Stars " for this " peg-leg " undercarriage when fate decided I should be a soldier instead.





? ? ? ASKED AND ANSWERED ? ? ?

Conducted by — "RUSHY"

Q. *Is it possible to install an electric motor in a model aeroplane?*

A. Naturally, but I would not like to guarantee its flying capabilities! I have no record of a model so powered having successfully flown, though I would not state off-hand that *no* such model *has* flown. A motor of sufficient power output to successfully fly a model aircraft would require to be fairly large, and the accessories, such as accumulators, are also very weighty components. The power/weight ratio is, in consequence, very poor, and I do not think it a practical proposition to attempt to use such motive power. Electrically motivated propellers are usually found on exhibition models.

Q. *How does a club go about affiliating to the S.M.A.E.? Can we affiliate with only thirteen members? What is the cost of affiliation? Do we have to submit our accounts for inspection if we have only been formed for six months?*—(P. G. B., Elstree).

A. Application should be made in writing to the Secretary of the Society, stating full title, number of members, names and addresses of officials, etc. Small memberships are no bar to affiliation, and all clubs, whether large or small, are welcomed, providing they prove that their affairs are conducted in a proper manner. It was for this latter reason that the Society requested applicants to submit a copy of their balance sheet, together with their application, but this is not insisted upon under present conditions, the committee realising that extraordinary conditions exist in many cases. A club of six months' standing would not be required to forward a balance sheet even in normal circumstances.

Prior to the war, affiliation fee was 1s. per head of membership, with a maximum of 3 guineas, but to meet the special circumstances obtaining to-day this has been revised to 1 guinea per club, irrespective of numbers, but the committee have the right to consider a lower fee where they feel the individual application necessitates.

Q. *Is it possible to qualify under present conditions for the F.A.I. Certificate?*—(H. A., Rhyll).

A. I presume you mean the F.A.I. Competitors' Licence. Whilst there are no international competitions taking place at the moment, this licence is always a handy thing to possess, as it must be remembered that a world record cannot be claimed unless the claimant holds this licence. (It would be just too bad to break a record and be unable to claim it owing to non-possession of the necessary document!)

Q. *Is there a tow-launch tailless glider record, and if so, what is the figure?*—(P. G. B., Elstree).

A. Mr. R. F. L. Gosling, of Bradford, set up the existing record for this class, using a 100 ft. towline. Time, 85·5 seconds. (Copyright of this design has been secured for THE AERO-MODELLER Plans Service, and details of the record-holding model are given on page 766).

Q. *What is the best A/R for a glider, and what percentage should the tail-plane be in relation to the wing? What measurement should the fuselage be in realtion to the wing, and what should the estimated position of the wing be?*—(R. A. L., Cheshunt).

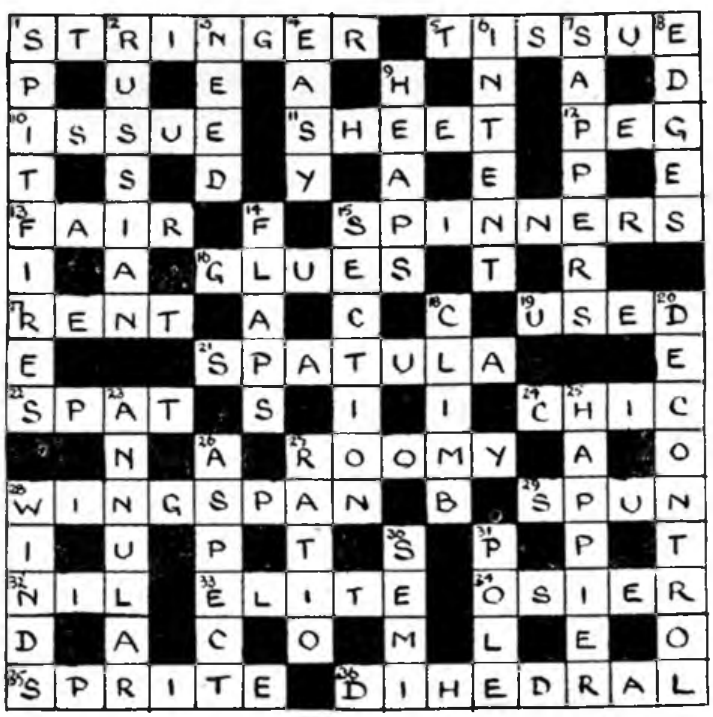
A Actual A/R figure is mostly a matter of individual taste, but generally a high A/R figure is preferable. Try 12 or 15—1. Tail-plane area can be less than used on power-driven models, but a safe ratio is from 20 to 25 per cent of the wing area. Length of fuselage is difficult to answer, as this, of course, depends on the design, but remember to retain a long moment/arm. I should incline to use a length of from 75 to 100 per cent of the wing span. Place the wing about one-third back from the nose, thus cutting down balancing ballast.

Q. *Can you tell me the turret armament of the following 'planes—North American N.A.40a, Fokker G-1, and the Bell Aeracuda?*—(D. G. C., Tewkesbury).

A. N.A.40a: One movable gun in a turret at the extreme rear of the fuselage, operated by a gunner in a prone position. Fokker G-1: Conical turret at the rear of the nacelle is equipped with one machine-gun, operated by the observer, and can fire above or below the tail-plane. Turret revolves horizontally. Various combinations of machine-guns and cannon are installed in the nose and operated by the pilot. Aeracudo: A shell-firing gun is installed in the nose of each nacelle, operated by forward gunners. Guns in the "blisters" on the fuselage aft on the wing are operated by the radio operator.

SOLUTION TO X-WORD No. 2

The 10/6 prize has been awarded to Mr. E. C. Osborne, 10 Chelsfield Road, St. Mary Cray, Kent



GADGET REVIEW

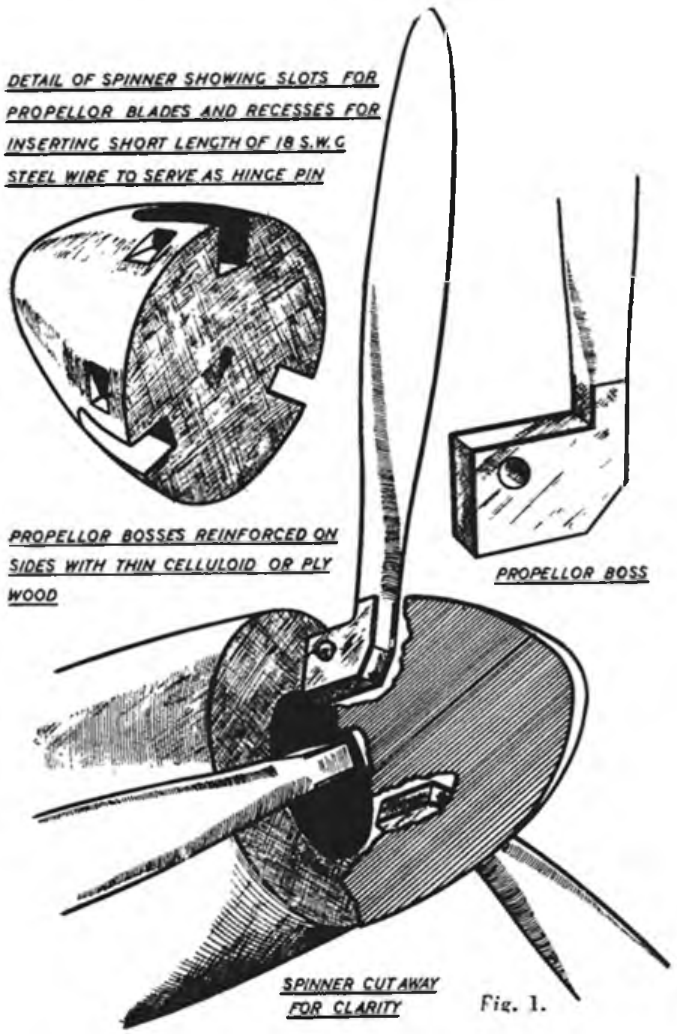


Fig. 1.

THIS month ' Gadget Review " is something of a milestone in the, so far, short history of my association with THE AERO-MODELLER. It is now just a year ago since I first took up the post of staff draughtsman, and I don t think I need say what an interesting, if not illuminating, experience it has been. That I have enjoyed the experience goes without saying, though it hasn't been " beer and skittles " all the time ! This is perhaps not to be wondered at, for it would be difficult to find a more keenly critical or discriminating body than the aero-modelling fraternity.

Constructive criticism I have always welcomed, and one of the most encouraging features of the past year has been the number of letters I have received from readers up and down the country. I sincerely hope that they will continue to flow freely !

Of perhaps still greater significance is the fact that this is the Christmas issue, and I do wish to extend my very best wishes to all my readers. We are living in stirring times, and it is grand to know that we are still carrying on, almost unhampered, and certainly undeterred, by the exigencies of war It is my sincere wish that you will all have a really enjoyable and happy Christmas , may all your landings be happy ones. With which sentiment I will turn my attention to the business in hand

The first item on the agenda concerns an idea for folding propellers. Folding propellers are not a recent innovation, nor is there anything involved about their construction, yet to the majority of lone hands they are regarded with mixed feelings, and I accordingly think it would not be out of place to illustrate a typical propeller of the folding variety here

Mr. J. H Stutt is responsible for the particular design in question. Mr. Stutt, by the way, hails from Barrhead, Scotland, and I have shown his idea in Fig. 1. Each of the blades is hinged independently about a small piece of 18 s w.g. wire, and the operation is entirely automatic. While the motor is expending its energy, centrifugal force ensures that the blades " stay put " in their normal flying position During the glide the propeller has lost most of its momentum, and the pressure of the air is sufficient to fold the blades back on to the fuselage.

Fig. 2.

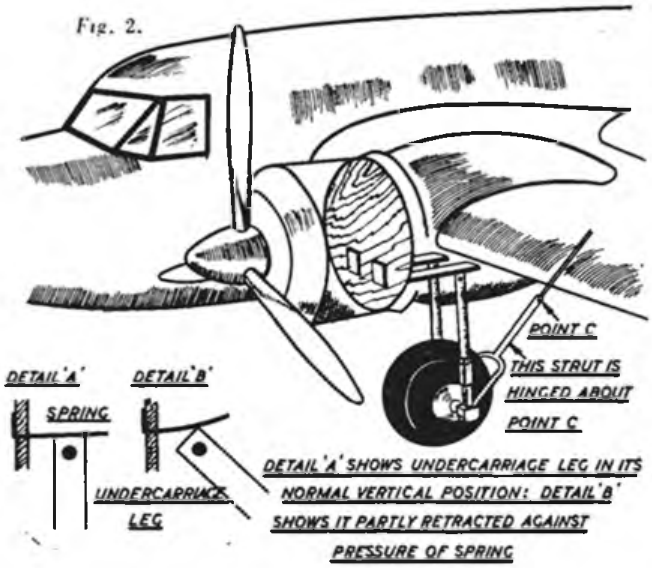
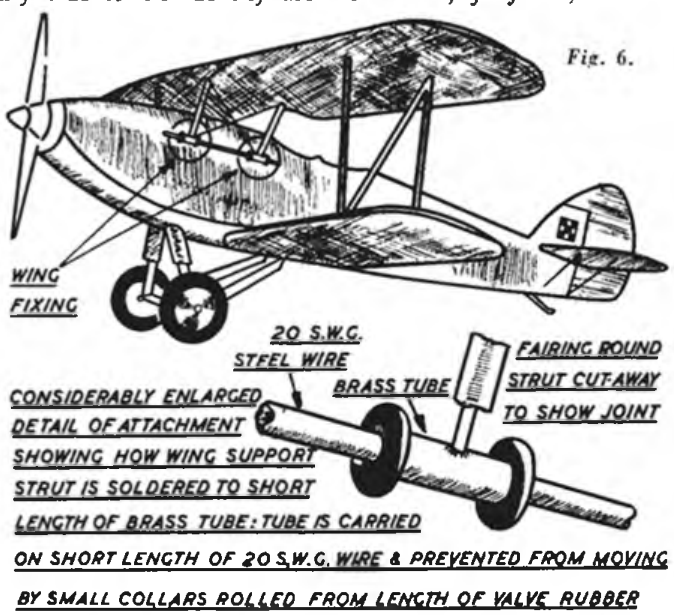


Fig. 2 is a locking gear for retractable undercarriages, and is the work of another of my anonymous friends. The only clue to his identity are his initials, J. J. S., and I

Fig. 6.



By C. A. H. POLLITT

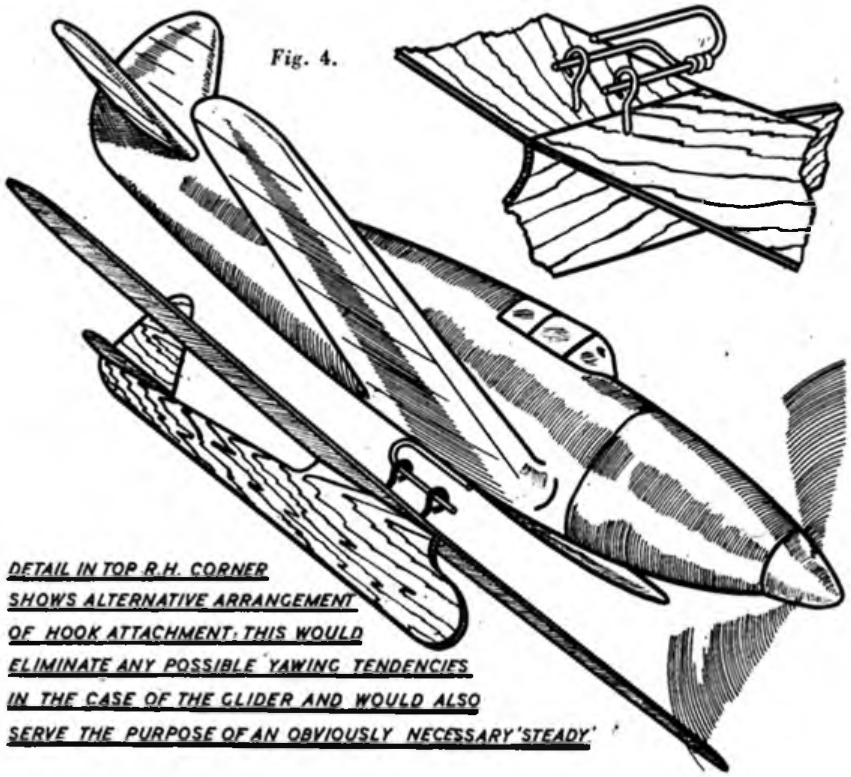


Fig. 4.

conclude that he is " somewhere in England "; anyhow, he will no doubt identify his idea and notify me accordingly. This locking device makes use of a flat leaf spring, against the tension of which the undercarriage leg is pivoted from one position to the other.

Mr. Harold Shipton, of Surbiton, Surrey, has constructed a shock-absorbing wheel, enclosed within a spat. The vertical movement of the wheel is resisted by two lengths of elastic, each attached to the two pieces of piano wire, A and B. The method of bringing the elastic bands outside the fairing, and over the wheel axle, is clearly shown in Fig. 3.

For the next idea I have used draughtsman's licence and illustrated a single-seat fighter, carrying a sailplane, which arrangement may be technically inaccurate, although it does nevertheless explain the very simple method whereby Mr. W. Garratt, of Shotton, near Chester, contrives to launch a model glider. I would myself imagine that the glider would come dangerously close to the propeller immediately after launching, though a certain amount obviously depends on the proportions of the model that is to carry the glider.

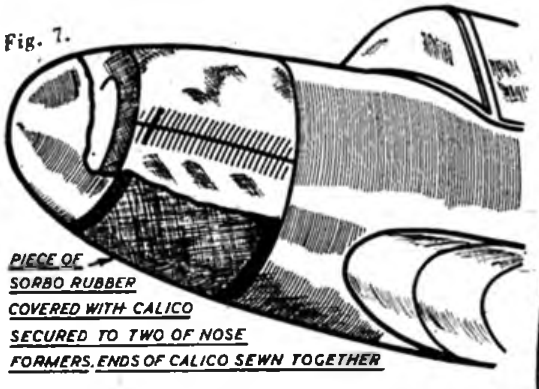


Fig. 7.

From Fig. 4 it will be inferred that the hook for carrying the glider must be positioned as near to the C.G. of the 'plane as possible.

Mr. P. S. M. Murray, of Gloucester, has designed a tail-plane with adjustable incidence which I think Fig. 5 explains fairly clearly. The elevator is strut-braced with wire to the fuselage, and the method of adjusting the incidence is by moving the two small pieces of balsa, shown in the sketch, either forward or aft, as the case may be.

Fig. 6 is a wing-fixing device specially suitable for parasol monoplanes, or even certain biplane types. In Fig. 6 I have shown how the arrangement could be applied to one of the Hawker biplanes. Mr. W. Fowler, of Offord D'Arcy, Hunts., explains that the whole mounting comprises nothing more than a few lengths of 20 s.w.g. piano wire, some brass tubing, and a little solder.

One of three gadgets I have received from Mr. S. J. Peerless, of Eastbourne, is a shock absorber for sailplanes, and is in the form of pieces of Sorbo rubber sandwiched in between two of the nose formers. Particular attention should be paid to the method of lapping the edges of the calico, in which the rubber is contained, round the formers. This may be more clearly understood from the sketch, Fig. 7.

Next month I am hoping to have an equally varied collection of gadgets to review, so in the meantime let me hear of your latest.

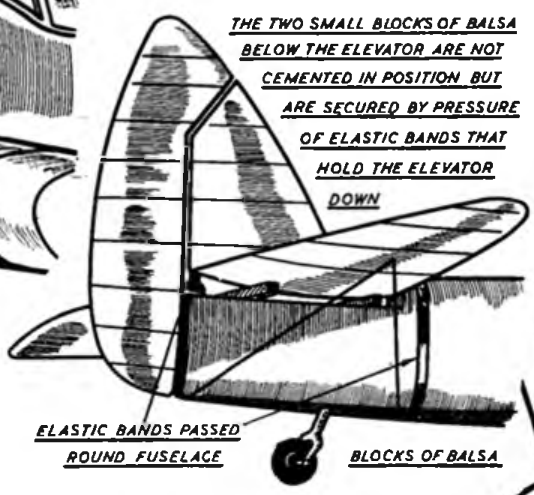


Fig. 5.

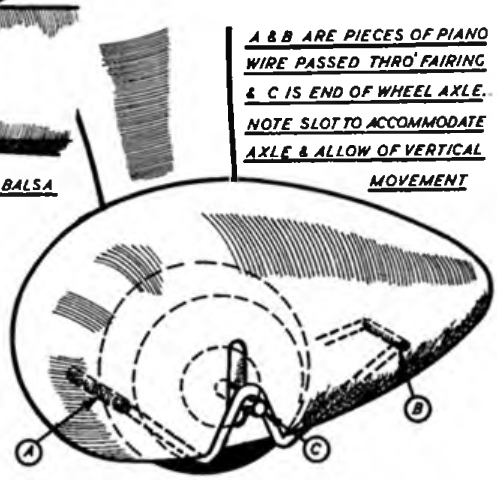


Fig. 3.

AN "AIRY-TALE"

" Dave let out a squawk like a chicken about to have its neck wrung."

" BOMBS an' bombers! That's all we 'ear about nowadays," grumbled the old man, pulling his chair even nearer the bar fire. " Bombs an' bombers. They're just like wimmin—all they do is to cause a lot o' trouble to all concerned. And believe me, they *can* cause some trouble.

" I shall always remember the terrible destruction an airyplane caused round these parts years ago. At least, it warn't really the airyplane that done the damage, it would be more correct to blame the owner, Eli Brown, 'im that I was telling you about the other day.

" The trouble all began on a January night, when we was walking 'ome from the ' Jolly Waggoners ' at Lower Nuthatch. It's a long way by road, but we was comin' by the field path, which is much shorter. Just as we got to the corner of the meadow, where the plank-bridge crosses the stream, we 'eard a weird noise comin' from behind an 'ay-stack. A spooky sort of 'owling noise, it was, that made us all stop sudden, and look round slowly.

" We couldn't see anything at first, then suddenly something appeared from behind the stack. Tall, it was, tall as an 'ouse and garstly white all over, with long arms danglin' at its sides like a nape. All at once it began to run towards us, takin' great strides, and jumpin' over bushes. As it ran it made the 'orrible yowling noise.

" The others didn't wait to see any more, but ran away, cowardly like. I wanted to stop and fight, of course, but I thought the others might come to some 'arm alone, so I ran after them to 'elp protect them.

" We all ran to the narrer bridge, but just as we was 'alfway across, it began to bend in the middle. The others, who were just behind me, tried to jump back to the bank, but they were too late, because the plank suddenly broke in the middle, and pitched us all in the icy water. We splashed to the other bank, clambered up, and ran 'ome along the path as quick as we could. As we ran, we could 'ear the spook behind us, larfin' in a nasty spooky way.

" The next mornin', which was Sunday, I met Alf Juggs and the others that 'ad been with me the previous night. We all started talkin' about the ghost, of course, and Alf told us 'ow he had spent 'alf the night tryin' to persuade 'is missis that he 'ad only 'ad two pints.

" Just at that minute, Alf's boy came up to us, grinning all over 'is monkey-face.

" ' I say, dad,' he called out. ' I reckon somebody was caught proper last night.'

" ' What do you mean? ' Alf asked 'im.

" ' I've just been up by the old plank-bridge. Somebody must ha' sawed part-way through it. Judgin' by the look o' things several silly fools got tipped in the stream last night.'

" ' Oh,' said Alf, sarcastic, undoin' 'is belt. ' And what else did you see? '

" The little brat fished something big and white from behind 'is back, and threw it down.

" ' I found that. It was 'anging on a bush,' he yelled, running down the road, out of reach of Alf's belt.

" ' It's an old sheet,' Alf told us, pickin' up the bundle.

" ' The bridge was sawed through, too,' somebody remembered.

" ' Jake Samms, over at Nuthatch, used to be in a circus, doing a stilt-walking act,' Alf said, very slow, lookin' at us each in turn.

" Everybody was quiet for a minute. We could all see what 'ad 'appened, although we 'ad a job to realise that growed-up men could do such silly things.

" ' There's no doubt about who done it,' I told them, at last. ' It was the regulars at the " Waggoners "—Jake Samms and his lot. They never 'ave liked anybody from this village since Joe raffled them ducks last Christmas. It wasn't 'is fault that 'is sister-in-law and three married daughters was lucky to be picked out of the 'at first.'

" ' I thought Jake was lookin' at us a bit queer last night,' Dave said, scratching 'is chin. ' I bet they're splitting their sides about it, now.'

" ' We must 'ave our own back,' said Alf, very determined. ' We can't 'ave them larfing at us like that. Any suggestions about what we can do? '

" There was plenty of suggestions, most of them being enough to make a good-living person's 'air curl.

" At last Dave got fed up with it.

" ' We don't want any fancy ideas,' 'e said, ' what we want is something that will work.'

" ' That's right,' I said. ' Now, my idea is this; they tried to frighten us with a spook; we ought to do the same to them.'

By C. A. HAWKES

" ' And 'ow do you think you're going to do that? ' Dave asked.

" ' Easy,' I said. ' You know Eli Brown has built a flying-machine? Well, that's frightening enough, in any case, but if we paint it white, and Eli goes over to Nuthatch one night, and flies round and round the " Waggoners " that should be just about enough to turn them teetotal for the rest of their lives.'

" ' But they'll know it's only Eli,' said Alf, very cross because 'e 'adn't thought of the idea. ' They must 'ave seen 'im flying about.'

" ' No, they won't,' I told 'im. ' They don't come over this way often, and Eli 'asn't been flying long. Even if they 'ave seen 'im, they're so iggerant that they would only go to the " Waggoners," and ask the landlord what 'e meant by sellin' such stuff.'

" They all stood quiet for a minute, thinking. They could all see what a clever idea it was. At last Alf found something wrong.

" ' It won't work,' 'e said, quite pleased. ' There's tall trees all round the " Waggoners." Eli won't be able to fly low.'

" For a moment I was took aback, but it ain't easy to catch me out.

" ' Well, then, we'll invite them over to the " Red Lion " 'ere,' I told 'im.

" They was all quiet again, but this time nobody could find anything wrong.

" ' Right! That's settled then,' I said. ' We'll fix the details later.'

" ' What about Eli? ' somebody asked, just as we was going. ' Won't 'e mind? '

" ' I'll call in and see 'im on the way 'ome,' I said. ' 'E won't have to mind.'

" One night, about a fortnight later, everything was fixed, with Jake Samms and 'is friends all set in the " Red Lion." They 'ad come like a shot when we offered to buy the beer. At first there was a lot of argument about who was goin' to pay for it, because the others thought that, besides thinking of the 'ole scheme, I was going to pay my share as well.

" We 'ad arranged that Eli was to come over just before closing-time, so that, when the landlord turned everybody out, the Nuthatch men would 'ave to run all the way 'ome, chased, o' course, by Eli and 'is flying-machine.

" I stood in the bar that night, with one eye on the clock and the other on Jake Samms and 'is friends. They needed watchin', too, especially when they was playin' dominoes. Dave and Alf and the others was watchin' as well, but I think they was more concerned about 'ow much Jake and 'is friends was drinking.

" At last, when I judged it to be the right time, I slipped out of the door, quiet. In the field across the road Eli was waiting for me with 'is airyplane. I got the big 'andle and wound up the elarstic, while Eli climbed into 'is seat. I just reminded 'im about what 'e 'ad got to do and then, after I 'ad watched 'im flap away in the moonlight, I 'urried back to the bar.

" They wall all singin' when I got back, but I managed to tell Alf and the others that everything was all right. About five minutes later Dave, who was standin' ready by the window, let out a squawk, like a chicken about to 'ave its neck wrung.

" ' Look! ' 'e yelled, purtending to be frightened.

" Everybody rushed to the window in time to see Eli and 'is flying-machine flapping away, showing silvery-white in the moonlight, and throwing a big black shadow on the ground. It certainly did look spooky—a lot more so than I would ever 'ave believed. I must admit that it would nearly 'ave frightened me, if I 'adn't knowed what it was.

" ' What is it? ' yelled Jake, diving away from the window.

" ' It's the ghost! ' said Dave, 'is voice quavering. ' It's the ghost what used to 'aunt the village in my grandfather's days. One look at it means instant death.'

" After that there was no 'olding the Nuthatch men. They daren't run away out of the door, so they 'owled to the ghost for mercy, and did their best to 'ide in the bar. I shall never forget seeing Jake try to crawl under the door-mat.

" ' Ghost or no ghost, you're all goin' outside,' bellowed the landlord, tryin' not to grin. ' I can't afford to 'ave my licence took.'

" How it would 'ave all ended I don't know, for I'm certain the Nuthatch men would rather 'ave worked for the rest of their lives than go out and face that ghost.

" Just at that minute, 'owever, there came a terrific crash from above and, at the same time most of the plaster off the ceiling came down on top of us. A nine-gallon barrel of bitter flew up and 'it Alf in the chest; the 'ole bar, with the landlord underneath it, suddenly collapsed; about 'alf a ton of soot fell down the chimbley, and shot out into the room; and in the same second the lamp went out. In the darkness everybody struggled to get out at once, and a free fight started. I had never 'eard such a row since my brother had tried to put 'is wife in 'er place. There was crashing and yelling, and cussing coming from all around. Judging from what I 'eard, several people was trying to push someone else up the chimbley, thinkin' the spook was comin' down that way.

" What with the darkness, and what with several people thinkin' I was the ghost and doin' their best to twist my 'ead orf, it took me some time to fight my way out.

" Just as I reached the door, and staggered outside, I collided with somebody comin' in.

" ' What the—Eli! ' I yelled. ' What did you do? '

" ' Nothing,' 'e said, surprised, ' I was just flying round like what you told me to, when I 'eard a lot of noise below, so I landed in the field across the road to see what was wrong.'

" ' Wrong! ' I shouted at 'im. ' Nothing's wrong. Something's only wrecked the pub, and that noise you can 'ear is only made by about thirty men fighting each other in the dark.'

" He seemed quite surprised to 'ear it.

" ' I've just 'ad a narrer escape, too,' 'e said, quite excited. ' You may not believe it, but when I came down to land just now I noticed in the moonlight that both landing-wheels and that brand new iron axle had fell orf somewhere.'

" ' What! ' I yelled.

" ' Yes,' 'e said, very pleased. ' Luckily I was able to make a careful landing, otherwise — "

" ' Otherwise what? ' I asked 'im, clenching my fists all ready.

" ' Otherwise,' 'e said, ' I might 'ave crashed and caused some damage.' "

THIS being the Christmas issue, though you will be reading this some time before the happy day, it behoves me (Corklino, where do 'e learn all 'is big words from?) to wish you all you wish yourselves and, even if you *are* having to make an egg take the place of the traditional turkey, remember you couldn't get the bird much younger! In these days of rationing, Milk Boards, Pig Boards, dart boards, *ad infinitum*, it seems the only thing one does not have to fork out coupons for is good-will. However, joking apart, may you all have the best of times possible under the circumstances and, with you, I trust that the next festive season will see all the world back on a sensible basis, and the Wakefield, King Peter, trips to Flers and all the merry occasions that we aero-modellers look forward to once again in full swing.

Now that the colder weather has set in, I expect to hear a great deal about indoor flying. I hope to see many inter-club fixtures of this nature carried out, as this is one type of flying where one does not have to make prior arrangements with the Clerk of the Weather. The R.T.P. model designed by R. Warring should give many newcomers—and some of the old stagers—some good groundwork to start upon, and I fully expect to hear of all last year's records, etc., going by the board.

There is a suggestion that the S.M.A.E. stage a Decentralised R.T.P. Competition, and I think this a very sound move. Naturally, there will have to be a reasonable standard laid down for both height of pole and length of line, and in connection with this I would be pleased if all clubs would advise me by letter to THE AERO-MODELLER offices, *at once*, the maximum line they could use in their premises. Obviously, the final figure will have to accommodate those with limited space, but as long as everyone is using a standard length of line the possibilities are unlimited.

So please drop me a line *immediately*, as I am sure the Emergency Committee will welcome some facts to work from, and I can forward your replies in one batch to the right quarter. Now, do not go and treat this request like you have some others in the past, but get a postcard and write straight away. (You know, it is up to you club secretaries to see to such details, otherwise you are not doing your best for your members. Honestly I have been surprised at the lack of attention to such requests in the past, but all will be forgiven if I get a good reply this time).

I have had my first taste of indoor work already this season, and it is surprising how one seems to lose all the knowledge gained last year. I had forgotten what power I used to use in my "circler," how many turns to put on the thing, where the wing was placed and, in fact, all the very things that I should put down in my flying log. I wonder how many of you really keep anything like a proper record for reference purposes. I started one a few years ago, but like many other things, it gradually got left and left, until I got a shock to note that the last entry was over eighteen months ago. Like the Debs Diary, I must have left out all the parts I did not like to remember, and the entries are mainly of "wonderful" flights—and nothing about the many crashes. I am certain the latter outnumbered the former by quite a large margin.

I suppose that the Albert Hall will be taboo for micro-film flying, and many large halls will be difficult to obtain for such purposes under the recently intensified conditions. However, I am sure that we can turn out some type of small model that will potter round a smallish room for two or three minutes, and competitions should prove quite simple to run. So go to it and let us see if we can make the winter season of 1940-41 something to be remembered in the model aeronautical world.

Shades of Jack Warner and Cyril Fletcher—I have been called a messer of reports!

"I'm a mucker-up of reports—
I'm a Club News mucker-upper—
Such ingratitude after all my work and pains!
If I knew the little louse
(For he is anonymous)
I'd kick him hup and dahn the rawlway lains.

"I'm a 'ard-worked Press sob-sister,
In your interests I blister
All my digits—and the place I sit upon.
And not one of yer says 'Fanks'
(If yer did I'd know yer pranks),
But there's one fing what I'd like—a petrol coupon.

"For my mighty Dodge-Rolls-Bentley
Is a sucker-up of petrol,
She's a petrol sucker-upper, that's what she are.
And if I can't get more ration,
I'll soon be in the fashion,
And *walk* to work and do wivout me car.

"So from a 'mucker-up of reports'
I'll be a lapper-up of White Ports.
For with walkin' I shall have to keep me strength,
And with every step I'll curse,
And my temper will get worse—
So look out those who send reports at length.

"For I'll wield me old blue pencil—
Yus, an old blue pencil wielder,
And the speculative wonder will be rife.
Till one day an intimation
From the Ministry of Information
Will inform me that I've got a job for life!"

After which sad moment, suppose we get to sterner things? I have received a specially printed card from the

(Left to right) The "Brainstrom," by G. Dunmore, of the Leicester M.A.C. Mr. Greaves, of the Newcastle (Staffs) club, with his "Quaker Flash." And to finish off, what about this for a scale model—the "Oxford," built by D. Jones, of Boscombe.

S.M.A.E., on which the new rules and regulations governing the flying of model aircraft are fully set out, together with a few words of advice as to the correct action to be taken if questioned about the right to fly your model. Wisely, these cards have been printed for universal distribution, irrespective of whether you are a member of an affiliated club or not, and a copy can be obtained from the offices of THE AERO-MODELLER on receipt of a stamped addressed envelope. It is advisable to always have this card on you when flying your models, as it can be shown to anyone who questions your rights, and should in most cases clear up any misunderstanding. One thing is stressed on this card, and that is, do not argue with any person in authority who raises any objections, but immediately stop flying and refer the matter to the proper quarter, e.g. the Secretary of the S.M.A.E. To enter into needless discussion gets one nowhere, and even if the authorities were eventually satisfied that you were in order in flying, any previous "heated" argument will not make things easier.

Owing to the intensified happenings in London of recent weeks it has not been possible for Mr. J. C. Smith, the competition secretary of the S.M.A.E., to work out all the points etc., for the Plugge Cup and Individual Championship events, but I hope to be able to announce these in the next issue. I trust all those who are anxiously awaiting these details will realise that the various officials who live in London have their work cut out in other directions at the moment, and naturally any work of national importance must have first call on the time and activities of these gentlemen.

However, I have the results of both the Women's Challenge Cup and the Thurston Glider Cup events, these being as follow :

WOMEN'S CHALLENGE CUP.
(September 8th, 1940).

Miss D. Humphries	Bushey Park ...	251·5

THURSTON GLIDER CUP.
(September 22nd, 1940).

1. F. Brench ...	Hayes	...	266·5
2. F. S. Cameron	Wirral	...	256·6
3. J. Marshall ...	Hayes	...	247·0
4. L. Stott ...	Halifax	...	231·2
5. A. Wilson ...	Hayes	...	189·0
6. D. G. Lees ...	Halifax	...	171·6
7. N. Lees ...	Halifax	...	143·8
8. A. Tindall	Lancs	... ...	141·5
9. C. B. Jackson ...	Ashton	... ...	140·4
10. N. Lancaster ...	Lancs	... ...	122·0
11. H. Parrish	Ashton	... ...	106·0
12. C. Frear	Bradford	... ...	93·3

There were 32 entries.

Unfortunately there was only one entry for the women's event, but nevertheless that does not detract from Miss Humphries' performance, which is very creditable. The Hayes lads seem to have concentrated on gliding since the King Peter event last year, and to good purpose. Out of 32 entries, only one was from the London area. 'Nuff said. Still, we hope for better conditions next year.

The trouble is that, for years past now we have had bad weather almost the whole of the outdoor flying season, and then in 1940, when most of us have been too busy with other matters to give our usual attention to model flying, we go and get one of the finest spells of "model" weather for donkey's years. Fair makes yer 'eart bleed it do! And I suppose that when we are able to get down to things again we shall have gales, deep depressions, rain, snow, and Uncle Tom Cobley and all.

Whilst on the subject of S.M.A.E. Competitions I think we have proved the success of making all events decen-

Mr. L. B. Mawby demonstrates his "Rotator IV" to an interested "crowd" of spectators.

THE BEDFORDSHIRE SILVER TROPHY. WITH TEAM REPLICAS & INDIVIDUAL AVERAGE CUP.

tralised. Many of us have thought for years that these national events should be run as nationally as possible, and I am glad to see that the scheme has received good general support from all over the country. Without the final results and figures it is not possible to analyse the events, but I am sure that 1940 has seen a much wider interest taken in national events, where before practically all energies were directed to purely local affairs.

I look forward to the day when we can run things somewhat on the lines the Americans take. I am no slavish follower of American methods, but I do think we could take a leaf out of their book and run a good two or three days " Nationals " of our own. There are various competitions that would be better for staging as a centralised event, and if these were grouped together with such old favourites as the Wakefield Trials. National Cup, etc., we should have chaps coming from all over the place to compete. Under previous conditions it was not practical for many enthusiasts to take part in these events, but with reasonable grouping one journey—and most important, one set of expenses—would enable a chap to compete in all the events he has so far only dreamed and read of. Maybe I am looking too far ahead. but I do not think we should lose sight of such eventualities even under present conditions.

With which, suppose we get along to your reports for this month.

I want to start off with a letter from a chap at the moment confined to bed. By name Sam Wilson, he is 19 years old, hobbies—aero-modelling and stamp collecting, and address —The Sanatorium, Whitley Grange, near Dewsbury, Yorks. This chap unfortunately has been on his back for four years, but is very keen on model aircraft, and would appreciate anybody who happens to be round that way to call and have a good chin-wag on " shop." Letters will also be appreciated, so I trust some of you will be able to get in to see this fellow or write to him. Visiting hours, by the way, are 2 p.m. to 4 p.m. on Wednesdays and Sundays.

Had a nice letter from Mr. A. D. Paine, previous holder of the British Hand-Launched Record, which he held for some years, who is now in an A.A. battery. He congratulates the new holder of the record, and states that he is now concentrated on bringing "gas jobs" down rather than getting them up. His experiences are rather different than hitherto, as he finds more difficulty in getting machines down, whereas before his main task was getting them to stay up.

An interesting war exhibition was organised by the staff of Messrs. Lewis's Ltd., Manchester, in aid of the Staff Spitfire Fund. and was held in the store's Concert Hall in Manchester. from Monday, September 30th to Saturday, October 6th. The highlight of the show was, of course, " The Messerschmitt 109 " which was brought down by Spitfires " somewhere in England."

Considerable enthusiasm was witnessed round the Model Aircraft Stand, and among those displayed were Mr. A. Tindall's " Lynx " Wakefield model, Mr. L. Robinson's " Meteor II," and the ever popular scale " Lysander " loaned by Mr. P. Smith. The theme of this display was " How model aircraft are helping to win the war," and pictures from THE AERO-MODELLER, *Picture Post* and *Illustrated*, showing R.A.F., Fleet Air Arm and Home Guard personnel receiving tuition with the aid of models, were effectively grouped together.

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(By R. A. Cherry)

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** The "AIR CADET"

(By C. A. Rippon)

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NEW!

***"R.F.L.G.- 53"

(By R. F. L. Gosling)

(Holder of British Tail-less Gliding Record.) Designed by a well-known aero-modeller, this model is the result of intensive testing and selection over a number of years. Of unusual, yet sound design, this machine recently raised the British hand-launch record to 52 seconds, and the tow-launch record to 85.5 seconds. Simple yet sound construction ensures a model that will give pleasure and satisfaction. Full working drawing size 30" × 21"
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* The "G—ADAR"

(By D. A. Russell, A.M.I.Mech.E.)

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The "STOTHERS GLIDER"

(By K. L. Stothers)

All balsa, mid-wing Glider, holder of club records. (Wing in two halves for easy transport.)
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*** The "HEINKEL He.112"

Another German Fighter type model, featuring detachable wings. Average performance 35 sec. Drawing 23" × 18" Span, 18½" Price 1/3 post free.

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The "SUNSTAR"
(By A. H. Smith)

Yet another design of interest to the beginner, this model is of high - wing cabin type, employing simple, rugged construction. A steady average flight is guaranteed, the original model having been timed for many flights of over two minutes. This model should appeal to those looking for a useful medium-sized machine, capable of good competition performance and easy to transport.
Span 28" Price 2/- post free.

"VIPER II"
(By C. Rupert Moore)

A well-designed semi-scale model, containing many practical and unusual features, combined with a high flight performance. Two drawings
36" × 30" Span, 48" Price 6/- post free.

The "KING FALCON"
(By R. E. Bowyer)

A finely designed British Glider, following some of the best Continental practice, this model has a guaranteed performance. Winner of many contests, this model has high performance, and comes within the regulation size laid down by the Air Ministry
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Build a replica of the popular low-wing machine Design incorporates simple construction, and ensures good performance.
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The "FIREFLY"
(Canadian Stick Model Record Holder)

(By F. J. Rogerson)

A high performance "Class C" model, with stick type fuselage. Holder of the Canadian record with a time of 20 min. 26 sec. (Unofficially timed 28 min. 13 sec.) Simple construction with super performance.
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The 'WESTLAND LYSANDER'
(By Howard Boys)

A finely designed, large flying scale model of one of the most popular types in this class of model. Drawing 41" × 40"
Span, 50" Price 5/- post free.

**The 'SPARROWHAWK'
(By J. Van Hattum, A.F.R.Ae.S.)

A good design for the beginner, this model is designed by a well-known Dutch aero-modeller, famed for his many successful designs and instructive writings on aero-modelling.
Span, 30" Price 1/3 post free.

The "J.B.3"
(By J. Bezemer)

A high-wing cabin type Monoplane suitable for the beginner.
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The "PTERODACTYL"
(By S. E. Capps)

An unusual type of model for those who like something out of the ordinary.
Span, 60" Price 2/- post free.

The "1940 GAMAGE CUP WINNER"
(By A. F. Houlberg, A.M.I.Ae.E.)

Winner of the first main competition of the 1940 season, with a total time for three flights of 717.4 seconds. Consistency, coupled with sound design by a well-known aero-modeller, makes this an asset to any collection of contest models.
Drawing 30" × 40" Span, 44" Price 3/6 post free.

description of models. Items marked * * complete with fully-detailed building instructions.)

of its kind in Model Aeronautics.

Allen House, Newarke Street - LEICESTER

Top (left to right) Mr. Houlberg winds his "Flying Minutes." A good-looking scale "Camel," by C. Bonsor, of Bradford. Members of the Newark M.A.C. enjoying themselves.

Bottom (left to right) A fine piece of construction by S. W. Lee, of Southport, the model being a "Junkers 87." Now, don't you say it! Dug Bower, of the Huddersfield M.A.S., starts a spot of repairing. Nicely away, and a nice spot of moorland to chase it over. The flyer is S. Stansfield.

An added interest was given to the stand by the use of photographs (kindly lent by *The Aeroplane*) of the early efforts of Bleriot, Farman, Latham, and the Wright brothers, while next to the flying models were about thirty solid scale models of modern aircraft, exhibited by Mr. Heaton.

On the whole, the stand (although only small) was a good effort, and should provide a bit of impetus to model aircraft clubs for the coming winter.

" Rip " advises me that the NORTHERN HEIGHTS M.F.C. are holding fortnightly meetings for lectures, indoor flying, etc., on alternate Sunday afternoons, commencing at 3 p.m. at " Ashridge," A.D.C.C. headquarters (opposite Enfield West Tube Station). Dates until January 1st are: November 17th, December 1st, 15th and 29th. The flying activities of this club are in no way curtailed, but naturally raids have forced them to discontinue meetings in the evenings. (Incidentally, I am informed that the " quota " for the club ground to date is two land mines, six high explosives and an oil bomb. Nice woik !)

The STOCKTON-ON-TEES M.A.C. regret to announce the suspension of activities until better times, and funds have been deposited in the bank so that they can have a flying start when the time arrives to start off again. These chaps sent along a fine contribution to the S.M.A.E. Fighter Fund, and I extend my own thanks to all those who so ably helped the fund along.

Incidentally, I hope you are all doing your bit towards the fund. I do not want to keep harping on the subject, but we must get down to it and boost the figure up. I saw that we passed the £100 mark last month, but we need a heck of a lot more than that before we can buy a Spitfire, Hurricane or other " scrapper." I see that Norman Lees has offered his Wakefield model to the highest bidder, and I trust we shall see a really big offer for this fine machine. I would also like to offer a word of thanks to the Woking Club, who have agreed to combine their own effort with that of the S.M.A.E.

The WIRRAL M.A.S. report an inter-club event between themselves and the Chester Club, the latter running out the winners with an average time for 18 flights of 74·57 sec., the Wirral score being 66·11 sec. Unfortunately bad weather took the gilt off things, but a good time was had in spite of Jupiter Pluvius.

Mr. Fullick won the club championship of the EGHAM AND D.M.F.C. with a total of 24 points, Mr. Hill scoring 23 points and Mr. Hewitt 10 points. (*Points* I said, not *pints*). A donation to the Fighter Fund has been made from the club funds, while members are hoping to " raise the wind " by still further efforts.

Nearly forty competitors took part in an inter-club fixture staged between the NEWCASTLE (Staffs) AND D.M.A.C. and the Stafford M.F.C. on the former's ground. A dull day with some mist put the early starters at a disadvantage, for about 11.30 a.m. the sun came out, and there were thermals galore. One Staffordite, carrying out tests across the field, launched his model into the blue—and lost it O.O.S. after 15 min. This was followed in almost the same manner by a Newcastle member, and altogether four models were lost under test. After a lively contest Mr. J. Sheldon, of Stafford, was the winner, Messrs. Greaves and Stevens, of Newcastle, being second and third respectively. A return contest will take place on the Stafford ground at an early date.

The PORTSMOUTH AND D.M.A.S. have decided to suspend payment of subscriptions until the end of hostilities. Though numbering about forty members, many are in the Forces, on war work or other activities, and it is hoped that by this suspension all will be able to continue.

One of the " not-so-big " clubs is the HAWICK AERO-MODEL CLUB, but their enterprise and energy would

do credit to many a larger body. Formed in April, membership now stands at 21, and a club room has been taken at a cost of £8 per annum. Each member has his own table to work on, and a locker of his own to keep his tools and materials safe.

There being no aero-model supply house in the district, a " shop " has been opened in the club, the small profits from this going to the general club funds. An exhibition was staged, and in the six hours of showing over 700 passed through. Pole flying was a great attraction, and much valuable publicity was gained. Over seventy 'planes were on show, and £20 was handed over to the local " Spitfire " Fund—and if you do not think that is some effort, you do not know what collecting is!

The ALDENHAM M.A.C. would be pleased to get in touch with other aero-modellers and clubs in their area. Please write to P. G. Browne, Meads House, Aldenham School, Elstree. Formed last winter, the club records now stand at :

H.L.	...	...	...	5 min. 10 sec.
Glider	...	...	...	4 min.
Scale	...	...	...	45 sec.

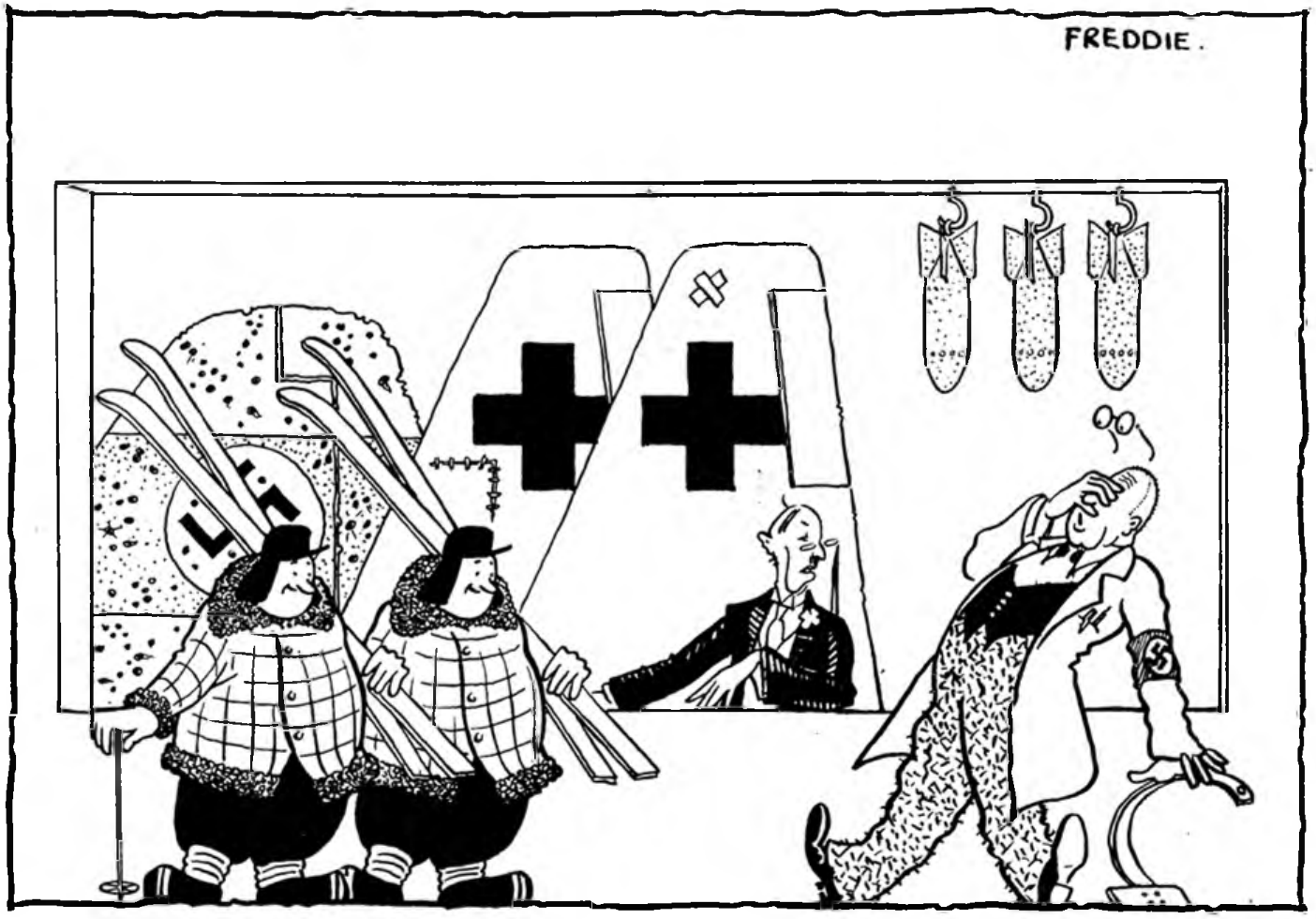
A. Tindal, of the LANCASHIRE M.A.S., has again won the President's Championship Trophy, with a total of 181 points, winning a matter of eight out of the eleven events staged during the season. N. Lancaster, a junior member, placed second wtih 139 points, with his brother, A. W. Lancaster, third at 100 points. N. Lancaster also won the Junior Championship Trophy, runners-up being E. Currington and J. Miller.

The Lancaster brothers seem to have made their weight felt in their first year of membership, but I note there are a number of the old names missing from the list. I hear rumours of a spot of falling out on the question of continuation during the war, which all seems rather ridiculous—and very unfortunate in a club with the reputation this one enjoys.

The SHEFFIELD AIR LEAGUE SOCIETY is to stage an Open " Glider Cup " event on December 26th, open to all those living in a radius of 18 miles of Sheffield. Any type of glider not exceeding 6 ft. 6 in. span is eligible, and models will be tow-launched. Entry fee is 6d. for seniors and 3d. for juniors, and the contest will be for the average of three flights. Winner holds the Cup for six months, and full particulars may be obtained from the Secretary.

E. G. Bibby, of the MERSEY M.F.C., won the Coligny Trophy, a competition for H.L. duration, with an average time of 89·73 sec. His first flight clocked 3 min. 6·8 sec., a new record for the club.

This Christmas will find the BLACKHEATH M.F.C. in somewhat different circumstances to last year, members in many instances carrying their work into the country where they can study aerodynamics without " Nasti " interruptions. Last month the club room was damaged by " that



"THE TWIN FINNS FOR YOUR NEW AIRCRAFT—HERR HEINKEL"

Top (left to right) Messrs. Wilson and May, of the Furness M.A.C., comparing notes. A fine "Spitfire," built by Bob Renaut, of South Shields. The "Henschel," built from THE AERO-MODELLER *plans by C. E. Moth.*

Bottom (left to right) A sleek-looking Wakefield type model designed by E. Sieffol, of Ilford. No, it's not the real thing —just a model "Camel" constructed by G. Penrose, of Dunmow. A most unusual model under construction by J. D. Campbell, of Saffron Walden.

man," who probably thought it was a shadow factory. One member has been obtaining good results flying a Lincol with a foot-long windsock; the model R.O.G.'s well and there is no tendency to stall.

The HALIFAX M.A.C. held its first indoor meeting in a local gymnasium, which proved a most enjoyable affair, the humorous side of things receiving as much attention as flying. Whist and bridge drives are being held in an effort to swell the Fighter Fund, while some of the members, with characteristic thoroughness, are already designing next season's contest winners.

Pole flying has also been started in the LEICESTER M.A.C., E. Powdrill winning the first event of the season, with the best time of the day at 41·5 sec. G. Dunmore placed second, with D. J. Dawson third. At the Annual General Meeting it was decided to slightly raise subscriptions, these now being 10s. 6d. for seniors and 5s. for juniors.

October 16th saw the annual prize-giving of the FURNESS M.A.S., this club now having seven silver cups and four trophies to its credit. Mr. D. H. Wheeler carried off three "pots," while Messrs. Booth, White and Vanner bagged two each. G. B. Vanner also collected record certificates for both the Senior Duration at 3 min. 14 sec. and the Biplane at 56·5 sec.

At a meeting of the OXFORD M.F.C. a new H.L. record put up by Mr. A. F. Houlberg was passed, the figure being 7 min. 2 sec. Mr. Perker suggested that members should fly three old models before the Home Guard, who would use them for target practice.

It is almost a foregone conclusion that W. Keen will win the Gliding Competition to be staged by the YEOVIL AND D.M.A.C., his exploits so far tending towards this "prophesy." Their Fighter Fund effort has been started with a ciné show and general meeting.

The HUDDERSFIELD A.M.S. has had a new lease of life in the shape of a cheque for £9 15s. from the Corporation for the use of their club room for A.R.P. use. Well, well, anyone want to use my cellar? Ron Calvert has won the "Sir Stanley White Cup," while a number of enjoyable visits have been paid to other clubs in the vicinity.

Since the inauguration of the club the EASTERN ENFIELD M.A.C., a matter of 22 members have been enrolled, a very encouraging start in these hard times. Many new designs are being born in Anderson shelters, and the results are quite worth while. F. R. Marsden is the secretary, and he will welcome any enquiries at his address, 240 Hertford Road, Enfield, Middlesex.

Following unavoidable delays, the competition for the "St. John and the Holy Cross Silver Challenge Cup" was held in ideal weather condtions by the COTEBROOK M.A.C. Unfortunately the attendance was very poor, several of the clubs who had been invited by post not even troubling to reply. (This is a thing that gets my back up. Time and again I hear of secretaries spending time and money on trying to accommodate other modellers in their area, and not even get the usual courtesy of an acknowledgment. It's damn bad form if nothing else, and about time some chaps started to brush their manners up a bit). B. V. Haisman, of the Liverpool M.A.S., won the event with an average time of 2 min. 23 sec., with F. Wilde, the runner-up, flying an "Air Cadet."

The LIVERPOOL M.A.C. have already made a start with their effort for the Fighter Fund by raffling a "Lynx," the booty being 36s. Members are also busy making "solids" for sale, and it is hoped to send along quite a substantial sum. Congratulations!

This month's report from the CROYDON AND D.M.A.C. will speak for itself:

"In spite of the aerial activity around these parts, which is at all times quite considerable, the club has not 'capitulated' to Hitler.

"Naturally all outdoor flying meetings are out of the question, or at least around here, as several of our members were machine-gunned on the flying field a few weeks back.

(Left) members of the newly-formed Eastbourne club with their models—and grins. (Right) Some of the Yeovil M.A.C. out for a day's sport.

Our extensive winter indoor programme is also quite out of it, since there is a warning every night from about 7.30 to 8 o'clock, until dawn, and the danger of bombs and shrapnel is rather large.

" Another blow is the loss of our hon. chairman, Mr. Stuart Davis, and also Mr. Stone, our competition secretary, both to the R.A.F., as well as a number of other members.

" Another drawback is the paper shortage and increased postage, but in spite of these rather heavy odds we decided at a committee meeting that we refused to give in, although having dwindled a good bit. We hope to be able to hold some Sunday morning indoor meetings, probably for pole flying, but we are not beaten yet, so ' thumbs up ! ' and we hope that we are setting an example to other ' windy ' clubs.

" That is all until next month, when you will hear again if we are still successful in bomb-dodging."

Full particulars of the ILKLEY M.A.C. Indoor Pole Flying Rally are now to hand. To be held on Sunday, December 22nd, at the " Troutbeck Hotel," Crossbeck Road, Ilkley, flying will commence at 2.30 p.m. and continue till approximately 6.30 p.m. Pole is 3 ft. 6 in. high, and length of line 9 ft., and three events will be staged—duration, scale and nomination. All models must conform to the following rules :

Maximum span ... ... 36 in.
Maximum weight ... ... 3 oz.

and conform to the S.M.A.E. fuselage formulæ. There will be prizes for both juniors and seniors.

During the afternoon a 30 in. span flying scale model of the Boulton-Paul " Defiant " will be auctioned for the Fighter Fund, so take your money along with you lads.

Every Wednesday a constructional class is held, and Mr. Anning, the new secretary, has designed a model which all will build, starting off with drawing the plans up, etc., and a competition will be staged at the end of the constructional course.

While there is no club in Saffron Walden, a number of chaps got together for a spot of flying and recently staged an exhibition in aid of the local Spitfire Fund and Troops Comforts. The sum of £5 was raised, so you see what can be done with a bit of effort.

Another new club to be announced this month is the HULL AND DISTRICT M.A.C., the secretary being Mr. D. C. Carey, of 714 Spring Bank West, Hull.

Now is the time for modellers to prepare their models for the 1941 SKYBIRDS ANNUAL MODEL RALLY, this being the eighth of the series. All being well, this will take place next March, and the following Skybird models are eligible :

Messerschmitt Me.109.
Hampden.

" Model-building in darkest Africa."

Dornier Do.17.
Henley.
Defiant, and any subsequent model introduced in the series.

Further particulars will be available by January 1st on application to "Skybirds," 3 Aldermanbury Avenue, London, E.C.2.

J. Laily, of the SALISBURY AND D.M.E.S., won the "Neale Cup" with an average time for 18 flights of 61 sec. These chaps are concentrating on building petrol engines, which they hope to install in models when the ban is lifted. These chaps are the lucky possessors of five lathes, so we should see some sparks flying in this direction.

And so I think that will be all for this time fellows. Don't go and hibernate till the sun comes out again, but polish up those models and start a spot of indoor flying. Take it from me, there is a lot to be learnt from these small "round-the-polers," and a lot of sticky fingers to be cleaned if you start on microfilmies. So, till the New Year, keep on building.

THE CLUBMAN.

Small Traders' Announcements

The charge for these insertions is 5/- each prepaid for a minimum of 30 words, extra words charged at rate of 2d. per word.

BEDFORD.—Good stock Atlanta, Cloud, Truscale, Veron, etc. Complete range of accessories, balsa, wood, Joy-plane carrying cases.—Goldings, 107 High Street.

BERKHAMSTED.—J. W. Wood & Son, 20 Lower King's Road. M.A.T.A. for Flying Scale, Duration and Solid kits by Cloud, Veron, Aeromodel, Keelbild, Penguin, Skybird, etc. Selected balsa, and full range of accessories.

BLACKPOOL.—The Sports Shop, Palladium Buildings, Waterloo Road. All model supplies. Joy, Studiette, Cloud, 'Drome, kits, balsa, cements, dopes; grand flying scale kits at 1s. 6d., including postage. Latest models, solids, duration. Remember "The Sports Shop."

BROMLEY.—H. E. Hills & Son, 481 Bromley Road, Downham, 646 Downham Way, Bromley (Phone HIT 4197). Model aeroplane supplies. Dozens of kits, plenty of spares, miles of balsa.

CHISWICK, W.4.—G. W. Jones, Bros. & Co., 56 Turnham Green Terrace (Chiswick 0858). Stock balsa wood and cut special sizes as required. Agents for Club, Cloud, Aeromodels, Atlanta, Skyleada and Scalecraft kits. Caton's rubber. Joy-plane products. Large stock of propellers and all accessories.

CHISWICK, W.4.—A. A. Baker, 526 High Road. Large stocks of Atlanta, Aeromodels, Cloud, Club, Comet, Skyleada, Keelbild, Veron, Truscale, Scalecraft, etc. Splendid selection of blue prints, propellers and accessories. Agents for Hobbies. 'Phone Chiswick 3816.

DUMFRIES.—Campbell's, 46 High Street. Penny stamp brings our price list. Balsa, stripwood, dopes, kits, all sundries. Skybirds, Skyryda, Aeromodels, Studiette, Tower, Comet. Hand-painted tarmac paper 9d. per sheet, post free.

EDINBURGH.—" Calling all aero-modellers." Whatever your requirements Frank Royle, 54 South Clerk Street is at your service. Fullest range of kits, balsa wood, accessories.

EDINBURGH.—Everything for the aero-modeller. All the leading models stocked. Joy-plane cements, dopes, Japanese tissue, ball races, etc. Wade & Co., 40 Chambers Street.

GUILDFORD.—Model Aircraft supplies up-to-date kits and all accessories. Post orders receive prompt attention. Pascall, Woodbridge Road, Guildford.

HARROW.—A. H. Matthews, 15 Peterborough Road. For model aircraft supplies, balsa wood, cements, dopes, Japanese tissue, piano wire, celluloid wheels, plywoods and hardwoods of every description.

HERNE HILL, S.E.24.—T. W. Standivan, 1 Milkwood Road. 'Phone BRI 3741. For all model aeroplane supplies—Cloud, KeilKraft, Skyleada, Keelbild, Studiette, Veronite. All accessories. Postage 6d. extra. Open Sunday morning. Satisfaction guaranteed.

ILFORD.—Whitehead's Model Airport, 718 Eastern Avenue, Ilford, and 11b The Market, Broad Street, Dagenham. Model aircraft kits and instruction books for Christmas presents. Ample stocks of all aero-modellers' requirements.

IPSWICH, Suffolk.—A. J. Sneezum & Sons, 31-35 Norwich Road. 'Phone 3779. Model aircraft supplies, Aeromodel, Atlanta, Cloud, Elite, Frog, Skyleada, Studiette, Tower, Veronite, Penguin, Scalecraft, Skybird, Truscale kits. Caton's rubber. Joy-plane productions, etc.

LEICESTER.—Aero-modellers! C. Farmer can supply all your requirements. Kits, balsa, tissue, propellers, wheels, dope in bottle or sold loose, wire, cement. Caton's rubber, etc. Call and have a chat. The address is 183 Green Lane Road, 'Phone 27722. Also THE AERO-MODELLER in stock.

LEICESTER.—Harper's, The Aero-Modellers' Stores. Over 1,000 kits to choose from. 34 Belgrave Gate and 67 Braunstone Gate.

OXFORD.—Hopkins' Stores, Hollow Way, Cowley. 'Phone 7123. Comprehensive stocks. All accessories. Kits by Cloud, KeilKraft, 'Drome, Scalecraft, Truscale, Veronite, etc. Joy-plane products. Caton's rubber. Ship kits.

STAFFORD.—Aircraft Models, South Walls. Is just the place to call and see a good variety of models and obtain advice on the best way to buy from modellers like yourself.

STOCKPORT'S Aeromodel Shop.—All materials and accessories in stock. Large range of kits—Frog, Cloud, Studiette, KeilKraft, 'Drome, Tower, Chingford, etc.—54 Wellington Road South.

TRURO.—John Langdon, St. Mary Street. 'Phone 2207. Stockists of model aero supplies, kits from 1s. 6d. to 90s. Cloud, Sweeten, Joy-plane and 'Drome products. Balsa wood and all accessories.

WILLESDEN'S leading aero-model suppliers.—Wood's Sports Ltd., 98 Chamberlayne Road, Kensal Rise, N.W.10. Comprehensive stocks of all kits, materials, prints. Write for free catalogue. 'Phone LADbroke 1414. Buses Nos. 6, 46, 52, 70 stop at door.

WOLVERHAMPTON.—The aero-modeller's rendezvous: Start & Sons, 61 Victoria Street. Kits by all popular makers. Selected balsa, spruce, cements, dopes, etc., and a complete range of materials and accessories.

WOLVERHAMPTON.—Regent Cycle Stores for latest duration, flying scale and solids by leading makers. All Frog spares in stock. Balsa, cements, tissue, rubber. Expert advice given. Cleveland Street, Wolverhampton.

WOLVERTON.—A good range of scale and duration kits, Cloud, Studiette, Atlanta, Aeromodels, Keilcraft, Frog, Penguin, etc. Joy-plane cement and dopes, high-grade balsa and all accessories at Lake Bros., 28 Stratford Road.

WORCESTER.—A. N. Cutler, Bridge Street. For balsa, dopes, tissues, elastic, propellers, cements, etc. In fact, all accessories for the aero-modeller. Stockist of 'Drome, Studiette, Skyleada, Scalecraft, etc. 'Phone Worcester 4137.

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APPENDIX - Links to the plans

Build this fine flapper (Free plan) by J.H.M. Smith
Free Plan for an Ornithopter. Union page added
https://www.hippocketaeronautics.com/hpa_plans/det ...
Document Page: 23
Document Page: 24
Document Page: 25

A Solid 1/72nd Scale Model Of The Heinkel He 111 Mk Va by J.H. Elwell
Construction details and scale plan. Union page added
Document Page: 45
Document Page: 50
Document Page: 51
Document Page: 104

Avro 504k Biplane scale model by E.J. Riding
36" span solid model Avro 504K
Document Page: 54
Document Page: 57

Spencer Larsen Amphibian by H.J. Towner
68" Rubber scale Construction details of the Amphibian Model Aircraft
Document Page: 63

A Petrol Engine driven Hydroplane by T. Farnworth Jun.
Document Page: 68

A 16" span RTP model (Free plan) by Ron Warring
16" span construction details. Union page added.
https://www.hippocketaeronautics.com/hpa_plans/det ...
Document Page: 76
Document Page: 78

1/32 Bamboo

Fold

1/16 x 1/32 Bamboo

2 Layers

Fold over and stick

Skid 18 S.W.G

Fold over and stick

1/32 Rubber

3 Layers

Fulcrum

Cotton

Fold over and stick

WING SPAR

Pin

Beads

Bead

1/16 □ Bamboo

3/32 x 1/16 Bamboo

1/8 □ Balsa

1/16 Sheet Balsa

Bind

Connecting Rods

1/8 x 1/16 Bamboo

FRONT VIEW OF WING BEARING TRIANGLE

1/32 Sheet Balsa

SKID

Cotton passes through hole

Note angle of Fulcrum

Diagram showing laminated bamboo WING SPAR Front View - Half Scale.

1"

Stick tab to Tail Plane

1/32 Rubber

Cotton

Hole

3/32 x 1/16 Bamboo

1/32 Bamboo

Tail Tube

20 S.W.G.

Cotton tied here

4 Strands 1/8 x 1/30

Position of Skid

Half Plan.

20 S.W.G.

U.C. Leg.

22 S.W.G.

1/20" □

Incidence - 1"/4

22 S.W.G.

1/4" Washout on both wing tips.

Wing Ribs. 1/32" sheet.

Tail Ribs. 1/32"

1/16" □

1/16" □

1/16" sheet.

1 2 3 4 5 6 7

1/16" □

1/8" x 1/16"

1/8" x 1/16"

1/16" □

1/8" x 1/16"

Rubber

Cement Fin to Tail Plane.

Block of rubber.

U.C. Retracted.

Thread.

Pin

Rubber Peg.

Dihedral 1/2" at L.E.

1/16" □

1/16" □

1/16" □

1/8" x 1/16"

Noseblock.

1/16" □

1/16" x 1/8"

℄

Dihedral 3/4 at T.E.

Airscrew Block.

Catch

Rubber Block.

1/32" Rubber.

Thread

Pin

Diagram showing U.C. in "down" position.

3 MIN. 43 SEC

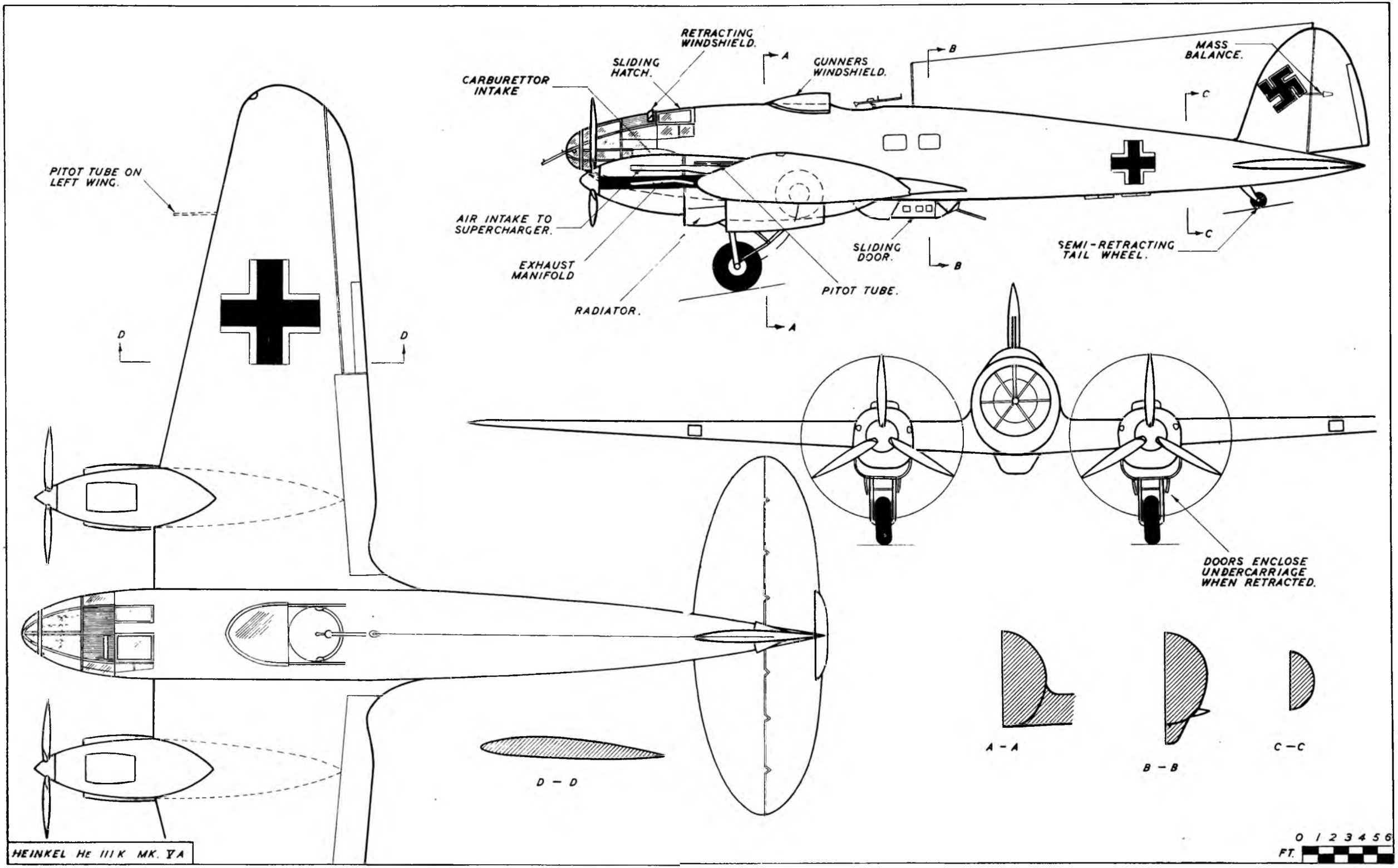
R·T·P·

MODEL

made by

R. WARRING

West Sussex M.A.S.



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