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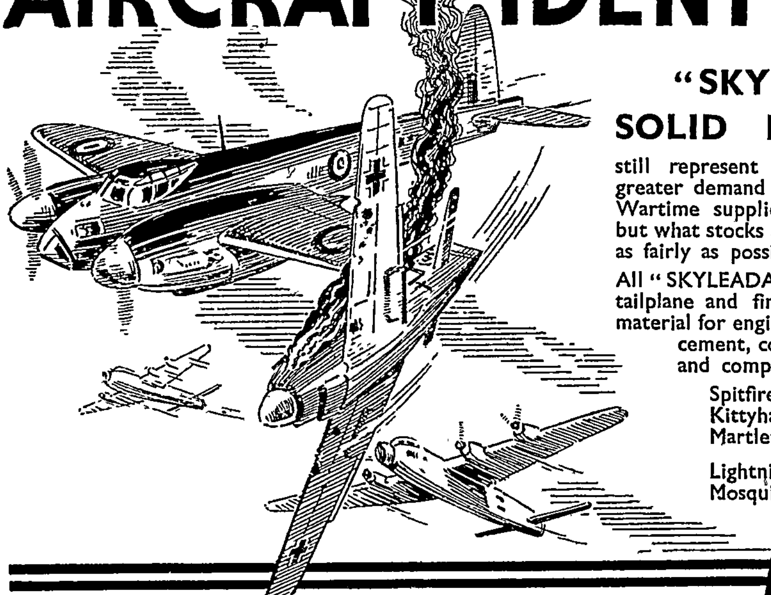

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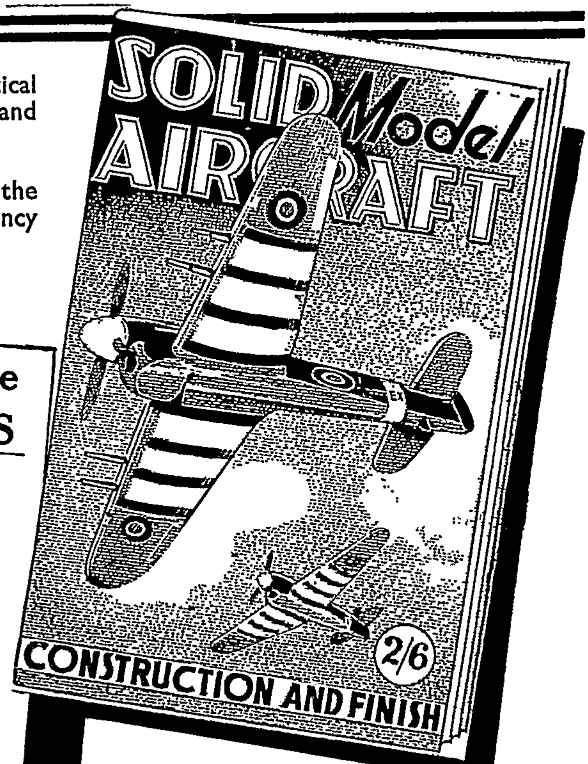

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EDITORIAL

ONCE again we remind all members of the N.G.A. that their subscriptions for the year 1944 are now due, and immediate use should be made of the form printed at the bottom of the inside cover of this issue.

Whilst lapel badges are still not available, we have good stocks of the attractive black and gold transfers, and these should be ordered when the subscription is sent, all communications being addressed to the Hon. Secretary, N.G.A., Allen House, Newarke Street, Leicester.

In the middle of last year we introduced a new feature in the N.G.A. Insurance Scheme, which provided for reimbursement up to the sum of £2 per model irrevocably lost when flying or gliding out of sight. The premium is 2s. *per model* for the year, and as many models as the owner likes may be insured. Registration forms are available from our offices at Leicester upon receipt of a stamped addressed envelope. This insurance has proved quite attractive, though not a large number of readers took it up, probably because it was introduced rather late last season. With the present balsa and rubber shortages, it should prove a great attraction to readers, and we advise all those who specialise in "Thermal Hunters," both rubber driven or of the glider type, to insure themselves against total loss by O.O.S.

In regard to the main insurance, we would again emphasise that all aeromodellers should be insured. The nominal subscription of 6d. per person per annum cannot possibly cause the least financial strain on the pocket of even the youngest of aeromodellers, whereas a claim, even for a few pounds, much less for serious personal damage, could be not only a serious financial embarrassment but a major disaster. All N.G.A. insurances are covered by Lloyds A1 policies, and Third Party claims for accidents caused by the flying of any type of model aircraft (other than petrol planes, which insurance is suspended whilst the Air Ministry ban continues), are limited only to £5,000 for any one claim.

Plan Packs.

The range of 1/72 scale three-view drawings of all the aircraft described in the "Aircraft of the Fighting Powers" series, and past issues of the AERO MODELLER are, of course, extremely well known and widely used by Spotters' Clubs, Observer Corps, A.T.C., and many A.A. and R.A.F. units, for training in aircraft recognition. (It is quite common to receive individual orders for several hundreds, which is an indication of the use made by the Services of these plans.) Recently we introduced "Plan Packs" of the more popular aircraft. There are three series—British, American and German—there being 1/72 scale three-view drawings of 24 aircraft in each series. The *names of the aircraft* are given on the back page of this issue of the AERO MODELLER.

Have a Heart—please?

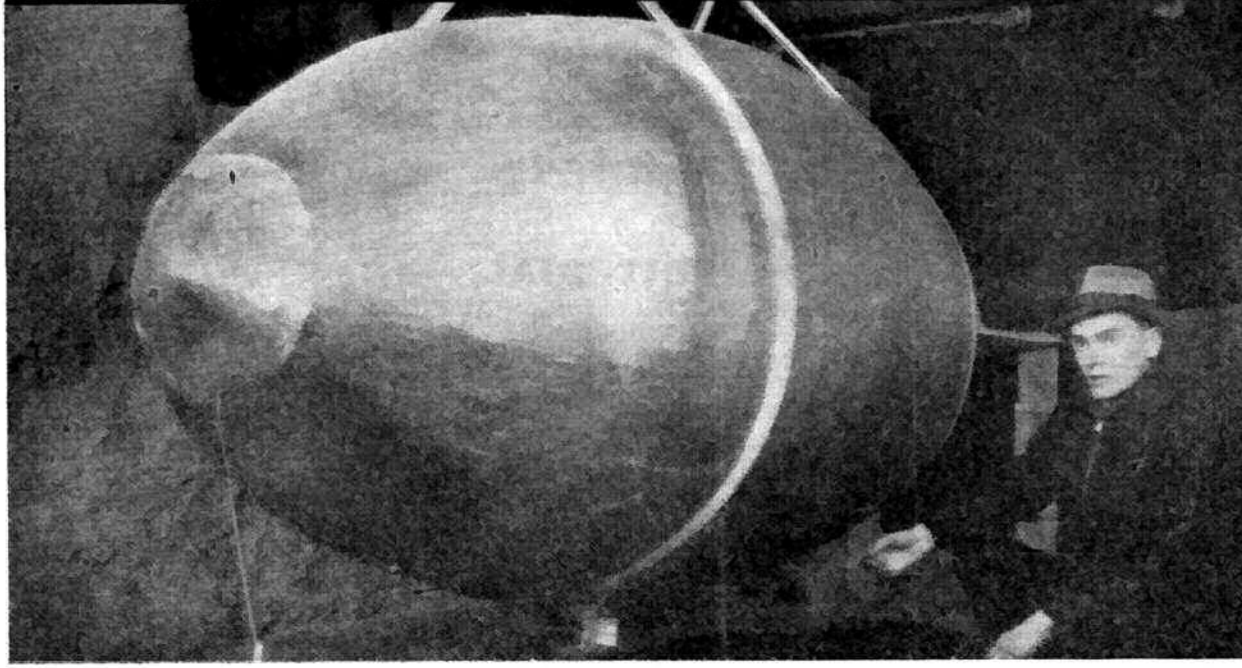
We have received a number of "complaints" at late delivery of Volume IV of "Aircraft of the Fighting Powers." The position is that first orders were received for over 20,000 copies, and it is quite impossible, particularly under war-time conditions, to effect instantaneous delivery of such a large number of books. Every care has been taken to effect distribution as equitably as possible; but it follows that some folk must wait for their copies, and will not find it the easier for meeting other folk who have already received theirs. Every effort is being made to produce and deliver as many books as possible each week, and we understand from the Harborough Publishing Co. that arrears of orders are fast being overhauled. We fully sympathise with those who have to wait for their copies, but are bound to point out that it is quite impossible to produce and bind a large print of books all in the course of a few weeks, and effect delivery of a complete edition on the publication date. Will those who ordered copies and have not yet received them, please realise this, and wait in patience, knowing that distribution is being effected as rapidly and equitably as possible.

Air League of The British Empire.

The article on pages 73, 74 and 75 of last month's issue has brought a number of enquiries for the address of this organisation. We regret the omission of the address from our article, and now give the name and address of the Secretary: Mr. L. Taylor, Air League of the British Empire, Kinnaird House, 1a, Pall Mall East, London, S.W.1.

CONTENTS OF THIS ISSUE

THE ZE-2 GOES TO WAR!



A full view of the first gas model dirigible, now being used as a pre-flight trainer by the U.S. Navy. Ted Alexander, who designed and constructed the model, is shown beside the craft.

BY TED ALEXANDER

AMERICA'S first gas model dirigible has gone to war, and its going to war offers proof again of the value of aeromodelling in winning the victory that will be ours.

This huge model, the first of its kind in America, if not the world, has been considered one of the most outstanding feats of modern model building. Modellers in America and England have eagerly awaited news of the first trial flights, but such awaited news regarding the model now falls into the category of military information. For on 21st May, 1943, the Bureau of Aeronautics of the United States Navy Department, in Washington, D.C., officially took possession of the model as a pre-flight trainer for the men who will make up the crews of the real blimps now patrolling the North Atlantic coast of the U.S. against Nazi submarines.

A few days later a large Navy van took aboard the model, under the direction of officers and men, and moved it to an East Coast Naval Air Station, where it is now in service for the Allied cause.

Known as the ZE-2, the first gas model dirigible ever to be credited with a licence by the Academy of Model Aeronautics, official model aviation society in the United States, its construction details were fully described in an exclusive article appearing in the May, 1942, AERO MODELLER. As some readers may not have a copy available, the writer will attempt to describe these details briefly.

While the model is a completely rigid frame, its design appearance is that of a Goodyear Navy " blimp." The hull is over 10 ft. in length, has a main diameter of 4 ft., and is of rather unusual construction, having no internal bracing. Instead of the usual internal cross bracing, the hull is made up of a system of 30 balsa rings spaced 4 in. apart, forming a vertical frame supported by 172 longitudinal balsa struts running the full length of the ship, each strut 1/16th of an inch square. Over ten thousand notches of this exact size had to be cut into the rings so that each strut would be flush with the surface of the rings. Each ring is made up of grained sections of balsa to obtain an even degree of strength over the entire hull.

Despite the fact that the hull has no keel of any sort, the ship is very strong. It is possible to suspend the entire ship from any portion of the frame with but slight strain being apparent.

Aeronautical engineers from America's leading technical institutes have observed the model and are doubtful of this type of construction for a full-size airship. They concede, however, that because of the many outstanding contributions made to aeronautical engineering by the model builder, this novel construction may be developed. The construction principal offered convincing proof of its ability to " take it " a few months ago when the ship slipped from its hangers and dropped 5 ft. to a concrete floor. Damage was confined to torn covering and breakage of two sectional struts. Technicians who observed the accident and resultant damage were of the opinion that such a fall for a model with internal cross bracing would have been irreparable.

The covering is mostly of Japanese tissue, with some areas covered with bamboo paper for additional strength. This has been doped three times, with a final application of silver dope, which prevents sudden expansion of the lifting gas by reflecting sunlight. As this is an actual working model of a dirigible, it was necessary to spray the interior of the hull with a solution that resists ultra-violet rays harmful to airship operation. Ten automatic air ventilators, weighing only one-eighth of an ounce, are spaced along the top of the hull to maintain

even pressure. They are capable of drawing in or expelling 3 cubic ft. of air per minute. The lifting gas is contained in three Darex balloons of the type used by the U.S. Weather Bureau. These are inflated through hatches built into the hull that completely enclose the appendices of the balloons.

The gondola is detailed even to tiny chairs and desk, doors that open and close, and a machine gun "nest" in the rear. It is the actual nerve centre of the ship, for it contains the control wheels that operate the cables running to the rudders and elevators, as well as the ballast toggles for the entire ship. The gas engine is suspended from the gondola and is controlled from it. The engine is a light-weight Class A type, weighing less than 2 oz. without coil, batteries and condensor. It provides sufficient power for the model, having $\frac{1}{2}$ in. bore, $\frac{1}{2}$ in. stroke, and a displacement of ·097 ins. Four fins provide control. Top fin acts as a stabilizer, while the two side fins support the elevator control surfaces. The bottom fin supports the rudder surface.

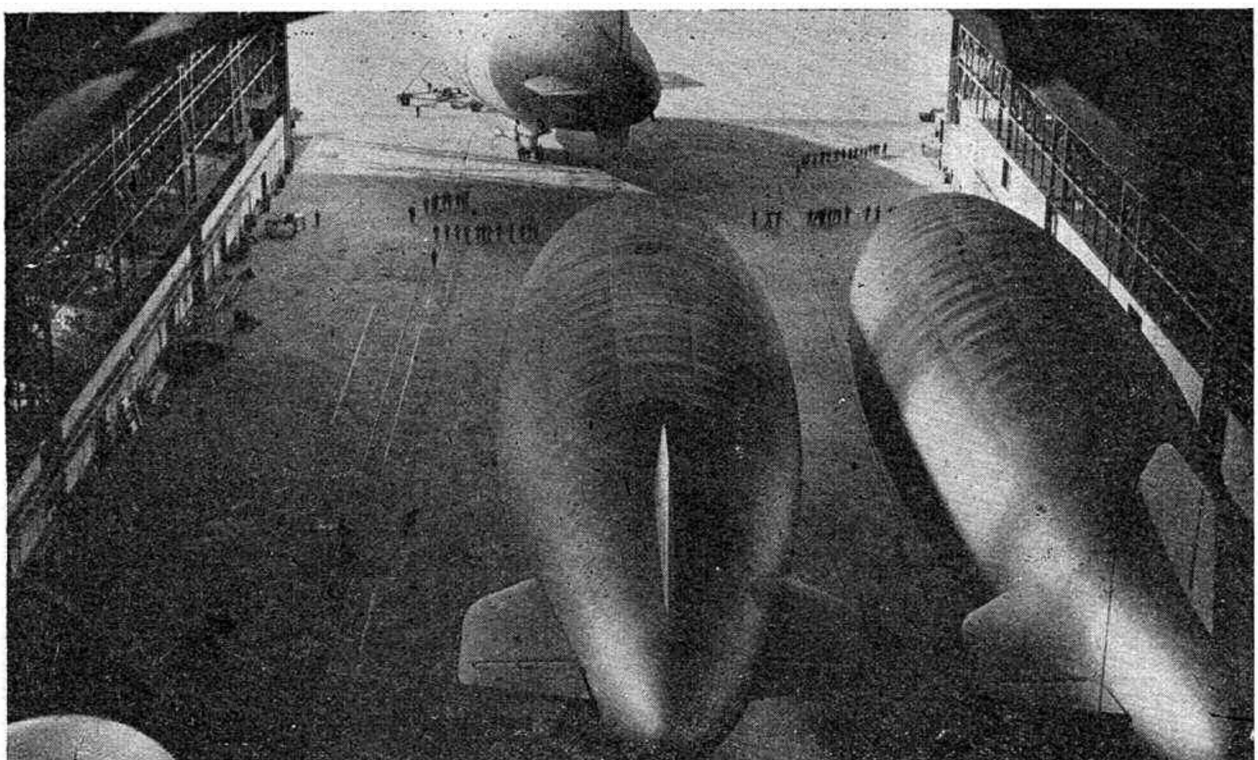
The total weight of the model, less engine, is only 36 ozs. The model involved over eight hundred hours of work, covering a period of four years. Thirty-two pages of scaled blue-prints had to be drawn, and the weight of each section estimated before work was commenced. Full-size drawings were then necessary to make the templates and had to be worked up from the original scale drawings. This involved considerable work that later was well repaid when individual sections were joined in perfect agreement.

It will be understood that because of necessary Navy censorship, it is not possible to describe the exact method used by the Navy in applying the model to class-room instruction. But it can be readily understood from a description of the model and from the photographs, that the model could be mounted on a swivel stand and inflated, or it could be permitted to float in a tethered flight in the class-room or hangar. From the description of its construction it can be seen that the instructor would find a perfect medium for illustrating his lectures. Any problem of airship operation could be explained and worked out by reducing or increasing the amount of helium lifting gas or by altering ballast. The student would have before him a clear and visible demonstration of the aerostatic or aerodynamic problem the instructor seeks to explain.

The model presented a difficult problem for shipping to the East Coast Naval Air Station. To reduce the possibility of damage or vibrational shock, the craft was suspended within a wooden frame. Cables in triple units were attached to the ship's handling cables, top, underside, starboard and port. Thus the ship hung in complete suspension, free from movement or vibration of the vehicle. The crate could be lifted into any position without possibility of damage to the model. It made the journey without damage of any kind.

The original purpose of the model was to prove certain theories relative to airship design. It is understood that the Navy will use the model for further developments at a later date. In the meantime, the writer intends to carry on his work in this field. At the conclusion of the

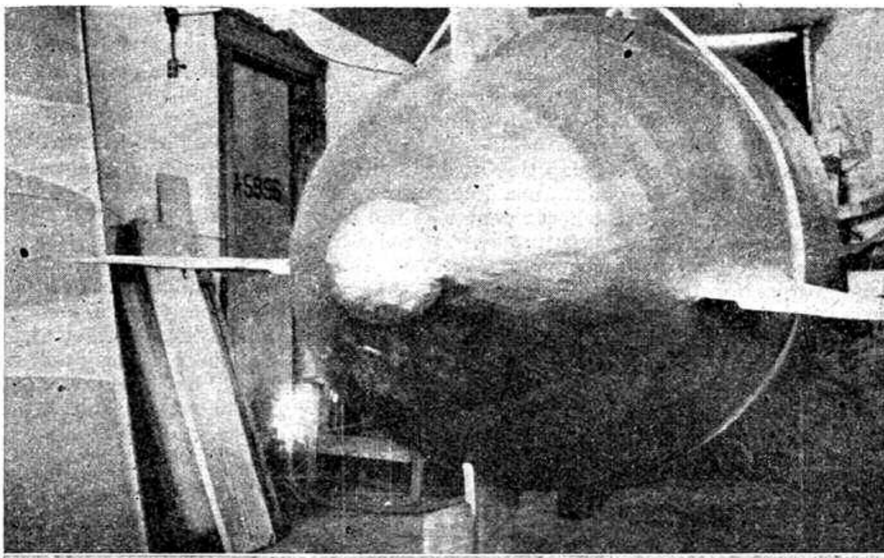
An interior view of the East Coast Navy hangar where America's first gas model dirigible is now stationed as a pre-flight trainer. One of the huge blimps can be seen ready to take off on Atlantic patrol. The ground crews hold hard to the landing lines as the ship glides on to the field.



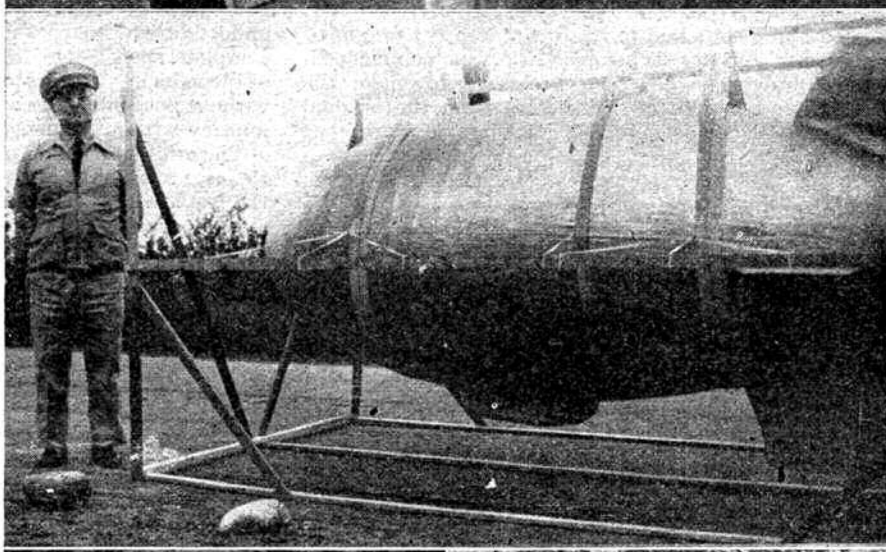
"Official U.S. Navy Photograph."

war a third model dirigible will be constructed that will not only be useful to the aeronautical scientist, but to the radio remote control engineer as well. It will be of such a size as to be useful in commercial advertising. Certainly with the name of a product painted on its side, a larger craft directed by radio control would arouse considerable public interest.

The writer wishes to thank Mr. Langley W. Islom, of the Dewey & Almy Chemical Company, Cambridge, Mass., U.S.A., who assisted regarding pressure and lift calculations, and who suggested the successful use of Darex balloons. Also, Mr. R. C. Myers, E. I. DuPont De Nemours & Co., Inc., Wilmington, Delaware, U.S.A., who gave early assistance, as did Mr. Seth Leffert, Skyway Model Aircraft Supply Co., Brooklyn, N.Y., U.S.A., who was responsible for the selection of proper grades of balsa wood for specific purposes of construction. These gentlemen received no compensation for their valuable assistance, but each contributed to the final success of the model dirigible.



Top photograph shows an excellent view of the tail area of the gas model dirigible, showing the movable fins and plastic tail tip. The nose and tail tips were made up from an original plastic composition developed for the purpose.



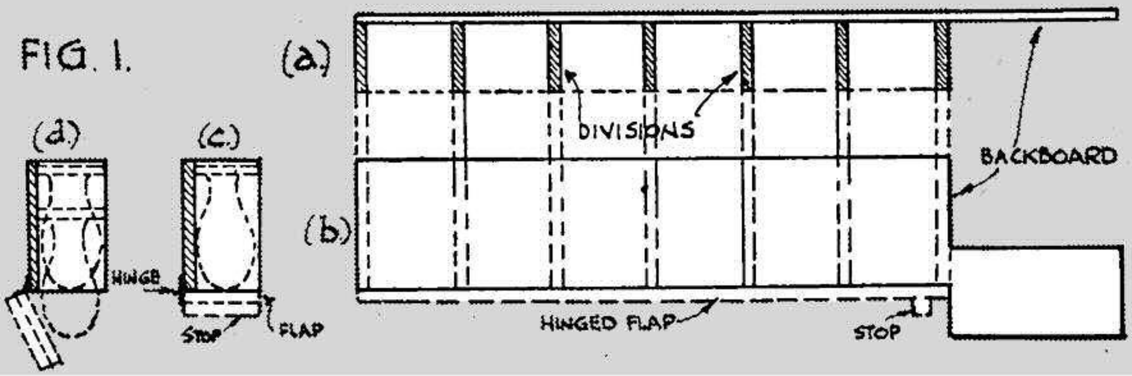
The centre photograph depicts an U.S. Naval officer, A. J. Rocheleau, C.S.K., in charge of moving the model dirigible to an East Coast Naval Air Station, standing beside the craft.
Motor was removed during shipment.

Bottom right is front view of the gas model dirigible on board a U.S. Navy truck just before leaving for the Naval Air Station. The unique suspension method of crating can be clearly seen in this photograph.

Bottom left is a view looking down through the gas model dirigible during construction. This clearly shows the vast amount of work involved. Holes punched in the rings reduced the weight by six ounces.

A SIMPLE BOMB RELEASE FOR SOLIDS

By C · T · DEAN



"FLYING FANS" have evolved several methods of dropping bombs automatically whilst their models are in the air. Here is a means by which the "Solid Fans" can do likewise, from a stationary position of course. The idea relies on the action of a solenoid, which, as all electricians will know, is a device by which a metal core is drawn into a coil of wire by the action of an electric current. The dimensions given are for 1/72nd scale models, but may easily be increased for larger work.

Main Assembly. (Fig 1.)

The backboard is made from any hardwood, 1/16 in. thick and cut to outline shape as at (*b*). This is divided into compartments by pieces of $\frac{1}{8}$ in. wood glued on (*a & b*). At the base is a flap, loosely hinged to the backboard and fitted flush with the divisions (*a & b*). Approximately $\frac{1}{8}$ in. from the right-hand end of the flap a small piece of wood is glued, underneath, to act as a stop for the wire holding the flap in position, as at (*c*). Attached to the shaded portion of the backboard is a small solenoid, for details of which see Fig. 2.

Solenoid. (Fig. 2.)

Materials required :—

1. About 1 in. of stiff wire to act as catch. (A piece of stout paper clip was actually used.)
2. Two pieces of 1/16 in. hardwood about $\frac{1}{8}$ in. square, drilled to take 3.
3. About 1 in. cistaflex, or sheathing, 1/16 in. bore.
4. A quantity of 36 gauge enamel-covered wire.
5. About 5 in. of stout wire to use as a trigger for replacing catch after device has been actuated.

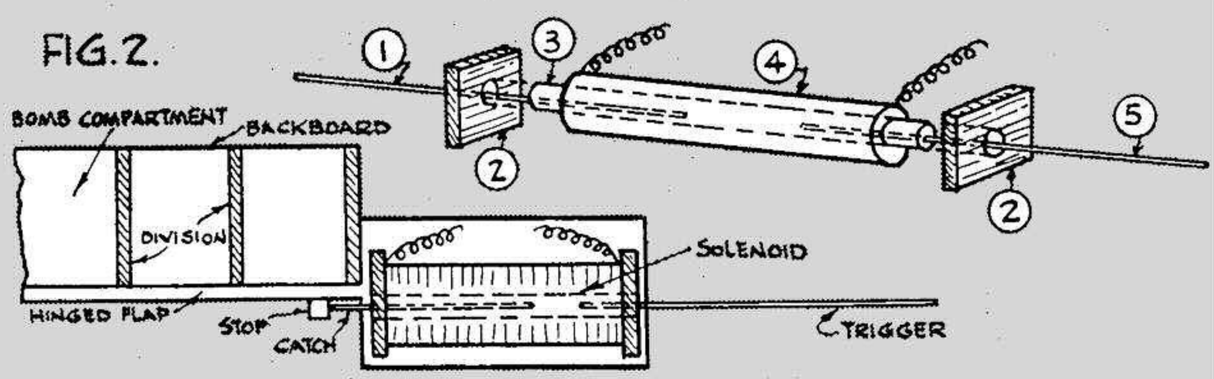
The length of cistaflex is inserted in the two pieces of wood and glued into position so as to form a small bobbin. This is wound with 200–240 turns of the enamel-covered wire, leaving a long lead at either end. The short piece of wire must move freely inside the whole length of the bobbin. The long length is inserted from the other end and should be a tight fit. This complete assembly constitutes the solenoid, and is glued into position as shown in Fig. 2 (*b*), so that the short wire will slip under the flap and act as a catch to hold it in the closed position.

Small wooden bombs complete the device. They should be as light as possible; hard balsa was actually used.

The whole assembly is inserted through the bomb doors and glued into position directly above the opening so that the hinged flap is free to fall into a vertical position. The two leads from the solenoid may be taken to any concealed spot on the fuselage for ultimate connection to a 4-volt cycle battery.

For the original model a 1/72nd scale Halifax was used, the loads being taken to two pins stuck through the escape hatch in the roof of the fuselage. The pins acted as terminals for the battery leads.

To operate the device the bombs are loaded into the compartments, the hinged flap closed and the wire catch pushed into position, by means of the trigger. When the current is switched on the action of the solenoid draws the catch sharply into the bobbin, the hinged flap drops and the bombs are released.



HOW SCIENTIFIC WELDING CAN HELP

By C. W. BRETT, M.Inst.W.

(Managing Director of Barimar, Ltd., Scientific Welding Engineers)

MODELLING tests an enthusiast's powers of resourcefulness to the utmost. In fact, it is this challenge which is one of the greatest charms of such work, however exasperating the temporary effect may be.

There are limits, however, to what can be accomplished by the most ingenious. To waste hours upon a job that can be achieved in a few minutes, if the proper equipment is available, is a futile proceeding. Far better let the firm with the facilities lend a willing hand.

Many of those who are skilful in modelling with wood, lack corresponding ability to deal with metal. This is a deficiency sometimes felt by those who possess aircraft powered with miniature petrol engines. Dismantling for cleaning and inspection offers no real difficulties, but a major overhaul necessitated by wear or damage resulting from a smash is quite another matter. Some owners will wish to make modifications to major components, but lack the facilities to put their ideas into effect; others, with still more ambitious plans, have experimental engines drawn out but cannot produce them.

At the outset it is necessary to emphasise that no single simple solution is available to dispose of all these problems, but at the same time scientific welding can accomplish far more than is generally supposed. There have been enormous advances in technique; new processes and equipment have made jobs commonplace that were regarded as virtually insoluble not long ago. Therefore, by describing what can be done in the simplest terms, model makers will then know if one welding process or another can meet their particular difficulty both in regard to repair or modification of design.

Crankshafts of all types, even those of railway locomotives, are welded perfectly by specialists after breakage. This work is done with such precision that there is no doubt that a full measure of strength is restored. If this were not the case it would be impossible to cover such an exacting task with the usual "money back" guarantee.

When a smash of this kind happens it is seldom that the shaft is not bent out of truth, therefore it is insufficient merely to restore the strength; alignment, too, must be regained. This is done to a plus or minus tolerance of one-thousandth part of an inch, but if still finer limits are called for they can be accepted. When work of this kind is carried out it is a convenient opportunity to build up afresh any bearing surfaces that are worn. Sometimes these are ground oversize, so that when further wear is evident then grinding is all that is necessary (apart from fitting new bearings) to restore everything to a perfect condition once more.

As this service is available to model engineers, professional and amateur alike, it may be of interest to indicate some of the problems it has been necessary to solve before this class of work could be done with precision and complete trustworthiness.

It is not widely known that for a long time the welding of steel offered stubborn problems. Not the least of these was a proneness to surface pit marks. For many classes of work this would be ignored, as there is no reduction in strength, but even the smallest blemish in the high finish of a bearing surface cannot be tolerated.

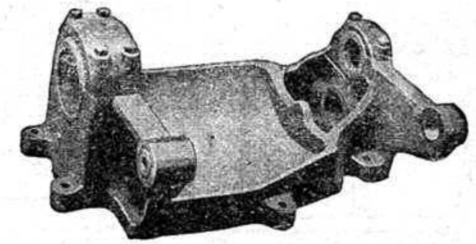
The reason for this trouble is well known, the "nigger in the wood pile" being the affinity of the oxygen in the atmosphere of the molten metal. Ultimately the solution proved simple, for it was found that by surrounding the weld with an inert gas, such as hydrogen, contact with the air was prevented and risks of surface faults overcome. An additional advantage is greater purity of the weld metal.

It is this method which is applied to crankshafts and other precision components of steel. The hydrogen is usually generated from a chemical coating on the welding rod, which gives off the required volume of gas directly it is heated. Alternately it can be derived from a high pressure cylinder with equally successful results.

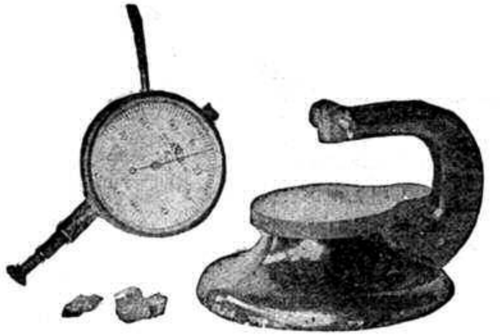
Some model makers do not realise that any metal in commercial use to-day can be welded, and that such work is by no means confined to ferrous metals. The present output of light metals is on a prodigious scale, consequently when the flow is directed into peaceful channels once more it is certain that prices will be lower than has ever been possible hitherto. Owing to their exceptionally light weight combined with surprising strength, magnesium alloys are particularly attractive for model aircraft work. Although this material is often highly inflammable in the form of swarf or filings, yet means have been devised for welding it perfectly.

In passing it is of interest to observe, regarding

A broken lathe headstock. An accident like this might cause great inconvenience to a model engineer



The speedy remedy is a repair by scientific welding. Here is the repaired headstock. (Repaired in the Barimar Welding Works.)



(Left.) A broken gauge. A repair would be useless unless it were perfectly accurate.

(Right.) Even a job like this is not beyond the skill of the welding specialist. This is the same gauge perfectly restored and as true as ever. (Repaired in the Barimar Welding Works.)

magnesium, that the source of supply is unlimited, as it is being produced economically from sea water.

Remarkable and helpful to the model maker as is the welding of metal that can burn spectacularly if it is not handled properly, a new process of great potential value is still more important. It is a perfected method whereby totally dissimilar metals can be welded together.

When cast or malleable iron was first welded to steel after a lengthy period of research, it was considered, in some quarters, that the practical limit had been reached. Some argued that attempting a similar union of metals having greater divergence in their respective co-efficients of expansion would render welding physically impossible. This contention has proved totally false, so much so, in fact, that nowadays aluminium is being welded to steel with the utmost regularity and dependability. Although this process was developed primarily to widen the scope of repair work still further, obviously it is a development of paramount importance in matters pertaining to new production, particularly where questions of great strength and ultra-light weight are involved.

Sometimes it happens that a gudgeon pin is insecurely fastened and this may lead to a scored cylinder if no end pads are fitted. This does not mean that a replacement is needed or even that reboring and fitting an oversized piston is necessary, for scientific welding engineers can fill in the score perfectly and in such a way that the original piston can be retained. Cracked crank-cases, distorted or broken lugs can be made sound once more at the cost of a shilling or so and without leaving a trace of what has been done.

Plug threads in the cylinder head can be filled in and re-cut if they become worn and damaged, whilst other possibilities in regard to worn or broken items are almost unlimited. There is no need to emphasise the resources which such service offers, particularly in these days when replacement parts are virtually unobtainable.

Some enthusiasts have reduced the factor of safety by drilling connector rods and carrying out other work with a view to lightening, reciprocating and other parts. Breakage on this account might imply indefinite delay were it not for the possibilities of efficient repair.

Some may think that the small size of the parts concerned makes them too insignificant for welding specialists to concern themselves with such jobs, but this is not the case. Very small items as well as massive ones are welded, cinematograph projectors calling for the utmost accuracy and alignment are often dealt with: the size of these may be such that several can be held in the palm of the hand.

It is well that these facts should be appreciated, for they open up new avenues of opportunity which may make all the difference when replacements are proving a difficult obstacle.

(Ed.—The Holborn works of Barimar, Ltd., were "blitzed" and readers may like to know their new address, which is, Barimar House, Peterborough Road, Fulham, London, S.W.6.)

A NEW ASPECT ON THE CLIMB OF MODEL AIRCRAFT

By "C." B.Sc. (Eng.) Hons., S.I.Mech.E., Stud.R.Ae.S.

A SHORT time ago considerable interest was aroused in the aero-modelling world over a series of articles in THE AERO MODELLER on the much discussed subject of downthrust. These articles, which were wound up so admirably by Mr. A. F. Houlberg, all dealt entirely with the lines of directions of the forces acting on a model under power, and none of them gave any consideration to the value of the forces acting.

Great care may be taken with the design of a model by endeavouring to get all the forces, lift, drag, thrust, and weight, to pass through one point, which condition most writers seem to agree, would do away with the necessity of downthrust; and yet, when the model is flown on full power with no downthrust, as soon as it is launched it whips up into the familiar stall. The designer then usually comes to the conclusion that either his estimation of the layout of the forces is completely wrong or that there are such things as gremlins!

Calculations that I have made show that to make a Wakefield size model stall, the error in estimating the position of the line of drag of the 'plane must be in the region of three inches, and the error in estimating the position of the total lift of the model must be in the region of two inches.

These figures show that errors in the estimation of lines of directions of lift or drag that we are likely to make, are not liable, in themselves, to cause our models to stall, due to the couples arising.

To find the cause of the stall of a model under the large initial burst of power, let us examine again the forces acting on it during a steady climb.

Fig. 1 shows the forces acting during such a climb at an airspeed Vc.

Let us compare this case with that of level flight at the same angle of incidence. Let a suffix "c" denote climbing conditions.

In level flight:—

$$L = W \quad \text{———} (1)$$

$$\text{and } T = D \quad \text{———} (2)$$

In climbing flight:—

$$Lc = W \cos\theta \quad \text{———} (3)$$

$$Tc = Dc + W \sin\theta \quad \text{———} (4)$$

Dividing (3) by (1) we get:—

$$\frac{Lc}{L} = \cos\theta$$

$$\therefore \frac{Vc^2}{V^2} = \cos\theta \qquad \text{or:—}$$

$$Vc = V\sqrt{\cos\theta} \quad \text{———} (5)$$

$$\text{and also } \frac{Lc}{L} = \frac{Dc}{D} = \cos\theta$$

Now we have that:—

$$Tc = Dc + W \sin\theta$$

$$= Dc[1 + \frac{W}{Dc}\sin\theta]$$

$$= D\cos\theta\,[1 + \frac{W}{D}\tan\theta]$$

$$= D\cos\theta\,[1 + r_a\tan\theta]$$

where $r_a = L/D$ ratio of the whole model.

If H is the thrust horse power:—

$$\therefore \frac{Hc}{H} = \frac{TcVc}{TV} = \frac{D\cos\theta\,[1 + r_a\tan\theta]\,V\sqrt{\cos\theta}}{DV}$$

$$\therefore \frac{Hc}{H} = [1 + r_a\tan\theta]\cos^{1.5}\theta \,* \quad \text{———} (6)$$

A rough graph showing the form of the above equation for a fixed value of r_a is shown in Fig. 2. From inspection of this graph it can be seen that $\frac{Hc}{H}$ increases with the angle of climb until it reaches a maximum at a value of θ of about 50 degrees to 53 degrees.

It can be shown that the maximum values of $\frac{Hc}{H}$ are given approximately by:—

$$\max \simeq \frac{Hc}{H} = 0.62\,r_a + 0.5 \quad \text{———} (7)$$

As long as a model does not have a value of $\frac{Hc}{H}$ in excess of the maximum value given by the equation (7) or by the graph in Fig. 3, steady climbing is possible, and provided the forces are in equilibrium it will be perfectly stable; but should the value of $\frac{Hc}{H}$ exceed the maximum, then steady climbing flight is no longer possible and the model begins to loop, even though the lift, drag, and thrust may all act through the centre of gravity of the machine.

The intial torque of a rubber motor may be three times the mean torque during the power run, or even greater, and the mean torque may be four times that necessary for level flight. The variation of airscrew efficiency with the applied torque is rather doubtful, but it can be said that with the initial burst of power of a rubber motor $\frac{Hc}{H}$ for a model may be in the region of nine.

For a 'plane with $r_a = 9$, $\frac{Hc}{H}$ maximum from equation

(7) comes out to be nearly 6.1 So that a model may have a value of $\frac{Hc}{H}$ at the beginning of its flight in excess of that permissible for a steady climb.

We can now see that the possible cause of all our trouble is the initial burst of power of the rubber motor and not the aerodynamic design of our models, though this also may be at fault.

What probably happens is that a model aircraft on being released has an $\frac{Hc}{H}$ greater than the permissible maximum and starts to loop as explained, its angle of climb becoming greater than that for maximum $\frac{Hc}{H}$ and its condition being represented by a point such as A in Fig. 2. Then the power begins to drop and its condition falls to a point such as B ; as the power falls still further, instead of the model flattening out things become worse and it starts to go down the right-hand portion of the curve.

The initial burst of power, however, may be very short, perhaps about 10 seconds, and this short period may not be long enough to enable the model to climb to an angle greater than that for maximum $\frac{Hc}{H}$ and its condition at the end of the burst of power might be represented by some such point as C. In this case, when the power drops off, its condition is represented by point D and it will pull out of its steep climb provided that it is otherwise stable.

It can be seen from equation (7) of Fig. 3 that an increase in r_a can help considerably by permitting higher values of $\frac{Hc}{H}$ to be used.

Equation (6) is particularly useful for solving problems on the climbing of model aircraft, and unlike the familiar equation $\frac{550\ (E.H.P.)}{W}$ for the climbing speed, is perfectly accurate, as it takes into account the decreased velocity during the climb.

As it is rather tedious to solve, values of $\frac{Hc}{H}$ against θ for several values of r_a have been calculated and plotted as shown in Fig. 3.

This graph should be kept handy during the design of a model, as all one has to do is to calculate $\frac{Hc}{H}$ and r_a find the corresponding point on the graph, by interpolation if necessary, and obtain θ. This obviates all the previously tedious calculations and is more accurate.

The climbing speed of the model, v, in ft./sec. can be obtained from :—

$$v = V \sin\theta\sqrt{\cos\theta} \qquad \text{—————(8)}$$

where V is the airspeed in level flight in ft./sec.

It is to be hoped that this article has " cleared the air " still further with regard to the necessity for downthrust on model aircraft, and that stalled " take-offs " are to be things of the past.

* Note for calculation $\cos^{1\cdot5}\theta = \cos\theta \times \sqrt{\cos\theta}$.

FIG. 1.

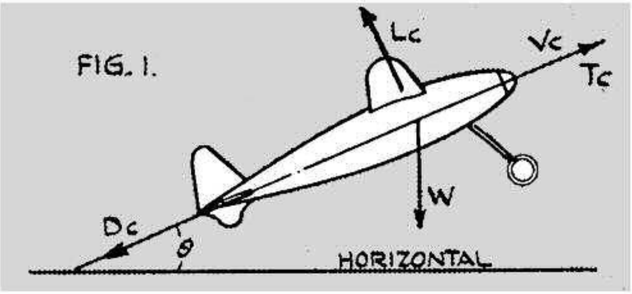


FIG. 2

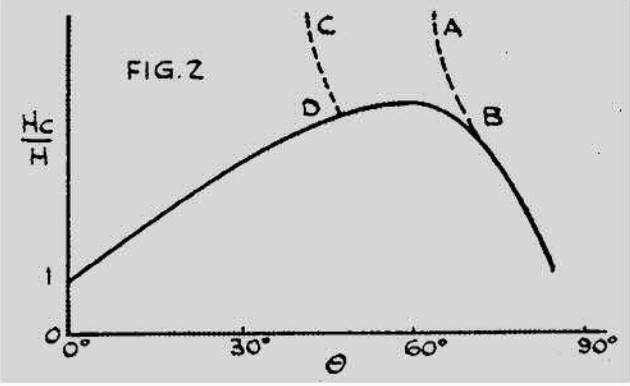
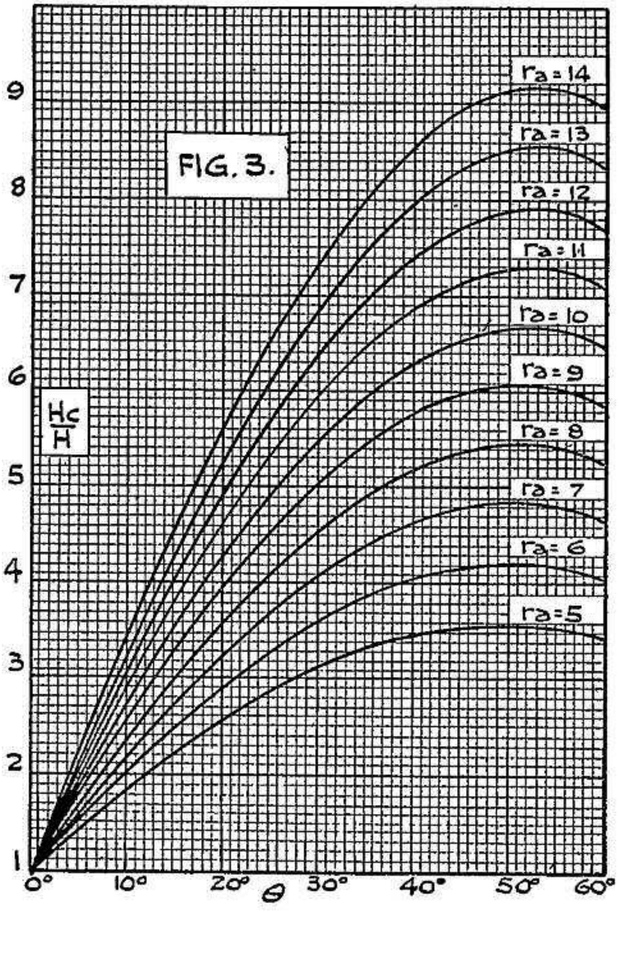
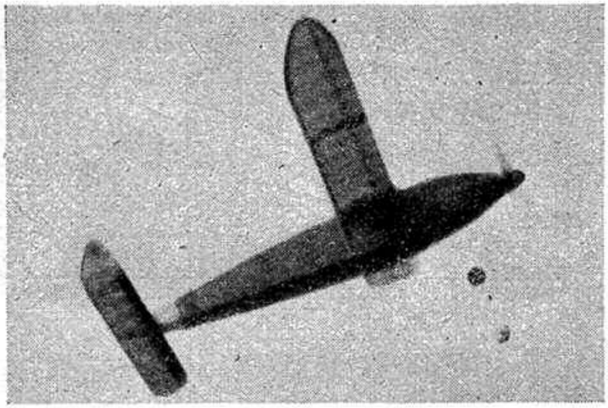


FIG. 3.





OPTIMIST III

BY E · J · S · TOWNSEND

THE model described here has been developed from a Wakefield machine originally designed at the end of 1939. The Mk. I had a two-wheel fully retractable undercarriage, a two-bladed folding propeller and was entirely covered with 1/32 in. sheet balsa. Optimist II had a fixed wire undercarriage and a single bladed folding propeller. The fuselage was double covered with two layers of tissue. From this model the Mk. III was developed, and now a Mk. IV, with a single leg retracting undercarriage, single fin and rudder, is awaiting flight tests.

Mks. I, II and III have all been steady and consistent flyers, Mk. III placing second in the Gutteridge Trophy and fifth in the Weston Cup, also winning many club competitions.

A point worthy of note is that all the marks have been fitted with Mattioli Randisi disruptors which improve lateral stability in gusty weather.

Fuselage.

Build up on the plan, both sides simultaneously. This requires care in pin-sticking but gives two identical sides. Longerons and cross-members are 3/32 in. substitute, a strong cellulose glue being used for construction. Allow to set overnight before removing from the plan. Fix the sides together with cross-braces and add the plywood nose former. Add stringers to form a rounded nose-section back to the second cross-brace. The tail and nose sections should be filled in with 1/16 in. sheet for strength when handling. The tail section is then cut off and a ply of 1/4 in. sheet fitted into it, forming a tight fit into the main fuselage structure.

The undercarriage and tail skid are then bound and cemented to the fuselage.

Tailplane and Rudders.

Should be cemented to the fuselage by cutting the stabiliser in half at the centre (it is built in one piece) and cementing on half to each side of the rear fuselage section. Join the main spars projecting internally and reinforce with sheet, in front, and behind the join.

Wing.

Each rib is in two parts, top and bottom, cut from 1/16 in. sheet balsa, about 1/8 in. wide. This not only saves a little weight, but also balsa, which is a great asset nowadays.

Pin the T.E. to the construction board; and cement the lower rib members at right angles to it, at the rib stations marked on the plan.

Now add the main spar (1/16 in. by 3/8 in. substitute) and cement to the top of the lower rib member, making sure that it is vertical, and in the correct place.

Add the top member, as shown by the dotted lines in Fig. 2, cementing front and back, as well as to the mainspar. The L.E. of 5/32 in. square substitute is then added and sanded to fit.

This wing structure is immensely strong when covered, but light.

The centre section fairing is built up by adding the extra rib pieces and spars, and covered on the *bottom only* with 1/16 in. sheet. This should be done after cracking and fixing the dihedral braces at the centre and towards the tips.

Front Assembly.

Carve the propeller blade from the block shown, and fit hinges (see diagram) before cutting blade from centre boss. Build up the spinner by planking from front to rear formers. The front of the spinner is plastic balsa.

The nose-block is of four layers of 1/16 in. sheet, cross-grained and bushed. Use a ball-bearing if possible, between the spring and the nose-block. The tensioner is made from a nail filed to a knife edge and recessed as shown on the plan. The end of the propeller shaft engaging with the tensioner is also filed to a knife edge, making a positive stop.

Covering.

Cover the fuselage with two layers cross-grained dope, and then banana oil to make a waterproof finish. The propeller is also covered with a layer of tissue, banana oiled and then well polished. Take care to have the wing and tailplane, covering with the grain from tip to tip, not forgetting to glue to the underside of the wing-ribs.

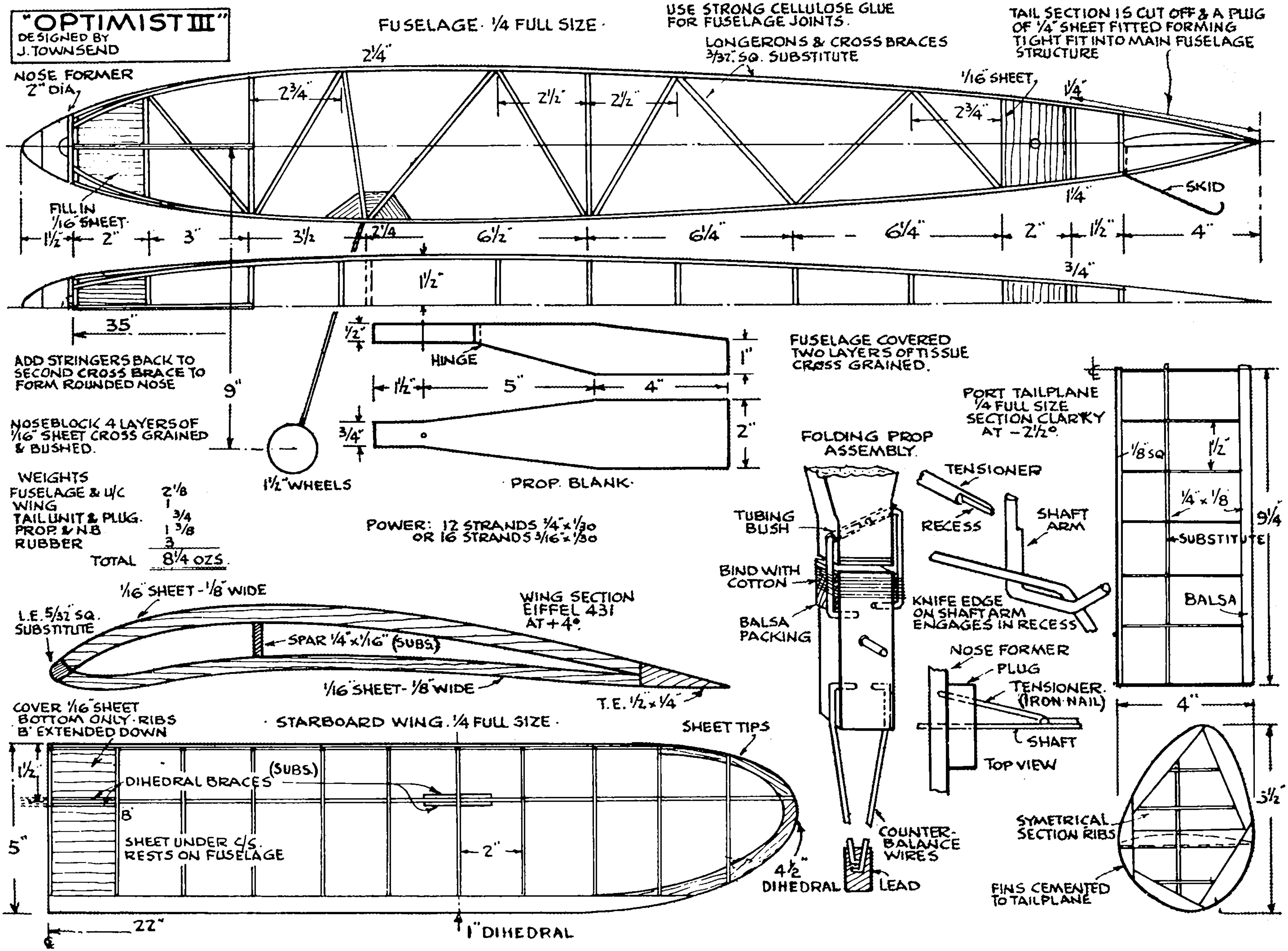
Flying.

Check up alignments and then test gliding. When as satisfactory as possible, put on gradually increasing turns until the propeller folds at sufficient height to allow the glide to be properly seen. Then readjust the glide until perfect. Then you can increase turns gradually and adjust the power flight. Circles should be 100 to 150 ft. diameter on power and glide. No "Downthrust" was required, and should not be if correctly built and adjusted.

Power is three ounces of rubber arranged in twelve strands of 1/4 in. by 1/30 in., or sixteen strands of 3/16 in. by 1/30 in. strip rubber, preferably the latter. This motor should take 1,250 turns if properly treated.

WEIGHTS (OZS.).

Component.	*Uncovered*	*Covered and Doped.*
Fuselage and undercarriage ..	1 7/8	2 1/8
Wing	7/8	1
Tail segment, rudder, tailplane, fuselage end	5/8	3/4
Prop. and nose-block	1 3/8	1 3/8
Total	4 3/4	5 1/4
Rubber		3
		8 1/4


"OPTIMIST III"
DESIGNED BY J. TOWNSEND
FUSELAGE · 1/4 FULL SIZE ·
USE STRONG CELLULOSE GLUE FOR FUSELAGE JOINTS.
LONGERONS & CROSS BRACES 3/32" SQ. SUBSTITUTE
TAIL SECTION IS CUT OFF & A PLUG OF 1/4" SHEET FITTED FORMING TIGHT FIT INTO MAIN FUSELAGE STRUCTURE
NOSE FORMER 2" DIA.
FILL IN 1/16" SHEET
1/16" SHEET
SKID
ADD STRINGERS BACK TO SECOND CROSS BRACE TO FORM ROUNDED NOSE
NOSEBLOCK 4 LAYERS OF 1/16" SHEET CROSS GRAINED & BUSHED.
1 1/2" WHEELS
HINGE
· PROP. BLANK ·
FUSELAGE COVERED TWO LAYERS OF TISSUE CROSS GRAINED.
PORT TAILPLANE 1/4 FULL SIZE SECTION CLARK Y AT -2 1/2°.
1/8" SQ
1/4" x 1/8
SUBSTITUTE
BALSA
WEIGHTS
FUSELAGE & U/C 2 1/8
WING 1
TAIL UNIT & PLUG. 3/4
PROP. & N.B. 1 3/8
RUBBER 3
TOTAL 8 1/4 OZS.
POWER: 12 STRANDS 1/4" x 1/30 OR 16 STRANDS 3/16 x 1/30
FOLDING PROP ASSEMBLY.
TUBING BUSH
BIND WITH COTTON
BALSA PACKING
TENSIONER
RECESS
SHAFT ARM
KNIFE EDGE ON SHAFT ARM ENGAGES IN RECESS
NOSE FORMER
PLUG
TENSIONER. (IRON NAIL)
SHAFT
TOP VIEW
COUNTER-BALANCE WIRES
LEAD
1/16" SHEET - 1/8" WIDE
L.E. 5/32" SQ. SUBSTITUTE
SPAR 1/4" x 1/16" (SUBS.)
WING SECTION EIFFEL 431 AT +4°.
T.E. 1/2 x 1/4"
COVER 1/16" SHEET BOTTOM ONLY. RIBS 'B' EXTENDED DOWN
· STARBOARD WING. 1/4 FULL SIZE ·
SHEET TIPS
DIHEDRAL BRACES (SUBS.)
B
SHEET UNDER C/S. RESTS ON FUSELAGE
4 1/2" DIHEDRAL
1" DIHEDRAL
SYMETRICAL SECTION RIBS
FINS CEMENTED TO TAILPLANE

THE DE HAVILLAND 80A "PUSS MOTH"

BY E · J · RIDING

Machine used for 5/- circuits by Surrey Flying Services, Ltd., Croydon Aerodrome.

A MACHINE which has contributed not a little towards the progress of civil flying all over the world, the D.H. 80, was designed and built at the companies' works at Stag Lane, Edgware, in the early part of 1930.

The prototype, G-AAFA, was fitted with the new 120 h.p. D. H. " Gipsy III " four cylinder in line, air-cooled inverted engine. Later models fitted with the " Gipsy Major " engine of 130 h.p. were known as the type 80A and differed considerably from the original design.

The prototype machine had a slab-sided ply-wood covered fuselage with rather a narrow cabin sub-divided almost in the same manner as an open machine. Two doors were fitted on the starboard side only and the wings had a pronounced dihedral.

In later production models, the fuselage was of welded steel tubular construction, and it was almost wide enough at the attachment point of the rear wing spar to seat two passengers side by side in comfort. The machine was designed as a two-three seater, the third seat being fixed to rails, enabling it to be moved up to a position alongside and slightly to the rear of the second seat. The pilot sat in front, where he had an excellent view in all directions. Dual control was installed, the pupil's seat being removed when two passengers were carried. The wings and tail surfaces were of normal wooden construction; the wings were capable of being folded about the rear spar attachment point and were braced externally by steel tubular Vee struts from the bottom longerons to a point half way along the wings. The whole machine was fabric covered, that on the fuselage being laid over light stringers in order to obviate wear and to give it a neat appearance.

Air brakes in the form of swivelling fairings on the undercarriage shock legs gave quite an appreciable amount of drag when turned through an angle of 90 degrees to the line of flight—an innovation which was embodied in later designs, such as the " Leopard Moth " and " Hornet Moth."

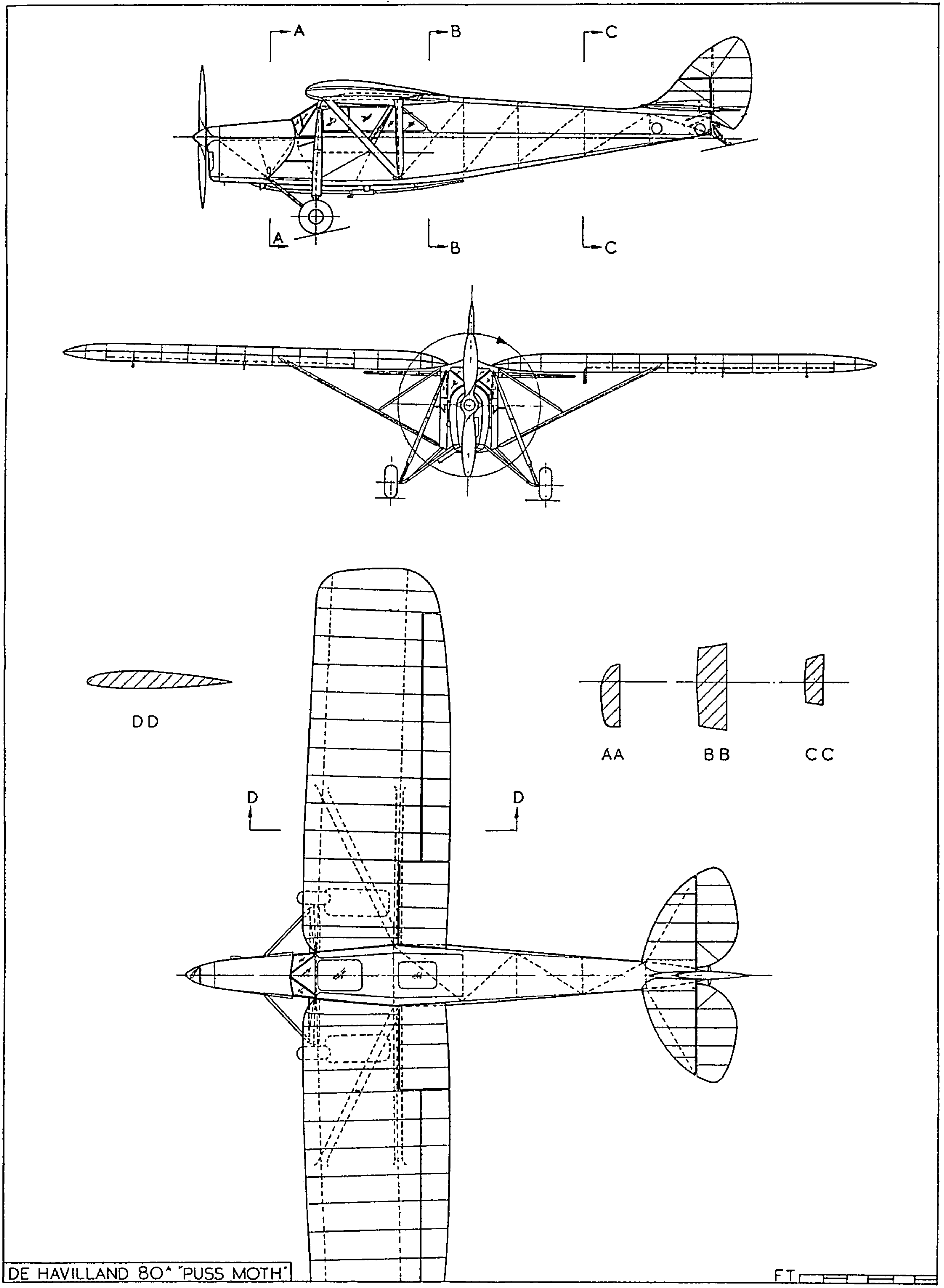
Apart from competing in the King's Cup races of 1930, 1931, 1932, 1933 and 1934, the D.H. 80 has many fine pioneer flights to its credit, notably those of J. A. Mollison and the late H. J. Hinkler. Hinkler flew from New York to London *via* the South Atlantic crossing, a distance of 10,000 miles in the autumn of 1931. In March, 1932, J. A. Mollison (now with A.T.A.), flew from Lympne near Folkestone, to Cape Town, in four days, seventeen hours. In August of the same year, Mollison flew from Portmarnock Strand to Newfoundland—an outstanding flight and incidentally the first solo flight across the Atlantic from east to west. A specially prepared " Puss Moth " equipped with a 120 h.p. " Gipsy III " engine and a fuel capacity of 162 gallons, was used on the latter flight. In addition to the two wing tanks of 20 gallons each, two extra tanks of 75 and 47 gallons were carried in the forward and rear part of the cabin respectively, the pilot occupying the space between the two tanks. At the take-off, the machine, which had been named " The Heart's Content " and registered G-ABXY, had a total loaded weight of 2,754 lbs.

About 260 " Puss Moths " were built in this country, production ceasing in favour of the " Leopard Moth " in 1933. The first D.H. 80 machines were registered G-AAFA, G-AARF, G-AATC and G-AAVA-B, and they have been used extensively in their two and three seater versions by clubs and various charter firms for a number of years. At the outbreak of war, D.H. 80A's were still being used for pleasure flights and light transport work by four companies in this country. Seven flying clubs and schools were using it for instructional purposes, and it says a lot for the materials and workmanship put into these machines when one realises that a considerable number of " Puss Moths " are still doing useful work with R.A.F. Communication Squadrons and as service craft for various contractors. About a year ago one of these machines, G-AAZV—formerly owned by the late Amy Johnson—was put at the disposal of Messrs. Handley Page, Ltd. It carried the service number X.9402 and was painted in the standard training colour scheme.

Other impressed " Puss Moths " seen recently carry the serial numbers AX.889 and HH.981.

Specification :—

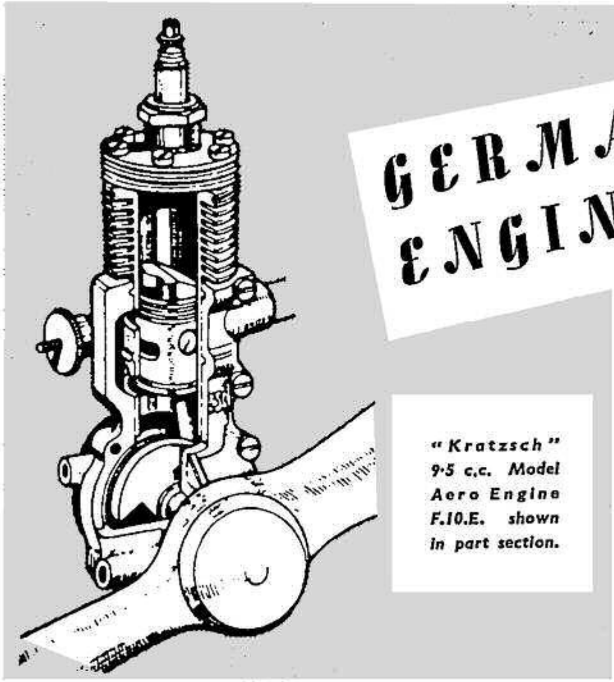
Span	.. 36 ft. 9 in.	Wing area	.. 222 sq. ft.
Length	.. 25 ft.	Weight (empty)	1,150 lbs.
Chord (max.)	6 ft.	„ loaded)	1,900 lbs.
Tailplane		Speed (max.)	130 mp.h..
Span	.. 9 ft. 6 in.	„ (cruising)	105 m.p.h.
Chord	.. 4 ft. 6 in.	„ (landing)	45 m.p.h.
		Width (folded)	.. 12 ft. 9 in.



DE HAVILLAND 80A "PUSS MOTH"

GERMAN MODEL AERO ENGINE DEVELOPMENT

BY R · H · P · NOTT



"Kratzsch" 9·5 c.c. Model Aero Engine F.10.E. shown in part section.

Fig. 1

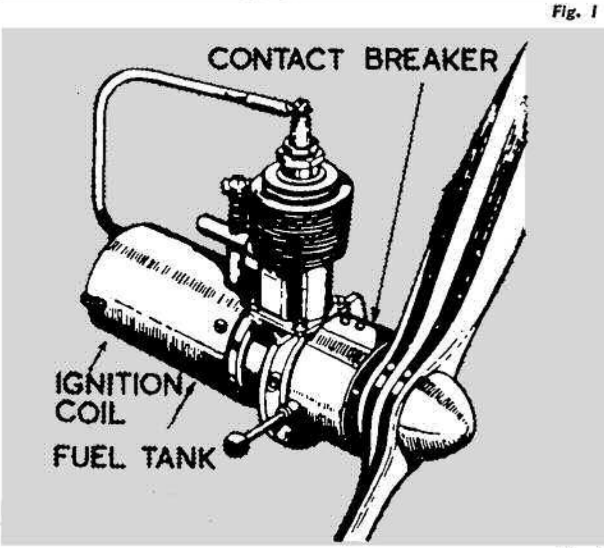


Fig. 2

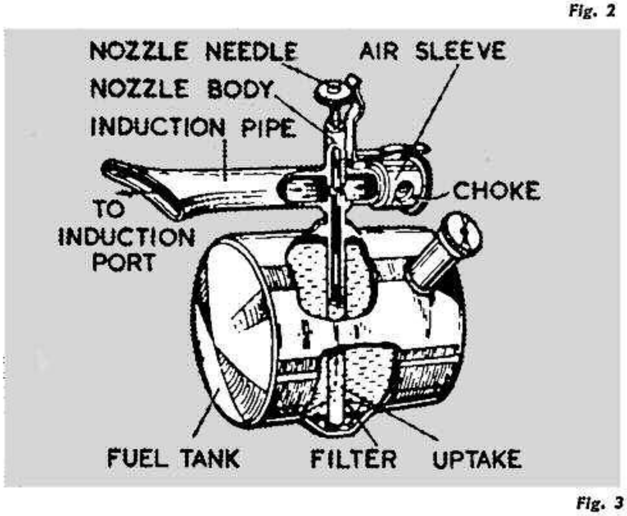


Fig. 3

DETAILS which should be of interest to enthusiasts in this country have recently become available concerning the development of model aero engines in Germany.** Subsequent to the quantity production of miniature petrol engines in America, interest in powered model flying began in Germany about the year 1934, and was favoured by the German Government as a means of promoting air-mindedness, Walter Kratzsch of Gössnitz being the first on the scene in the economic production of these miniature power units.

** "Motor Schau," Feb. 1943, page 61.

"Kratzsch" Engine Types.

The design F.10.E, shown in section in Fig. 1, found a wide market. This engine is of the three-port type with crankshaft running in two bearings and has a steel cylinder with detachable light alloy head. The vertically divided crankcase is extended up to the lowermost cylinder cooling fin and has the transfer port cast integral with it. Grooves turned in the bore of the crankcase upper section secure the cylinder barrel by engaging with corresponding circular flanges on the latter. The light alloy deflector topped and ported piston carries three cast-iron piston rings. The carburettor is fed with fuel under gravity. Leading particulars are :—

Bore	.. ..	22 mm. (0·866 in.)
Stroke	.. ..	25 mm. (0·985 in.)
Swept volume	..	9·5 c.c.
Power output	..	0·22 h.p. at 4,500 r.p.m.

Later models, "Kratmo 4" and "Kratmo 10" by the same firm, have undergone fundamental improvement in their internal and external design. A neat streamlined installation in the nose of the aircraft has been achieved by housing the fuel tank, ignition coil and condenser in a rearward extension of the crankcase. These two models, which differ only in size, each have a thin-walled steel cylinder turned from the solid with a base flange, the transfer port being attached by brazing. The light alloy piston carried two cast-iron rings in order to maintain compression over a long period of operation. For this reason, no engines made by Kratzsch are fitted with ground ringless pistons. The hollow crankshaft is of the overhung type, supported by a single bearing. A steel ring surrounds the contact breaker directly behind the airscrew and serves as a fracturing point for the latter, thus protecting the crankshaft from

Fig. 2. The new "Kratmo 4," 4 c.c. engine. The "Kratmo 10," 10 c.c. engine is similar.

Fig. 3. Section through a Suction Atomising Carburettor of present-day form.

damage in the event of a crash. The 10 mm. spark plug developed by Kratzsch, the only German mass-produced miniature spark plug to date, weighs 8 gm. (0·28 oz.). It can be stripped for cleaning. The depression caused by the piston on the induction stroke is used to lift the fuel from the tank to the needle mixing valve, where it is atomised. The progress made with this form of carburettor, which is basically similar on all three-port two-stroke model engines, is shown in Fig. 3.

Performance data :—

"*Kratmo* 4"	..	Power output 0·15 h.p. at 6,000 r.p.m. Total weight 250 gm. (0·55 lb.).
"*Kratmo* 10"	..	Power output 0·35 h.p. at 6,000 r.p.m. Total weight 450 gm. (0·99 lb.).

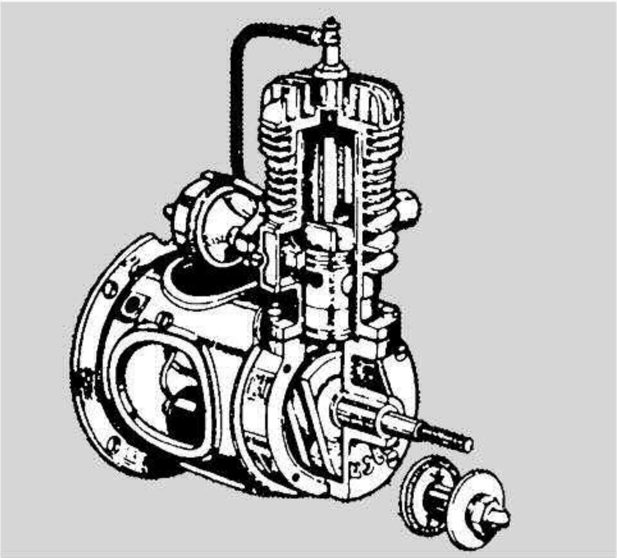


Fig. 4

The "Hausler" 10 c.c. Engine.

This engine made in Münich-Baierbrunn, and unique in several respects, appeared in the year 1937. It is shown on a light alloy mounting in part section in Fig. 4. The chrome-nickel steel crankshaft is supported in two bearings, while the ported piston and cylinder are of light alloy, the latter being fitted with a pressed-in steel liner. The detachable cylinder head is screwed on to the cylinder barrel. Caro-bronze is the material of the three-piston rings. Fig. 5 illustrates the mounting of the contact breaker timing lever away from dirt at the rear of the crankcase. The carburettor control is unusual, the needle being stationary and the nozzle, together with the fuel pipe, displaced by rotating the external threaded sleeve (Fig. 6).

Leading particulars :—

Bore	.. ..	22 mm. (0·866 in.)
Stroke	.. ..	27 mm. (1·06 in.)
Swept volume	..	10·3 c.c.
Power output	..	0·27 h.p. at 4,500 r.p.m.
Weight	.. ..	500 gm. (1·1 lb.).

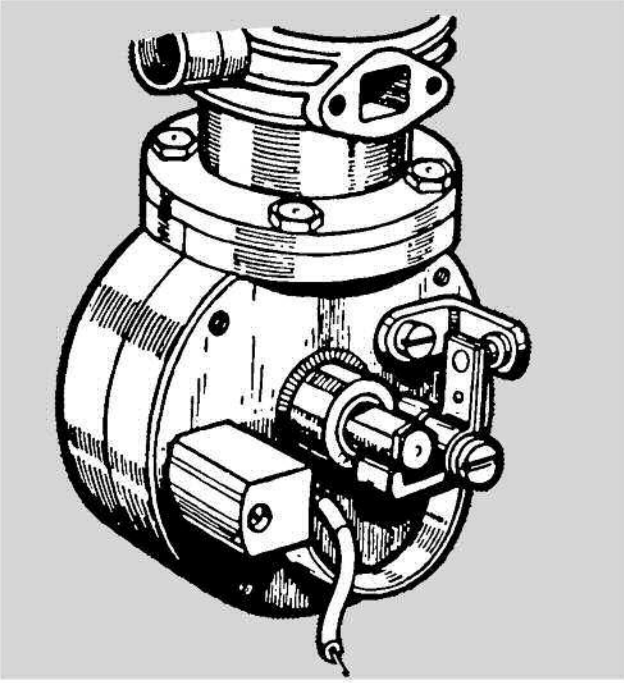


Fig. 5

The "Argus" Engine.

Also about 1937 the Argus Co., Berlin, brought out a more powerful engine for flying models of up to 3 metres (9·8 ft.) wing span. As will be seen from Fig. 7, the piston has a flat top, while the exhaust port is situated at the rear of the cylinder and the induction pipe diametrically opposite, facing forward in the line of flight. The two transfer ports are cast in the light alloy crankcase, which extends up to the lowermost cylinder cooling fin. The steel cylinder is turned from the solid and houses a light alloy piston with three rings. The lower edge of the piston controls the induction port. A calibrated nozzle without needle control projects into the port, feeding the engine with fuel. The procedure in starting is to spray a little fuel through the open induction port into the crankcase. Then the engine, after initial four-stroke running on rich mixture, changes over to a pure two-stroke. An overhung crankshaft with single bearing is featured. "Floating" suspension of the

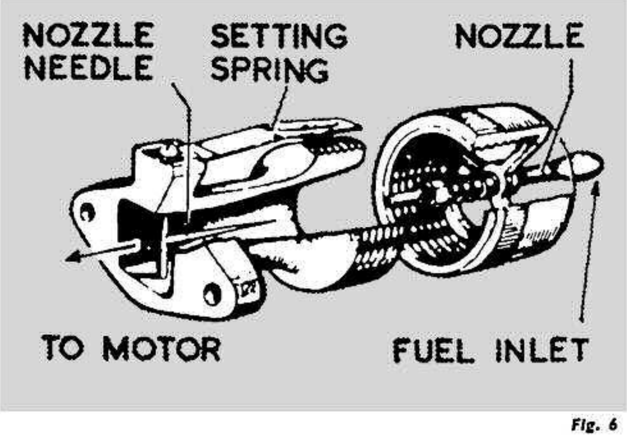


Fig. 6

Fig. 4. The "Hausler" 10 c.c. engine.

Fig. 5. Arrangement of the Control Breaker away from dirt on the rear of the "Hausler" engine.

Fig. 6. Section through the "Hausler" Carburettor with fixed nozzle needle.

engine is achieved by means of three flexible steel rods attached to the bulkhead. The oil content of the fuel mixture, which normally approximates to a 1 : 10 ratio in model aero engines, is here increased to 1 : 7.

Performance data :—

Power output ..	0·75 h.p. at 3,800 r.p.m.
	1·0 h.p. at 5,000 r.p.m.
	1·5 h.p. at 7,600 r.p.m.
Power plant weight ..	1,000 gm. (2·2 lb.).

The "Ortus" 6 c.c. Engine.

The Ortus engine of 6 c.c. swept volume, developed by A. Thusius and produced by the firm of Oswald Ried, is unusual in several respects. Timed induction of the fuel takes place through the crankshaft arranged as a rotary valve (Fig. 10). Hence there are only two ports, transfer and exhaust, in the light alloy cylinder and pressed-in steel liner. The atomizing nozzle with needle control is located at the front of the engine below the crankshaft bearing. The ringless steel piston with light-weight deflector is shown in Fig. 11, as is also the considerable cross-section attained at the transfer port without weakening the cylinder wall. Due to the latitude in timing available with the rotary valve the Ortus engine exhibits a good cylinder filling. The Elektron crankcase is cast cleanly and without a joint in steel moulds. The contact breaker is operated through a short push rod.

Leading particulars :—

Bore	19 mm. (0·750 in.)
Stroke	20 mm. (0·787 in.)
Swept volume ..	5·8 c.c.
Compression ratio	5 : 1
Power output ..	0·18 h.p. at 4,500 r.p.m.
Fuel consumption	10 c.c. (0·018 pints) per hr.
Weight	220 gm. (0·48 lb.)

The "Eisfeld" Engine Series.

The Eisfeld Co., Gera, has produced engines of 3·2, 7·5, 15 and 29 c.c. swept volume. These are of the three port standard type with singly supported, hardened and ground crankshaft, light alloy crankcase, steel cylinder with shrunk-on aluminium cooling fin sleeve, and ringless steel piston. The ignition timing is variable. The clean appearance of these engines is recognizable in Fig. 12, which shows the B. 11 7·5 c.c. engine. The Eisfeld Co. has also been the first in Germany to attempt the development of a 15 c.c. Diesel engine; but apparently the experiment was abandoned only due to the increased weight and high cost of manufacture. Owing to the present shortage of ignition equipment, such as batteries, ignition coils and condensers, the subject of Diesel model aero engines has again come to the fore.

The "Otto-Werke" 9 c.c. Engine.

This Münich firm, which produced a series of light motor bicycles after the last war, has developed for quantity production the 9 c.c. aero engine shown in Fig. 13. It is the second production engine to have a crankshaft rotary valve. The cylinder barrel is of light

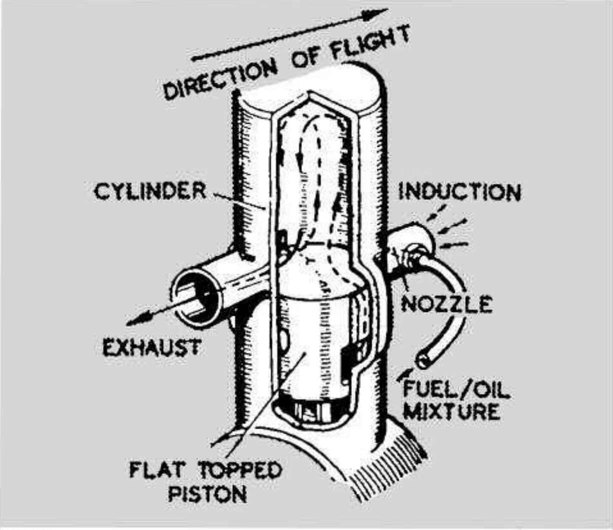


Fig. 7

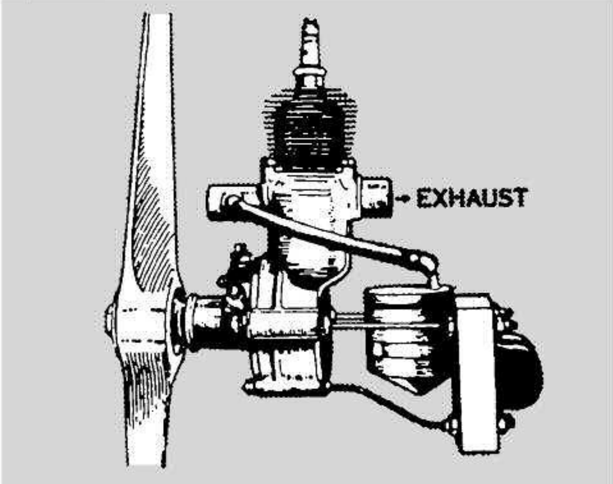


Fig. 8

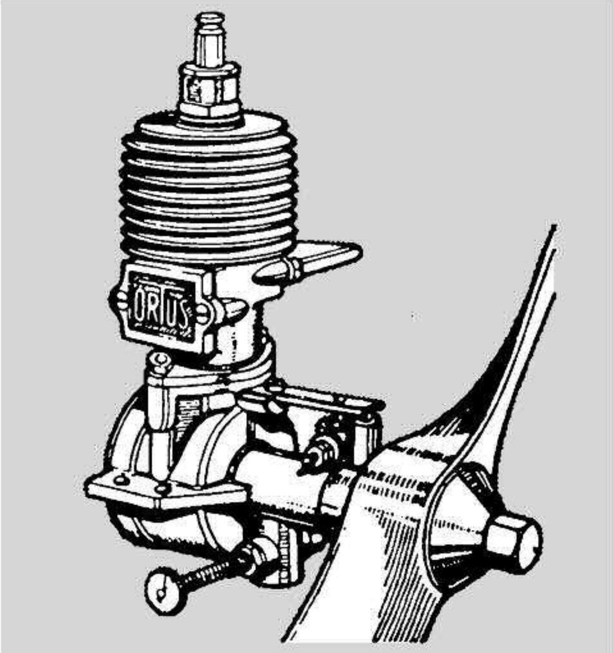


Fig. 9

Fig. 7. Schematic diagram of Mixture Flow in the Cylinder of the 1 h.p. "Argus" engine with flat-topped piston.

Fig. 8. The 1 h.p. "Argus" model Aero Engine.

Fig. 9. The "Ortus" 6 c.c. Engine with Crankshaft Rotary Valve.

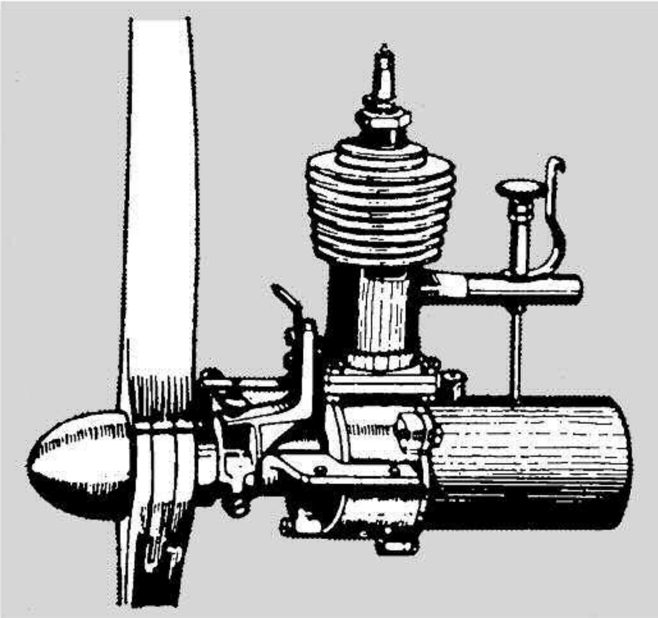


Fig. 12

alloy with pressed-in cast-iron liner, and houses a fine grained cast-iron piston without rings. Light alloy is utilised also for the crankcase and cylinder head. The head and cylinder are attached to the crankcase by two tie bolts with cap nuts. The connecting rod is a die-stamping and the crankshaft is of the overhung type, hardened and ground. The complete power unit is well streamlined, including the contact breaker, which is totally enclosed above the crankshaft at the front of the engine.

Bore ..	.. 22 mm. (0·866 in.)
Stroke ..	.. 24 mm. (0·945 in.)
Swept volume	.. 9 c.c.
Power output	.. 0·2 h.p. at 4,000 r.p.m.
Total weight	.. 500 gm. (1·1 lb.)

Among other quantity productions are the 9 c.c.

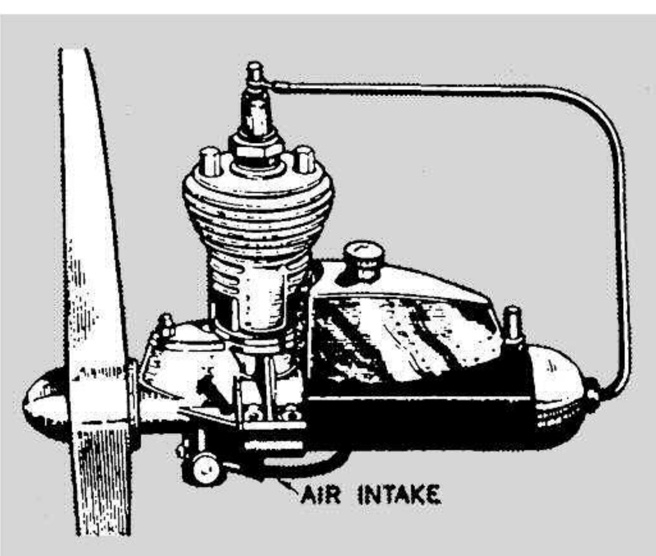


Fig. 13

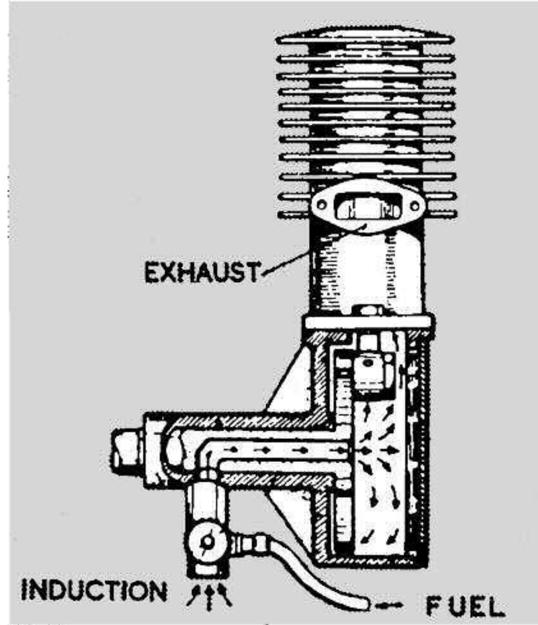


Fig. 10

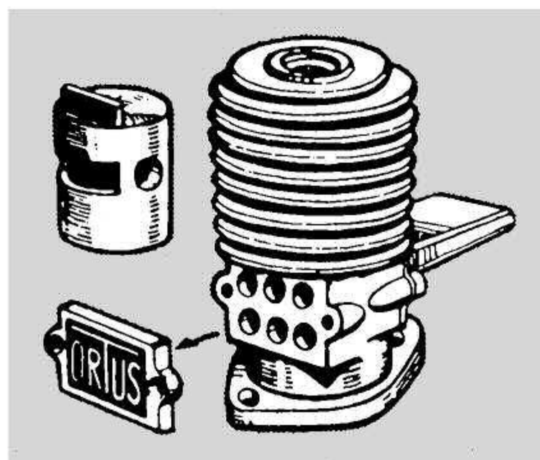


Fig. 11

engine of Thaler, Berlin, which develops 0·25 h.p. at 6,000 r.p.m., and a three-port two-stroke by Frank (Thür).

Successful experiments have been carried out by B. H. Kratzsch on the running of Elektron pistons in cylinders of a special Nüral alloy (aluminium-silicon-copper). Many hours of endurance running have proved that wear of the piston skirt is no greater than in the case of cylinders with steel or cast-iron bearing surfaces.

Fig. 10. *Diagramatic representation of the Induction Process in the "Ortus" Engine.*

Fig. 11. *The light alloy Cylinder of the "Ortus" Engine with pressed-in steel liner and detachable transfer port cover. Note the ported piston.*

Fig. 12. *The "Elsfeld" 7·5 c.c. Engine.*

Fig. 13. *"Otto-Werke" 9 c.c. Rotary Valve Engine.*

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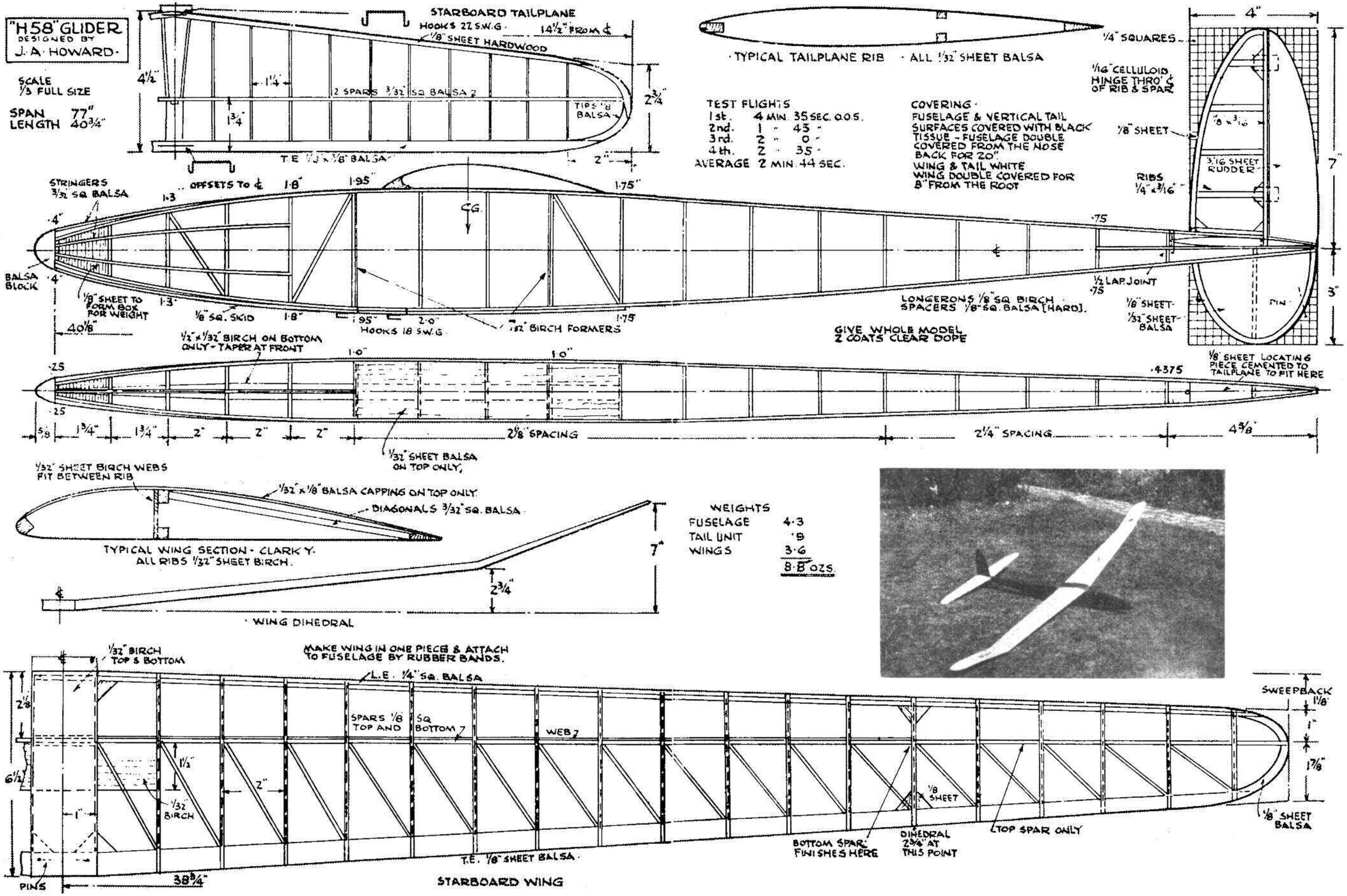

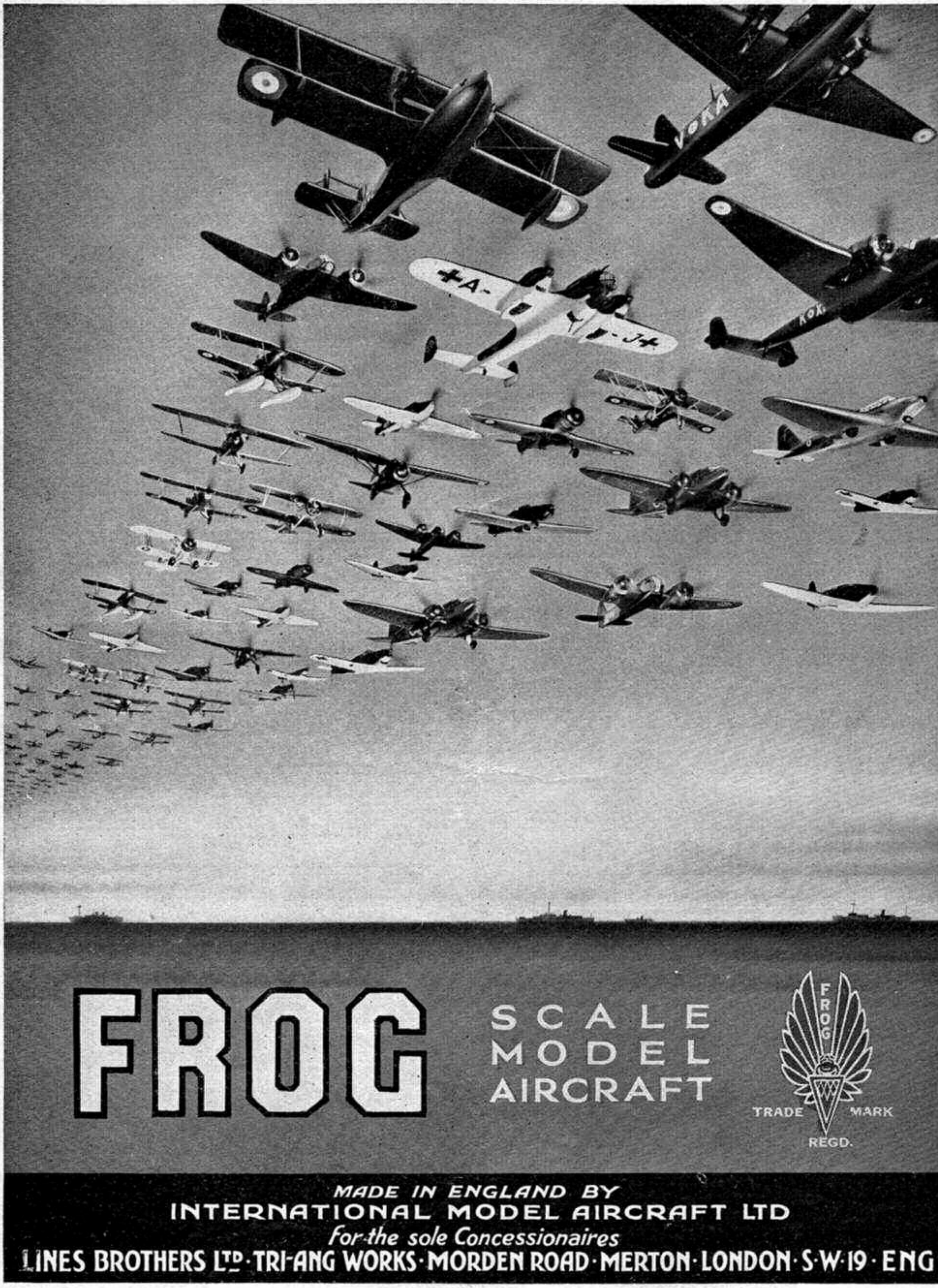
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TRIMMING FOR INDOOR FLIGHT

BY J · H · M · SMITH

BEFORE starting to trim our model, let us consider its various points and their functions.

Airscrew.

Supplies thrust by drawing in air from ahead and driving it aft in the form of a spiral slip stream rotating in the same direction as the airscrew. Thus the aeroplane is pulled through the air from the nose, and, in addition, those parts and surfaces in the slip stream will tend to be rotated in roll in the same direction as the rotation of the airscrew.

Another most important, but often overlooked, airscrew characteristic is the gyroscopic effect while the aeroplane is accelerating directionally. This is known as "precession," and its effect is to cause the plane of rotation of the airscrew, or, for that matter, any rotating mass, to turn on an axis at right angles to the axis of any turn applied by an outside source. It is due to the fact that elements of the revolving mass getting nearer (because the airscrew is revolving) to the axis of the applied turn tend to speed up, and those getting further away to slow down. This is best illustrated by sitting on a freely revolving chair with arms extended, and a dumb-bell in each hand. Get someone to start you slowly spinning, and then bring your hands to your sides and you will at once "rev. up," and on again extending your arms you will slow down, e.g., with arms extended the dumb-bells are travelling at, say, 5 m.p.h. On bringing your arms to your sides inertia tends to keep the dumb-bells still travelling at 5 m.p.h., and as the radius of their path of travel is now less, the revs. must go up.

The best example of gyroscopic precession is a child's hoop. When you wish to deflect a bowling hoop from a straight course, you do not push the front round as in a motor car, nor the back round as in a boat or aeroplane—you push the *top* over, or, in other words, you deflect the spinning hoop at right angles to the change of direction desired.

Therefore, when trying to decide which way precession will affect any manœuvre of your aeroplane, just think of the airscrew as a child's hoop and you will get the answer at once.

In practice, this means that with the normal "hand" model airscrew (revolving clockwise when viewed from the rear) :—

If the nose is pitched up precession yaws it to the right;

If the nose is pitched down precession yaws it to the left;

If the nose is yawed right precession pitches it down;

If the nose is yawed left precession pitches it up.

Another, rather loose, way of thinking of it is that if the nose of the aeroplane is deflected from straight and level flight, it tends to acquire a further deflection at right angles to the first, and in the same direction as the motion of the imaginary airscrew tip towards which the first deflection is made.

Rubber Motor.

Stores the energy wound into it, and delivers it in the form of a torque to the airscrew. Owing to the natural law of action and reaction, there is an equal torque trying to rotate the aeroplane in roll in the opposite direction to the airscrew rotation and against the rolling tendency caused by spiral slip stream. Only the greater air-resistance to rotation of the wings as compared to the airscrew prevents the wing or airscrew revolving about each other in opposite directions.

The best illustration of torque reaction is to hang a rotating armature-type electric razor by its flex from a lamp socket and switch on the juice. Immediately the razor spins in the reverse direction to the rotation of the armature.

Wings and Tail.

Supply the lift and contribute to the stability. For best efficiency, obviously the tail must not be a passenger. Therefore, as well as being a stabiliser, it must contribute to the lift.

The wing should be of elliptical plan, ample centre chord, and should have tapered spars giving uniform flexibility.

The tail plane should be a miniature edition of the wing, and of not less than one-third of the wing's area.

The fin should be small (not more than one-quarter the area of the tail plane for a normally designed model).

Always bear in mind that stability in yaw and lateral stability are very closely related.

Lateral stability is achieved always and only by side-slip or skid caused (in the case of a dropped wing) by gravity; (in the case of a flat turn) by inertia.

The "projected horizontal area" idea is soon blown out by pivoting (in roll) a well dihedralled wing at its C.G. (and so preventing slip and eliminating gravity) in an air stream. It then has no lateral stability at all, and will remain wherever set.

Therefore, bearing in mind the side-slip necessary to correct every lateral displacement, too much stability in yaw may result in a dropping wing to cause a spiral dive in ever decreasing circles until finally, etc.! This is because too quick a yaw into the slip caused by a dropping wing may result in sufficient excess lift from the outer or higher wing (by virtue of the gain in speed over the inner wing tip) to overcome or seriously delay the self-righting tendency caused by the effect of side-slip on the dihedral setting of the wings. Also the yaw, if quick enough, tends to correct the side-slip which caused it before the side-slip can restore lateral level by increased angle of attack to the lower wing.

Let us now consider the layout of our Super mike. It is of conventional shape—i.e., underslung tractor screw. Dihedral wing parasol mounted above motor stick. Dihedral lifting tail plane. Fin below tail-plane. Why this shape? Because each feature has a job to do :—

(1) Underslung airscrew to prevent rubber fouling stick;

(2) Parasol wing to keep it sufficiently clear of slip-stream to allow at least centre portion of slip stream to reach the tail reasonably undisturbed. Also to promote a nose up couple from high centre of drag and low centre of thrust in order to ensure that the tail must lift to compensate this;

(3) Lifting tail to compensate nose up couple (two above) and to provide longitudinal stability in the normal manner by correcting for the centre of pressure travel of the wings.

Dihedral tail-plane to ensure that, as a lifting tail, it always *will* lift. During small radius turns *against* the yawing tendency resulting from slip resulting from roll

caused by torque reaction, there is considerable skid and the turn is somewhat flat. If the tail-plane on its own possesses inherent lateral stability, and is also inevitably somewhat flexible, the tail tip on the outside of the turn is apt to " dig in " and momentarily acquire a negative lift, while all the time a steady positive lift is required for equilibrium, as the tail has to balance the nose up couple caused by high drag centre and low thrust line.

Sudden attempts to loop in the middle of steady turns are usually attributable to this cause. A dihedral tail plane will prevent this occurrence by providing inherent lateral stability to the tail plane and so allowing light and flexible construction and a constant positive angle of attack. Fin below tail to ensure that the spiral slip stream (carefully left undisturbed by the wing) will tend to give the fin an angle of attack such as to induce a yaw in the direction against the yaw resulting eventually from torque reaction. If the fin is placed above the tail plane (or slip stream centre) the angle of attack is on the other side and a yawing tendency in the same direction as the yaw resulting from torque action results.

Now for practical trimming !

Assemble model complete with air screw and rubber, and ensure that the incidence of the wing and tail are about the same. Adjust the wing position so that the C.G. is at about 50 per cent. of the wing chord from the leading edge. Set the tail boom so that the wing and tail are in the same place. Do *not* offset the fin.

Try a few glides and " low power " descents and set the wing as far forward and apply as much lift (by incidence) to the tail as longitudinal stability will permit.

Note.—It is quite possible to have stability within a pitch range of, say, 30 degrees up and down, beyond which the model will stall one way and bunt the other, and by careful trimming these limits will not be exceeded in flight.

Now test with ⅛ to ½ full turns and the model should climb steadily in a left-hand turn and probably stall. If necessary, move the wing forward till it just stalls and probably loses height in a tail slide with the air screw (slowed considerably) still pulling and keeping the nose up.

We now prevent this " half-power " stall by making the model circle to the right, so that the airscrew's gyroscopic precession (which was nose *up* in a turn *with* the yaw resulting from torque reaction), is now a nose *down* couple in a right-hand turn.

To cause the right-hand turn don't fiddle about with the fin, but set the tail boom (which for a 30 in. span model should be a circular section piece of straw) so that the tail plane is out of line with the main plane—left tip of tail below and right tip of tail above the plane of the main wing. With this setting the tail's lift will be partially offset and so will tend to " heave " the tail to the left, i.e., to promote a right-hand turn. This is more satisfactory than an offset fin, and also provides an easy method of setting any desired radius simply by varying the " twist."

If a double bearing is used for the airscrew shaft, a little side thrust may be used, but should not be overdone, at any rate, in a small room, because we want the radius of turn to remain constant throughout the various power conditions of the whole flight, including the final glide.

Don't use down thrust because this only upsets the incidences which we have proved to give the best angle of attack for the middle and final parts of the flight.

We can cope with full power in one, or a combination of the two ways :—

(1) A flexible constant speed airscrew with advanced leading edge which, under full power, flexes into a course and inefficient pitch, so keeping R.P.M. and thrust low.

(2) Allowing the model to fly stalled for the first part of the flight, the powerful thrust from the nose preventing loss of height.

I prefer a combination of both ways.

If lengths of cobweb are attached to the wing tips, quite good vortices are demonstrated during this absurd stalled flight. These vortices are very feeble though, and the thinnest cotton will not show them.

If this model is trimmed to fly in circles in the same direction as the yaw resulting from torque reaction there is usually a slight loss of efficiency for several reasons :—

(1) The *nose* up couple caused by the airscrew's gyroscopic précession when turning this way can not usually be counteracted by more tail lift as longitudinal stability may forbid this. Therefore, the wing must go further back, and as a result, there may be a dive or, at any rate, an inefficiently fast cruise and steep glide when the R.P.M. get slower after the first burst of power ; or if the radius of turns should increase, i.e., if the nose *up* couple due to the airscrew's precession should be reduced ;

(2) While the aircraft is *descending* in left-hand turns, it is also rolling to the left, and as this roll is opposed to the direction of the rotating slip stream, there will be a greater difference in angle of attack between left and right wing panels than when turning the other way, when roll and slip stream are in the same direction. Thus, once the aeroplane starts descending, the radius of turn may tend to increase and result in collision with the wall ;

(3) During the first part of the flight, torque reaction is greatest and the aeroplane is doing a climbing turn. Now, in a climbing turn to the left, the aeroplane is rolling to the right. Therefore, we now have torque reaction, greater speed of right wing tip and greater angle of attack of right wing tip, *all* depressing the left wing tip, and so an ever increasing angle of bank may result. In a climbing turn against the yaw resulting from torque reaction (a right-hand climbing turn), we have the greater speed and greater angle of attack of the *left* wing tip tending to counteract the " left wing low " torque reaction.

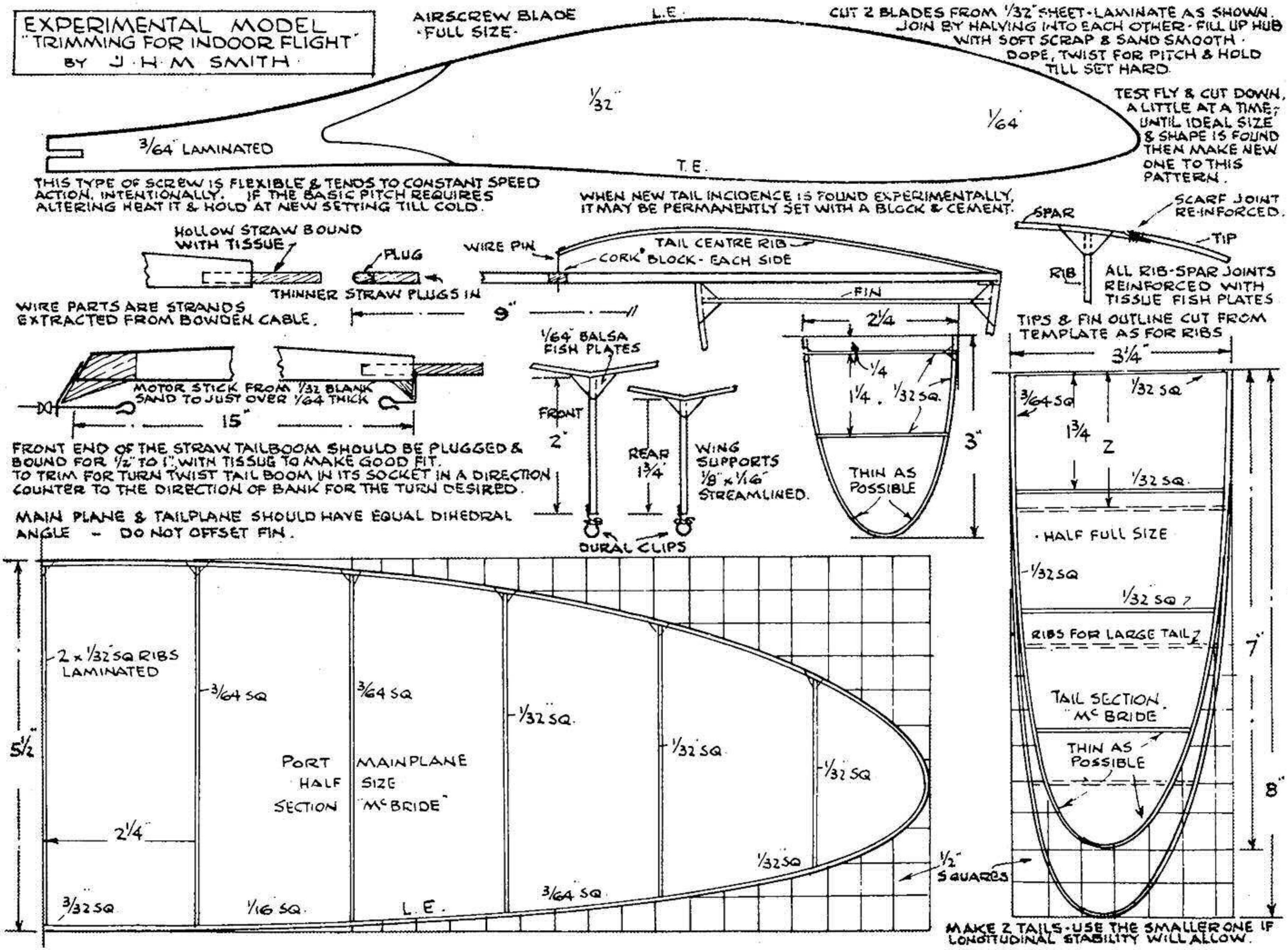
For those reasons the right-hand turn usually produces a much more constant radius of turn and constant general trim than when turning the other way.

To sum up, make the model as rigid as weight will allow, so that adjustments stay put.

Visualise all the various forces, their relative " strengths " and effects on various manœuvres, and balance one against the other as required to achieve the results you need with the least offsetting of " drag makers."

There is nothing impossible, or even difficult, in trimming for an angle of attack of about 30 degrees under full power, followed by angle of attack for lift best drag ratio for climb and cruise followed by angle of attack (now increasing again) for lowest sinking speed.

It is the old " full scale " problem of angle of attack for best range and angle of attack for longest endurance, and a properly trimmed model inherently sets itself right by virtue of the change in forward speed and thrust during its flight.


EXPERIMENTAL MODEL
"TRIMMING FOR INDOOR FLIGHT"
BY J·H·M SMITH
AIRSCREW BLADE ·FULL SIZE·
L.E.
T.E.
1/32"
1/64"
3/64" LAMINATED
CUT 2 BLADES FROM 1/32" SHEET · LAMINATE AS SHOWN. JOIN BY HALVING INTO EACH OTHER · FILL UP HUB WITH SOFT SCRAP & SAND SMOOTH · DOPE, TWIST FOR PITCH & HOLD TILL SET HARD.
TEST FLY & CUT DOWN, A LITTLE AT A TIME, UNTIL IDEAL SIZE & SHAPE IS FOUND THEN MAKE NEW ONE TO THIS PATTERN.
THIS TYPE OF SCREW IS FLEXIBLE & TENDS TO CONSTANT SPEED ACTION, INTENTIONALLY. IF THE BASIC PITCH REQUIRES ALTERING HEAT IT & HOLD AT NEW SETTING TILL COLD.
WHEN NEW TAIL INCIDENCE IS FOUND EXPERIMENTALLY, IT MAY BE PERMANENTLY SET WITH A BLOCK & CEMENT.
SPAR
SCARF JOINT REINFORCED.
TIP
RIB
ALL RIB-SPAR JOINTS REINFORCED WITH TISSUE FISH PLATES
TIPS & FIN OUTLINE CUT FROM TEMPLATE AS FOR RIBS
HOLLOW STRAW BOUND WITH TISSUE
PLUG
THINNER STRAW PLUGS IN
WIRE PIN
TAIL CENTRE RIB
CORK BLOCK - EACH SIDE
FIN
9"
WIRE PARTS ARE STRANDS EXTRACTED FROM BOWDEN CABLE.
MOTOR STICK FROM 1/32 BLANK SAND TO JUST OVER 1/64 THICK
15"
1/64" BALSA FISH PLATES
FRONT
2"
REAR
1 3/4"
WING SUPPORTS 1/8" x 1/16" STREAMLINED.
DURAL CLIPS
2 1/4
1/4
1 1/4
1/32 SQ.
3"
THIN AS POSSIBLE
FRONT END OF THE STRAW TAILBOOM SHOULD BE PLUGGED & BOUND FOR 1/2" TO 1", WITH TISSUE TO MAKE GOOD FIT.
TO TRIM FOR TURN TWIST TAIL BOOM IN ITS SOCKET IN A DIRECTION COUNTER TO THE DIRECTION OF BANK FOR THE TURN DESIRED.
MAIN PLANE & TAILPLANE SHOULD HAVE EQUAL DIHEDRAL ANGLE - DO NOT OFFSET FIN.
3 1/4"
3/64 SQ
1/32 SQ
1 3/4
Z
1/32 SQ.
· HALF FULL SIZE
1/32 SQ
1/32 SQ ?
RIBS FOR LARGE TAIL Z
7"
TAIL SECTION "Mc BRIDE"
THIN AS POSSIBLE
8"
5 1/2"
2 x 1/32" SQ RIBS LAMINATED
3/64 SQ
3/64 SQ
1/32 SQ.
1/32 SQ
1/32 SQ
PORT MAINPLANE
HALF SIZE
SECTION "Mc BRIDE"
2 1/4
1/32 SQ
1/2" SQUARES
3/32 SQ
1/16 SQ.
L. E.
3/64 SQ.
MAKE Z TAILS - USE THE SMALLER ONE IF LONGITUDINAL STABILITY WILL ALLOW.

JET PROPULSION FOR MODEL AIRCRAFT

This article was written prior to the release of "Jet Propulsion" in the Daily Press and is therefore of special interest. The author is unfortunately unknown; perhaps he will communicate with me in due course. His suggestions will undoubtedly raise many comments and a great deal of discussion, if I know my readers correctly. Here is a subject you can really "get your teeth into" via Readers' Letters column.—Ed.

RECENT interest in the application of jet propulsion to full-size aircraft, and discussion of the numerous designs already patented, led me to ponder on jet propulsion for models. The many advantages of this form of motion do not apply in their entirety to models, but the possibility of improved stability, and the elimination of the airscrew, seemed a stimulus to the idea.

The following is a description of two designs of different form, but both employing the basic principles of full-size design. For the benefit of those readers not acquainted with these principles, the main idea is to propel a stream of gas (largely air) to the rear of the aircraft, movement of the aircraft then being obtained by the reaction. To produce this propellant effect, air is compressed by a blower, and then expanded from a nozzle at the rear. To provide power for the compressor, either a gas turbine or an internal combustion engine can be used, and many designs incorporating one or both of these prime movers have been evolved. The air must be brought in to the interior of the aircraft by scoops, and some provision for cooling adopted in all systems of jet propulsion. In my two "model" units, both principles are used to drive the blower, in order that existing "petroleers" may combine their units into a jet propulsion system. Throughout, the question of materials has been the background for the design, since in the full size units, the stresses and temperatures encountered put a severe strain on the metals used. Simplicity is essential in a model "J.P." unit, but any suggestions as to further simplification would be welcomed, the two designs submitted are only initial tentative plans.

UNIT I.

This unit incorporates a twin-cylinder engine to drive the compressor, with two propulsion nozzles for the gas expansion. The accompanying sketch shows only main details, as follows. The air stream is led into a radial cowling which embraces the cylinder heads of the engine and carries one of the bearings, only the plugs of the engine and engine controls will protrude from this cowling. The exhaust gas discharges into the air stream on the inlet side of the blower, which is driven by direct coupling to the engine. The blower would be ideal in a magnesium alloy, machined carefully from a block or casting. Surrounding the blower on the outlet side is a collecting ring which leads into two propulsion nozzles. Into each nozzle projects a fuel pipe with a fixed silica nozzle, the nozzle being surrounded again by a fused silica tube to decrease the radiation falling on the metal walls of the propulsion nozzle, and to act as a combustion chamber. The combustion tube is held in position by a spacing ring, so that the air flow splits between the inside and outside of the combustion tube. The final expansion of gas to the rear is achieved by a convergent tube, divergence being provided at the point where combustion takes place. The bearings may be of the porous bronze type, to eliminate oil-feed, and thin sheet aluminium would serve excellently for the outer casing. The convergent tubes in the propulsion nozzles would preferably be steel or copper, in order to resist the heat of the expanding gases.

This unit could best be incorporated either in a twin-motor design or in a model of the "flying-wing" type. For ease of operation, a suggested fuel is methylated spirits, though most hydrocarbon fuels should give equally good results. High calorific value fuels would probably lead to excessive heating, and lagging of the nozzle tube in the vicinity of the combustion chamber would perhaps be necessary.

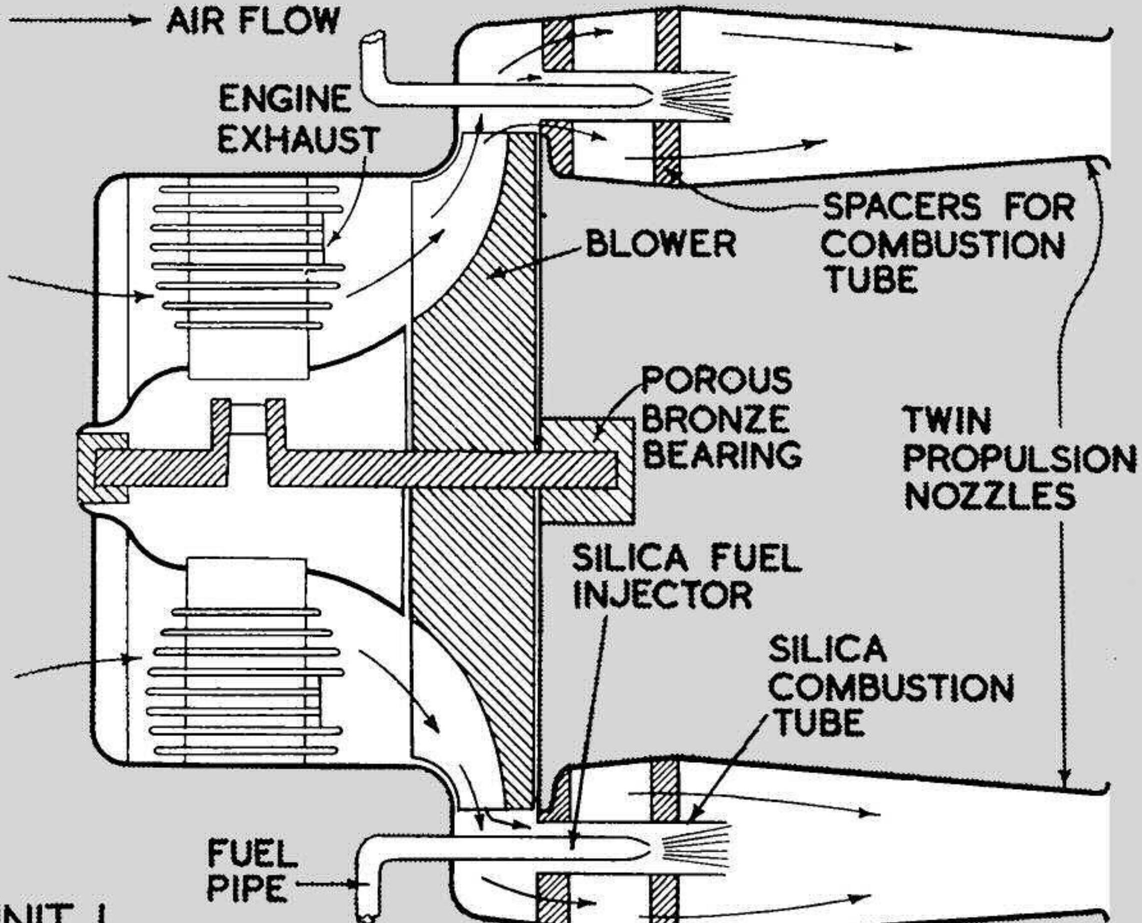
It should be emphasised again, that these plans are only tentative suggestions, and after the conclusion of experiments with fuels, nozzles, and varied types of blower, I hope to give more precise information on probable performance.

UNIT II.

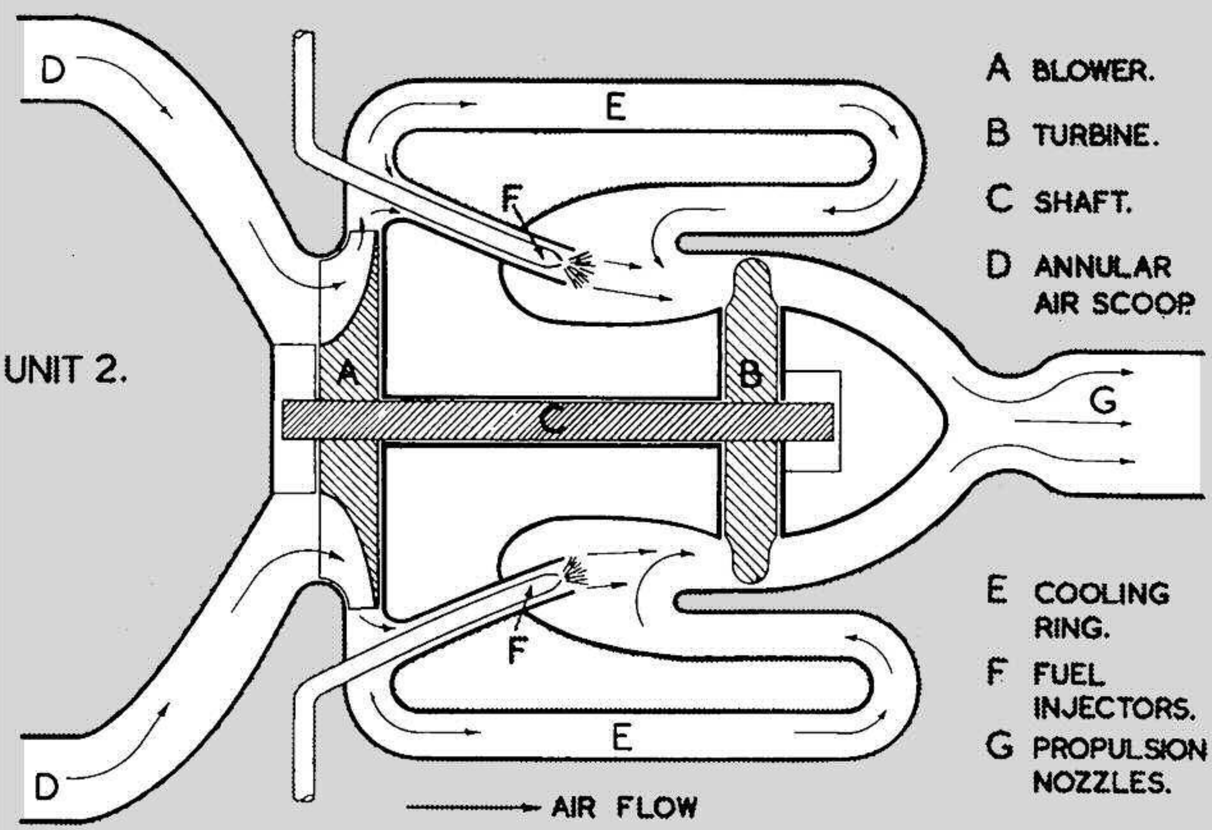
The design employs a gas turbine in place of the petrol engine and would therefore run at higher temperatures, necessitating adequate cooling of the combustion chamber and turbine casing. The advantage of this design is its compact form, and the fact that it fits into the conventional arrangement of a fuselage, though variations in the air collecting scoop are possible for application to twin-motor or "flying-wing" designs.

In this unit, air enters by means of an annular scoop into the blower, which discharges it into a second annular collecting ring. The main air flow proceeds round the outer casing, doubles back, and enters the combustion chamber, thus providing cooling of turbine casing and combustion chamber. The fuel pipes project through the blower casing and enter tubes which also collect some air from the blower. Silica nozzles and combustion tubes are again incorporated in the combustion chamber, the hot gases entering the turbine casing immediately. From the turbine the gases are collected from an annular ring into the propulsion nozzle, which converges just beyond the bearing, and then diverges slowly to the gas exit. The blower-end bearing is supported by the fuselage which in turn is connected by spacers to the unit, through the air collecting scoop. The turbine-end bearing is housed in a streamlined "pip" connected to the propulsion nozzle by spacing rings. Except for the combustion chamber, shaft, and turbine rotor, light alloys are again possible for the main construction, with heat-resisting steel for the turbine rotor and combustion chamber. Owing to the small size and high speed of the rotor, this would be machined from a solid piece, instead of having blades separately made and fitted to a disc. The number of fuel nozzles is variable, but should provide perfect combustion without turbulent flow into the turbine casing.

In conclusion, I hope these ideas will provide discussion and constructive criticism, and that others may be led to attempt such propulsion units for flying models. Considerable experimentation remains to be done, but I, for my part, am satisfied that the application of jet propulsion is very possible.


AIR FLOW
ENGINE EXHAUST
SPACERS FOR COMBUSTION TUBE
BLOWER
POROUS BRONZE BEARING
TWIN PROPULSION NOZZLES
SILICA FUEL INJECTOR
SILICA COMBUSTION TUBE
FUEL PIPE

UNIT 1.


A BLOWER.
B TURBINE.
C SHAFT.
D ANNULAR AIR SCOOP.
E COOLING RING.
F FUEL INJECTORS.
G PROPULSION NOZZLES.
AIR FLOW

UNIT 2.

"MY ENGINE"

SOME NOTES ON DR. J. F. P. FORSTER'S CRITICISM

BY LAWRENCE · H · SPAREY

LIKE Dr. Forster, I have waited in vain for the flood of criticism which, I expected, would inundate, submerge, and finally wash away all traces of my engine design, and it was, therefore, with great pleasure that I read the remarks of so redoubtable a critic in the November issue of the AERO MODELLER.

As readers and Dr. Forster are now aware, many points of his criticism have been cleared up in my final design. These include such items as the design and position of the contact breaker, the layout of the carburetter, and the final decision to fit a lapped, cast-iron piston, without rings. As I had made all these alterations before I was aware that Dr. Forster had even looked at my design, I am particularly grateful for this endorsement of my ideas.

Taking the Doctor's criticism as a whole, it is particularly kind to me, in so far as it does, in general, agree with my principles. It is in details that his main objections lie. One of these objections is, I think, unfounded, and one, at least, is due, apparently, to my drawing not being sufficiently clear.

Regarding the point that my drawing shows the engine in an *upright* position, this seems to call for no comment, except to say that I have always designed my engines this way up, and it would be most awkward for me to do my original drawings inverted. However, the manner in which the engines are finally mounted in the plane seems not to bear directly on the matter under discussion.

I should like first to mention the one unfounded criticism in an otherwise very helpful article. This deals with the detachable cylinder head. I would assure Dr. Forster that there is very much more in it than just easy facilities for inspection and cleaning, and that, far from being "debunked," the detachable head is almost an essential for the home constructor of small petrol engines. Let me explain. The precision fitting of small cast-iron pistons to a lap fit within the cylinder bore calls for the separate lapping of both the piston and cylinder. By this I mean that the piston and bore are not lapped together, but that the bore is first lapped on a copper lap with lapping paste and, finally, metal polish. The piston is then lapped in a female lap, in a similar manner, until it is a precision fit within the bore. Now, the manner in which the cylinder is lapped is by means of a length of copper, turned to a sliding fit in the rough bore, and having longitudinal grooves cut into it, to hold the lapping compound. This bar of copper is revolved at high speed in the lathe, and the cylinder placed over it, and run, by hand, backwards and forwards along it, turning the cylinder with a complete movement of the wrist, the while. This, for one thing, means that the cylinder must be *open-ended*, as the lap must run right through. If the bore is formed as a blind hole, grooves will be made in the cylinder walls, owing to the lapping paste mounting up into some quantity at the end of the bore, thus forming ridges of its own, which are transferred to the bore of the cylinder.

An equally important consideration, however, is the fact that it is not possible to hand lap without getting the ends of the bore slightly bell-mouthed. I assure readers that this fault is not due to my own somewhat limited engineering skill, but that any toolroom engineer will endorse my statement. This being so, the only practical method of obtaining a parallel bore is to make the original cylinder considerably longer than the finished engine will require, and when lapped, to turn away the bell-mouthed ends. An additional merit of this system is that the longer bore does, in itself, reduce the amount of the bell mouths. When lapping is thus applied to blind holes, it is almost impossible to obtain a parallel bore—as I have found to my cost!

Furthermore, with a good reamer, slow speed, and plenty of "suds," it is possible to obtain a bore which requires but the minimum of polishing with metal polish and lap; but, the reamer must pass right through the job. Blind holes, such as those formed by a cylinder with attached head, cannot be reamered successfully, owing to the fact that all reamers have a slight "lead" towards the tip, amounting to at least .002 ins.

The only practical way to finish machine the bore of a "blind" cylinder is on a universal grinder, or special internal grinding machine, a thing which few model engineers are wealthy enough to possess. With commercial engines, machine plant presents few difficulties, hence the prevalence of cylinders with integral heads on this class of engine. Like Dr. Forster I entirely agree that the integral head has great merits—but not for the man who makes his own engines. I trust that I have shown that Dr. Forster's statement that "This arrangement is easy for the amateur to produce" is not true.

Pursuing this matter of detachable heads still further, another advantage is to be found in the fact that separate heads *can be machined* on the inside with an ease that is impossible with the integral head. A plain, spherical head may, of course, be machined with equal facility in either type of cylinder, yet, when special heads, shaped to conform in some manner to the profile of the piston top are used, a detachable head is a necessity. As I always make my cylinder heads in this manner, usually with a small filling piece to conform to the exhaust side of the piston top, I must have a detachable head which I can machine. Such heads not only improve the compression ratio, but they have a pronounced deflector effect which aids in scavenging the cylinder. In the published drawing of my engine these points were not shown, as they would lie upon the opposite cross-section.

Dr. Forster asks why I should go to the trouble to

fit an electron head instead of a cast-iron or steel one which would dissipate less heat. The reason is that electron is lighter in weight, and very easy and " clean " to machine. By using short, thick fins I can dissipate just as little heat as I wish. I could, if necessary, retain all the desirable features of electron, and design my head without fins at all. I take it, one of the merits of small aero engine design is to do the job efficiently with all the lightness possible. The use of a heavy cast-iron or steel head would run counter to this maxim in the present case.

The next point of criticism really becomes void, because it would appear that it arises from the fact of my drawing not being sufficiently clear. The fault is, probably, mine, as I should have given another drawing showing a longitudinal section of the engine on a plane at right angles to the one shown. However, I hope that the present pictures will make the matter clear.

The matter arises over the fixing of the cylinder and port belt by means of long studs screwed into the top of the crankcase extension. Let us take the port belt first. Dr. Forster says that it would appear to the ordinary reader that I had forgotten the inlet to the transfer passage into the cylinder liner. Well, you may take my assurance that such an important item as this was not overlooked by me. The fact is, that as it does, of course, lie on the other cross section which I have not shown, it is obviously not in my drawing. At the time, I did not think this very important, as I really did not think that anyone would imagine that I would design an engine without a transfer opening. I think that my picture of the " exploded " view of a similar assembly will clear the matter. Here may be seen the cylinder and port belt withdrawn partially from the crankcase. When in assembled position the belt encircles the transfer opening in the cylinder, and also the exhaust outlet. On the exhaust side the belt carries an exhaust pipe, the opening of which registers exactly with the exhaust opening in the cylinder. On the transfer side, however, the belt is milled out to form a little dome-shaped recess, which registers with the transfer opening in the cylinder, and forms a cap over the transfer passage in the crankcase.

By using one wall of the cylinder as a wall of the transfer passage, it is obvious that the whole of the transfer passages may be machined with greatest ease, and that the rounded bend necessary at the top of the passage, being contained in the port belt, may also be machined with equal facility. Strangely enough, Forster doubts if the transfer passage can be machined, but I attribute this to the fact that it was not illustrated in my drawing. What I cannot reconcile, however, is the alternative arrangement of transfer passage as given by Dr. Forster in his drawing in Fig. 1 of his article. I really cannot believe that he means this! His drawing shows a transfer passage cast into the crankcase casting. In the first place, I doubt if there are many amateurs with sufficient knowledge of pattern making to make the complicated cored pattern necessary for the arrangement. Quite apart from this, however, assuming that a successful casting had been obtained, it is now quite impossible to machine the transfer passage at all! My knowledge of small castings, and especially of long cored holes, such as this, tells me that the inside of the passage would be in a terrible state as received from the foundry. Apart from the lumps and irregularities which would be there, it would be impossible even to remove the traces of sand which cling so tenaciously into every nook and cranny, except in a special pickling bath, which few amateurs possess. I am afraid that recourse would have to be had to that old engineers' joke—the rubber drill.

Joking apart, the smooth and polished condition of the transfer passage, and especially the attention needed to ensure a smooth rounded corner at the point where the cylinder entry is situated, is important on small engines. The passage must be as unimpeded as possible, and quite unlike the irregularly surfaced, half-choked, cast passage which Forster's arrangement would give us. In addition, liquid petrol and oil would collect in the irregularities and crannies—with all the host of bad starting troubles which this means. I am speaking from experience, as I have found that even a *square* corner instead of a rounded one in gas passages will give rise to this trouble.

The fear of leakage around the port belt which Dr. Forster expresses has no foundation in fact. Once the joint is made it is there for good, and I have never had the slightest trouble with this arrangement. As a matter of fact, the photographs which I show here are of the arrangement as fitted to a " Kestral " engine, my own engine now being in other hands. In spite of its unsuitability for model aircraft (for which it was not designed), the " Kestral " engine remains one of the outstanding units for amateur construction, and many hundreds of successful engines have been made to Mr. E. T. Westbury's original design.

Dr. Forster suggests that the thick flange into which the cylinder holding-down bolts are located should be placed above the port belt and not below it. A study of my photographs, however, will show that this arrangement is impracticable, as the long bolts hold the cylinder head, cylinder, and port belt to the crankcase extension. Were the fixing flange placed as Forster advises, there would be nothing to hold these components to the crankcase.

The above matter, in conjunction with my previous article, wherein I dealt with the questions of the carburetter and contact breaker, seem to be all that is necessary to clear up some apparent misapprehensions regarding my own design in particular, and small engine design in general. It is curious how near my amended contact breaker approaches that of Dr. Forster. Perhaps thinking along logical lines produces the same conclusions.

In proof that my experiments with small engine design have, in actual fact, covered most of the points raised by Dr. Forster, I give here pictures of two of the many engines which I have built. These two have been selected, not because of any outstanding merits, but because they embody some of Dr. Forster's proposals. It may thus be seen that this article is not merely an attempt to justify my engine design by words only, but that the basis is actual building experience.

Finally, I should like to say that I cannot but feel that Dr. Forster's criticism of my engine has been based too much upon comparison with proprietary makes (of which he has a profound knowledge), wherein everything is sacrificed to speedy and cheap production on the American lines, and without sufficient consideration for the needs and facilities of the amateur engineer.

Readers' . . . . . . Letters

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

Dear Sir,

The details of the model Lysander published in the Christmas issue of the Aero Modeller were particularly interesting to me as a Pilot who earlier in the war flew 250 hours in the real thing.

I noticed that this model has not yet been test flown, and it occurs to me that its builder and many other readers might care to have a Pilot's impressions of the full-scale job, if only to serve as an interesting comparison with the future performance of the model.

It may seem strange that a Fleet Air Arm Pilot should have ever had the handling of an R.A.F. aircraft. It happened this way. I was a member of a training squadron which had the job of flying pupil Observers over the dreary wastes of the North Sea while they carried out Navigation exercises. These pupils had already completed their preliminary ground training, but each of them were given more than 100 hours in the air, during which they exercised their black magic, and if they worked it out correctly, finally got the aircraft safely home. On those occasions when the magic failed they announced the fact to the Pilot, who is his wisdom was never supposed to be lost. In practice the North Sea was not difficult to get out of, and if one flew westwards for long enough the British Isles invariably turned up in due time.

For this job the R.A.F. had given us 25 Lysanders which were adapted for an extra seat in the back, and as such carried a pupil Navigator and pupil Telegraphist/Air Gunner. The machine guns in the spats were incidentally always kept loaded and cocked . . . just in case.

I must say that the " Lizzie " gave me a bit of a shock the first time I flew it. I had been used to Swordfish and Albacores, and was not ready for the almost sensational rate of sink which the " Lizzie " produced when coming in to land with engine off. In fact, landing the Lysander was not at all easy until you grew accustomed to her peculiarities. The trick was to rumble in at about 1,400 revs., reducing speed to about 85 m.p.h., and then trimming the aircraft on the trimmer so that she flew straight and level while continuing to lose height at about 500 ft. a minute. The automatic flaps used to come out with a substantial " bump " at just under 90 m.p.h., and if you came in at round about this speed they defeated the best laid plans of the Pilot by bobbing in and out without warning. Each time they came out the lift was increased and the rate of descent slowed. Any calculations on landing were consequently hopelessly upset.

I always had my own pet method of putting this aircraft down. It consisted of flying a foot or two above the deck, closing the throttle and then giving a sudden and brief burst of engine as she stalled. By this method it was never necessary to wind back the tail trimmer more than half-way, and consequently if it was necessary to go round again there was never any difficulty. If you came in with the tail trimmer wound right back, as was necessary without engine, any attempt to take off again had to be accompanied by a wrestling match with the stick. You would need all your strength to push it forward and hold the nose down while flying speed was regained.

I have, perhaps, implied that the " Lizzie " was difficult to land. This is not really true . . . she was merely an aeroplane of considerable character.

As regards her flying qualities in the air she was one of the most stable aircraft imaginable. For long periods it was possible to fly hands off and with just an occasional touch on the rudder to hold the aircraft dead upon her course. We generally used to cruise at about 130 m.p.h., well throttled back, but she was good for 160 m.p.h. in the cruising range at any time. If necessary she would also fly remarkably slowly. I remember sitting over the top of a Naval Air Station for nearly ten minutes without moving forward against a gale of wind. The people in the control tower thought I had gone mad.

Aerobatics were not permitted and, incidentally, were almost impossible to execute owing to the automatic flaps and the extreme stability. On the other hand, I once dived my own machine to 300 m.p.h., and for a moment was alarmed when I discovered that however hard I pulled on the stick it was quite impossible to move it. Even standing on the rudder bar and heaving with both hands had not the slightest result. It was necessary to ease the tail trimmer gently towards me before she came out of the dive. This is a quality, of course, of many other aircraft, and there was nothing about the occasion to warrant a " line shoot."

One last point which may be interesting. The Mercury motors with which our particular machines were fitted never once let us down over a period of two years' flying. This is a fine tribute to Bristols, and if the motor fitted to the model does as well, there should be few complaints. Incidentally, we found that we had a climb of a full 2,000 ft. a minute when the aircraft was light.

A Naval Pilot.

Dear Sir,

On the boxes of many duration kits you may have noticed the following : " To be sold only to members of H.M. Forces, A.T.C., R.O.C., N.A.S., Official Schools of A/C. Recognition Training," etc. The fact that there are no full-size counterparts of such models disposes of the recognition value. The excuse of shortage of supplies is not enough because the majority of people in the above services are not interested in aeromodelling, whereas many modellers are unable to be in any of the services.

Was the restriction imposed by the Board of Trade ? Or by the manufacturers themselves ? In the former case, does this mean the Government wishes to hold up in advance the aeromodelling field ? In the latter case the manufacturers are quite evidently the losers.

I am in the A.T.C. myself, so this is not an outsider's complaint. Would it not be better, since sales are restricted, to sell only to members of the N.G.A. who can prove their authenticity ?

J. L. Prior.

Kent.

The notice to which Mr. Prior refers was drafted by the Model Aircraft Trade Association with the approval of the Timber Control Department of the Board of Trade and is affixed to all kits containing balsa. To our certain knowledge many duration kits are bought by members of the R.A.F. and A.T.C. for training in the elementary principles of flight. We cannot see any reason why sales of these kits should be restricted to members of N.G.A., since this organisation as is well known, exists for the provision of Third Party Insurance for Aeromodellers flying any type of model aircraft.—Ed.

THE SPAREY MINIATURE PETROL ENGINE

Comments on Dr. Forster's Remarks

Dear Sir,

I should like, if I may, to make some comments and friendly criticisms on Dr. Forster's article in the November Aero Modeller. He states that the one-piece cylinder and head can be easily produced. This, I am afraid, is not correct. In boring holes, or cylinders, of any length, it is always difficult to apply support to the cutting edge of the tool, as, of course, the tool or its holder must be sufficiently small to enter the hole. Boring tools always " spring " to a certain extent, and the only satisfactory way of producing a truly circular and

parallel bore is to use the lapping method. Here, again, satisfactory results can only be obtained when the lap itself can be passed right through the bore. I am, of course, referring only to the methods which would be available to amateurs. A blind bore *can* be accurately produced by grinding, which calls for a precision grinding machine.

The lap is usually made of brass or copper, and it is advisable to have some means of adjusting it to take up wear. It is held in the lathe chuck, and run as fast as possible. The lapping compound can be jewellers' rouge and oil, or special lapping materials can be obtained ready made. When a sufficiently good finish is obtained the piston can then be lapped to fit the bore. Again, brass or copper can be used, and the lap this time takes the form of a split ring, with some means of adjustment for taking up wear. A jubilee hose clip is just the thing for this. I believe quite a lot of people are under the impression that a piston can be lapped into its own bore, but this is not so, as the lapping compound wears away both surfaces, and defeats the whole object of lapping, which is to obtain high finish and close fit.

I should like to emphasise that too much time cannot be spent in obtaining accuracy, and it would be amply repaid by the increased resistance to wear and the retention of good compression which would result.

With regard to Dr. Forster's design for a crankcase, I should like to point out that the transfer passage as shown in his sketch would be most difficult to machine, and I doubt if a foundry could be persuaded to turn out such a casting, with the very small bore that the design entails.

I should like, if I may, to bring to Dr. Forster's notice the 5 c.c. Kestrel engine, as designed by Mr. E. T. Westbury, who is well known in the model engineering world for his efficient miniature two strokes. This engine incorporates a port belt which I believe is similar to the one used by Mr. Sparey. The engine is reasonably easy to construct, if due care is taken over the machining processes, and these can all be accomplished with the small equipment which the amateur usually possesses. I should be pleased to let Dr. Forster have a copy of the blueprint of the Kestrel, and can supply the address of the people who produce the castings. As it happens, I am just finishing such an engine for a friend, who is willing to forward the engine for inspection if the Doctor is interested.

F. Gray.

Catford.

"STREAMLINE MODELS"

Dear Sir,

At the risk of reopening the old Smith-Copland controversy on whether or not to streamline, I should like to raise a point which, I believe, has hitherto been overlooked.

The general opinion seems to be that streamlined models are theoretically best, and Mr. R. N. Bullock has gone so far as to say " The time is now past when any other than circular or elliptical section fuselage should be considered suitable for a good Wakefield design ; in fact, so much so that representation of Great Britain with a rectangular section fuselage should be ruled out, as this straight away reduces our chances. . . ." Yet a large proportion of competitions are still being won by ordinary box-fuselage jobs. The usual "lucky thermal" excuse is wearing somewhat thin, and it is high time that we found a more scientific reason.

I should like to suggest that the answer to this problem lies in the relative stability characteristics of the two types. My reasoning is as follows :—

In the Longitudinal Stability Formula, Dr. Lanchester shows that the stability factor of an aircraft is proportional to the tangent of its gliding angle, or, in other words, inversely proportional to its L/D ratio. But more plainly, this means that a non-streamlined model is more stable than a streamlined—other things being equal. As an example, let us say a streamlined model of L/D equal to 12 is moderately stable, having a stability factor of 2. Then the stability factor of a similar non-streamlined, L/D equal to 6 model, would be 4; which takes it into the very stable class.

Lanchester proved that this formula was accurate for models weighing from 1 grain to 2½ lbs., and similar results have been observed by later experimenters.

Thus, it appears that streamlined models hold the advantage in dead calm conditions, while the less sleek models have the extra stability necessary to carry them through gusty winds. This conclusion is borne out by innumerable competition results, and it explains why streamlined models are more tricky to trim and fly.

I am not suggesting that we should return to box fuselages —that would be a retrograde step—but I do suggest that there is scope for developing the stability side of streamliners so that they can beat the similar types in all weathers.

J. H. Maxwell.

Bristol.

Dear Sir,

Having been reviving during the last two years an early interest in model flying, through the medium of your periodical (and with a young son as the excuse), I would like to suggest that adequate *advance* notice be published of the various competitions, both club and national, that take place during the season.

There must be numerous members of the public like myself, interested in model flying, but for various reasons not members of clubs, who could nevertheless find time to attend occasional meetings if the date and venue were known beforehand.

Clubs are no doubt circularised with this information, but the general public, not " being in the know," can usually only read about these meetings long after they have taken place. There is consequently a lack of support from the very people who would doubtless welcome an opportunity of providing it.

John C. Nassau.

Middlesex.

During the summer months it is our practice to compile a " calendar " giving the dates of Club competitions and we are always prepared to insert advance notices upon receipt of the appropriate particulars from Club Secretaries.—Ed.

DOWNTHRUST

(Mr. Maxwell, please note.)

Dear Sir,

I have read Mr. Maxwell's very interesting article on downthrust in the October, 1943, Aero Modeller. To my mind he has not disproved the " no downthrust necessary theory." He states, quite correctly, that in Fig. D the thrust acting along the datum line produces a positive pitching moment about the C.G. He also states that in Fig. C, the thrust line, tilted to pass through the C.G., causes a negative pitching moment due to the increased angles of attack of the wing and tail. He then says, to quote, "That the correct thrust angle lies somewhere between the two, in the position where the positive and negative moments balance one another ! " Quite so, but why tilt the thrust-line ? Surely, a better way is to make the thrust-line pass through the C.G., but have it *parallel to the datum line*. This will neither increase the angle of attack, as in Fig. C, nor produce the positive pitching moment of Fig. D. This will simply mean that the fuselage would not have to be symmetrical about the datum line in the side view, as it is in all Mr. Maxwell's figures.

A model designed in this manner will have less drag than one designed to Mr. Maxwell's theory, because the fuselage will be flying along the datum line and the wing and tail angles of attack will not be increased.

C. Furze.

Leeds.

Dear Sir,

Many aircraft preparations (microfilm) necessitate the use of acetone. This substance being unobtainable I am giving a method of preparing it.

A few lumps of chalk are put in a vessel and acetic acid (vinegar) is put in. The calcium acetate (the remaining solution) is heated to dryness and distilled dry. The condensed vapour is acetone.

A. E. Brock.

Thornton Heath.


OF COURSE—
ITS BIG LOOK
WHAT IT IS!
MODEL AIRCRAFT
MANFD BY THE BRITISH MODEL AIRCRAFT MANFG. CO. MITCHAM

MONTHLY MEMORANDA

By O · G · THETFORD

Photo by courtesy of Planet News.

Italian Markings—New Fashion.

It was announced in Cairo during December, 1943, that all Italian aeroplanes operating alongside the R.A.F. and U.S.A.A.F. carried a new type of national insignia in place of the fasces device formerly carried. The new marking is similar to that carried on the Italian aeroplanes of the 1914–18 war, except that the position of the colours has been reversed. It consists of a red, white and green roundel painted above and below the wing tips and on the sides of the fuselage. The green is in the centre and the red ring on the outside. No markings of any description are carried on the tail assembly, whereas vertical stripes were painted on the rudder of the 1914–18 types. The camouflage systems employed on the Italian machines flying with or handed over to the Allies remain the same as before, and none of the machines carry British or U.S. insignia.

U.S.A.A.F. News.

During the closing weeks of 1943 yet another change was made in the official insignia carried on aeroplanes of the U.S.A.A.F. (and also the U.S. Navy). The red band surrounding the entire insignia described in these columns in the issue dated October, 1943, was replaced by the blue band now carried on all types. The new insignia with the *blue* outer band is painted on the sides of the fuselage, above the port wing and beneath the starboard wing as formerly.

An interesting innovation in the markings of U.S. heavy bombers was revealed recently. On many Boeing B-17Fs and B-17Gs and also B-24s (Liberators) the machine identification letter carried on a large triangular background on the fin(s) is repeated above the starboard wing near the tip in the place occupied on some types by a national insignia. The national insignia is carried in the usual location on the opposite (port) wing. The triangular background to the identification letter is painted white and the letter in black or dark blue. The triangle is equilateral and has its apex pointing towards the leading edge of the wing and the base, running parallel with the aileron hinge.

It was pointed out recently how many U.S.A.A.F. squadrons employed code squadron letters formerly used (or still used) by squadrons of the R.A.F. Another instance has occurred in connection with a Thunderbolt squadron. These Thunderbolts have operated as escorts for B-17s and B-24s over Europe on many operations, and carry the squadron letters " WZ " in white on the fuselage sides ahead of the national insignia. A further identification letter in white is painted aft of the national insignia. Readers may recall that the letters " WZ " were originally painted on the first Spitfires ever to join the squadrons of the R.A.F.—those of No. 19 (Fighter) Squadron, stationed at Duxford before the outbreak of war.

Some powered versions of the Waco Hadrian glider are flying with the U.S.A.A.F. and are fitted with two six-cylinder Franklin motors. The glider in both powered and unpowered versions is known as the Haig in the U.S., and one of the powered versions carried the serial number 327315 in yellow on the rudder.

In November, 1943, after over a year of operations by the U.S. 8th Air Force from this country, the veteran Boeing Fortress was disclosed to be a B-17F named " Knock-Out Dropper " by its crew. " Knock-Out Dropper " made its first operational mission over St. Nazaire in November, 1942, and in the ensuing year survived 49 operational flights. " Knock-Out Dropper " carries her name in block capitals on the nose (see heading photograph) and last November had forty-nine white bombs painted in a row along the fuselage from the nose to the rear of the pilot's cockpit. The U.S.A.A.F. serial number is 124605 and it is painted in yellow across the bottom of the fin. At the top of the fin is a large white triangle against which is painted the unit identification letter, in this case " C." It is repeated as described earlier above the starboard wing. A second name, " Smilin' Jack," is painted in small white capitals beneath the pilot's cockpit just above the row of bombs.

Early in 1943 many Packard-Merlin powered Mustangs had gone into service with the U.S.A.A.F. under the designation P-51B. They will be known as Mustang IIs in the R.A.F. The Allison-powered four-cannon version with the R.A.F. is the Mustang IA. The P-51B has a revised nose to suit the new motor and a *four-blade* airscrew. Some have been taken off the British production line and have U.S. insignia on wings and fuselage and British fin " flashes " and serial number. One P-51B transferred in this way to the U.S. Army is serially numbered FX 883.

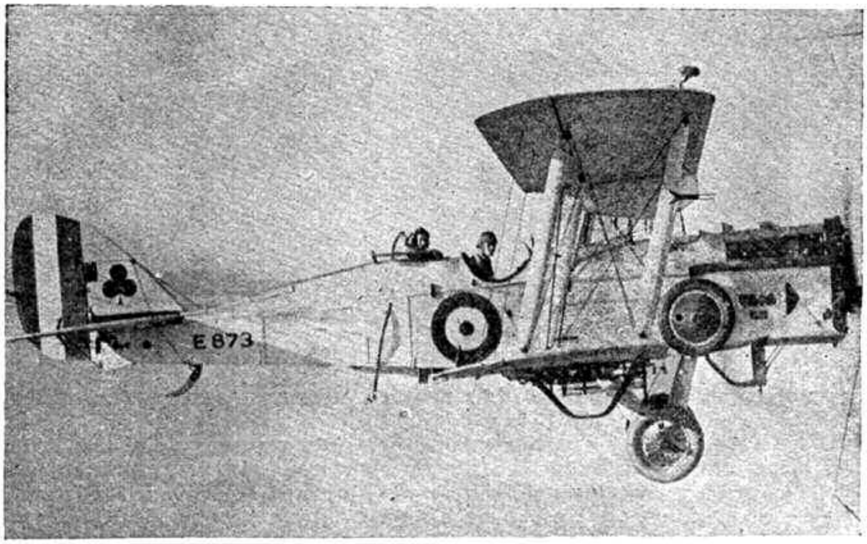
Coupe Stringbag.

A new lease of life has been given to a veteran member of the F.A.A., the Fairey Swordfish, by the fitting of a transparent hood over the pilot's and gunner's cockpits. Many of these " hooded " Stringbags continued to fly with the Royal Navy during 1943 and probably will to the end of the war. One batch of modified Stringbags in service is numbered HS 553, HS 554, HS 555, etc.

Bomber Command Newcomers.

The Avro Lancaster II with Bristol Hercules XVI sleeve-valve radial motors is now in service in large numbers with Bomber Command, and some markings details are available. One of the first squadrons equipped with the Mk. II Lancaster carries the code letters " EQ " aft of the roundel on the starboard side and ahead of the roundel on the port side. Lancaster II " EQ-S " is serially numbered DS 698 and " EQ-W " is DS 704.

A squadron of Short Stirlings, recently inspected by the Duke of Gloucester, carry the code letters " EX " and are fitted with Hercules XVI " power eggs " in place of the Hercules XIs which were previously standard on Stirlings.



AEROPLANES DESCRIBED—XIII

THE D.H. 9a

BY H·J·COOPER

●

Next Month :

The Pander Eg. 100

WITH a service record almost as long as that of the Bristol Fighter, the D.H. 9a, more commonly known as the "Ninak," was in service with the Royal Flying Corps and Royal Air Force from 1918 until 1931, and during that time had as varied a career as any aircraft.

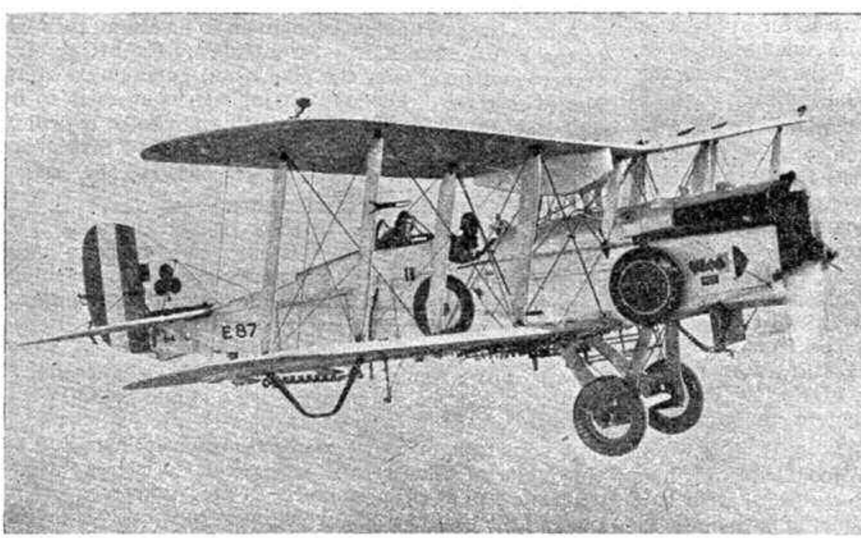
Upon its introduction it was issued to squadrons of the Independent Air Force in France, and during the final stages of the 1914–18 War was instrumental to an important degree in bringing about Allied air superiority, much as its manufcturer's immediate military successor, the Mosquito, is doing to-day. The Ninak served on all fronts with a successful versatility, and after the Armistice remained in service in this country and in the Middle East. Our cover painting, by C. Rupert Moore, shows a flight of Ninaks on "recco" over the North-West frontier, where they were constantly occupied in the R.A.F's permanent war on recalcitrant tribesmen. The pictures on this page show a Ninak in the typical "Christmas-tree" embellishment of the period. This particular machine is, incidentally, being flown by the late Captain V. Gorry-Wilson, formerly chief test-pilot to the Fairey Aviation Company and a transport pilot of Imperial Airways.

The Ninak was designed by Captain G. de Havilland before the formation of the De Havilland Aircraft Co., Ltd., and was built under licence by various sub-contractors, notably the Westland Aircraft Works, who afterwards designed the Wapiti as a replacement type. The Ninak was also built in America and was used as a mail-carrying and passenger aeroplane after the War.

Originally, the Ninak was designed as a day-bomber, and is always referred to as such, but its duties have included night-bombing, reconnaissance and army co-operation, and it has been operated as an ambulance. In the latter category stretcher cases were carried in the far from comfortable position strapped on to the top decking of the fuselage!

Four hundred and fifty pounds of bombs could be slung under the wings and beneath the undercarriage, and other equipment included w/t. apparatus, message picking-up gear and camera. On foreign service, spare parts, rations and water were carried, the latter in animal skins slung on to the gun-ring. A spare wheel was carried under the fuselage, or, as shown in the accompanying photographs, bolted to the side.

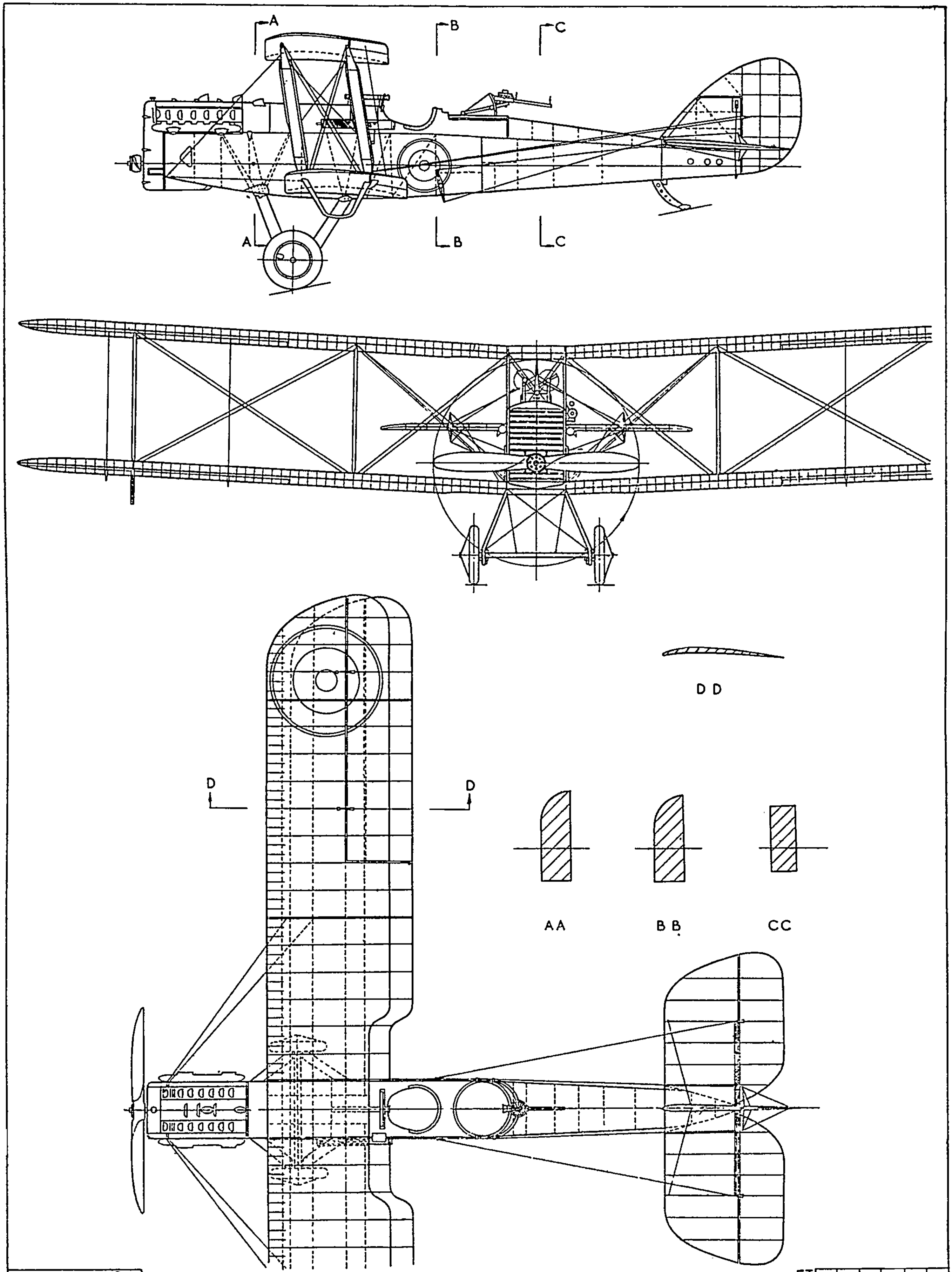
The motor usually fitted to the 9a was the 400 h.p. Liberty, but the 350 h.p. Rolls-Royce Eagle VIII was sometimes employed. With the former motor the maximum speed was about 120 m.p.h.



Armament consisted of a Vickers gun for the pilot with 750 rounds and a movable Lewis with six drums on a Scarff mounting in the rear cockpit for the observer.

Main dimensions of the Ninak are: Span, 45 ft. 10 in.; length, 29 ft. 10 in.; height, 11 ft. 8 in.; chord, 5 ft. 9 in.; gap, 6 ft.; stagger, 16 in.; airscrew diameter, 9 ft. 6 in.; wing area, 497 sq. ft.; incidence, 3 degrees; dihedral, 3 degrees.

Loaded, the Ninak weighed 4,000 lbs.; the wing-loading was 8·05 lbs./sq. ft., and the power loading 10 lbs./h.p. There was capacity for 108 gallons of petrol and for 13 gallons of oil.



DE HAVILLAND 9A.

AN ELECTRICALLY DRIVEN MODEL AEROPLANE

Seeing the article on an "Electric R.T.P. Miles Magister," by H. A. C. Hassall, in the August "Aero Modeller," reader F. Wilde, was prompted to send in this interesting article, contributed by J. L. Cannon. It appeared on October 21st, 1909 in the "Model Engineer and Electrician" and we reproduce the article by kind permission of "The Model Engineer" as it is known to-day.

BASE is made of four sticks of American whitewood, each $\frac{3}{8}$ in. by $\frac{3}{8}$ in.; they are $2\frac{1}{2}$ ins. apart at one end and meet at the other, and held together by two pieces of wood nailed at the sides. The design, as will be seen from the illustration, is of the monoplane type. The main plane is made of thick cardboard, 18 ins. across the tips by $5\frac{1}{2}$ ins. breadth. The rear plane is 11 ins. across the tips by $3\frac{1}{4}$ ins. breadth. This includes two small movable end planes which are each 2 ins, in width. A two-bladed screw propeller is placed at the front; it is 9 ins. diameter; blades $1\frac{1}{2}$ ins. breadth at the tips, made of a single piece of American oak, $\frac{1}{8}$ in. thick twisted out of straight; the blades are $\frac{3}{4}$ in. breadth at the centre and canted about $\frac{1}{4}$ in. It is driven by a compound electric motor working at 4 volts pressure, current being supplied by the refill dry batteries for a pocket electric lamp, and it is attached direct to the motor spindle, which has been extended by a piece soldered on. The weight of machine and motor is $1\frac{1}{2}$ lbs., or with batteries on just under 2 lbs.

Our readers will notice that this machine is similar to the Bleriot monoplane, but it has no vertical rudder. Steering to the right or left is accomplished by either of the two small end planes situated at the rear. If these two planes are both dipped the machine rises, this position being used when starting.

When the machine is to be used a short length of strong rubber is attached to the under side of the frame, a light line is attached to the rubber, the object being to absorb any sudden jerk when pulling down. An assistant holds the line loosely, and the operator launches the machine off a tall pair of trestles. It then flies in a large circle, plenty of line being played out at discretion. When the batteries are exhausted the machine descends slowly, and is caught by the operator before it reaches the ground. The highest flight yet accomplished is about 35 ft.; duration eight minutes, approximate.

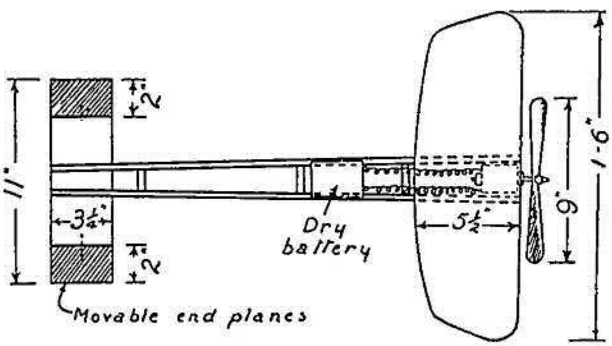
Mr. Cannon calls this machine an electroplane, and considers that an electrically-driven model is better than an indiarubber-driven model to experiment with. He states, however, that the batteries become exhausted very quickly, so that convenience is obtained at some expense if many flights are made.

A drawback to electric propulsion is also heaviness, but this does not matter if a high number of revolutions per minute is used.

In a recent experiment a higher voltage was tried with the result that the motor winding fused somewhere.

Mr. Cannon concludes from this that there is a limit to the number of revolutions it is possible to obtain.

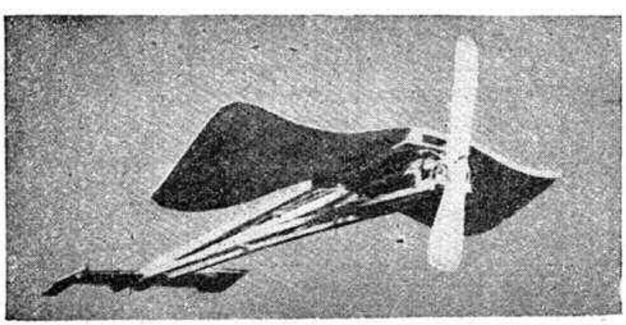
It is gratifying to find an experimenter having the courage to use an electric motor and battery to drive his model, instead of the almost universal twisted rubber cord. That electricity is not hopelessly outclassed seems evident by Mr. Cannon's sad story of the loss of an electrically-propelled model of the box

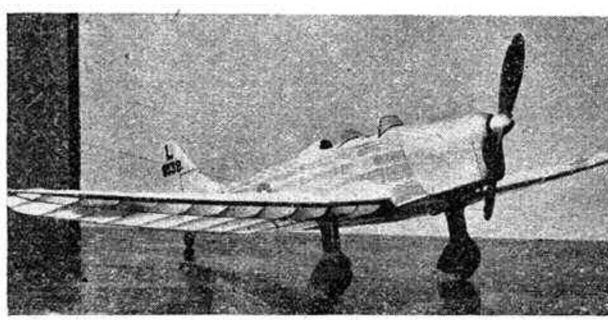


type which, imitating the unfortunate dirigible *La Patrie*, broke away one evening in the early part of this year and flew into the unknown, the course being from Belsize Avenue over the Alexandra Palace.

The lifting surface of this machine was about 12 sq. ft. and it carried an electric accumulator weighing about 6 lbs. Mr. Cannon, though highly gratified at the flying capabilities of his machine, still deplores his loss. If any of our readers have found a derelict aeroplane which appears to be the long lost one, perhaps they will be kind enough to communicate with Mr. Cannon?

"The old and the new." Below left is the machine described above and right is Mr. Hassall's Miles Magister.





CLUB NEWS

BY CLUBMAN

" Tethered Flight." Cpl. C. Wyatt with his 4 year-old swallow.

I NOTE from recent reports of the S.M.A.E. Council meetings that at long last an attempt is to be made to conduct a card vote for the annual election of officers. You will remember that this is a system I have advocated for some years past, as in my opinion it gives the only fair means to provincial clubs to voice their wishes in such important matters. Unfortunately—and particularly under present-day conditions—it is given to only a few clubs to attend meetings and air their grievances, etc., and much controversy has been experienced when matters have not quite met the approval of non-attenders.

The fact that a few clubs and individuals have been able to sway matters in the past has not been a good thing for the Society in general, and I trust this latest move towards really national voicing of opinion will be followed up in all matters concerning nation-wide model aeronautics. Many difficulties will be experienced, I know, but I am sure that the provincial clubs are realising now more than ever that they have to stick out for a hearing, and the movement generally should benefit from a wider contact with the whole of the interested personnel.

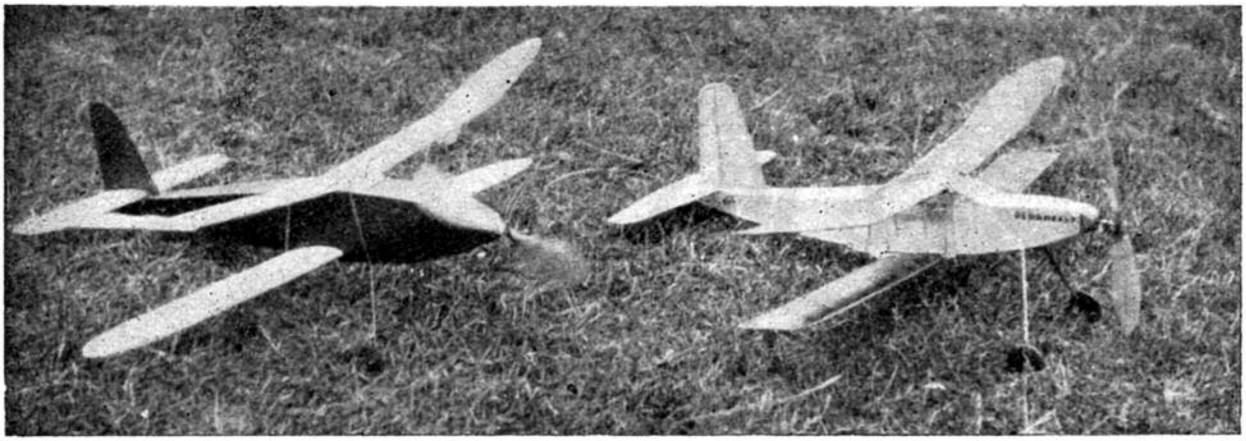
I have had endless letters from time to time, complaining that the S.M.A.E. did this—or did not do that—and accusing the Council of a purely London outlook. This in part was true, but purely from a circumstantial situation, owing to the fact that the vast majority of any meeting consisted of members from the London clubs. Naturally, when a subject came up for discussion, the voting could not help but be biased towards the majority opinion, and provincials often found matters not entirely to their liking. Let us hope that the new system suggested will eliminate at least the majority of such snags, as it is becoming increasingly imperative that we get down to a really national basis for all things aeronautical.

The seed of things to come can be discerned in the success of the London Cup contests, followed by the present series of indoor events. People are realising that quite a lot of peacetime activity can be carried on during the war, and in spite of travelling restrictions quite worth-while meetings can be arranged, provided that the old defeatist attitude is abolished. I think that recent events have proved that anything can be done, provided the will to accomplish them is there, and I am confident that we shall see a much wider establishment of inter-club contests in this new year of 1944.

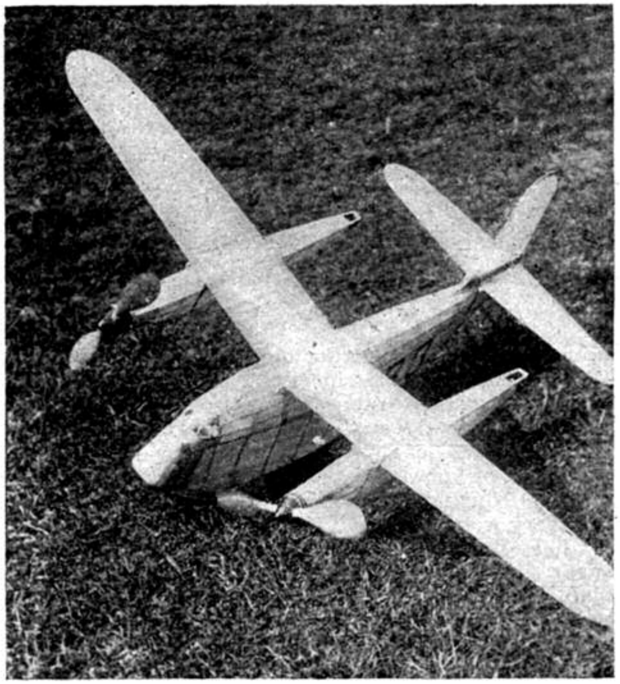
A move in the right direction has been made in the preparation of the 1944 Competition Programme. The success of open events last year prompted the Editor to propose that a greater percentage of the contests be of an open nature this year, particularly in view of the increasing difficulty of providing machines of a special nature, suitable perhaps for only one contest per year. Glider events are on the inevitable increase, and there is no doubt that this " rubberless " period is giving a much needed fillip to the study of gliders in this country—a study that was definitely required in view of our almost total lack of knowledge prior to this war. (Remember the 1939 King Peter Cup affair at Faireys ?)

A very worthwhile and timely note has been written by J. P. Buckeridge, National Champion for 1943. He says : " . . . My success is tied up with that of the club. . . . We had long ago come to the conclusion that what was needed was a combined operation—that is a concerted effort by all members, and not just a few individuals. With this end in view we persuaded nearly everyone to enter the various contests, juniors and seniors alike . . . and I think the result speaks well for our policy." Well, J. P. B. certainly has something there, and I can recommend the Pharos Club's keenness with those other clubs who do not make any effort to compete, but sit back and say, " What's the good of us trying ; there are too many experts up against us." As I've said time and time again, one gets nowhere if one doesn't try, and a non-competitor never can win ! Team work always pays in the end, and I should like to see more clubs following the Pharos technique this year.

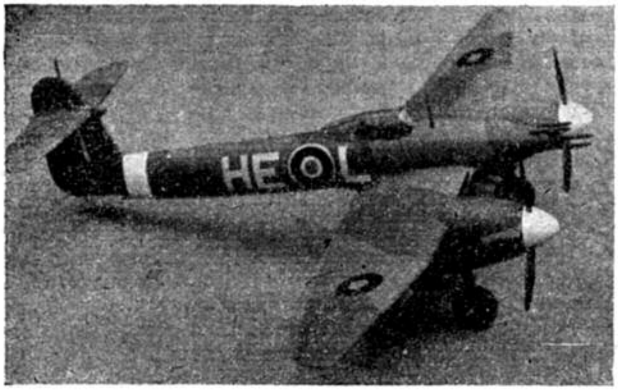
The questionnaire recently conducted by the S.M.A.E. on the subject of de-thermalisers has brought up some very controversial points. One thing must be stressed, however—the S.M.A.E. are at the moment only seeking information, and not, as some seem to think, ready to clamp down and say that these gadgets are a compulsory fitting to all models. If the majority approve,



Two "Converts." Left is a biplane version of I. S. Cameron's "Zipper" IB, plans of which were published in the October, '43 issue. On the right is R. F. Gosling's "Redbreast," the original machine, a monoplane, was published in the July, '43 issue.



H. S. Sayer's J.B.3. This flying boat, which has adjustable pitch props, made a successful R.O.W. on its first flight.



Our old friend, G. R. Woollett, sends this photograph of another of his excellent solids. This is a 1/20 scale "Whirlbomber" containing details far too enumerable to list here.

and it proves a good scheme, more might be done about it; but for the present—well, you can still go on losing your models without hindrance! However, it is interesting to record that, to date, honours are almost even between the two schools of thought.

Another interesting fact was the result of the questionnaire on National Committees. Sixty per cent. voted for such an innovation, and only 8 per cent. against. (What's that ? . . . what about the other 32 per cent. ? Oh yes—well, their letters were of the type that one could not decide whether they were for or against. Amazing, isn't it ?)

An interesting letter to hand this month comes from Australia, W. Fenner, of Adelaide, writing as follows :—

"I have been building model aeroplanes for almost twelve years. My pets are solid hand-launched gliders and the American type 'stick jobs.' However, I have also built three gas jobs, many rubber fuselage jobs, and several soarers. I've never had a serious attempt at indoors, though one of my close friends holds two Australian championships in this line. Also, scale jobs have never attracted me enough to take them on properly. I like the flying side of it, not the scale side. You must excuse my frequent use of the word 'job' for a model aeroplane ; it's a bit of slang we use here constantly and seems to cover just whatever we are talking about (i.e., in the model world).

At the present time modelling as a sport is quite dead here ; at least in this State. We can get no rubber, balsa, tissue, silk, glue or its components, engines, coils, condensers, petrol, or any of the better hardwoods as substitutes for balsa. Personally, I've been lucky in having a fair supply of materials, but most others aren't so fortunate, and so the game is practically at a standstill, barring a relatively small crowd of youngsters building scale jobs from almost any kind of wood lying about.

Due to the war many old builders are away in the fighting service and so have neither the time nor facilities to build. The rest are in munitions works, and they, as I've said above, have no materials available. In fact, I can't understand how you people in England are still flying rubber jobs. How are you doing it ? I have about 20 yards of American brown left in any condition, and treat it like a new baby !

Your magazine arrives fairly regularly, and I haven't missed any copies for many months now. As with you my present interest is centred on soarers, and hence you can

imagine my pleasure each time an article by Mr. L. G. Temple comes along."

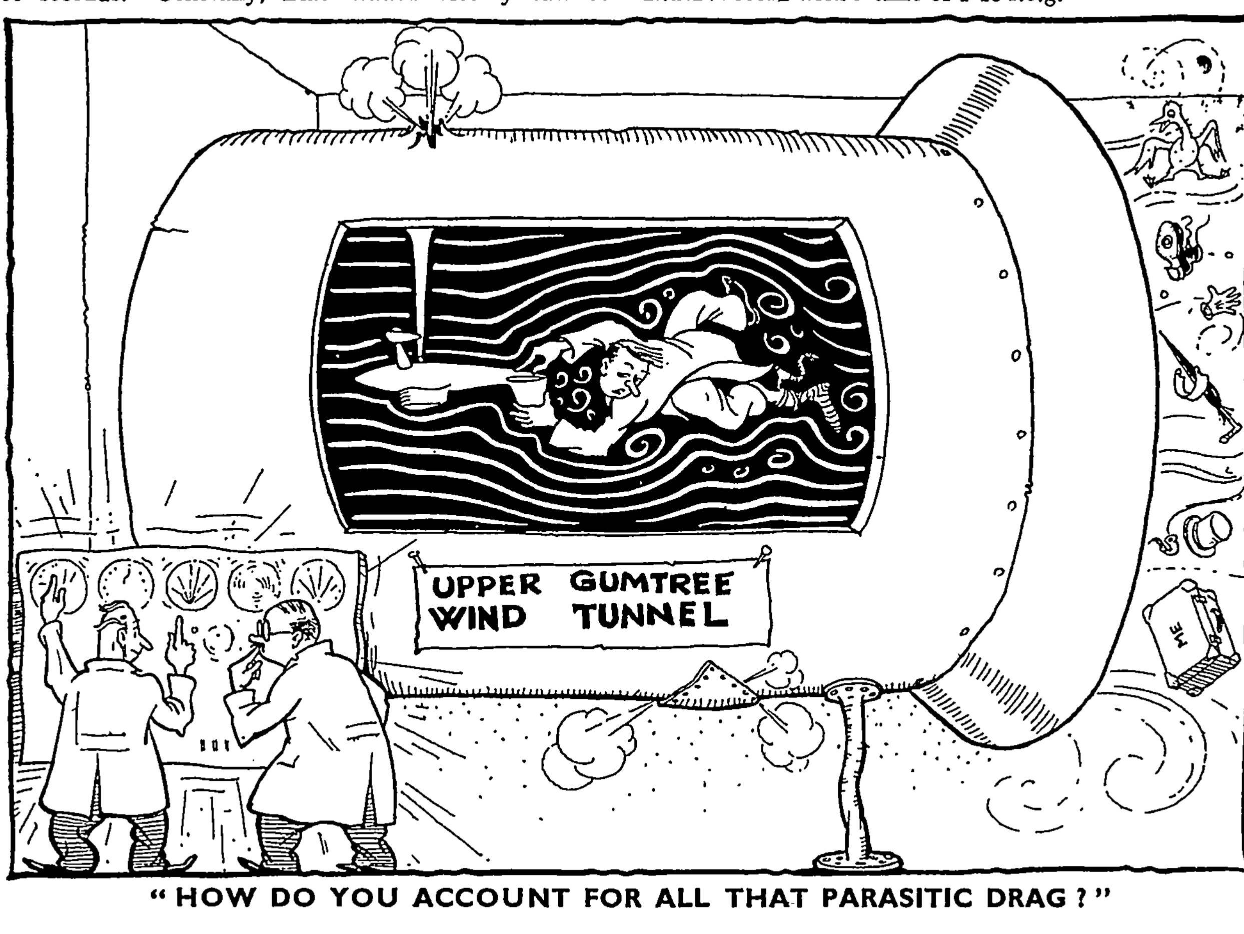
Over one hundred and twenty enthusiasts attended the First Indoor R.T.P. Knock-out organised by the London District Inter-Club Challenge Cup group, who were joined by the Kodak Society of Experimental Engineers and Craftsmen (Model Aero Section) in arranging this event at Kodak Hall, Wealdstone, on December 5th. Very many more than this figure were present, but failed to sign the visitors' book handed round as a memento of the event.

Four poles were in operation—three for the main inter-club contests, and one, first for trimming, and later for the benefit of losing teams who were provided with a competition of their own. On this, undoubtedly the best-supported R.T.P. gala to be staged as yet, many novelties were to be seen. At last this section of model aeronautics is developing types all of its own. Streatham aeromodellers turned up in force, with lifting fuselages—not merely shaped to airfoil section, but contributing up to a third of the lifting area. It was unfortunate that both their teams were knocked out in the first round—but even so they were able to show their paces to some extent on the "loser's" pole! Brentford and Chiswick (a newly affiliated club) provided one of the surprises of the day in the form displayed, F. Young's elliptical wing job performing well throughout the day. Most unusual was Galbreath's Tractor Canard, developed from a pusher canard that has been successful in the field. That it is no freak is proved by its consistent times: there is no doubt it can improve on the best registered of 99 seconds. Generally, Blackheath's victory can be attributed to the fact that they were a team—not four people flying together. Their consistent times do not indicate that they were any more fortunate than the rest in the matter of rubber Gremlins, etc., but that they all got down to repairs and flying tactics as a body.

Several "Mike" jobs were in evidence (one, reminiscent of Bob Copland's old Albert Hall winner, showed splendid form), and their presence enlivened the intervals. Houchin, of Harrow, also demonstrated fine control in flying his R.T.P. job "free." Mention must be made of the "clown plane" provided by "Butcher," of Harrow—this can only be the result of going to bed with the Duraplane plans after a lobster supper—and baffles description: it is reputed to have become slightly airborne at one time, but no real proof exists.

Has any reader any old model books or magazines he has no further use for? If so, what about sending them to 1235248 L.A.C. Fowler, 299 P.R.C. (Att. 320 M.U.), R.A.F., India. He and his friends are hoping to start up a club there, and would appreciate any literature on the subject available.

Considering that the AYLESTONE M.F.C. have only a small flying field, surrounded by trees, pylons on two sides, and a canal running across the middle of the field, they did well in the final placings in the Plugge Cup, bagging seventh place. W. Jones finished sixth in the Individual Championship, and claimed second places in both the Flight and Biplane events. To cap this, Aylestone won the October R.T.P. contest with a total of 288·1 points, while later Jones set up a new club R.T.P. record with a time of 1·46 r.o.g.



"HOW DO YOU ACCOUNT FOR ALL THAT PARASITIC DRAG?"

Fox Photos.

A GOOD JUDGE. Sir Frederick Handley Page, C.B.E., with Air Chief Marshal Sir William Mitchell, K.C.B., C.B.E., D.S.O., M.C., A.F.C., the Commandant of the A.T.C. for London, judging some of the models of aircraft at the A.T.C. Exhibition at Harrods.

The MERSEYSIDE M.A.S. are to experiment with de-thermalisers this season, and I. S. Cameron has worked out an ingenious system whereby two flush-fitting leaves are let into the fin, and clockwork operated to a 90 degrees spread. R. F. L. Gosling has also been making some interesting modifications to his well-known sailplane "Ivory Gull," and the results of these experiments will shortly form the basis of an article to appear in this magazine.

NORTHERN HEIGHTS M.F.C. had a certain amount of success at the Indoor Rally at the Kodak Hall, mentioned earlier. Two individual prizes were won by the team, and they got as far as the finals, being walloped at the post by their old rivals, Blackheath. At the Annual General Meeting of the club, it was pointed out that 100 new members had joined during the year, and 64 members are now in the Forces. This is certainly one of the clubs that combine both quantity and quality!

The STREATHAM AEROMODELLERS rounded off a very successful year by winning the indoor meeting held at Pharos, team being Messrs. Taylor, Roch, Armstrong and Howall. Three scale petrol models are under construction, while most of the members are concentrating on gliders—90 per cent. of the club models being of this type.

A pole flying contest held by the EAST BIRMINGHAM M.A.C. was won by the team of Jennings, Thomas and Pretty, who set up a total of 267·4 points against the North Birmingham club total of 245·3. A Penn, of the North Birmingham club, made best flight of the day with 1 : 26·8.

Well, there is a terrific dearth of reports this month, and I trust you are not all feeling the effects of too many good things at Christmas. I know it must sometimes be a bit of a job finding news at this time of the year, but surely there is some indoor flying still taking place and models being built that would make interesting reading! Get down to it, chaps, and let's hear from you.

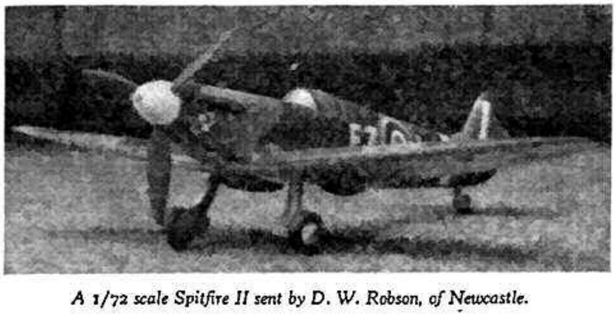
F. Lockyer, of 19, Council Cottages, West Malling, Kent, has the following copies of the AERO MODELLER to dispose of: October, November, December, 1942; and from January to October, 1943.

Corporal Whiston, of the Corporals' Club, No. 1 Wing, R.A.F., Hereford, wishes to obtain a pair of 4-in. air wheels (cash or will exchange a pair of 3-in. ditto), also a petrol tank and needle valve assembly for a Brown Junior engine. Also, M. Cox, of Old Quarry Nurseries, Dursley, Glos., wishes to obtain the plan for a 52-in. span Cloud "Elf" petrol model. Any offers?

A. H. Phelps, of "Merley," Bear Wood, Kinson, Bournemouth, wishes to start a club in his district, as also does F. N. Potter, of 82, Beeston Road, Dunkirk, Nottingham. What about it, you aeromodellers in those districts?

Well, so much for another month, and for goodness sake let's hear what you are all up to. 1944 should be a good season, both for the war and aeromodellers, and let us hope that the former finishes P.D.Q., and the latter go on and on—like the babbling brook—for ever. All the best for 1944.

THE CLUBMAN.



A 1/72 scale Spitfire II sent by D. W. Robson, of Newcastle.

NEW CLUB.

CWMBURLA A.M.C. K. Jones, 56, Middle Road, Cwmburla, Swansea.

CHANGE OF SECRETARY.

BISHOP'S STORTFORD M.A.C. J. Lockwood, Alfriston, Old Road, Harlow Essex.

EAGLE M.A.C. J. D. Ashton, 35, High Street, Guildford, Surrey.

THE SOCIETY OF MODEL AERONAUTICAL ENGINEERS

From the Individual Champion.

J. P. Buckeridge, of Pharos M.A.C., 1943 Champion, in an article in January S.M.A.E. News, says: ". . . My success is tied up with that of the club. . . . We had long ago come to the conclusion that what was needed was a 'combined operation,' that is, a concerted effort by all members, and not just by a few individuals. With this end in view we persuaded nearly everyone to enter the various contests, juniors and seniors alike . . . and I think the result speaks well for our policy." Team work will always pay in the long run—so, next season, let us have more entries, more clubs, more co-operation, and the S.M.A.E. team will "go places."

S.M.A.E. "Solids" Contest.

Entries are coming in well for these contests, but the Comp. Secretary, H. J. Towner, would be saved a lot of extra work if entrants would state name of their club when writing in as affiliated members; equally, non-members should remember to enclose that extra shilling for solid membership! More clubs willing to stage exhibitions would be welcome. Brentwood School M.A.C. have shown enterprise by teaming up with the local National Savings Group, who are having a local model aeroplane contest, and will be running a three day show in their school hall in April. This idea might be developed in other districts. Other clubs who have promised shows are Streatham, Brentford and Chiswick, Central (Muswell Hill) and West Yorkshire. Rhyl and Prestatyn hope to manage one. The Bromley Club—formerly an "all-solid" group—will, of course, be well to the fore, not only with their own show, but also with "guest exhibits" at other shows.

Dethermalisers.

Seldom has any more controversial subject been offered to members—letters pro and con have poured in, with honours at last almost even. It should be pointed out, however, that the S.M.A.E. are only seeking information—there is no question of making these "spoilers" compulsory without a lot more research, and then only if a majority agree to it, and it proves a good scheme. Our American friends are devoting a lot of time to this line of thought, and it seemed wise for the Council to explore its possibilities at once, rather than let the Wakefield—who knows ?— slip out of our grasp through ignorance of a new advance. Remember balsa—once that wasn't; and look what befell! Of course, it isn't again, but that is not the point.

Round the Pole.

Indoor galas have brought to light many new ideas in R.T.P. design. After developing for several years as "scaled down" outdoor duration types, a real effort is now being made to produce a specialised R.T.P. design method. Several schools of thought have points to commend them. Simple as can be without regard to aerodynamic niceties; lifting fuselages with up to one-third of the lifting area in the fuselage; wedge fuselage low-wings which attempt a "mushing" flight hanging on the line; automatic variable pitch airscrews (yes! it works) to develop a constant speed *aeroplane*, and thus use up all the turns; these have all achieved degrees of success. A little pre-war rubber would soon send the record soaring well over the four-minute mark.

About the S.M.A.E.

An illustrated booklet explaining the work, purpose, management and ideals of the society is now ready and will be forwarded to any would-be reader or club on receipt of a 2½d. stamp. Whether or not you belong to a club there is room for you in the S.M.A.E.—so send at once and learn how you can help the movement as a whole.

R.T.P. Contest.

Over one hundred and twenty enthusiasts attended the First Indoor R.T.P. Knock-out organised by the London District Inter-Club Challenge Cup group, who were joined by the Kodak Society of Experimental Engineers and Craftsmen (Model Aero Section) in arranging this event at Kodak Hall, Wealdstone, on December 5th. Many more than this number were present—but failed to sign the visitors' book handed round as a memento of the event.

Four poles were in operation—three for the main inter-club contests, and one, first for trimming, and later for the benefit of losing teams, who were provided with a competition of their own. On this, undoubtedly the best supported R.T.P. gala to be staged as yet, many novelties were to be seen, and it seems that at last this section of model aeronautics is developing types all its own. Streatham aeromodellers turned up in force (with their attendant flute-player, as usual) —with lifting fuselages—not merely shaped to airfoil section, but contributing up to a third of the lifting area. It was unfortunate that both their teams were knocked out in the first round—but even so they were able to show their paces to some extent on the "loser's" pole! Brentford and Chiswick—a newly affiliated club, provided one of the surprises of the day in the form displayed. F. Young's elliptical wing job performing well throughout the day. Most unusual was Galbreath's Tractor Canard, developed from a pusher canard, that has been successful in the field. That it is no freak is proved by its consistent times: there is no doubt it can improve on the "best registered" of 99 seconds. Generally, Blackheath's victory can be attributed to the fact that they were a team—not four people flying together. Their consistent times do not indicate that they were any more fortunate than the rest in the matter of rubber Gremlins, etc., but that they all got down to repairs and flying tactics as a body.

Several "Mike" jobs were in evidence—one reminiscent of Bob Copland's old Albert Hall winner, showed splendid form—and their presence enlivened the intervals. Houchin, of Harrow, also demonstrated fine control in flying his R.T.P. job "free." Mention must be made of the "clown plane" provided by "Butcher," of Harrow—this can only be the result of going to bed with the Duraplane plans after a lobster supper—and baffles description: it is reputed to have become slightly airborne at one time, but no real proof exists!

Croydon's tie with Brentford, and consequent fly-off, shows the close nature of much of the flying. Some clubs, it will be seen were unable to field a team of four and had to "double," but this was mutually agreed, and led to no abuses! The thanks of all concerned are due to Messrs. Kodak, Ltd., for kind provision of the hall, lighting, A.R.P. squads, etc.

FINALS.

BLACKHEATH M.F.C.

1.	M. W. White	116·5	112·3	228·8
2.	R. E. Galbreath	81	74·5	155·5
3.	G. Bishop	99·6	110·9	210·5
4.	G. Hinkley..	3·2	120	123·2
				718

NORTHERN HEIGHTS M.F.C.

1.	D. Lofts	85	9·4	94·4
2.	A. S. Cox	3	—	3
3.	J. S. Davall	38·5	38	76·5
4.	K. M. Tansley	45	75·4	120·4
				204·3

R.T.P. Results for November, 1943.

(*Aggregate of* 3 *best flights*)

1.	Streatham ..	414·6 secs.
2.	Pharos	381 „
3.	Blackpool ..	338·2 „
4.	Blackheath ..	321·5 „
5.	Aylestone ..	310·5 „
6.	Cheam	*245 „
7.	Leeds	207·4 „
8.	Croydon	207·1 „
9.	East Birmingham	195·4 „

* 2 Flights only.

Individual Aggregate of 2 Flights.

1. D. R. Taylor, Streatham, 283·4 (Class A).
2. R. H. Warring, Blackheath, 254·2 (Class B).

The first two places average over two minutes per flight, and there is no doubt that by next month still further advances on times will have been made. Quality and quantity is steadily improving.

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