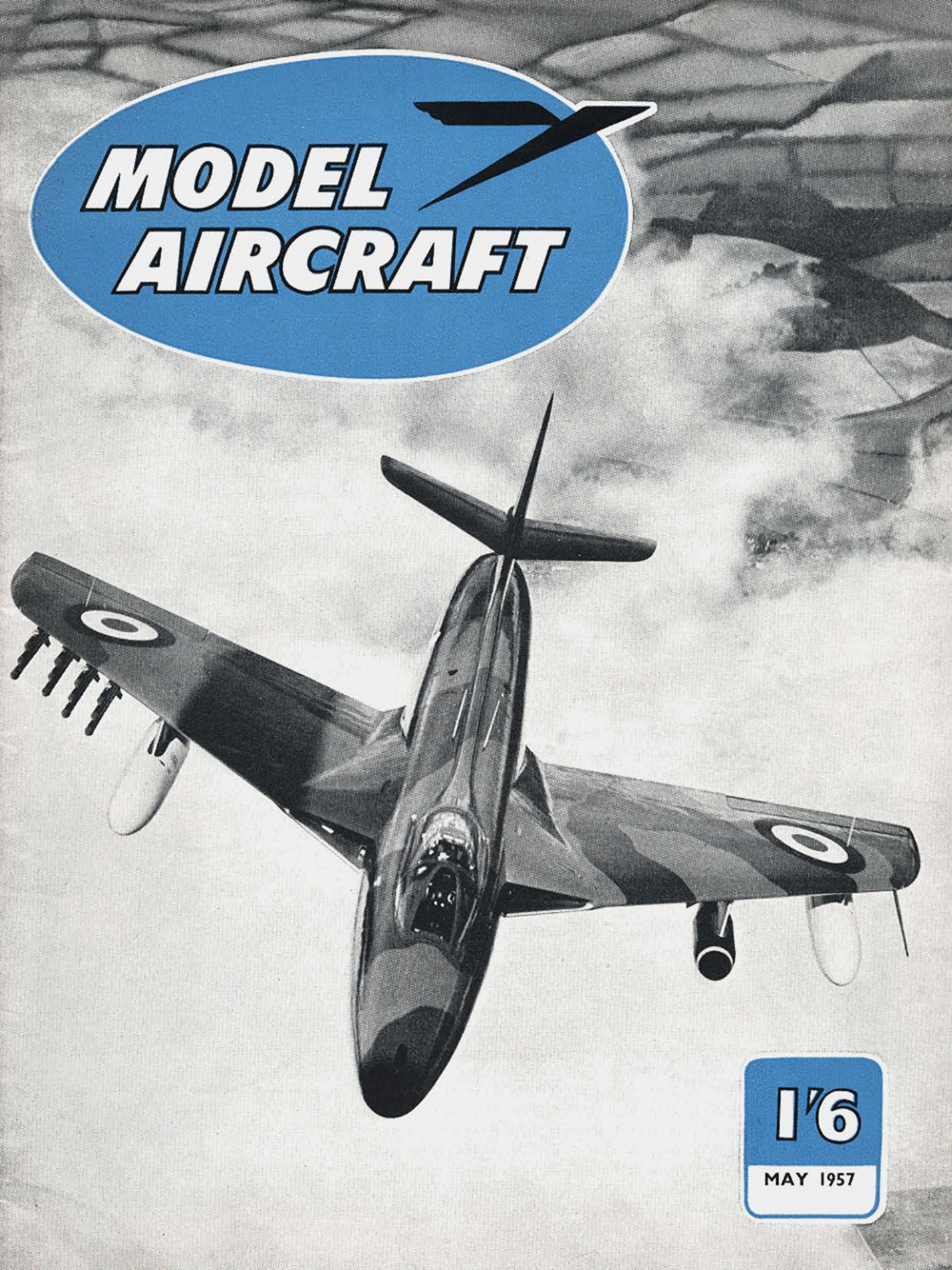
MODEL AIRCRAFT



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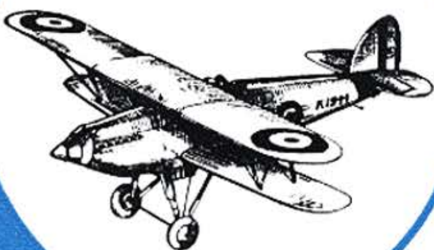

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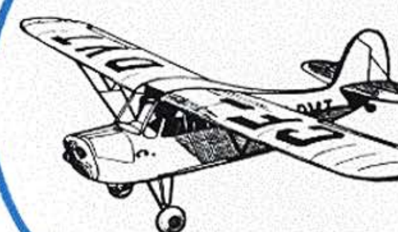

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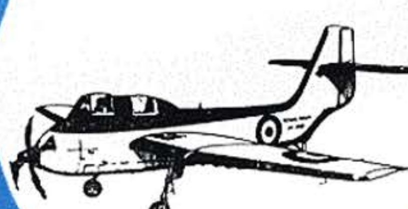

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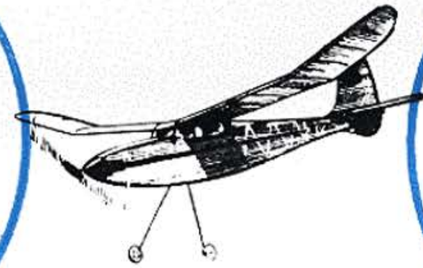

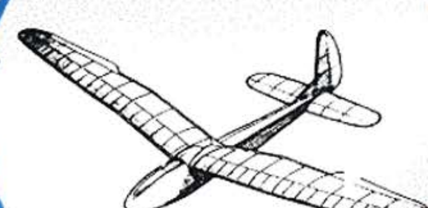

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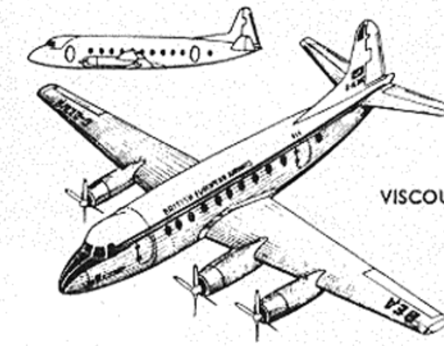
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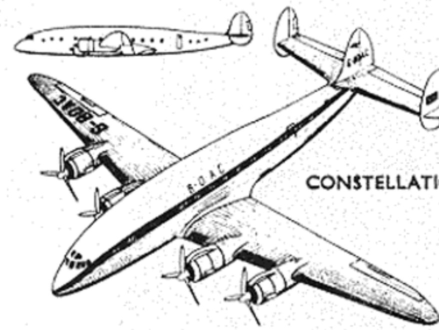
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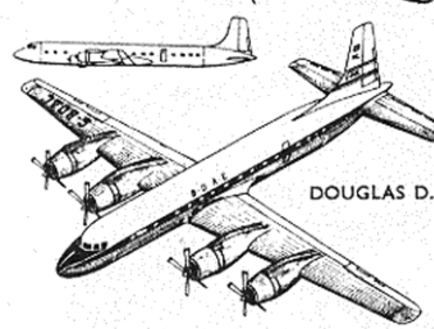
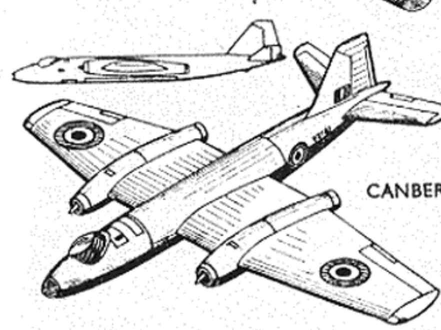
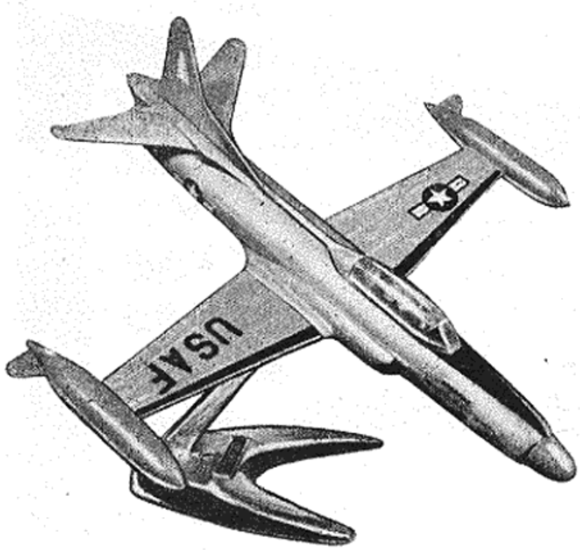

DOUGLAS D.C 7


CANBERRA



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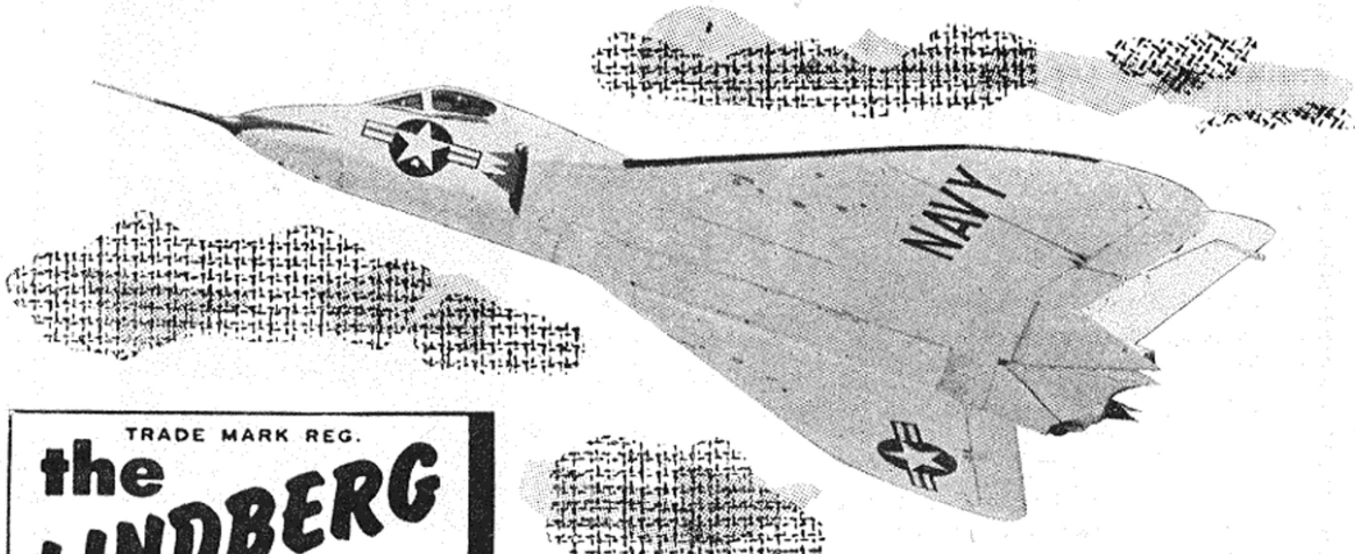

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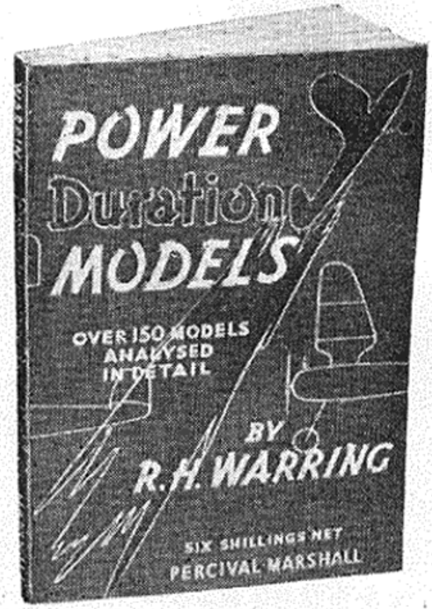

CONTROL LINE FLYING

By R. H. Warring 10s. 6d. Numerous photographs, diagrams and tables. The first of three companion books by a famous author. This is a general introduction to the subject and consideration is given to the following: how control-lining started; types of control systems; control-line model types; control handles, lines, equipment; operation and flying technique. Then follow chapters on the design characteristics of control-line models; considerations in airframe construction; types of motors; suitability for flying scale models; sport flying, &c. 11s. 2d. post paid (U.S.A. and Canada $2.50).

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By R. H. Warring 10s. 6d. Aerodynamic design and airframe construction are dealt with in detail in this third book with scale drawings of outstanding models and data tables analysing over 60 different types. Motors, fuels, operational technique (including dolly and drop-out undercarriages) are all treated in a thoroughly practical manner. Jet speed models are covered in a separate chapter. There is also a complete set of speed tables, covering one lap, quarter-mile, half-mile and one kilometre distances. 11s. 2d. post paid (U.S.A. and Canada $2.50).

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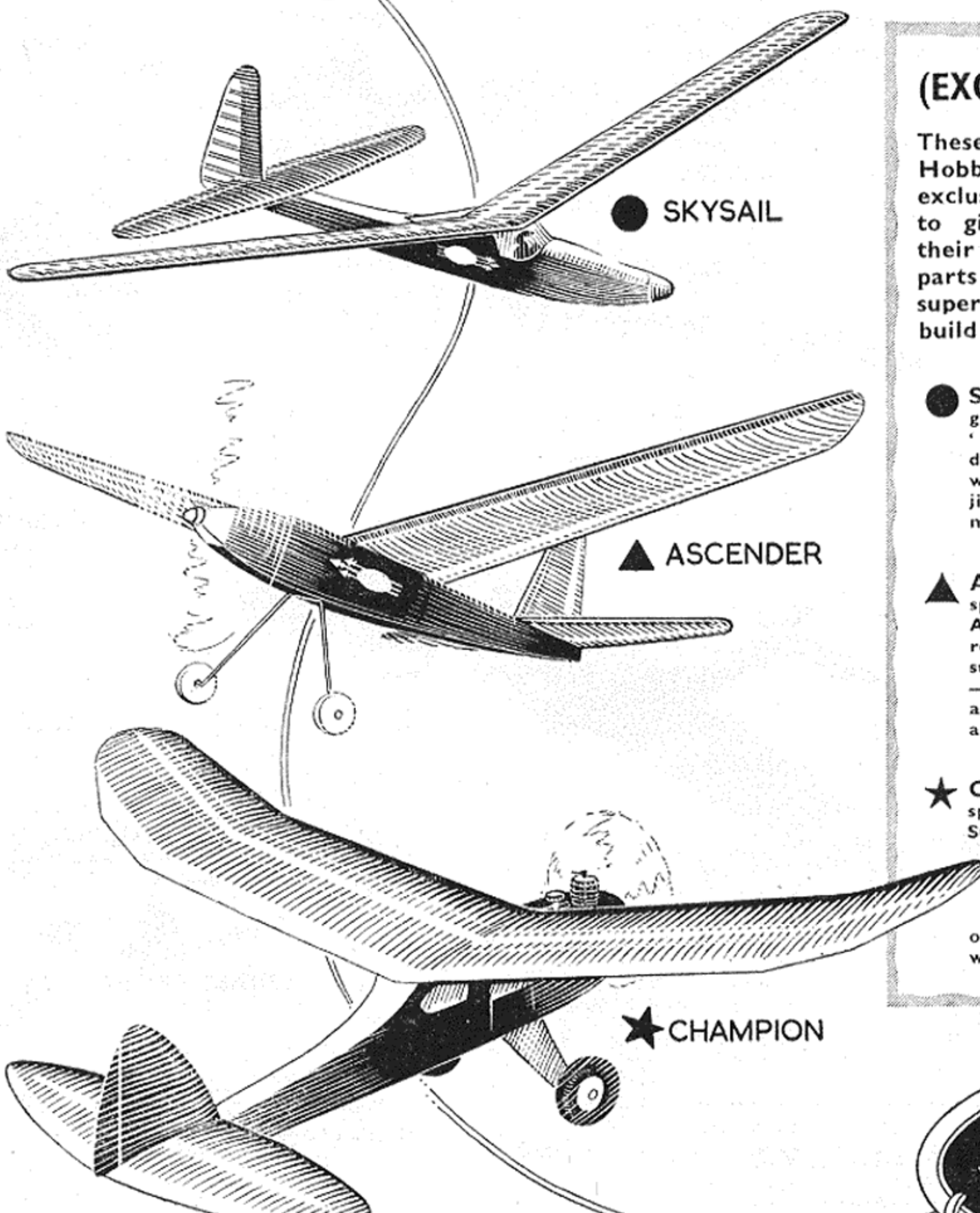

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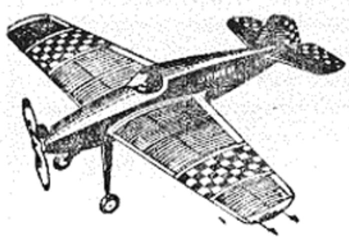

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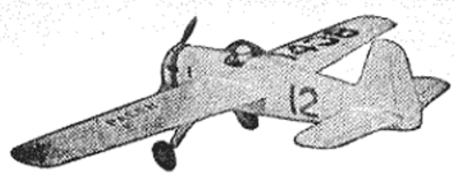

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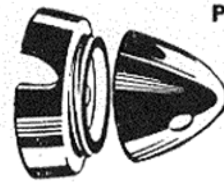

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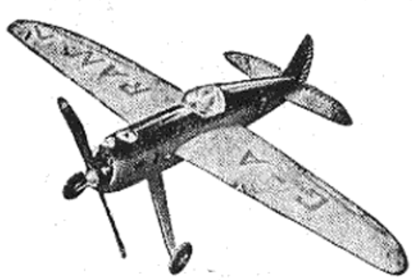

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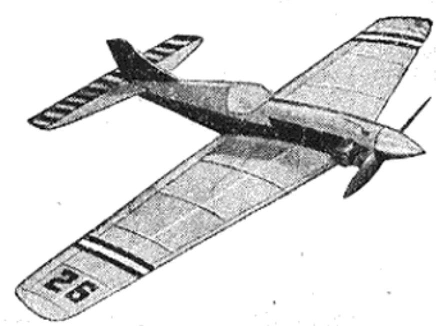

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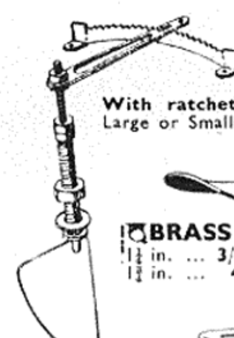

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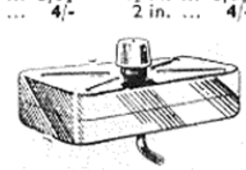

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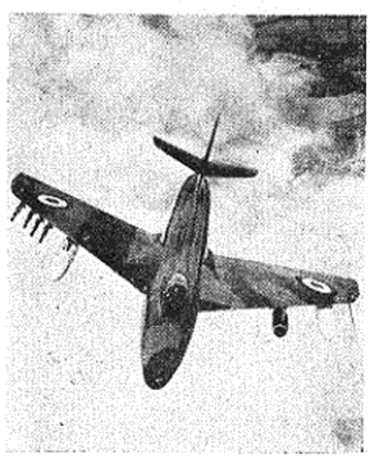
MAY 1957 No. 191. VOL. 16

Contents

Cover Story

Despite its load of 12 rockets and a 100 gallon drop tank below the starboard wing, and drop tank and a 1,000 lb. bomb below the port wing, this Hawker Hunter F.4 certainly gives the impression of speed and manoeuvrability. The F.4 version has also been supplied to Sweden. Power comes from the 8,050 lb. s.t. Rolls-Royce Avon R.A. 21 series giving a maximum speed of around 730 m.p.h.

(Air Ministry Photo)



THE JOURNAL OF THE SOCIETY OF MODEL AERONAUTICAL ENGINEERS

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Telephone: GERrard 8811. Annual Subscription 20s. 0d. post paid.

Letters TO THE EDITOR

Letter of the month

DEAR SIR,—I am a new but keen aeromodeller, having been infected with the bug at the ripe old age of 39.

It is obvious that the diversities of the hobby cater for all classes and tastes, and it is indeed difficult for a novice to decide in which branch of the hobby his interests would best be served.

Would it not be a good idea to run a series of articles by leading exponents in each branch explaining, in their opinion, the advantages and satisfaction to be obtained from specialisation.

I feel personally that the views of purely " speed " and " power duration " devotees have no place in such a series.

On the former, success depends 99 per cent. on the design, or in most cases the complete re-design of a standard engine necessitating facilities and skills not available to the run-of-the-mill modeller.

On the latter, fame depends on the attainment of maximum height in the minimum time, flying [sic] time being accumulated by the model's ability to stay aloft notwithstanding the handicap of its now useless engine and associated timing equipment, etc. This class might very well be re-designated " the mechanically assisted glider " class. The recent controversy between r.o.g. and h.l. in connection with this class must, I assume, have been fought between the 4 ft. and 6 ft. sections of the fraternity.

No doubt the above remarks will strike sparks of righteous wrath from the classes attacked but I would say this: " Reflect, what benefits, apart from fleeting mention in the modelling Press, do you really get from your hobby."

Yours faithfully,

Swansea, Glamorgan. THOMAS J. JONES.

Questions from the U.S.

DEAR SIR,—As an officer of the Academy of Model Aeronautics and a former Wakefield flier may I ask the following three questions?

1. Who decided to take the organising of the Wakefield Contest out of the hands of the S.M.A.E. and give it to the F.A.I.?
2. Why was this done?
3. What is to prevent the S.M.A.E. again taking over the Wakefield Contest and thereby removing it from the hands of the F.A.I.?

(Continued on page 168)

PLASTIC KITS—

The ideal introduction to the hobby?

ONE of the most noteworthy developments in the model aircraft movement has been the growth in popularity of the plastic kit, and we have heard many gloomy forebodings regarding the effect which this will have on the sales of most other types of kits. We do not share this pessimistic outlook, on the contrary, we believe that plastic model aircraft kits have been the means of attracting many modellers to the hobby who would not otherwise have joined our ranks.

There is no doubt, however, that the sales of the balsa wood solid scale model have been adversely affected, but surely this was only to be expected? True, these are now very much better than the solid scale " kits " that were produced in the immediate post-war years, which more often than not consisted of three or four sticks of wood, a duplicated " plan " and a postage stamp-sized piece of glass paper. It should also be noted that the firms which produced them have now deservedly gone out of business. The fact must be faced, nevertheless, that it is not possible to make a solid scale model from the present day balsa wood kit as realistic as that which can be made from the plastic kit without a great deal of effort or constructional skill.

We have for some time been very concerned that many who buy model aircraft kits for the first time become discouraged before they have finished the model and, as a result, probably never buy another. This wastage of potential enthusiasts is a serious problem and is, we believe, to a certain extent due to the fact that most beginners seem to be attracted towards making a scale model of a full-sized aircraft. Many of them buy one of the small, inexpensive, flying scale kits at present on the market and these require quite a fair degree of skill on the part of the constructor in order to produce a satisfactory model. It may well be, therefore, that the plastic solid-scale model is a better introduction to our hobby and one which is more likely to encourage the beginner to go on to more advanced aeromodelling. If this assumption is correct—and we think it is—then the advent of plastic kits will in the long run benefit both the model aircraft trade and the movement as a whole.

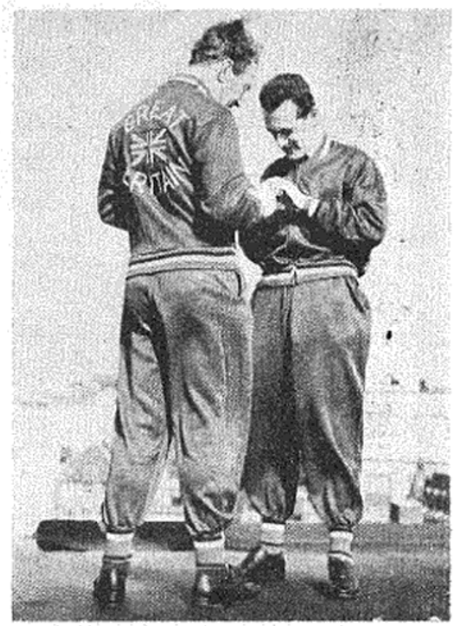
Conscription Restriction

DESPITE recent rumours that the end of conscription for National Service could be expected in the near future, it has now been stated that this is not likely to take place until the end of 1959.

Whether National Service could, or could not, be dispensed with is a matter which it would be inappropriate for us to comment on here, but we are certain that if, and when, it is, the model aircraft movement will benefit.

Many modellers start in their early 'teens and by the time they reach the calling-up age most of them have become serious model fliers. During the two years in the Forces they lose touch and when they are demobbed often never pick up the threads again.

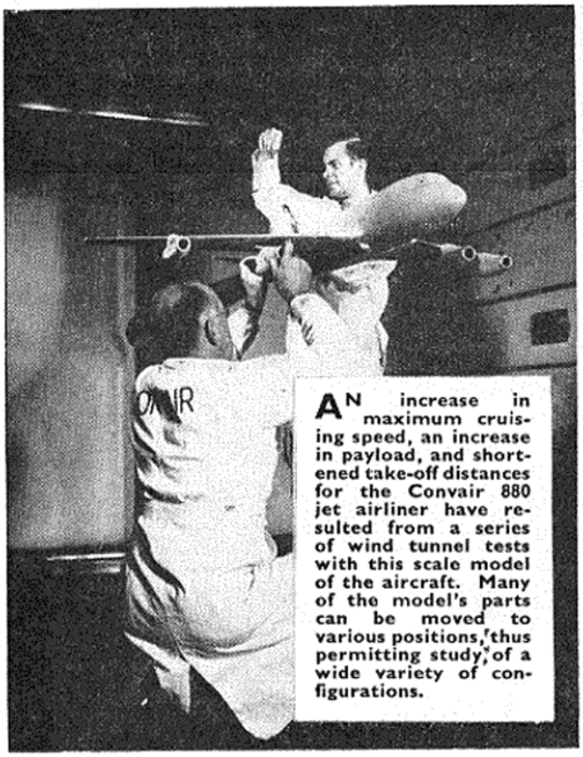
A comparatively small number of enthusiasts, particularly those who go into the Royal Air Force, are able to carry on, but we know from personal experience that it is not easy to make model aircraft whilst in the services, especially as the possibility of a posting is always in the offing.



HEIGHT OF FASHION.—Pictured on the roof of the M.A. offices, members of our staff display the new track suits presented to the S.M.A.E. by the Federation of Model Aeronautical Manufacturers & Wholesalers for wear by British teams in future International contests.

EPSOM DOWNS

EPSOM DOWNS can continue to be the Mecca of South London fliers provided a few commonsense restrictions are observed. This was the outcome of a recent meeting between a committee of the Conservators and representatives of local clubs, the S.M.A.E.



An increase in maximum cruising speed, an increase in payload, and shortened take-off distances for the Convair 880 jet airliner have resulted from a series of wind tunnel tests with this scale model of the aircraft. Many of the model's parts can be moved to various positions, thus permitting study of a wide variety of configurations.

THE NATS. IN 8 mm.

MODELLERS who fancy themselves as budding Clark Gables, may have the chance to disprove this at Whitsun, as a film covering the flying at the Nationals will be made. As such a project is obviously beyond the scope of one man and camera, assistance would be welcomed from any competent 8 mm. enthusiasts who will be attending this meeting. Anyone willing to co-operate should write to the Technical Secretary, S.M.A.E. Ltd., 19, Park Lane, London, W.1, giving *full* details of their camera and allied equipment (which must be 8 mm.), also any previous experience they may have in this type of photography.

. . . not forgetting club events

AN inter club film exchange service is the idea to brighten up club nights put forward by Jack Ashcombe, of the North Kent Nomads M.A.C. Mr. Ashcombe has been using his 8 mm. cine-camera to make a record of his club's activities, and as he has seen many other cine-camera users at various meetings, he is certain that other clubs also have their movie enthusiasts. His idea is that these clubs should loan their films on an exchange basis to each other, which to us sounds like a good scheme for getting acquainted. So if you are interested, write direct to Jack Ashcombe at 47, Arcadian Avenue, Bexley, Kent.

London Area Committee and the R.Ae.C.

Among the problems discussed were the danger of accidents involving the public and the already agreed use of the Downs until 1 p.m. daily for the training of racehorses. The following provisional agreement was arrived at and will form the basis for further discussion with the Epsom Downs Conservators :—

(1) No model flying shall take place before 1 p.m. on any day, but no other time restriction. (A gentlemen's agreement has been observed for some years whereby no models are flown before 12 noon.)

(2) The launching of models shall be confined to that area of the Downs enclosed by the racecourse.

(3) An area shall be set aside in which C/L models may be flown.

(4) No restriction on the type of model flown, except possibly a ban on catapult projectiles.

The co-operation of all model fliers is sought, particularly with regard to observing items 1, 2 and 4, so that a successful outcome of future negotiations is in no way jeopardised.

QUIZ WINNER

This month's lucky quiz winner is D. Williams of Orpington, Kent, and the answers were 1. (d), 2. (d), 3. (c), 4. (d), 5. (a), 6. (a & b) 7. (b) 8. (c).

BACK TO BATTLE

HARDLY a day passes without our mail containing requests for information on World War II aircraft, and we feel sure that the *Corsair* feature on page 153 of this issue will go some way in satisfying popular demand. Talking with John W. R. Taylor, who did the research, it came to light that until recently, Chance Vought's vice-president of sales and service used a red and white painted *Corsair* for trans-continental business flights. Now, this machine—an F4U-1—has been turned over to Paul Mantz for use in films about the Pacific War.

It was collected by James Thompson (one of Mantz's two stunt pilots, who hadn't flown a *Corsair* for 12 years), and the aircraft safely joined the Mantz collection of 28 old types (see MODEL AIRCRAFT, June, 1955) at Orange County Airport at Santa Ana in California.

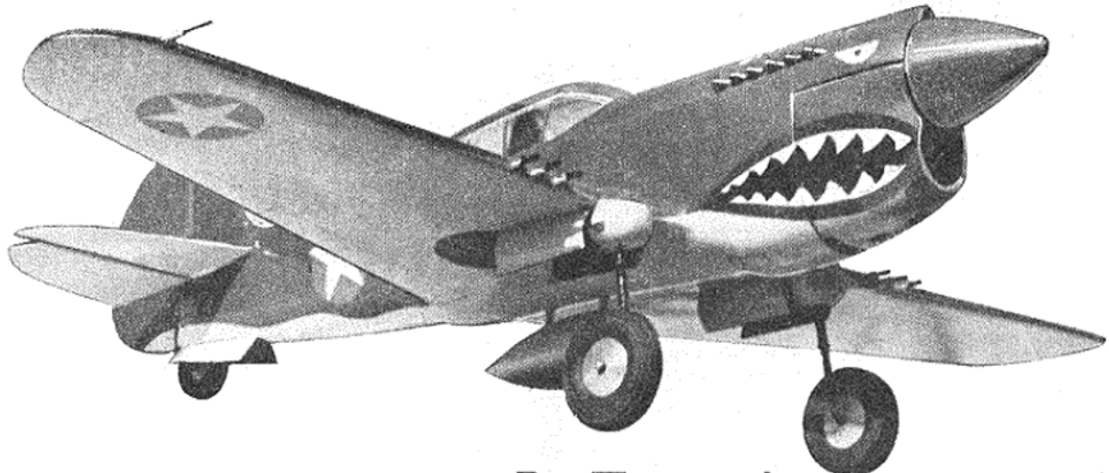
Incidentally, it was James Thompson who flew the Lindbergh Ryan replica for the film " Spirit of St. Louis," and also the 14 ft. (yes, 14 ft.!) span Hisso-Standard float-plane which chases Maureen O'Hara's car through a 21 ft. wide hangar in " Wings of Eagles." It seems the hangar roof was so low that the floor had first to be covered with grease in case the plane's floats touched, which, while possibly easing Thompson's doubts, made the driving of the car a very tricky business.

One final note. We have deliberately kept "fussy detail" to a minimum on the *Corsair* plan so that the modeller can use it as a basis for any variant as detailed in the accompanying notes.

For those whose interests are in flying models there is, of course, the very fine C/L scale version of the F4U-2 Cosair designed by P. M. H. Lewis (" M.A." plan 141, price 3s. 6d.) and suitable for any of the popular 1.5 c.c. engines.

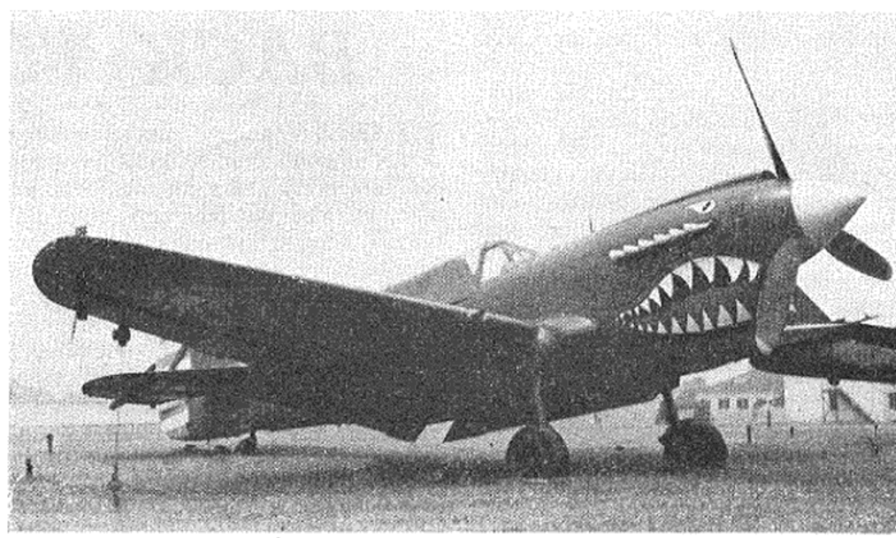
The P-40 WARHAWK

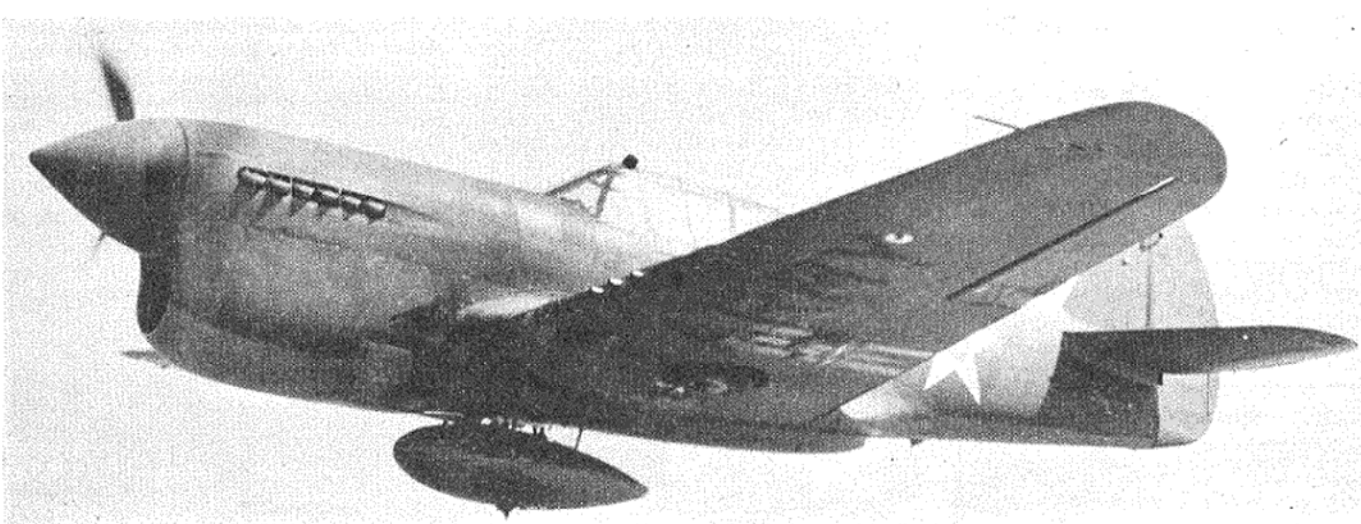
A REALISTIC C/L SCALE JOB FOR 1-1.5 c.c. ENGINES

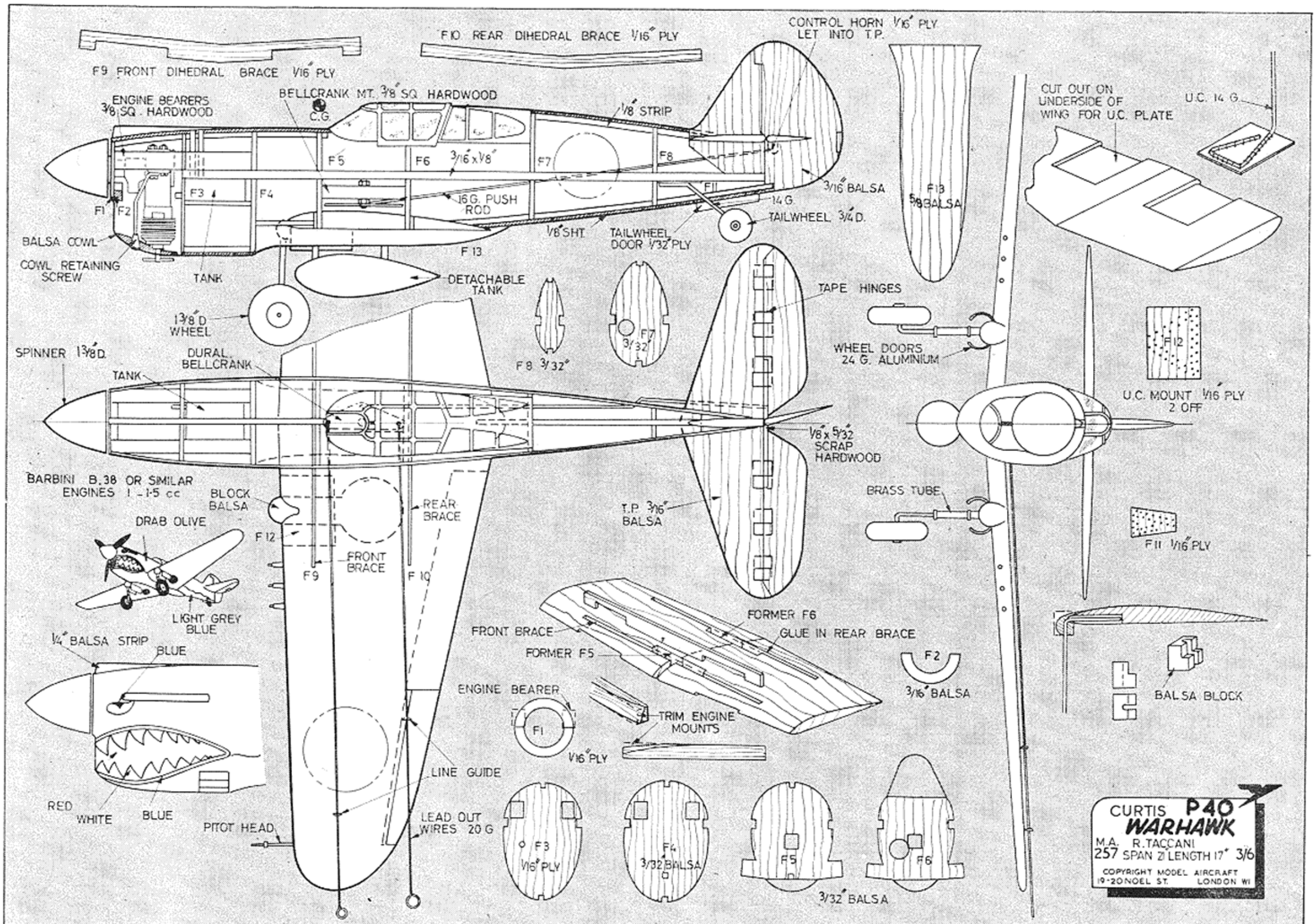


designed by——————R. Taccani

THIS is another MODEL AIRCRAFT plan that really requires no explanation on the building aspect. It is perfectly straightforward and in fact the colouring of the completed model is the stage to take extra care if you want to achieve results comparable to the model *Warhawk* shown in our heading illustration. We believe that one or two large pictures convey far more than just words, and the two full size machines shown here should be studied when deciding on how much extra detail to add to your model. One photo, that on the right, shows a slight variation of the sharks' teeth design that seemed a "natural" for *Warhawks*; just discernable beneath the wing of this machine is the insignia of the Chinese Nationalist Air Force. Photo below is of a U.S. Army Air Force *Warhawk* of the 1942 period.







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

Getting it to fly

YEAR by year millions of small flying models are produced in kit form, but only a relatively small percentage end up as *successful* flying models. This despite the fact that commercial designs are flight tested before being put into production, and building and flying instructions are invariably given with every kit. If *you* are having trouble in getting

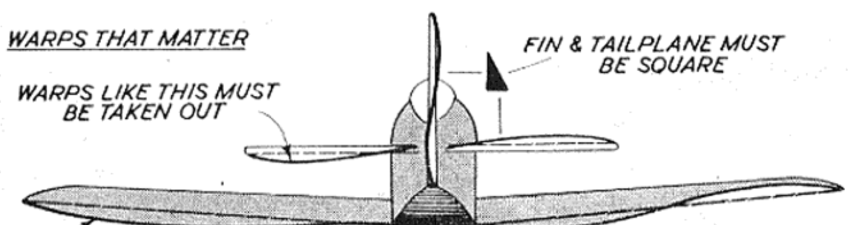


FIG. 1

your kit model to fly, we hope this short article will sort out the snags for you !

A model does not have to be *perfectly* built before it will fly properly. In fact, quite a number of successful contest models have been more than a little rough as regards construction and finish—particularly the finish—but there are a number of basic rules which cannot be ignored.

The most attractive models are, more often than not, the most difficult to get flying properly. Thus a flying scale model, attractive because it looks like the "real thing," is far more tricky to trim than an out-and-out duration design, which may appear freakish by comparison. Full size aeroplanes are designed to be controlled by a pilot. Models have to be able to control themselves automatically, or to be automatically *stable* in flight and the only way to do this successfully is to differ from full size design practice in such matters as the following:—

(i) Using more dihedral on the wings.

(ii) Increasing the area of the fin, which is necessary to balance (i).

(iii) Increasing the area of the tailplane.

(iv) In the case of a rubber model, using a reasonably large propeller to give satisfactory thrust and length of motor run.

All these factors can be built right into a " duration " design, but the flying scale model design can only incorporate them at the expense of departing from true scale outlines. Much depends, too, on the full size prototype. Some full size layouts scale down readily to make stable flying models with little modification (other than perhaps an increase in dihedral and enlarged tail surfaces).

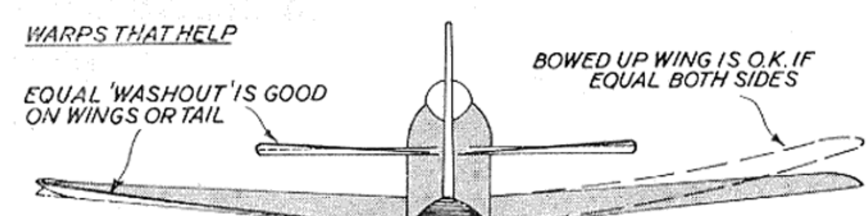


FIG. 2

Others, low wing models in particular, are another problem and would need major changes in shape to get a really stable performance. So the designer has to compromise—sacrificing a certain amount of stability so as to retain a reasonable degree of scale appearance. As a rough rule, high wing monoplane prototypes usually make the best *flying* scale models.

The two main things to aim at with a small flying model are to get it rigged accurately, and to keep it as light as possible. A heavy model will never perform as well as a light one of the same size. If it is too heavy, it will not fly at all. This means, if you want a coloured model, cover it in coloured tissue and finish with clear dope. Coloured dope is far too heavy to apply to small models, except for trimming details, such as lining the leading edge of a wing or painting the noseblock. Avoid any extra weight in the way of coloured dopes aft of the wing. The lightest coloured dope of all is silver, but even this is still too heavy to apply all over a finished model although when you have got a little experience in trimming and do not mind sacrificing a little performance, one thin coat of silver can be used to finish a flying scale jet job, if you wish.

Be careful what type of clear dope you use for finishing your model. Some dopes are quite strong and will tauten tissue covering so much on drying, that the framework will be pulled out of shape or warped. For preference, on light frames, use a non-tautening dope or a " mild " dope mixed with an equal proportion of thinners. Your retailer can offer you advice on this point.

Accuracy in rigging implies that the model must be lined up accurately. Any warps in the wing or tail must be taken out, if the model is to have a chance of flying properly. The best way to spot warps is to view the model " end on " from the rear—Fig. 1—since it is usually the trailing edge which warps most on a wing or tailplane.

Warps are quite easy to take out. Hold the part affected about a foot in front of an electric fire for a few seconds and then twist to a true shape. Still holding in this position, remove from the fire. Release after about ten seconds and the wing (or tail) should stay put at this new setting. You may have to repeat the process from time to time if the warp persists in working back in.

One type of warp will actually *help* make a model stable. That is where the trailing edge of a wing or tailplane warps upwards slightly towards the tip and *the warp is the same* on both sides (Fig. 2). Use the heating method just described to put in such warps, or even-out natural warps of this type. Do not bother to straighten out a wing which has warped upwards, i.e. has become bowed, unless it is uneven on each side. The extra dihedral will help.

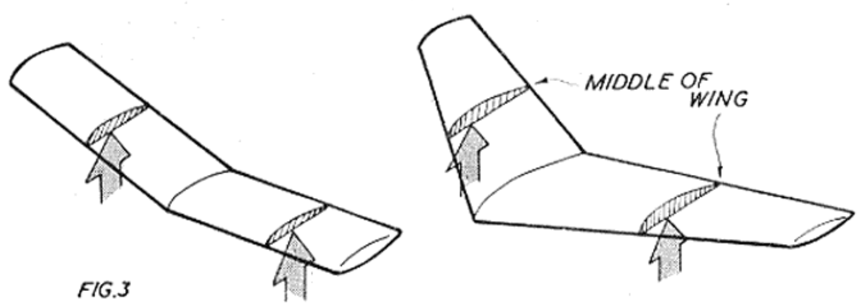


FIG. 3

Balance is not as critical as most people imagine, as fine trimming can be done with the tailplane. For a good, stable set-up, however, a model should balance about four-tenths of the wing chord back from the leading edge. On a tapered or swept wing, mark the balance point on the *middle* chord of the wing and support the model at this point to check (Fig. 3). The usual way or adjusting balance is to add plasticine or similar weight to the nose (or tail) of the model. Models are nearly always tail heavy and it is seldom necessary to have to add weight to the tail end. Of course, for balancing purposes the model must be completely assembled ready to fly with rubber motor in place (or *empty* Jetex unit, if jet powered).

Another rigging check which should then be done is shown in Fig. 4. Lay a flat strip of balsa against the underside of the wing and sight against the tailplane. The tailplane should have negative incidence, i.e. be tipped up, relative to the wing. With warps removed, the model balanced as above and the rigging angles checked, then the model *will* fly unless there is a basic fault in the design, or it is too heavy.

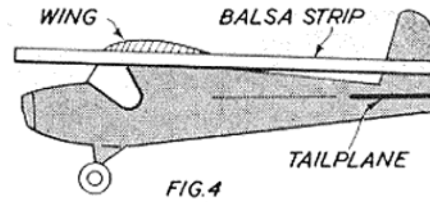


FIG. 4

Choose suitable weather for flying. A light wind has the equivalent strength of a hurricane to a small model. Flying in a garden or an enclosed place means, too, that wind will produce gusts and eddies so that you cannot expect any model to behave smoothly under such conditions. A calm evening or early morning is best for test flying. And never fly a small model, even when fully trimmed, in anything like a strong breeze.

Your first test flights should be glides—launching the model with a smooth, throwing motion, aiming at a spot about six paces in front of you on the ground. If the balance point is roughly correct as described above, it is best to make any adjustments to glide trim by bending the trailing edge of the tailplane upwards or downwards. This can readily be done, even on a tissue covered structure, if you are careful. Bend up slightly to flatten the glide, if the model shows signs of diving, or down slightly to cure a nose-up and dip flight path (stalling) (Fig. 5). Also take out any turn by warping the fin or rudder in the opposite direction. On models with sheet wings or fitted ailerons, correct any turn by bending the wing tips or ailerons (see Fig. 6). Turning up both ailerons slightly is beneficial to stability. One can then be turned up more than the other for further trimming, if necessary to straighten out the flight.

If you have got the glide trim correct—preferably slightly under-elevated — successful power flights should follow, provided you still keep the model flying straight (or in a very wide circle) and make sure that there is *downthrust* on the noseblock or nose button (Fig. 7). Downthrust is nearly always necessary on small rubber models, as without it the power flight will just consist of a violent stall, or even a loop. You can use as much as $\frac{1}{16}$ in. packing for a start, to be on the safe side. Cement in place, so that it will not drop out. If the model does not climb but flies fast and level, you can trim off a little of the downthrust with a razor blade.

Do *not* try to get the model to fly in small circles. Also do not expect anything spectacular in the way of

(Continued on page 168)

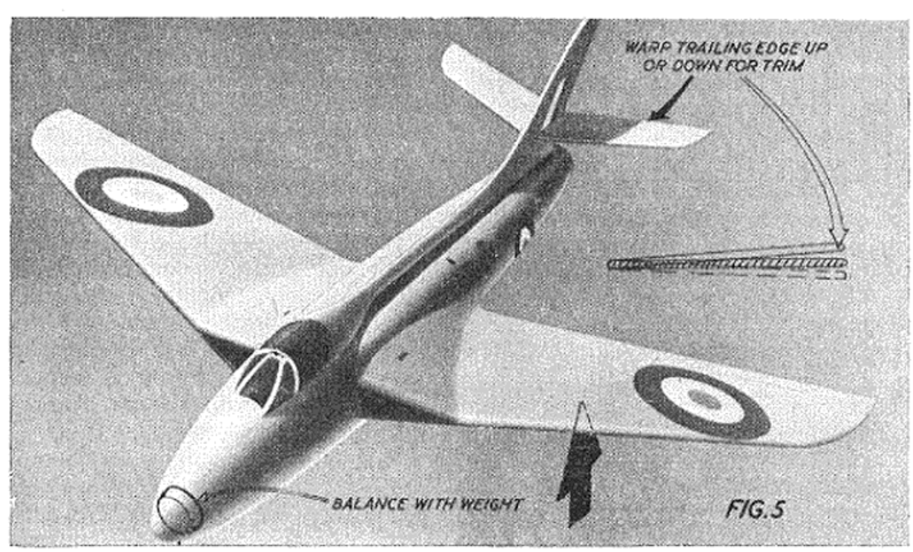


FIG. 5

ENGINE TESTS

The Allbon RAPIER

". . . gives the impression of being a lively engine . . ."

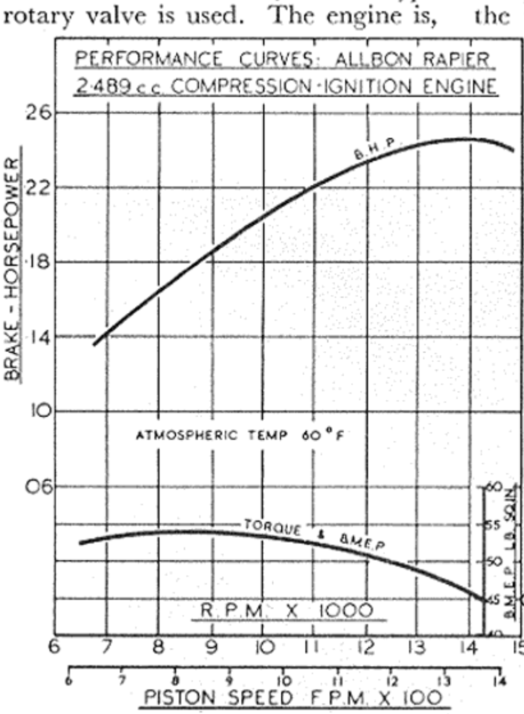
2.5 c.c. DIESEL

MARKING the long-expected entry of Davies Charlton Ltd., into the 2.5 c.c. class is the Allbon Rapier, an entirely new engine, which should be reaching retailers in increasing numbers by the time these words appear.

In this 2.49 c.c. engine, the makers have departed noticeably from the layout favoured for all previous D-C and Allbon engines. Hitherto, these, ranging from 0.5 to 5 c.c., have been of the plain bearing type and all have had shaft-valve induction, with the exception of the original Allbon 2.8 and D-C Wildcat, which were of the 3-port type.

In the Rapier, a switch to a twin ball race main bearing is made and, also for the first time, a disc type rotary valve is used. The engine is, of course, intended for competition work, as well as for more general use, and this is reflected in a specific output higher than for any previous Davies Charlton motor.

Structurally, the Rapier follows current Davies Charlton design practice in so far as a plain, flanged, cylinder liner is used, clamped at the flange between the crankcase and cylinder barrel which are screwed together. The main bearing housing is in unit with the crankcase, and the piston, with its full-floating, low-positioned gudgeon-pin, is of the typical thick walled, short skirt pattern of the Merlin and Sabre.

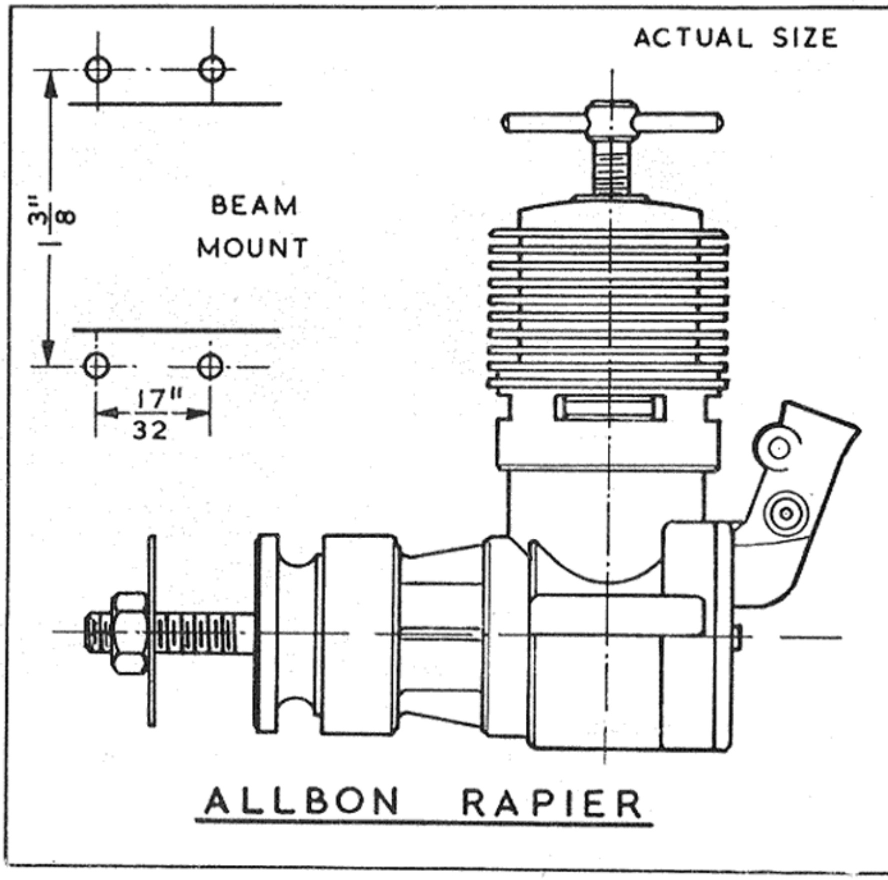


In many other details, however, the Rapier differs appreciably. The crankshaft, which has a ¼ in. journal and a 3/16 in. crankpin, is of the counterbalanced pattern instead of the full-disc type. It is of the fully counterbalanced type, in that it balances all rotating mass — i.e. crankpin plus a proportion of the connecting-rod weight. At the front end, the shaft is reduced to 3/16 in. dia. and, in place of a tapered or splined section for the prop driver, a brass split tapered collet is used. The connecting rod, forged Hiduminium RR.56 on the smaller models, is, instead, machined from L.64 alloy.

The cylinder is, of course, of the radial port pattern, with 360 degrees transfer passage between the liner and case wall. Unlike the Sabre, Merlin and Spitfire II, however, which have three slit-type exhaust ports, staggered in relation to three similar transfer ports, the Rapier has four exhaust and transfer-ports and each transfer port is placed immediately below an exhaust port. The cylinder is retained by a finned alloy barrel and head which screw *over* (instead of into) the crankcase, and as a result, the exhaust exits, four in number, are in the barrel instead of the casting.

The engine is more compact than most rear intake 2.5 c.c. motors, overhang being reduced to a minimum by the adoption of an inclined downdraft carburettor. The induction unit consists of a normal diecast flange fitting crankcase backplate with integral intake and a diecast valve rotor. This gives a 180 deg. induction period, timing being 45 deg. after BDC to 45 deg. after TDC. There is provision for the installation of a secondary needle-valve (or choke disc) for two-speed control.

The Rapier is well made and nicely finished. The bore of our test sample was 0.005 in. in excess of the quoted figure, but doubtless the nominal figure will be closely adhered to in subsequent production models.



The crankcase, which has a tumbled finish, is adequately webbed and is provided with strong mounting lugs. The propeller driving hub extends back into the front housing, thus protecting the ball bearing against the ingress of dirt.

Specification

Type: Single cylinder, air-cooled, reverse flow scavenged two-cycle, compression ignition. Rotary disc-valve induction with sub-piston supplementary air induction. Radial exhaust and transfer porting with conical crown piston.

Swept Volume: 2.489 c.c. (0.1519 cu. in.).

Bore: 0.580 in. Stroke: 0.575 in.

Compression Ratio: variable.

Stroke/Bore Ratio: 0.991 : 1.

Weight: $5\frac{1}{4}$ oz.

General Structural Data

Pressure diecast crankcase and main bearing housing in LM.2 aluminium alloy. Heat-treated nickel-chromium steel counterbalanced crankshaft running in two $\frac{1}{4}$ in. × $\frac{3}{4}$ in. ball-journal bearings. Hardened steel cylinder liner with radial exhaust and transfer ports and flanged at exhaust port level. Liner clamped at exhaust flange between the crank-case and cylinder barrel, the latter screwing over the former. Ground and lapped Meehanite contra piston and piston, the latter with 5/32 in. dia. full-floating gudgeon pin. Connecting-rod of machined L.64 aluminium alloy. Pressure diecast crankcase backplate with integral carburettor intake and carrying die-cast valve rotor. Brass spraybar type needle-valve. Beam mounting lugs.

Test Engine Data

Running time prior to test: $1\frac{1}{2}$ hours.

Fuel used: 40 per cent. I.C.I. technical ether, 30 per cent. Shell Royal Standard kerosene, $27\frac{1}{2}$ per cent. Castrol R, $2\frac{1}{2}$ per cent. amyl-nitrite.

Performance

The Rapier gives the impression of being a lively engine, perhaps more so than the actual performance figures indicate. It bursts into life with that abruptness that characterises several of the hotter variety of diesels, such as the German Mach-1. Unlike the latter, however, it did not take too kindly to attempts to start it on small props without reducing compression and we earned a couple of sharp raps on the fingers before we managed a "team-race" re-start

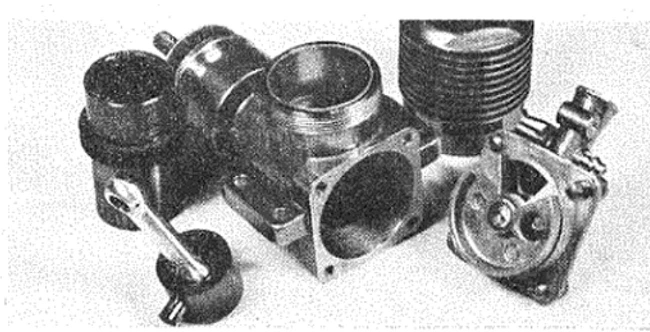
A first start from cold was obtained without recourse to port priming and re-starts, making use of the smooth working compression lever, were obtained with one or two preliminary choked flicks. Both controls were comfortable to operate, were non-critical and held settings firmly at all speeds. A weak point appeared to be the sweated joint on the needle-valve, which broke during the tests. This fact was communicated to the manufacturers, who, within three days, put into production an improved pattern.

The Rapier ran well and although the cylinder temperature was somewhat higher than usual, there was no serious power loss as the engine warmed up. The engine seems happiest when running at speeds in the region of 9,000-11,000 r.p.m., which roughly corresponds to 9 in. props of 4 to 6 in. pitch; 9,500 r.p.m. were obtained on a Frog Nylon 9 × 6 and 10,700 r.p.m. on a Trucut 9 × 4.

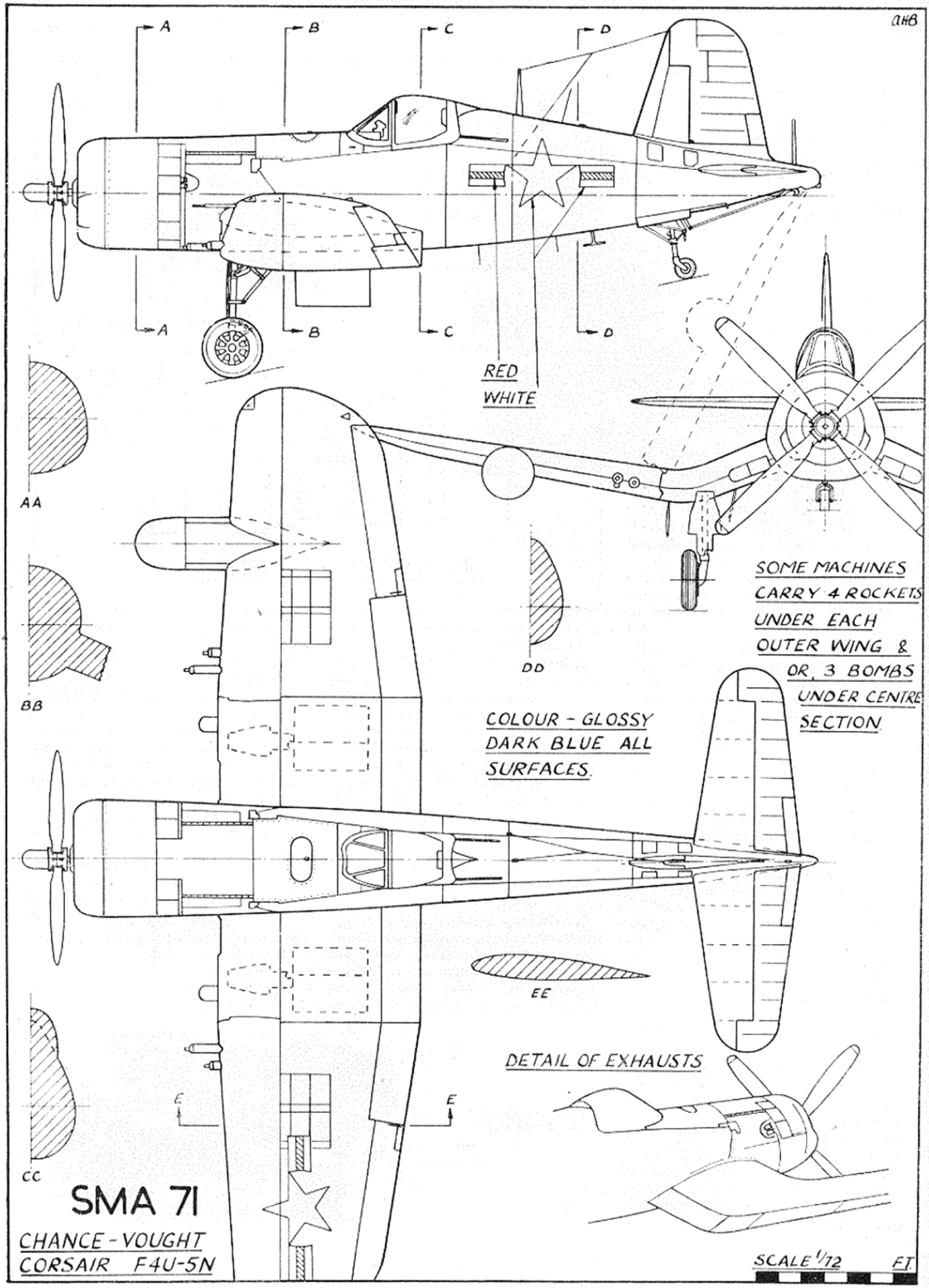
On the torque-reaction dynamometer, maximum torque was found at between 8,500 and 9,000 r.p.m. and was equal to a b.m.e.p. of 54 lb./sq. in., which is up to standard. Torque declined quite smoothly, allowing the power curve to climb to a peak at around 14,000 r.p.m. Actual maximum output recorded here was fractionally under 0.25 b.h.p., which, close to the 100 b.h.p./litre figure that indicates a "hot" performer, can be considered good.

Power/Weight Ratio (as tested): 0.75 b.h.p./lb.

Specific Output (as tested): 99 b.h.p./litre.



The main components of the Allbon Rapier.


AHB
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SOME MACHINES CARRY 4 ROCKETS UNDER EACH OUTER WING & OR, 3 BOMBS UNDER CENTRE SECTION
COLOUR - GLOSSY DARK BLUE ALL SURFACES.
DETAIL OF EXHAUSTS
SMA 71
CHANCE - VOUGHT CORSAIR F4U-5N
SCALE 1/72
F.T.

The Chance Vought
CORSAIR

★ PHOTOS
★ MARKINGS
★ SCALE PLAN
★ CUTAWAY DRAWING

A U.S. Navy F4U-4 "Corsair" (serial number 49763).

STILL in service nineteen years after its design was started, the *Corsair* can rightly be regarded as one of the great fighter aircraft in aviation history.

It had its beginnings in a U.S. Navy design competition in February 1938, at a time when the U.S.A.A.F. believed that the future for high-speed fighters lay with liquid-cooled engines. Despite this, Chance Vought designed their project around the most powerful radial in the world—Pratt & Whitney's 2,000 h.p. R-2800—and gave it the now-familiar inverted gull wing to provide clearance for the 13 ft. dia. prop. while keeping the undercarriage as short as possible, to keep down the height with wings folded and to provide an aerodynamically-desirable right-angle juncture between wings and fuselage.

The company received a contract to build the prototype XF4U-1 on June 11th, 1938, the requirement being for a single-seat fighter with a service ceiling of at least 27,000 ft. A mock-up was approved in February 1939 and the prototype flew on May 29th, 1940.

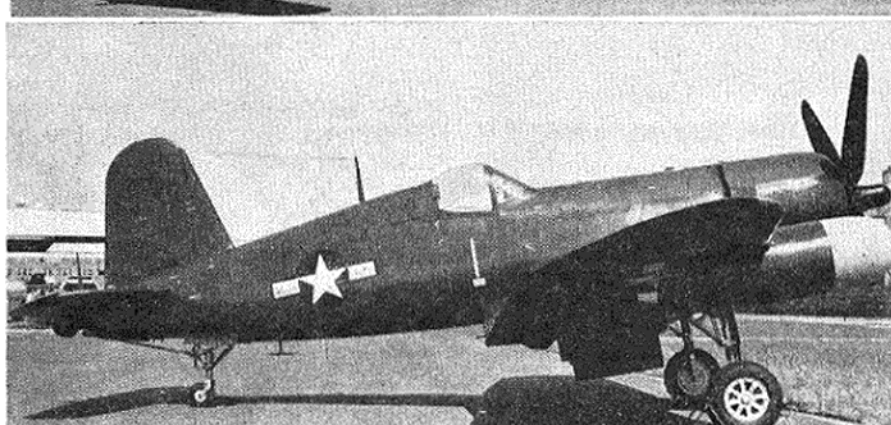
Within a few weeks it was demonstrated at 405 m.p.h. over a speed course, before Rear Admiral John Towers, chief of the Navy Bureau of Aeronautics; but the production contract was not finally signed until June 30th, 1941, less than six months before Pearl Harbour.

By then the design had been changed to meet new Navy requirements. The integral fuel tanks were removed from the wings and replaced by a large self-sealing fuselage tank, which necessitated moving the cockpit back 3 ft.—the only basic design change ever made to the *Corsair*.

The XF4U-1 had one 0.30 in. and one 0.50 in. machine-gun in the nose and two 0.50s in the wings, plus recesses in each wing for 10 small bombs for dropping on bomber formations. For production, this armament gave way to first four and then six wing-mounted 0.50s. About 170 lb. of armour plate was added, the arrester gear was changed, a jettisonable canopy and IFF radio were fitted and the aileron span increased.

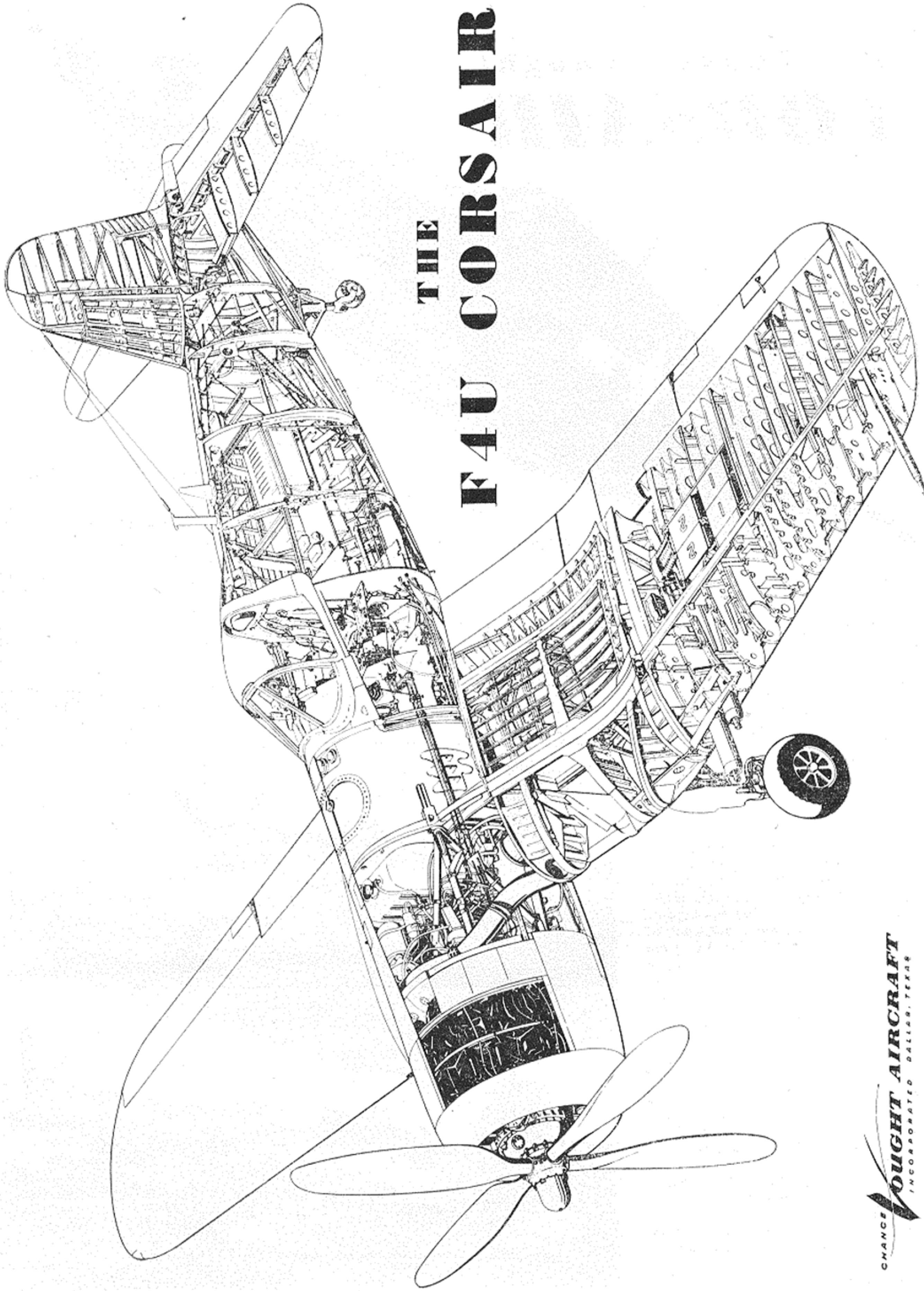
After Pearl Harbour, production was stepped up, with the help of the Brewster Aeronautical Corp. and Goodyear, and out of a total of 11,446 *Corsairs* built during World War II, Brewster built 735 (designated F3A-1) and Goodyear 4,014 (designated FG-1).

The first production F4U-1 flew on June 25th, 1942, and the *Corsair* did its first deck trials on September 25th of that year, one result of which was that the top of the canopy was raised, producing the F4U-1A. More serious than limited forward view was a stiff landing gear which made the aircraft bounce when landing on and kept it off the decks of U.S. carriers until late 1944, although the British Fleet Air

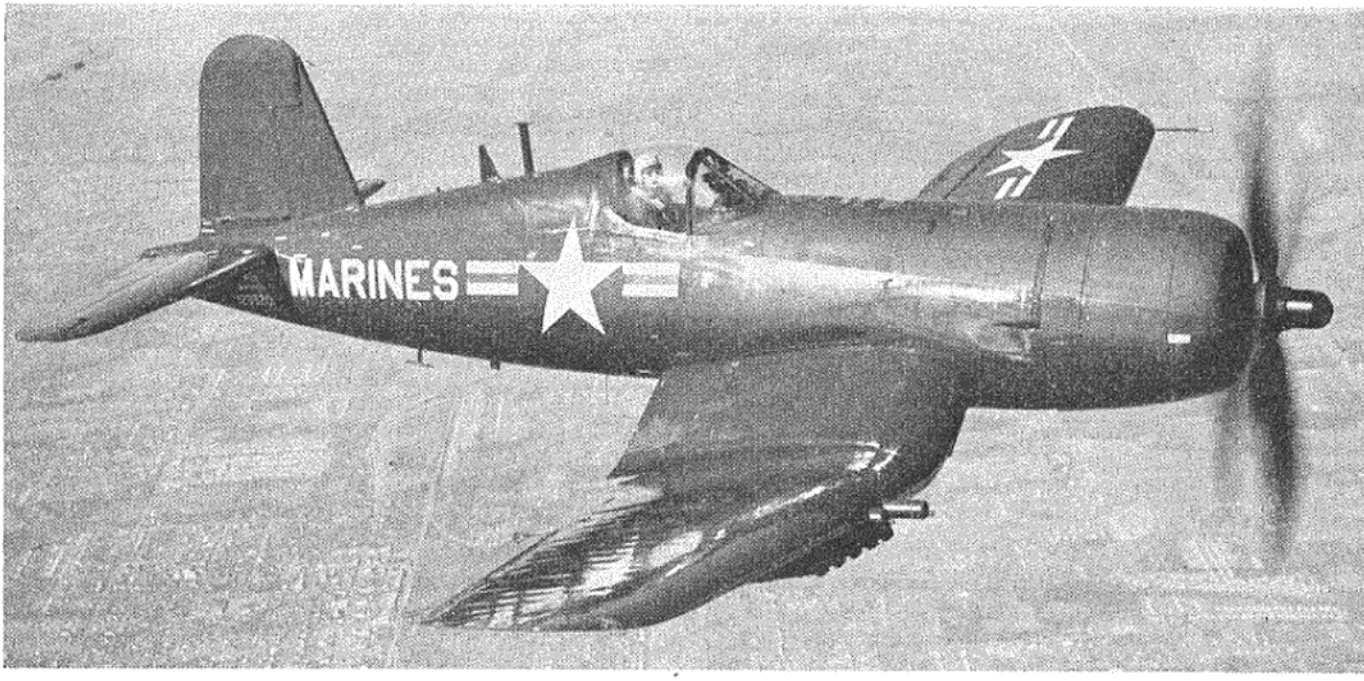


Two views of an F4U-5N. Note the insignia.

THE F4U CORSAIR



CHANCE VOUGHT AIRCRAFT
INCORPORATED DALLAS, TEXAS



Arm began carrier ops with *Corsairs* early in that year. A landing twitch on touch-down was countered by lengthening the tailwheel leg and adding a small spoiler on the leading edge of the starboard wing.

Following is a list of the major variants:—

XF4U-1 Prototype with 2,000 h.p. XR-2800-2 engine.

F4U-1 Production, repositioned fuel and cockpit, revised armament of 4 x 0.50 in. machine-guns. R-2800-8 engine. Span, 40 ft. 11 in. Length, 33 ft. 4 in. Height, 15 ft. Loaded weight 11,093 lb. Max. speed 415 m.p.h. Ceiling 37,000 ft.
F4U-1A had raised canopy. F4U-1B was *Corsair I* for F.A.A. F4U-1C with 4 x 20 mm. cannon. F4U-1D (clipped wings) was first version with pylons for bombs or tanks (F.A.A. *Corsair II*). F4U-1P for photo-recce.

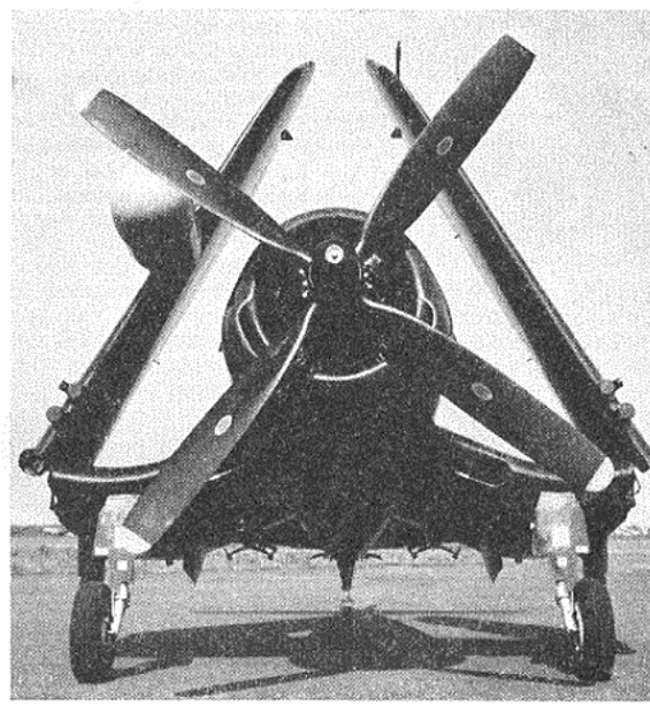
F4U-2 Night fighter with autopilot and airborne interception radar. 12 F4U-1 converted by Naval Aircraft Factory, Philadelphia.

XF4U-3 Thirteen experimental aircraft with turbo-superchargers used for test work at 40,000 ft. and over. R-2800-16 engine.

F4U-4 Fighter-bomber with 6 x 0.50 in. guns and 8 x 5 in. rockets or 2 x 1,000 lb. bombs. R-2800-18W or 42W engine. Span, 40 ft. $11\frac{3}{4}$ in. Length, 33 ft. $8\frac{1}{2}$ in. Height, 14 ft. 9 in. Loaded weight 12,400 lb. Max. speed 450 m.p.h. Ceiling 41,000 ft.
F4U-4B for F.A.A. F4U-4C with 4 x 20 mm. cannon. F4U-4N night fighter with radar. F4U-4P for photo-recce.

F4U-5 Improved model, with metal-covered outer wings and spring tab ailerons. R-2800-32W engine. Span, 41 ft. Length, 34 ft. 6 in. Height, 14 ft. 10 in. Loaded weight, 13,426 lb. Max. speed 480 m.p.h. Ceiling 45,000 ft.

Above: An AU-1 "Corsair" specialised ground-attack fighter. Lettering on the fuselage side beneath the tailplane is: AU-1, MARINES, 129320. Centre picture shows an F4U-5 NL, which was a special "winterised" version used in Korea with considerable success. Although "Corsair" pilots shot down 12 enemy planes —with many others damaged—during the Korean War, the "Corsair's" main role was that of ground-attack fighter.



F4U-5N and NL (winterised for Korea) night fighters with radar. F4U-5P for photo-recce.

F4U-7 As F4U-4 for French Navy.

AU-1 Production attack aircraft for Korea. 2,400 h.p. R-2800-83WA engine. 4 x 20 mm. cannon, 10 x 5 in. rockets and 2 x 1,000 lb. or 1,600 lb. bombs. Dimensions as F4U-5. Loaded weight 12,845 lb.

F3A-1 F4U-1 built by Brewster. (F.A.A. *Corsair III*).

F3A-1D F4U-1D built by Brewster.

FG-1 F4U-1 built by Goodyear.

FG-1D F4U-1D built by Goodyear (F.A.A. *Corsair IV*).

FG-1E Goodyear-built, radar-equipped.

FG-3 This version was fiitted with turbo-supercharger, built by Goodyear.

F2G Goodyear version with 3,500 h.p. Wasp Major 4360 engine.

COLOUR SCHEMES

Standard U.S. Navy wartime camouflage was deep blue, merging to a grey or azure undersurface. Undersurface of folding portions of wings also deep blue. Normal national insignia, except that pale grey substituted for white star. Later aircraft midnight blue overall.

Fleet Air Arm *Corsairs* originally had standard R.N. dark slate grey and extra dark sea grey upper surfaces and sky undersurfaces. Later had U.S.N. blue/grey camouflage.

Topical Twists

by PYLONIUS

Blue for the Boys

Sad to say our future teams abroad will no longer be distinguished by the national hobby-fiend costume of shirt sleeves and braces. They will be garbed in the nondescript apparel of sporty romper suits. This gives rise to the horrible suspicion that we Sunday morning hobbyists are about to take this model flying business seriously—flying the national flag instead of an oil stained shirt tail. On the other hand there is the comforting possibility that the fancy dress is nothing more than a gesture to our foreign friends who take their "Keep the Airfields Tidy" campaigns more seriously than we do.

One shocking danger which emerges from the adoption of standard romper outfits is that of our flyers being mistaken for foreigners. To provide against such humiliation our blue rompers are to carry a large size in Union Jack and the legend Great Britain in bold letters. Even so, mistakes could still occur. When a romper suited figure is seen to stand immovably unconcerned as his model soars away for a max., instead of jumping six feet in the air in wild exultation, anxious first aid squads would be on the spot in no time, administering treatment for shock and sunstroke. Only after the romper suit had been removed to reveal the phlegmatic Englishman in all his shirt sleeved glory would they realise their mistake.

Sheer Saucer-y

I may be wrong, but I've got the impression that Flying Saucers are heading for the antique store. Our own guided missiles and 2,000 m.p.h.-plus rocket planes seem to have left them on the shelf, as it were. Apart from the annual Earth to Mars Old Crocks' Race we thought they had gone out of business completely. But from latest reports they are still very much around and much nearer to home. In the old days they restricted their earthly excursions to Superman country only, we not being sufficiently comic conscious to have acquired the necessary super-vision to detect their roosting on our ancient chimney pots.

For some obscure reason they park their visiting cards on lonely and primitive farmsteads, take one look at the pig-sty and then streak for home, appalled at the pinky nudity of the human race and shocked at their dreadful table manners. Out in the Middle West the saucer visitors had become a perfect pest. The persecuted farmer had only to pop out for a spot of muck-raking and down would come a saucer to hover over him like a large blue-bottle. To make matters worse his every movement would be watched by creatures with long hair and soulful faces, making him feel like Liberace. On top of this he has to down tools and rush indoors to write a book of his experience. More often than not he left this chore to his good wife; from which feminine source we get the terms U.F.O. (Underdone Fried Omelette) and Vimana, an old American dish resembling jellified semolina.

Why they should have given up their Middle West hunting grounds in order to snoop round our own modest muckheaps, goodness only knows. Perhaps they're on the look out for a better mannered form of pig-life or, to be more romantic, they might be futuristic modellers travelling back through space time looking for a lost Wakefield.

"Jet" Models

Members of the Enfield Club, looking forward to an exciting film show on Gas Jobs, were rather let down by the Gas Company's choice of cooking appliance hints. Not even a shot of Mike Gaster's "Gastove."

However, their morale was uplifted by the creation of a model making machine for a club display. This gadget differs somewhat from the standard type of model making machine. I refer to the one which stands between 5 ft. and 6 ft. in height, is kept either in the garden shed or box-room, and operates on a high consumption rate of midnight oil.

Weak-End's Work

We so take it for granted that full size design is a long winded business that its hard to believe that there's any short cut to producing a modern jet. The usual practice is for 500 designers working feverishly for five years in order to decide whether the already obsolete plane will go into production either in 1969 or 1975. We learn though, that a jet plane was designed overnight following a lightning visit to the local model shop.

This mysterious procedure had me puzzled at first—I just failed to see the connection. Then it dawned on me. Quite simple really. A study of the antics of models on the flying field will confirm the belief that a model of successful jet plane just won't fly.

News Hound

Looking through the list of do's and don'ts for Club Reports it seems that the Club reporter has got to forget all that club routine stuff about comp results, who's building what, flight times, and really get down to "News." From this I take it that the ideal club report would read something like this:

MODELLER BITES DOG. "Whilst chasing his m-d-l p-a-e across Hogswort Common, Mr. Joe Bloggs was followed by a large dog. As the m-d-l p-a-e landed the dog pounced upon it, whereupon Mr. Bloggs was heard to give vent to a deep growl, and then bite the dog viciously in the region of the left ear. Fortunately, the dog was undamaged as Mr. Bloggs is in the habit of leaving his teeth at home when m-d-l f-y-n-. Had the dog also done so it would not have been necessary to have raised a club subscription for a new pair of trousers for the gallant Mr. Bloggs."

Jungle Lore

A wag has referred to this column as "Tropical Twists." Perhaps he's under the impression that it's author is suffering from a touch of the sun. I can only refute this outrageous suggestion by saying that I do all my model flying in this country.

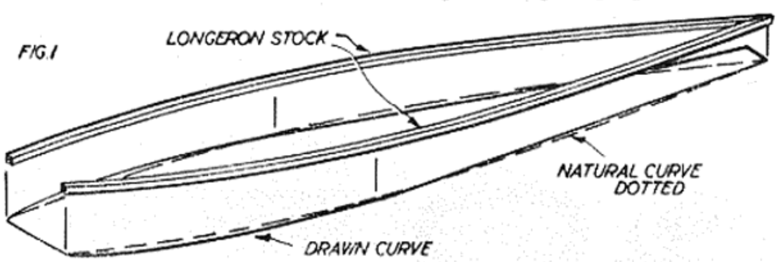
Of course, it might be that he's got rather mixed up about all those funny Tiger Tales which are now pouring in. He will not, perhaps, be sorry to learn that my own entry, written under the nom-de-plume of Colonel Eyewash, will not be included. A pity really, as it contained quite a few helpful hints on Tiger Flying. For instance, always land your tiger near a tree so that you can shin up it as soon as you jump off its back. And again, always fly your Tiger sitting firmly astride it, and never inside it.

CRACKING CURVES

— or how to bend balsa the simple way

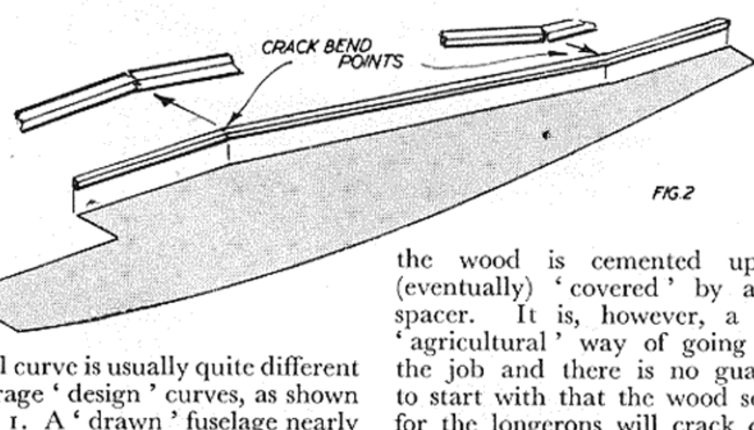
BALSA is not an easy material to bend. In typical longeron sections it is usually quite stiff and often too brittle to be formed through sharp curves. Yet designers frequently call for such curves in the interest of outline appearance; or at the other extreme, respect the limitations of balsa so much that they end up with very plain 'straight' shapes.

Ideally, all fuselage curves should follow the natural curve of the longeron material when held apart to a distance corresponding to the greatest width and pulled in at nose and tail to the required end dimensions. Even with simple shapes this natural curve is usually quite different to average 'design' curves, as shown in Fig. 1. A 'drawn' fuselage nearly always calls for a more exaggerated nose curve and a more pulled-in rear section curve. But provided the two are not widely different there is normally little difficulty in pinning out the longerons over the plan.



What is more likely to cause trouble is where abrupt changes in outline are called for, such as at the wing trailing edge position and the tailplane leading edge position (the latter being necessary to arrange for the tailplane seating to be at the correct angle). Sharp bends like this are only produced cleanly and accurately if the longerons are actually cracked or weakened at these points—Fig. 2.

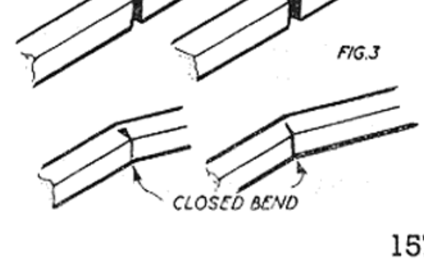
This is more or less standard practice and does not necessarily weaken the frame since the crack in the wood is cemented up and (eventually) 'covered' by a cross spacer. It is, however, a rather 'agricultural' way of going about the job and there is no guarantee to start with that the wood selected for the longerons will crack cleanly and not break right through.



A better alternative for such sharp bends is 'kerfing,' which means cutting a notch part way through the section to weaken it, filling the slot with cement and then bending to close up the slot completely. Two methods of kerfing are shown in Fig. 3, the one utilising a parallel slot such as would be cut by a saw blade and the other a V-shaped notch, such as might be formed with a razor blade. The second method would appear, geometrically, to be the best, but in practice the parallel slot is to be preferred. Either method is better than simple crack-bending since there is no separation of the fibres of the wood. And once the slot is closed, and filled with cement, the joint sets really strong.

Kerfing slots are usually cut to a depth of one half to three quarters of the depth of section, depending on the wood. The width of slot depends on the amount of 'closure' required to complete the required angle of bend. Rather than treat this theoretically the best method, especially with balsa, is invariably to try first on a piece of scrap wood of the same section and similar density. Using any standard saw blade, see how much a slot half-way through the section enables the test piece to be angled to close the slot. Then adjust accordingly—see Fig. 4—so that the required angle of bend is reached just as the kerf or slot closes.

(Continued overleaf.)



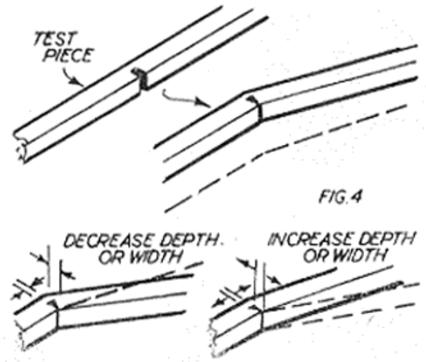


FIG. 4

Kerf bending can be carried a stage further. Suppose instead of bending longerons we require a number of lightweight formers for a streamlined fuselage. The normal method of making these formers is to cut them from sheet or built-up strip frames, laminate sheet, or wind them from 1/32 in. thick strip laminated to three or four layers—Fig. 5.

With less than half the trouble the 'wound' former can be duplicated in strength and weight by kerf bending square section strip to the required section. To take a circular fuselage as a typical example, this is first marked out with the

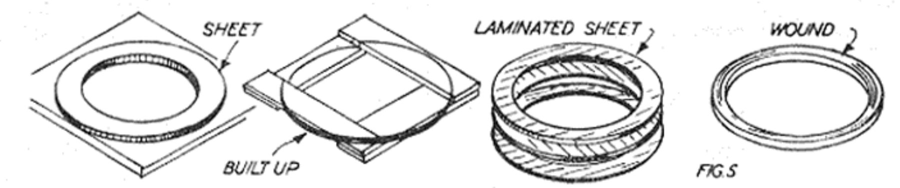


FIG. 5

required numer of sides (corresponding to stringer positions). These effective outside lengths are then marked along one edge of a strip of balsa and suitable kerfs cut in the opposite edge at these points—Fig. 6. A test piece decides the width and depth of kerf required to make the necessary angle of bend between each former 'face,' after which the strip can simply be bent to the required section, butt jointing the two ends.

Provided you look for the right kind of wood this type of former can also be made by crack bending. This method is not as accurate nor as strong as kerf bending, but is quicker. Generally, too, a crack-bent former even with the edges coated with cement tends to be flexible, whereas a kerf-bent former is quite rigid.

Extending this principle to wing tips, there is no reason why these should not be formed from strip wood of good 'stringy' texture. For convenience, the same saw blade can be used to make all the kerfs, which incidentally should also *always* be cut to the same depth on any length, otherwise there will be local weak spots at the points of the deeper cuts, leading to kinking. To accommodate the sharper curve at the extreme tip the kerfs are simply

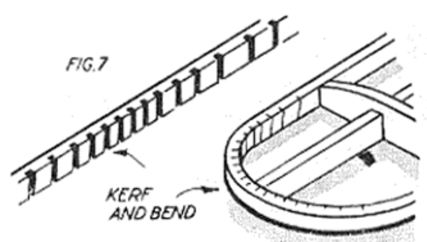


FIG. 7

made closer together. The closer the kerfs, the more readily the wood can be bent and the closer the *outside* edge can be formed to a perfectly smooth curve, comparable with steam bending, Fig. 7. In fact, the former construction described in Fig. 6 could have been made truly circular (instead of octagonal or poly-sided) by spacing the kerfs quite close together and making them slightly deeper. As a general rule, however, balsa, because of its variable properties, is not a good subject for 'smooth' bending or kerfing. But it can be done very satisfactorily if you take the trouble to find the best quality wood for the job.

Sheet balsa can also be bent in a similar manner. It is becoming increasingly common to find in kits 'integral strip' in which the strip lengths instead of being cut separately and bundled are cut in a piece of sheet, not quite separated but easily pulled off piece by piece. Such a matched strip sheet is quite flexible crossways and can often be rolled

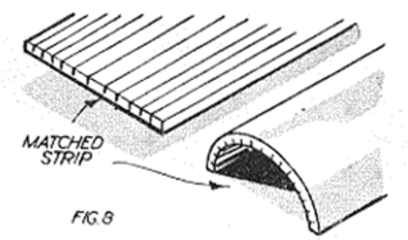


FIG. 8

into a semi-circular shape without splitting or separating—Fig. 8. The sheet is, in fact, effectively kerfed along its length. Provided the spacing of the individual cuts is uniform the sheet will bend to a uniform curve. With only slightly wider cuts than those normally used in producing matched strip the whole sheet could be rolled up into a tube without any trouble at all—and if the kerf slots were previously filled with cement the resulting tube would be as strong as any wound from 'solid' sheet.

Cutting uniform kerfs along a length of sheet is only readily possible with a machine, but could be duplicated with a knife cutter set so that the blade could never cut through the complete thickness of sheet, the individual cuts then being made one by one. A length of matched strip, or a hand-made equivalent, is then easily applied in the form of a rounded cowling or decking in quite thick sheet—Fig. 9. As with all other forms of kerf bending, the kerfs come on the inside of the curve where they are closed up by the bend.

One of the main attractions of kerf bending is that really stiff wood can be made quite flexible by this

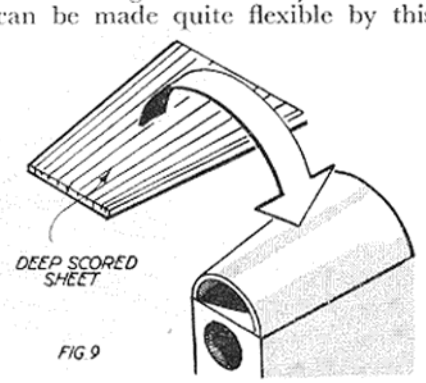


FIG. 9

treatment, yet retaining all its original stiffness when the bend is completed and the cemented kerfs set. It is also far more accurate then crack bending, just as scoring and bending a piece of card is more accurate than "freehand" bending. Few modellers use it, yet it is a method full of possibilities for all parts of the airframe. And it is just as effective when applied to hardwoods.

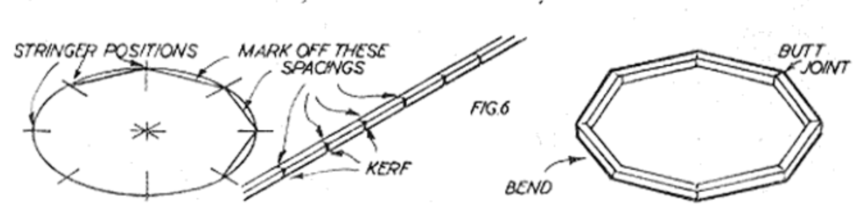
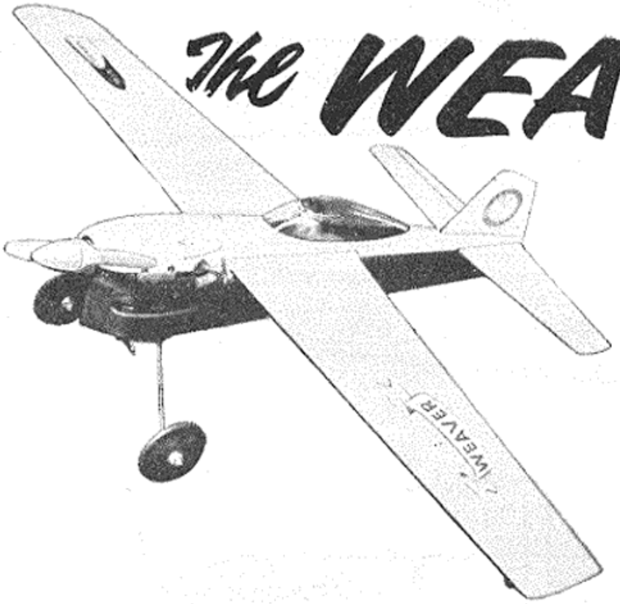


FIG. 6



The WEAVER

HALF 'A' TEAM RACER

Designed by *Dave Platt*

THIS little racer has been designed for competition flying in the new S.M.A.E. $\frac{1}{2}$A Team Racing Class. This accent on contest requirements has resulted in a model which is not claimed to be a one-evening project. It will take six or seven evenings to build, but the time is amply rewarded by a model which is strong, accessible and efficient. Much of the extra time will be taken by the detail design, which is such that the tank, controls and motor are all readily accessible, also the u/c if you wish; this will be appreciated on the flying field.

As the *Weaver* may be the first "two piece" model to be built by many modellers, full instructions are given for assembly, but before detailing these, some tips are given to help you to get the best out of your model.

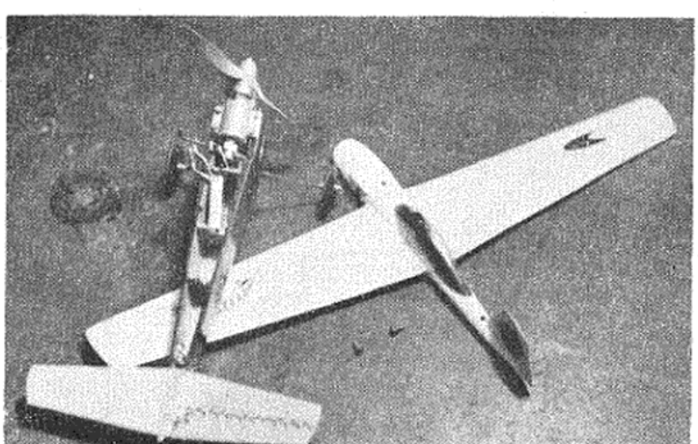
The tank has been made movable for a good reason, so make use of this. Start by having the tank against the inside fuselage side, and pivot the rear outwards $\frac{1}{16}$ in. at a time until the ideal combination of good motor run and good range is found. The tank shape shown has proven the best, so do not alter it.

Use thin lines—33 g. wire, available commercially, is too thick for $\frac{1}{2}$A models—36 g. is more than strong enough. This is 0.008 in., the thinnest obtainable easily, so use this wire for all flying.

Props. To get good speed, let the motor rev. The original model had a Taifun Hurrikan, which runs at 15,000 + r.p.m. in the air. Don't be afraid to use small props, 7 or 8 in. pitch will be found best, the higher pitch for the more powerful motors. Trim blade diameter and thickness until the motor shows a static r.p.m. of approximately 15 per cent. less than the speed at which maximum power is developed. Look at the MODEL AIRCRAFT figures to find out the peak speed for your motor. When you have found your ideal prop, stick to it and remember that re-working your blades and paying attention to finish and balance will pay off in a race.

The front line has purposely been designed as the "up" line. This is so that any obstacles which the front line may hit on take-off or glide will give up elevator. Front induction motors are easily accommodated in the design by shortening the duct-piece to suit. The A.M.10 should give 70 m.p.h. on a 5 in. × 8 in. or a $5\frac{1}{2}$ in. × 7 in. prop.

Finally, bear in mind that the type of construction employed in the *Weaver* is also very suitable for all sizes of team racer.



The "split" construction of the Weaver is clearly shown in this view. Note particularly the angled tank.

Step by Step Building Instructions

1. Carve wing to section, glue in tip weight, line guide and bellcrank bearer. Install pivot bolt in bearer. Remember to leave centre section uncarved to glue into the top block.
2. Cut out tailplane, sand to section, cut elevator free. Do not join elevator to tailplane yet.
3. Cut bearers to length, bolt motor in position to check holes. Remove motor and relieve inside edges of bearers to a gentle arc between bolts to allow motor to be dropped between the bearers from the top. Remount motor with the bolt heads under the bearers, solder wire strip across bolt heads. Nuts come on top of the mounting lugs of the motor.
4. Leaving the motor mounted, glue sides to bearers.
5. Sew undercarriage to duct with strong thread. (The designer prefers to have a removable undercarriage—this can be held with tin straps and 4-8 B.A. nuts and bolts.)
6. Cement F1 in place, followed by F2, 3 and 4. Cement sides together at rear. Cement duct in place.
7. Carve cowling front block to shape, cement in place, then cowling bottom and fuselage bottom.
8. Cement tailplane to fuselage.
9. Remove motor. Mark out top block and carve to external shape. Cut recess for wing and a small hole to take head of pivot bolt. Glue wing firmly in place, check that bottom of wing is flush with bottom of block.
10. Hollow out top block at front to take motor and rear of wing to take pushrod. Glue fin in place on top, do not let into block.
11. Cut spokes to length and instal permanently in bottom half of fuselage.
12. Drill top block to receive spokes and tank vents. Assemble fuselage halves to check for good fixing.
13. Cut exhaust slots, air inlet and needle hole in cowl.
14. Clear dope model once, sand, then cover with tissue and apply several coats of sanding sealer, sanding between each. Colour model as required.
15. Stick canopy and pilot to top half. Sew elevator to tailplane with strong thread and bolt the elevator horn in place.
16. Make leadouts and pushrod, solder to bellcrank and install on pivot bolt. *Do not* solder washer to rear end of pushrod as this must be removable from elevator horn. One small rearwards bend will prevent it slipping out when the top half is in position.

Assembly of model is as follows:—

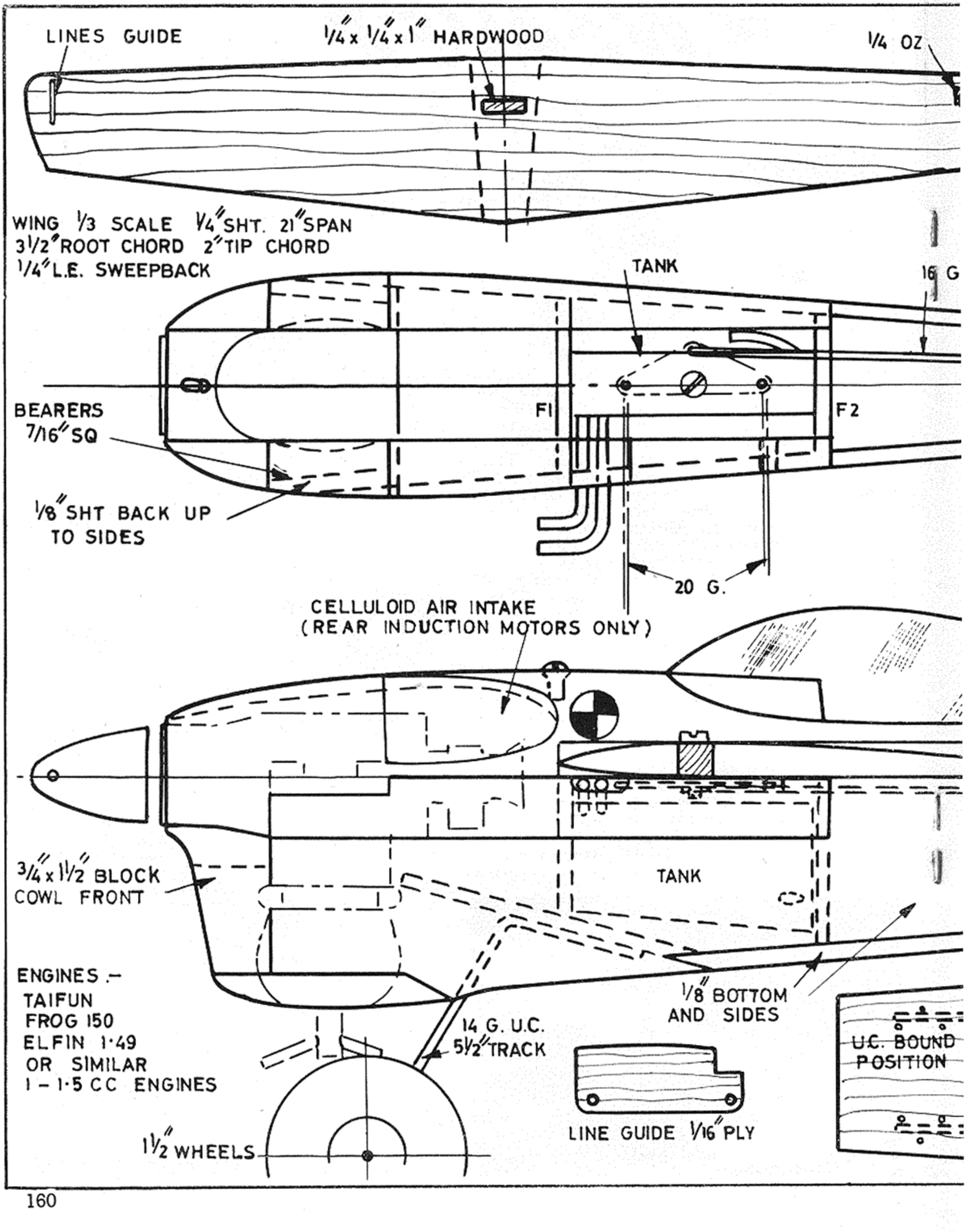
Connect neoprene to tank, thread through F1 and push tank down into place. Connect neoprene to motor, remove needle and comp. screw and slip head through the bearers and screw on the four nuts which hold the motor down. Replace needle and comp. screw. Slide pushrod through elevator horn, position the leadout correctly and slide top half over the spokes. Check controls. Screw the spoke nipples down and the model is complete.

Materials

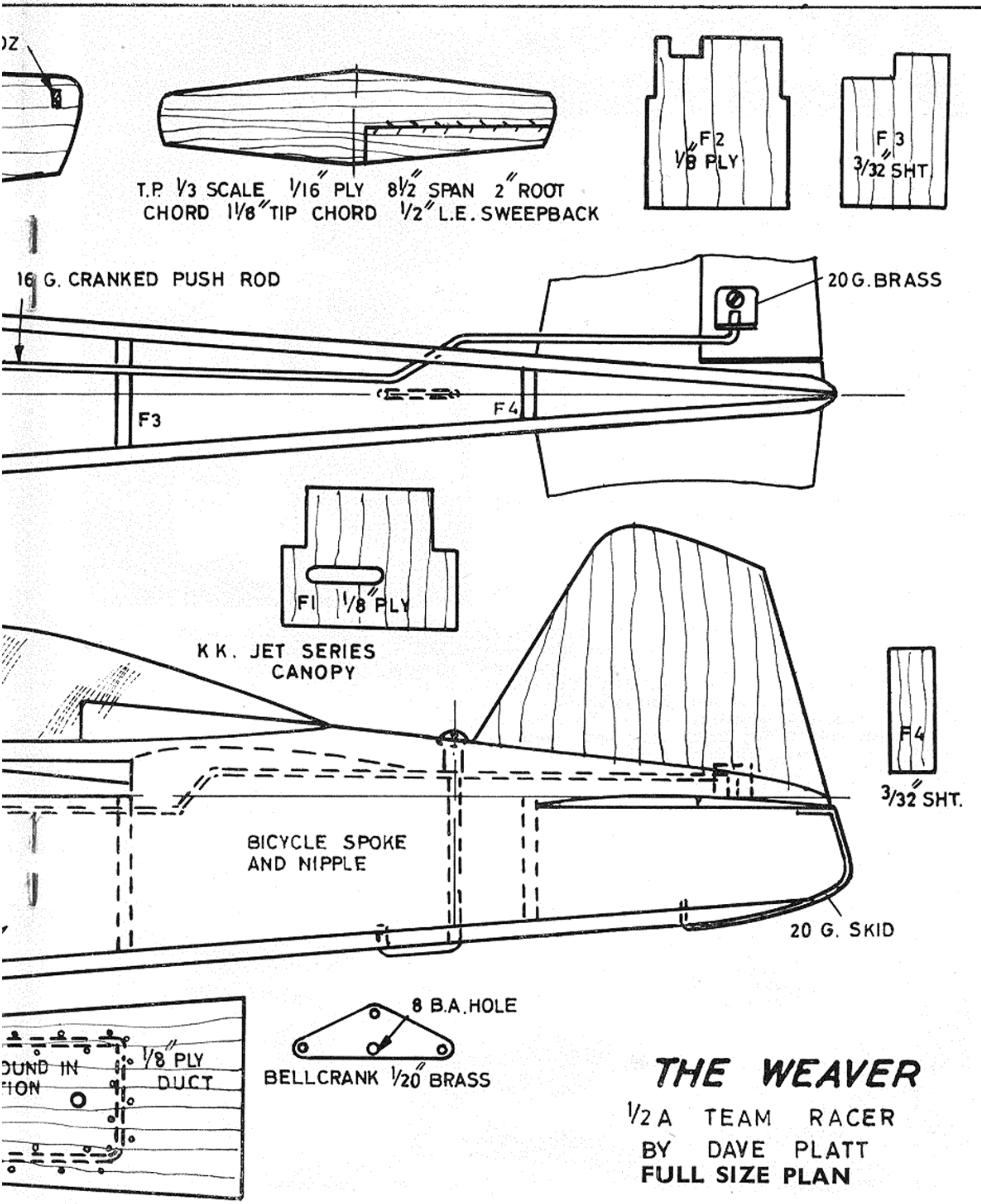
$\frac{1}{4}$ in. hard sheet 3 in. × 24 in.; $\frac{1}{8}$ in. hard sheet 3 in. × 36 in.; hard block 15 in. × $1\frac{1}{2}$ in. × $\frac{3}{4}$ in.; $\frac{1}{8}$ in. ply 6 in. × 2 in.; $\frac{1}{16}$ in. ply 9 in. × 2 in.; $\frac{3}{16}$ in. sq. bearers × 12 in.; 16 g. wire × 12 in.; 14 g. wire × 12 in.; 20 g. wire × 12 in.

Use Cascamite or Aerolite glue. Other small items can be found in most modeller's workshops. Cheap enough? If so, let's get weaving.

FULL SIZE PLANS OVERLEAF

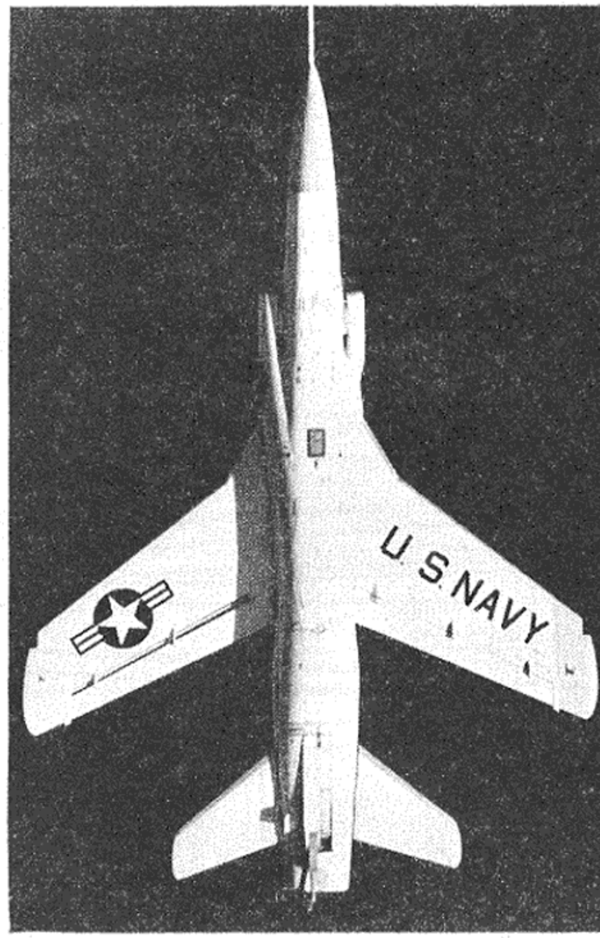


LINES GUIDE
1/4" x 1/4" x 1" HARDWOOD
1/4 OZ
WING 1/3 SCALE 1/4" SHT. 21" SPAN
3 1/2" ROOT CHORD 2" TIP CHORD
1/4" L.E. SWEEPBACK
TANK
16 G
BEARERS
7/16" SQ
F1
F2
1/8" SHT BACK UP
TO SIDES
20 G.
CELLULOID AIR INTAKE
(REAR INDUCTION MOTORS ONLY)
3/4" x 1 1/2" BLOCK
COWL FRONT
TANK
ENGINES :-
TAIFUN
FROG 150
ELFIN 1·49
OR SIMILAR
1 - 1·5 CC ENGINES
14 G. U.C.
5 1/2" TRACK
1/8" BOTTOM
AND SIDES
U.C. BOUND
POSITION
LINE GUIDE 1/16" PLY
1 1/2" WHEELS


T.P. 1/3 SCALE 1/16" PLY 8½" SPAN 2" ROOT
CHORD 1 1/8" TIP CHORD 1/2" L.E. SWEEPBACK
F 2
1/8" PLY
F 3
3/32" SHT
16 G. CRANKED PUSH ROD
20 G. BRASS
F3
F4
F1 1/8" PLY
K.K. JET SERIES
CANOPY
F4
3/32" SHT.
BICYCLE SPOKE
AND NIPPLE
20 G. SKID
8 B.A. HOLE
BELLCRANK 1/20" BRASS
1/8" PLY
DUCT
THE WEAVER
1/2 A TEAM RACER
BY DAVE PLATT
FULL SIZE PLAN

AVIATION NEWSPAGE

by J. W. R. Taylor



The Grumman *Tiger* which **HIT 1,220 m.p.h. DURING TESTS** at Edwards Air Force Base, California, is now known to be the 37th production machine (serial No. 138646).

Designated F11F-1F, it is one of two *Tigers* that have been re-engined with a General Electric J79 turbojet and afterburner, instead of the usual Wright J65 Sapphire. The plan view (right) shows well its "Marilyn Monroe" area-ruled fuselage, newly-enlarged air intakes and compound sweep on the wing leading edges. The control surfaces have also been modified in an effort to eliminate the handling problems that have delayed introduction into service of this promising lightweight naval interceptor.

* * *

UNUSUAL MARKINGS on the tailbooms of the *Vampire* 5s (below), consisting of a wide band of light blue edged with dark blue, show that the aircraft are based at the R.A.F. College, Cranwell.

All training 'planes flown by the cadets wear this insignia in place of the usual yellow bands, and it can be seen currently on *Provosts* and *Vampire* T.11s as well as 5s.

"SINGLE-FIN EXPEDITOR" reported at London Airport recently was a Cessna *Bobcat* belonging to Balair and carrying Swiss civil markings.

Although a rare sight nowadays, the *Bobcat* was built in very large numbers during the war, first as a training version of the civil T-50 for the R.C.A.F., who called it the *Crane*. The U.S.A.A.F. ordered 33 AT-8 trainers with 295 h.p. Lycoming engines in 1941, followed by 1,199 AT-17s and 3,437 UC-78 light transports with 225-245 h.p. Jacobs engines. In addition, the U.S. Navy had many Jacobs-powered JRC-1s.

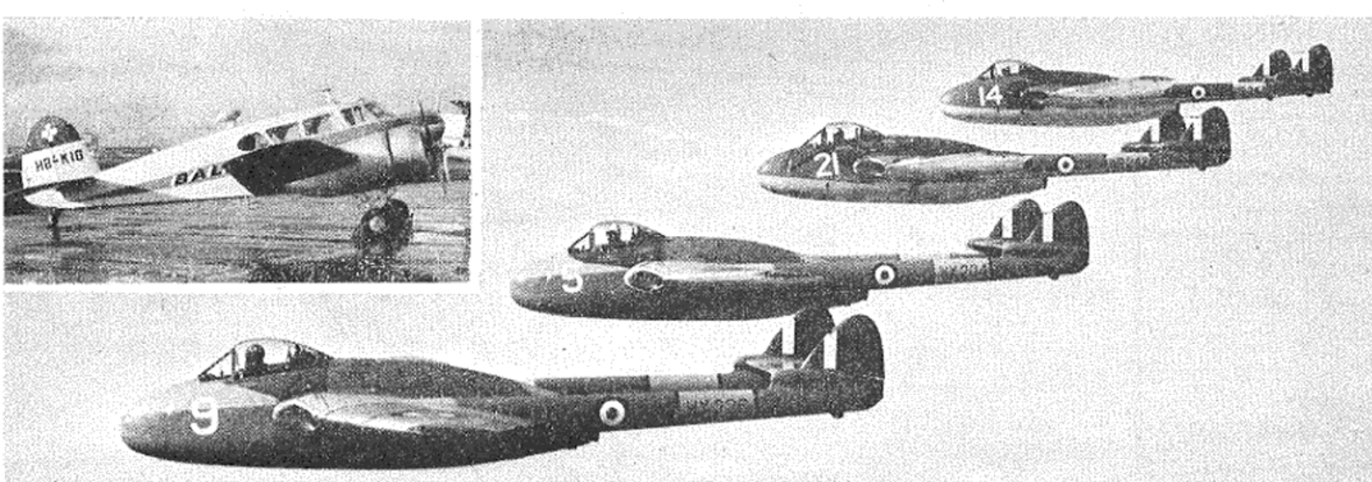
Smaller than the all-metal *Expeditor*, with a span of 41 ft. 11 in. and weight of 5,700 lb., the fabric-covered *Bobcat* has a top speed of 175 m.p.h. when carrying four persons.

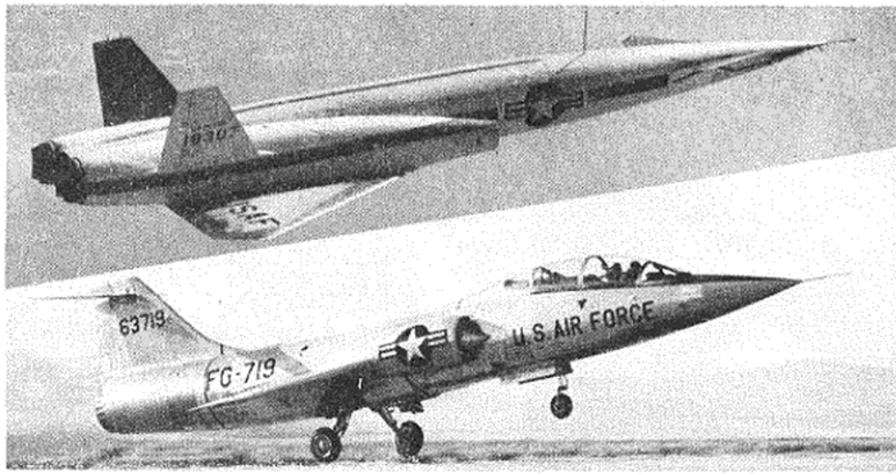
* * *

LAST FLIGHT of North American's tail-first X-10 was announced a few weeks ago.

Built as a pilotless test vehicle for the SM-64 *Navaho* intercontinental missile, the X-10 was powered by two Westinghouse J40 turbojets and fitted with a retractable undercarriage for recovery and repeated use. It flew hundreds of miles at supersonic speeds in a programme to prove the missile's aerodynamic design, as well as its guidance and control systems.

Little is known officially about *Navaho* itself, although development has been under way since 1945. It is reported to be designed for a 5,000-mile range at Mach 3 at very great heights, and is rocket-boosted to flying speed, after which two





Upper view shows North American's X-10 guided missile on a test flight. Below: A snappy take-off is demonstrated by Lockheed's diminutive F-104B Starfighter—the two-seat version of the F-104A.

Wright RJ47 ramjets take over. Weight at launching is 100,000 lb., total thrust 180,000 lb. and guidance by a self-contained "star-tracking" system which is said to ensure unrivalled accuracy at the target.

* * *

FIRST FLIGHT of the two-seat F-104B *Starfighter* dual-purpose trainer-tactical fighter was made at the beginning of the year and this variant is now in full production at Lockheed's California and Georgia factories.

* * *

Cleanliness has long been **SECOND TO PODLINESS** for the engines of large American jet aircraft; but the

sight of the weapons pod of Convair's B-58 *Hustler*, like a second fuselage slung under the aircraft's slim belly, came as a shock to British eyes and left little doubt of the need for the stalky undercarriage.

Nevertheless, Convair certainly know what they are doing, for the *Hustler* is the only true supersonic bomber in the world and the quickly-removable pods can carry nuclear or H.E. bombs, flight refuelling gear, reconnaissance cameras, air-to-air missiles or radio countermeasures equipment, giving it unrivalled versatility.

* * *

WATCH FOR *Banshee* jet fighters and Canadian-built CS2F-1 (Grumman) *Tracker* anti-submarine aircraft wearing maple leaf insignia over southern England this month. Two of each have been flown over to the U.K. via Labrador, Greenland and Iceland, for flight trials on board the new R.C.N. carrier *Bonaventure* and will be based at R.N.A.S. Ford, near Arundel, during their stay.

* * *

THE LAST YORK transport in R.A.F. Service, *Ascalon II* (MW 295), is being retired. It bears a famous name, for the original *Ascalon* (named after the sword with which St. George slew the dragon) was the first production *York* (LV 633).

Only *York* with square windows, the first *Ascalon* went to the Far East after the war, where it was replaced in due course by *Ascalon* II.

FROM THE PAST - - - - - - - - - - - - - - - - - - - No. 12

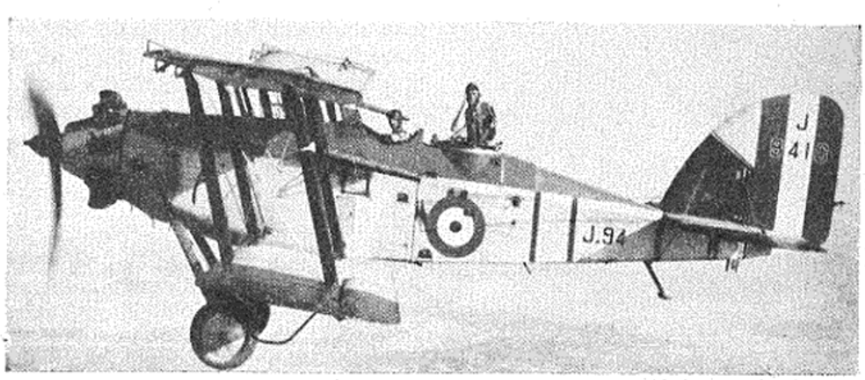
The Westland Wapiti

THE WESTLAND *WAPITI* was the winner of an Air Ministry competition in 1927 to find a replacement for the veteran D.H.9A general-purpose aircraft. Because times were hard, one requirement was that it should incorporate as many "Nine-ack" components as possible and the wings, ailerons, interplane struts and tail unit of the prototype (J8495) were standard D.H.9A parts. A larger fin and rudder were fitted after the first test flight; but it was some time before the switch to metal construction made the complete design a new one.

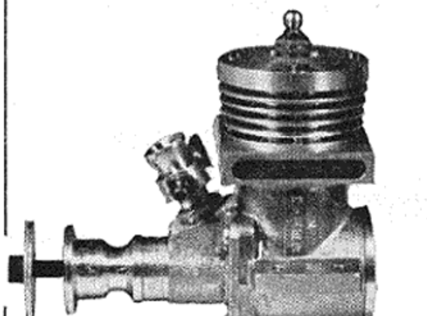
Many hundreds of *Wapitis* were built, later machines having a 480 h.p. Bristol Jupitor VIIIF or 550 h.p. Jupiter IXF engine, which gave them a speed of 140-144 m.p.h. at 5,000 ft. Standard armament consisted of a Vickers gun on the port side of the fueslage, a Lewis gun on a Scarff ring in the rear cockpit and up to 580 lb. of bombs: but special versions were equipped for army co-operation with message hook, brakes and tailwheel; for operation on floats and skis; for long-range desert operation; target-towing and training. One was delivered in 1929 for the personal use of the Prince of Wales. Another became a flying test-bed for the Bristol Phoenix diesel-engine, while Armstrong Siddeley Jaguar S and Panther II engines were standard alternatives to the Jupiter.

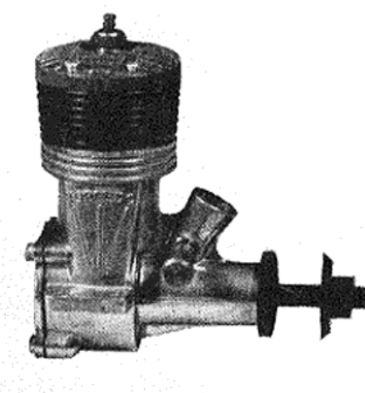
The *Wapiti* illustrated was flown by No. 30 Squadron in Iraq and is something of a spotter's nightmare as presumably, the pilot demanded the aircraft to fly before the ground types had finished painting its serial number on the fuselage! It has the standard all-silver colour scheme of the time, with black anti-glare top, unit identification bands on its fuselage, and red-painted fin, wing-tips (up to 5 ft. from tips) and tailplane tips (up to 2 ft. from tips) adopted by the squadron to make its aircraft more easy to find after a forced landing in the desert.

Span: 46 ft. 5 in. Length: 34 ft. 2 in. Height: 11 ft. 10 in. Service ceiling 20,600 ft. Max. range 660 miles.



Peter Chinn sums up the 35 controversy





THE past four months has seen a lively correspondence in the "Letters to the Editor" column regarding the lack of a British made 0.35 cu. in. size stunt/combat motor. The controversy was initiated by a paragraph in our October article, in which it was disclosed that engine designer Basil Miles had designed a 0.35 cu. in. motor based on his well-known E.D. Miles-Special 5 c.c. diesel—a move which, itself, had been prompted by our comments on foreign 0.35's and the absence of a British equivalent, in the June, 1956, article. The correspondence on this subject has now been closed and we have been asked to sum up the situation.

First, however, we feel that some acknowledgment of the interest shown by Mr. Miles and his efforts to produce an answer to the demands of "35" enthusiasts is due. When the report of his disc-valve, twin ball-bearing "35" met with criticism, he forthwith set about producing a simplified, shaft-valve motor more in accordance with apparent requirements, and within a few days, had sent along a prototype for the writer to test out and report upon in time for this article. Our thanks are due to Mr. Miles for his helpful attitude.

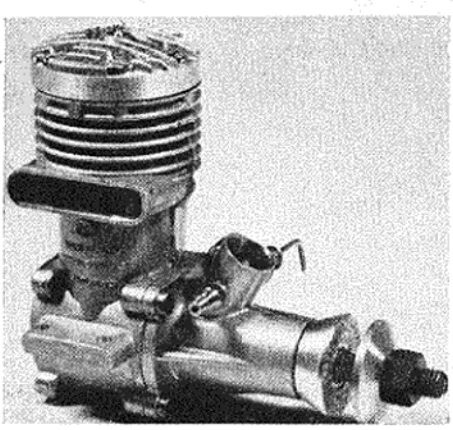
Most of the readers who have criticised the Miles approach have wanted what would be, in effect, a copy of the typical American "35" engine : i.e. loop-scavenged cylinder, shaft-valve and a plain (bushed) bearing. This is understandable. Engines of this type have been specificially developed for stunt and combat work. As we have said before, they are, in general, very powerful, easy to start, of moderate weight and, properly tanked, will go through a stunt schedule, or abrupt combat manoeuvres, without loss of power.

Although it is a fact that not every copy of a typical American layout has met with equivalent success, we agree that, for a manufacturer wishing to produce a "35" from scratch, with a minimum of expensive research and development work, the use of the American formula is undoubtedly a good starting point.

It is necessary to realise, however, that compared with the sales of small general-purpose engines, the bigger jobs are in relatively modest demand and it seems that no British manufacturer has, up to the present, considered offering a "35" to the modelling public to be worth the risk of the quite substantial investment that would be involved. The presumed retail price of the Miles engine has been adversely compared with that of American "35's," although, in fact, the usual selling price of the latter is not generally less than £5 and is frequently more—e.g. $14.95 (£5 6s. 9d.) for the Veco 35, $15.95 (£5 14s. od.) for the K. & B. and Johnson 35's and $19.95 (£7 2s. 6d.) for the newest Fox 35. This, be it noted, is in a country where the popular small engines sell as low as $3.95 (£1 14s. od.).

The moral is obvious: even in the U.S.A., "35's" cannot be sold in sufficient numbers to enable prices to be brought down to much less than three times the price of a popular small "bread-and-butter" motor. Where an occasional exception is found, it will usually be evident that some substantial saving in production costs has been made somewhere—not necessarily in a reduction in quality—sometimes by the utilisation of parts common to other engines in the maker's range or, perhaps, by speculation on an uncommonly large production volume over a limited time. As an example of this, we have it on good authority, that in order to market these larger type engines at a price well below that of their competitors, one large American producer has planned continuous production runs of up to 50,000 units per model.

The only British engine of the larger type which has been produced in appreciable quantities is, of course, the Frog "500." The 0.30 cu. in. Frog "500" has been put forward as an example of a good British glowplug engine produced to sell at a moderate price. This is one argument that cannot be disputed, although it must be remembered that the "500" was introduced at a time when engines of this size comprised a much larger proportion



Typical example of the conventional loop-scavenged 35 class: the Italian Super-Tigre G.21/35, seen here in its latest version which has the bore increased from 19.5 to 20 mm. (0.7874 in.)

of the demand for all types of model engines than is the case today. In seven years, the makers, International Model Aircraft Ltd., have not, evidently, thought it worth while to bring out a new engine of this type, but have preferred to devote their resources to replacing their smaller diesels with new, improved models.

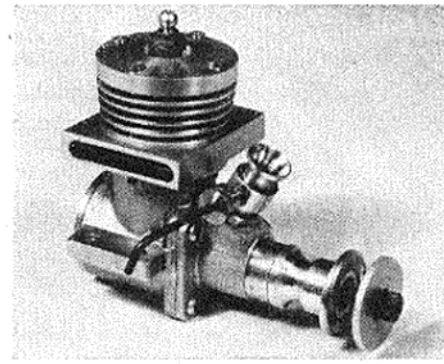
Whether I.M.A. will be persuaded to bring out an inexpensive new 0.35 cu. in. model of the required standard of performance, or a new "500" with a "35" companion model, remains to be seen. Such an engine would, of course, require to be entirely new: it is not thought that any of the existing "500" components could be utilised, but there is no reason why the layout with which the makers are familiar should not be retained. This, comprising a diecast crankcase in unit with a bushed main bearing and a one-piece steel cylinder with integral fins and a detachable diecast head, is substantially similar to that successfully used by such engines as the K. & B. 35, O.S. Max-35, etc.

The big difference, of course, would be in the size of the gas passages, etc. The ⅜-in. shaft journal of the current "500" would need to be increased to not less than 7/16 in. to allow a bigger induction port (preferably rectangular) and a larger bore intake passage. The transfer passage would be of greater width and the bottom edge of the transfer port lowered considerably in order to present a less acute entry into the combustion chamber. The existing stroke measurement of 0.680 in. could be retained (if the 0.750 × 0.680 in. "500" model was to be perpeturated in a new guise) by employing a 0.810 in. bore cylinder to volume of 0.3504 cu. in.

Alternatively, if a stroke/bore ratio of under 0.84/1 is thought to be a trifle low, one can visualise a "square" bore and stroke of 0.725 in. being used for the "500" (0.2992 cu. in.) with a 0.785 in. bore for the "35" version (0.3517 cu. in.) giving a stroke/bore ratio of 0.924/1. A move in this latter direction (i.e. an increase in the stroke common to both models) might be considered the better proposition as it would mean bringing the "500" just within the 0.30 cu. in. limit, as well as the 5 c.c. limit as at present, while still retaining the maximum swept volume for the "35" version.

Both combinations, it will be noted, are based on an increase in bore of 60 thou. for the "35" version. Such a figure, equal to a reduction in cylinder-wall-plus-casing thickness of less than 1/32-in., can be taken care of by a crankcase casting common to both capacities. Thus, an alternative piston and cylinder assembly would be the only essential components required to convert our imaginary modernised Frog "500" into a "575" stunt/combat class motor.

Having indulged in a little fanciful thinking about what *might* be done for the larger engine enthusiast (and we hope that I.M.A. will forgive our presuming to improve their well-tried "500") let us now examine what has already been done: in the shape of the Miles "35."



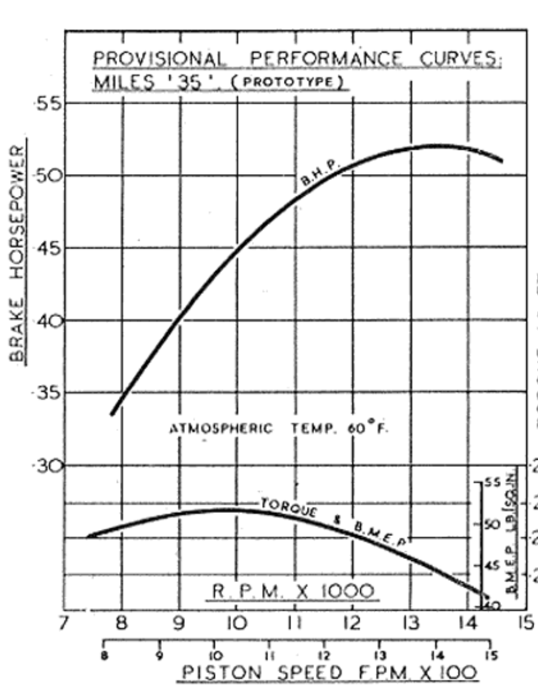
The first prototype of the Miles 35 shaft-valve glowplug engine. This is the first British engine built specifically for the 0.35 stunt/combat class.

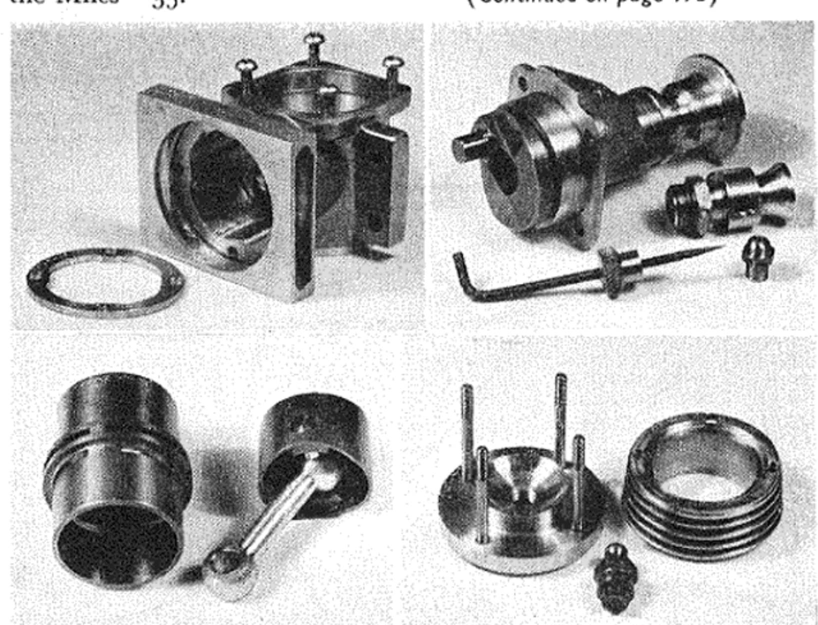
First of all we should make it clear that the Miles "35" is not merely intended as a one-off special. If sufficient interest is shown this new engine will be put into small-scale production.

We have already seen that development and tooling costs versus limited potential sales, is probably the reason why British manufacturers have been reluctant to venture into this class. It is not surprising, therefore to find that the Miles is, in some respects a compromise solution to the problem. It uses the basic crankcase die-casting of the current Miles Special 5 c.c. diesel and, in consequence, it remains a reverse-flow scavenged engine and not a loop-scavenged type in the recognised "35" tradition.

This, undoubtedly, has biased some people against the design even before it has appeared. We can only suggest that it will be far better to

(Continued on page 175)

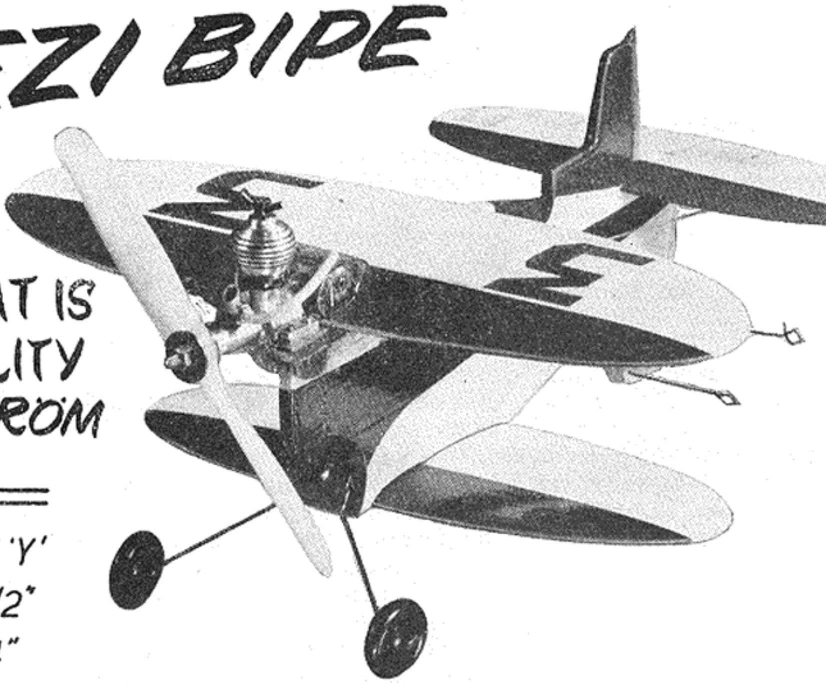




Component parts of the Miles 35. The engine is notable for its very short stroke and unusual main bearing. Unlike most of the established 35's, it employs a reverse-flow scavenged cylinder.

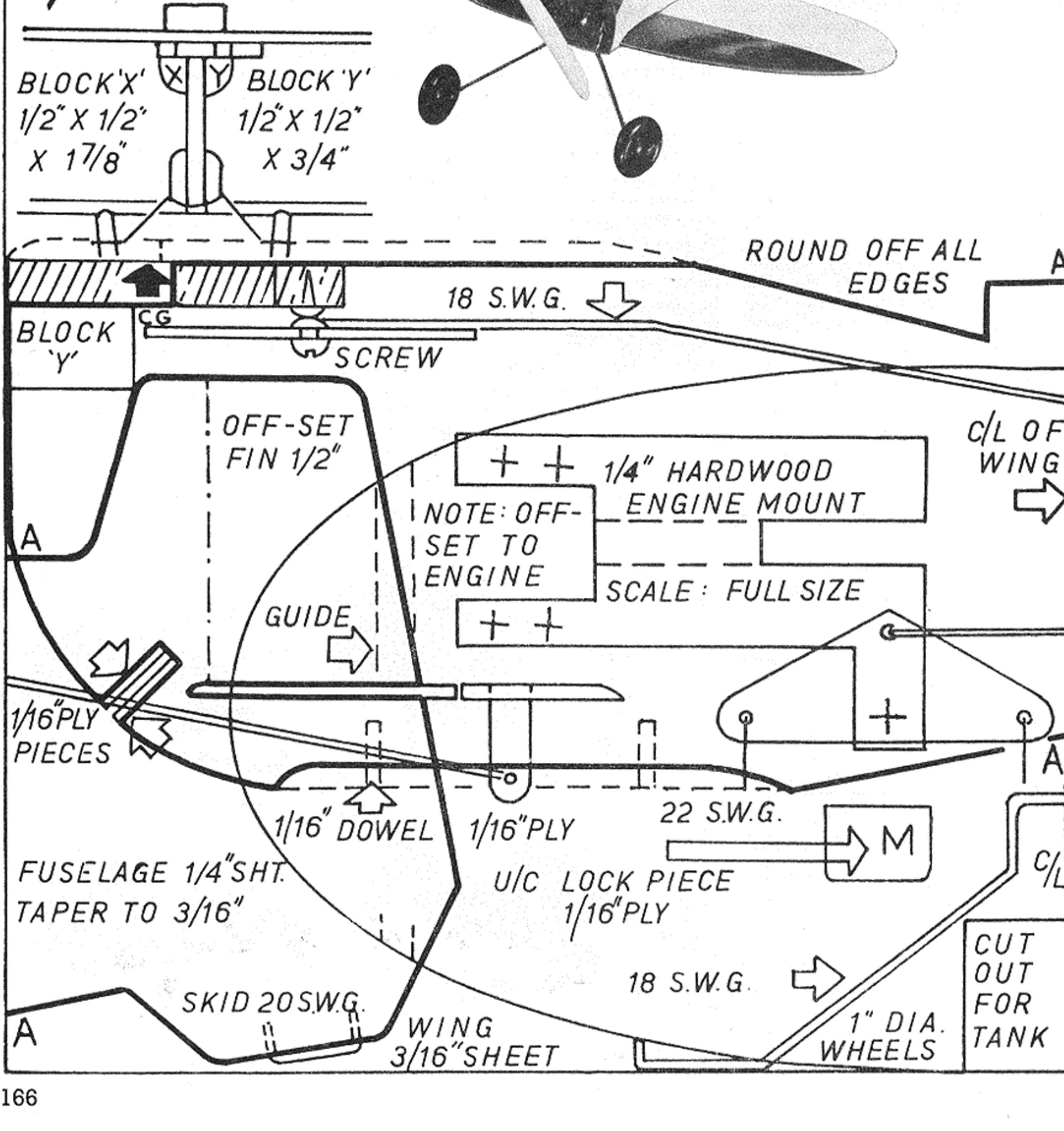
SOMETHING DIFFERENT FOR THAT ·5

BREEZI BIPE



A VEST-POCKET JOB THAT IS FULL OF FLY-ABILITY

by RAY MALMSTRÖM



. . . all the building gen

VEST pockets and biplanes. Any connection? Well, yes, there is if you feel like building this tiny two-winger! Its 10 in. span is almost (yes, I said almost) small enough to fit into a vest pocket and certainly transport problems are nil. You do not wear a vest?—never mind, this job's a lot of fun anyway.

Although of midget proportions it flies as well as any of its bigger brothers, and you must be ready for a really zippy take-off. Like the *Victor* it practically lands itself. Ah! I can see you've got that "balsa-butchering look," so let's go.

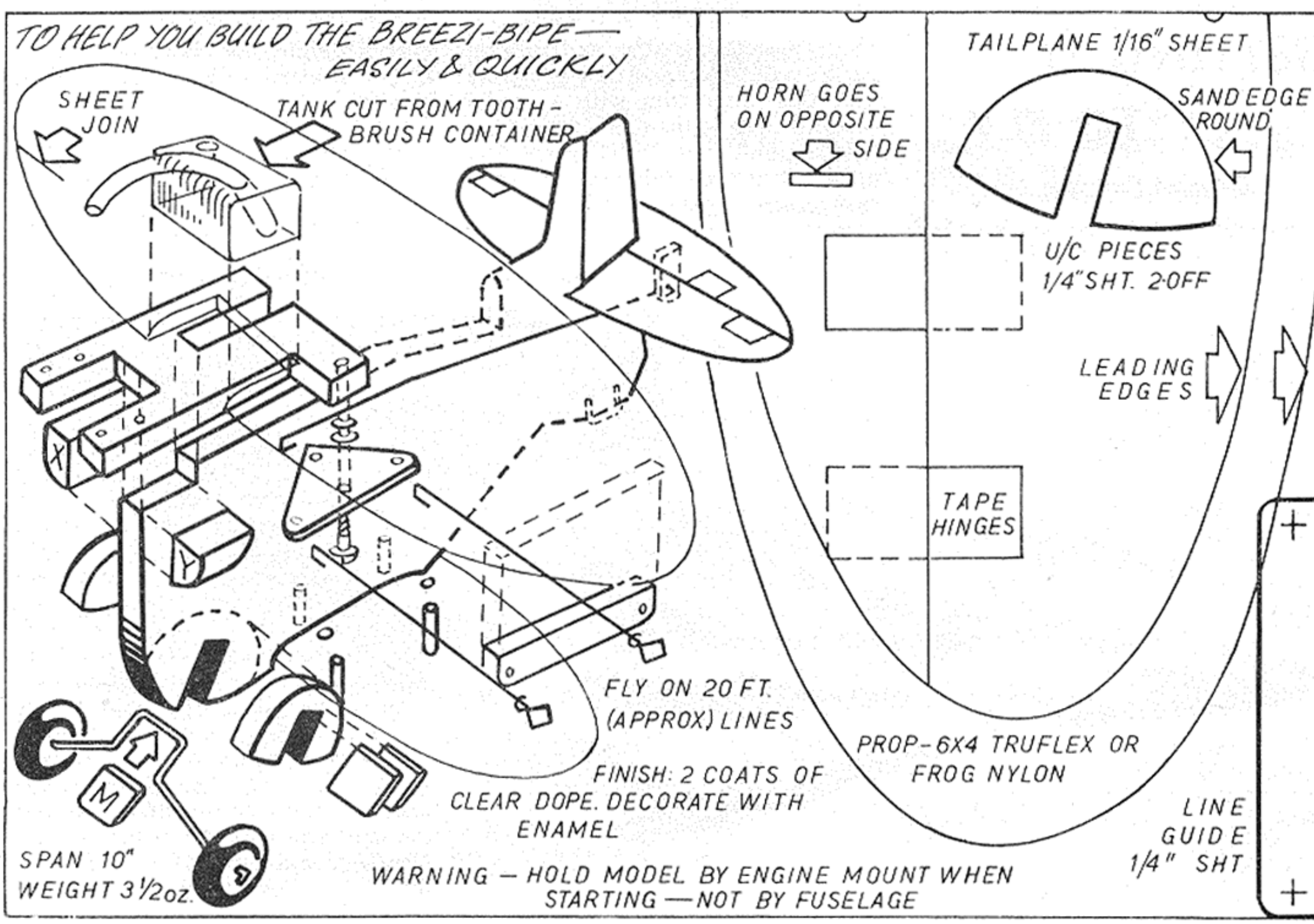
If you have some 4 in. wide $\frac{1}{4}$ in. sheet the fuselage can be cut in one piece. If not you will have to join a 9 × 1 × $\frac{1}{4}$ in. strip to the 3 in. wide sheet before tracing on the fuselage shape. Taper rear to $\frac{3}{16}$ in. and round-off edges. Drill two $\frac{1}{16}$ in. dia. holes for the lower wing locking dowels. Cut engine mount from $\frac{1}{4}$ in. hardwood or ply. Drill to suit your 0.5 engine, noting the off-set. The original *Breezibipe* is powered with a Frog 50. Cement mount to front of fuselage and add blocks *X* and *Y*. Mount ply bellcrank complete with wires, and check for free movement. A small piece of neoprene tubing can replace the washers shown on the plan. Add wire tail-skid. Cement on U/C blocks of $\frac{1}{4}$ in. sheet, and ply plates. Bend U/C wire to shape, slip into U/C slot and lock with ply plate *M*. Wheels are of hardwood or plastic. Make tailplane, and cement firmly into tailplane slot. Check for alignment. Do not connect up control-horn to wire at this stage.

Cut wings from sheet and sand to section. Note cut-out for tank in centre of top wing. Drill $\frac{1}{16}$ in. dia. holes for locking dowels in lower wing. Assemble both wings to fuselage. Add line guide to top wing. Check that when the lead-out wires are at neutral the elevator is at neutral. This is important. Make fuel tank from sheet celluloid or the end of a tooth-brush container, blanked-off and drilled for filler hole and feedline, which is much quicker. Give entire model two coats of clear dope, decorate to your own choice with coloured enamel. A final coat of fuel-proofer will help preserve your artistry!

Use a Frog Nylon or K.K. Tru Flex 6 in. × 4 in. prop. Fly on approximately 20 ft. thread lines, choosing a calm day for your first flights. When starting your engine, always hold the model by the engine cylinder-head, or the engine mount, *never* by the fuselage, as should the engine hydraulic, a hard flick on a locked-up prop may cause damage.

On calm days, and particularly if you are using a Dart 0.5, you can increase the line length to around 25 ft. without any fear that *Breezibipe* will come in on the lines.

The plan is full-size and the exploded drawing will guide you easily through the building to that always-exciting-moment of your first take-off. My original *Breezibipe* on its first flight took off so quickly that I hardly realised it was air-borne, so check your elevator position before you wave your assistant away. Lots of flying and lots of fun to you.



Letters

Continued from page 107

The reason I have asked these questions is because I am being asked these same questions by A.M.A. members here in District XI (Washington, Oregon and Idaho). I read with interest the comments on the F.A.I. rule changes in the February issue of MODEL AIRCRAFT and I must say I wholeheartedly agree with Messrs. Gaster, Posner and Jays when they suggest withdrawing the Wakefield Cup from the control of the F.A.I. I frankly cannot understand the S.M.A.E. allowing the " premier contest of the world " to sink to the level of " another event " in a bi-annual contest. This " kicking about " of the Wakefield Cup is to me, as an American, incomprehensible. I think, too, the S.M.A.E. has failed to realise what high regard there has been in the United States *in the past* for the Wakefield Contest.

Speaking personally, I have made a 2,000 mile round trip at my own expense just to compete in the Wakefield team elims. I would do it again too *if* the Wakefield Cup were returned to its rightful place in the modelling world.

What do you say we put a stop to this " mucking about " and put the Wakefield back on an annual " one only " type of a contest?

Yours faithfully,

Seattle, 16, Washington. CHARLES R. WOOD.

We recommend the following letter to the many readers who ask for advice on forming a club, as it fully bears out our contention that the only ingredient required for success is enthusiasm.

DEAR SIR,—An aero-modelling club founded just over three years ago by two schoolboys at Redruth (Cornwall), in a basement room at the home of one of them, now has a collection of models, aircraft photographs and data which is the envy of the district.

Barrie Bennetts, then 15, and Barrie Wallace, then 14, started their venture with two model aircraft and about 20 photographs. The club membership is now only six, but in the basement club room are over 100 models suspended from the ceiling, 2,000 photographs on the walls, and over 8,000 photographs and Press cuttings in the files.

Hundreds of hours, and a few pounds, have been devoted by the band of enthusiasts to working in the club, which even features an annual dinner.

There are models for flying as well as the desk variety, and five have been made from scrap firewood.

The club has had many visitors, including pilots of both the World Wars, who have been amazed by the six boys' club achievement.

The club is known as the Redruth Aero Modelling Club, " Casita," Albany Road, Redruth.

Yours faithfully,

J. B. BENNETTS.

This month's X-acto Knife Chest winner is THOMAS J. JONES. Have you anything to say?—Choose your own subject, but keep it short, snappy and of general interest. "Flannelling" letters are NOT likely to win!

An 'Insulated' Incident

DEAR SIR,—Your recent R/C article on " Actuators " brought to mind trouble experienced with a hard valve receiver and ED current saving type escapement. Current drop was excellent, until the escapement current was switched on, when it was greatly reduced. Screened wires and suppressors were tried. No improvement. Eventually found that escapement only interfered with receiver when fitted with the usual long wire crank, which no doubt formed an " aerial " for it. Fitted an insulated coupling and my troubles were over.

Yours faithfully,

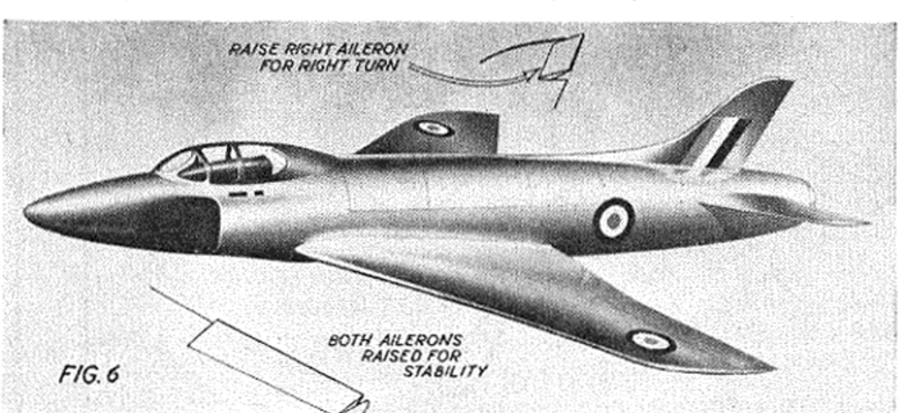
Egham, Surrey. G. MURPHY.

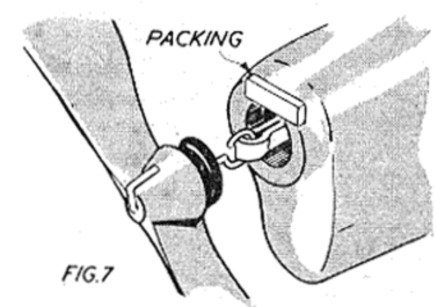
GETTING IT TO FLY

Continued from page 149

performance with a very small rubber model. If it will climb smoothly and steadily until the power runs out and then settle into a reasonable glide, you have gone about as far as you can with trimming. As a general rule you will find the model most easy to trim under power if the glide is a little on the fast and steep side, contrasting with " contest " trim where the glide is slow and verging on the stall. You can only get away with this latter trim with a model which is light for its size.

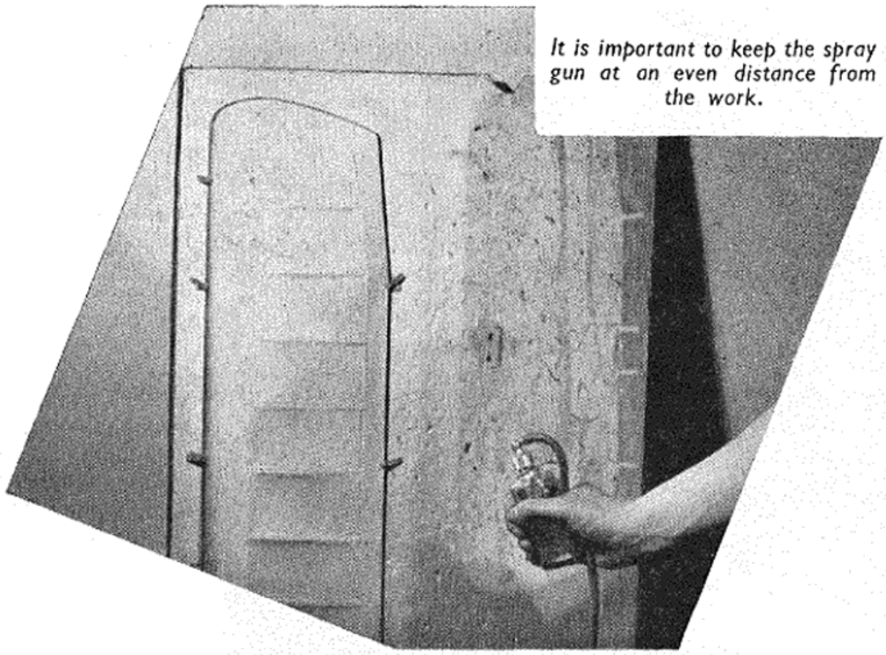
If you find your model persistently turns off to one side, or needs an exaggerated amount of rudder to correct, perhaps one wing is heavier than the other. This can easily occur on an all-sheet model, due to differences in wood density. If one wing is too heavy, push scraps of wire or cement a small ballast weight into the " light " tip to balance. This is quite a common fault on small gliders which persistently refuse to tow up straight on the line. The cure is simple, but check also that it is not a warp causing the original trouble.





As a final word on flying, never neglect to repair any damage as it occurs, however slight. A minor break, if neglected, may turn into a major collapse of the structure, when a touch of cement in the first instant would have repaired it straightaway. You can go on flying a model with torn tissue although, again, it is dead easy to do an on-the-spot repair with cement—but not with part of the structure broken. And if your model does start misbehaving *after* you have got it trimmed out, look for the *cause*. It must be something, so find the fault and cure it. A model once trimmed, and properly looked after, should be a *consistent* performer.

Silk Covering & Colour Finishing



It is important to keep the spray gun at an even distance from the work.

The NEW M.A. BEGINNERS' COURSE PART XV

IN an earlier article we dealt with the fundamentals of covering and doping, following the construction of a simple built-up glider. This basic procedure, involving the use of special lightweight coloured tissue paper covering materials treated with clear dope, is the same for all lightweight models such as gliders, small and medium-sized F/F contest power models and all rubber-driven models.

When, however, one progresses to other types, especially C/L models and also F/F models other than pure duration types, the process of finishing becomes a somewhat more varied and extended operation and, in many cases, alternative covering materials, for example silk or nylon, may be used.

Many readers will now have reached the stage where they have started building a power model, such as the "Deacon" described in our previous article, or are contemplating a C/L stunt or scale model. Accordingly, we are devoting this article, firstly, to a description of how an alternative and stronger covering material, lightweight silk, is applied and, secondly, to the various methods of colour finishing. It is undoubtedly true that the average model which has been colour doped seldom looks as good as it might and this is certainly due to the fact that few model builders stop to think that colour finishing goes somewhat beyond the acquisition of a brush and a jar of dope.

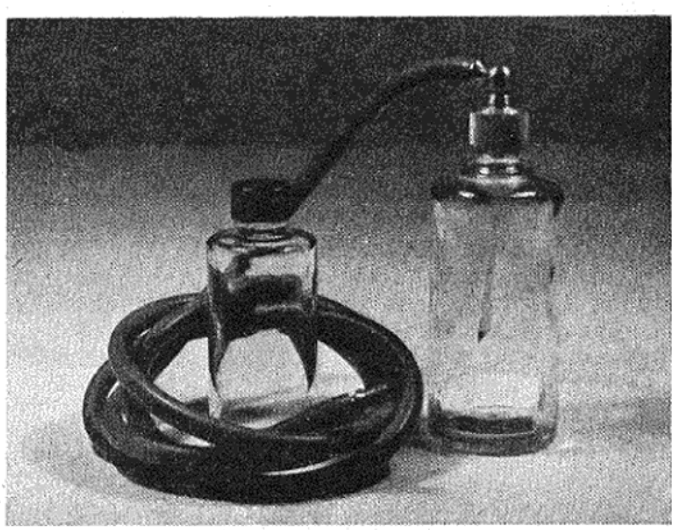


Fig. 2. Colour finishing is greatly simplified by the use of the inexpensive, tyre-pump operated Celspray gun; 2 oz. or 4 oz. containers may be used and a hand-bulb operated model is also available.

First, however, we must deal with the question of the various methods of covering.

Lightweight paper-type covering materials, such as Modelspan and Silkspan, are, of course, ideal for all lightweight models. For larger models, however (roughly speaking, all types weighing upwards of 25 oz.), a somewhat more serviceable covering medium is desirable. This can be one of the heavier grade paper type covering materials available, or, alternatively, silk or nylon.

Paper type materials are, of course, the least expensive. On the other hand, all three materials soak up much more dope than ordinary tissue and it is necessary to remember that the cost of dope and coloured lacquer, for a given model size, can amount to just as much as the cost of silk for covering the same aircraft. Therefore, since a paper type covering is much more prone to split and tear when your model meets the inevitable obstruction, it is often worth the extra cost of silk or nylon to have a stronger material which will more effectively preserve the finish on which you have spent both time and money.

Silk and nylon are available in various grades, but the most widely used is lightweight parachute silk. This is the kind used for the small, 14-ft. dia. parachutes employed for supplies dropping by the armed forces, and a few model shops do, in fact, still offer surplus 'chute panels for model use. Alternatively, a similar or slightly stronger grade silk can be bought by the yard.

When using silk, it is necessary to be even more careful about the preparation of the framework than when using paper. Slight splinters, blobs of cement or other rough spots will snag silk more readily than paper. It is advisable to paint the entire framework first with clear dope, lightly sanding it all over afterwards. Where extensive areas of sheet or block balsa are to be covered (as with a nose section), it is worth while, too, to apply a couple of coats of " sanding sealer." A good sanding sealer can be made by adding talcum powder to clear dope.

Another thing to remember it that, when silk is shrunk over a framework, it pulls much more strongly than paper. If tissue is put on too tight, it will tend to split when shrunk, but silk will tend to warp the framework instead. Do not, therefore, silk cover a weak framework.

Important, too, is the " grain " of the silk, which should not run diagonally, as this will tend to warp the surface, causing a difference in angles of attack between the tips and centre-section. Silk tends to shrink more across the " grain " than with it. It is necessary to remember this when cutting the silk for the various panels. Generally speaking, it is best to have the maximum shrinkage lengthwise on a component, i.e., from centre to tips on wings and tails and from nose to tail on fuselages. This will ensure a minimum of " sag " between ribs on flying surfaces, while, in the case of fuselages, there will not be an excessive inwards pull on the longerons or stringers.

Silk can be applied dry or wet. The main advantage of applying silk wet is that it can be made to follow a double curvature without wrinkling. Fixed to the framework while wet, the silk tends to dry out more taut than when applied dry and water-shrunk afterwards.

As with paper covering, the type of adhesive used may be either a solid dextrine paste, such as Gripfix, or a thickened dope. We have always found the former entirely satisfactory and a good deal more economical. If dope is used, it may need to be thickened by the addition of up to 50 per cent. of balsa cement. Some thick dope should, in any case, be available for sealing the edges of the silk after a panel has been drawn taut over a framework.

When using silk dry, the same general procedure applies as for tissue covering, described in Part VI of this series. Pull the silk lengthwise and then work out the wrinkles across the component. Seal the edges by folding them over and doping down and then trimming off.

The advantage of using silk wet is especially appreciated when covering a rounded fuselage or a rounded and tapered wing tip. The piece of silk to be used should be cut to size, then folded and completely immersed in water. It is then squeezed out (do not wring out as this may stretch it out of shape), carefully unfolded and hung from the edge of the bench or work table. It does not matter if some of the excess moisture evaporates during the minute or two required to apply adhesive to the frame; if the silk is too wet when it is applied to the frame, the paste will be kept soft and will not dry before

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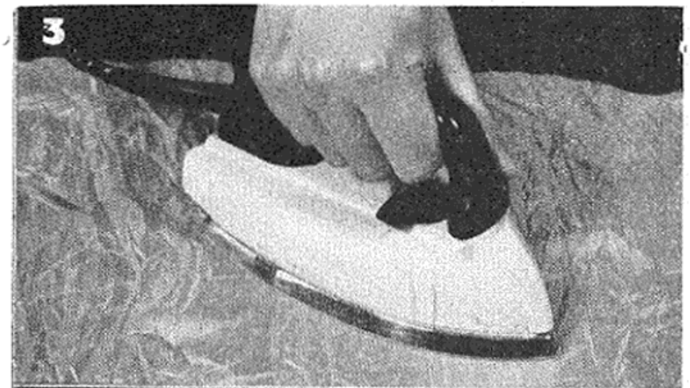

Fig. 3. Badly crumpled silk may require ironing. Use minimum heat, i.e. lowest thermostat setting on auto-controlled irons.

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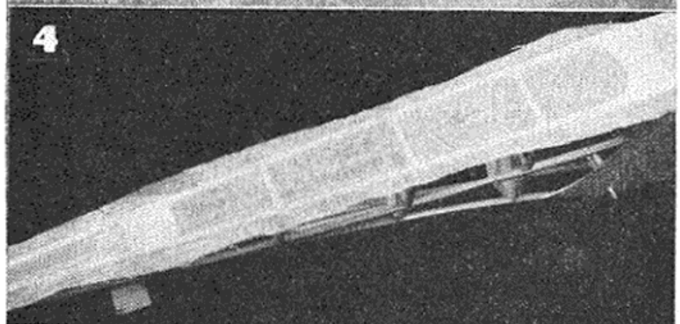

Fig. 4. Cut silk so that " grain " runs across the fuselage rather than lengthwise.

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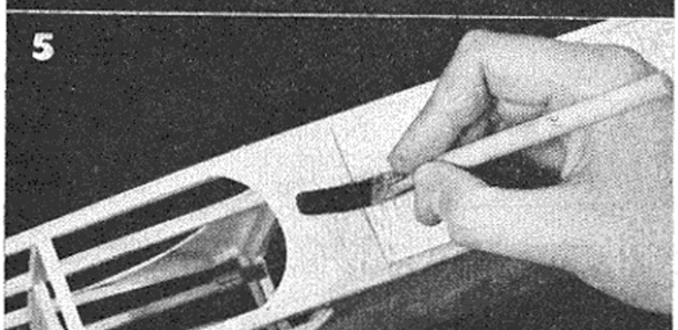

Fig. 5. When using the dry silk process, first apply adhesive to the ends of the frame.

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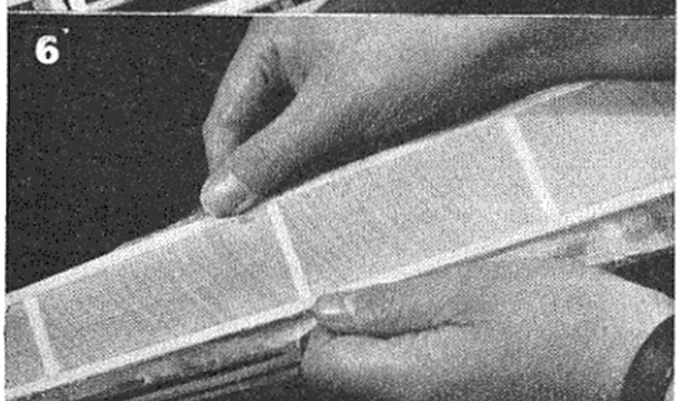


Fig. 6. Pull silk tight, end to end, on the framework, then apply adhesive to longerons and pull out sides.

7


Fig. 7. When using the wet silk process, soak as shown, then gently squeeze out as much water as possible.

the silk has begun to dry out and shrink. In any event, to guard against this, the edges of the silk should be doped down as soon as the panel has been smoothed out and made wrinkle-free.

Silk is ideal for use in conjunction with a sheet balsa covered cabin section and balsa block engine cowling. Fig. 8 shows how a single piece of silk, used to cover a cabin section, can be formed around the windscreen frame and around the double curvature of the cowling. In this case the silk will normally be applied wet, although it is also possible to obtain similar results by "doping on" the silk, provided that the latter is well saturated with dope in the process. Silk over balsa sheet greatly strengthens it, while to block balsa, it gives a far more serviceable surface, resistant to chips and dents.

Before applying shrinking dope, it is advisable to spray all covered frames with water and pin down all flying surfaces to avoid warping during the drying out. All silk covering needs a minimum of two coats of clear dope, preferably three, and more if you use the dope thinned. Follow the same procedure as for tissue, pinning down wing and tail surfaces as usual. Doped silk takes longer to dry than paper and slackness may, therefore, take some time to disappear.

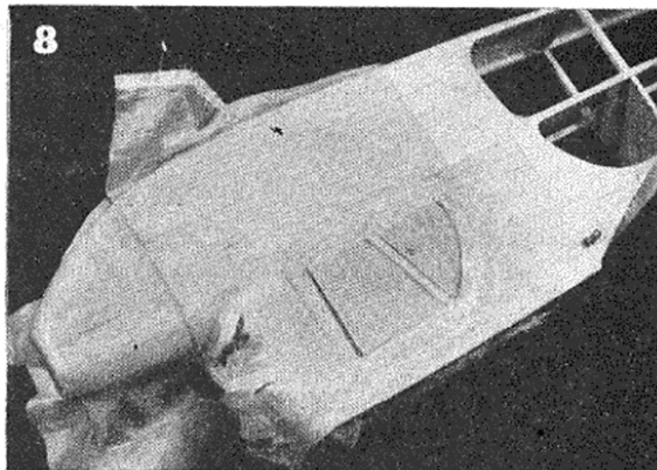
We now come to the question of colour finishing. Undoubtedly, the best way to apply coloured lacquer is with a spray-gun rather than with a brush. Previously, spray equipment has mostly been beyond the means of the average model builder—even a spray-gun of the type which operates from a vacuum-cleaner costs more than many enthusiasts wish to spend, but, happily, the requirements of the modeller are now most adequately and inexpensively met by the Celspray type unit.

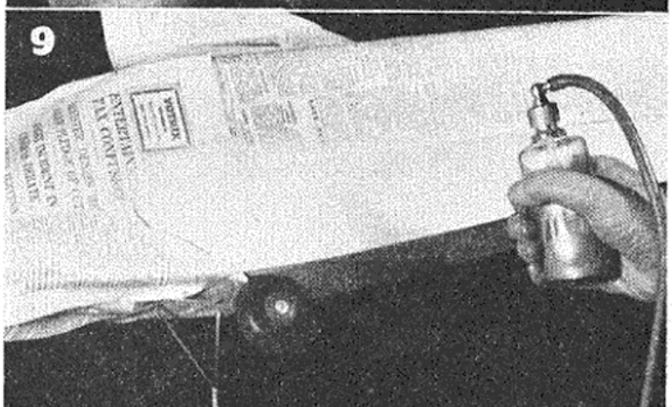
The Celspray is available in two types, the first being equipped with a hand-bulb, while the second is designed to operate from a tyre pump.

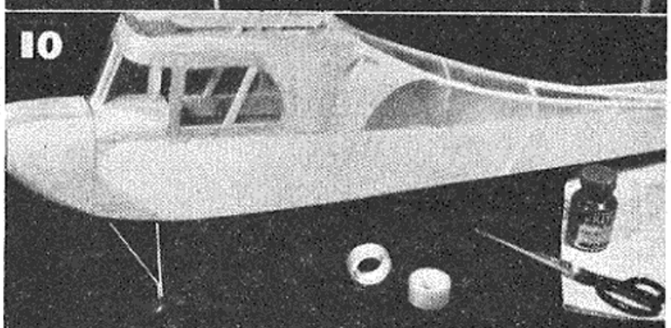
Provided that the silk has been adequately filled with clear dope, considerably less coloured lacquer than clear dope will be required. For a 54-in. span model, for example, 8-10 oz. of clear dope may be used for the expenditure of no more than 4 oz. of coloured lacquer. Spraying calls for a plentiful supply of cellulose thinners and a half-pint, costing about 2s. from any garage, is advisable.

Different coloured dopes or lacquers have varying covering powers; a component finished in one colour may thus weigh more than an identical component finished in another colour due to the extra coats required. Aluminium or silver lacquers are the best in this respect and will go four or five times as far as a light colour such as yellow. Dark reds, blues, etc., come between these two extremes. Incidentally, silver dopes, in particular, benefit from sprayed application.

Most model lacquers require thinning about 30 per cent. for use in the spray-gun. The technique adopted in spraying depends on whether any after-treatment (i.e. cutting down and polishing) is to be used. Normally, this latter will only be employed if the surface is wood or metal based—such as in a speed model, C/L scale model,







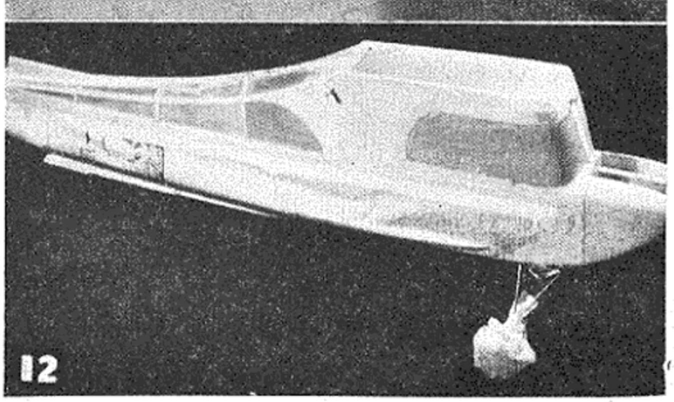


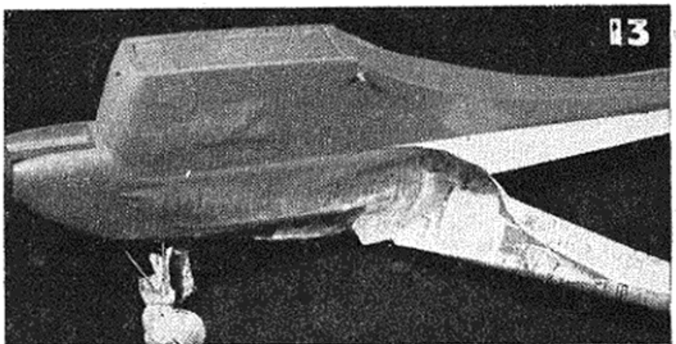
Fig. 8. Advantages of wet silk are most appreciated when covering rounded nose and cabin sections.

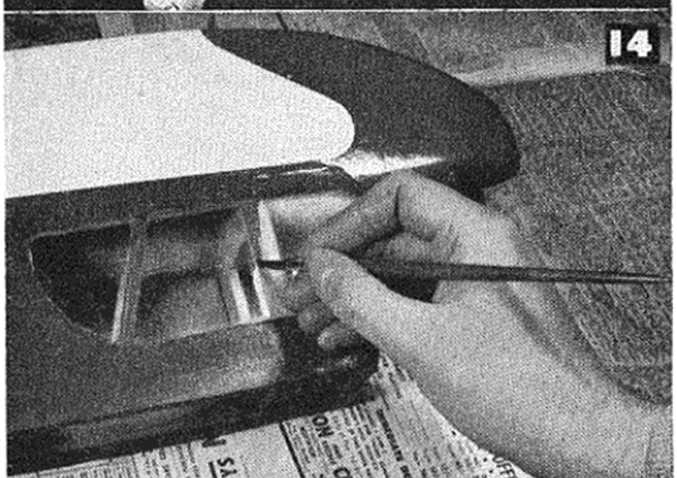
Fig. 9. After three coats of clear dope, the fuselage is masked for the first colour coats.

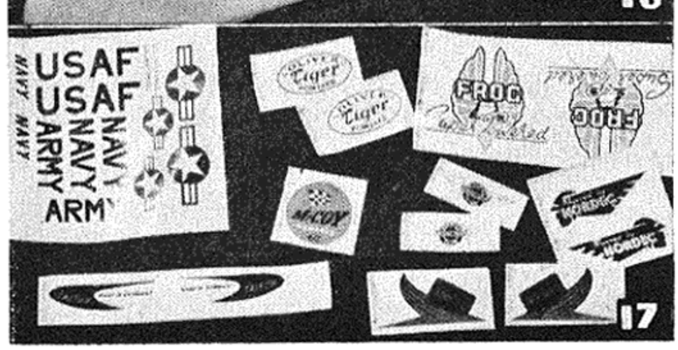
Fig. 10. The fuselage after spraying on the lighter colour.

Fig. 11. Before masking for the second colour, the raw edge left by the first coat should be feathered down.

Fig. 12. The fuselage masked for final spraying. Cellulose tape, newspaper and gummed paper strip are used.







the fuselage of a stunt model or, perhaps, an exhibition scale model. Here, after the surface has been carefully prepared, filled where necessary and rubbed down with fine sandpaper, it is sprayed with a succession of thin coats (preferably with grey "primer" to start with) and then, when dry, "cut down" with silicon-carbide paper, this being dipped in water and lubricated with a smear of soap.

The object is to get the surface perfectly flat and smooth. Two or three coats of colour are then sprayed on and the cutting down process repeated. The spray-gun is moved across the work sufficiently to prevent the lacquer from gathering on the surface and acquiring a "wet" appearance. As many as twenty or thirty thin coats may be applied in this way, by which time, with frequent rubbing down with No. 400 silicon-carbide paper lubricated with soap and water, the surface will be beautifully smooth and ready for polishing.

This is best carried out with Brasso metal polish. Applied with a soft cloth, the Brasso cuts another thin layer from the lacquered surface, removing the minute scratches left by the silicon-carbide paper and leaving, instead, a highly polished surface, marred only by still smaller scratches left by its own abrasive action. These, in turn, are removed by the application of a good car polish, such as Lifeguard and, as a finishing touch, the surface can be treated with a wax polish such as Simoniz.

"Cutting down," however, cannot be satisfactorily practised with fabric covering and the usual method here is to use a slightly different spraying technique to obtain a glossy finish. A number of coats are sprayed on, as before, until sufficient depth of colour is obtained, then a final spray over with a very thin solution (at least 75 per cent. thinners) is used to "run out" the minute "hills and dales" of the sprayed finish.

With practice, spraying can produce a matt, satin or glossy finish. A matt finish, such as would be used for a camouflage scheme on a scale model, is produced by spraying as "dry" as possible, i.e., keeping the gun moving and spraying on a succession of quick coats with not too much thinners in the lacquer. A satin finish (which often gives the neatest appearance on a fabric surface) is obtained by using a thinner consistency and spraying with a steady movement that just allows the lacquer to appear slightly wet on the surface.

Where two or more colours are required on a single component, this is easily obtained by masking, as shown in the photographs. Spray on the lighter colour first, roughly masking off the remainder. To produce a clean, straight dividing line, cellulose tape is positioned so that the darker colour slightly overlaps the lighter. Before applying the tape, feather down the raw edge of the light colour, as shown, with No. 400 paper, used wet. After spraying the remaining coats, leave to dry properly before attempting to remove the masking.

Numbers and other markings and decorations can be produced by masking, or with transfers, as shown.

Fig. 13. Showing how a clean line is obtained with cellulose-tape masking.

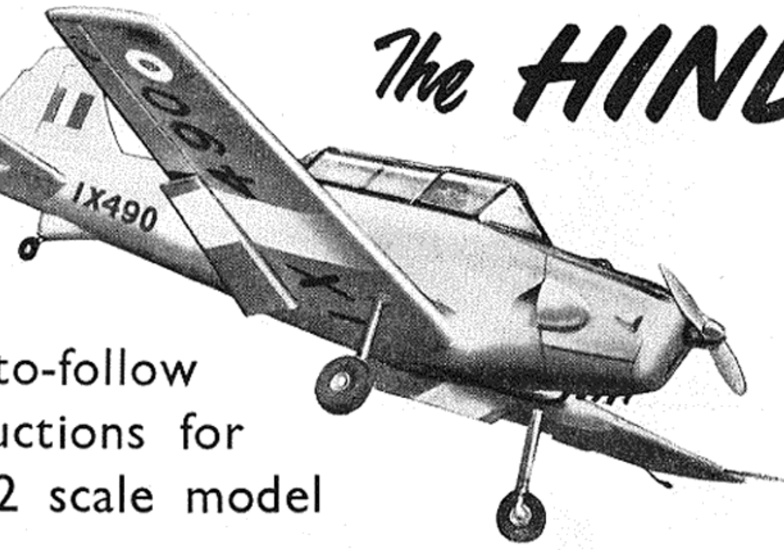
Fig. 14. Windows may be masked separately or as a whole and a brush used to paint uprights afterwards.

Fig. 15. A "cut down" finish on an A2 glider fuselage. The rubbed surface is finished with car polish.

Fig. 16. A quick method of applying lettering and other decorations is with transfers.

Fig. 17. A selection of transfers, including some of those issued by model engine manufacturers.

The HINDUSTAN H.T.2



By

J. E. COURT

Easy-to-follow instructions for a 1/72 scale model

How to start

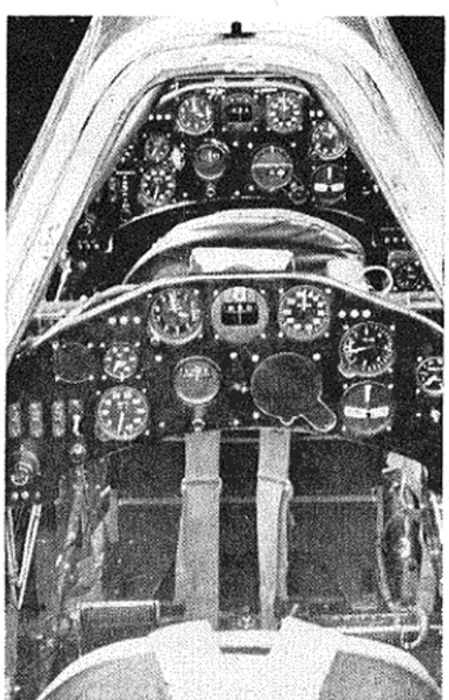
THE fuselage is constructed in three parts viz.: (*A*) the main portion of the structure, (*B*) the engine compartment and (*C*) the engine cowling face (see 'exploded' drawing). The fuselage is cut from a block of suitable hardwood and is eventually cut down to an exact size of $2\frac{11}{16} \times \frac{1}{2} \times \frac{5}{8}$ in. The main body (*A*) is cut from the rest of the fuselage, after rough shaping and sandpapering has been carried out, and the cockpit hollowed out. This hollowing out should go straight through the floor of the fuselage as the centre section of the mainplanes will later provide the "floor." A cut-out at the rear of the fuselage should now be made for the tailplane. The two depressions for the exhausts at the side of the fuselage immediately behind the engine section (*B*) should be cut out. The engine section (*B*) need have nothing further done to it at the moment; the front cowling face should have the two air intakes cut through it and then all three components should be cemented together.

The mainplanes should now be cut to plan view (minus the tips) from a piece of $\frac{1}{8}$ in. sheet hardwood; when complete shaping and rough sandpapering has been done, the ailerons should be cut off and set aside for further treatment at a later stage. The dihedral, which is from the roots, should be incorporated by means of sawing half-way through the top surface of the mainplanes at the dihedral break and then cementing at the correct angle. The tips are cut from matchsticks and cemented in position. The tailplane (from $\frac{1}{16}$ in. sheet hardwood) is treated in a similar manner to the mainplanes, the elevators being cut away after rough finishing has been carried out. The fin and rudder are cut from a piece of $\frac{1}{16}$ in. sheet hardwood and then separated; the fin should be cemented in position on the fuselage and given a smooth filleting with plastic wood. The mainplanes can now be fixed to the fuselage and a fillet built up at the correct places.

The whole model should be sandpapered smooth and a coat of sanding sealer applied, followed by another thorough rubbing down with medium sandpaper. Colour doping can now begin—two thin coats of silver dope should be applied with an intermediate rub down with fine glasspaper. The control surfaces should be similarly treated. When a satisfactory surface is achieved, details can then be added—the interior of the cockpit first being doped light grey and then the various items added—seats, dashboard, joysticks, etc.

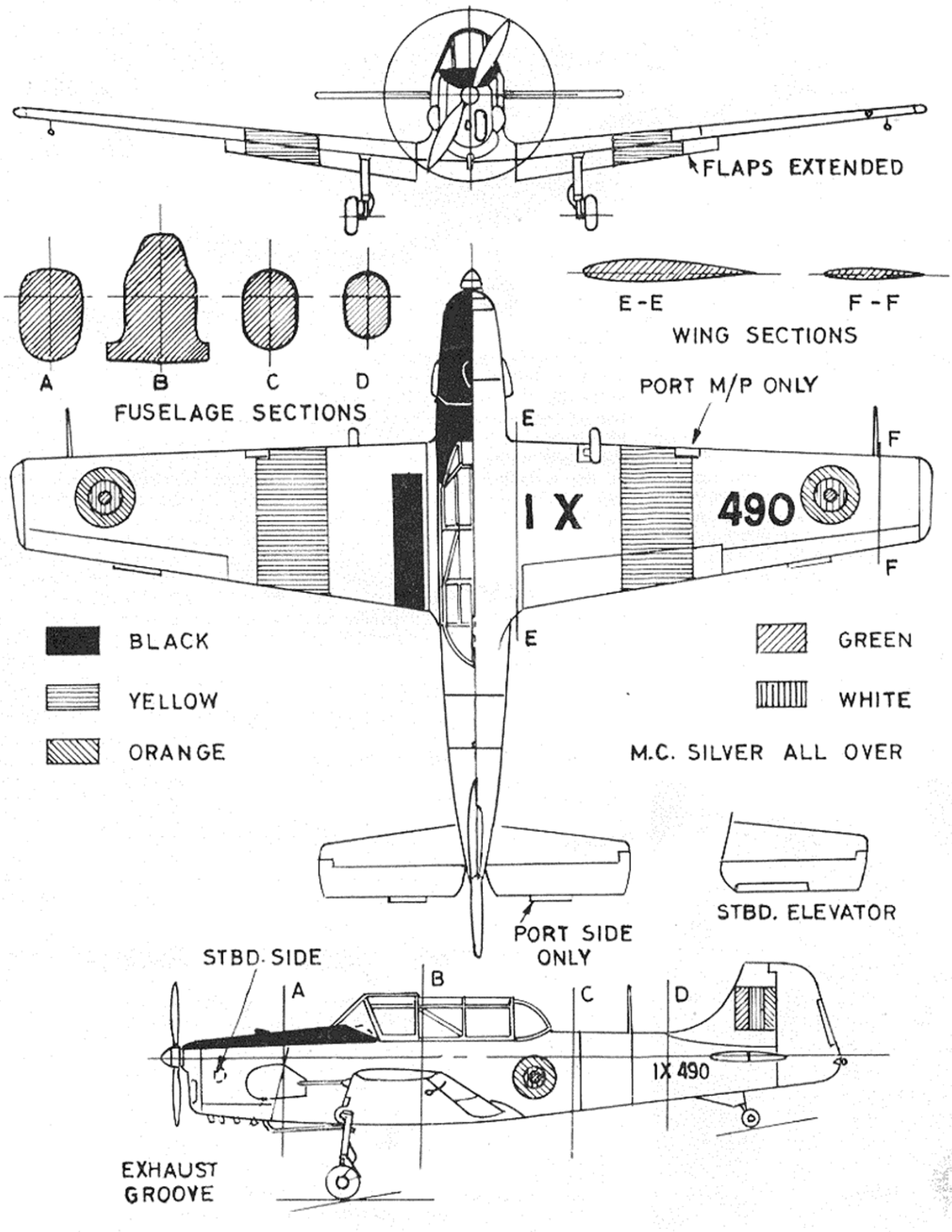
External details such as the undercarriage and engine intakes should now be fitted: this is followed by the cockpit canopy, which should be made up from sheet celluloid and lined in thin black dope—the rear part of the enclosure can be made out of the front portion of a com-

The twin instrument panels of the HT-2



What you will need

Part	*Material*	*Basic Size*
Fuselage	... Hardwood	... 2 13/16″ × 9/16″ × 3/8″
Mainplanes	,, ...	... 5 5/8″ × 1″ × 1/8″
Fin and rudder ...	,, ...	... 1 1/4″ × 13/16″ × 1/8″
Tailplane	,, ...	... 2″ × 1/2″ × 1/8″
Dashboards (2)	... Cardboard	
Seats (2) ...	... Balsa and notepaper	
Joysticks (2) ...	... Matchsticks	
Propeller ...	... Hardwood	
Exhausts (4) ...	... Matchsticks	
Pitot tubes, aerial, etc.	,,	
Undercarriage legs	... Wire, gummed paper	
Wheels	... Hardwood dowel or commercial type	
Trim tabs, flaps	... Stiff notepaper	
Cockpit canopy	... Sheet celluloid	
Intakes, etc. ...	... Scrap hardwood	

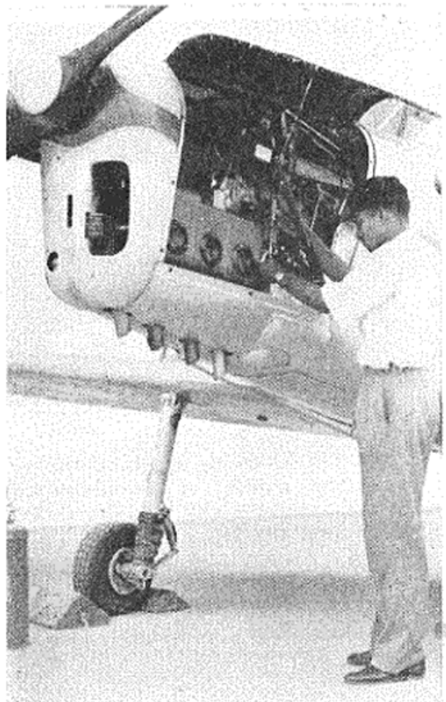


SMA 70

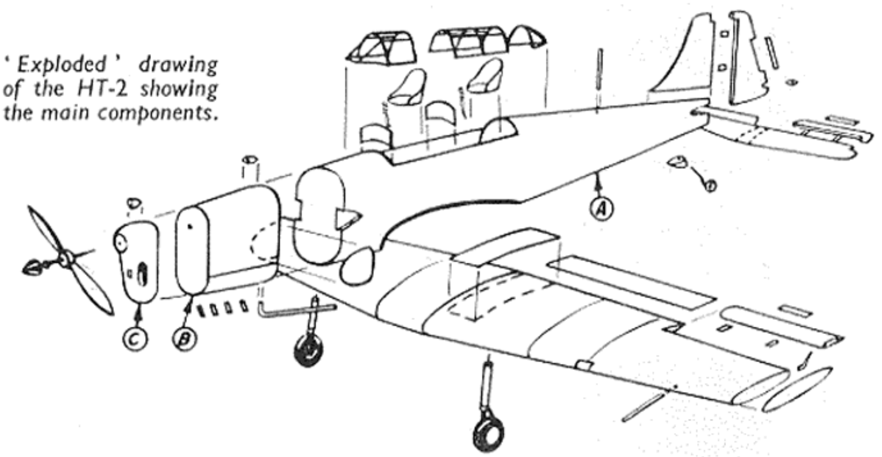
HINDUSTAN HT-2

mercial canopy that is supplied for modern jet aircraft. The doping of registration letters and other insignia should be completed at this stage. The area covered by the flaps under the trailing edge of the inboard mainplanes should be doped light grey. The next step is to cement control surfaces in position. The flaps are now cut from thin notepaper and doped silver on one side and light grey on the other and then cemented in position—silver on the outside, of course.

Lastly, minor details can be added: the foot board on the left-hand mainplane is cut from thin black paper (from a magazine, etc.) and cemented in position; trim tabs added to the rudder, elevators and ailerons; pitot head and aerial from pins; exhaust pipes, of which there are four, from matchsticks, and horn balances from pins. Lastly the propeller is added and the machine is now completed.



'Exploded' drawing of the HT-2 showing the main components.



Top photo shows a close-up of the undercarriage and engine. Photo immediately above is of the prototype HT-2 with civil registration markings.

The '35' Controversy

Continued from page 165.

let the Miles "35" show what it can do before passing judgment. After all, the proof of the pudding is in the eating and if the Miles delivers the required level of performance, it is surely better to have a radial port "35" than no "35" at all.

Many factors go to make a good stunt and combat engine and one of the first, obviously, is a good power/weight ratio—preferably 1.0 b.h.p./lb. or better. The prototype shaft-valve Miles submitted for test weighed slightly over 7½ oz. and we understand that this has been reduced to 7¼ oz. in the second prototype. This compares with an average of 7.1 oz. for the weights of six other "35's" we checked for comparison.

Our next step was, of course, to determine the power output and this is shown in the accompanying graph. Insufficient time was available in which to experiment with fuels, plugs and compression ratios to determine the best possible performance under given atmospheric conditions, but it will be observed that a maximum of 0.52 b.h.p. was realised at between 13,000 and 14,000 r.p.m., which, of course, is fully adequate. This was obtained when using a 25 per cent. nitromethane content fuel, K.L.G. Miniglow short-reach plug and in an air temperature of 60 deg. F. It indicates a power/weight ratio of 1.1 b.h.p./lb. and a specific output of 92 b.h.p./litre.

It is only fair to remark that a high power/weight ratio does not, alone, make a good stunt engine and that the ability to function smoothly through various manoeuvres—usually a product of carburettor design (notably choke area and the position of the jet)—is equally important. The performance of the Miles in this respect will only become known when it has been given vigorous flight tests. Any shortcomings in this direction, however, should not be difficult to deal with before the motor is put into production. Starting characteristics, incidentally, were good and running qualities were smooth and consistent. Checked on a 10 × 6 prop—a popular size for stunt with a "35" engine—the motor achieved a steady 11,000 r.p.m.

Some idea of the structural design of the Miles "35" can be gained from the accompanying photographs. The engine is of very short stroke design, the bore and stroke being 0.844 × 0.625 in., giving a stroke/bore ratio of 0.74/1 and a swept volume of 0.345 cu. in. or 5.643 c.c. Cylinder porting is of typical Miles-E.D. design consisting of four radial slits of similar total area for both transfer and exhaust. The piston is of a short-skirted semi-slipper design with a machined dural conrod. The cylinder liner is surrounded by a machined finned alloy barrel and topped by a hemispherical head, the whole being held down by four screws.

The crankcase is modified from the standard Miles 5 c.c. in that it is turned back to front, the standard ball-bearing housing being cut off and replaced by a screw-in cover, and the former backplate flange used to mount the new sandcast shaft housing with its inclined, screw-in carburettor assembly. The new shaft has a massive rectangular induction port and correspondingly large (⅜ in. bore) intake passage—quite the largest, in fact, on any "35" seen to date. Induction timing is conventional: 45 deg. ABDC to 45 deg. ATDC.

A most unusual feature of the engine is the main bearing layout. The previous arrangement of twin ball-journal races has been dispensed with and, instead, the hardened shaft journal runs in direct contact with a ring of balls at the inner end which also take the thrust. The front end of the journal is supported in a plain bearing, this being bronze-bushed in the second prototype. The prop drive hub is pressed onto a splined crankshaft nose. A convenient feature is the screw-in carburettor, secured by a locknut, thus allowing it to be reversed or angled back for safer location of the adjusting stem. The needle-valve itself resembles that employed by the Miles diesel, which, we would venture to say, is the best of its kind ever devised for a model engine. The needle is threaded and is thus held securely in the needle-block. Tension of the adjustment is then maintained by means of a neoprene packed gland-screw, knurled on the outside and which screws over a thread on the outside of the needle-block.

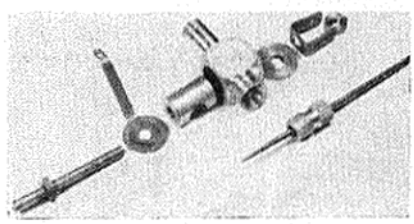
In conclusion, it is, perhaps, worth mentioning that the Miles is not entirely alone in employing a 360-degree reverse-flow scavenged cylinder. This system is, in fact, used by the American Herkimer Cub 35 and the Japanese Fuji 36.

Model Aircraft's

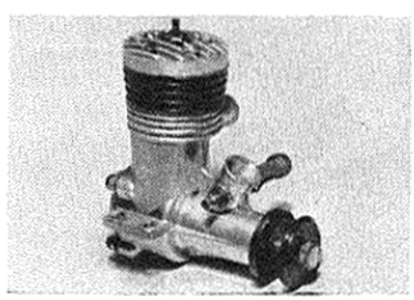
CASH QUIZ

Two Guineas To Be Won

1. The following anagrams represent the names of world-famous British and American model engines. Rearrange the letters to find their names. All are international contest winners.
(a) LERI-VERTIGO (c) MYCCO
(b) LOGINOD (d) PETRODO



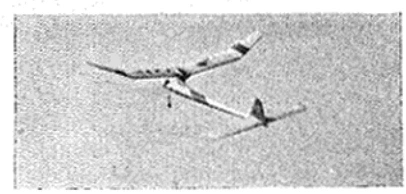
2. Seen dismantled is this throttle unit by:
(a) Mills (c) Red-Wing
(b) Jim Walker (d) Bramco



3. This shaft-valve glowplug engine is a:
(a) K. & B. Torpedo-15
(b) K. & B. Torpedo-19
(c) Veco 29
(d) Sabre 19

4. Before the "3 min. maximum" regulation was introduced, the maximum flight time recorded in British contests was:
(a) 3½ min. (c) 5 min.
(b) 4 min. (d) 6 min.

5. The Pilcher Cup is an event for:
(a) Unrestricted rubber
(b) Unrestricted glider
(c) F.A.I. Power
(d) F.A.I. Glider



6. This model carries the letters M.A.F.J. on its wings, which identify its country of origin as:
(a) Jugoslavia (c) Jamaica
(b) Japan (d) Java

7. If you were building a model from an American plan which specified 0.080 in. wire, you would select wire of:
(a) 12 S.W.G. (c) 16 S.W.G.
(b) 14 S.W.G. (d) 18 S.W.G.

8. Team racing was first introduced into British contests in:
(a) 1947 (c) 1954
(b) 1950 (d) 1955

Entries must reach us by May 1st—the first "all correct" line opened on that date gets the prize. It's as simple as that!

Address is "Model Aircraft," 19-20 Noel Street, W.1

CLUB NEWS

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

WEST MIDDLESEX M.F.C.

Winter interest was kept alive with a one design contest for the K.K. *Senator*; any modifications were allowed so long as the outline was not interfered with. The comp. was run to five 2 min. max's., r.o.g., rules. Weather was calm; but non-stop drizzle dampened models and bods. considerably. Results: Senior—L. M. Sargent, 9 : 16. Junior—D. R. Allen, 5 : 11. Broken motors and props. spoiled what might have been a very tight contest.

BAILDON M.F.C.

It's all right boys, don't get worried—this is only the Bradford and Leeds clubs in a new guise.

Yes, it's happened at last—we really have amalgamated this time. At a meeting held in Leeds recently and attended by both sides, the Baildon Model Flying Club was officially inaugurated from the combined membership of the original clubs.

The object of this new club (whose title, by the way, was chosen with the dual purpose of drawing attention to the situation of our flying ground and of resolving the inevitable argument of which town's name should take precedence !) is to serve the entire Leeds and Bradford areas, and all prospective new members will be welcomed if they contact the secretary (see " New Clubs ") or come along to the meetings, which will be held fortnightly on Friday nights in the Parish Church Rooms, Leeds, at 8.0.

WEST OF SCOTLAND AREA

The West of Scotland now has two competition secretaries in W. N. Cliff for F/F and J. G. MacArthur for C/L. Mr. Kerr, who held the post, resigned to run the model flying at the Glasgow Schoolboys' Own Exhibition. Events at this were as follows: 1.5 c.c. team racing at which speeds of up to 90 m.p.h. were no uncommon occurrence; ½A combat (results over tarmac were as always spectacular, and a novel event for Scotland—a carrier contest.

The 1957 P.A.A. contest, with its usual fabulous prizes, will probably be held at R.N.A.S. Abbotsinch at a date to be announced shortly.

EPSOM & D.M.F.C.

Our slope soaring rally will again be held at Box Hill on July 28th. There are two contests, the Albatross Trophy for F/F models, and the William Paul Trophy for controlled models. In the latter magnetic, gyro or radio steering devices are eligible. Full details can be obtained from the secretary. (See " Change of Sec.")

CROYDON & D.M.A.C.

The club dinner had for the main course an extremely (to judge from the facial contortions) tough chicken, but was nevertheless enjoyed. Any over indulgencies were worked off by the hectic after-dinner fun and games which lasted right up to throwing out time and of which most were won by the Ecurie Nerk combat team.

The indoor flying programme has expanded to include r.t.p. flying, but the draught it makes does funny things to the regular indoor models.

SIDCUP A.S.

Our Exhibition, held in aid of the Handicapped Scouts of Sidcup, was not so well attended as we had hoped for (proof that an advertising campaign is very important before an exhibition). However, a large number of fine models were on show including Ray Gibbs' 2.5 c.c. world record holder, together with a collection of new Carter motors—yes, we were fully insured !

Our run of good luck which we encountered at Wanstead remained with us at Heston for the London Area Team Race League meeting, where Mike Templeman and Mike Bassett took first and second places respectively in ½A.

Class A featured an all Sidcup final, resulting in a win for Bassett with a model to S.M.A.E. specifications, while the Templeman brothers each flew an F.A.I. model into second and third places.

Congratulations to West Essex in organising a smooth running and most enjoyable meeting.

DEBDENAIRS M.F.C.

Of great interest is the news of a novel display effort in collaboration with the local librarian. This consists of photographs loaned from MODEL AIRCRAFT and a club poster in bright colours, coupled with books on aircraft and flying displayed in the public library.

This display is being set up in several branches in the area, and should rouse some interest.

Membership is still on the increase, no doubt helped by flying at Grange Farm Centre near Chigwell.

ENFIELD & D.M.A.C.

The club got away to a good start at the first of the London Area T/R championship meetings; both the entries of the Pete Hartwell/George Allen team got through the heats O.K. but both had minor troubles in their semi-finals unfortunately. The Don Walker/Ray Tuthill team in Class B went through in spite of an unexpected extra stop in the heat, and won with a time of 7 : 47. At the moment we're still using last year's motors and models but it is hoped to remedy the motor situation as soon as exams. are cleared.

The C/L rally is now finalised and will be July 7th at the usual venue. Comps. are T/R, A & B and Combat, all to S.M.A.E. rules and handicap speed. The pylon will be available for records. The Northern Heights Club are again presenting their Coronation Cup and Model Engineer Cup for the A & B T/R respectively. Entries close at 12 noon.

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RULE CHANGES

Revisions to Radio and C/L Stunt Rules

Several rule changes were recently approved by the S.M.A.E., and as these are to come into effect AT ONCE, those that will most affect competitors this year are outlined below.

R/C Rules

The rule for spot landing has been modified to read : The spot for the spot landing shall be clearly indicated by the competition judge to the competitor and the landing strip and spot shall be defined by posts and tapes forming a letter H measuring 100 ft. by 50 ft., the central spot being a white circular target 24 in. in dia.

The angle of bank required for a spiral dive is altered from 30 degrees to 45 degrees.

A spot landing is now defined as one in which the model must make a normal approach and landing, remaining on its undercarriage and tail wheel (or skid) after the completion of the manoeuvre, the point of first contact to determine the points gained. A maximum of 50 points to be awarded, one point being deducted for every foot of distance between the " point of first contact " and the indicated spot. The model must land (i.e. the point of first contact must be) within the H of the landing spot area.

The special manoeuvre is now deleted and replaced by an *Immelman Turn*, in which the model completes a half loop followed by a half roll at the top with level recovery at the higher altitude. The model will then be flying in the opposite direction to the original flight path.

The bonus points for flying single channel control equipment in competition with multi-channel equipment in the same contest to be reduced from 50 per cent. to 25 per cent.

Revised scoring for the S.M.A.E. R/C and Taplin Trophy

(a) unassisted take-off	40 pts.
(b) level turn left, 180°	20
(c) level turn right, 180°	20
(d) figure of eight	60
(e) spiral dive (up to 3 turns)	60
(f) loops (up to 3 consecutive)	150
(g) Immelman turn	50
(h) spot landing	50
Total	450

S.M.A.E. C/L Aerobatic Contest Rules

A clause is now inserted to the effect that the competitor must be the builder of his model.

A new manoeuvre is included which is a *Double Wingover*, in which the model starts from normal level flight, makes a vertical climb and dive passing directly over the pilot's head and bisecting the flight circle, recovering in the inverted flight position at normal flight level (height 2 metres). The model then continues for half a lap inverted to the starting point for the manoeuvre, makes a vertical climb and dive again, bisecting the flight circle over the pilot's head and recovers into normal (upright) level flight at normal flight level to score 25 pts.

For inverted flight the rule has been modified to read : The height must not vary by more than plus or minus one metre from a mean height of two metres.

Revised scoring for horizontal figures of eight: 1st eight 10, 2nd eight 15, 3rd eight 15—Total 40.

BOOK REVIEW . . .

AIRCRAFT CAMOUFLAGE AND MARKINGS 1907-1954. 212 pp. Written and compiled by Bruce Robertson.

"Only one word would cover the impressions given by this book—fabulous. Only from England could a work such as this be expected. This book on camouflage and markings will undoubtedly be considered one of the finest reference works on the subject available to aviation historians for many, many years to come.

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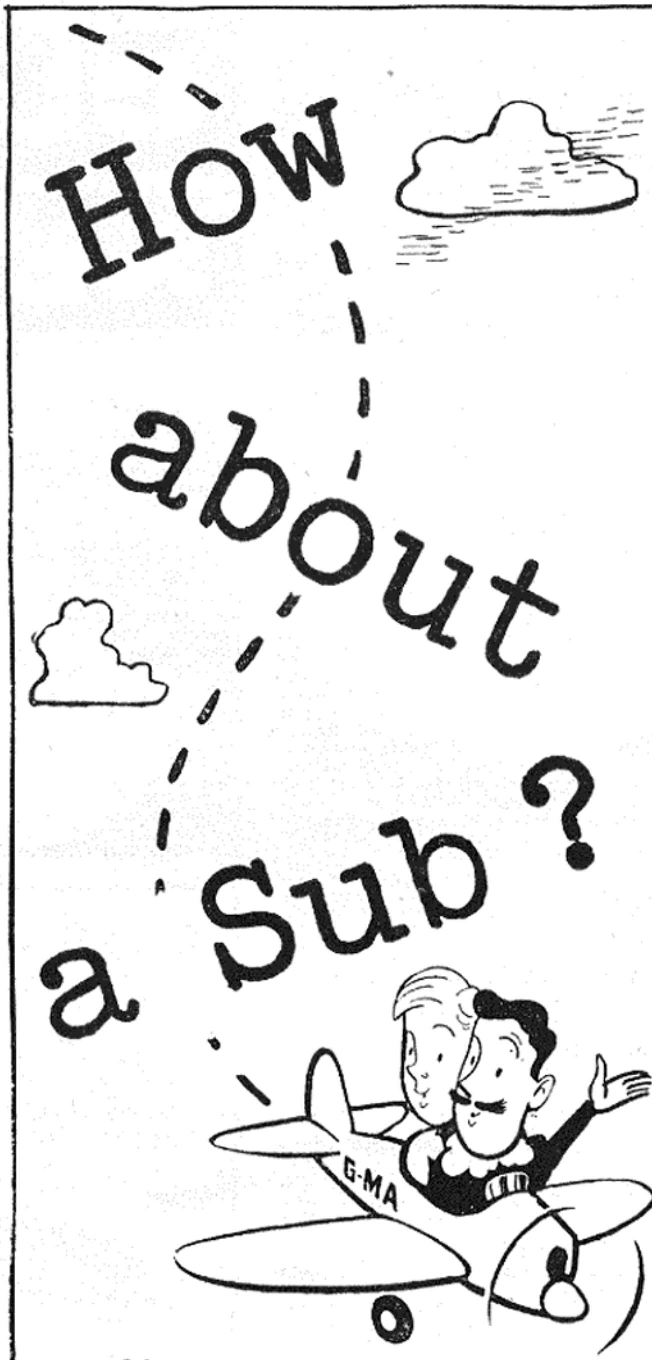

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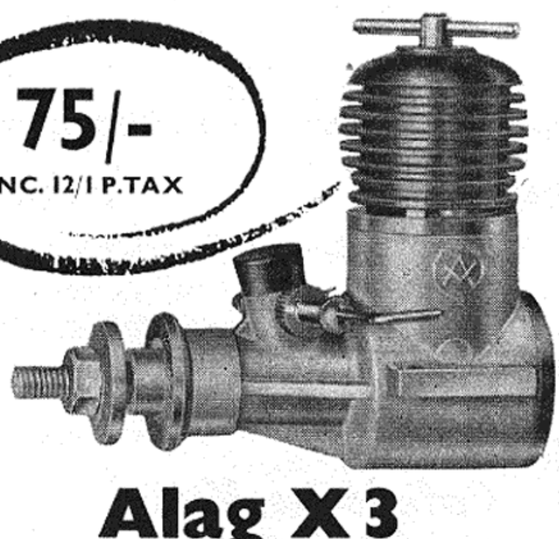

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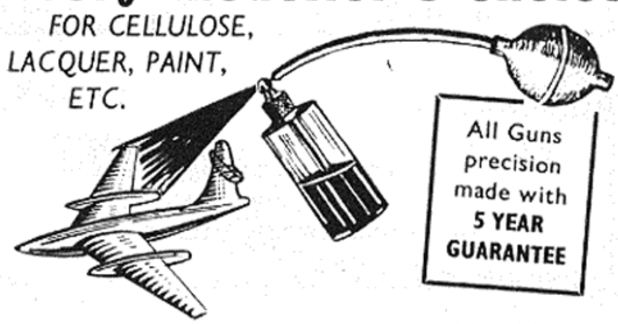

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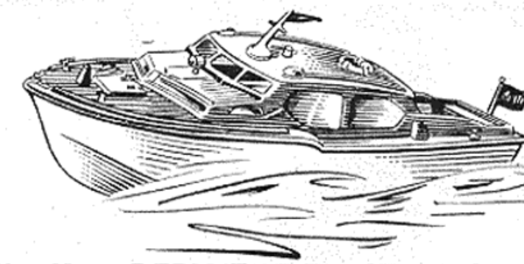

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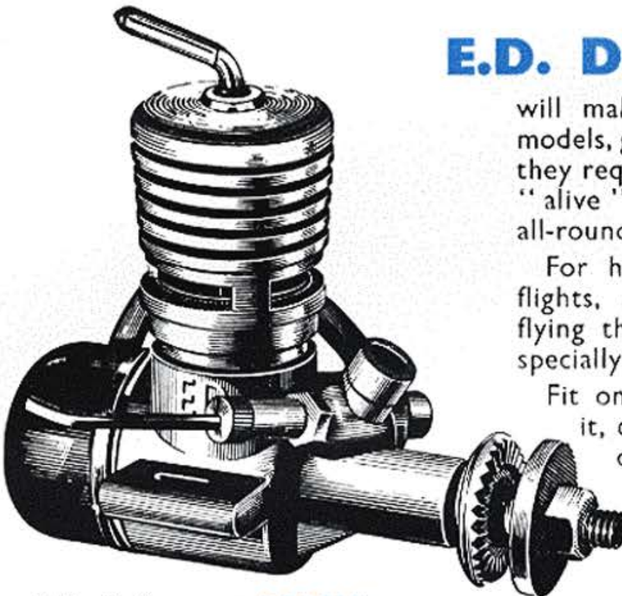

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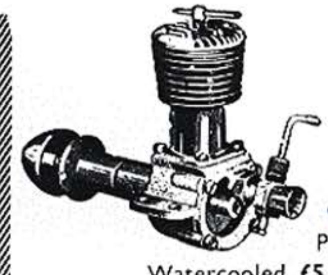

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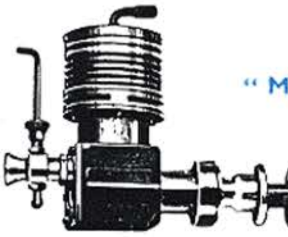

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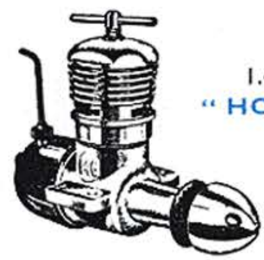

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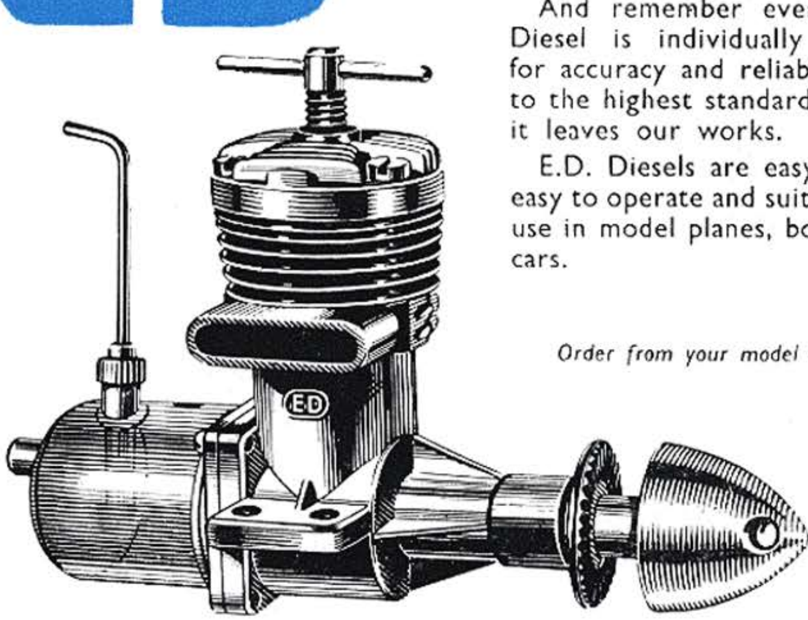

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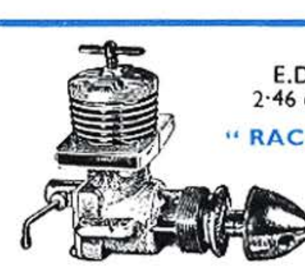

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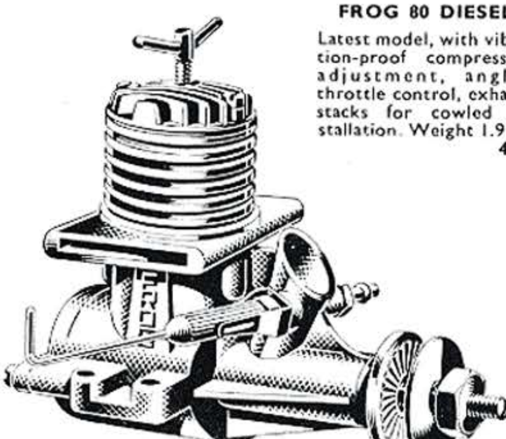

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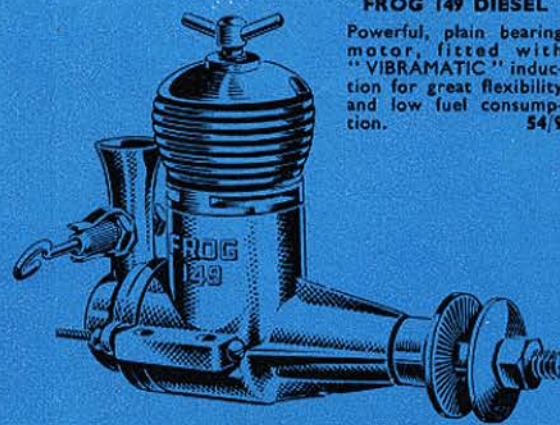

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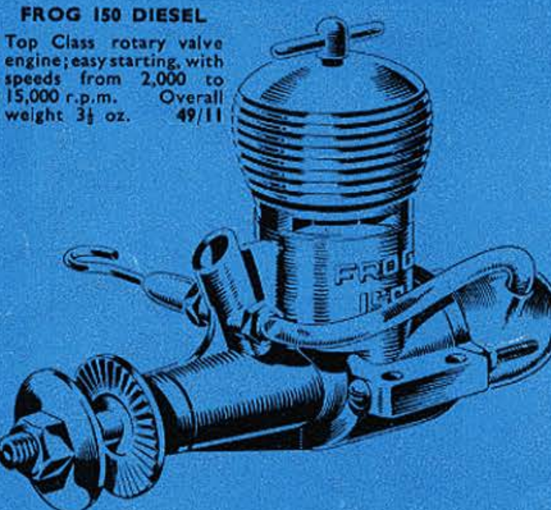

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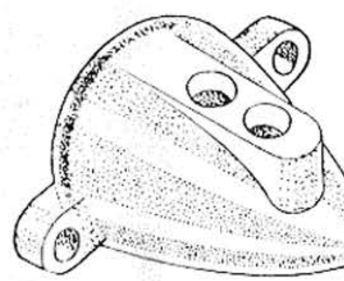

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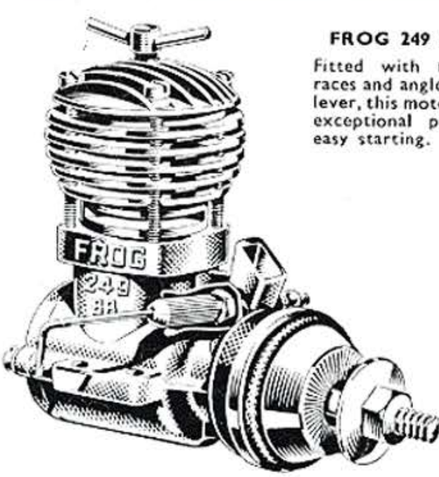
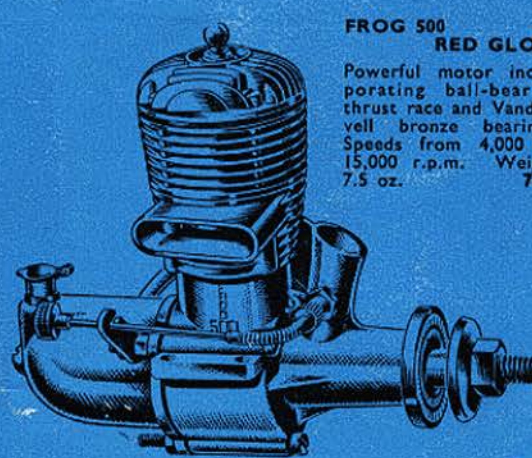


FROG 249 DIESEL

Fitted with twin ball-races and angled throttle lever, this motor features exceptional power and easy starting. **79/3**



FROG 500 RED GLOW

Powerful motor incorporating ball-bearing thrust race and Vandervell bronze bearings. Speeds from 4,000 to 15,000 r.p.m. Weight 7.5 oz. **73/6**

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