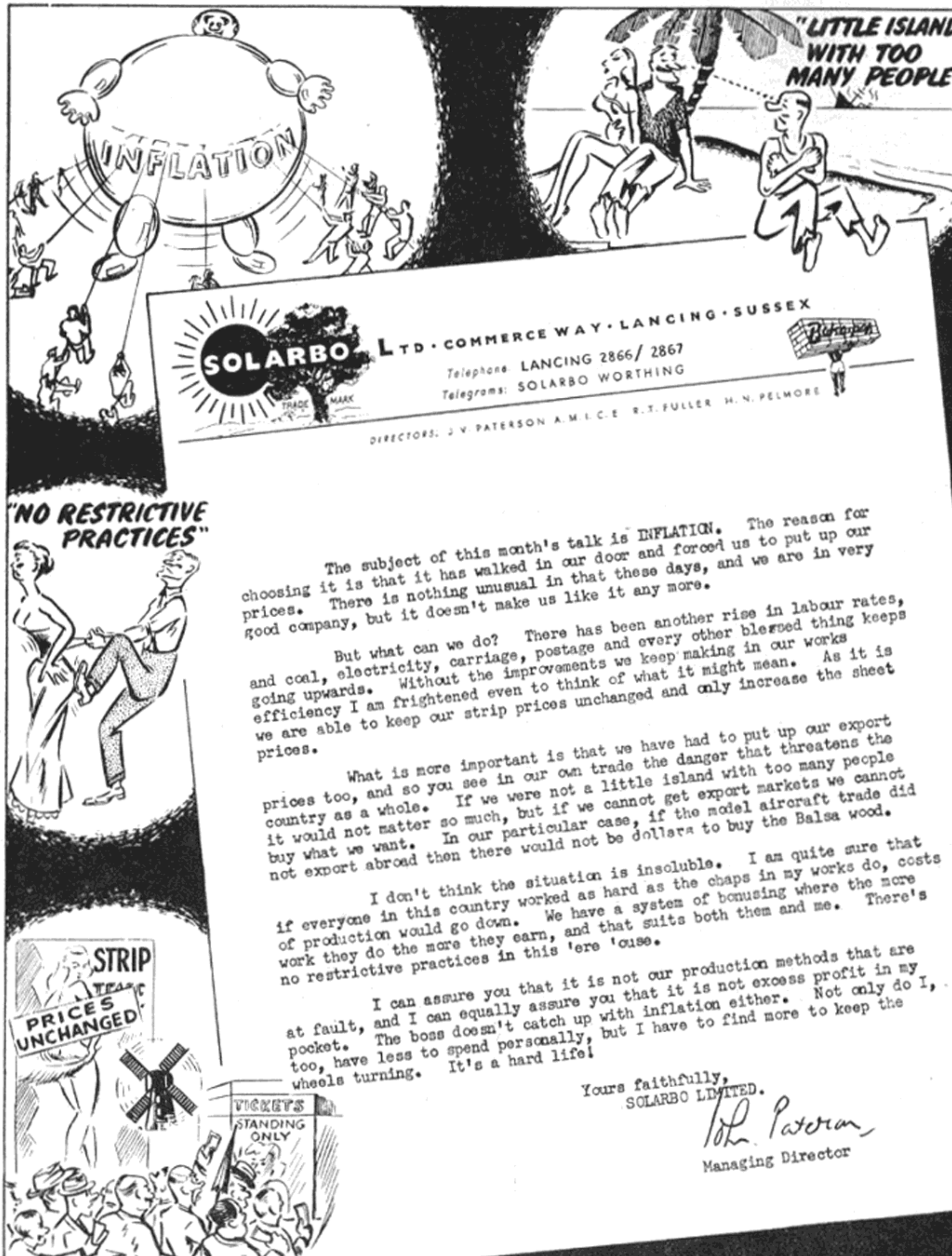
MODEL AIRCRAFT

Exclusive! THE D.H. HERON 4 ENGINE CONTROLLINER

1'6

MAY 1956



The subject of this month's talk is INFLATION. The reason for choosing it is that it has walked in our door and forced us to put up our prices. There is nothing unusual in that these days, and we are in very good company, but it doesn't make us like it any more.

But what can we do? There has been another rise in labour rates, and coal, electricity, carriage, postage and every other blessed thing keeps going upwards. Without the improvements we keep making in our works efficiency I am frightened even to think of what it might mean. As it is we are able to keep our strip prices unchanged and only increase the sheet prices.

What is more important is that we have had to put up our export prices too, and so you see in our own trade the danger that threatens the country as a whole. If we were not a little island with too many people it would not matter so much, but if we cannot get export markets we cannot buy what we want. In our particular case, if the model aircraft trade did not export abroad then there would not be dollars to buy the Balsa wood.

I don't think the situation is insoluble. I am quite sure that if everyone in this country worked as hard as the chaps in my works do, costs of production would go down. We have a system of bonusing where the more work they do the more they earn, and that suits both them and me. There's no restrictive practices in this 'ere 'ouse.

I can assure you that it is not our production methods that are at fault, and I can equally assure you that it is not excess profit in my pocket. The boss doesn't catch up with inflation either. Not only do I, too, have less to spend personally, but I have to find more to keep the wheels turning. It's a hard life!

Yours faithfully,
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Managing Director


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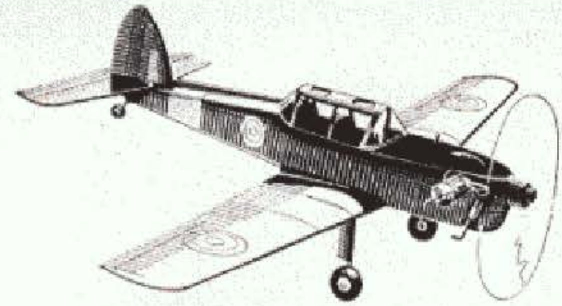


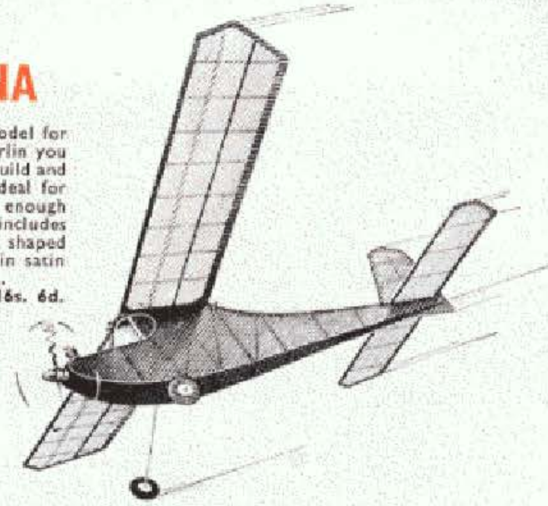
CHIPMUNK

For Dart or Super Merlin. Accurate control-line replica of the Duke of Edinburgh's trainer with authentic registration letters, etc., supplied as sheet of first-class transfers. Kit is complete with wheels, tank and pre-shaped wing. All other parts are printed on top grade balsa and construction is made ridiculously easy by the special schematic stage-by-stage instruction sheet. **Price 15s.**

BALLERINA

A better free-flight model for the Dart or Super Merlin you will not find. Easy to build and simple to trim it is ideal for the beginner and lively enough for the expert. Kit includes accurate printed parts, shaped trailing edge, etc., all in satin smooth top grade balsa.

Price 16s. 6d.



Reduced Price BAMBI

The world's smallest production diesel, 0.015 c.c. now available at a greatly reduced price due to improved methods of manufacture. Perfect for miniature flying scale and free flight models it now costs only

£3 19s. 8d.

Control-line or Free-flight

Whatever your modelling taste there is a Davies Charlton Kit or Allbon Engine to suit your requirements. All our products are borne of years of experience in the model trade and made from the finest materials to meticulous standards. In addition they are backed by a complete spares and accessories range including useful items such as Test Stands, Cut-off Valves, Extended Compression Screws, Extended Needle Valves, Sidewinder tanks for the Super Merlin, Propellers, Marine Accessories and Allbon Ready Mixed Diesel Fuel. Ask to see them at your Local Model Shop, or in case of difficulty contact the manufacturers.

DART 0·5 c.c. 0·03 cu. in.

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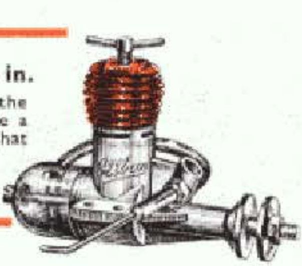
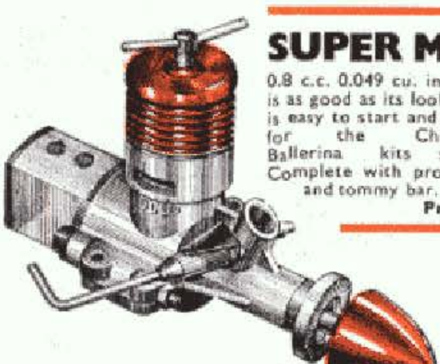
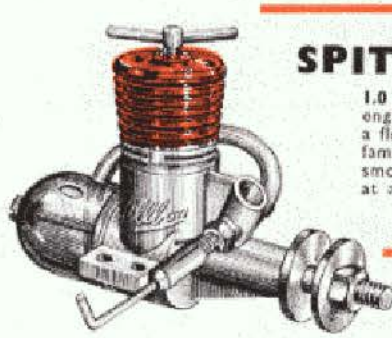




SUPER MERLIN

0.8 c.c. 0.049 cu. in. Performance is as good as its looks, and it really is easy to start and operate. Ideal for the Chipmunk and Ballerina kits shown above. Complete with propeller, spinner and tommy bar.

Price £2 16s. 9d.



SPITFIRE

1.0 c.c., 0.06 cu. in. The perfect engine for the beginner, starts with a flick and runs for a lifetime. It is famous for its flexibility, running smoothly from tickover to full revs., at a turn of the throttle.

Price £4 6s. 6d.

SABRE

1.49 c.c., 0.09 cu. in. Complete with integral tank, propeller, spinner and tommy bar this powerful motor is ideal for the smaller radio control model as well as free-flight and control-line. **Price £3 7s. 5d.**

MANXMAN

3.5 c.c., 0.21 cu. in. A powerful, rugged motor beautifully made and finished that is suitable for any type of model and especially suitable for radio control flying.

Price £3 19s. 8d.

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Contents

Cover Story

Inspired by Russell Adams' fine cover photo? Inside you will find detailed plans and instructions to build a four engined control line replica of this fine machine. Frank Buckland's original won the Concours d'Elegance at last year's All Britain Rally, and many will remember the impressive sight it made in flight. The plane on the cover is the Heron of the Queen's Flight, which is, on occasion, piloted by the Duke of Edinburgh. This machine is the latest type with retracting undercarriage. Frank Buckland's model is, of course, an earlier Mk.

THE JOURNAL OF THE SOCIETY OF MODEL AERONAUTICAL ENGINEERS

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Letters TO THE EDITOR

Continental Contradiction

DEAR SIR,—With great astonishment I read in the February issue of MODEL AIRCRAFT a letter from Mrs. Pamela Buckland about toilet-facilities at an English contest.

I can hardly imagine that such primitive conditions would be accepted in a country like, for example, Holland. The remark that "these shoulder high contraptions are the rule rather than the exception on the Continent," is exaggerated and I advise the writer to visit a Dutch contest, in order to assure herself that better provision is made over here.

Yours faithfully,
G. A. M. GUSSENHOVEN.
Vliegbasis Volkel,
Holland.

The Old Routine

DEAR SIR,—Yes, it's the tune title, but this letter has nothing to do with melodies! I'm back into the old routine and all because of a visit to Epsom Downs, that paradise of control-liners, eight miler's and gliders.

More years ago than I care to remember—and I'm not that ancient!—I built 'em, flew 'em and lost 'em. They were the "good old days" of J.B.3's, scale Tiggie's, Phineas Pinkham of the Flying Aces Magazine. Also the meetings at Fairey's ground, seeing the big men of the S.M.A.E.; watching, goggle-eyed, the superbly built young Germans competing with our own British teams in the international gliding finals, and breathlessly reading of Lord Wakefield's latest cup award.

All that came with the days of rubber and soft soap and the folding airscrew. Well . . . what's happened to it all? What did I find at Epsom Downs this time? Talk of 0.5's and 0.87's with conversations of "Use a heavier mix, old chap; you'll get more climb." Sleek little buzzers and Jetex pills all out of a ready to assemble kit!

Sadly, I thought, "Maybe they get the same enjoyment, but I doubt it. For where's the pleasure of building?" What kind of a modeller is it that can't cut a true $\frac{1}{16}$ in. strip from a 1/32 in. sheet by hand? What kind of a modeller is it that can't cut and sand a prop from a blank? Or fashion full balloon wheels from a hardwood block? "Can they," I wondered, "even do a quick banana

(Continued on page 187)

THE NATIONALS
New Venue Announced

THE R.A.F. Station Hemswell is the venue for the 1956 Nationals. It is situated approximately 15 miles north of Lincoln on the A15. A camping site will be available, but for the "hoteliers" the nearest towns are Lincoln, Gainsborough or Market Rasen. The cancellation of Waterbeach is but another reminder of the increasing difficulty of securing suitable venues for centralised contests. With the stepping up of R.A.F.V.R. weekend flying, and the greater use of aerodromes for gliding and other flying activities by the A.T.C., it behoves ALL members of the Society, when an aerodrome is made available, to show every consideration in its use.

Now that both the main centralised events of the year are in the north, we look forward to a large northern entry, and confidently predict that the clubs who have complained of unfair allocation of these contests in the past will rally round and organise the most memorable Nationals ever.

Readers Can Write!

IT seems that there may exist in the minds of some of our readers a misapprehension as to the sources from which we receive the articles and plans that are published in MODEL AIRCRAFT. A reader recently sent in an article for our consideration, and in his letter he suggested that as we no doubt had a regular team of writers, we would probably not be interested in material submitted by a casual contributor.

Well, this is just not the case. It is true that the work of certain writers appears quite frequently in our pages but we still rely largely on the "solo" writer for our feature material. We are always ready to consider articles, plans, photographs and cartoons, and of course anything published will be paid for at our usual rates. Provided working drawings are clear and accurate, our draughtsmen can prepare finished tracings from pencil originals. In connection with plans, we like to have photographs as additional illustration, and prefer to reproduce from enlargements about 6 in. × 4 in., but we can make our own enlargements from negatives.

Home & Away

HOW many models do you keep operational ? One ? Two ? Well, not many more if your building programme is limited to an occasional foray on the kitchen table, or if the proceeds of your workroom are expended as rapidly on the airfield as are ours. Possibly some of the keener flying scale types can boast a veritable fleet of airworthy craft built up over the years, but for sheer output the ardent contest type takes the proverbial cake.

Broaching our leading question to one such addict he casually reeled off a formidable list of Wakefields, power jobs, gliders and Jetex, all in showcase condition and rarin' to go. An equally formidable list was his nostalgic inventory of machines that had gone forever o.o.s. during the season.

The total score, we believe, was 8 home and 6 away. Can anyone better this for a season's output ?

ARE YOU FIREPROOF ?

IT is strange, in a way, that the power driven model aeroplane is comparatively immune from the hazard of fire. A full size aeroplane is potentially a highly inflammable "package" as witness the high percentage of crashes which end up with the aircraft catching fire. Yet even in the days when petrol was the standard fuel for model engines, very few models met their end in this way.

Diesel fuel appears almost completely "fireproof" in this respect, especially as no separate ignition

Pickles asks M.A.

WHAT, we wondered, would Wilfred Pickles want with a model aeroplane, as we struggled through the West End crowds bearing a large model box ? Our uncertainty was resolved when we arrived at Wilfred's flat and met young Rodney, a sixteen year old who, until he shattered his left hand, had ambitions to be a R.A.F. pilot. However, with the help of Wilfred Pickles, he is now assured of a job in aviation. Meanwhile he has his hobby, which is making model aircraft, and in the photograph Rodney is seen discussing the finer points of a Frog 45 with him.

system is necessary to ignite it. Glow fuel will burn—and an almost certain way of setting a glo-motor alight is to prime it through the exhaust with the plug connected. But the resulting blue flame licking round the cylinder is easily enough put out with a strong puff, if you take action at once.

Sometimes things *do* get out of hand. Once we helped check out a power model for a friend in the passage of his house, just before leaving for a contest. Between us we got the model well alight, when the only thing left to do was to grab it, rush through to the back door and hurl it into the garden. With commendable presence of mind our friend seized a full bowl of water conveniently to hand near the kitchen sink and hurled its contents over the still burning model—water plus all the breakfast cups and saucers still waiting to be washed up! In fact, in totalling up the damage later, replacement crockery was by far the largest item!

IT HAD TO HAPPEN!

BILLED as "The Greatest Show on Air," Gloria Ann and Rolando, the Cuban rhumba and mambo team, perform nightly in Cubana de Aviacion's specially decorated *Tropicana Special* Constellation en route from Miami to Havana. (*See photo. below*).

Designed to popularise the service with holidaying New Yorkers prior to the inaugural flight of a non-stop New York-Havana service later this year, the floor show is backed up with cocktails, music and champagne. The cabin is fitted out with stage backdrops and sidewalls and there is even an airborne piano. With the added attraction of dinner, drinks and two floor shows in a Havana night club, what are we waiting for?

FIRST with the FASTEST

The man and the machine—Peter Twiss, who attained 1,132 m.p.h. in the Fairy F.D. 2.

WHILE Fairey's scored the first "over 1,000 m.p.h." with the F.D.2, MODEL AIRCRAFT also scored a first with this machine. Our November issue (on sale September 20th) contained the first 3-view drawing of the F.D.2 ever published. One or two provisional silhouettes had appeared before then, but this was the first authentic drawing, completed incidentally from Fairey's works drawing. S.M.A. 58 is now among the "best sellers."

But this is not the only time MODEL AIRCRAFT has been first with the gen. A monthly aviation journal recently published a photograph of the Grumman TF-1, with the claim that it was the "First photograph . . ." etc. The January MODEL AIRCRAFT (published December 20th) showed the TF-1 in "Photographs from Philadelphia," which just goes to show!

These points, we think, provide the perfect squelch to a correspondent who asked why MODEL AIRCRAFT included information on full size aircraft when it could be seen in any of the specialised journals free at the local library. Answer: Can it?

The Model or the Man?

WHAT makes a contest winner—the model or the man? Well, the model counts quite a lot, but in the end it is really the man flying it who is responsible for winning—or losing—the contest.

That is why we can regard with some amusement the highly accurate plan of a certain "championship" model, rib spacings detailed separately to 1/32 in. and every part drawn out with the utmost precision. We happen to know that the builder disdained the use of anything like a detailed plan when building the model and, in fact, sighted in the ribs by eye!

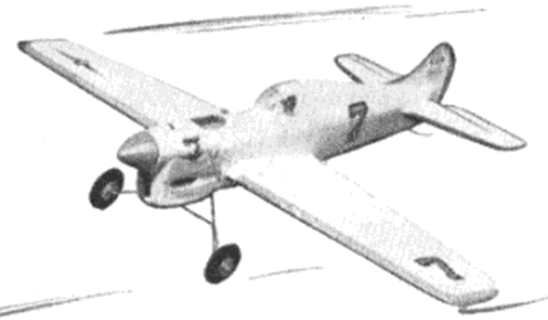
The Hard Way

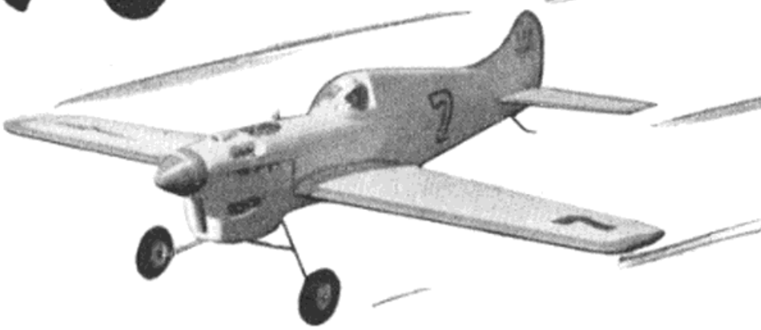
PROBABLY the most accurate and finely finished of all models are those produced for wind tunnel work. In the low speed tunnels the models used are made from mahogany or teak laminatons, with a tough, durable lacquer finish. Tufnol is used for parts which require exceptionally precise manufacture, like control surfaces.

In the high speed tunnels, and particularly in the case of supersonic tunnels, the loading on the front of the model may be as high as one ton pressure per square foot. Wood is out of the question as a building material and these models have to be made from high tensile steel, with the finest surface finish possible.

One establishment who makes and tests these models employs (unknowingly?) at least three top contest fliers.

KESTREL





CPL. GODFREY'S 100 m.p.h. Class B Team Racer

THIS model holds the R.A.F.-M.A.A. Class 2 speed record of 111.9 m.p.h., officially timed at the 1955 R.A.F.M.A.A. Championships. Total weight of model was 24 oz., and it was powered by a normal ETA 29 Series 4, fitted with a Frog 500 needle and spray bar.

First cut out the solid crutch from medium hard $\frac{1}{2}$ in. balsa, and cement the $\frac{1}{2} \times \frac{3}{8}$ in. hardwood engine bearers to this. Then place the crutch with bearers, in a vice or cramp under slight pressure, and leave to dry completely. Next cut out the $\frac{1}{8}$ in. ply former F1 and fix undercarriage to same; this can be attached either by the method shown on the plan or by the normal binding method. When u/c is fitted cut out the $\frac{1}{8}$ in. balsa F1a and laminate behind the ply F1.

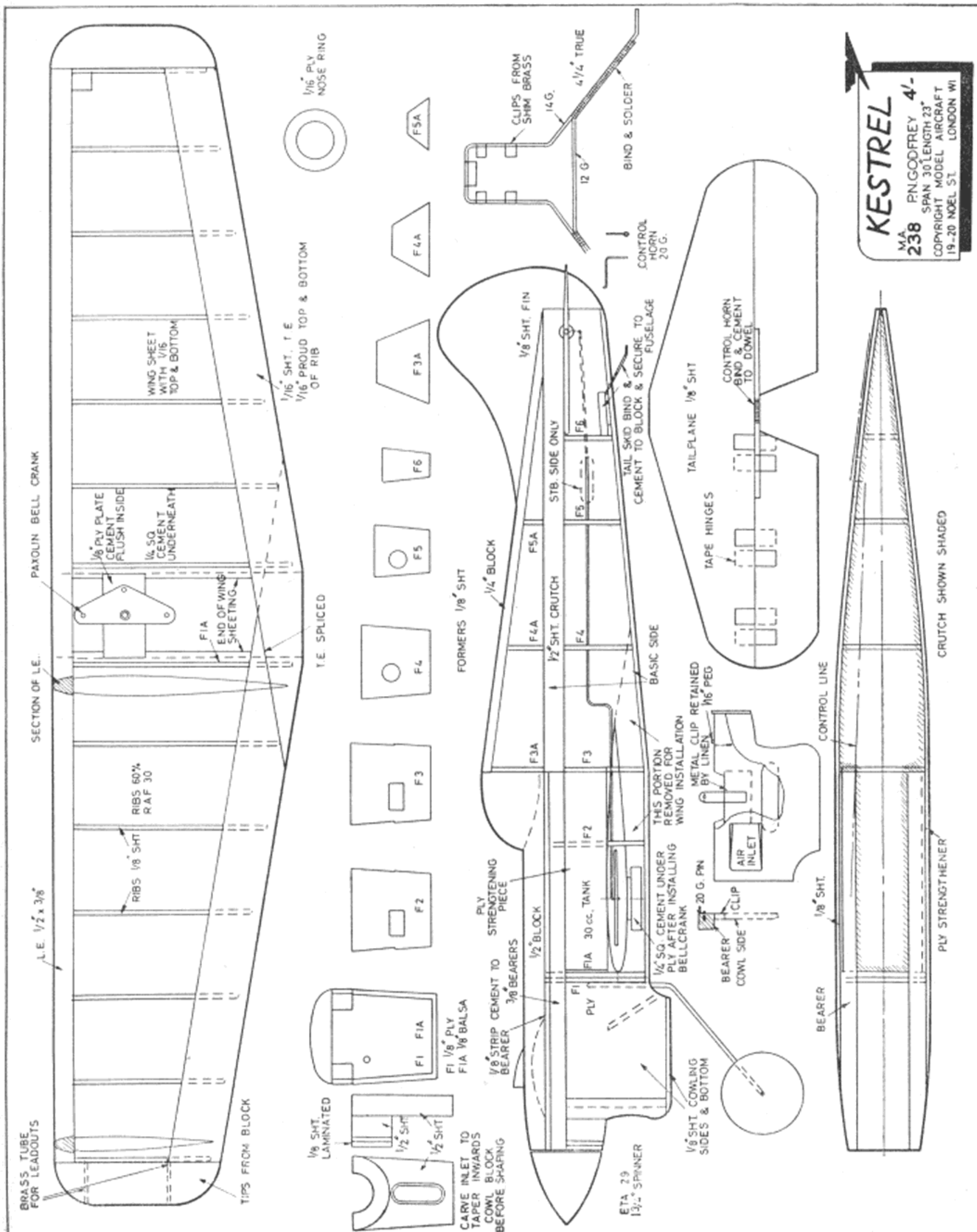
Next step is to fit the fuel tank to the crutch. If a normal 30 c.c. commercial tank is fitted, it will be necessary to extend the vent tubes so that they protrude through the crutch and the top decking block. The tank is held in place by cementing it straight on to the crutch; this will hold it until F1 and F2 are in position, then it is packed firmly with scrap balsa. Now fit the bottom formers F1, F2, F3, F4, F5 and F6. While these are drying you can cut out the basic sides so that they overlap the crutch, thus forming one side of the bearer box. Before fixing sides to the crutch, drop in the 1/32 in. ply strengtheners (shown by broken line on the plan) each side; these are fitted flush with the sheeting, i.e. let into the formers. Now you may fix the basic sides holding the rear end with a clothes peg or similar clip.

Fit the top half formers in position, the side upper decking and the $\frac{1}{4}$ in. backbone and leave to dry, then trim off and sand to rough shape. Fit the front top decking block in place, not forgetting to cut out the cockpit. It is also advisable to mark and drill out the engine bolt holes before fitting this block, and to remember that the tank vents must pass through this block. The $\frac{1}{16}$ in. ply nose ring can now be cemented in place and left to dry, then carve off all surplus block to conform with the plan.

The top block is carved away and recessed so that the engine mounting bolts can be replaced at any time (see photographs).

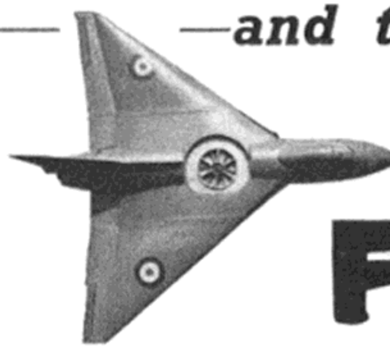
The cowling is the next item and it must, of course, suit the motor used. However, the construction can easily be followed in the exploded view. For an ETA, cut out front block from $\frac{1}{2}$ in. sheet, then mark out the cooling hole as shown on plan, and carve away so that it tapers inwards. After cutting out the hole for crankshaft cement to $\frac{1}{16}$ in. ply nose ring and lightly cement to engine bearers, so that it will hold firm whilst carving. Next cut out the sheet sides and cement to nose block only, not forgetting the exhaust outlet, then cement bottom sheet in position and leave to dry before carving to shape. When all carving is completed remove from the fuselage by splitting the $\frac{1}{16}$ in. ply nose ring so that there is $\frac{1}{8}$ in. overlap over the bearers (see plan). Next cut out and cement in place the back former of the cowling, but make sure this is cemented at an angle so that it deflects all hot air downwards to the outlet hole at bottom (see plan). Now fix the holding clips; these can be followed from the exploded view.

The wing is built over the plan and is covered with medium grade $\frac{1}{16}$ in. sheet. Lead outs can be either heavy "Laystrate" or 20 S.W.G. wire. When complete it is offered up to the fuselage and firmly cemented, after checking for negative incidence and correct line up. When dry, the parts F.S.1 can be cemented in position; these form the fuselage sides underneath the wings. Now the bell-crank assembly can be fitted; the $\frac{1}{8}$ in. ply bell-crank plate is fitted flush inside the pieces F.S.1 and then strengthened by cementing $\frac{1}{4} \times \frac{1}{4}$ in. strip under the ply plate (see side view of plan). Once the wing and bell-crank assembly are in position, fit the tailplane and check for correct line up, and connect up push rod and lead outs to bell-crank. Finally, the bottom sheeting of fuselage can be placed in position. When dry, sand off all square edges and also sand the complete model down before covering with lightweight Modelspan.



FULL SIZE WORKING DRAWINGS ARE OBTAINABLE FROM YOUR LOCAL DEALER, OR BY POST FROM THE "MODEL AIRCRAFT" PLANS DEPARTMENT, 19-20, NOEL STREET, LONDON, W.1, 4s. 0d., POST FREE

JET PROPULSION—— —and the MODEL



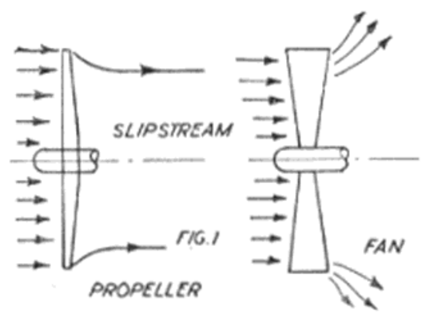
PART FIVE

DUCTED FANS

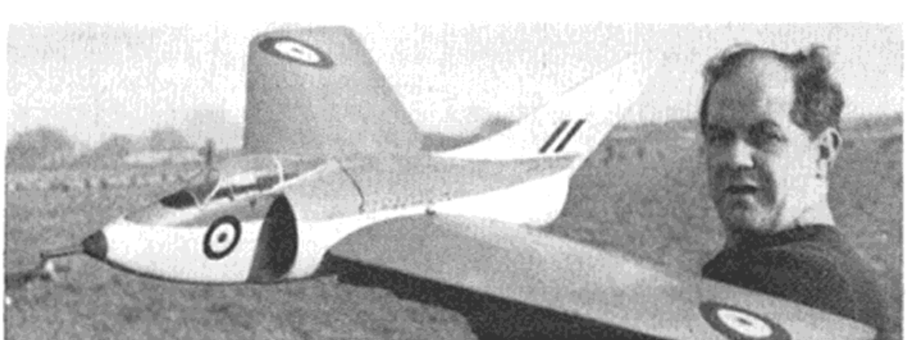
THE ducted fan has often been called the "poor man's jet engine" since it consists, essentially, of a propeller-engine combination enclosed within a tube or duct. To reduce the arrangement to a practical size, propeller diameter must be reduced to a minimum, calling for a multi-bladed fan in place of a conventional airscrew but otherwise, apart from the fact that the unit is mounted inside the fuselage of a model, the arrangement is not much more complicated than an ordinary engine installation. Thus it becomes a practical system for powering jet-type F/F models with all the advantages of normal engine operation. Its main limitation is that the system is less efficient than a conventional propeller-engine combination so that, unless careful attention is given to detail design, the resulting model may be underpowered. Largely this is a question of "scale effect" for, full size, the ducted fan can be a most efficient system, as developed in the modern by-pass engine.

The thrust produced by any propeller system is largely a matter of the *quantity* of air it displaces and, ideally, should move the maximum quantity of air per unit time. Thus the smaller the diameter of the propeller the greater must be the displacement rate, for similar results. The greater the displacement rate the higher the slipstream or "jet" velocity and, inevitably, the higher the energy losses. Thus the most efficient propulsive system is one which handles the most air, for a given power, with the lowest velocity jet. This explains why the larger diameter propeller tends to be more efficient than a small diameter fan as a thrust producer.

A conventional fan also has one further limitation. In the case of a propeller the slipstream is contracted behind the propeller disc—usually called the actuator disc when considering airflow characteristics. With a wide-blade fan rotating at high



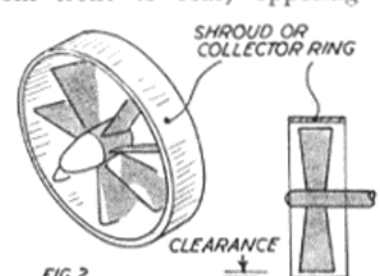
speeds there is a considerable spillage of air outwards from the actuator disc, again giving higher energy losses—Fig. 1. This defect, however, can be overcome by fitting a collector ring around the fan so that enclosing the fan within a duct immediately tends to improve its efficiency. To minimise such losses, the collector ring must be closely fitted calling for the minimum clearance between the periphery of the fan and the ducting—Fig. 2.



Well known experimenter P. E. Norman with one of his ducted fan models.

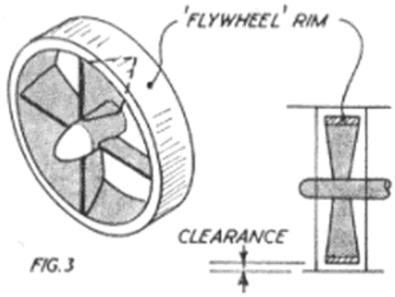
The solution here is largely a practical one. How closely can the duct be made to fit the fan without any danger of actual contact during operation? The closer the fit the better, which means an accurate installation free from vibration and the fan periphery truly circular. Another solution is to fit the collector rim to the tips of the fan blades themselves—Fig. 3—the flywheel action of this rim also being helpful in promoting smooth running. Such a fan, however, is more difficult to make and one of the chief attractions of the ducted fan layout is the simple construction which can be used to produce satisfactory fans of reasonable efficiency.

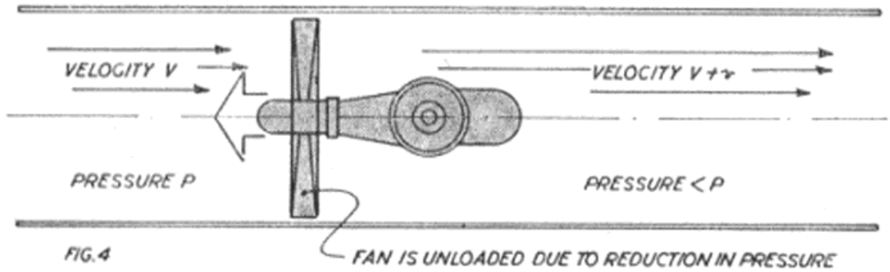
Just putting the fan within a close fitting parallel tube will result in a very inefficient system—Fig. 4. Air is speeded up in passing through the fan and thus is flowing faster through the tailpipe section than the intake section. The intake end is therefore operating at a higher pressure than the tailpipe end so there is a definite force acting from front to rear, opposing the



reaction thrust force generated by the fan. Hence the effective thrust will be low. Also the drop in pressure will tend to "unload" the fan, causing it to speed up and probably result in a loss of power output from the engine, or even produce erratic running and overheating.

Ideally, then, the diameters of the intake and tailpipe sections should be adjusted to match the pressure-

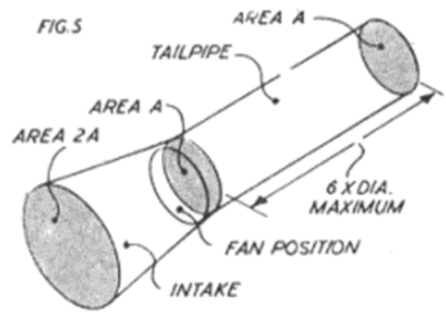


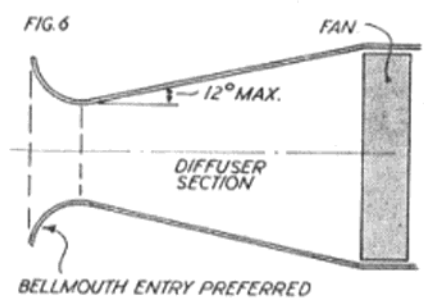


velocity in each section. To accommodate the higher air velocity behind the fan the tailpipe is made smaller in diameter than the intake leading to what is the more or less " classic " arrangement for ducted fan systems shown in Fig. 5, the fan being located at the transition point of the two sections. For the intake section to have twice the area of the throat or tailpipe section its diameter must be nearly $1\frac{1}{2}$ times that of the smaller section (actually $\sqrt{2}$ or 1.414 times).

This is not necessarily the best practical arrangement, for a large diameter intake seldom fits in with a scale fuselage shape without reducing the throat section, and thus the fan diameter, to an impractical size. The most efficient system, too, will come from the largest diameter fan possible within the limits of fuselage section.

Fortunately, satisfactory results can be obtained from diffuser type inlets (i.e. where the inlet area is smaller than the throat or fan area and consequently the entering air is expanded and slowed down slightly, or diffused). Some experimental data of American origin are reproduced in Fig. 7 showing the effect of varying the inlet area relative to the exit area on a typical ducted fan system. Another authority recommends that where a diffuser type intake is employed the actual taper should not exceed 12 deg. and that the efficiency of the system can be increased by rounding the lips of the actual intake end into the form of a bellmouth as shown in Fig. 6 above.





The efficiency of any intake shape will be different at low speeds (or zero speed) than at high speeds. In general, the smaller the intake area the poorer the inflow at low speeds, so static thrust may be appreciable lower than the thrust obtained at normal flight speeds. Bellmouth entries are generally good for high speeds, but tend to have rather high drag. The increase in thrust obtained with some ducted fan arrangements at speed, compared with static running, is often erroneously put down to " ram " air effect. Below about 50 m.p.h. the effect of ram air is negligible and above that is increasingly effective in *reducing* the actual thrust.

A similar set of experimental curves for different exit areas are shown in Fig. 8, again from American data. Fairly obviously a large exit area is desirable although with the exit area as large as the fan diameter the flow velocity past the engine will be high and some losses are inevitable. Hence the gradual tapering off of these curves as the exit area approaches the fan area. Conversely, restricting the exit area too much will cause excessive back pressure which may stall the fan blades so that it will not handle all the air it can, and again the thrust output is reduced.

Largely, finding the optimum arrangement of shapes and sizes is a matter of practical experiment. Further improvements in efficiency can then result from careful detail design in streamlining the contents of the duct, i.e. the engine installation. In this respect it should be re-

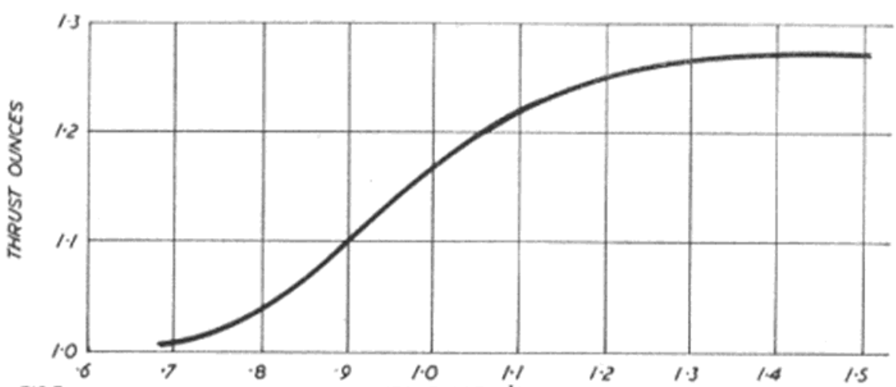


FIG.7

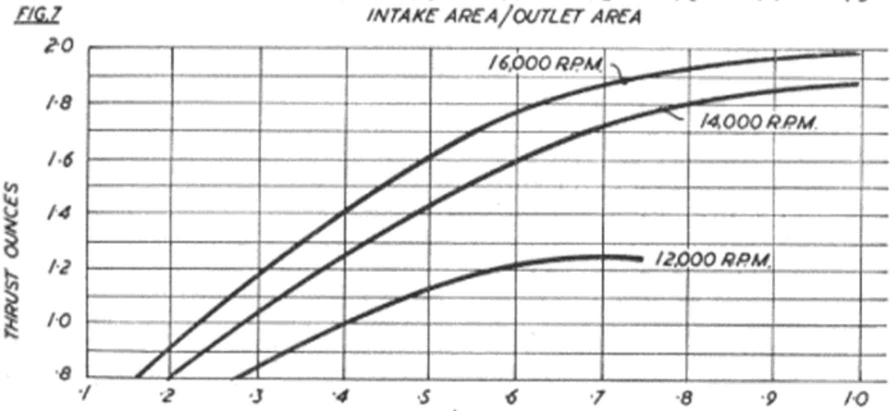
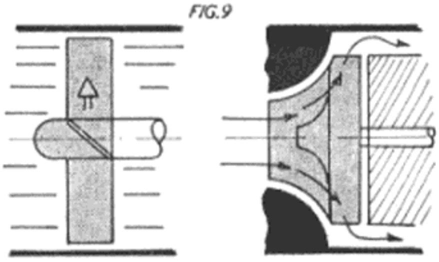
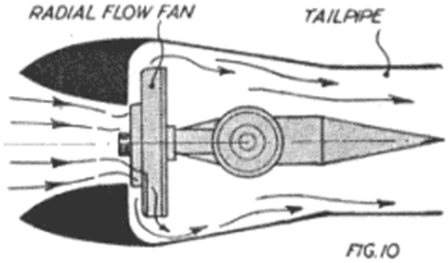
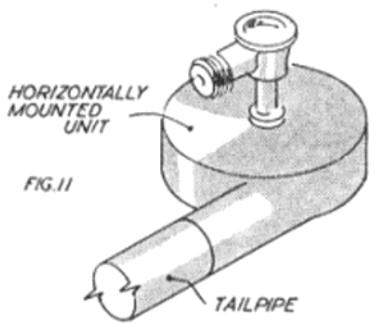
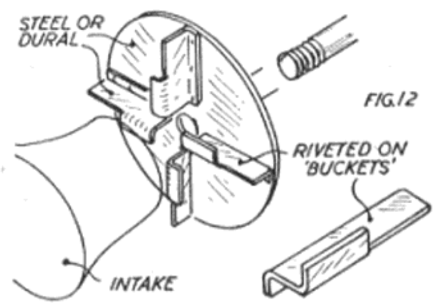


FIG.8









membered that one of the basic laws of streamlining is that the rear shape is far more important than the front shape and so a tail cone fairing in the engine crankcase and tank will be far more effective than a spinner on the front of the shaft in saving drag. The whole of the interior of the ducting should be smooth without abrupt changes in section, corners or other obstructions.

Regarding fans, there are two basic types which can be considered—the normal axial flow fan and the radial flow or centrifugal type—Fig. 9. The pressure rise which can be obtained from a single axial flow fan is quite small which is why, in full size jet engines, axial flow compressors consist of numerous rows of such fans. It generally takes at least eight sets of axial flow fans to get the same pressure as can be achieved with a single centrifugal fan. In model sizes, for the same diameter an axial type fan (centrifugal) should be capable of producing at least twice the pressure of a single radial fan.

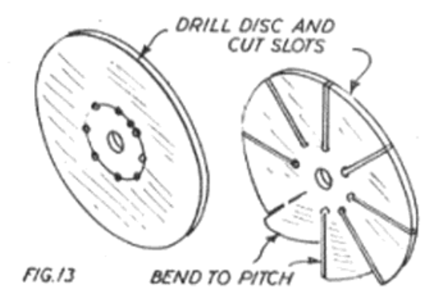
A centrifugal "blower," then, appears to be a far more attractive proposition but has the disadvantages of being more complicated to make and more difficult to install. Of two possible arrangements—Figs. 10 and 11—the most attractive solution appears to be to mount the blower on its side fitted within an elementary form of plenum chamber which exhausts into the tailpipe (Fig. 11). The direct system—Fig. 10—has the disadvantage of requiring rather careful ducting design and construction to maintain good efficiency in collecting the radial airflow and turning it back into the tailpipe.

Quite elementary forms of centrifugal fans will give good results, a suitable type being shown in Fig. 12 together with a typical axial fan made from sheet metal (usually 16 S.W.G. dural) in Fig. 13. More complicated forms of built-up fans (of both types) are now in common use and may show increased efficiency. It is claimed by one authority that for axial flow fans a four-bladed carved wooden fan is more efficient than bent metal fans.

Pitch angles required on axial fans are related to the exit area of the system, the fan diameter and engine power. With fan diameter made as large as possible, operating r.p.m. must be such that the engine does not exceed the peak b.h.p. point otherwise even if the engine is going faster it will, in actual fact, be doing less useful work on the air. The exit area governs the pitch in that the shape and volume of the tailpipe govern the back pressure and thus the point at which the fan blades will be stalled. Some American figures are summarised in Table I.

Operating conditions are slightly different with axial flow and radial flow fans. In the latter case induction is generally less critical and the required air can be drawn in from side- or upright-facing intakes, if preferred. With a forward facing intake and a centrifugal, ram air (e.g. when operating at speed) has the effect of loading the engine and thus flight r.p.m. may be less than static r.p.m., whereas the reverse is true with an axial type fan. Here the engine will tend to speed up in the air as the fan blades are "unloaded."

Although "jet" engines, ducted fans are not free from torque. The torque reaction, in fact, is exactly similar to that on a conventional propeller-driven model except that the engine driving the ducted fan is usually operating at a higher speed and thus the actual torque force is less. Torque effect is most conveniently trimmed out by "balanced" reaction, e.g. by using a small offset vane in the extreme end of the tailpipe or the use of angled "straightening" vanes in the main tailpipe section. Such vanes are effective in straightening out the airflow, which



is relatively unimportant, but the side load imposed on them in so doing is effective in countering the natural rolling force generated by torque reaction.

Undoubtedly the efficiency of the ducted fan system at its present state of development is still lower than the optimum figure which could be achieved and thus there is considerable scope for further development. On a majority of applications the power output is marginal and keeping the total model weight down to compensate for this is, in most cases, essential.

TABLE I

Fan diameter (in.)	3	3½	4	4	5
Motor size (cu. in.)	.049	.049	.149	.19	.19
Outlet diameter (in.)	2.5	3.0	3.5	3.5	4.0
Fan tip angle (deg.)	30	25	37	38	38
Static thrust (oz.)	6.25	8	14	26	30*

* Estimated

IT'S THE ATTENTION TO DETAIL THAT GIVES

Superior Solids

says

David Stock

Just how "superior" the author's solids are is shown by the following photographs. Those on this page show a De Havilland 2 well on the way towards completion. The "ribs" effect can be clearly seen in the heading photo.

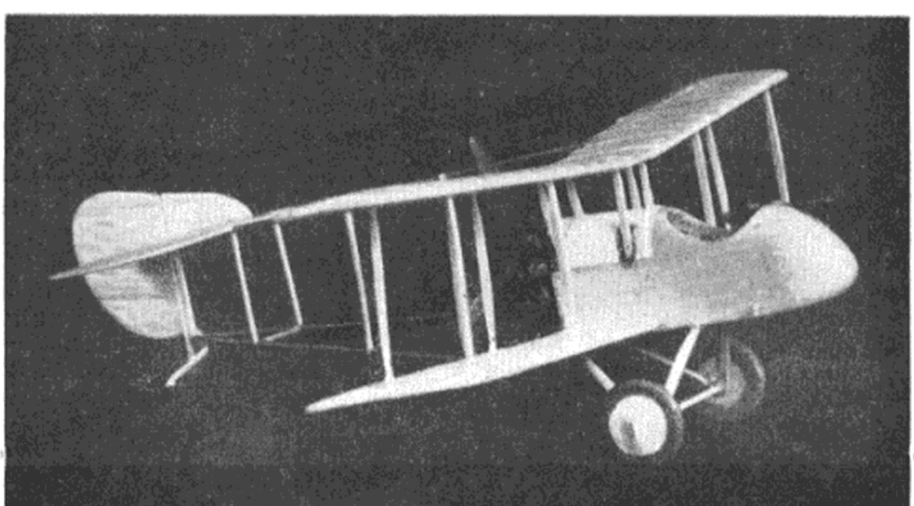
WHETHER you have built one or one hundred solids, there is always something new to learn in constructional and finishing techniques, which will make the difference between just another model, and a show job.

If you have made several 1/72nd scale models and are now trying more detailed work then the "ways and means" to the results shown may be of help to you. Firstly, let me say that I use balsa for all main components, my experience being that the ease of working with balsa far outweighs any difficulties in "finishing."

Cockpit details can be attempted by making your fuselages from two pieces of medium hard balsa, lightly cemented together so that you can shape the exterior and then separate to carve out the cockpit. A coat or two of clear dope before separating strengthens the wood considerably so that the cockpit walls can be worked down to about 1/32 in. thickness. Add details on a false floor set into one side. The Mig 15 fuselage was one block, so I removed the whole of the top of the nose, replacing the "skin" section after hollowing.

Engines like that on the R.E.8 can be made from 8 B.A. bolts, with their heads removed, placed in an inverted V-jig: liquid solder is then squeezed over the ragged ends of the bolts and left for 48 hours before slipping off the jig to clean up. Does the word "jig" worry you? Well you will certainly be using templates to get the correct sections on fuselages and wings—so why not try a jig for an engine? Why stop there? Most of my assembling is done on quickly made rough jigs—mainly wood pinned to my board with scrap blocks holding fuselage and surfaces correctly. It is not a lot of trouble and the finished job is certainly accurate.

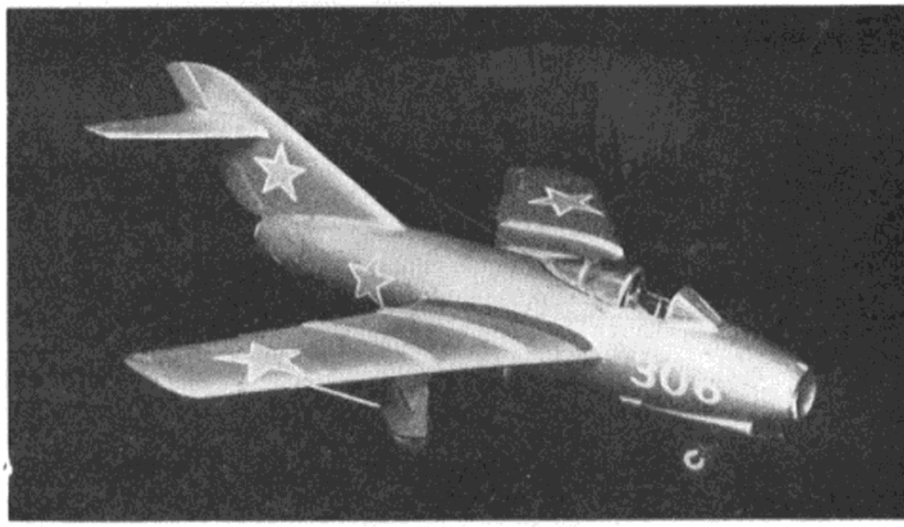
Radial types of engine are made by shaping the crankcase on a small block, leaving it attached to facilitate handling, and cementing behind the crankcase a piece of paper marked with radial lines indicating the cylinder positions. "Screw-cut" a length of wood with a small nut, giving the resultant screwed rod a coat of clear dope and passing it through the nut again. Cut a length gauge from scrap and use it to cut the screwed rod into identical cylinders. Cement them round the crankcase using the paper pattern as a guide. Valve rods on the DH 2's Gnome were bent from 5 amp. fuse wire using the end of my tweezers as an impromptu jig. The Armstrong-Siddely Jaguar engine, for a "Siskin," was made similarly—rotating the paper pattern, which was for seven cylinders, for the second row. You can make smaller details from matchwood in preference to balsa. Always complete and paint an engine before cutting the crankcase from its original block.



For fabric covered wing surfaces I use the old method of covering cotton "ribs" with tissue "fabric." Wings for most smaller aircraft are $\frac{1}{16}$ in. hard balsa and after shaping and including dihedral this needs a coat or two of clear dope, particularly on the undersurface, to strengthen it against warping. Attach the cotton ribs using a slower drying cement, cutting the cotton in easily handled lengths and trimming when "ribbing" is complete. Brush clear dope over each rib and lightly sand, ensuring that there are no cement projections above the ribs. Cut away the ailerons. Paste one edge of a piece of Japanese tissue below the trailing edge, folding it over the upper surface and round the leading edge, pasting beforehand the tips, the inboard end and the under-surface adjacent to the original tissue edge. Cut away the tissue below the aileron spining, paste down the two flaps so formed. Trim and watershrink.

Dope the undersurface and now—the hardest job—dope the upper surface very carefully and very lightly. Avoid adhesions between the wood and the tissue and as there is only the depth of a piece of cotton between them you cannot afford one heavy brush stroke. The second coat will go on more easily than the first, so take heart! Cover the ailerons separately. The result is surely worth the trouble but be warned that you will get different results with different combinations of cement and dope. The moral is obvious!

Struts are easily made from match-box wood—clear dope again stiffens this and practically "finishes" at the



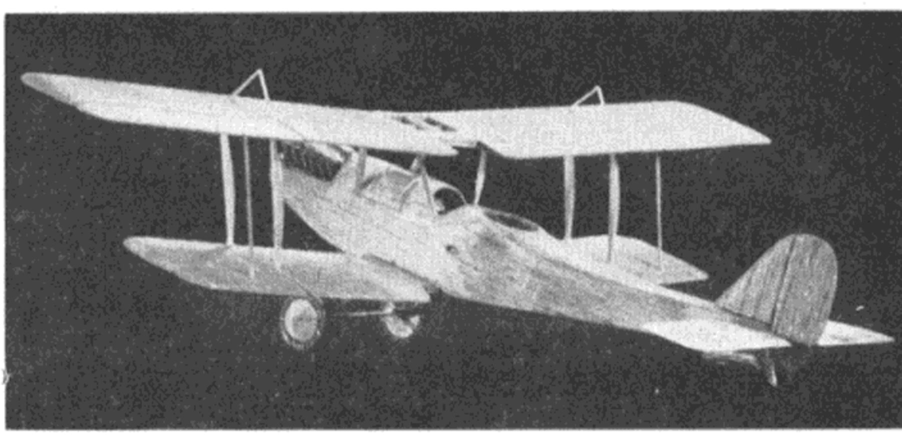
A completed model of a Mig 15—notable points are the highly detailed undercarriage and the sliding canopy, which reveals a wealth of internal detail.

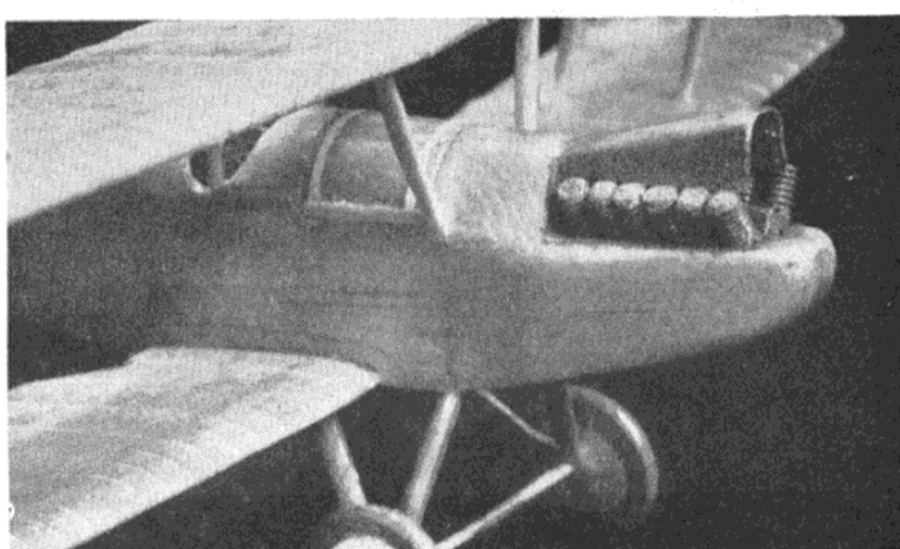
same time. One millimetre ply, with one layer of wood, suffices for most undercarriage Vs, while wheels are made from discs of $\frac{1}{16}$ in. sheet, with paper cones representing fabric covered spokes.

Guns, seats, struts, etc., can all be more simply made if you form them while they are still attached to a larger section of the material used. Obvious? Yes—but do you do it? Ease of handling a small part while working on it is half the battle towards finishing it correctly.

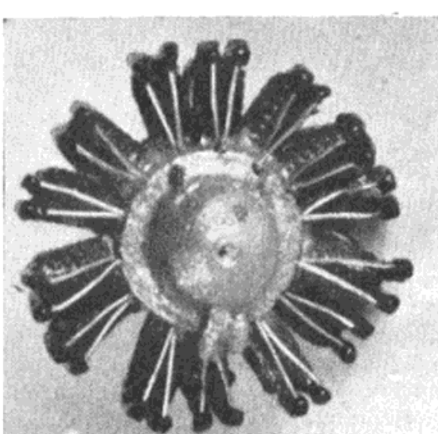
For details of the older aircraft depicted and mentioned in this short article, the following sources of reference can be extremely useful: "Camouflage of 1914-18 Aircraft," and "Aircraft of the 1914-18 War," by O. G. Thetford and E. J. Riding.

The value of photographs also as an aid to modelling cannot be too highly stressed: the Imperial War Museum have an excellent range covering a large number of early aircraft.





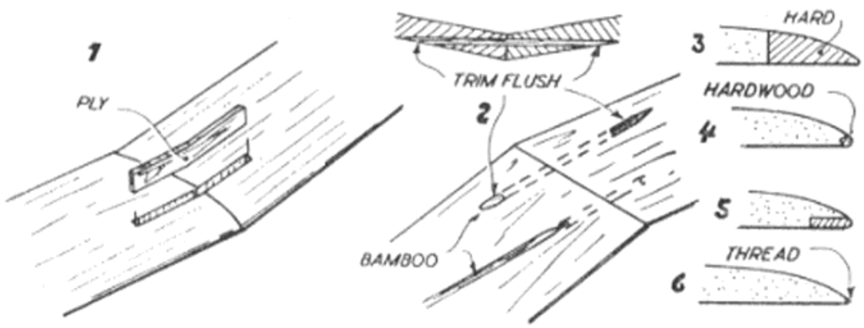
General view and close-up of an R.E.8 (Harry Tate). The realism resulting from the method of engine construction described in the text is clearly visible.



This beautifully detailed radial, which we would emphasise is to 1/72 scale, clearly illustrates the amount of finish the author considers essential in an authentic model.

TIPS ON CHUCK GLIDERS

Every modeller has a go at a chuck glider at one point in his career and one of the secrets of this type of model is to make them long lasting. The wings are heavily stressed during launching and the centre wing joint is usually the weakest part of the model. If the wing is thick enough, slot to take a 1/8 in. ply gusset (*1*).



Make the gusset a snug, but not too tight, fit and double-cement when assembling.

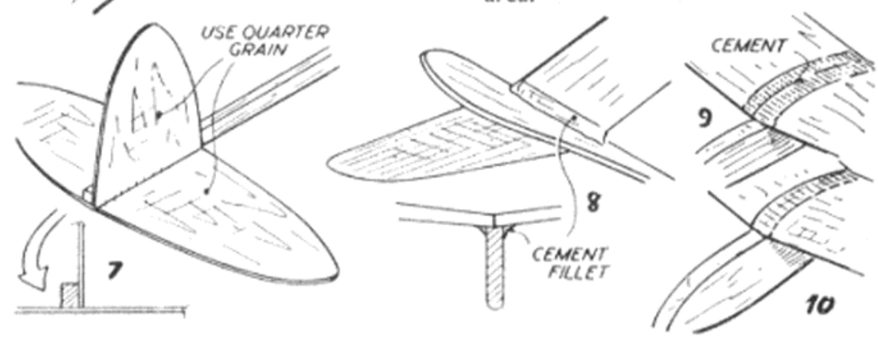
Another little-known dodge which works very well is to use sharpened bamboo dowels, about 3/32 in. in diameter, pushed through the wing joints as in (2). Coat the bamboo with cement before forcing in place and then trim off the ends flush with the underside of the wing.

Wings should always be made from *light* balsa. This makes the edges weak and reinforcing the leading edge is good practice. You can make up the original panel from soft sheet with a 1 in. strip of hard balsa butt jointed to it (*3*), or use a hardwood insert in the leading edge—diagonal (using square strip) (*4*), or flat strip inset flush with the bottom (*5*). These inserts should be added before carving and finishing the wing panels.

Failing this, just cement a length of thread right around the outline of the wing (*6*). This will give a surprising amount of protection.

Never stint the cement during assembly. Tail surfaces are far stronger if the fin is offset along one side of the fuselage (*7*). Always use quarter-grain sheet for the tail and, again, use the lightest sheet suitable.

After cementing the wing in place and letting it set, build up really generous fillets of cement as in (*8*). Then add a coat of cement over the top joint (*9*), or better still, cement on a narrow strip of gauze bandage and you should have a wing-fuselage joint stronger than the wood. If anything breaks it should then be the wood—outside the cemented area.



RECOGNISE THIS PLANE?

—it's Russia's Tu-104 Jet Airliner

THIS and many other fine photographs of Russia's latest jet airliner will be appearing in next month's MODEL AIRCRAFT, **together with a three view plan** from which you can build an accurate and fully detailed model.

John W. R. Taylor will be giving the salient facts of the Tu-104, while the special photographs will show every detail of the aircraft, from nose to tail.

Among the flying models presented will be a fine C/L scale job of a real old timer, the Curtiss XF-7-C3 Seahawk. Those with a preference for free flight models will enjoy building and flying the M.K. Sportster, designed by an overseas enthusiast.

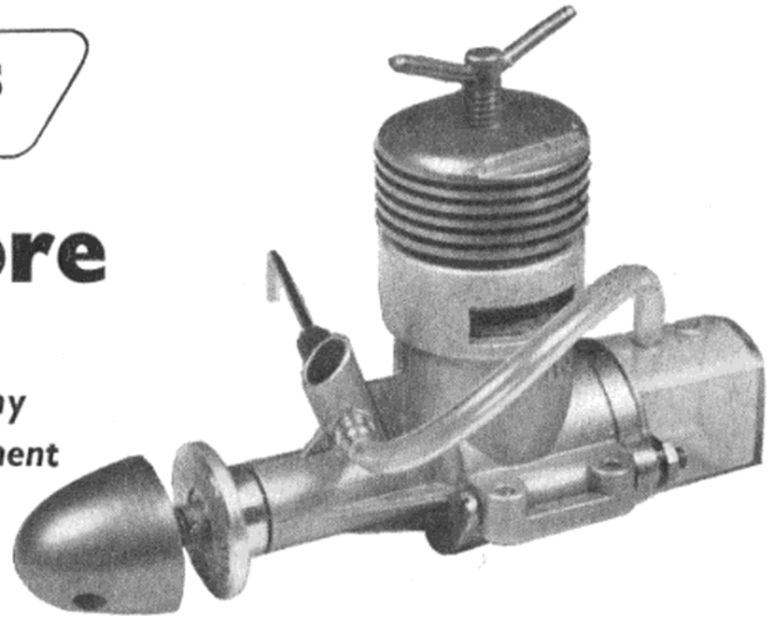
Len Ranson will show you how to make props from sheet, while Peter Cooksley will pass on a few tips on spraying for beginners. But these are only a few of the contents of the June M.A.—we just haven't the space to mention them all here. **Watch out for the Tu-104 on the cover.**

ENGINE TESTS

THE Allbon Sabre

1·49 c.c. diesel

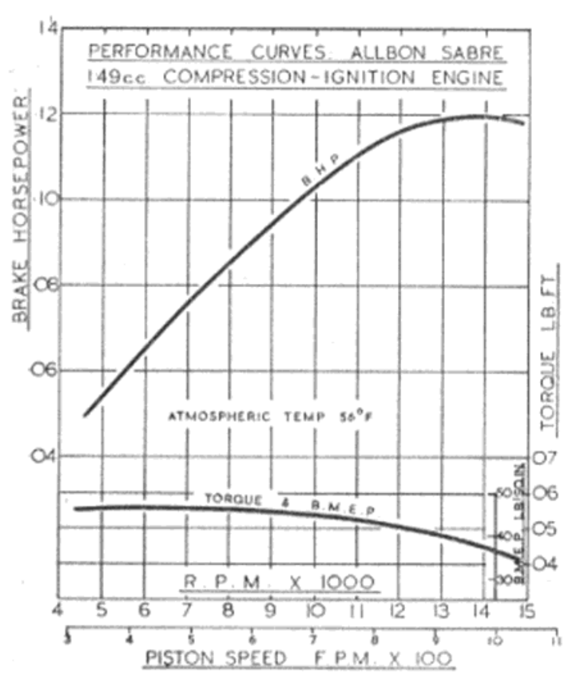
"a worthy replacement for the Javelin"



THE Allbon Sabre has already been briefly described in MODEL AIRCRAFT and readers will be aware that this recently announced Davis Charlton product succeeds the popular Javelin engine of the same capacity, first marketed in February 1950.

Probably the first question which the average enthusiast will ask, therefore, is " how does its performance compare with that of the Javelin ? " and so, without more ado, we shall attempt to briefly summarise our findings in this respect.

Firstly, the engine is just as powerful but requires to reach higher r.p.m. to develop its peak output. The actual performance at speeds below 11,000 r.p.m. may, in fact, be slightly lower than that of a good Javelin. Secondly, although the early Javelin was easy to start on most props, it became tricky when lightly loaded for high speeds, whereas the Sabre remains reasonably docile over a wide range of loadings. Thirdly, the running qualities appear to be a little more consistent.



Two engines were received from the manufacturer for test and the better of the two was used for our performance tests.

Externally, the Sabre differs widely from the Javelin and follows the new Davies Charlton layout first adopted in the design of the Merlin. The changes have been mainly brought about by the need to keep production costs as low as possible, in order that the price to the model builder may be maintained at a low level, despite rising costs in other quarters. They do not mean a " cheapening " in terms of lower quality, but rather the modification of structural design in order to eliminate or simplify some machining operations. The general nature of these was explained in our report on the Merlin (Engine Test No. 69–January 1955 MODEL AIRCRAFT) and will not be repeated here. It will suffice to say that such changes are inevitable in the development of the mass-produced model engine and have already been seen elsewhere, particularly in the U.S.A.

The main casting comprises the crankcase, which extends above exhaust port level, and front bearing including carburettor intake. It is a good example of modern diecasting and involves a minimum of machine finishing. The diecast backplate is of extremely deep section so that, despite the fact that it is retained by only two external lugs, it is sufficiently rigid to resist any tendency to distort and cause leakage. As currently marketed, the engine is equipped with a self-contained transparent plastic fuel tank which is attached to the back of the crankcase by means of the two screws which retain the crankcase cover. The tank is of rather small capacity, giving no more than 30 sec. running time except at low speeds and cannot be rotated to side positions. On the other hand, there is less tendency to leak than with the normal centre-fixing backplate tank. Some care should be exercised when tightening the securing nuts to avoid risk of damaging the plastic tank lugs.

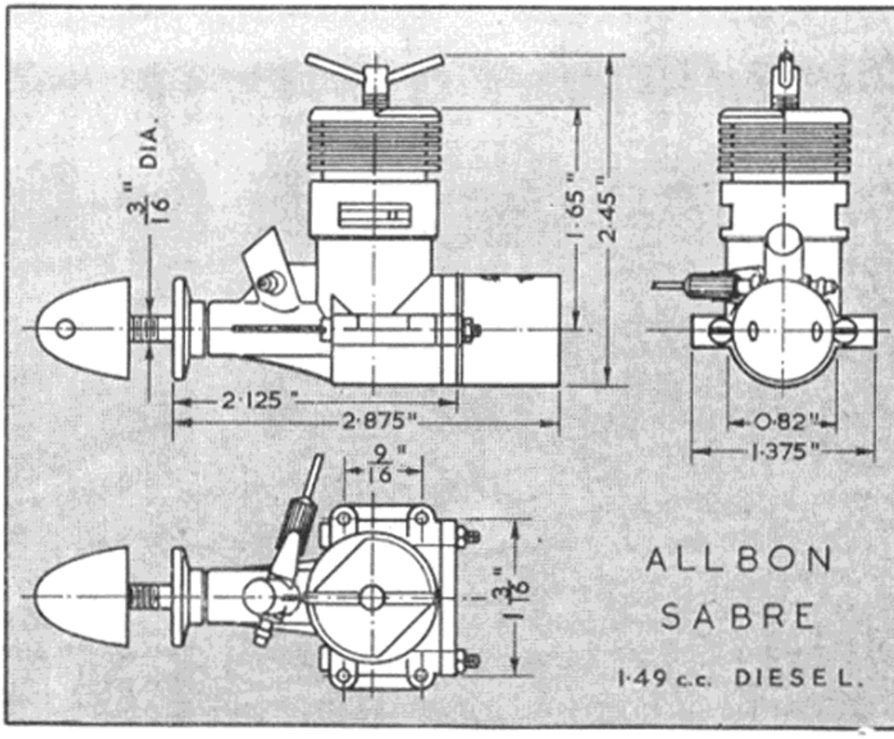
The cylinder barrel screws directly into the top of the crankcase and retains the cylinder liner by clamping at the exhaust flange. Porting is of the radial type, with a very long exhaust period (about 170 deg. of crank angle) and a very short transfer period (about 90 deg.). This is accounted for by the use of slotted type circumferential ports for both exhaust and transfer and the very short stroke of the engine.

The piston is unusual in that no attempt has been made to keep it light. It is virtually solid, bored ¼ in. dia. to take the little end, so that the walls are a full ⅛ in. thick and the average crown thickness is approximately the same. Although this rather disagrees with theory about keeping reciprocating parts as light as possible, it has three advantages, namely: good bearing area for the full-floating gudgeon-pin, improved crankcase depression and good heat conductivity with no risk of distortion. This latter point may be of especial value, in this particular design, in view of the fact that heat transference from the cylinder walls is bound to be rather poor due to the finned cylinder barrel being in intimate contact only at the exhaust flange and compression screw.

The rest of the design is fairly conventional. The crankshaft is supported in a 9/32 in. × 1 in. main bearing and in both test engines the fit was good. Rotary valve porting is fairly modest. The valve opens at 70 deg. after b.d.c. and closes 35 deg. after t.d.c., a total period of 145 deg. of crank angle. The circular inlet port is 5/32 in. dia. and the shaft is bored 9/64 in.

Compared with earlier Javelins, which were noted for their light weight of only 2.3 oz., the Sabre is a good deal heavier, weighing 3.25 oz. without tank, but is also more robust.

In general, the engine is a worthy replacement for the Javelin, although we would have preferred to have seen the latter's name perpetuated in this new design, especially as the name "Sabre" is the registered trade name of the Australian Sabre engines (which range includes a Sabre 1.5 c.c. diesel) and may, therefore, lead to some confusion.



Specification

Type: Single-cylinder, air-cooled, two-stroke cycle, compression ignition. Shaft type rotary valve induction. No sub-piston supplementary air induction. Annular transfer and exhaust porting with flat top piston.

Swept Volume: 1.489 c.c. (0.0909 cu. in.).

Bore: 0.525 in. Stroke: 0.420 in.

Compression Ratio: variable.

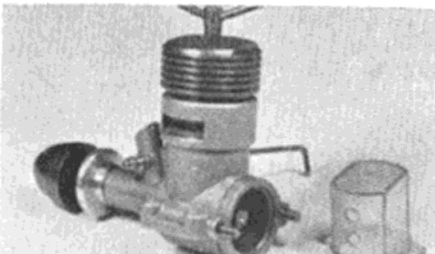
Stroke/Bore Ratio: 0.8 : 1.

Weight: 3.25 oz.

General Structural Data

Diecast aluminium alloy crankcase and main bearing with detachable rear cover. One piece crankshaft of nickel-chrome steel, with full disc web, running in plain bearing. Forged Hiduminium RR.56 alloy connecting-rod. Alloy steel piston with full-floating gudgeon pin, running in hardened nickel-chrome steel cylinder liner having three exhaust and three transfer ports. Machined and colour anodised cylinder barrel. Alloy prop driver fitted to matching crankshaft taper. Brass spraybar type needle-valve assembly inclined backward 15 deg. Combined beam and two-point bulkhead mounting lugs. Self-contained detachable fuel tank.

Note the similarity in appearance to the other new engines in the D.C. range.



Test Engine Data

Running time prior to test: approx. 4 hours.

Fuel used: 40 per cent. technical ether BSS.579, 30 per cent. Shell "Royal Standard" kerosene, 28 per cent. Duckham's racing castor oil, 2 per cent. amyl-nitrate.

Performance

The test engines started readily. Priming through the ports was at no time found necessary, two or three choked preliminary flicks being all that were required. Despite the fact that the closing of the intake valve is by no means late, the fuel tends to pump back through the delivery tube if the intake is closed continuously when choking. The finger should, therefore, be released momentarily from the intake as the piston passes over top dead centre. This tendency is no doubt due to the exceptionally good crankcase depression resulting from the small crankcase volume (a by-product of the short crankthrow and "solid" piston).

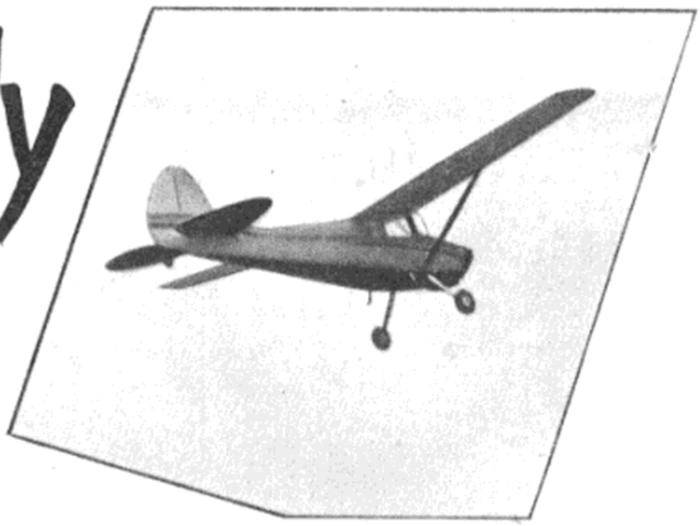
Response to the compression lever was positive and there was no tendency for the contra piston to seize, irrespective of engine temperature. The new needle-valve tensioning device, which is similar to that found on many American and Japanese engines, works well, despite the fact that the knurling on the brass sleeve is rather futile, since it wears smooth within an hour or so of use.

The usual loss of power with warming up was only very slight and running qualities were, in general, quite good. Due to the test engine's ability to run satisfactorily over a wide range of loadings, performance tests were carried out covering an 11,000 r.p.m. speed range (4,500 to 15,500 r.p.m.). At no time was the torque developed such as to cause any excitement and the maximum relative b.m.e.p. remained average at approximately 47 lb./sq. in. Thanks to the quite gradual decline of the torque curve, however, the b.h.p. curve rose to an unexpectedly high peak r.p.m. of *circa* 13,700. Due to the exceptionally short stroke, the mean piston speed at these revolutions is still well below 1,000 f.p.m.

Power/Weight Ratio (as tested): 0.59 b.h.p./lb.

Specific Output (as tested): 80.6 b.h.p./litre.

Flight Simply Explained



IN Parts I and II, we first described various types of models and then continued with building methods, materials and tools. In this third article, it had been our intention to go straight on to the building of an elementary glider. Instead, we have decided, at the risk, perhaps, of disappointing some of our new readers, to first introduce a chapter on the elementary mechanics of flight—in other words, to simply explain how the aeroplane flies.

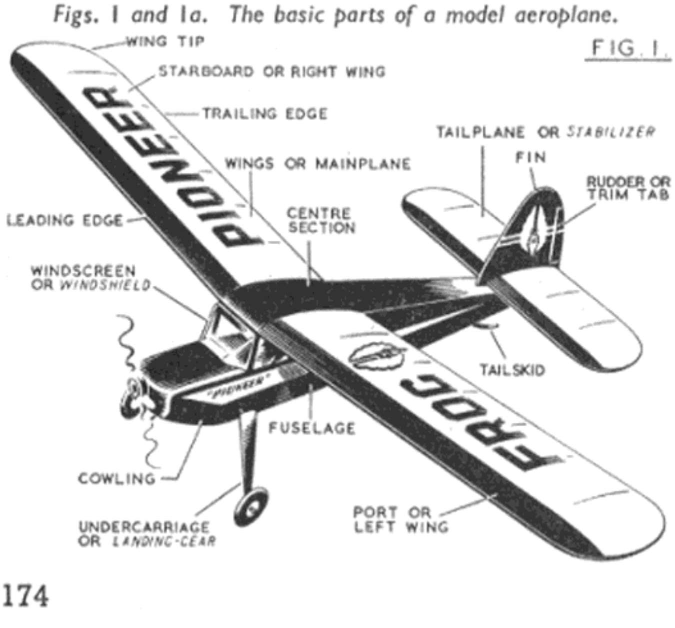
The NEW M.A. BEGINNERS' COURSE PART III

Our purpose here is twofold. Firstly, it enables us to introduce to the reader the names of the various parts of an aircraft, so that he will be familiar with these without our having to explain them in later chapters. Secondly, as some idea of the basic principles which govern stable flight is essential if one's first effort is not to be quickly reduced to a pile of wreckage, this seems to be the best point at which to bring them forward; i.e. *before* building a model, so that, even if you do not thoroughly digest, now, everything we have to say here, and even though we shall not deal with detailed trimming adjustments until later, you will be forewarned on one or two points. Most newcomers to the hobby are anxious, just as soon as they have built a model, to go out and fly it without more ado, and one can, perhaps, forgive the over-enthusiasm which causes them to read about the hows and whys of flight only *after* they have attempted to fly a model.

In Figs. 1 and 1a are shown the names of the main parts of an aeroplane. In some cases, there are two or more names for the same part. This is often due to differences in British and American usage, For example, the landing wheels and struts are usually known in Britain as the *undercarriage*, but, in the U.S.A., *landing-gear* is the term more commonly applied. Similarly, the English *tailplane* becomes the American *stabiliser* or " stab." American seamen do not talk of " port " and " starboard " and these, which, like so many aviation terms, were derived from nautical terminology, have, in any case, become rather less commonly used in model aircraft circles, so that it is quite permissible, instead, to talk simply of " left " and " right."

In our hobby, too, there is considerable freedom in the use of alternative names for certain parts. A side strut between two longerons, for example, may be called a

Figs. 1 and 1a. The basic parts of a model aeroplane.



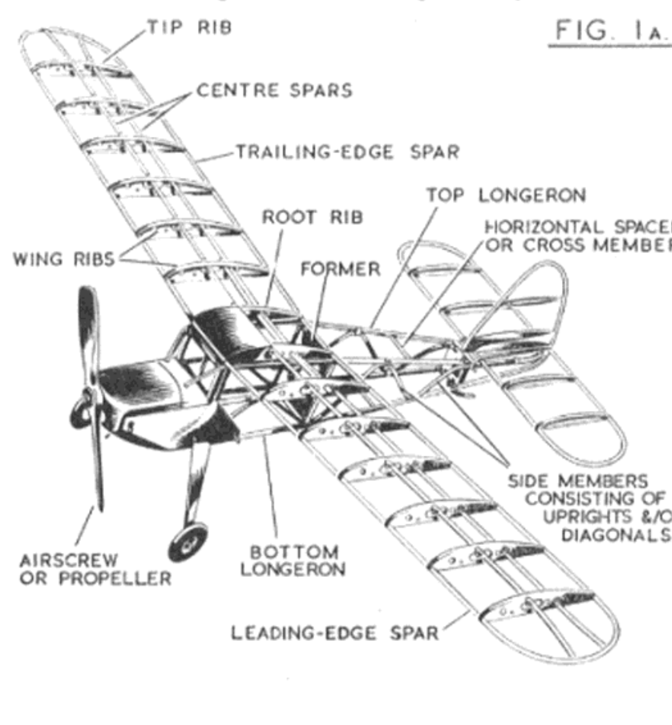


FIG. 2.

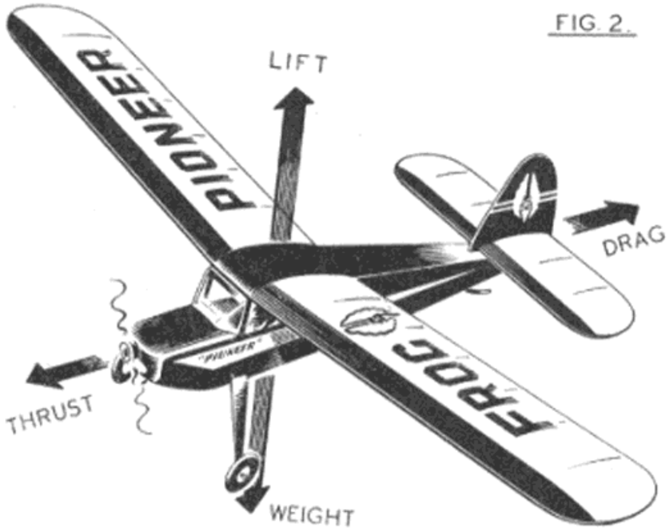
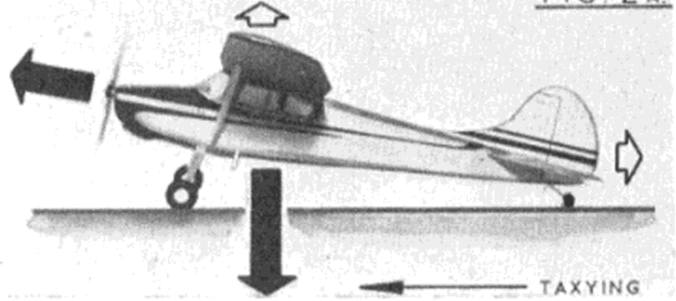


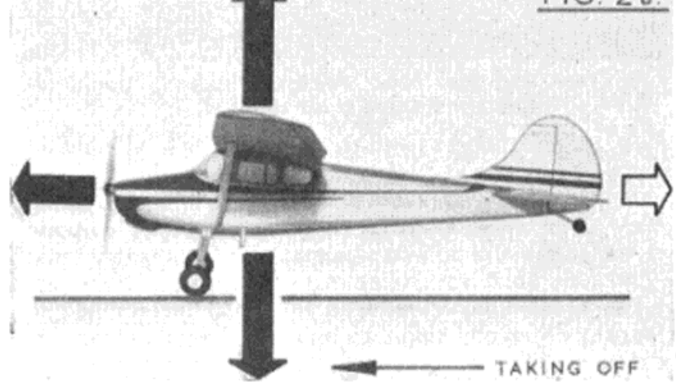
Fig. 2. The Four Forces. In steady flight, drag equals thrust and lift equals weight.

FIG. 2A.



In Fig. 2a, the aircraft has just moved off from a standstill and lift and drag are small due to low speed.

FIG. 2B.



In Fig. 2b, the machine is accelerating and is just about to become airborne.

FIG. 2C.

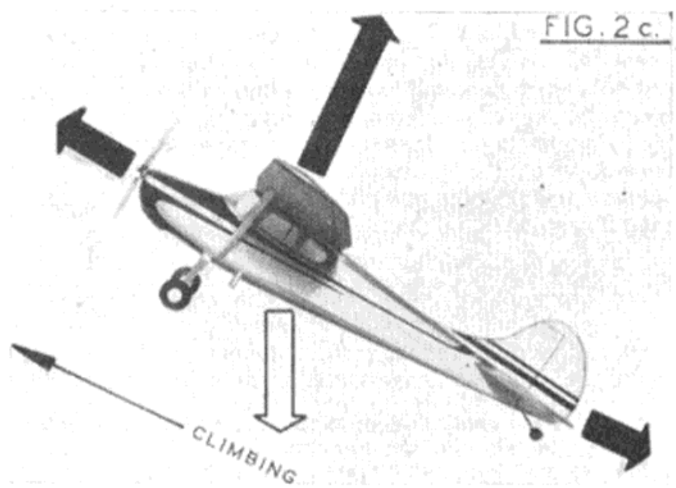


Fig. 2c. Model is climbing rapidly. Note that the "lift axis" [illegible] not truly vertical.

FIG. 2D.

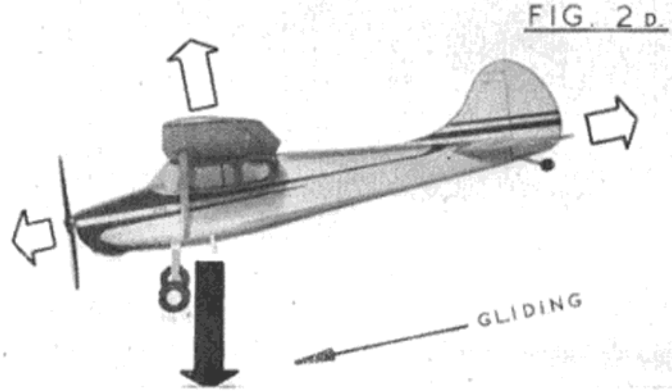


Fig. 2d. Now the model is gliding. Lift is reduced and the lift axis is inclined forward.

vertical spacer, an *upright* or a *side member*, or even variations and combinations of these terms. *Longerons*, however, which are main longitudinal members, should not be confused with *stringers*, which are light auxiliary longitudinals whose main purpose is to support the outer covering and preserve the external form of the fuselage or other component.

The Four Forces

We have said that this will be a chapter on the elementary mechanics of flight. What we want to do is to explain as simply as possible the basic principles of aeroplane flight without getting the reader too involved with aerodynamics. Any treatise on the first principles of aerodynamics usually starts off by describing, with the aid of diagrams, the reaction produced by moving a flat plate through the air and develops the theme from there. We have discarded this rather formal approach by starting, instead, with the four main forces acting on an aeroplane. From this we shall show how stability is obtained and we have illustrated the various points with photographs.

Fig. 2 shows the four main forces acting on an aircraft in flight. First, there is the *thrust* (produced either by an airscrew or jet motor) which moves the whole craft through the air. In opposition to this force is the *drag*, the resistance to forward movement produced by the air. Thirdly, we have *lift*, which is the upward force generated by the wings due to their movement through the air. Lastly, we have *weight* or the force of *gravity*, acting downwards.

In steady level flight, the forces of thrust and drag are equal and the lifting force equals the weight. Read this sentence again. Some people find it difficult to understand that this should be so and assume that thrust must be more than drag and that lift is more than weight. Let us explain in more detail.

When an aeroplane begins to taxi along the ground, the thrust is many times the drag and the weight many times the lift. (Fig. 2a.) As the aircraft moves faster, however, the differences are lessened. When a certain speed is reached, the lift equals the weight (Fig. 2b) and then exceeds it and, immediately this happens, the aircraft leaves the ground and begins to climb. Now that ground resistance is eliminated, the aircraft continues to accelerate until the drag equals the thrust. The speed will now

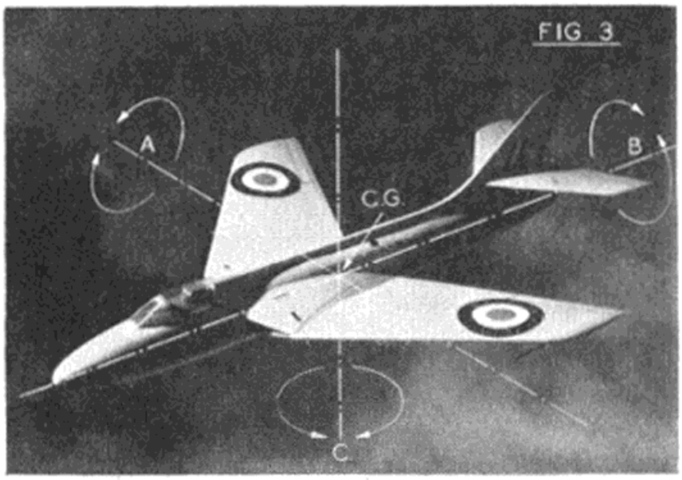


Fig. 3. The Three Axes about which Longitudinal, Lateral and Directional Stability are obtained.

remain constant and so will the rate of climb. Therefore, we now have thrust and drag equal, but the lift force greater than the weight. (Fig. 2c.)

Now here is the essential difference between a model and the flight of a full-sized aeroplane. Our model goes on climbing until the engine stops. The pilot of the full-sized aeroplane, however, who is usually interested only in getting from one point to another, levels out his aircraft and reduces his engine speed until lift equals weight and the aircraft flies at a constant speed and altitude.

Suppose now that the engine of our model stops. Thrust is lost. Drag will slow up the aircraft and lift will thus be reduced. Weight will now cause the machine to descend. Will it just plummet to earth? No, because drag will limit its speed and the wings will still generate enough lift to cause a gradual descent, i.e., a *glide*, provided that the aircraft continues to travel nose first and does not become unstable. (Fig. 2d.)

How is this stability ensured? For this we have to look to the Three Axes.

The Three Axes

Like every other solid object, the aeroplane has a *centre of gravity* (see Fig. 3) and whenever it points upward, downward or sideways, or rolls to the left or right, it does so with the centre of gravity as a pivot point. And so, for the purpose of studying stability, we declare the aeroplane to have three *axes*, marked *A*, *B* and *C* in Fig. 3.

Axis *A* is known as the *lateral axis*. The nose-up and nose-down movements that that aircraft makes with this line as a centre point are called *pitching*. Axis *B* is the *longitudinal axis* and when the machine banks left or right, this is called *rolling*. Axis *C* is called the *normal axis* or *vertical axis* and directional movements left or right are called *yawing*. Pitching, rolling and yawing. Once again, terms of nautical origin.

Longitudinal Stability

Now, our first requirement is longitudinal stability, which concerns pitching. A little confusing, perhaps, but we must remember that this takes place about the lateral axis—not the longitudinal axis.

We have seen that a wing produces lift when moved through the air. The amount of lift it produces depends primarily on the speed at which it travels and its angle to the airstream, called the *angle of attack*.

Now, there is a point, relative to the width or *chord* of the wing, through which width the lifting force is concentrated. This is called the *centre of pressure*. The position of the centre of pressure is not constant. At a zero angle or very low angle of attack, the centre of pressure is near the mid-chord point. At high angles of attack it is nearer to the leading edge. At negative angles of attack, the centre of pressure moves towards the trailing edge.

We can see that this presents rather a problem.

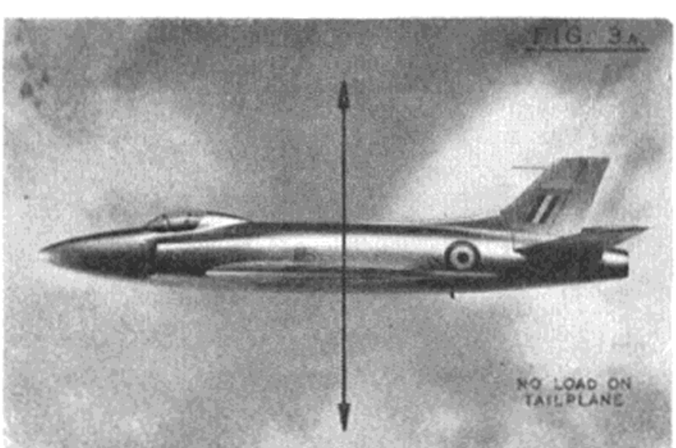
Let us suppose that we have balanced the aeroplane so that the centre of gravity is immediately below the centre of pressure at the required angle of attack. The two opposing forces are now in equilibrium: the lift directly opposing the weight.

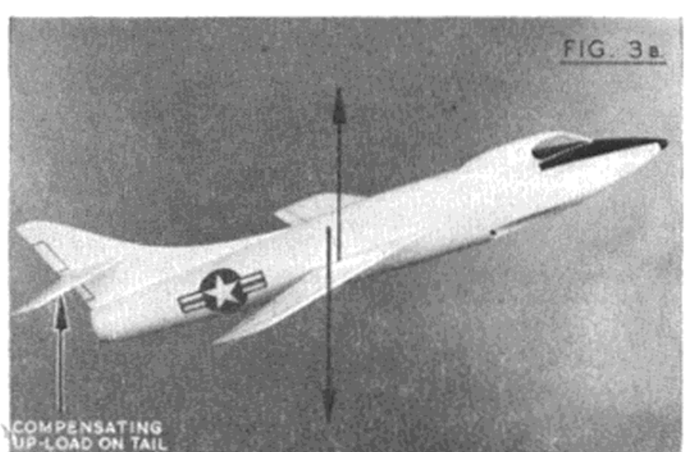
However, if anything occurs to alter the angle of attack, i.e., if the aeroplanes pitches, stability will be lost. If the nose rises, the centre of pressure will move forward in front of the c.g. *and thus tend to lift the nose still more*, in turn causing the centre of pressure to move yet farther forward, so that the wing will tend to rotate completely and turn the aeroplane over on its back.

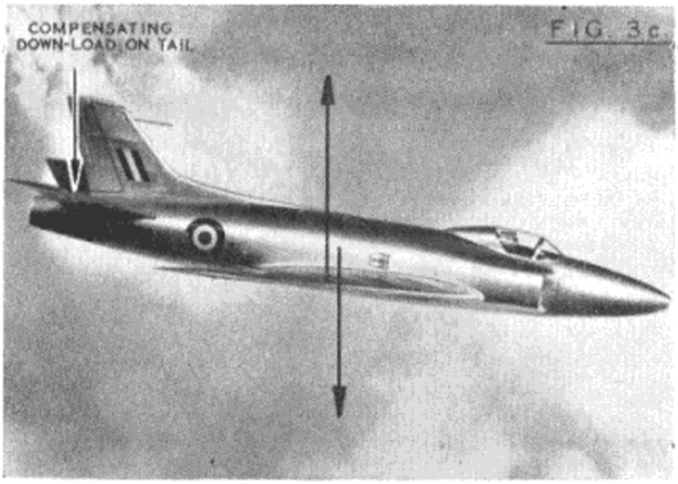
This is where the *stabiliser*, as the Americans so sensibly call it, or *tailplane* comes to the rescue. The tailplane is merely another, much smaller, wing attached to the rear end of the fuselage, to *stabilise* the main wing.

In constructing our aeroplane, we can now mount the wing on the fuselage at a suitable *rigging angle*, or *angle of incidence* so that, in normal flight it is inclined at such an angle of attack as to produce the required amount of

In Fig. 3a, we see steady flight with the centre of lift immediately above c.g. In Fig. 3b, the nose has been deflected upward, resulting in the centre of lift being moved forward. Upward corrective force by tailplane restores balance.







In Fig. 3c, nose is deflected downward. Centre of lift moves back. Downward corrective force by tailplane restores balance.

lift. We can then arrange that the c.g. should approximately coincide with the centre of pressure at this angle of attack and we mount the tailplane at zero degrees so that it merely "floats" in the airstream. (Fig. 3a.)

Now, suppose that flight conditions are disturbed in such a way that the nose is raised. As before, the centre of pressure of the wing moves ahead of the c.g. and tries to make matters worse. But now, our tailplane, which, hitherto, has had no hand in the proceedings, is also inclined at a positive angle and also begins to generate lift. And because it is situated at the end of the fuselage, it exerts great leverage which, acting through the lateral axis, restores the aircraft to level flight. (Fig. 3b.)

Conversely, if the nose of the aeroplane should drop, the tailplane will now assume a negative angle and generate a downward load behind the lateral axis, thus restoring level flight again. (Fig. 3c.) And so we have achieved longitudinal stability.

Lateral Stability

Lateral stability is achieved in quite a simple manner. If you look at an aeroplane head-on, you will see that the wings are not usually horizontal from tip to tip, but are inclined upwards at the tip to form a shallow *dihedral angle*. (Fig. 3d.)

Now, it is not too difficult to grasp the fact that the more we incline the wings upward like this, the less will be the lift in a vertical direction that they generate. However, a roll to right or left also causes a sideslip in the direction of the roll. This is due to the fact that a small sideways force is introduced by the entire lift being inclined sideways instead of acting in direct opposition to gravity.

Dihedral now acts as the correcting force. In moving sideways as well as forwards, the lower surface of the wing presents considerable resistance to the inclined airstream and thus tends to roll the aircraft back on to an even keel.

Directional Stability

The basic method of ensuring directional stability is to place more side area behind the vertical axis than in front of it. This is the reason for fitting a vertical tail fin. The principle can be likened to that of a weather vane.

When an aircraft is thrown off course and yaws to one side, it continues momentarily in the same line of flight and is therefore flying slightly crabwise. Thus, the airstream is striking one side of the aeroplane and, in striking the considerable area of the fin, the machine is turned back in line with the direction of flight, just as a weathervane is swung into the airstream when the direction of the wind changes.

The C.G. and How to Find it

Some modelling wag once wrote a treatise picturesquely entitled (if memory serves correctly) "The Elusive Cee-Gee Crittur" . . . Facetious comment on how to find the c.g. and what to do with it when you have found it are legion in modelling circles. Every sort of humorous suggestion—from imprisoning the c.g. in a matchbox and hanging it from the undercarriage, to doing away with it altogether—has been put forward.

But, seriously, as we have said, every solid object has a c.g. and, so far as aircraft are concerned, we usually need to know where it lies. It is the first thing we need to determine, for example, before we attempt to fly a new model, when, if necessary, we ballast the model in order to re-locate the c.g. according to the design requirements.

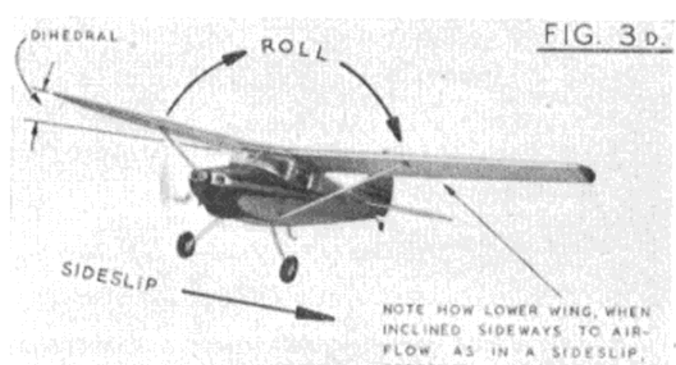
When talking of models, one frequently refers to the position of the c.g., relative to the wing chord; for example: "40 per cent. chord," meaning that the c.g. is vertically in line with a point four-tenths of the distance back from the leading edge. The simplest way of finding out whether a model is correctly balanced longitudinally is, in fact, to lift it with the finger tips placed in the appropriate position under the wing. However, this establishes the balance in one dimension only and, though we may assume that the aircraft is properly balanced about its longitudinal axis, we still do not know the vertical position of the c.g. It is sometimes desirable to know this precisely, especially, for example, when determining the tow-hook position on a glider. The process is simple and is as follows.

Firstly, hang up the model slightly in front of the estimated balance point. The machine will hang at an angle, tail downward. From the point of suspension, draw a vertical pencil line down the side of the fuselage—preferably with the aid of a simple thread plumb-line.

Now suspend the aircraft from a point rearward of the estimated balance point. The model will now hang at an angle, nose downward. From the point of suspension, draw another vertical pencil line down the side of the fuselage.

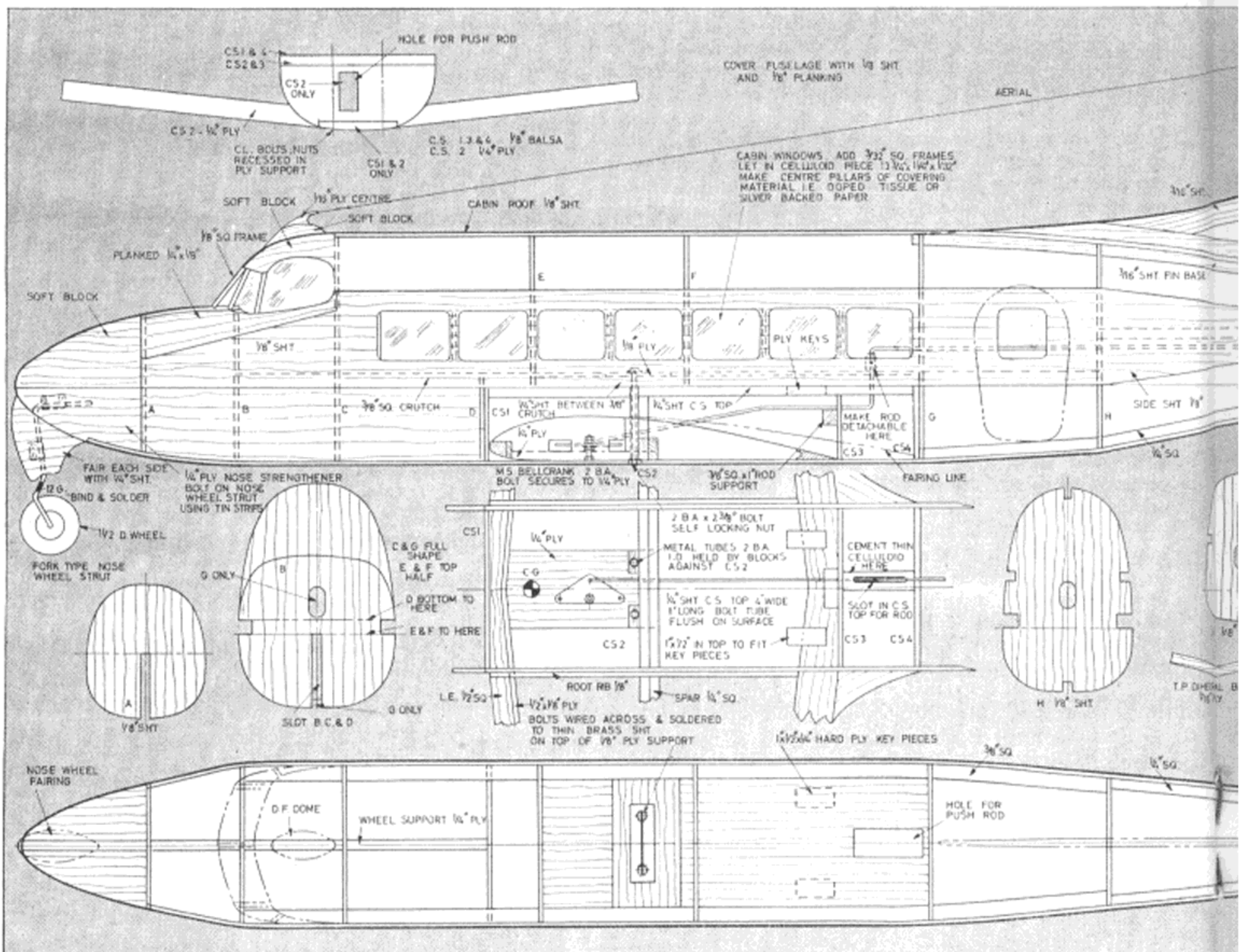
Where these two lines intersect, establishes the c.g.

In Fig. 3d, we see how the lateral dihedral angle of the wings maintains lateral stability. (Models used: Jetex Hawker "Hunter," Supermarine "Swift" and Douglas "Skyrocket"; Cessna 170.)



DE HAVILLAND HERON

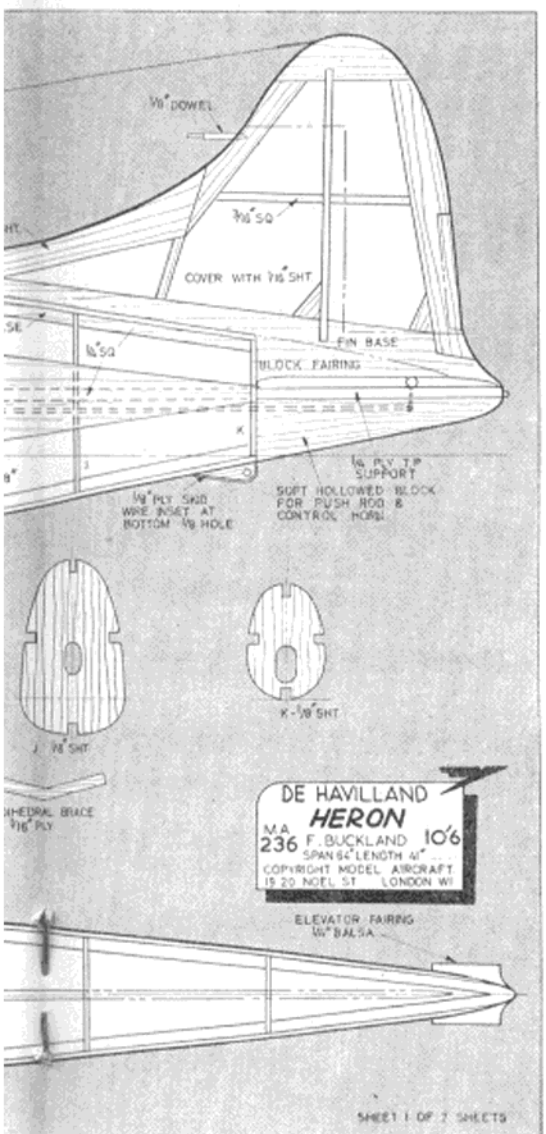
A Model That is Different? Build This Four Engined Control Liner——*by* ***FRANK BUCKLAND***



FULL SIZE WORKING DRAWINGS ARE OBTAINABLE FROM YOUR LOCAL DEALER, OR BY POST FROM THE "MODEL
19-20, NOEL STREET, LONDON, W.1, 10s. 6d. (TWO SHEETS), POST FREE

START with wing centre section. Cut out C.S. 2 and bellcrank support from $\frac{1}{4}$ in. ply and glue together. Add C.S. 1, bellcrank and control rod; fit bolt tubes. Make centre section top from $\frac{1}{4}$ in. sheet, cutting slots as shown for key pieces, and push rod, and cement to C.S. 1 and 2. Add C.S. 3 and 4 and cover with $\frac{1}{8}$ in. sheet about 1 in. down each side. Set aside and build wings. These can be built flat on plan. The $\frac{1}{8}$ in. ply leading edge brace, leading edge and spar must be notched to fit over $\frac{1}{4}$ in. ply bellcrank and bolt support Note the angle at which nacelle ribs are placed. When dry, shape trailing and leading edges, leaving $\frac{1}{16}$ in. proud on latter for wing sheeting to butt against. Do not shape leading edge behind firewalls—leave square, so as to ensure a firmer joint.

N.B. Drill undercarriage bolt holes in leading edge support and C.S. 2. Offer wings to centre section and cement well all joints. Jig up to ensure accuracy whilst setting. Make up main undercarriage legs of 10 g. wire.



"MODEL AIRCRAFT" PLANS DEPARTMENT

Engine Nacelles

Cut out firewalls and bearers, cement $\frac{3}{8}$ in. sheet between bearers, place tanks in position and add $\frac{3}{8}$ in. sheet nacelle sides, cutting slots in latter to key over leading edge. This should form quite a square assembly to fit snugly between the pairs of ribs; final shaping is done after fitting to wing. Ensure that cowlings are vertical and *not* at right angles to wing. Wedges are necessary behind firewalls to take up leading edge sweepback.

When wing nacelle joints are thoroughly dry, bolt on main undercarriage, using tin straps and 6 B.A. bolts (note $\frac{1}{8}$ in. ply piece behind spars); 8 B.A. bolt on outer engine is not really necessary and can be omitted. Add $\frac{3}{8}$ in. sheet on top of bearers, cut holes at inboard nacelle for 16 g. lead outs. These can now be fitted to bellcrank. If this is tricky cut a little trap door in centre section above bellcrank and cement back when lead outs are soldered. in. *Do not bend line hooks on ends of lead outs yet.* Wings can now be covered with $\frac{1}{16}$ in. sheet, but don't forget line guide and tip weight. Add rear nacelle blocks and shape up. (A Woolworth shoemaker's rasp is useful to shape bearers.) Fit tip blocks and pairs of fairing blocks under wing at nacelles. Outer engine fairings should be slid over line guides after the holes have been cut. Lead out hooks can now be bent up. Make up and add undercarriage fairings and 2 in. wheels.

Fuselage

Cut out all formers, side sheets and $\frac{1}{4}$ in. ply nosewheel support. Jig up wing till centre section is level and place a piece of greaseproof paper over centre section, as basic fuselage is built on here. Lay $\frac{3}{8}$ in. crutch pieces along centre section and fit formers B, C, D, E, F and G. Fit $\frac{1}{4}$ in. sheet between E and F, and F and G. Make up $\frac{1}{8}$ in. ply and brass strip bolt support and solder bolt heads after wiring up. Ensure that bolts slide freely in centre section bolt guides.

When you have cut out windows add side sheets, formers H, J and K and $\frac{1}{4}$ in. square tailplane supports. Fit nose wheel support and former A, also $\frac{1}{4}$ in. square rear fuselage bottom longeron. Make up nose wheel gear and when fuselage is thoroughly dry, bolt in position. Tailplane can now be built as per plan using $\frac{1}{16}$ in. ply dihedral keepers to join the two halves. Tips are movable with elevators. Main push rod can be made with T-end piece soldered on; this pushes into small loops on the end of each control horn. Check for accuracy before finally cementing complete and shaped tailplane to $\frac{1}{4}$ in. square tailplane supports. The latter should be lightly chamfered on the inside edges to accommodate tailplane dihedral. A Meccano or similar joiner should be soldered securely to main push rod, not to centre section rod.

The fin and rudder is next and this is built up on a $\frac{3}{16}$ in. base. Cut this component out accurately and check that it fits snugly in former slots and (after chamfering) down well on to tailplane V. When satisfied, pin to plan and build fin and rudder as shown.

Cabin Windows

A study of the plan will show that these are glazed in one piece. Now add 3/32 in. (or $\frac{1}{16}$) square strips vertically to divide windows and also along top and bottom edges. Fit well back to inside face of side sheet, thus leaving a recess for the one piece of celluloid window to fit in. Thickness of your celluloid will of course determine which size of wood you use for window frames. Before adding celluloid, paint frames and all inside surfaces of cabin dark green. (Scale colour is beige, but this does not look so well without all the cabin details, which cannot be fitted with ease as the floor is too high, and just the tops of the seats look odd.) The shaping of individual windows is done with covering material on the central pillars. Finally the cabin roof is made of soft $\frac{1}{8}$ in. balsa; paint this inside before fitting.

Fin and rudder should now be cemented accurately on—no off-set. Entire fuselage can now be covered with $\frac{1}{8}$ in. sheet. Use softish wood aft of wing, to keep tail end light. Cement hardwood key pieces under the cabin, so that they slot into centre section top accurately.

Make cockpit top from a hardish piece of wood, cement on to former C, and add $\frac{1}{8}$ in. square frames which, when dry, should be carefully rebated to the celluloid depth to allow each cockpit window to be fitted separately. This is simply done by placing a piece of celluloid over the window and marking with a needle (or blade) the shape required; cut out and ease into position on frames to give a flush fit. A floor should be cemented to the crutch and any desired cockpit detail added before building cockpit, of course.

Hollow and fit lower tail block; ensure that the elevators can move freely. Fit elevator fairings and fin fairing blocks. Then cover fin and rudder with $\frac{1}{16}$ in. sheet and sand to shape. Add wing fairings and all remaining centre section sheeting that is necessary.

Balance

Roughly shape nose blocks and *pin* in position. Temporarily mount all engines and screw $\frac{1}{8}$ in. ply nose pieces on bearer ends with small wood screws. Don't fit props. Now balance model on, or slightly in front of, the front line at the bellcrank. Ballast will probably be needed forward, and this should be of strip lead wrapped over $\frac{1}{4}$ in. ply above nose wheel, and bolted securely in position.

When all is well, fix nose blocks securely and sand to shape; fair in nose wheel

This close-up of the original model clearly illustrates the realism possible, with careful lining and lettering.

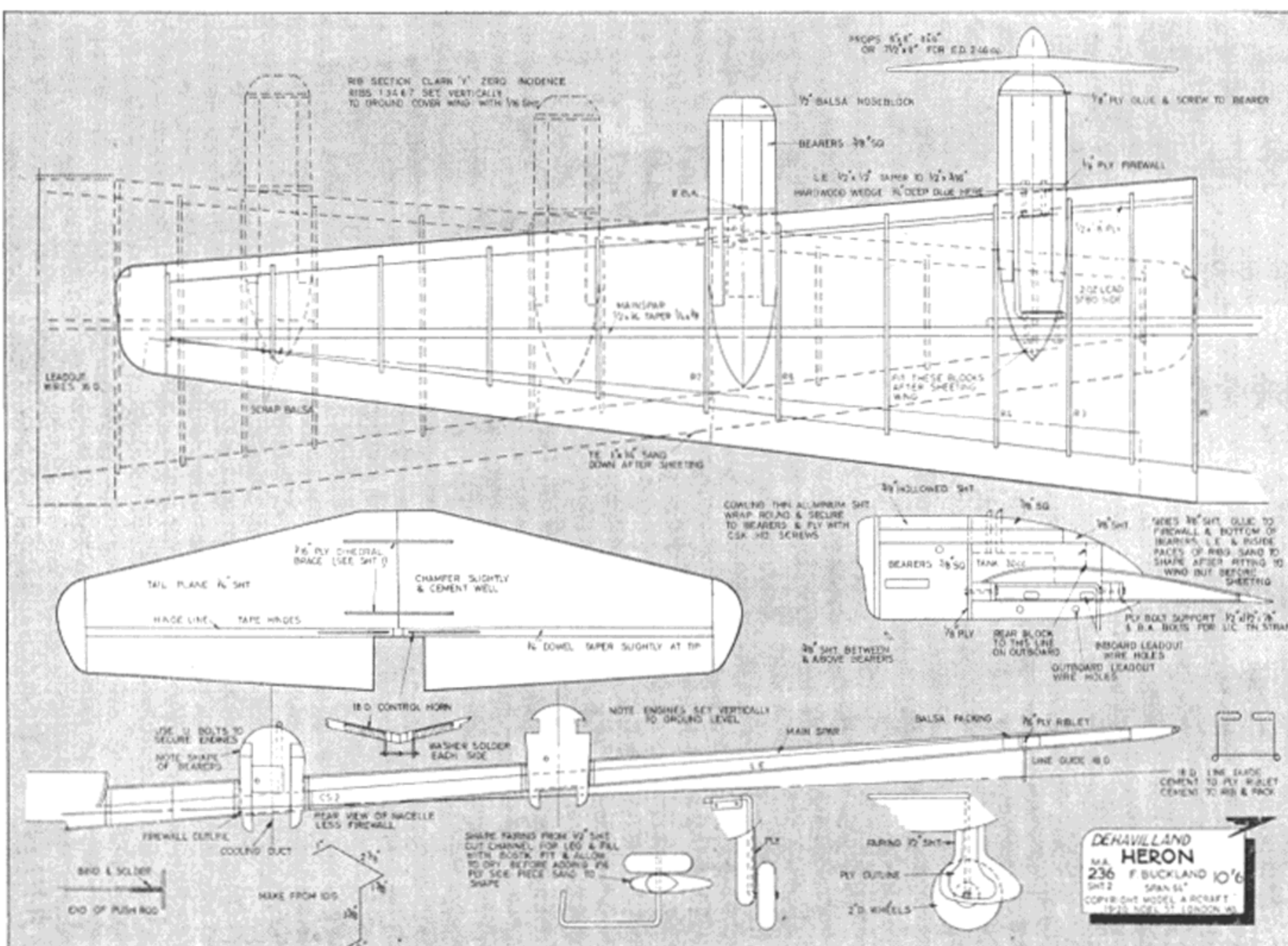
piece with $\frac{1}{4}$ in. balsa each side. Make sure nosewheel is tracking straight or slightly right to ensure right lines on take-off and landing. Make and fit aerial dome on cockpit as shown. Plastic wood is useful for fairing in smoothly here. If you are familiar with your engines and the settings are about right they can now be permanently mounted. Make and fit nose blocks and thin aluminium cowlings. These are best made with the aid of thin card templates which are first wrapped round and cut to shape with exhaust stack holes, etc., marked. Secure cowlings with small wood screws. Don't forget to fuel proof liberally before fitting cowls.

Finishing

Several colour schemes are available for this model but I shall describe the one I used. By permission of Jersey Airlines, Gatwick, I inspected a *Heron* 1 and used their colours.

One roll of silver backed paper was obtained from a newsagents, price 4s. 6d. and was ample for the job. The white parts on top of fuselage and fin and rudder were tissue covered and painted with "Starlon" (two coats). The remainder was sealed with a sanding sealer and rubbed smooth. Silver paper was then applied with thick clear dope, and cemented in places where there are tricky curves. This paper is easy to use and butt jointing is not essential.

Carry paper to just above window line and follow the curve of dark blue paint on nose. The trim line is dark blue and is from the top of the window to the top of the side sheeting. Carry white roof to top of window line, $\frac{1}{16}$ in. up from here mark a $\frac{1}{8}$ in. blue line a $\frac{1}{16}$ in. white, a $\frac{1}{16}$ in. blue, a $\frac{1}{16}$ in. white and $\frac{1}{8}$ in. blue. These reach to cockpit; the bottom white line curves down and around the edge of the blue nose. The bottom lines also touch the tailplane, but the remainder get shorter in steps till the top one, which is about 2 in. short of tailplane. A matt black (blackboard paint) anti-dazzle panel on the nose comes to a point at the extreme nose and is edged $\frac{1}{16}$ in. white.



Topical Twists

by PYLONIUS

A-Frame Up

We are all inclined to wax nostalgic over the glorious past. Things old fashioned, like this year's Wakefield, have a certain sentimental appeal, and we were particularly intrigued by that cover picture of the " How to make it " book of the 1920s. This was known as the age of the Flapper—nothing to do with model ornithopters, as you might suppose, but descriptive of something equally flighty and a good deal faster.

Looking at the cover picture, I couldn't quite fathom whether the A-Frame slinger in the " natty gents " of the period was a truant choirboy or a white collar worker doing overtime. Approaching the problem mathematically, I calculated the dimensions of the collar on the basis of a size 20 plus. Multiplying this factor by the average chord, the vintage neck stiffener had a " gross " area equal to, if not greater than, that of the supersonic fighter depicted on the adjacent cover of the modern " How to make it " book. This led me to believe that he was the original man from outer space; the collar being an ingenious form of one man saucer.

On the other hand the diabolical starched yoke might have been worn as a sort of penance for experimenting with fiendish model machines, but even so, the 1920 model heaver lived happily in ignorance of the supersonic fighter model. True, his A-Frame Pusher may not have flown much better, but was virtually crashproof, and could be turned out in one violent evening with the aid of a mallet, bradawl and a mouthful of blue tacks. Since the know-how cost a mere 9d., he could become a fully fledged modeller in one lost weekend. Nowadays the process is more lengthy, though perhaps not more expensive, as it is no longer obligatory to build a model.

Then, of course, our be-collared ancestor was lucky to live in the pre-flying field age, when launching exercises could be carried out on a small size cow pasture under the benevolent gaze of the ancestral farmer. The modern modeller now casts hopelessly about for a flying field big enough to fly his model out of without giving the impression that he's trying to do so. But, anyway, it was fortunate that the 1920 model operated at sub-thermal level as any extreme contortion of the collared neck would have had the most disastrous results.

No Middle Way

The trouble with our hobby is that there are too many beginners, too many experts, and not enough plain, in-between modellers. The experts are so busy teaching beginners to become experts that the production of common, chuck-it-and-run model fliers is showing a sharp decline. This state of affairs might be helpful in solving the flying field problem, but some of us old sentimentalists like to see the odd model flapping around the skies, if only to remind us of the good old days.

Not that you can fairly blame the experts. They, no doubt, would like to make life easy by teaching the beginners just the basic facts of life without having first to explain why radio models seldom fly. All the beginner needs to become a model flier is the elementary gen on a 30-in. glider, and if his ears are more than 2 in. apart the rest should be just plain sailplaning. But the modern initiate doesn't take too kindly to that sort of kindergarten stuff. He is a budding electronic genius, loftily regarding a radio controlled jet as just a bit on the old fashioned side. It would be unfair to insult his Superman intelligence with a kid's toy aeroplane.

The expert who was naive enough to try the 30-in. glider approach would get the bird just as surely as the misguided scientists who tried to capture a space-fevered public imagination with the archaic idea of a football sized satellite. Naturally, the reaction of a comic strip wise public, which had traversed the farthest heavens in a thousand weekly instalments, explored saucer factories on Mars, and was all set to H-bomb Jupiter, was one of extreme cynicism. It contemptuously asked when Stanley Matthews was likely to make the kick off.

Why beginners are so anxious to become experts, goodness only knows. In these science-ridden days its a dog's life. Instead of charging merrily across ditch and field in pursuit of a 30-in. glider they are mugging up like mad on the latest racing engine and the newest in 20 channel radio receivers. The next thing they know is that the racing engine has gone out of production and all the radio modellers joined the boat club.

Mostly though, the graduated experts give up the R/C jet somewhere about the second wing rib and look about for new worlds to conquer. This has led to a state of affairs where there are more experts floating around than beginners, and perhaps the only way to rake in a few more bods for the 30-in. glider stakes is to get the beginners to write text books for experts as well as vice versa. In this way they won't know whether they are coming or going, and become so confused that they'll build that 30-in. glider out of sheer desperation.

A Contest-able Verdict

A year or so ago the last rites were about to be performed over the prostrate fuzz of the Contest Model. That which was functional was pronounced defunct, and the Fearnley Crusaders were celebrating a resounding victory in the cause of truth and beauty. The future was a rosy one. The age of the freak was past, and the flying field would shimmer in a flamboyant haze of rainbow dopes and crystal cabins. Realism was the password to the model Utopia, and we all breathlessly awaited the golden age of modelling. Model societies were re-organised to meet the demands of the new Scale Age, and prophetic thinkers were hastily devising genteel competitions to enliven the picturesque scene.

All the evidence of great success was there. Scale kits and plans sold like hot two point fives. But, in the general tumult everyone overlooked the flying fields. It was blissfully accepted they were overflowing with a glittering abundance of super scale models. Had they only made the effort to look they would have seen the defunct Contest Model in full possession. Not a cabin or spot of coloured dope in sight.

Now, of course, we know that the Nine Day Scale Wonder is safely over, and we must content ourselves with the depressing fact that the model flying machine is here to stay.

Wingless Wonder

Engine fanciers will be saddened to learn that the racing engine is on the decline. Aeromodellers, too, will regret the passing of the mass produced hot-rod, even though its airborne operations were mainly limited to the elevation of an occasional loose bench.

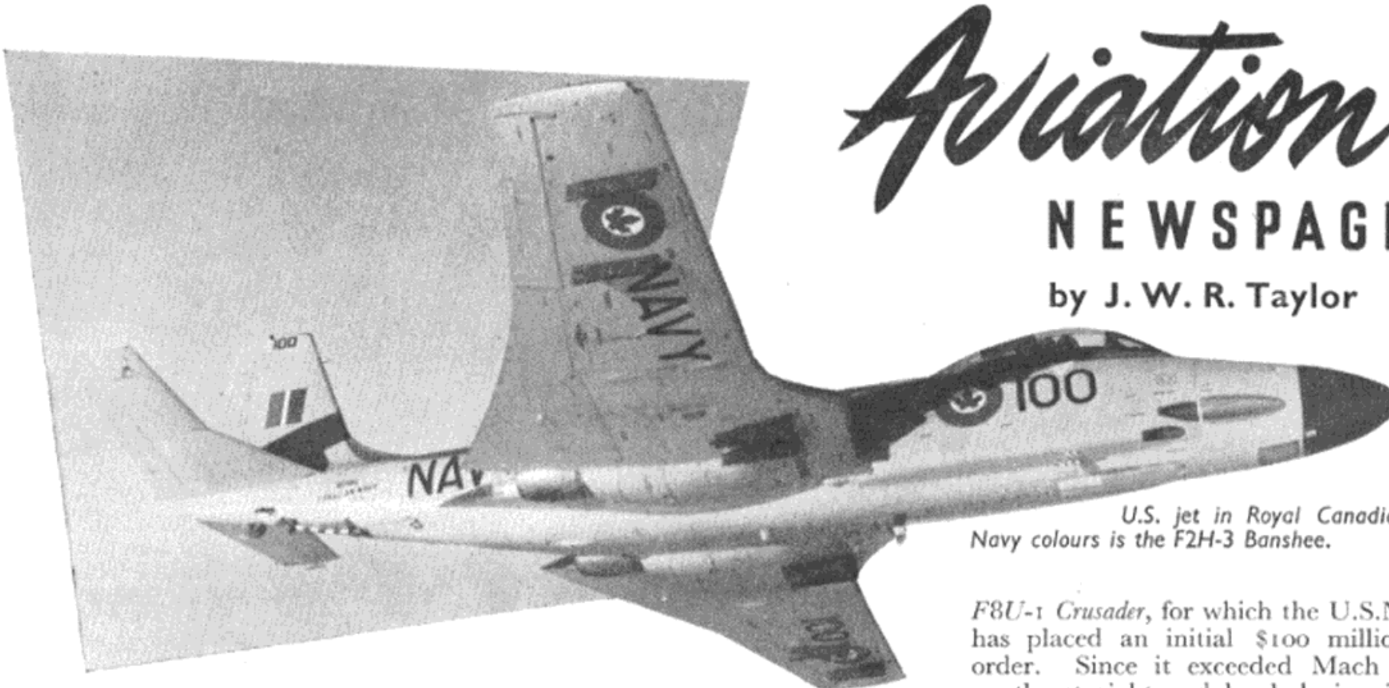
In one or two exalted instances these ear drum blasters have successfully demonstrated the futility of equipping speed models with wings. But here I must tread warily. We " brick-on-a-string " jeerers, according to a recent scientific article, are wrong in supposing that a speed job would fly without wings. I, for one, am humbly prepared to accept the truth of this, as, obviously, without wings it would no longer be a model aircraft.

This may well be the reason why the racing engine is on its way out. It too definitely pointed the way to the wingless model aircraft, and as there ain't no such animal, at least not in the model menagerie, there would be a grand exodus of speed fliers from the hobby. That would be a tragedy, if only for the newsreel men who would be forced on the dole.

Ali DID THE SKETCHES

Aviation NEWSPAGE

by J. W. R. Taylor



U.S. jet in Royal Canadian Navy colours is the F2H-3 Banshee.

Rumours of forthcoming **SUPERSONIC BOMBERS FOR THE R.A.F.** make sense following Supply Minister Maudling's comment in the House of Commons that there will be at least one more bomber between the present V-bombers and ballistic missiles. So let's guess it will look something like the needle-nosed, tail-first project, with tip-mounted jets at the end of broad straight wings, illustrated in a recent copy of Handley Page's house magazine.

Other news is that some *Valiant* orders have been cancelled now that the *Vulcan* is expected in squadron service this year, with *Victors* to follow; and that some *Shackleton* 3s and *Seamews* have also been axed. Far more sad is that official support for Fairey's *Ultra Light* helicopter has been withdrawn, and that the anti-submarine Bristol 191, *Whirlwind* with Twin Turmo turbines, and Percival *P.*74 helicopters have likewise been cancelled.

On the credit side, it seems likely that the Royal Navy will replace the Bristol 191 order with one for Westland-built Sikorsky *S*-58*s*, fitted maybe with the promising Napier Gazelle turbine; and a new version of the *Gannet* is promised, with "guppy" radome, to replace present early warning *Skyraiders*. Reference was also made to a new strike aircraft under development.

* * *

NO MORE NEWS of odds and mods from Britain, so over to Canada, where the R.C.N. has released first air-to-air pictures of its *F2H-3 Banshees*, newly-modified by Fairey Canada. Complete with the now-standard swept-forward tailplane roots, underwing racks and fittings for tip-tanks, they have gone to the Navy's first jet-fighter squadron, VF-870, based at H.M.C.S. *Shearwater*, near Dartmouth, Nova Scotia. In due course, they will embark on the new carrier *Bonaventure*.

* * *

ANOTHER NAVAL FIGHTER in the news is Chance Vought's *F8U*-1 *Crusader*, for which the U.S.N. has placed an initial $100 million order. Since it exceeded Mach 1 on the straight and level during its first flight in March 1955, this lengthy single-seater, with short, saw-tooth, variable-incidence wings, has proved itself the world's fastest deck-fighter. The prototype has a J57-P-4 turbojet, giving a peak 14,000 lb. of thrust with the afterburner cut in. Production *Crusaders* are expected to have the more powerful J57-P-21.

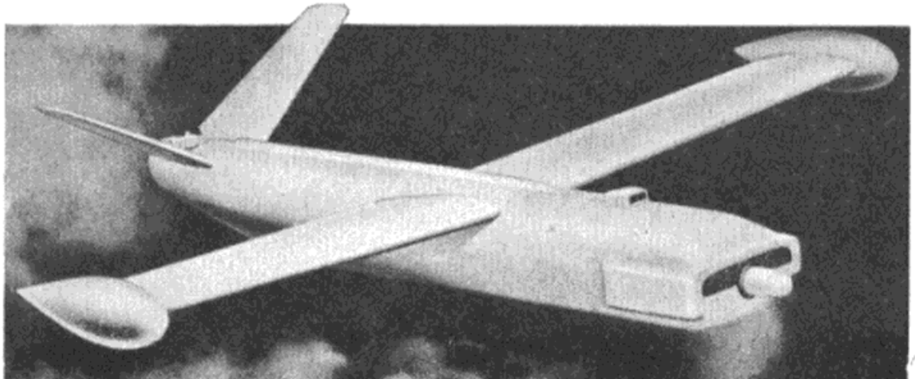
* * *

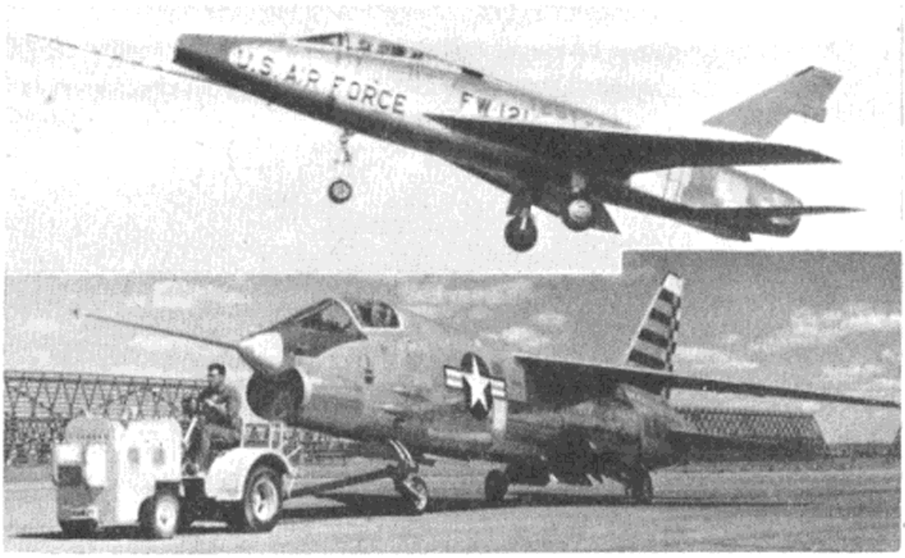
SCOOP FOR "MODEL AIRCRAFT"—we hope—is the picture of the first project from Beechcraft's guided missile division—the XKDB-1 target drone ordered recently by the U.S. Navy. Powered by a supercharged six-cylinder piston-engine, it is intended as an "out-of-sight" R/C target for ground-to-air and air-to-air firing practice. It has a recovery 'chute and is designed to float if it ends up in the water. Wing span is 12½ ft., length 13½ ft. and A.U.W. under 600 lb.

* * *

LATEST SUPER SABRE is the F-100D which, according to the publicity boys, can be left to fly itself supersonically to the target, whilst the pilot concentrates on his navigation and tactics. In fact, the Minneapolis Honeywell autopilot not only relieves pilot fatigue, but flies the aircraft more accurately than a human pilot in supersonic cruising.

Although it looks little different from the F-100A and C, production of the D involved some 550,000 engineering man-hours and 4,670


This is no aircraft of the future, but a radio controlled target drone designed by Beechcraft for the U.S. Navy.



Top: The F-100D "Super Sabre." Below: The chunky-nosed F8U-1 "Crusader" U.S. Navy fighter which is the world's fastest carrier-borne aircraft.

engineering drawings. Powered, like the others, with a J57 turbojet, it is 47 ft. long, 15 ft. high and spans 38 ft. An important scrap of information is that its built-in flight refuelling system is of the British-developed "probe-and-drogue" type.

* * *

WATCH FOR the first sight of Fairchild's C-123 *Provider* (Ex-*Avitruc*) twin-engined assault transports over the U.K., following the U.S.A.F. decision to send to Europe this spring the Tactical Air Command's 309th troop-carrier group, equipped with 48 of these aircraft. They will be stationed at Dreux in France.

* * *

KEEN TYPES in Ireland and elsewhere who signed the pledge after glimpsing what seemed to be Lindbergh's *Spirit of St. Louis* can take courage again. To avoid risk of damaging the original aircraft when filming the story of the first non-stop Atlantic hop, Paul Mantz converted two earlier Ryan B-1s into almost exact replicas of Lindbergh's machine. It was a big job which involved

fitting a new fuselage top and undercarriage for a start, and only their shorter fuselage identifies the replicas, which are complete with the N-X-211 registration of the original. Powered by a genuine 200 h.p. Wright Whirlwind, they have no forward windows and are flown with the aid of a sideways-protruding periscope of the kind used on the famous New York-Paris flight in 1927.

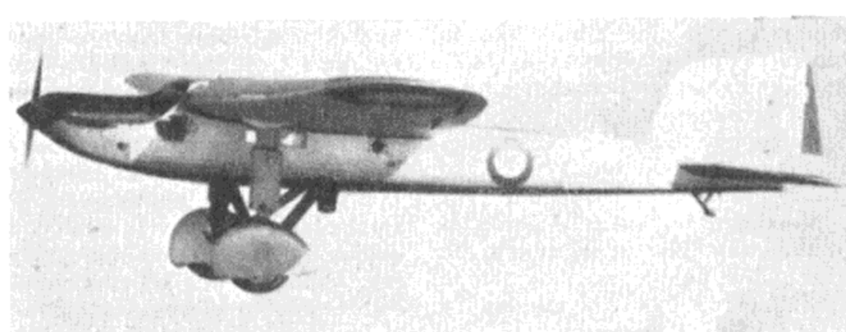
PLASTIC SURGERY has given the Hiller 360 a shapely rounded nose, with greatly improved downward view for its crew. Other changes in the new model, designated Hiller 12-*C*, are a re-designed main rotor hub to improve flight characteristics, a compact instrument panel only two-thirds the size of the old one, and a new tail rotor system with improved flapping hinge.

Powered by a 200 h.p. Franklin 6V4-200-C33 engine, the three-seat *Model* 12-*C* weighs 2,500 lb. and cruises 138 miles at 71 m.p.h. with full load. It is in production for the U.S. Army as the *H-23C*.

* * *

"BRANE"—the Bombing Radar Navigation Equipment developed by the International Business Machines Corporation for the *B-52*—is somewhat different from the crossed-wires sights of 20 years ago. Designed both for navigation to the target and automatic control of the bombing run, it costs about £107,000, occupies 30 cu. ft. of space and weighs 1,457 lb., which is 144 lb. more than the loaded weight of a Sopwith *Pup* fighter of the 1914-18 War.

FROM THE PAST . . . . No. 1



Fairey Long-Range Monoplane

THE Delta 2's speed record brings to mind an earlier Fairey world-beater—the Long-Range Monoplane which captured the world distance record in 1933.

There were, in fact, two of them. The Long-Range Monoplane Mk. I (J9479), built in 1928, was very advanced for its time.

The crew sat in an enclosed cabin, with pneumatic seats and bed and, according to the Air Ministry, "an instrument which ensured that if the machine went off its course inadvertently, either vertically or directionally, a hooter would sound in the pilot's ear."

Powered by a 570 h.p. Napier Lion XI, it was flown 4,130 miles from Cranwell to Karachi by Sq. Ldr. A. G. Jones-Williams and Fl. Lt. N. H. Jenkins, in April 1929. This was not good enough, and when they made a second attempt, this time with Cape Town as the target, they crashed into mountains near Tunis and were killed.

The Long-Range Monoplane Mk. II (K1991), completed in 1931, differed from the Mk. I in having wheel spats and an auto-pilot. Flown by Sq. Ldr. O. R. Gayford and Fl. Lt. G. E. Nicholetts, it set up a new distance record between February 6th and 8th, 1933, by covering the 5,309 miles from Cranwell to Walvis Bay, South Africa, non-stop in 57 hr. 25 min.

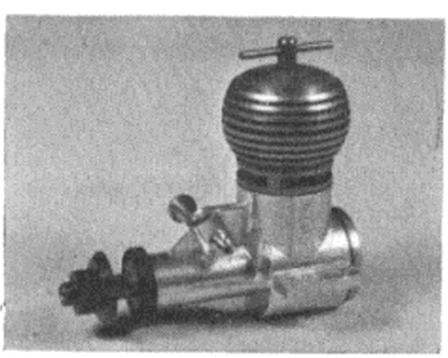
Span: 82 ft. Length: 48 ft. 6 in. Loaded weight (Mk. I): 17,000 lb.

THE thought in the minds of most F/F power men, at the moment, is: " what's going to happen about the new F.A.I. power loading rule? " Enough has been said already about the rights and wrongs of how the new rule was adopted and we shall shortly know whether it is to stay. What we are mainly interested in is whether the revised formula is a good one or not and what sort of models will result from it.

Now, most people have condemned the new 14.12 oz./c.c. loading rule, but some pretty muddled arguments have been put forward, both for and against it and we should like to attempt to put the subject into something like its proper perspective.

It is presumed that the rule was adopted solely to reduce flight times and thus reduce the possible need of deciding top places by means of a fly-off which, we entirely agree, is unsatisfactory. But the solution to the problem was simple: a reduction in the engine run from the present 15 sec. to a 10 sec. maximum.

Now, there are people who think that having the engine functioning for only about ten per cent., or less, of the flight duration, turns the model into a sort of catapult launched glider: by which argument, presumably, a power model should be under *power* during an appreciable proportion of its flight. This would probably sound perfectly reasonable to an outsider, but if we accept it, then we might as well abandon power-duration flying altogether because, even to have the engine running for half the flight time will be like putting development back 20 years.



A good example of sound orthodox design and construction: the Australian-built Sabre 2.5 engine. *See " In Brief."*

No, the whole object of the power duration contest should be a test of climbing ability and gliding efficiency and if, as has been shown necessary, we must limit the " still air " duration to below 3 min., everything should be done to ensure that the most skilful competitor still has the best chance of reaping his just reward.

Doubling the power loading is certainly *not* the way to achieve this object. It means that the optimum rate of climb will be easier for all contestants to realise and that the general standard of flying will be evened up—probably producing a still air time of around 100-120 sec. And, in every case, the winner, as likely as not, will be the man who has the luck to catch the most and strongest thermals to enable him to increase on this basic time: the very worst way in which to decide a contest.

Doubling the power loading rather suggests discrimination against those who have put in the most work developing designs which can handle high power.

The fast climb has been scoffed at in some quarters as " unrealistic," though how it can be so called in these days of jet aircraft capable of ascending at 200 ft. per sec. is slightly bewildering. Personally, we are all for the sizzling climb. It is rather exciting and an immensely satisfying flying experience to see one's effort go rocketing safely skywards. The fact that learning to trim and fly such a model is not without some hazard makes its attainment all the more rewarding.

A rather pointless argument here is the claim that, as the incidence of crashery is highest with the more powerful models, rules should be such as to produce a more docile type. One would think that broken necks had been involved. We are dealing with international competition men and models, not beginners and chuck-gliders.

In fact, with a modest quota of brain and some plain horse-sense, it is not so very difficult to avoid the common errors which lead to the majority of crashes. Most of the experts have now reached a stage where they do not habitually pile their models into the deck and a couple of seasons' concentrated effort is still quite sufficient to enable a capable modeller to reach national standard in this branch of model flying. With a little luck, it can be achieved even quicker.

In any case, the present 2.5 c.c. engined, 18-oz. model is not such a very great handful. 3.5 c.c. engines have been fitted into these same air-frames and climbed them even faster. Our own experience in this direction relates to such a model (417 sq. in., 18-oz., Amco 3.5) which was certainly hotter than any current " International." It took a little getting used to, but it won its first national contest only 20 days after the design was laid down and subsequently put up the highest average time for the 1951 season, mostly on 10-12 sec. engine runs. It was the builder's one and only competition season and this fact should be an encouragement to those who think that international class F/F is too difficult.

What of the other implications of the new loading rule?

A 2.5 c.c. model will now have to weigh approximately 35 oz. This is something new to most of us. Only in the United States Class C F/F category, do we find such a weight—in this case powered by 0.35 cu. in. (5.8 c.c.) glowplug engines developing twice the power of our international class motors. Under the F.A.I. area-loading rule, however, a total area of nearly 9 sq. ft. will be permissable at this weight. From this, it has been assumed in some quarters that models will therefore jump to impossible-to-transport dimensions of about 900 sq. in. wing area, with a 360 sq. in. (40 per cent.) tailplane.

In fact, such a model is impracticable for several reasons. Firstly, it would be difficult to build a serviceable model down to this weight. Secondly, nothing like a 40 per cent. tail is now required to control the climb. Thirdly, the upper limit of area has never been necessary with 2.5 c.c. international models, in any case.

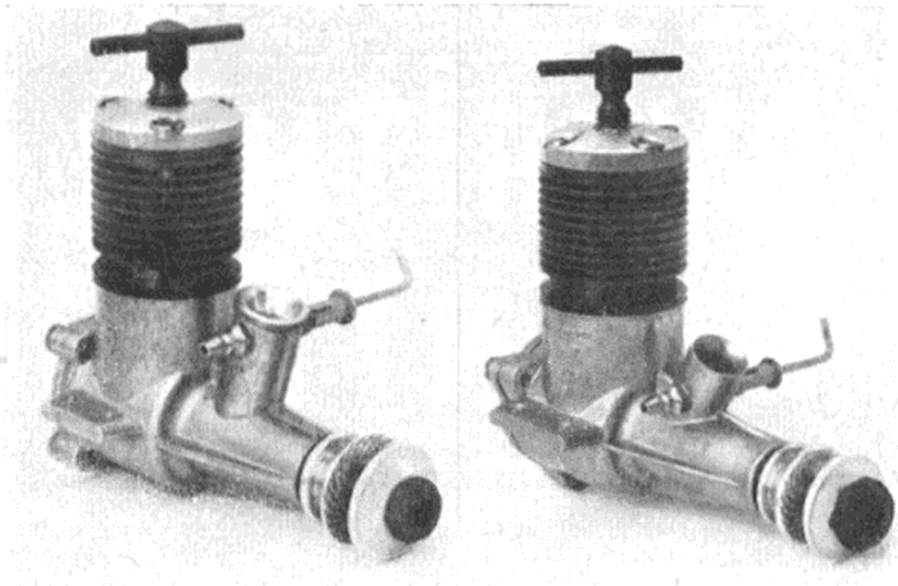
We would suggest that a 600 sq. in. wing should be adequate, giving a wing-loading of *circa* 8.5 oz./sq. ft. A 25-30 per cent. tailplane should suffice, which, being lighter, will also avoid the necessity of an excessively long nose-moment. Wingspan might, therefore, be established at about 70 in.

We still have a bigger model than before, however, and it is agreed that big models are an embarrassment to transport from one country to another. Modellers may, therefore, resort to smaller capacity engines and concentrate on more compact models.

If this happens, a situation that has taken a long time to bring about will go to waste: namely, the availability of 2.5 c.c. engines in every engine-producing country of the world—the only universally acceped size at the present time.

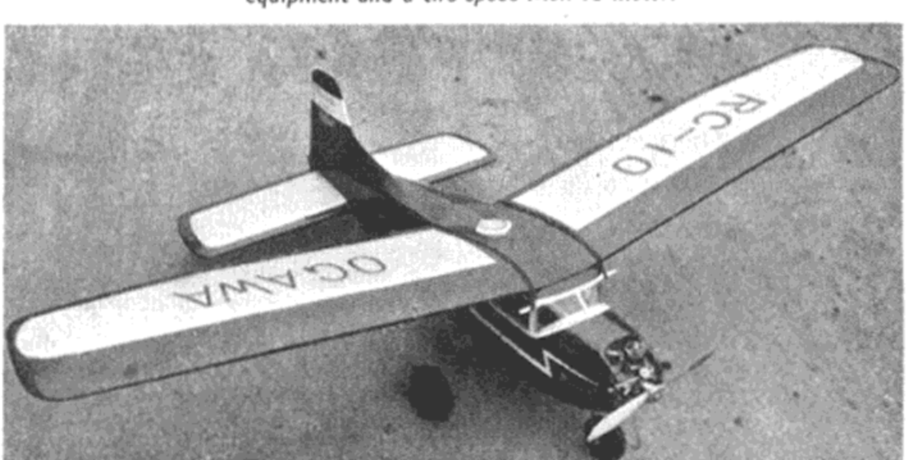
If smaller models are to be built, then the minimum area loading can be more closely adhered to and, if a trend towards the smaller engine develops, then it is possible that a level will eventually be found at the half-A to 1 c.c. size. One can visualise McCoy 049 diesel and Cox 049 engines being favoured by the Americans in 11.6 oz. models of 275-300 sq. in. wing area. European equivalents would probably be developed around the more powerful 1 c.c. engines, such as the Super-Tigre G.25, David Andersen 1 c.c. and Taifun Hobby. Weight here would have to be 14-oz. and wing areas might be established at around 350 sq. in. A very practical size.

This may portend the future of the international F/F model. If so, then the rules will, perhaps, in the course of time, become more favourably regarded.



Lesser known models in the famous Super-Tigre range of engines, are the G.23 and G.27 diesels. G.23 model, left, is of 2.47 c.c. and weighs 5 oz. G.27, right, is of 3.2 c.c. and weighs 6.5 oz.

A radio-controlled model a la mode *from Japan. It is equipped with OS Minitron radio equipment and a two-speed Max-15 motor.*



In Brief . . .

The latest engine to reach us from Australia is the Sabre 2.5 diesel illustrated. Superseding the earlier Sabre diesel of similar capacity, it is a neat and well-made engine displaying the usual pleasing finish associated with Gordon Burford's products. The crankcase is of the same high silicon content alloy used for the 0.35 model featured a few months ago in our Engine Tests series.

We have recently been inspecting a Bramco throttle. It is quite a simple affair, somewhat on the lines of the Mills throttle and consists of a conventional needle-valve carburettor but with the addition of a barrel type throttle which moves through approximately 80 degrees from the fully open to fully closed position. It is designed to plug directly into the intake of the various popular American glowplug engines in the .19-.35 cu. in. group, but, with modification, will fit other engines. We hope to report on our experience with one of these throttles in a later issue.

OVER THE COUNTER

The latest brain-child of R/C expert, G. Honnest-Redlich, is a single-channel transistor receiver. He claims that this has the following advantages over the normal hard-valve receiver—extreme range; lack of critical adjustments; low battery voltage and weight. It is hoped that this new receiver will be on the market in about three months.

* * *

The photograph below shows M. A. King, managing director of Contest Kits Ltd., presenting A. B. Abel

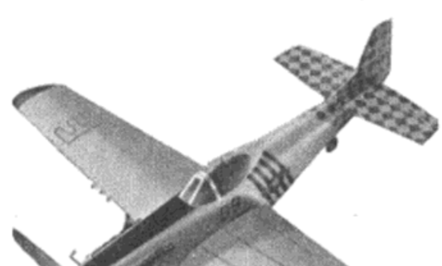
of Salisbury with the eight-day clock, the prize for the most outstanding performance with a Contest Kit during 1955.

Mr. Abel's win was achieved with an *Inch Worm* which won the Southern Counties Rally and made numerous outstanding flights, including one of 1 hr. 31 min.!

In addition to this contest, in 1956 a special Junior Competition is being run by the firm. Any person under 16 is able to enter, flying either a 24 in. span *Cygnet* or a 24 in. span *Captain*. Any three consecutive flights will count as contest times and the winner will have all travel and accommodation expenses paid to the World Power Championships. There are also eight consolation prizes.

* * *

After many years of stability, it now seems that some of the constantly increasing costs of importing balsa wood to this country must at last be passed on to modellers. At least two of our largest manufacturers are revising their price lists and the increases will probably be in force by the time you read this.

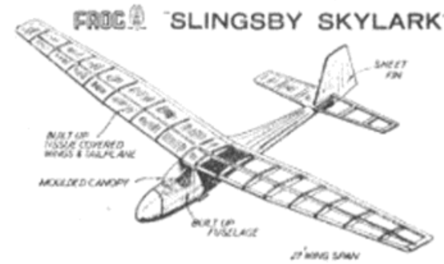


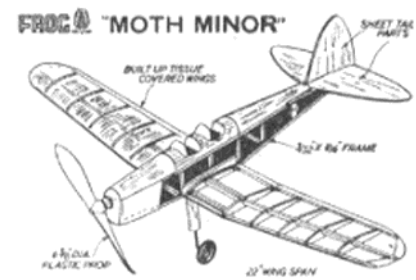
The "Mustang," the first of new Mercury scale kits, mentioned last month, to reach the market—sells at 32s. 6d.

Messrs. Electronic Developments have taken over the production of the P.100 relay formerly manufactured by Messrs. E.C.C. We understand that E.D.'s will be making alterations in the design of the relay in order to improve its performance and to facilitate production.

* * *

At the Tri-ang Trade Fair (see last month's "Over the Counter") several notable additions to the Frog





range of kits were on show. Firstly the new polystyrene plastic scale kits: five are currently in production—the *Hunter* and *Sabre* at 5s. 3d., the Sikorsky *S.55* at 5s. 9d., the *Javelin* at 7s. 6d. and the *Canberra* at 8s. 6d. These will be followed by the D.H. 110, *Meteor* 8, *Venom* and *Sea Hawk*. The kits are complete and ready to assemble. They include polystyrene cement, transfers, and a stand for mounting the finished model.

A Senior Scale series of flying kits has started with the *Moth Minor*, *Bird Dog* and *Seamew* as the first prototypes. All are of 22 in. span and sell at 5s.

Designed round the Frog 2.49, the *Aerobat* is a fully flapped 38 in. span stunt model. Ready in May.

Illustrations—above, the "Moth Minor" and "Slingsby Skylark"—below, some of the plastic solids.

Letters

Continued from page 161

and dope job on a crumbled fuselage or wing ? "

Just then, a self-assured young man roared up on a Corgi motor-cycle. He took his flight box off his back and within three minutes had taken out and assembled a 30 in. gas job. A few seconds later, after putting on left trim, he idly watched it fly in tight circles, and when the motor "cut," walked forwards a few yards and picked it up !

" No, no, no ! " I cried to myself. " Where's the sport in that ? What's happened to the small group of boys, and those earnest discussions on camber and dihedral, incidence and tail wag ? How about the cross section and the straight section ; aren't you interested in those any more ? "

After looking for two hours, I decided that the sport, as a sport, had sadly deteriorated—so now I'll tell you what I'm going to do. You can keep your 0.5's and your Jetex. I'm going out to buy some plain sheet and block, tissue and dope, varnish and rubber. Yes, rubber ! Then I'll sit down with foolscap sheet to design the finest 48 incher endurance job you've ever seen.

Then I'll take the finished job to Epsom Downs, spend 20 minutes—yes, 20 minutes—laying out my gear until I've got my audience (something no modeller's ego can do without), give it 1,000 turns and let 'er find a thermal. And you'll be so amazed at the flight time and constructional detail, you puny gas men, you'll walk quietly away and bow in recognition of a true modeller !

Yours faithfully,

Hampton Hill. MARK MACE.

'Balsa Bride'

DEAR SIR,—Help ! Could any of your readers tell me what on earth I am supposed to do with hundreds of aero-mags, umpteen kits, two huge building boards, scores of bottles of dope, loads of cement, pins (which I am eternally picking off the floor), in fact all the equipment of a modelling-mad husband?

Before we were married (four months ago) I looked on modelling as a splendid hobby (note " hobby "—huh !), and I laughed at my future mother-in-law's warnings. I even tried modelling myself —toiled for hours on end with tongue hanging out—only to produce a glider which for some reason or other caused my husband to go into hysterics.

When I took on my husband and " all his worldly goods," little did I know what that entailed. We are living in one room at present and you can imagine my state of mind ! Aeromodelling simply cannot be called a hobby—it's an obsession.

Now I no longer talk to my husband in the evenings because when I do he heaves a huge sigh and resignedly says " What is it now dear ? " Once again I take a hot water bottle to bed as by the time he has finished modelling for the evening my feet are like blocks of ice. Still, at least I can never complain at not going out on nice summer Sundays. I know where I shall be this year—on a windy field holding my skirt down and trying to keep my head from being chopped off.

Let this be a warning to other young brides. If he casually mentions aero-modelling when you first get to know each other—run like mad the other way. If you do think you can stick it, well, it's not so bad really, and you know, I'm darn sure I could make the wing ribs stick in properly this time; I might even make it fly.

Yours faithfully,

London, S.W.8. P. M. PARFETT (Mrs.)

Wiley Post(script)

DEAR SIR,— It is gratifying to know that Mr. R. Burrows found the recent civil colour schemes article to be interesting and that it prompted him to contribute some additions.

The colouring given for *Winnie Mae* in the article is correct from the time of Wiley Post's 1931 world flight. Space precluded extra detail but here it is now.

The lettering was in dark and light blue, with dark blue trim and light blue interior to the striping on the cowling and on the spats. The upper surface of the wing had a dark blue inset panel. The machine has been illustrated in colour with red and yellow trim and this may have been true prior to 1931. Study of photographs will show several structural modifications over the years and the deletion of the light blue trim during the subsequent repainting. Mr. Douglas H. Gilmour of New Jersey has been kind enough to confirm several of the above points and also that *Winnie Mae* is still trim(-med) in blue !

Yours faithfully,

Benfleet, Essex. P. M. H. LEWIS.

No Rules are Good Rules

DEAR SIR,—There has been a great deal written on the subject of decline in interest in contest flying. Practically everything but the real cause has been blamed. I would like, as an ex S.M.A.E. contest flier (I still participate in rallies), to put my point of view.

Let us briefly trace the history of post-war contests. In 1949 practically everyone had a diesel engined model and wanted to fly it in a contest. Unfortunately 90 per cent. of the entry at contests that year failed to take off. The writer

" *Who's flying this crate, you or me ?* "

was only one of the many who predicted what would happen if the ridiculous r.o.g. rule was not abolished. The S.M.A.E., of course, was not interested. It is difficult to say how many power modellers were lost to S.M.A.E. contests by that rule, but I personally know of at least 20. Now that the rule has been overcome by the use of the v.t.o. method, it is dropped—seven years too late !

Then in 1951 the F.A.I. rules were introduced—result ? Another terrific drop in contest entries. In 1954 another considerable drop in contest entries—this by a strange coincidence was concurrent with a new crop of F.A.I rules. It was this year you may remember, that sounded the death knell of the Wakefield Contest, not that it was the only restricted rubber event that went for a " burton," remember the Flight Cup ?

To say that last year's weather was partly responsible for the increase of entries over 1954 is surely no understatement. If we'd had weather like that in 1949 the pathetic figure of 3,700 entries would have been passed in the first six contests of the season.

I think it is high time the S.M.A.E. stopped this ridiculous search for the " Best Man " and " Still Air," etc. Three contests to F.A.I. rules per year are more than adequate. The system of two " trials " and a final was all very well in the days of large contest entries, but is hardly applicable now. It is a fact, whether we like it or not, that a person who is last in both the trials can still be first in the final hundred. Is he the " best man," and did the contest take place under " non-thermal " conditions ?

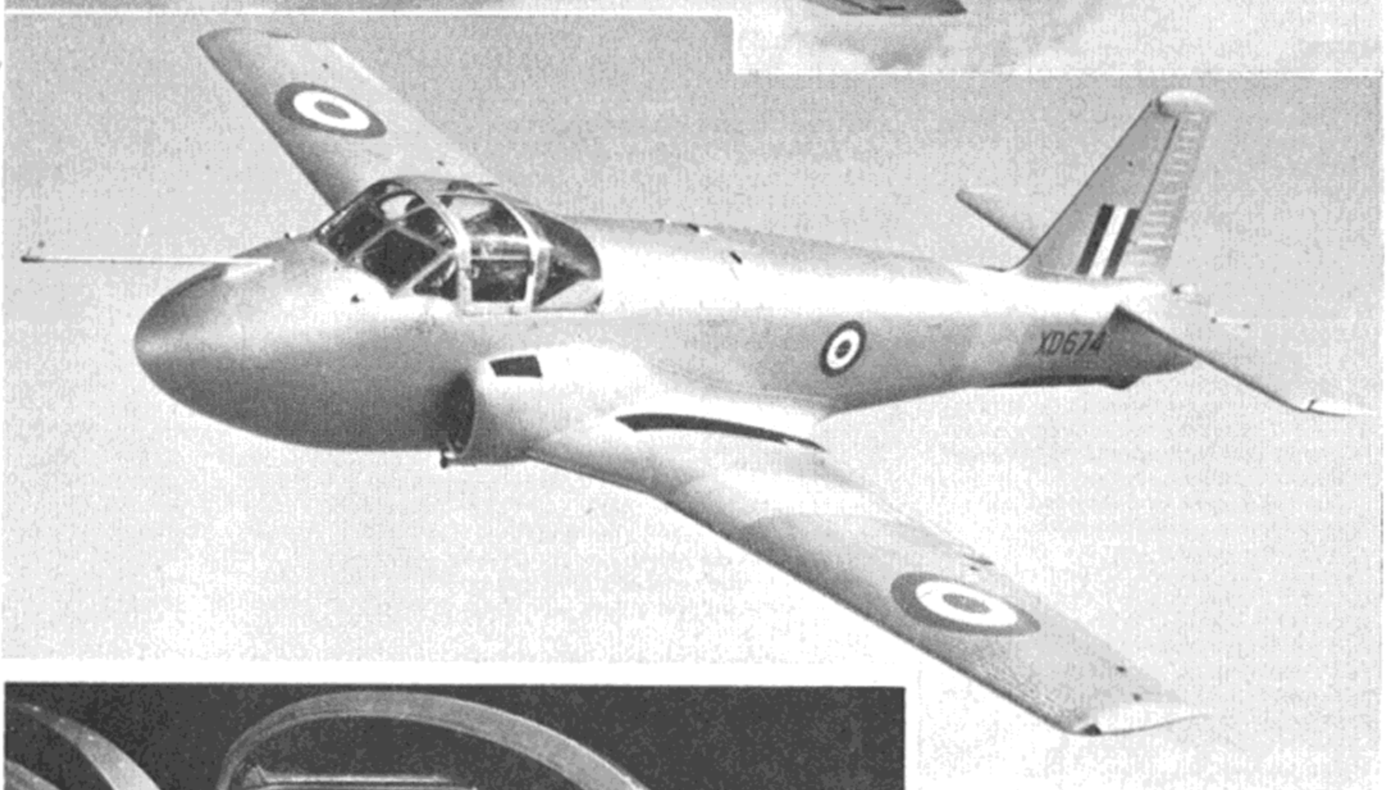
It may be noted that although interest in S.M.A.E. contests has dropped, there is still a large entry at most rallies.

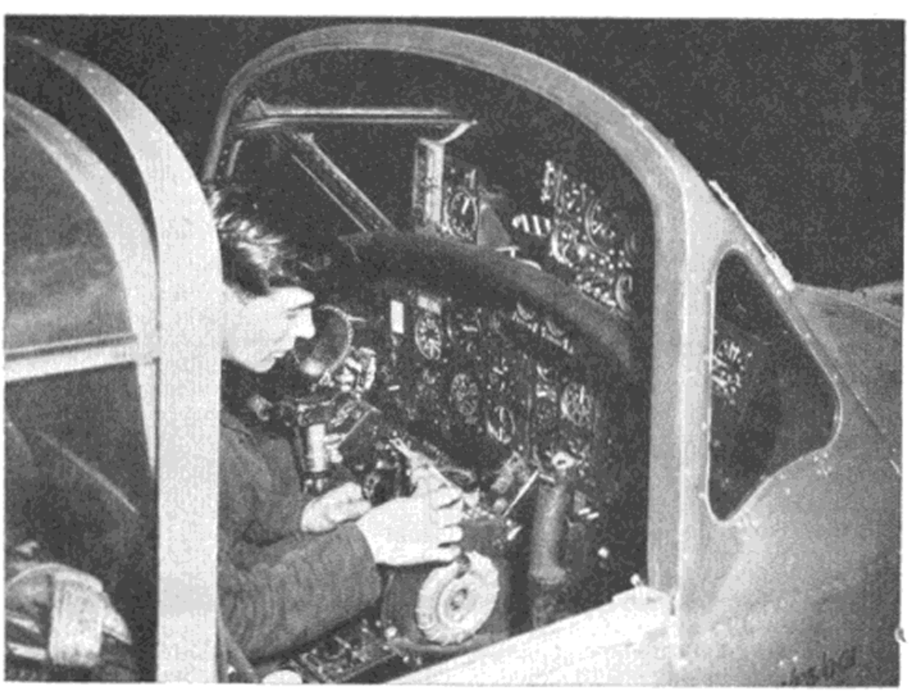
The way ahead is clear. The " open contest " must be revived, and let us revert to three fives instead of five three's.

Yours faithfully,

Dagenham, Essex. J. R. HOLT.

The HUNTING PERCIVAL *Jet Provost*





MODEL AIRCRAFT

DATA PANEL

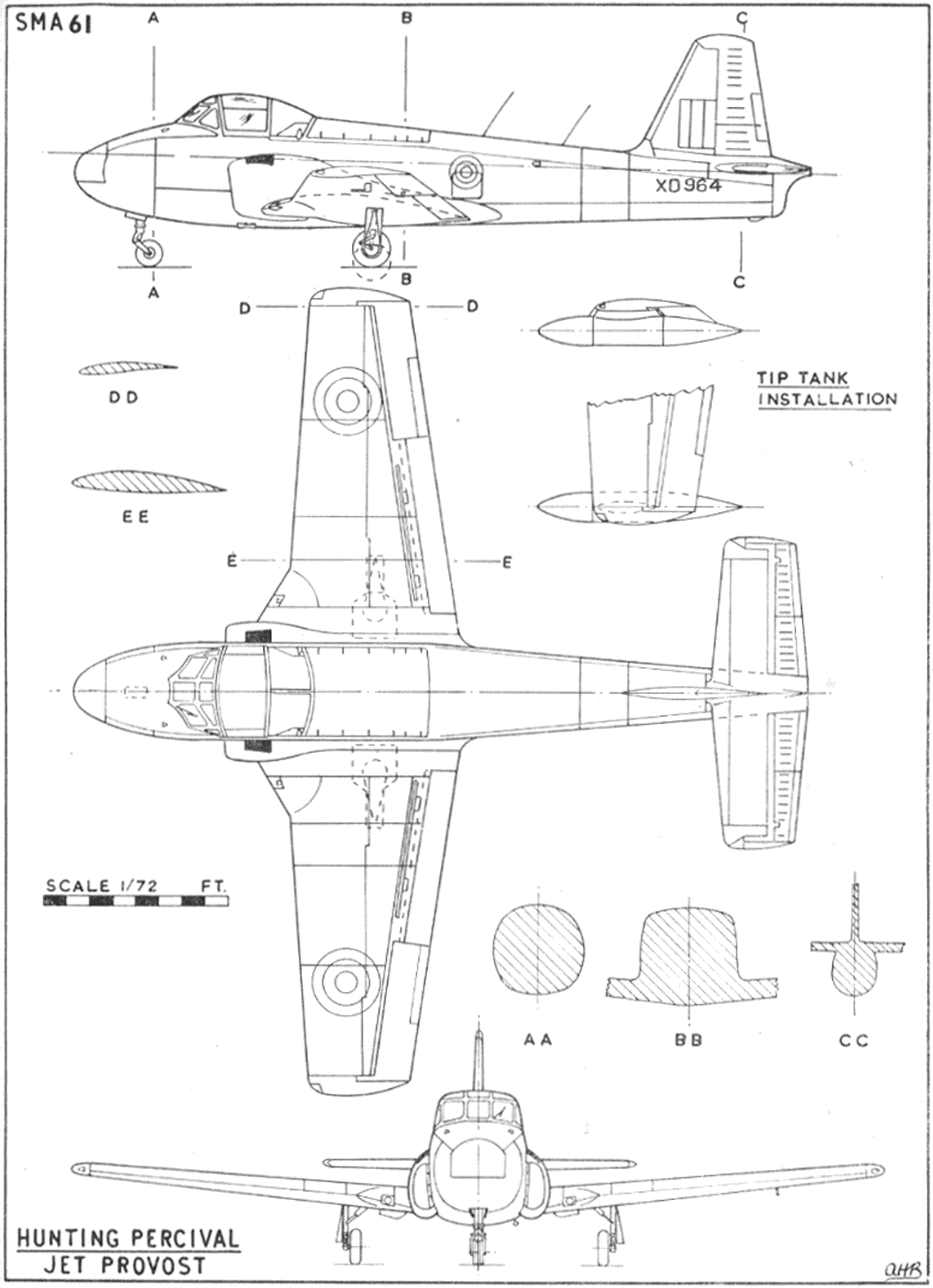
Type: *Basic Jet Trainer.*

Dimensions: *Span, 35 ft. 2 in; Length, 31 ft. 9 in.; Height, 10 ft. 2 in.*

Engine: *One Armstrong-Siddeley Viper 5 turbojet.*

Performance: *Max. level speed, 330 m.p.h.; Max. permissible speed, 442 m.p.h.*

Colour Scheme: *Silver overall, with yellow bands encircling fuselage immediately in front of fin; also yellow bands over and under wings as shown in the photographs. Usual R.A.F. roundels and fin flash, with serial No. in black.*



HUNTING PERCIVAL
JET PROVOST

Model Quiz

Test your knowledge of model aircraft matters with this interesting quiz. Score 10 points for each complete answer. A total of 50-60 is fair; 60-70 is good; 70-80, very good; over 80, excellent.

Answers are on page 197.

1. (a) What is the name of this well-known model?
   (b) Is it a magazine plan or kit model?
   (c) To which competition class (if any) does it belong?
   (d) What is its wing span?
   ($2\frac{1}{2}$ points each question)

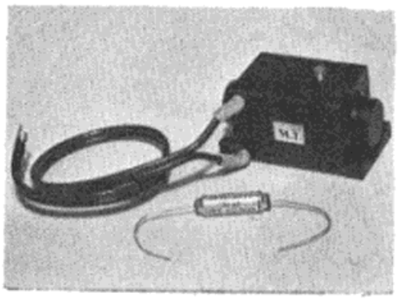
2. Wakefield Special.
   (a) Who won the Wakefield Trophy as a member of the first British team to visit America?
   (b) Which year was this?
   (5 points each question)

3. This fuel tank belongs to a famous model aircraft engine of which many thousands were made. Can you name it?

4. Who wrote the following two model aeronautical books:
   (a) "The New Model Aeroplane Manual";
   (b) "The Model Aircraft Handbook"?
   (5 points each question)

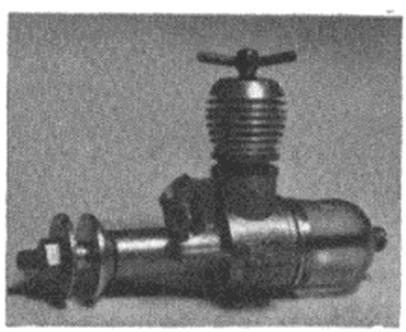
5. Modern high-performance F/F contest models have exceedingly high rates of climb which are often comparable with those of full-scale aircraft. With which of the following aircraft would you expect the rate of climb of an Oliver Tiger 2.5 c.c. powered International model to most nearly approximate:
   (a) Tiger Moth. (c) Percival Provost.
   (b) Piper Tri-Pacer. (d) Spitfire II.

6. (a) What are these?
   (b) What are they used for?
   (5 points each question)



7. (a) What is the official FAI glider towline length in feet?
   (b) What are the minimum and maximum total areas allowed under the A/2 glider specification?
   (5 points each question)

8. (a) What is this noted M.A. plan model?
   (b) Who designed it?
   (5 points each question)



9. The world's smallest production engine is the Allbon Bambi. Can you give:
   (a) its capacity;
   (b) its weight, to nearest $\frac{1}{8}$ oz.?
   (5 points each question)

Book Reviews

When an American Air Force pilot was told to report to his Colonel one spring day in 1947, he little dreamed that this summons would make him the first man to fly faster than sound. In his book **Across the High Frontier** (Gollancz, 16s. 6d.), W. R. Lundgren tells the story of Charles E. Yeager, whose complete stability and calmness had qualified him for a task that many test pilots had vied for the honour of having. This book, although obviously intended to have a wide appeal, contains a wealth of technical detail that blends unobtrusively with the story of Yeager himself.

Mention of a famous airman generally calls to mind a particular aircraft or flight that is inseparably linked with his name. Thus, Lindbergh is better known for his solo New York-Paris flight, rather than for any of his other contributions to aviation progress, while Alcock and Brown are best remembered for their crossing of the Atlantic. In **Six Great Aviators** (Hamish Hamilton, 10s. 6d.) author John Pudney does not concentrate solely on the highlights of his subjects, but rather he deals with their backgrounds and overall careers.

To choose six names from the scores of aviators that have achieved fame, was, in itself, no mean feat if they were to truly deserve the appellation of great, but with A. V. Roe, Alcock and Brown, Kingsford-Smith, Lindbergh, Saint-Exupéry, and Neville Duke, he has chosen well and at the same time provided a diversity of achievement.

Ever had a job to find a correct colour scheme for that scale model? Almost certainly the answer is in **Know Your Airliners,** a dumpy-style book by John W. R. Taylor, and published by Shell-Mex at a modest 2s. 6d.

Altogether 28 aircraft are described, and each is accompanied by a full page colour picture by aviation artist Roy Cross. Authenticity is the keynote of this little book and just to tie things up neatly, there are two pages—again in colour—of 29 airline badges.

MODEL AERODYNAMICS No. 16

One of the essential features of producing lift is that the airflow must be three-dimensional—in simple terms, sideways as well as up and down. With purely two-dimensional or what is technically termed translational or translatory flow there is very little difference between the behaviour of an aerofoil section and, say, a cylinder. The flow parts at the leading edge in each case, journeys round each side of the section and rejoins at the trailing edge. The resulting force produced is purely frictional, i.e. just drag.

Taking the cylinder on its own, if this is rotated in still air a surrounding envelope of air will be dragged round with the cylinder, again due to friction, producing what is known as circulatory flow. If now a translatory flow is superimposed on this circulatory flow (i.e. the cylinder moved forwards or an airstream blown past it) the resulting streamlined will be "humped" over the cylinder and a stronger aerodynamic force will be produced. This force will now be directed at some angle upwards from the direction of the airstream and so contributes lift as well as drag—Fig. 1.

Lift from an aerofoil section can be considered as being produced in an exactly similar manner—a circulatory flow superimposed on a straight translatory flow. In this case, however, the circulatory flow is produced automatically. There is no need for the aerofoil to be rotated. When it is "working" in three dimensions it generates this circulation which inclines the reaction force upwards and so produces lift as well as drag.

The phenomenon of obtaining lift from a rotating cylinder placed in an airstream is quite well known. The Fletner rotor ship of the mid 1920s replaced sails with rotating cylinders and it was calculated that the equivalent "power" of the rotors was 3 to 4½ times that of sails—Fig. 2. With endplates fitted to the rotors to reduce spillage at the tips the rotors were 9 to 10 times as efficient as sails, area for area. On this craft the rotors were power driven to give a surface speed 3 to 4½ times that of the wind.

For various reasons the Fletner rotor ship was never a commercial success, although three were built. Neither have attempts to use rotating cylinders in place of wings on conventional aircraft proved to be a practical proposition—Fig. 3. The most satisfactory results in this sphere have been obtained on wings where the leading edge is made a cylinder and rotated—Fig. 5—giving a high lift and nearly non-stallable wing, although presenting many practical problems to construct. An allied phenomenon to this "cylinder" lift or Magnus effect is the deflection of bullets fired broadside from fast moving aircraft. Depending on the direction of spin on leaving the muzzle the bullets either fly up or down, and to one side—Fig. 4.

As far as its behaviour in three dimensional flow is concerned a wing can be replaced by a lifting line with circulation around it, as shown in Fig. 6. Trailing vortices run downstream from each end of the lifting line (each wing tip) and there is a mirror image of the lifting line, with reversed circulation, at some infinite distance downstream. This "mirror image" can be demonstrated, under suitable conditions, shed off an aerofoil starting from rest.

The production of trailing vortices can also be appreciated from Fig. 7 which shows how the airflow over the top surface of a wing tends to curve inwards and that over the bottom surface outwards. Where the two join at the trailing edge they roll up into a series of vortices—equivalent to one large vortex trailing from each tip.

The net effect is that the effective airflow direction *approaching* the aerofoil is slightly reduced and so the *effective* incidence of the wing is less than the geometric incidence—Fig. 8. The amount of deflection is obviously dependent on the strength of the lift produced and can be calculated as the lift coefficient divided by π times the aspect ratio (A) of the wing. This means, in practice, that a wing operates at a slightly lower angle of attack than the apparent geometric angle and this difference varies with the aspect ratio. Similarly an additional drag force is produced by this deflection.

Thus fully to calculate the characteristics of a particular wing one must also take into account the aspect ratio, subtracting the deflection from the geometric incidence to arrive at the effective incidence and multiplying the deflection by the lift coefficient (C) again to find the added (induced) drag produced.

FIG 1

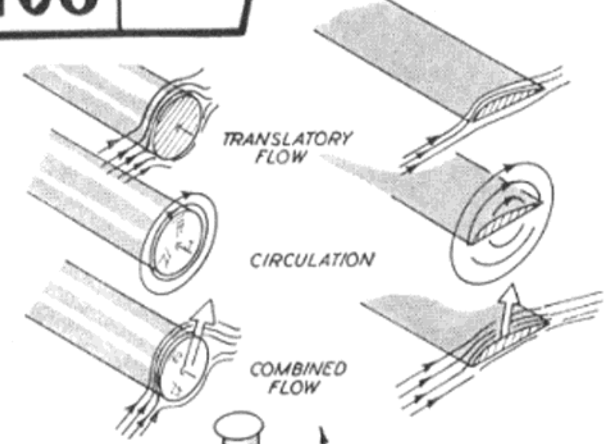


FIG 2

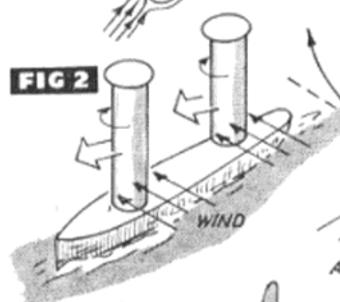


FIG 4

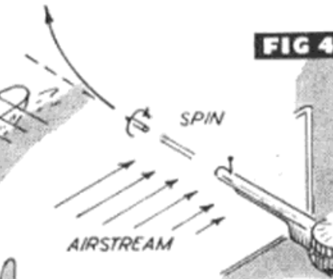


FIG 3

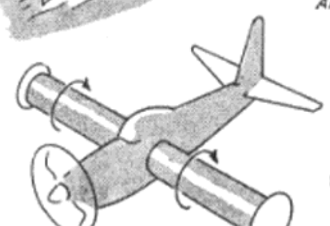
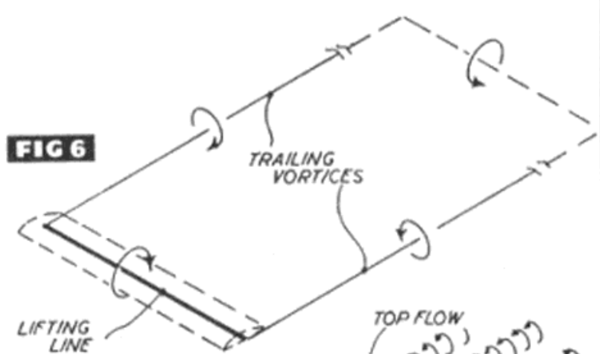


FIG 5

FIG 6



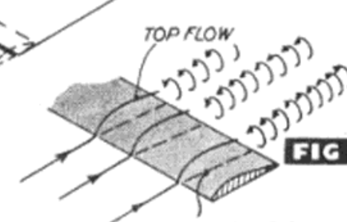
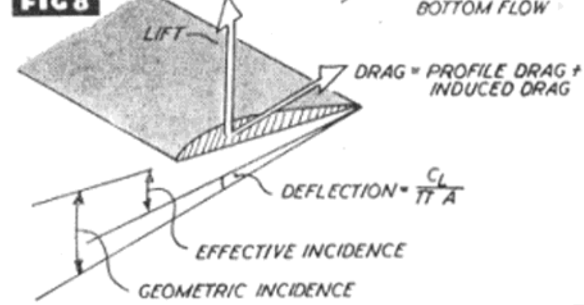
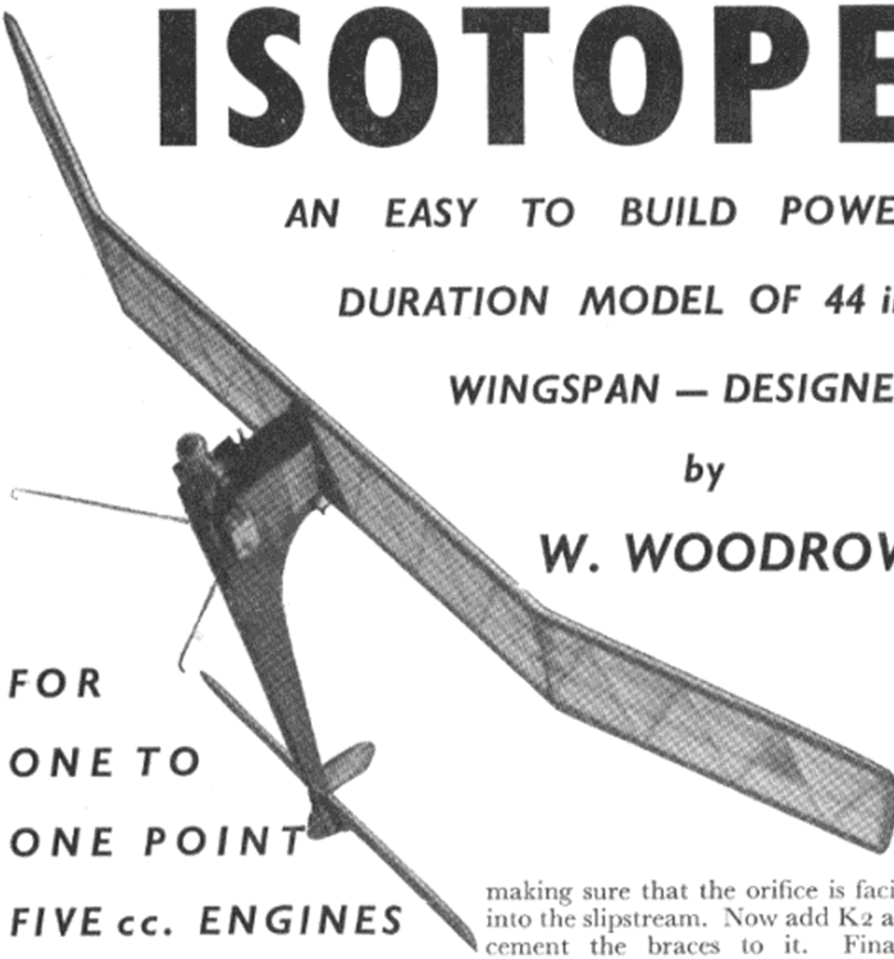


FIG 7

FIG 8



ISOTOPE



AN EASY TO BUILD POWER DURATION MODEL OF 44 in. WINGSPAN — DESIGNED by W. WOODROW

FOR ONE TO ONE POINT FIVE cc. ENGINES

THIS easy to build power duration model features anti-warp, geodetic wing and tail structures, plug in undercarriage, and has a good all-weather performance.

Fuselage

Make the tank from thin sheet tin and brass tube. Now cut out K1 and formers F5 to F9 and cement them into position on K1. Cut out F1 and F1A and cement together. Make the rest of the formers and fin, also the undercarriage box and bind it with sellotape.

Cut out the base, mark the position of the formers, and pin to the plan Now cement the keel and former assembly to the base. Join the F1A assembly to F2 with the engine bearers, at the same time positioning the tank between them. Now add the rest of the formers, fin and $\frac{1}{2}$-in. sheet tail support, and fill in between F9 and F10 with soft block. The undercarriage box can now be added, also the pylon braces.

Sheet in the sides of the pylon as shown, and cement neoprene tubing to the upper vent of the tank and pass up and over the lower pylon brace and hold in place as shown, making sure that the orifice is facing into the slipstream. Now add K2 and cement the braces to it. Finally cement into place the soft nose block. When the entire fuselage has set, lift from plan, sand the nose block to shape and the tail support to conform with the fuselage outline. Add the wing and tailplane dowels and the platforms of same. Then finally cement into place the underfin.

The undercarriage is quite straight forward and if required is made from 14 S.W.G. piano wire and plugs into the box in the fuselage.

Wings and tailplane

Warren Girder construction is used, for like most modellers, I hate the necessity of pinning wings down when doping, also there is no danger of future warps. The wings are built as follows. Cut the trailing edge of the centre section to length and notch to accommodate the ribs. Pin the trailing edge and leading edge to the plan and add the ribs making sure that the two ribs W3 are in the centre, then add the spruce main and rear spars plus the dihedral braces. Now add the cement fillets between the tails of the ribs.

When set, remove from plan and build the tips in a similar manner taking care to set the inboard W3 to the angle given by the dihedral template. Finally cement the tips to the centre section and when dry, add the soft block tips and sand the leading, trailing edge and tips to shape. Now cement to the centre of the centre-section at the trailing edge of a strip of 1/32 in. ply to protect the trailing edge from the rubber bands, and sheet in the top.

The tailplane construction is similar to that of the wings and finished by binding the D/T hook into position with adhesive tape.

Covering

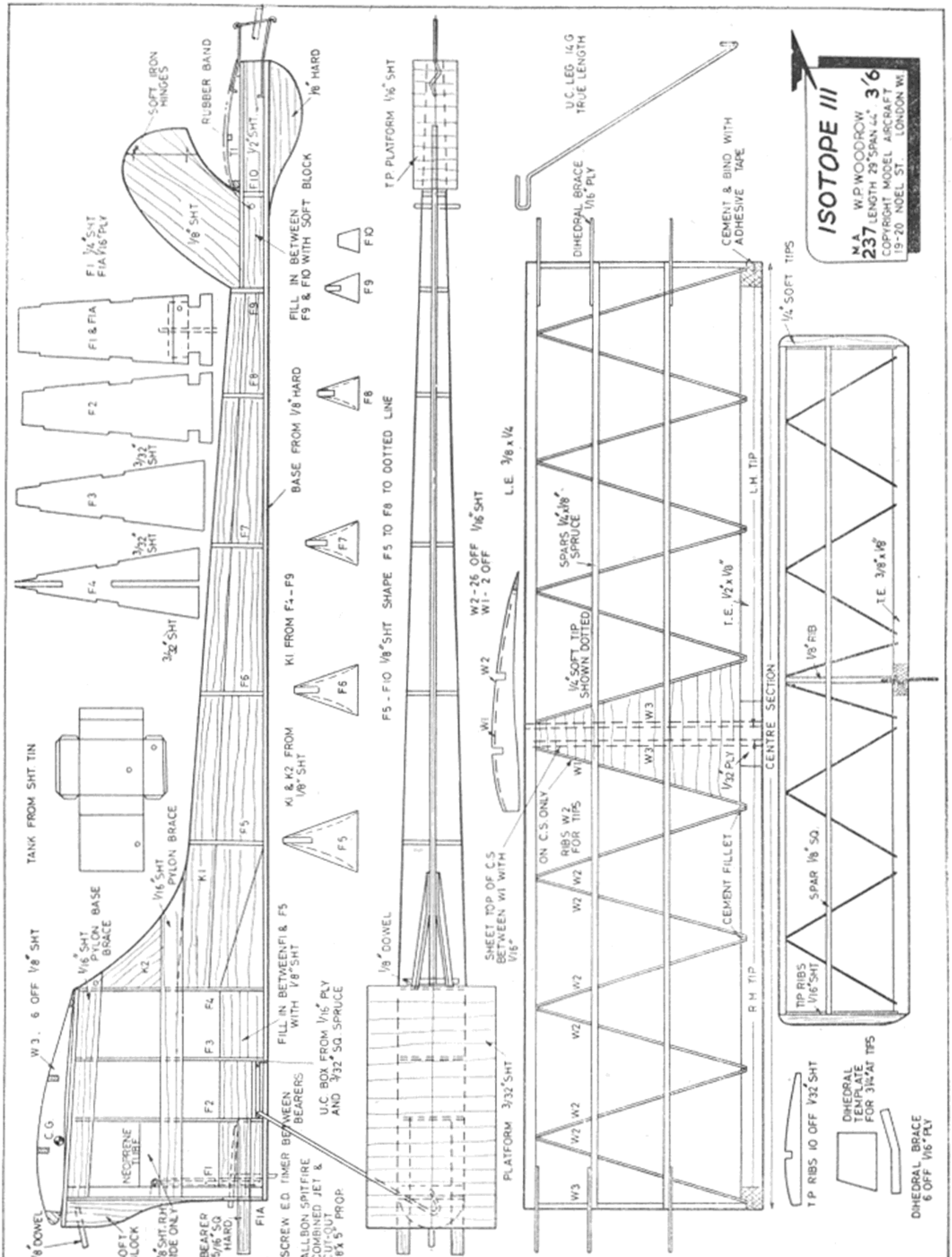
The entire model is covered with light weight model span, the fuselage then receiving three coats of clear shrinking dope and the flying surfaces two coats. The original was painted with aerolac and another coat of clear dope added. This provided ample fuel proofing with the minimum addition of weight.

Assembly

An Allbon Spitfire with combined jet and cut-out was used, and an E.D. clockwork timer was screwed to the left-heand bearer. This combination proved entirely satisfactory. Other *Isotopes* have performed just as well with 1.5 c.c. engines, but do not use any motor that is heavier than the Spitfire. The wings are held securely in place with three medium thickness rubber bands and ensure that they do not wobble. The tailplane is held by the D/T fuse band and a band around the dowel and passing around the tailplane D/T hook.

Flying

Hand launch the model into wind and a fast glide of about ten yards should be obtained with a slight turn to the right. A left turn is fatal. Now start the engine and with it running under low power give a five second run and note the turn and rate of climb. If the model turns to the right all well and good, if not set the rudder accordingly. If it climbs too fast slight down thrust should be given to the engine by packing washers under the rear of the engine. Now give it a 10 sec. run on full power and trim until an almost vertical spiral climb to the right is obtained. With the Spitfire it was found that a 1/32 in. upthrust was required. When trimmed to satisfaction, tune the engine to full power, set the timer to 15 sec., light the D/T fuse, and start running. But before you attempt any flying put your name and address on the model.



FULL SIZE WORKING DRAWINGS ARE OBTAINABLE FROM YOUR LOCAL DEALER, OR BY POST FROM THE "MODEL AIRCRAFT" PLANS DEPARTMENT 19-20, NOEL STREET, LONDON, W.1, 3s. 6d., POST FREE

PHOTONEWS

1

THE clocks have been put on that extra hour, so the time is now ripe to put to practical test the results of those long winter evenings spent at the building board. No doubt we have all complained of the winter with its curtailed flying time, but after all, if we had continuously fine weather, when could we find the time to build the models to fly? Of course, there are modellers whose main interest is in building rather than flying models, but they are rather rare birds—or are they?

2

3

4

Our heading photo, however, shows the result of craftsmanship and a keen flying interest in the form of Ron Helliwell's semi-scale biplane powered by a D.C. 350. It features a swept-back top wing and a straight lower wing. D. B. Dumble, who sent in the photo, says that the immaculately finished red and white model took a year to develop to its present form, and was previously underpowered with a 2.49 c.c. diesel; the flight pattern is now smooth and stable on power and glide. Special attention has been given to cockpit detail and the front cockpit contains an instrument panel, padded seat, hank of rope, an axe, and a first aid kit—the latter is no doubt for Ron's use if the model ever prangs!

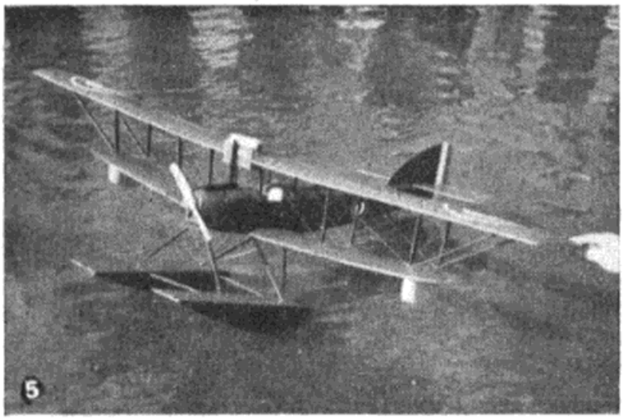
Gay sportster in photo **No. 2** is the handiwork of Heinz Lichius, and is, of course, his R/C Cessna 180 which put on such a great show in the King of the Belgians R/C contest last year. Wilfried Kroger, our correspondent in Germany, took this picture just before it took off on its last flight at the meeting. We say last, because after putting on a fine display of clean, inverted flying, it crashed in the landing approach due to over control.

Most unusual model to come our way in recent months is seen in photo **No. 3.** This realistic missile is Pete Russell's 1/5th flying scale V.1. At present it is powered by a Dynajet and has flown successfully from a dolly. The supporting ramp seen in the photo imposes too much of a load for the fuel supply. Complete model weighs $5\frac{1}{2}$ lb. but it needs 2 lb. of ballast in the nose to trim properly.

Photo **No. 4** is of a scale model of the Mooney M-18c *Mite* (since re-named *Wee Scotsman*) built by American modeller Walt Mooney, who says he is, unfortunately, no relative of Al Mooney who heads the firm which builds the *Mite*! The model is painted to match the original aircraft owned by Dallas Sherman of PAA-Load fame, which perhaps accounts for the fact that Walt has flown his *Mite* with a 5 oz. PAA-Load—a 4 oz. dummy and 1 oz. of cargo. Loaded, it weighs 21 oz. and it even has scale rib spacing.

Arthur Evans of Bromley M.A.C. has a yen for float planes. He won the super scale trophy at last year's Nats. with his Brandenburgh Seaplane, and photo **No. 5** depicts his Short N.B. 2, which would appear to be another winner.

A "one-off" job built by G. Coleby is seen in photo **No. 6.** A control-liner, it features simple but robust construction. Span is 24 in. and almost any



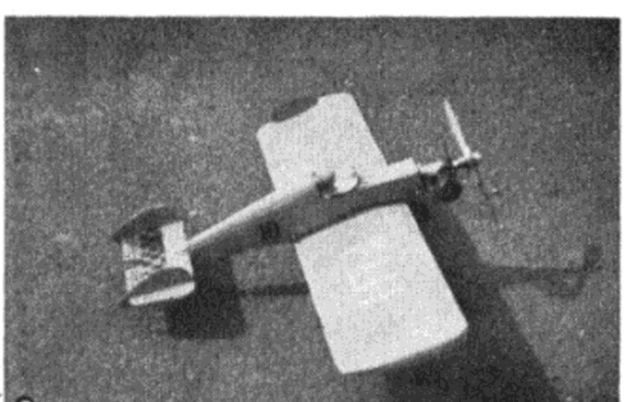
1 c.c. radially-mounted power unit is suitable. This particular version uses an old Frog 100 and a 7 × 4 in. prop.—a combination which still takes it round at 40 m.p.h. The long undercarriage legs, not visible in the photo, give plenty of clearance.

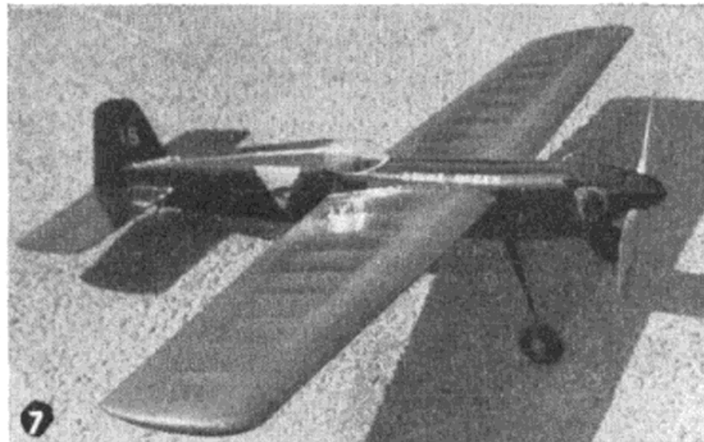
We like to think that M. L. Matthews built the KeilKraft *Stunt Queen* in photo **No. 7** amid the sound of Maori music and the swish of grass skirts—with an address like Haerehuka Street, Otorohanga, North Island, New Zealand, what would you think? (We only hope that the natives also regard the unmistakable buzz of a control-liner as sweet music!) But to get down to more mundane affairs, the cowling partly hides an Amco 3.5 B.B., which drives a 9 × 6 in. prop; top speed is in the region of 65-70 m.p.h. on 70 ft. lines.

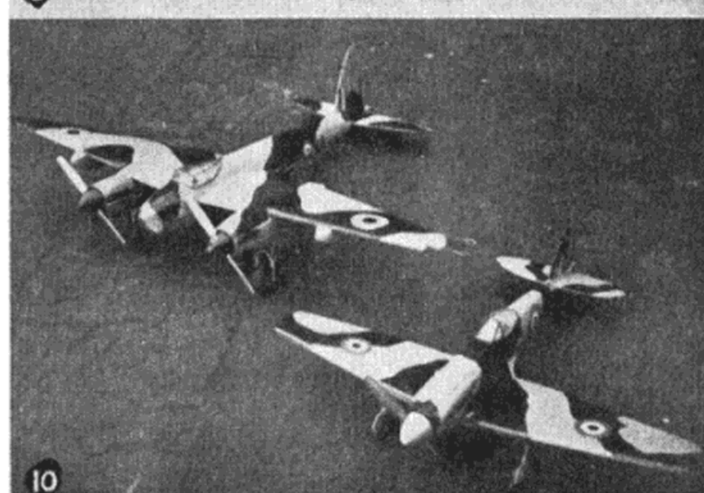
Our past articles on Civil Markings, and in particular a heading photograph of a *Rapide*, prompted David Nutt to send us photo **No. 8** of his 48 in. span C/L *Rapide*. His working drawing was scaled up from a recognition silhouette and for a 16 year old we think he has done a creditable job. One nacelle carries an E.D. 2.46 Racer, and the other an Allen-Mercury 25.

Although details of the model in photo **No. 9** were sparse, we thought it merited inclusion in Photonews if only by reason of the *Balliol* being a little-modelled type. The builder is unknown, but Bill Hume of the Seaham Club snapped the model at the R.A.F. Club, Abyad, where it took the Concours prize. A control-liner, it is powered by an E.D. 2.46.

A business-like pair are the *Mosquito* and *Spiteful* (built from M.A. plan 183) in our last photo. Michael Reynolds of Wolverhampton is the builder of the *Spiteful*, while the *Mossie* is the work of J. Levy. Both models are powered by E.D. 2.46's.







CLUB NEWS AND NEWS FROM THE S.M.A.E.

BRISTOL ACES M.A.C.

This club has now been revived due mainly to the efforts of our secretary Bob Smith (ex-Cardiff M.A.C.). Membership is restricted to junior employees of Bristol Aeroplane Co.

At present we can only fly C/L and indoor models but we are hoping for a flying field on R.A.F. Filton.

Models under construction include stunt models and team racers, but no scale *Britannias* !

HUDDERSFIELD D.M.A.C.

A concours contest was held on February 25th; Mr. and Mrs. Shirt were the judges, and the winners were:

Seniors. 1st. A. Bradley, *Hurricane*; 2nd. J. Woodhouse, team racer; 3rd. T. Mathewman, team racer; 4th. D. Boocock, *Javelin* F/F.

Juniors. 1st. M. Heywood, *Stunt Queen*; 2nd. A. J. Bailey, glider; 3rd. D. Whiteley, *Mosquito*; 4th. D. Bruce, *Bee Bug*.

The club will be having their annual rally in the near future: date will be given later.

WIGAN M.A.C.

Wigan M.A.C. made their way down to the winter rally held at Tern Hill. A cool enjoyable day was spent, especially by J. Wilkie, who flew his Wakefield into third place.

ENFIELD & D.M.A.C.

In spite of the recent inclement weather, there has been plenty of activity. A film show and an auction, somethat livened up indoor goings on, while outdoors, several new models have put in an appearance.

The 1956 C/L rally is now almost certain to be held on Sunday, July 15th, at the same site as the past two years.

HALIFAX M.A.C.

"Rubber Models" was the subject of a most interesting talk given us by Ken Rutter at a recent meeting. The talk was centred on the development of an unrestricted competition model featuring 4 oz. rubber, 6¼ oz. all up weight, 180 sq. in., wing span about 35 in., prop 15 in. dia., 16 strands of ¼ in. strip rubber—climb genuinely vertical. We have seen it. This man's ideas are very definitely worth hearing.

Previous events on our winter programme have been a film show using Shell-Mex-B.P. films, and a "friendly" contest against Wakefield.

Still to come are another film show with Len Stott's films, and an A1 uncovered contest.

SOUTH BIRMINGHAM M.F.C.

We are constantly searching for ways and means of stimulating the junior members to some form of modelling activity. We started this year in fine style. First we had a competition for a design for a club lapel badge, which may eventually also be used for a new club transfer. The entries were of a commendably high standand and the winning design by Roy Jones is elegantly simple.

The club is running a scheme whereby groups of members are building team racers with materials and engines supplied by the club. There will be a prize for the best finished model, and, later, probably another prize for flying performance, judged when models are flown at displays or rallies.

The high-spot of the season so far came on February 25th. A week previously, commercial TV came to the Birmingham area with a great flourish and club member Phil Dash, who is also Midland Area Secretary of the S.M.A.E., received a summons to I.T.V. H.Q.—could he arrange a short item in a children's programme on the following Saturday? With the assistance of Allan Peach, on leave from Germany, he collected some models and in the morning sallied forth to the studios, where, after two rehersals, ably assisted (or distracted ?) by TV announcer Hazel Court the boys put on their show. It lasted only a few minutes, but everyone is hoping that sufficient interest will be shown to warrant having a series of programmes devoted to aeromodelling.

TYNEMOUTH M.A.C.

A meeting was held in the clubroom on February 20th.

The main items of the evening were the awarding of Mr. F. Nicholl's contest cups, which were won by the following: glider, R. Nicholls; rubber, R. Pollard; power, R. Pollard; stunt, R. Baser.

After the presentations a film show was held. Some of our friends from Novocastria were present and a very enjoyable evening was had by all.

ENGLISH ELECTRIC M.A.C.

After the dismal results of 1955, members are looking forward hopefully to 1956. The year has started off well by our second annual exhibition in our clubroom at the works. This was a great success, with about 45 models on show, the general standard being higher than last year. A repeat exhibition is to be staged in July at the firm's Social and Sports Association sports day, together with a C/L demonstration.

A competition with Blackpool resulted in a team win for Blackpool by 50 sec., English Electric winning the power individual and glider team events.

NORTHERN HEIGHTS M.F.C.

The club's A.G.M. was held recently and this year two secretaries were elected. Malcolm Young will in future deal which major items only, such as the gala and such other items as do not necessitate regular attendance at weekly club meetings. A. T. Widgery, a former secretary, will now deal with all the club's routine business. Nevertheless, correspondence addressed to either will find its way to the right quarter.

As announced at the club's dinner and dance, a club glider is under way and the drawing has now been duplicated. Several of these are under construction and it is hoped they will appear at the next contest. The design is an A/2 and construction is simple enough for all to attempt.

Interest in R/C is now becoming much more general and is quickly developing into the club's main single activity. There are at least six members whose first interest is now in R/C and all have models ready for the air, some of which have been flown regularly with success. Ernest Jones is the recognised expert in the purely radio side of the business and his multi channel reed sets are beautifully made and an inspiration to others to "have a go."

CHEADLE & D.M.A.S.

At the Area Winter Rally, Mr. Garth Evans and Mr. Neild both had large gliders out. Garth continued his successful run by winning this event with his 12 ft. span *Conquest*, which had not been flown since it was hit by a car three years ago.

At a long and noisy meeting it was eventually discovered that the most popular method of awarding the club championship trophies consists of holding a one day meeting with competitions for all F/F classes and leaving the rest to "Lady Luck." It was also agreed to make a separate award to the juniors.

BREDON & D.M.A.C.

The club meet every Wednesday at 7.30 in their own clubroom at Waterloo Cottage, Bredon, for informal talks on most aspects of model building and flying. Minimum age is 12 with no upper age limit.

At the moment the interest of members lies mainly in sport power flying, although a section is quickly becoming interested in C/L flying. As yet no flying meetings with other clubs in the area have been arranged, but it is hoped that in the not too distant future the club will have this experience.

Any keen modellers living in the district, whatever their interests, would be cordially welcome. Please get in touch with the Hon. Secretary: P. J. Berry, Waterloo Cottage, Bredon.

NORWICH M.A.C.

Since the last report two "monthly cups" and two C/L events have been held. The first monthly cup was won by L. Brock with his team racer. He was followed by R. Carr also with a team racer; B. Snelling was third. In the second of the two contests C. Sparrow "turned up trumps" with an excellent stunt model, K. Nash was second and B. Last third.

The first of the two C/L events was the monthly "A" team race; it was won by G. Davie with his old Tiger job; with R. Carr a very close second. Three weeks later R. Carr had his revenge when he emerged a weary and fuel soaked victor from the "A" combat. All these contests were very well supported and everybody had an enjoyable time.

Recently the club has had the good fortune to have a photograph of the members published in the local evening paper; this has helped membership considerably. Three keen members have also given talks at two Y.M.C.A. centres which aroused a great deal of interest.

SIDCUP A.S.

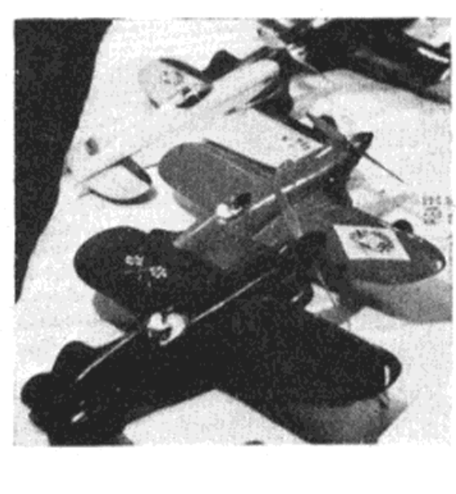
We organised an exhibition in aid of the 8th Sidcup (Handicapped) Scouts Troop recently. There were more than 300 models on show, of which about 150 were aircraft.

The standard of the models was very high and a few exhibits would have taken awards at the "Model Engineer" Exhibition. An ambitious model was in the form of an Avro *Manchester*, powered by two Frog "500" motors; it carried full navigational lighting.

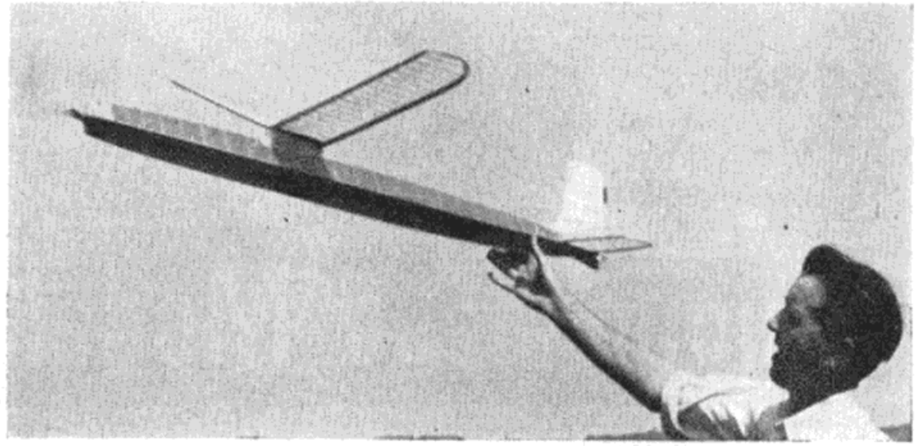
A novel item was a fully equipped model tool box for C/L work, which was equipped from fuel cans through to the smallest tool required, and included a set of drills, taps and dies from ¼ in. B.S.F. to 8 B.A.

The exhibition was open for only four hours on a wet Saturday afternoon, but more than £14 was raised for the scouts.

Team Racers at the Sidcup Show.



J. Wilkie launching his Wakefield model with which he obtained third place in the winter rally held at Tern Hill.



WHITEFIELD M.A.C.

At the recent winter rally organised by the N.W. Area, Whitefield had a field day. Funny, but they always seem to do best on windy days. G. Smith won power totalling 7½ min., with a huge 1.49 pylon job; rubber was won by J. O'Donnell with 8¼ min., followed closely by Bill Cooper; both were flying "Maxies." The "A" team race and combat were both won by M. Allen. Glider was the only event we did not win, J.O.D placing 3rd.

On the second fine Sunday of the winter J. Parrott won the club power trophy flying one of his "Monroe" series, which he flew at Wiesbaden, with which he totalled 8 : 48 with three flights, 3 min. max. B. Howarth placed 2nd, with 8 min. plus, flying a novel high thrust line job. J. O'Donnell won the glider trophy with 5½ min. on a very windy day. It was so windy that the max. was reduced to 2 min. (first time ever). J. Trainor was 2nd with 5 min. 15 sec.

After a lot of perseverance from our secretary, we have got our old flying field back. Now we are in the happy position of having two flying fields. Members are making full use of this as can be seen from the numerous models which are being trimmed in readiness for the contest season.

HIGH WYCOMBE M.A.C.

The C/L rally will be held on Sunday, May 6th. The events include class "A" and "B" team racing, combat, and a handicap speed event. Venue is the Kings Mead recreation ground—the same as last year.

Further information from M. Smith, 23, Roundwood Road, High Wycombe, Bucks.

MILL HILL & D.M.A.C.

This year, members will have two new trophies to compete for, a championship cup based on contest results only, and a junior champ. cup.

The annual dinner was held with D. A. Gordon as guest of honour, with Mr. and Mrs. Alex MacDonald to keep him company. After an excellent meal, Mrs. MacDonald presented the trophies to the following winners:

Annual Championship Cup, Minute Cup and Combat Trophy, Alan Blunt. Rubber shield, Bob Thorogood. F/F power trophy, John Lane.

HENDON A.T.C. M.A.C.

Hendon A.T.C. Model Aircraft Club held its A.G.M. recently. It was decided at the meeting to affiliate the club to S.M.A.E., and all forms, etc., have now been sent off.

The club has been given the free use of a small room in the headquarters of 120 Hendon A.T.C., which is situated on Hendon aerodrome. Flying meetings take place every Sunday afternoon on the aerodrome, which provides ample flying facilities due to the large areas of grass and tarmac available.

WANSTEAD A.M.C.

We have at present 12 members, our clubroom is at Highlands school, Highlands Gardens, Ilford, and we meet on Friday nights at 7.30. Our members are interested in everything and we would welcome new blood. Our flying field is at Wanstead Flats.

IPSWICH M.A.C.

The club is getting settled down now after its formation at the beginning of January, and boasts 11 members including one who has just returned from Singapore, and has not yet recovered from the shock he got when he discovered the alarming prices of modelling materials in England.

The secretary is R. Lindridge, and any modellers in the district interested in joining should drop in at 11, Daffodil Close, Chantry Estate, Ipswich, any Thursday evening after 7.30, irrespective of age or experience.

CHESTER M.F.C.

The club slope soaring rally will be held at Clwyd, North Wales, on June 17th. Events include open glider, junior open glider, A/2 glider, R/C glider, tailless glider.

ROCHDALE & D.M.A.C.

At the A.G.M. members discussed the organisation of events for the coming season and plans were made for members of the club to compete for the Dunkerley trophy, presented to the club by Mr. Fred. Dunkerley, who is well known in air-racing circles. Six events are to be catered for—three F/F and three C/L.

A series of lectures and discussions is to be arranged on all aspects of aeromodelling, for the coming season.

The club intends to offer its services in organising C/L demonstrations at public functions.

SECRETARIAL CHANGES

GLASGOW BARNSTORMERS M.F.C. P. Kimantas, 264, Seaward Street, Glasgow, S.1.

BRISTOL ACES M.A.C. R. Smith, 6, Chariss Avenue, Southmead, Bristol.

CHELTENHAM M.A.C. D. H. Wager, 3, Elm Close, Presbury, Glos.

WANSTEAD AEROMODELLING CLUB. D. R. Platt, 97, Inglehurst Gardens, Ilford, Essex.

ROCHDALE & D.M.F.C. G. Barlow, Fern-Lee, 77, Wardle Road, Rochdale, Lancs.

HUDDERSFIELD D.M.A.C. A. Bradley, 1, Roundway, Honley, Huddersfield.

SARNIA M.F.C. G. Goupillot, Eden Cottage, Havilland Road, St. Peter Port, Guernsey, C.I.

READING & D.M.A.C. E. Nicholls, 33, Sherwood Street, Reading, Berks.

WEST HANTS A.A. K. Wrighton, 1, Lawson Road, Parkestone, Dorset.

HENDON A.T.C. M.A.C. T. De'Ath, 99, Church Lane, Kingsbury, N.W.9.

ASHTON M.A.C. A. Bolder, 29, Milton Road, Audenshaw, Nr. Manchester.

NORTHERN HEIGHTS M.F.C. M. Young (gala), 19, Kingswear Road, London, N.W.9. A. T. Widgery (routine), 19, Wellside Close, Wellhouse Lane, Barnet, Herts.

NEW CLUB

BREDON & DISTRICT M.A.C. P. J. Berry, Waterloo Cottage, Bredon.

QUIZ ANSWERS

1. (a) Mercury Marauder, (b) kit model, (c) A2, (d) 65-in. 2. (a) A. A. Judge, (b) 1936. 3. Super Cyclone. 4. (a) C. A. Rippon & L. H. Sparey, (b) William Winter. 5. (d) Spitfire II. 6. (a) Miniature ignition coil and condenser, (b) for model spark-ignition engines. 7. (a) 164 ft. (b) 32-34 dm² or 495-525 sq.in. 8. (a) Supermarine Seagull, (b) M. W. Payne. 9. (a) 0.154 c.c., (b) ⅛-oz.

CONTEST CALENDAR

May	6th	HAMLEY TROPHY. U/R Power. Decentralised.
		High Wycombe C/L Rally. Speed. T/R. Combat. Kings Mead Recreation Ground.
June	3rd	Dartford C/L Rally, Central Park, Dartford
,,	17th	Clywd Slope Soaring Contest, N. Wales.
,,	25th	Midland Area Rally, R.A.F. Wellesbourne, near Stratford-on-Avon.
July	15th	Enfield C/L Rally, Enfield Playing Fields (by Gt. Cambridge Rd.).
,,	15th	Croydon Gala, Chobham Common.
,,	20-21st	**THE NATIONALS**
,,	20th	†THURSTON CUP. Glider.
		DAVIES TROPHY. Team Race. "A."
		SHORT CUP. 2.5 PAA-Load.
		GOLD TROPHY. C/L Stunt.
		S.M.A.E. TROPHY. Radio Control.
,,	21st	†SIR JOHN SHELLEY CUP. Power.
		†MODEL AIRCRAFT TROPHY. Rubber.
		DAVIES TROPHY. Team Race. "B."
		BOWDEN TROPHY. Precision Power.
		SUPER SCALE TROPHY. Power Scale.
		TAPLIN TROPHY. Radio Control.
		LADY SHELLEY CUP. Tailless.
Aug.	4-6th	**WORLD POWER CHAMPIONSHIP**—Cranfield.

* Plugge Cup events.

† These events will decide the Area Championship.

It is hoped the Trials will take place not later than June 10th.

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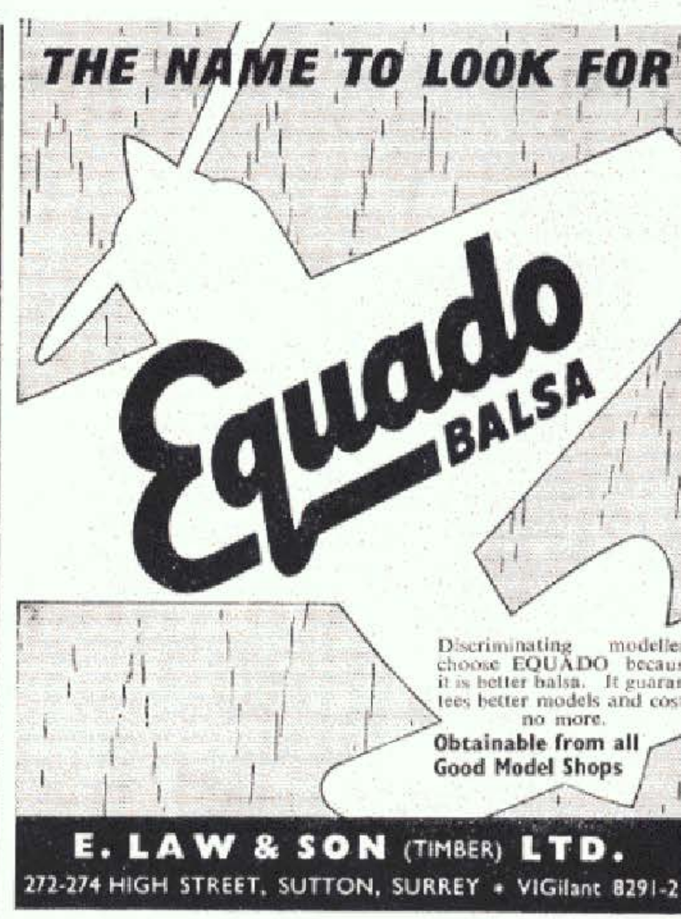

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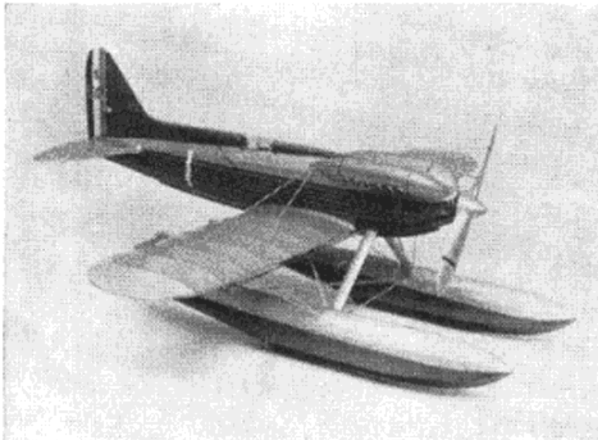

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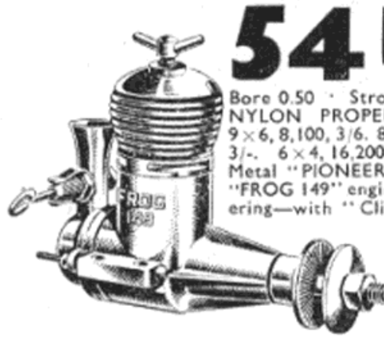

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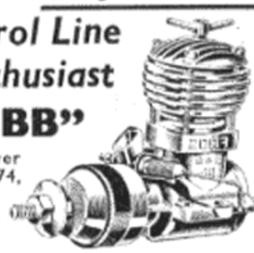

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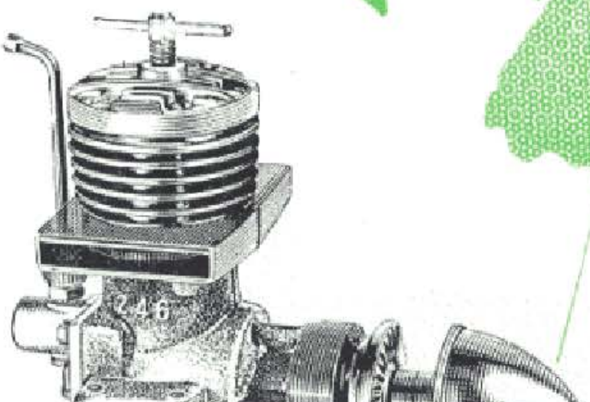

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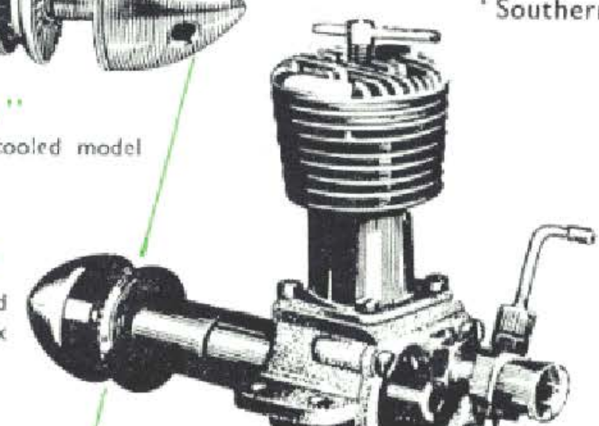

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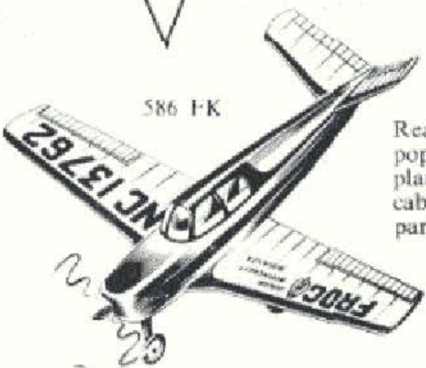

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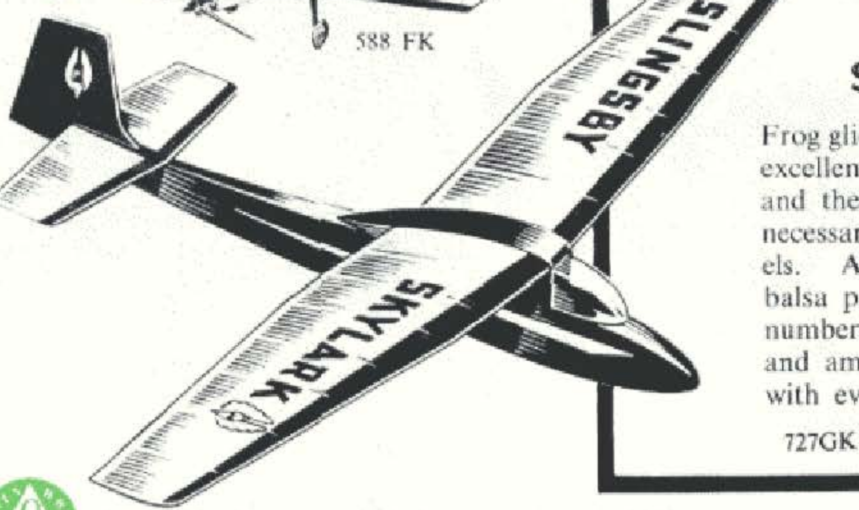

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