scale model aircraft IN PLASTIC CARD

by Harry Woodman

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Model & Allied Publications
Argus Books Limited
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DEDICATION

MANY years ago a young man with a consuming interest in aviation wrote his first book, it was called *Scale Model Aircraft* and was published by John Hamilton Ltd., of London in 1933, retailing at five shillings.

A few years later I managed to obtain a copy of this book, being about six years old at the time and this, more than anything else started off an interest in aeroplanes and modelling which has never diminished throughout my life.

I still have the book, the only relic of childhood and to browse through it's pages brings back all the memories of carving firewood, using Father's razor blades, 'Croid' glue, florist's wire, cut fingers and burning out cockpits with a hot poker.

The author of this book was James Hay Stevens a name which conjures up to my generation 'Skybirds', *Air Stories* and all the excitement of making 'solid' models. Apart from producing the first manual on the art of building solid scale models, as they were known in those days. Mr Stevens virtually started the 1:72 scale movement for until the mid thirties it was the practice to build such models in much larger scales, a common one being 1:36. As his collection grew he encountered the problem of space and in his own words..."something had to be done, so I tried halving the scale (i.e. one seventy-second), and the result was more than satisfactory...".

The introduction of the famous 'Skybirds' kits in this scale helped to popularise it, the drawings being provided by Mr Stevens. These were followed shortly before the last war by the first plastic kits, the Frog Penguin series all in 1:72 scale. During the war the value of models is an aid in teaching aircraft recognition was recognised and large numbers of models in 1:72 scale were produced, the scale being preserved until the present day as the most popular amongst modellers.

I should like to regard this book as an up-dated version of James Hay Steven's original work, the main difference being that the medium is plastic sheet instead of wood and all the aids and materials available today are incorporated. The aim is to try to demonstrate how much more enjoyment and satisfaction can be obtained from the hobby by building models from the basic materials instead of assembling kits and it is interesting to quote from James Hay Steven's original book for the remarks are extremely relevant considering that they were written in 1933.

"The pride of the person who has collected a series of models, however, is nothing to the pride of one who has actually built up his collection with the work of his own hands – adding his models one by one as completed. It is to this pride (the pride of the artists in his finished work) that the constructive as opposed to the ready-made, model owes it's success. I have used the term artist, because model-making is undoubtedly an art, when entered into thoroughly."

James Hay Stevens, C.Eng., A.F.R.Ae. S., died on 3rd March 1973 and it is with the kind permission of Mrs Stevens that I dedicate this book to his memory.

Harry Woodman
July 1975

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FOREWORD

It may seem strange but one of the more difficult things about writing this book was to decide upon a title. The term 'plastic modelling' to most people means plastic kit modelling and whilst a section is included which deals with kits and methods of improving them, the book as a whole is concerned with the modelling of aeroplanes mostly of the early days of flying, using plastic materials, which is rather different. The scale model aircraft hobby is as old as the aeroplane itself, and the only new thing is the range of materials now available.

There are basically two types of plastic modeller; the first is the man who has been building models for many years, probably starting in the days of 'solids' when wood had to be cut, shaped, sanded and filled. He may have used balsa or even cardboard and when plastic kits arrived on the scene he merely took them in his stride. He is the type who is most likely to have dabbled in plastic card modelling. As far as he was concerned, plastic was merely a new medium and he found that all his previous experience helped him to adapt to it. Building models in the old days was a long and laborious task and there were few aids to make it easier. This engendered adaptability and a talent for improvisation which most experienced modellers possess.

The other type of modeller and the most numerous today is the man or boy who never really built a model until the plastic kit arrived on the scene. His skill with kits is frequently of a high standard but he is restricted by the kit, he must have the parts made for him, even when he modifies or alters he must search for other kit parts and he will even buy special 'conversion' kits to help him. He does not lack talent nor imagination as long as it is within the milieu of the plastic kit.

For many years, I, like many others, modelled on my own until I decided to join the International Plastic Modellers Society. This was beneficial from the start both socially and from a modelling point of view. Almost all of my models in recent years have been plastic card creations built from scratch and I was surprised by the interest and the questions I was asked and am still being asked about methods of construction. It is in an effort to answer many of these questions that this book has been written, but more than that. My main aim is to liberate the plastic modeller from the kit, to show him what can be done and to assure him that the satisfaction he may get from his kit model is nothing compared to that he would experience from 'free' modelling. If he has the skill to build a good model out of a kit then he has enough to launch into plastic card modelling. What he must lose is his dependence on the 'instant' component, he must learn to make his own.

There are many techniques in plastic card modelling and I do not claim to include all of them in this book. However, all the techniques have been used by me and when there is more than one method of doing something I have included the one that has had the best result although it may not necessarily be the easiest.

The book is concerned almost entirely with 'vintage' aeroplanes and as far as I am concerned this covers the period from the Wright Brothers to the end of World War 2. The techniques described can, of course, be applied to all models and not just model aeroplanes. For example, those AFV modellers who laboriously stick six or seven layers of plastic card together and carve it and sand it as though it were a wooden block may find that it is far easier to mould a tank turret, and far quicker. Car bodies can be made in the same way and many of the techniques can apply to warships (one mould, six turrets – all identical – for instance).

My own favourite working scale is 1:48 and for continuity I refer to this scale throughout the book. However, the techniques are equally applicable to larger scales and with some reservations, to 1:72 scale.

The whole object of this book is to illustrate how much satisfaction and pleasure can be obtained from this hobby, for if you have only built from plastic kits then you have only scratched the surface. 'Free' modelling means no limit to what you can do, no more hopeful scanning of the advance lists to see if some manufacturer is to release a kit of your favourite aeroplane, no more disappointment when a reviewer tells you that the model you have built from the kit has dozens of fundamental errors, no more frustration when a magazine conversion feature tells you to use a pound of plastic putty, no more rummaging around for the 'rare' kit, no more despair when you turn up at the meeting with the latest kit which you have hurriedly put together only to find six other models there, all the same.

Why not experience the pleasure of building something unique? In any case it probably goes without saying that few new subjects which are commercially viable will emerge from the plastic kit factories, certainly nothing very far removed from the old favourites, though some firms will replace existing moulds or exploit different scales.

The plastic kit is one of the better things to have emerged in recent years. It gives a great deal of pleasure to thousands of people at a moderate price and this is no mean achievement these days. It has resulted in the formation of a unique society, IPMS (International Plastic Modellers Society) which is world wide and it is principally responsible for a large amount of published material which might otherwise not have been made available. Nevertheless, until you sit down at a table with nothing in front of you but a pile of raw material and out of it, create something, you will never realise the full satisfaction which can be obtained from the hobby. I hope that this book will encourage and help you to do so.

It may well be that even after reading this book you do not feel you have the confidence to get started on scratch-building – or you may be thwarted by that problem that affects all of us to different degrees, namely, the amount of time available to devote to the hobby. I know that lack of time is what restricts many modellers to working solely from kits rather than scratch-building. But whatever the personal degree of involvement you have in the scale model aircraft hobby – whether working only with kits, assembling vac-form 'kits', or building completely from scratch, you will find many hints and tips in this book which should help you to make better models.

Finally, I would like to acknowledge the photographic skills of Messrs Edward Eden, R. G. Moulton and David Edwards who between them provided the model and progress pictures in this book. Other photographs of individual models are credited separately where they appear.

1: Plastic Kits

WHEN polystyrene plastic model aircraft kits first appeared on the market sometime in the early 1950s many of the traditional solid scale modellers regarded them with complete indifference, indeed with disdain, the attitude being adopted that skill was quite unnecessary and that they were only suitable as children's toys.

It is true that the early kits were comparatively simple affairs which could be assembled in about ten minutes; however, their commercial success encouraged the manufacturers to expand their ranges and the kits became more refined and complex. Meanwhile, two things happened which had a considerable effect upon the plastic model industry as a whole. The first was that many people who had always possessed the interest but never the time to build models in the traditional way found that they could put together a reasonably attractive model in a short space of time. The first models were probably built as ornaments for shelves or mantlepieces but it only takes one interesting miniature to set off the collecting urge. The consequence of this was that an increasing number of individuals joined the ranks of the modellers. The industry that initially aimed at the children's market found that their products were increasingly being snapped up by all generations. The traditional modellers may have sneered at these 'plastic modellers' but they were the beginning of what has become an international fraternity. In 1963 the International Plastic Modellers' Society was formed the membership of which embraces countries around the world.

The second significant thing to happen was that many of the traditional modellers discovered that with correction and refinement, some quite superb models could be built from standard kits. Thus, interest increased, which in turn stimulated the manufacturers to constantly improve the quality and accuracy of their products until the high standards of today were achieved. The plastic kit is after all the end product of a lengthy and very highly skilled process, the metal master model from which the moulds are made being a masterpiece of the modeller's art. The outcome of all this is that the once maligned plastic kit has been directly responsible for the growth of an enormous interest and participation in model making quite undreamed of before World War 2.

It is worth pointing out in passing that Frog International introduced plastic model aircraft kits in the late 1930s with their Penguin series in 1:72 scale. These were made of bakelite which became slightly unstable after a few years. The manufacturing process in those days was rather expensive with the result that the kits were also expensive. The modern plastic kit is a rarity in that in the 1970s it cost about the same as the original Penguin plastic kits of nearly 40 years ago.

Plastic modelling may be regarded by some as only a minor art, but the creation of anything is a kind of achievement and through plastic modelling very many people are provided with a form of activity which gives great pleasure at a relatively small cost.

Despite the manufacturer's emphasis on kits which will be good universal selling lines (and they cannot be criticised for this very necessary basic consideration), the vintage aircraft enthusiast is quite well served. The vintage kits which form the subject of this section vary in quality but even the best can be improved upon. The following is a survey of kits of antique and vintage aeroplanes in quarter (1:48) or near quarter scale produced up to the time of publication of this book. It is emphasized that some may be no longer in production, although they can still be obtained from some retailers or private individuals who advertise from time to time in modelling magazines. Some have become collectors items due to their rarity. However it is surprising how many of the older kids can be located by the diligent searcher. Such people are well advised not to overlook the small toyshop where many an old kit has been found gathering dust upon a shelf by diligent searchers. The faults and inaccuracies noted here are the major ones only. The scale modeller who insists upon a very high standard of accuracy in his models might find that certain plastic kits are not worth the extensive amount of correction required and that it would be more satisfying to build the model from scratch. However, that feature is dealt with later and we are concerned here solely with improving the plastic kit.

As stated in the introduction this section concentrates on 1:48 scale mainly because it is my own favourite working scale. It also happens to be somewhat neglected in other modelling publications, yet the scale allows a high level of fine detail to be incorporated and is the favourite of many keen enthusiasts. If you prefer to work in the much more plentiful 1:72 scale or larger scales (like 1:32 or 1:24) then you will find good coverage given in other books and modelling magazines.

AURORA (United States)

This Company, one of the oldest producers of plastic kits, has been responsible for the largest range of quarter scale (1:48) models so far in the vintage range. Whilst the accuracy and quality of some of their earlier products generally, leaves a great deal to be desired, the quality of their vintage kits has always been reasonably good, by which is meant that their basic contours and dimensions are accurate enough to be worked on.

It should be remembered that it requires a certain amount of courage for a manufacturer to produce a line of kits which appear only to the minority. When it is remembered that this Company introduced their vintage range in the earlier, more uncertain days, it is even more commendable. Plastic modellers who agitate for kits of their favourite aeroplanes tend to overlook the basic financial considerations of business enterprise. Whether the vintage aircraft enthusiast likes it or not, it is the Spitfires, Messerschmitts and Mustangs which subsidise the more rarely produced SE 5A and Fokker kits and their like.

The scale of the Aurora range unfortunately varies which is a common factor where early kits are concerned for the kit was made in a scale to fit the standard box size. Their vintage aircraft are in the main in quarter (1:48) scale but the most infuriating about almost all Aurora kits of this period are the 'idiot marks' on wings and fuselage; these are the heavily embossed markings to show where the decals should go. Unfortunately as these marks appear on wings where the rib lines are formed, the task of removing them is very difficult indeed, but there are ways and means of getting around this. Aurora kits may also be seen or advertised under the 'K & B' title, an associated company.

Manufacturer's Title	Remarks
Fokker Eindekker	Fokker E. III; larger than 1:48 scale; undercarriage, tail skid and pylon very heavy, wings have inaccurate increased chord at tips.
Fokker Triplane	Fokker Dr. I; larger than 1:48 scale; heavy moulding of struts, etc. Oddly enough this model does not perpetuate the unequal aileron myth.
Fokker D 7	Fokker D 7; larger than 1:48 scale, wings have equal thickness instead of the correct taper from centre section to tips (in front view).
Fokker D 8	Fokker D 8; wing chord too narrow and in consequence inaccurate in plan view. Unlike Fokker D 7, taper is present except that it is the reverse to what it should be, that is, it tapers down instead of up. Tailplane cut out at apex absent and cowl is incorrect shape.
Pfalz D III	Pfalz D III; model has exposed guns of a D IIIa but horizontal tail surfaces of D III. Fuselage too deep but can be reduced as plastic is thick. Wing tip rake exaggerated, cut-out too big, horizontal tail surfaces too short in span, and spinner and propeller weak.
Albatross D III	Somewhat confused model and appears to be a combination of D III and D Va. Fuselage too deep tail assembly very thick; model has two radiators on upper wing, one of which must be removed unless model is to represent aircraft in Middle Eastern theatre of war. Single radiator placed on starboard side only.
Gotha G V	Several inaccurate drawings of the Gotha GV exist and this kit seems to be based on all of them. The wheels and possibly the nacelles may be useful.

Halberstadt CL II	Halberstadt CL II; fuselage too deep and too fat; upper wing tips are not raked enough, spinner and propeller weak.
Albatross	Albatross C III; straightforward, fairly good representation, is well worth working on, much refined moulding but still carrying embossed markings.
De Havilland 4	DH 4; the rarest of the Aurora range and one of the better ones; wing tips shape incorrect but can be improved. Model represents early production aircraft with low cut rear cockpit.
De Havilland 10	DH 10a; engine nacelles are tapered at rear as DH 10 so require building up to represent true shape of DH 10a nacelles. Heavy moulding of wings which have peculiar flat and angular camber; nose contours require correcting.
S.E. 5A Scout	SE 5a; one of the earliest in the series and heavily moulded; nose too shallow, all struts grossly oversize.
Sopwith Camel	Sopwith F.1 Camel; coarse detailing, rudder incorrect shape, large cut-out in upper wing which requires ribs to be inserted. Cockpit cut away on right side which although authentic was not general.
Sopwith Triplane	Sopwith Triplane; peculiar scalloping on under surface of wings, easily removed.
Bristol F2B Brisfit	Bristol F2B; very odd camber on wings which is virtually impossible to correct without damage to the part. As wings are also incorrect in plan view and the tailplane is too small the only useful items in this kit are the fuselage (even this must be worked on) and the wheels.
SPAD 13	SPAD 13 C1; heavy in detail and slightly incorrect nose shape, rib spines are overdone; otherwise it is worth working on.
Nieuport Scout	Nieuport II ('Bebe') or 16; slightly larger than 1:48 scale, early model and heavily moulded. With a great deal of refining, can look attractive.
Nieuport 28	Nieuport 28; much later kit than Nieuport above and much more finely moulded. Kit is accurate in outline, but cowl slots are omitted.

Breget 14	Breguet 14; moulding has blank side windows which suggests B2 version but lacks bomb rack fairings on lower wing. Sparse on detail but is worth working on. Wing ribs are at incorrect angle to leading edge.
Curtiss JN-4 'Jenny'	Curtiss JN-4D; another rare Aurora kit and quite acceptable; usual Aurora heavy detail and embossed markings spoil an otherwise good kit.
Boeing P-12E and F4B-4	The same kit with slight changes to suit type. Extremely disappointing kits in view of the popularity of these aeroplanes. Overall dimensions almost correct but kit is spoilt by crude engine, cowl and front plate and peculiar propeller shape. Poor undercarriage and excessively thick trailing edges to all surfaces. With a great deal of work a fair model can be made.
Boeing P-26A	Boeing P-26A; larger than 1:48 scale and control surfaces marred by clumsy unauthentic hinges to allow movement.
Curtiss SBC-3 'Helldiver'	Curtiss SBC-3; larger than 1:48 scale and detail very heavy. Wings in particular are very thick. With a great deal of work, makes up into attractive model.
Curtiss Hawk	Curtiss P-6E Hawk; larger than 1:48 scale and like the Helldiver is rather heavily moulded.
Douglas M-2 Mailplane	Douglas M-2; marred by even heavier embossing of markings than average for Aurora kits. Outline approaches accuracy but so much work needs to be expended to remove coarseness of detail and markings that it is probably easier to build a model from scratch.
De Havilland Tiger Moth	DH 82 Tiger Moth; fuselage a trifle narrow but otherwise a most acceptable representation. Unusual for Aurora kit inasmuch as embossed markings are absent.

HAWK (United States)

This firm's outstanding contribution to the veteran field is a group of racing planes of the 1920s and 1930s. Embossed markings mar the kits and Hawk have a habit of representing stringer lines by grooves. Some World War 2 types (eg. P-51 Mustang and Westland Lysander) have been produced by this firm in 1:48 scale.

Manufacturer's Title	Remarks
Howard 'Ike' Air Racer	Howard DGA 5 'Ike'; accurate outline.
Laird Solution Racer	Laird Solution, 1930 Racer; accurate outline.
Curtiss R3C-2 Racer	Curtiss R3C-2; Schneider Trophy winner 1925 but box lid painting shows wrong colour scheme.
Gee Bee Racer	Gee Bee R-1 Super Sportser.

The four kits listed above were originally issued as a set of four in one box. Hawk subsequently re-issued them as singles with various improvements and refinements.

Travelaire Mystery Ship	Travel Air Mystery, Model S 1929; extremely neat and well-formed kit, excellent engine detail.
Mister Mulligan	Howard DGA-6 'Mister Mulligan'; accurate kit of 1935 Bendix Trophy winner. Lack of cockpit detail unfortunate in view of large window and screen area.
Supermarine (first issue) Supermarine S-6 (second issue)	Supermarine S-6B: Early but reasonably accurate kit of 1931 Schneider Trophy winner. Wing area slightly smaller than it should be. Is worth working on.
SPAD XIII	SPAD XIII C1; generally accurate but exhausts moulded integral with fuselage, involving awkward removal procedure. Inferior to Aurora kit.
Nieuport 17 C1	Nieuport 17 C1; excellent kit for modification. Fine moulding somewhat spoilt by incorrect grooved lines which must be removed. Fairly accurate outline.

HELLER (France)

SPAD VII	SPAD S 7; the only '7' amongst the '13s'; this is a disappointing kit considering its country of origin. It is also in 1:40 scale which renders it out of place in a 1:48 collection.
Fiat CR 42	Fiat CR 42; this kit was originally issued as a 'Plastic Toy' product (Italian firm). Like the SPAD it is in 1/40th scale, and requires a considerable amount of refining.
Swordfish	Fairey Swordfish I; seaplane version. This is a re-issue of the Merit kit (see Merit section).

INPACT (British) LIFELIKE (United States)

A late starter in the plastic model, Inpact introduced itself with an outstanding range of six models of pre-1914 aircraft as listed below. These kits are moulded with a very high degree of accuracy. Very little modification is required to produce an excellent model, but the substitution of fine sprue for the slightly heavy strutwork is recommended. The wheels of the six antique models should all be bare spoked, and Inpact compromised by supplying transparent wheels which require the spokes to be painted in. In the second section of the book, methods of making spoked wheels are described. The second series of British fighter aeroplanes of the inter-war period are moulded with a degree of fidelity which must be regarded as the finest in the entire field. It is the attention to detail, and the completely accurate reproduction of this detail which raises these kits above all others in quality and value for money as they are very modestly priced. Inpact ceased production in 1968 but the US Pyro firm have acquired the moulds and have reissued all the models under the Lifelike label.

Manufacturer's Title	Remarks
Bristol Boxkite	Bristol Military Boxkite.
Bleriot	Bleriot XI.
Deperdussin	Deperdussin monoplane; single seat Gnome powered version.
Avro Triplane	Avro No 4 Triplane.
Avro Biplane	Avro 'D' Biplane 1911 version.
Martin-Handasyde	Martin-Handasyde No 3 Monoplane.
Gloster Gladiator I	Gloster Gladiator I.
Hawker Fury I	Hawker Fury I.
Bristol Bulldog	Bristol Bulldog IIa.
Fairey Flycatcher	Fairey Flycatcher.

KLEEWARE (United States)

Manufacturer's Title	Remarks
Grumman J2F Duck	Grumman J2F2; fin and rudder require replacing with taller unit. This kit was issued in the earlier days of plastic kits and shows its age somewhat; however with refining and replacing of some components with more true to scale items it can be assembled into a good representation of this famous old amphibian. This is one of the few vintage kits with transparent canopy and the kit glasshouse being far too thick is best replaced. The box states that the model is moulded in 1:55 scale but it is nearer 1:50, and sits very well with 1:48 scale models.

LINDBERG (United States)

One of the oldest firms in the business, Lindberg have produced only a few vintage models which achieve a good standard of quality. The Lindberg product always has two points in its favour; the first is that the models never had the awful embossed markings;

the second is that from the beginning they have always managed to mould fine sharp edges to their trailing edges and tail surfaces, even when the unit is in halves.

Manufacturer's Title	Remarks
Winnie Mae	Lockheed Vega; provided with decor of Post and Gatty's 'plane. A useful kit as there are many attractive colour schemes applicable to this machine.
Spirit of St Louis	Ryan NYP: Lindberg's historic aeroplane. Rather a 'plain Jane' but with a little refinement, and the addition of omitted detail, this can look reasonably impressive.
Curtiss Jenny	Curtiss JN-4D; moulded with an odd curved dihedral of upper wing which must be corrected. Apart from this and the unsightly troughs for receiving strut units, this model is well formed and has a good degree of detail.
British SE 5a	SE 5a; generally good with more refined moulding than Aurora kit but suffers from same fault of a shallow nose section. Considering the vast amount of reference material available on this aircraft including the full set of original Farnborough drawings, it is surprising that such errors should persist.
Curtiss Goshawk F11C2	Curtiss F11C2 Hawk; the best of the Lindberg vintage kits, this is a finely moulded and fairly accurate representation of one of the most beautiful biplane fighters ever designed. Some modellers may wish to replace the engine with a more detailed item, and the fairly large cockpit begs for detail (see photographs of Author's model).
Stearman PT-17	Boeing-Stearman PT-17 (Army), N2S1 (Navy); accurate model, well moulded but requiring additional detail such as upper centre section which is blank. Kit is supplied with Continental engine. Large twin cockpits require detail.
Howard 'Pete'	Howard DGA-1 'Pete'; accurate outline neatly moulded.
Monocoupe Special	Monocoupe 110 Special; very simple moulding with solid windows.

Manufacturer's Title	Remarks
Messerschmitt Me 262A	One of the few jet aircraft of World War 2 and thus qualifying for the 'vintage' category as defined by the author. Good, but needs extra detailing and removal of excessive rivet detail.

MONOGRAM (United States)

This company has a very well deserved reputation for very high quality kits of World War 2 models. Their only antique model is a 1:40 scale model of the 1903 Wright 'Flier'. It is very finely moulded but is more suitable as an ornament rather than an authentic model. The firm produces an excellent 1:48 scale range of World War 2 types and these include the following: Spitfire IX, Hurricane II, Bell P-39Q Airacobra, Curtiss Helldiver, Mustang, P-47D Thunderbolt, Douglas Dauntless, Hawker Typhoon, and others. The standard of accuracy is generally high and they require no further comment here. The range is particularly commended for beginners to 1:48 scale who want the minimum trouble with kit construction in this scale.

MERIT (British)

This company ceased production of plastic model aircraft sometime in the late 1950s but a number of their kits are still to be found at the time of writing and some have been reissued by other firms. The first group of Merit models were remoulds of the Aurora vintage range consisting of the Fokkers Dr.I, D 7, SE 5A, Camel, Nieuport II and Albatros DIII. The Merit product was exactly the same as the original Aurora kit so no further comment is required. Merit subsequently followed these issues with a series of six original models as listed here. One of the unfortunate features of these later Merit kits was that they perpetuated the habit of embossing markings on their mouldings.

Manufacturer's Title	Remarks
DH Tiger Moth	DH 82 Tiger Moth; not the same moulding as the Aurora model and somewhat inferior. Heavy on flying and tail surfaces.
Supermarine Walrus	Supermarine Walrus I; one of the best Merit kits, this representation of the 'Shagbat' is accurate and contains good interior detail. Mouldings of the wing and tail surfaces require thinning out, trailing edges being excessively blunt. The engine nacelle is designed in the kit to run parallel with the line of flight whereas in the full scale aircraft it is offset, the propeller boss being to starboard of centre.
Fairey Swordfish	Fairey Swordfish 1; suffers from the same heaviness of moulding as the Walrus kit and is only fairly accurate in outline. Clumsy belly joint of wing and fuselage requires much work and struts are fitted in long unsightly slots on undersurface of upper wing. Panelling on fore part of fuselage too heavily grooved and pilot's headrest is the wrong shape. Large rear

cockpit requires much additional detail and 'windows' in lower part of forwsrd fuselage are omitted in the moulding. Kit is supplied with floats and no provision is made for wheels. Generally with much work this can be built up into a very impressive model, being large enough for considerable detail. As mentioned previously, this moulding has been reissued by Heller.

Avro 504K	Avro 504K: accurate in outline and only marred by the strut troughs, this kit is a worthy tribute to one of the most famous and well beloved aeroplanes of all time. It can be transformed into one of the many variations and provides scope for many liveries.
DH 2 Biplane	DH 2: heavy moulding but a reasonably accurate kit. Much refining is required on nacelle and the usual strut troughs require filling.
Bristol Bulldog	Bristol Bulldog IIA; a disappointing product containing inexcusable errors. Propeller wrong shape, engine assembly grossly oversimplified and fairings behind cylinders are reproduced as rectangular blocks instead of the familiar triangular shapes. The upper wing is spoilt by extremely heavy embossing of No 19 Squadron checkerboard markings and the characteristic underside bulges of the fuel tanks are absent. This kit is now completely outclassed by the outstanding Lifelike product.

UPC (United States)

This firm appears to have specialised in the buying up of other firm's moulds and re-issuing them under their own name. This is in a way a most laudable thing as it often means that models which might otherwise vanish from the scene are given a new lease of life. Their only products in the quarter scale vintage field are listed below, but some other World War 2 types might well be found.

Manufacturer's Title	Remarks
Type 10 Torpedo Bomber	Mitsubishi, Navy Type 10 Carrier Torpedo Bomber: Originally issued by its native Japanese firm Marusan in the late 1950s this model has been given a new lease of life. Truly a collector's item, this kit is generally accurate (1:50 scale) but is a little sparse on detail, the cockpit having a shallow bottom and no detail at all. Requires work but is quite an attractive curiosity.
Mitsubishi Ki-15-1	Issued as military 'babs' or civil 'karigane', original Marusan kit. Good kit with quite fine moulding. 1:50 scale.

ARTIPLAST (Italy)

This company specialises mostly in Italian aircraft. They have produced two of the famous biplane fighters of the Regio Aeronautica, the Fiat CR 42 (produced in 1:40 scale and the same as that originally issued under the name of 'Plastic Toy' and subsequently by Heller) and the Fiat CR 32 listed below. This company have also reissued several older kits of other manufacturers as well as reissuing some of their own. Available under the label have been the following: Nieuport 11 'Bebe' (ex-Aurora, ex-Merit), Avro 504K (ex-Merit, Fairey Swordfish (ex-Merit, ex-Heller), Supermarine Walrus (ex-Merit, Bristol Bulldog (ex-Merit), DH 2 (ex-Merit).

Manufacturer's Title	Remarks
Fiat CR 32	Fiat CR 32ter; fair 1:50 scale reproduction, although compared with contemporary kits the moulding is rather crude. The undersurfaces of wings and elevators would benefit from flattening out as they are moulded with a very heavy and unrealistic rib ridges.
S.V.A.5	Ansaldo S.V.A.5: moulding rather crude by other standards and with very heavy components. Kit is overall accurate in shape but requires refining to a considerable degree. Undercarriage is slightly oversize and exhaust pipes are completely unacceptable. However the kit is well worth working on. Scale 1:50.
Macchi MC 72	Macchi MC 72; scale 1:50. Mario Castoldi's most beautiful creation is represented in a disappointing kit. Considering that the original aircraft is in a museum in Turin and that this is one of the most famous Italian aircraft ever built it is astonishing that such a poor kit as this was produced. It would be easier to build this model from 'plastic card' or 'scratch' than to correct this kit for the only usable items for the perfectionist are the floats. The kit is very poorly moulded, and not accurate in outline. The parts do not fit, there is a great deal of flash, such surface detail as exists is crude and irregular, the famous contro-rotating props are not contra-rotating in the kit, the nose contours of the fuselage are entirely incorrect and the float legs are the wrong shape. Even the colour instructions are incorrect and the decals have black lettering instead of white.

RENWALL (United States)

Some years ago this company launched a series of 1:48 scale vintage aircraft kits with a publicity campaign which emphasized their 'exclusive Fabric' technique. This consisted of supplying the entire outer covering of the model with a thin material rather like that used in the manufacture of paper handkerchiefs, on which is printed all colours and surface detail. The gimmick was that the wings and control surfaces were 'skinned' like the original. The manufacturers however appear to have misunderstood certain things about the aircraft involved and the people who buy the kits.

Fabric covered areas on the originals were treated with dopes to shrink them and make them as tight as possible. A study of photographs will reveal this, and on later aircraft the 'valleys' between the ribs and formers were very slight. The manufacturer who managed to reproduce this effect correctly was Inpact (now Lifelike models) and it is instructive to study their products just to see what a fabric covered surface looked like. What Renwall fail to understand is that the final appearance is what matters, not the means by which this is achieved; even scored metal foil can look like fabric skin if it is painted correctly. As the finish was printed on the 'fabric' in the Renwall kits, no scope was given for alternate finishes thus ignoring one of the favourite practices of modellers. Also only the exact amount of material was supplied so that there was no margin for error. Even when carefully assembled the model lacked authenticity for the trailing edges of surfaces are very blunt and the printed panelling, etc, made the model look very like a crude cardboard cut-out. Apart from the skinning gimmick several of the kits examined were poor in accuracy and general finish. The D.H.2 has a dubious shape including an oversize nacelle and incorrect rudder shape. The Fokker EIII has extremely clumsy undercarriage members, skid and pylon. To make matters worse, Renwall in their biplane models adopted the ugly (and quite unnecessary) system of strut troughs. It can only be assumed that the technique was developed for selling to the younger modeller. Other models in this range included the Nieuport 28, Curtiss Goshawk F11C-2 and Curtiss JN 4. Renwall made some similar models in 1:72 scale where the technique worked better because of the smaller size. At the time of publication Renwall models appeared to be off the market, but mention is made here since some modellers may still encounter them.

2 : Improving Plastic Kits

WHILST improving plastic kits manufacturers continue to raise the standards of accuracy of their kits, mass production methods do entail certain limitations which are unavoidable. These limitations are mainly seen in the simplification of some detail and, in some instances, the heavy moulding of small components. This section is concerned with the assembly of plastic kits and ways and means of improving upon the commercial product.

The kit should go through three phases before it can be completed as a scale model. These are:

(a) Checking and correction.
(b) Refining and substitution where necessary.
(c) Additional detailing.

CHECKING AND CORRECTION

The first thing to consider is the overall accuracy of the kit by which is meant the correctness of the dimensions and the shape of the components. Fortunately there is today an ever increasing selection of reference books dealing in whole or part with vintage and World War 2 aircraft. The hobby is also well served in the magazine field, indeed it is easier to locate information on aircraft of almost any type today than it has ever been before. Nevertheless it is surprising how many mistakes manufacturers make and these should be corrected. The selective list of kits given in Section 1 mentions the major errors in relatively few 1:48 scale kits, but there may be minor ones in almost any kit which can only be discovered by careful checking. Nothing is more infuriating than to spend time and energy on building a model only to have an error pointed out afterwards. Most model plans of aircraft are printed in 1:72 scale, this is because this is still overall the most popular scale with collectors where space is of importance, but it is also generally the most suitable size for reproduction in magazines and books. Anyone working from a 1:72 scale plan, but building a kit in another scale, must usually take measurements from the 1:72 scale plan and compute them into the necessary dimensions for the scale of the model. If you want anything more precise than this, you may be lucky enough to have a print or copying firm in the district who can produce an enlarged (or indeed reduced) print to your chosen scale. Take heed of the laws of copyright, however. Most publishers allow you to photostat from an original for your own modelling or research purposes, but not for distribution to others.

Drawings reproduced to 1:50 or 1:48 scales seem to be gradually on the increase, especially for vintage aircraft, as their increased size enables a large amount of detail to be presented, which is of course the principal advantage of 1:48 scale (or larger) models. Modellers should beware of drawings appearing in very old magazines as they are often inaccurate (with some exceptions). It is worth mentioning here the well-known Aeromodeller Plans Service, mainly consisting of plan packs of reprints from *Aeromodeller* and *Scale Models* drawings in a variety of scales. A catalogue is available from the publishers of this book.

Generally speaking, the older kits, many of which are still available, do not have the same degree of accuracy as more recent ones. This is partly due to the fact that manufacturers in earlier days aimed their product mainly at the juvenile market, and relatively little time and effort was expended in research. Some early kits of contemporary and 1939-45 aircraft were quite appalling but curiously enough the models of old-time aircraft were not generally too bad.

Correction to a kit may involve the cutting away of inaccurately shaped wingtips (a common error) alteration or substitution of tail assembly, and the filling in of gaps such as mounting slots and wide grooves which are meant to represent panel joints. It may also mean the paring down of an entire fuselage top which will mean the subsequent restoration of panel lines, stitching and any other detail such as louvres or scoops. In some cases, when a component is moulded smaller than it should be, it will be necessary to replace the part completely. When all the kit components are correct in dimension and shape you are ready to move on to the next stop.

REFINING AND SUBSTITUTION

A model cannot be described as being true to scale unless all of it is. There are many assembled plastic models sitting on the shelves which are neatly built, and superbly finished but which have the same faults that many of the old wooden solid models had. These faults are principally, oversize struts, booms and undercarriage members, and blunt trailing edges to wings and tail assembly. These faults are all too often present in plastic kits, but it should be appreciated that the manufacturer cannot always avoid the heaviness of some components. This sub-section deals with the items which need refining and the methods of achieving this.

EMBOSSED MARKINGS. The bane of the plastic modeller, this type of raised marking must be removed and this includes exaggerated panel lines, exaggerated lacing and egg-size rivets. If a finished model still retains inaccuracies of this type then it can rarely be taken seriously as a scale model at all.

Fuselage and rudder markings usually entail only scraping and sanding because they are more or less flat in most cases. The difficulty is in removing the markings from the upper wing surfaces because of the rib spines. The safest method is to wrap a piece of plastic foam around a pencil and a piece of sandpaper around the plastic foam. This forms a sanding tool which flexes to the camber of the wing and is not too harsh. The important thing is to keep the strokes parallel and even. Finish off with a very fine grade of sanding paper ('wet and dry' lubricated with soap is commended). Aileron lines may vanish but this is of little importance for they are best cut away from the wing in any case. This cutting should be carried out with a very sharp blade, preferably a new single-edged razor blade guided by a steel rule, or a craft knife or scalpel with a new blade. Make one light initial cut as a guide and sever the aileron by several strokes, this will prevent cracking or splintering of the plastic. However, the aileron should not be cut away until the under surface of the wing (or horizontal tail surfaces, for elevators should be cut away also) is treated.

Removing embossed markings: *for the final finishing the pencil can be removed using the plastic foam only as support. This is the upper wing of the Aurora (K & B) Breguet 14 and the typically heavy markings can be seen. As the wing ribs are moulded at the wrong angle (they should be parallel to the line of flight) this particular model would best be skinned with thin plastic card but it serves as a good example here of a typical task involved in improving old kits.*

Bevelling the inside edge of the cowl of a Merit Sopwith Camel. This procedure gives the impression of a fine edge and can be used on other surfaces apart from cowls where the plastic is far too thick. It is really a successful optical illusion. Most plastic kits with open cowls of this type can be improved in this way.

ABOVE: Sharpening the trailing edge: the thumb nail should be held under the leading edge, note the thin white paint line to act as a sight guide to prevent sanding too much. BELOW: The author's beautifully made 1:48 scale Gladiator model is from a Lifelike kit with many refinements including much added detail.

Markings on the under surface of the wing can be obliterated in the same way but where there is considerable under camber this requires care. A large piece of sand-paper should be wrapped around a suitably shaped block (eg. a rolled magazine or telephone directory) so that the sanding surface will reach the centre of the wing. In this case it is easier to ride the wing over the sanding block. Obviously all under-wing features will be removed including the rib spines. This is no loss as most of these on kit models are incorrect. The most prominent feature on the full-size aircraft were the rib tapes which can be represented by lightly scoring double lines with a knife ensuring that the 'tapes' correspond with the rib spines on the upper surface.

At this stage it would be well to consider whether or not the surface detail on a very inaccurate kit is worth preserving at all. It may be easier and far more satisfying to replace the old surface with a system of plastic skinning as described in the exercise on the Nieuport 24 bis. This is entirely up to the modeller but the skinning system, although involving a considerable amount of careful work, is infinitely superior in the long run. The wing of the Breguet 14 is used in the illustrations to show the removal of markings because it is of dark plastic. In actual fact the ribs as reproduced in the kit model are incorrect inasmuch as the ribs of the original aircraft were parallel to the line of flight. In the Aurora kit the ribs are reproduced at right angles to the leading edge. In consequence in building this model it would be best to re-cover the wing completely with thin plastic card.

Whatever system is used one thing must be done and that is that the trailing edges of wings and tail assembly *must* be reduced to as sharp an edge as possible. Blunt trailing edges have spoiled countless models and still do, and indicate that the modeller has never taken the trouble to study an aircraft or even look closely at photographs. Sharp edges are essential in large models and they are even more so in 1:72 scale. The writer makes no apology for stressing this point for it is one of the most overlooked features amongst plastic modellers.

Cowls: Cowls in plastic kits, if blown up to the size of the original would appear to be made of metal several inches thick. Six inch metal may be appropriate for the housing of a naval gun but not to the cowl of a lightly built aircraft like a Nieuport or Camel. There are two methods of reducing this thickness; one is to use a trick to give the impression of a thin cowl which will work as long as the cowl does not have perforations (eg. in a Sopwith Pup or other rotary engined aircraft). The method here is to trim away the plastic at the trailing edge by bevelling it to a sharp edge as shown in the illustration. This method was used on the writer's 1:48 scale Gladiator model as illustrated.

For a truly thin cowl and one that allows perforations it is necessary to mould one from plastic card. This is illustrated and is really quite simple provided that the correct precautions are taken.

Joints: In most plastic aircraft kits the fuselage or nacelle is nearly always moulded in halves, the joining of these parts usually being the only major joint in the model. It is absolutely essential that this seam be made invisible. With care this is not difficult but the writer has seen countless plastic models where the builder has spent loving care on applying the correct colour scheme and decals but has ruined the whole lot by failing to remove the unsightly central seam. Before the fuselage halves are joined, cockpit detail must be added. This aspect is dealt with elsewhere and for the purposes of this description it will be considered as completed. As moulded, the fuselage joint faces may appear to be flat and even but this is not always so. Moulding techniques invariably leave small lips on flat surfaces and the best way to ensure that the two faces of the joint are dead flat is to take each fuselage half in turn, place it with joint line downwards on a sheet of fine 'wet and dry' paper which in turn is placed on a firm flat surface, and gently move it to and fro. Plastic when sanded shows a slightly different colour and this can be used to check that all surfaces have been sanded.

There are several types of polystyrene cement, some are thick and sluggish and slow drying, others are thin and very quick drying. Both types are needed in plastic model construction and the type most suitable for joining kit fuselage halves together is the slower drying type as this allows for final corrective manipulation. If the fuselage is small then a fine smear of cement need only be run along the perimeter of the fuselage half and the two halves brought together and held firmly with adhesive tape pulling it very tight. This should be allowed to remain bound for at least one hour to allow total drying of the joint, for the cement sticks plastic by dissolving it and forming a 'weld', unlike contact adhesives. When applying the cement ensure that the bulk of it is in the lower or inner area of the face so that any that is exuded when the halves are pressed together tends to spill into the interior of the joint and not the outside. If after removing the binding an area still shows a gap where the halves have not joined do not squeeze the heavier cement into this but using a fine paint brush, induce a small amount of the thin cement and nip together quickly. Avoid large dollops of cement being left on the inner surface for these will slowly dry and soften the plastic resulting in a warp or ripple, sometimes several days after the job is finished. Remember, cement dissolves plastic, so treat it with caution.

Large fuselage halves are best joined in stages. First the nose and tail to ensure that the halves are correctly lined up then each area in turn placing a piece of adhesive tape over the joint. Even after great care there are sometimes gaps and these must be filled. Plastic putty (there are several types on the market) or 'Brummer Stopping' can be used for small cracks carefully applied with a wooden toothpick. Large areas such as 'wells' formed in the plastic, or holes or other flaws, should not be filled by large applications of plastic putty because of the effect on the plastic. The putty also tends to dry harder than the original kit plastic making it difficult to sand without removing much of the base plastic. The safest and indeed cheapest filler for this kind of work is one of the commercial household fillers, such as Polyfilla, sold by 'Do-it-yourself' shops or hardware stores which can be applied in abundance and easily sanded. A coat of ordinary plastic enamel paint (such as Humbrol) will hold the surface well for the final sanding. Before applying such fillers the receiving surface of the plastic should be roughened up a little to provide a gripping area, and a piece of fine emery board or glass paper can be used for this purpose. When the joint has been filled it should be scraped lightly with a blade to remove surface flash or excess filler. It can then be sanded gently which will result in the loss of some surface detail, such as panel lines, but this can easily be restored by careful work with a sharp knife point or scriber.

It has been the habit of certain kit manufacturers to provide a 'simulated fabric finish' on their models and boost this feature in their advertising as authentic. This is largely to attract the very young buyer, but it is no more authentic than the grossly over scale rivets which adorned the earlier plastic kits. Fabric surfaces, even on the very earliest aircraft, had several coats of protective varnishes and dopes in order to make the fabric waterproof and to shrink it. The result is that the actual texture of the fabric is smothered as can be seen by examining the tail surfaces of, say, a Tiger Moth, and the weft and warp of the fabric are not discernable on the full-size aircraft let alone one in 1:72, 1:48 or even 1:24 scale, for that matter. Simulated fabric finishes on plastic mouldings are pure 'window dressing' and the modeller need have no worry if this is removed or covered up when building his model.

The only other joints which may require treatment occur when the wings are supplied in two pieces (upper and lower surfaces) or where the lower wing is in one piece. The former situation seldom requires much work but the lower wing joint may require correction not only in an effort to make an invisible seam, but also to create a correct scale appearance.

One item which almost always requires refining (and frequently reshaping) is the kit propeller. Even when it is correct in size and shape, the blade edges need to be sharpened and the tips, thinning. Boss plates are moulded with the propeller and are usually represented by a crude group of pimples representing bolts and nuts. As the propeller is such a prominent feature, the effort required in scraping away the pimples, and replacing it with a plastic card disc, complete with more convincing nuts, is well worth while.

It is often a great deal easier, and infinitely more satisfying, to replace some kit components with scratch-built items. Struts, skids and undercarriage members supplied in kits, even when they are moulded in the correct thickness, involve so much work with the removal of flash and the sanding to correct section, that they are best replaced by sprue members. The method of producing sprue and uses of this material is described fully later in the book.

Tail units, both vertical and horizontal can often be replaced by plastic card fabrications, with a greater degree of accuracy and realism than the originals supplied. All windscreens and glazed panels should ideally be represented by thin acetate or transparent plastic card, a most useful material which has another interesting application described later on. Some kits are better in this respect than others, some recent offerings having thin crystal clear transparencies, and each kit must be treated on its own merits in this respect.

Items which should always be regarded as suspect as far as accuracy is concerned are seats, dashboards, control columns, guns, bombs, bombracks and flare brackets. All of these should be checked and if necessary, replaced. Fuselage panelling may be correct but is frequently simplified and is invariably represented by raised lines which presumably are easier for the manufacturer to mould. On the full-size aircraft the panels, of course, are seen as such and there are slight gaps between each. Kit panelling should ideally be obliterated and replaced by scribing or, in 1:48 scale or larger, by thin (5 thou) plastic card which is lightly sanded over after fixing. As with transparancies, however, some kits are much better than others and each model must be assessed individually. Lacing, a very prominent feature in most old time aircraft, requires special treatment and this is dealt with later. Elevator, rudder and aileron control horns are often moulded in the form of solid blocks of wood and at best are grossly over-size. These must be removed and replaced by thin items from plastic card or sprue depending on the shape and form of the original.

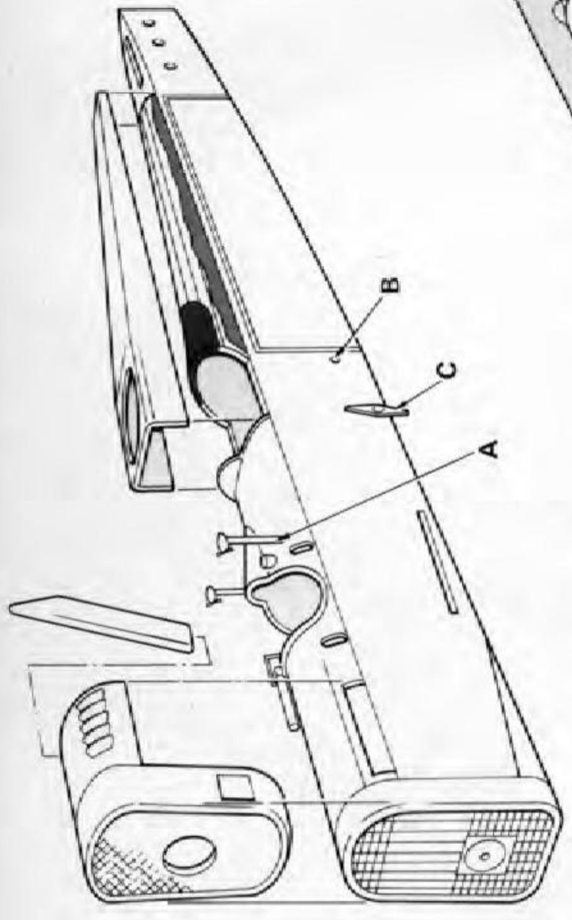
Additional Detailing: The great advantage of the larger scale model lies in the wealth of detail which can be incorporated. Whilst the later plastic kits provide more detail than previously, many things are missing and it is up to the modeller to create them.

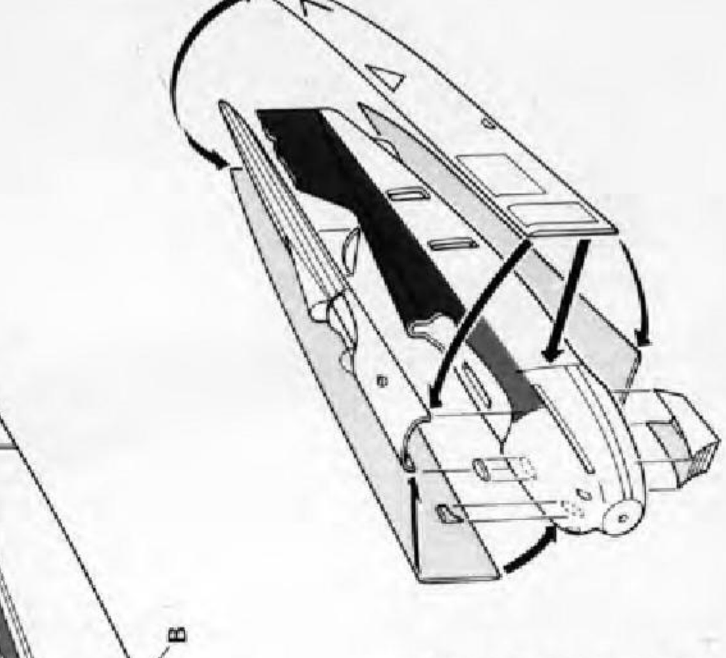
To the beholder, an open cockpit is always the focus of attention. It is important therefore, that this item be furnished with more than the bare necessities supplied by the manufacturer. In a typical kit these usually consist of a seat, dashboard and control column. The first thing to remember when it is decided to add detail, is *not* to overdo it. A few key units can often suggest a much more complicated set up than really exists. The first essential is a floor which in vintage aeroplanes could be anything from a few planks or duck boards to a steel sheet with seat runners and foot guides, depending on the period. Wood planking or duck boards can be reproduced by using strips of thin veneer, otherwise the floor can be made out of plastic card. Seats should be made to resemble the original, as should control columns and foot-pedals. The dashboard is the most prominent feature and the usual kit instruction 'to paint black with the dials picked out in silver' should be completely ignored. Additional instruments can be inserted; in some cases instruments were mounted outside the cockpit eg, compass were sometimes mounted in wing centre sections. Other common features of early cockpits were handpumps and various levers. Switches were often the same type as the old bulky domestic tumbler variety, complete with brass caps. The inner sides of the cockpit can be made more interesting by the addition of pieces of sprue representing longerons or stringers. Bracing wire can be realistically reproduced by ruling lines with a hard lead pencil. A fuller description of cockpit furnishing is given later in the book.

The engines supplied with kits vary a great deal in quality. Most require some modelling and correction whilst a few are best discarded entirely. Where the engine is exposed, as it is in many early aircraft, the kit engine should receive as much attention as other components. In-line engines invariably mounted with their upperworks showing can be made to look very impressive by a few small additions as shown in the diagram. Kit radials and rotaries are moulded in one piece, the result being that the fine push rods and rocker arms are moulded integral with the engine body and appear as thick slabs in front of the cylinders. The correction of this is very difficult as the cylinder can be easily damaged. If the engine is well cowled, it is only necessary to attach fine sprue rods over the top of the moulded ones, the originals being well hidden. When the engine is partially or wholly exposed this method is unsatisfactory and alternatives are to either replace the engine with a scratch item or reverse it. By reversing it, the crude push rods are out of sight. Rods made from heat-stretched sprue can be fitted over what were the backs of the cylinders and the crank case will also require a new face, of course.

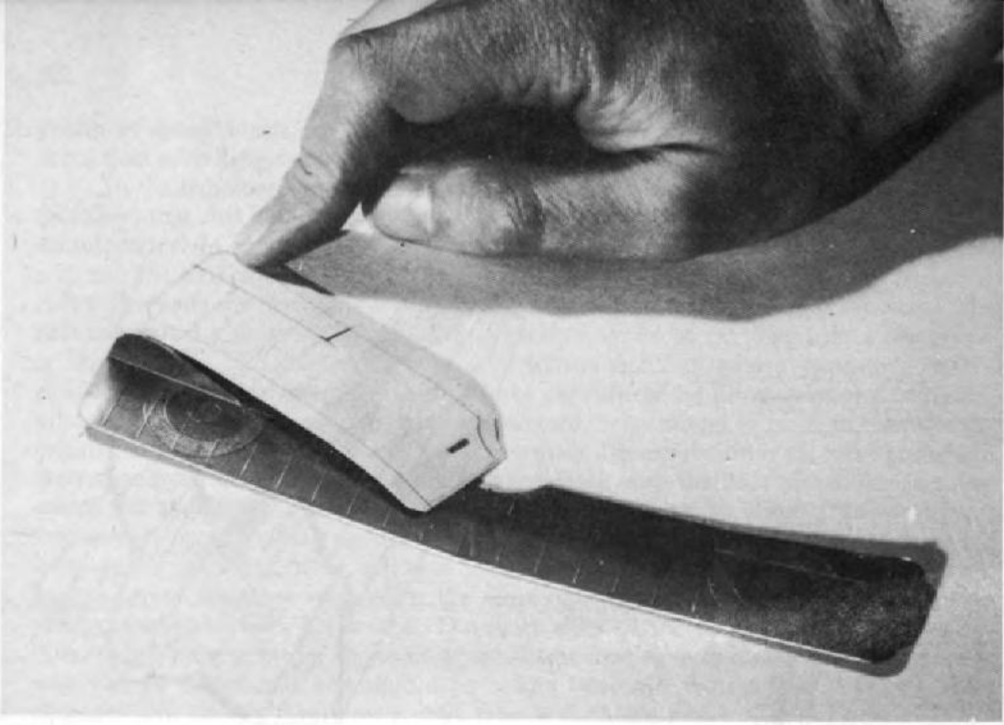
Kit undercarriage 'vees' are designed merely to accept the axle without any refinements. Little effort is needed to bind the joint in the correct fashion with pre-painted fine fuse wire. The use of fuse wire to represent the 'Bungee' shock absorbing is recommended because it can be applied and pressed into shape without an unsightly knot. Any patches where the paint has scraped off can easily be touched up later.

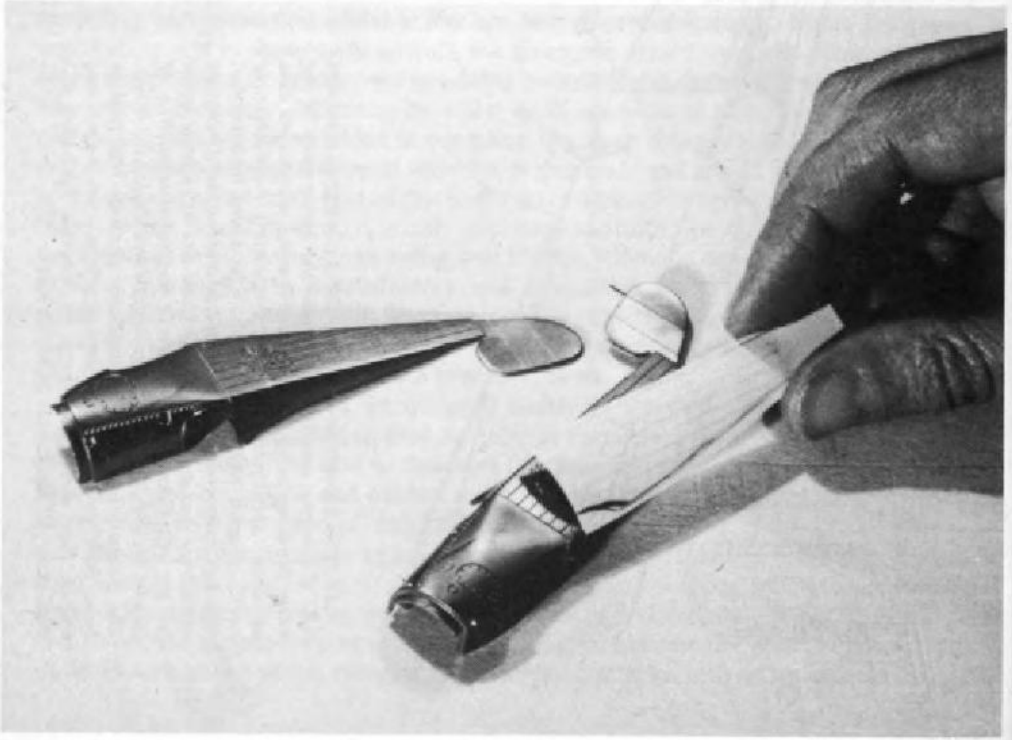
Small detail such as gun sights, flare brackets, bomb racks and bombs, gun rings and clips, camera apertures and racks, Very cartridge racks, pitot tubes, generators, stirrups and steps, aileron levers, radiator water pipes, air scoops, manhandling grips, fuel tank caps, and so on, are supplied either as crude mouldings or not supplied at all. It is the addition of detail such as this which converts an assembled plastic kit into a fine scale model.

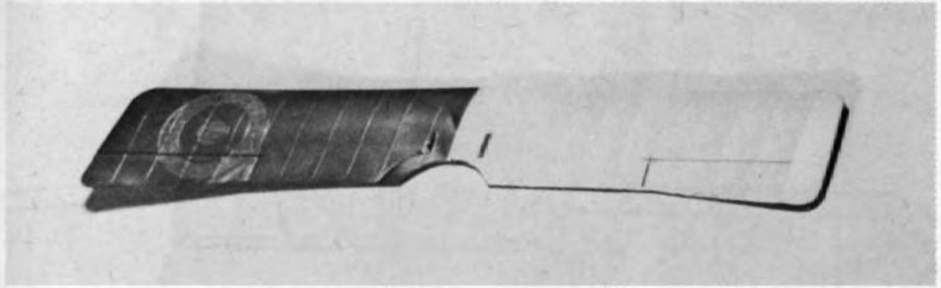




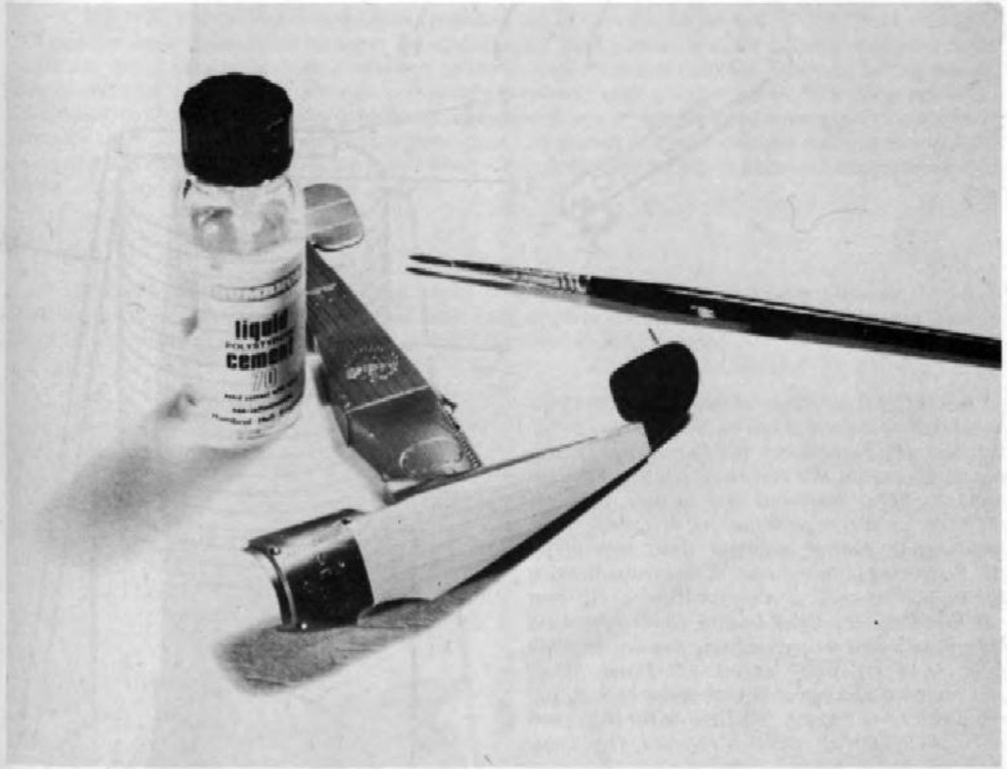
ABOVE: Alterations to Aurora DH 4 fuselage to represent RAF 3A engine version. This entails the paring away of the lower front, replacing the kit radiator with a plastic card item and additional skinning on top of the cowling. Note 'chimney stack' exhaust. (A) Other detail to be added includes fuel filler cap, pylon mounted petrol pumps and starboard mounted windscreen and gun sight. (B) Original site of elevator horns on kit. (C) Correct site. RIGHT: Suggested rebuilding of Hawk Curtiss R3C-2 kit fuselage to represent Curtiss P.1 Hawk. The forepart is correct in shape and size, the rear portion being built up with plastic card panels, suitably shaped and scored. Fine surface detail can be imparted by adding a 5 thou skin. All black areas to be cut away.

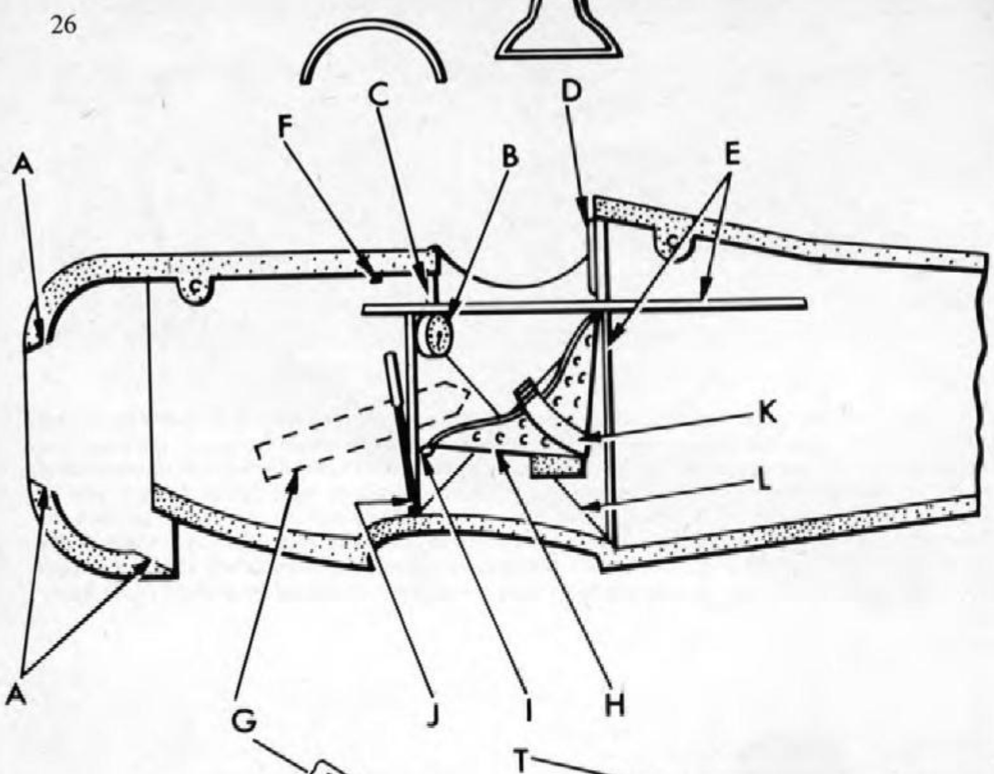


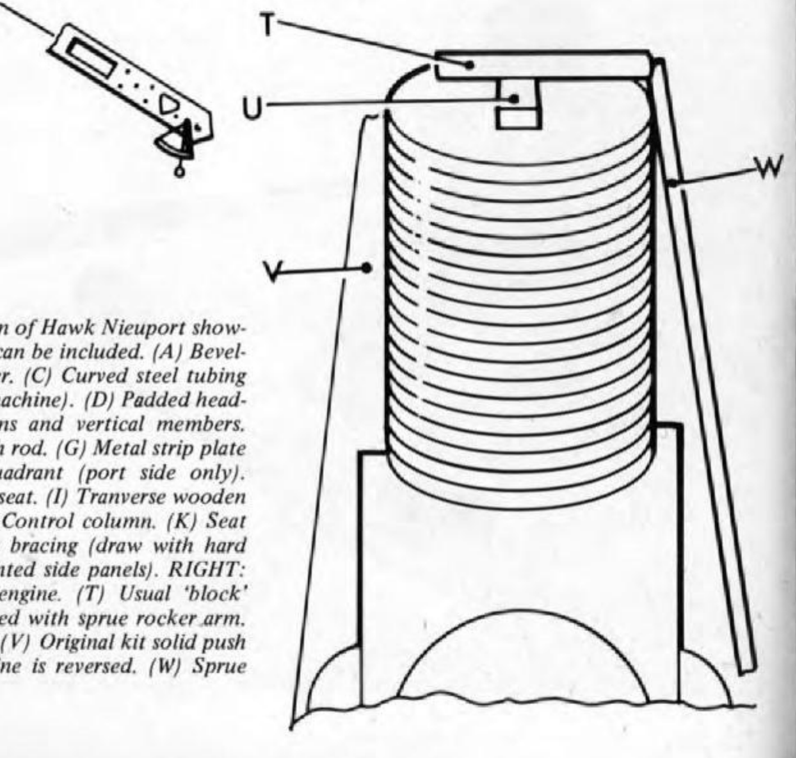




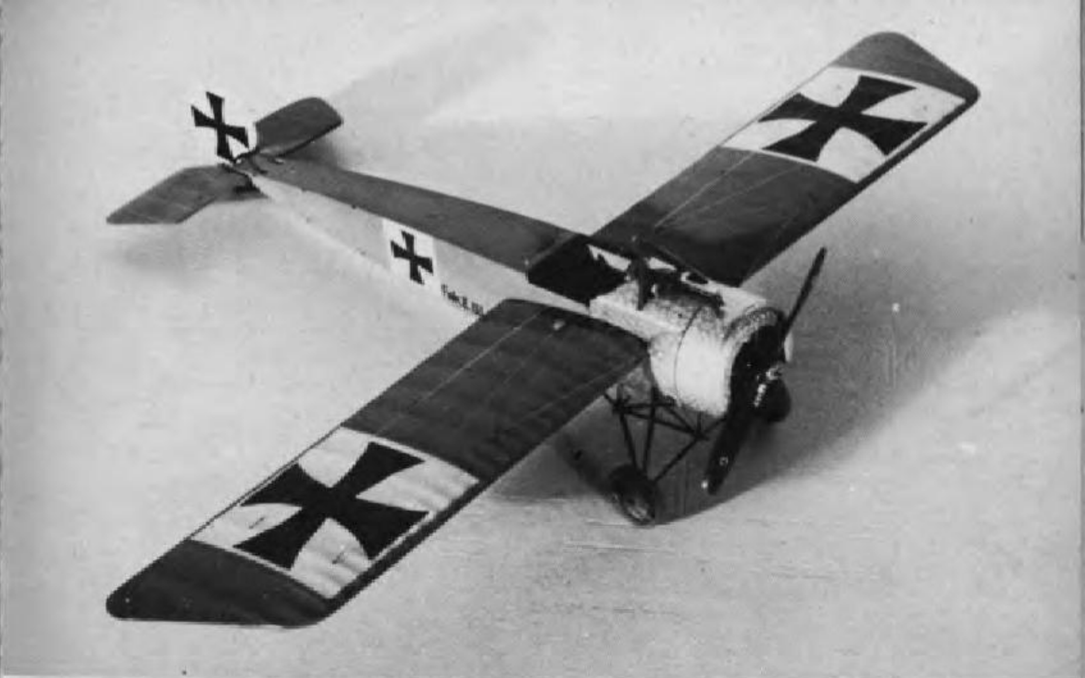
One technique which can be used to improve kits and to remodel them is to re-skin the surface with thin plastic card. The pictures on these two pages show how the upper surfaces of the wings of a 1:48 scale Hawk Nieuport 17 can receive an authentic appearance by covering with 10 thou panels of scored plastic card. The original plastic surfaces are sanded down to reduce their thickness and to provide a roughened surface for receiving the card skinning. The panel is cut rather larger than the actual shape to allow for waste to be cut away and trimmed flush. The basic Nieuport fuselage can be remodelled into a Type 24 or 27 fuselage by fitting scored panels and plain panels until the original surface is completely covered. See also the pictures of the author's completed model later in the book.







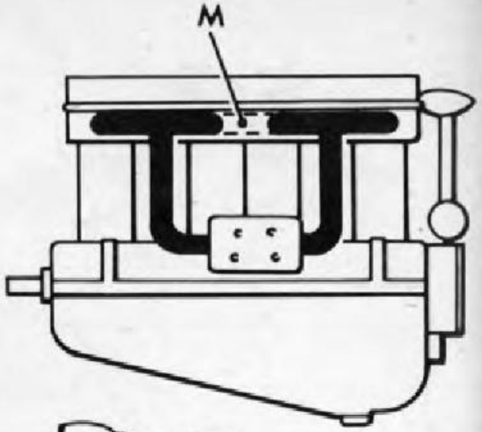
ABOVE: Cross section of Hawk Nieuport showing cockpit fitting which can be included. (A) Bevelled cowl. (B) Tachometer. (C) Curved steel tubing (no dashboard on this machine). (D) Padded headrest. (E) Sprue longerons and vertical members. (F) Hole for aileron push rod. (G) Metal strip plate with engine control quadrant (port side only). (H) Perforated plywood seat. (I) Tranverse wooden bar supporting seat. (J) Control column. (K) Seat belt (leather). (L) Cross bracing (draw with hard sharp lead pencil on painted side panels). RIGHT: Cylinder of kit rotary engine. (T) Usual 'block' gear removed and replaced with sprue rocker arm. (U) Small sprue mount. (V) Original kit solid push rod now hidden as engine is reversed. (W) Sprue push rod.

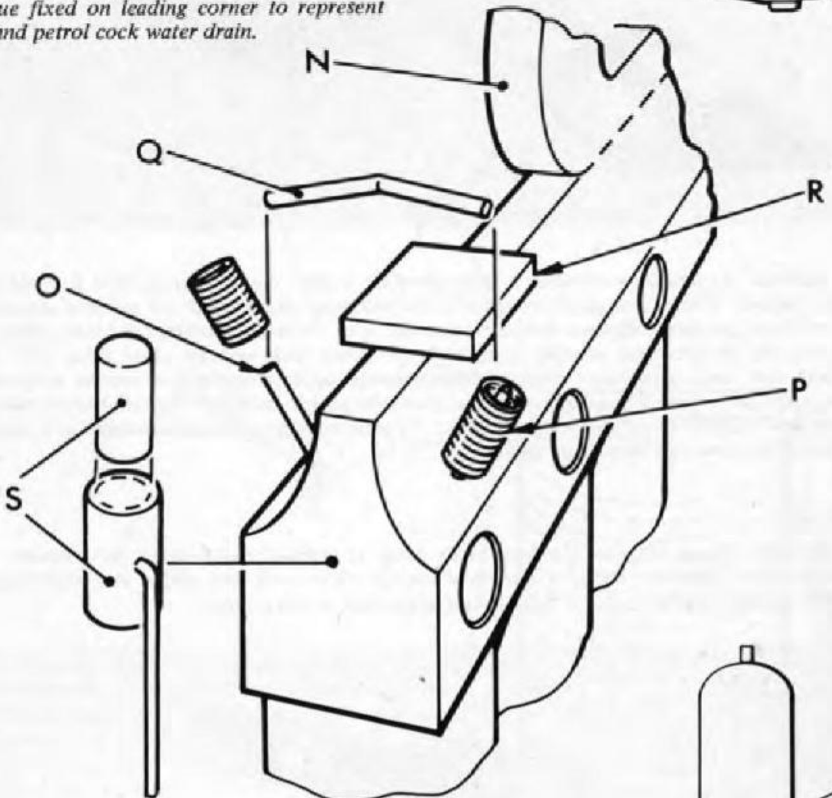


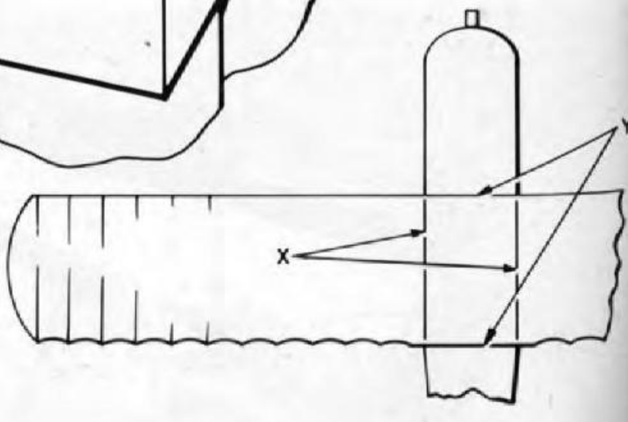
ABOVE: Typical improvements to a standard kit, in this case the Aurora (K & B) Fokker E. III. Changes include: rudder and elevators are scratch built from plastic card; kit tail skid discarded and scale one fitted; fuselage embossed markings removed; wing embossed markings removed, trailing edges sharpened and straightened; cockpit completely furnished with wooden plank floor (fine veneer), scale seat, seat strap, pump and additional instruments; upper stringers and bracing wires added to interior sides; kit pylon replaced by scale sprue unit with pulley; incorrect deep rib valleys under wings removed and replaced by scribed wing tape lines; kit undercarriage members discarded and replaced by scale assembly from heat-stretched sprue.

BELOW: Hawk Nieuport fuselage shells being re-skinned and re-lined for ultimate 24 bis conversion. Note new tail assembly and new cockpit floor with heel glides, and perforated seat. Typical techniques described in this book are all being used in this example.

RIGHT: Mercedes engine as supplied in Aurora and Merit kits. The intake manifold as supplied, is incorrect inasmuch as it is provided as one long unit. This should be cut as shown at M, to make two units of three. Further corrections can be carried out as follows: (N) Half depth of the top bar should be cut away. (O) Small pieces of sprue are stuck each side above centre of cylinder in 'Vee'. (P) Small fuse wire or sprue springs (see Chapter 3) dropped over sprue cores and fixed with a touch of clear enamel (matt), do not use cement for this. (Q) Piece of angled sprue joins tops of springs as rocker arm. A pair of fine tweezers and a mounted magnifying glass are really essential for this kind of work. (R) Small squares of plastic card fixed behind rocker arms, front edge of card should be immediately above cylinder centre. (S) Pieces of round sprue fixed on leading corner to represent air pump and petrol cock water drain.

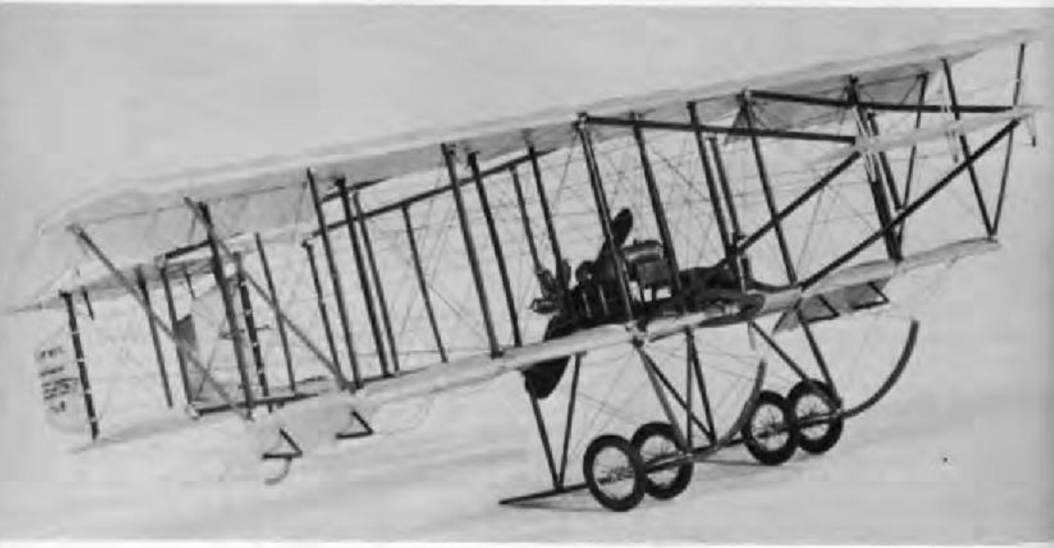






RIGHT: When lower wings are in one piece, areas Y should be filled and lines X scored to suggest seperate wing panels.

Author's model of Curtiss BF-2C in 1:48 scale. This is built up from the Lindberg F11C kit which is basically good but has some inaccuracies which can be overcome. This project included the virtual complete skinning of the fuselage to build it up to the BF-2C shape and to correct discrepancies in the original panel detail. The original kit engine and cowl were not only crude but undersized so that a completely new built-up engine had to be made and a new thin cowl made by using the original kit item as a male mould. The new cowl was made in two parts, front and back being joined in the middle and sanded over. As some sanding was required, 20 thou card was used and the seam filled with Brummer Stopping and paint. The entire tail assembly was made from plastic card, and the kit wheels and spats were replaced as they are too small. The spats in the kit were used as male moulds for the plastic card items. The kit propeller was also too small and was replaced with a new part and a great deal of extra detail was added including a completely detailed cockpit interior with acetate canopy. The kit wings, with some additions, were used as provided although the ailerons were cut away and the over-scale egg-size rivets were removed.



These are two models in 1:48 scale of aircraft of similar vintage and configuration. The one below is the Lifelike Bristol Boxkite with such extras as spoked wheels and improved engine. The upper shot shows a model of the 1909 Voisin 'Bird of Passage' which is entirely built from plastic card, no kit components being used at all. Despite the fact that the Lifelike kit is excellent, the limitations which the manufacturer cannot avoid are immediately apparent. The strutting is thick as are the wings and tail surfaces and this model would have been further improved if all struts had been replaced with thin sprue. Even so, the basic heaviness could not have been avoided and the wings and tail surfaces which are quite heavy in this kit might have been too much for fine sprue struts and booms. The finesse of the Voisin is mainly due to the fact that all components have been kept to their correct scale size, very thin sprue being used for all struts and bracing. The wings and tail surfaces are made from 10 thou plastic card which means that a razor sharp trailing edge can be achieved and the whole has a fragility which looks real and is essential for models of early aircraft. The model itself is not so fragile as it looks for it had twice been damaged before this photograph was taken. The second time it survived a glass shelf falling on top of it, the maze of 'struttage' was able to support the wing despite the 3-4 lbs weight of the glass. Plastic card construction is remarkably resilient for it tends to bend where moulded plastic, as in a kit, would crack.

3: Plastic Card Modelling

WHILST a carefully made, accurate and well finished plastic kit model is a thing to be proud of, even the most enthusiastic kit modeller would possibly admit to some feeling of interiority when confronted with a superb model built from 'raw' material starting from a basic set of plans. He cannot fail to see the potential in the model which does not require a kit to be produced before it is built. This is what is popularly known as 'scratch-building', and is already referred to as such in this book. Building models from plastic card enables the modeller to develop his talents to a limitless extent which is not possible when the modelling activity is largely curtailed by the components which the manufacturers provide. If the modeller has long been interested in the possibility of building a model of, say, a Rumplet CV, why on earth should he not do so instead of waiting around hoping that some day a manufacturer will bring out a kit, for the odds are that such a kit will not be produced.

There is, of course, no reason why plastic kit modellers should not themselves create models out of the excellent range of plastic material available today. In recent years frequent magazine articles have described how alterations can be carried out on kits to convert them into different versions or even other aircraft. The authors of these articles do not always exploit the full potential of plastic materials as some of the conversions described are cumbersome, unnecessarily complicated, sometimes expensive, and the results are occasionally dubious. Readers of the most complicated features are recommended on occasion to use vast quantities of fillers and large amounts of balsa wood to obtain the object. Curved shapes are made by laminating sheet plastic and cutting and sanding as though it were wood indicating that the writers have not made the most of the basic properties or possibilities of plastic sheet.

The fact is that polystyrene card can be used not only for alterations and remodelling but for building the complete model. What the plastic kit modeller has to do, and for some this seems an unsurmountable hurdle, is to fabricate all the items himself instead of having to merely put moulded items together from a box. He must also learn that true modelling takes time and perseverance, a plastic card model cannot be assembled overnight but the end result is worth it.

MODELLING TERMS

In the old days when models were made from hard wood or balsa wood the term used to describe the hobby was 'solid scale modelling'. This is now, of course, totally inappropriate and, indeed, new terms for several things need to be established. The techniques described in this book have been developed only in recent years and in order that they can be put into some kind of order a terminology has been introduced. The name 'plastic card modelling' is more true to the actual activity as a whole, and the term 'static models' can be applied to aircraft models which, as the term implies, do not actually fly. The term 'scratch-building' has been in use in the plastic model world for some time (and indeed has already been loosely used in this book) but it is not entirely suitable. It frequently refers to models where a large number of small items from kits have been used and to the layman it may mean nothing, whilst the term 'plastic card model' is self explanatory, at least in respect of the type of model described in this section of the book.

PLASTIC CARD

Plastic card is available in sheets of 5, 10, 20, 40 and 60 thou thicknesses. The term 'thou' is a shorthand way of saying 'thousandths of an inch' and is in common usage. The thinnest plastic card, 5 thou, is of about the same weight and character as the pages of a typical small book. For some inexplicable reason, 5 thou card is not always obtainable from hobby shops; indeed some dealers may deny that it exists. However it does, and patient enquiries will reveal where it can be located. Plastic card is usually manufactured in a white semi-matt finish and resembles good quality cardboard. It can, however, be obtained coloured and this is sometimes quite useful. A transparent card is available; however, it is not like the opaque card for it can not be moulded and itself becomes opaque when folded. It can only be used flat and its advantage is that it can be stuck with plastic cement. For transparent mouldings acetate sheet, obtainable from the larger art supply shops or sometimes from hardware shops, is the most suitable as it can easily be moulded or used flat but requires care when sticking to other materials. This will be discussed later in the book. Trade names under which plastic card is sold include Plastikard, Polycard and Polyglaze (for the transparent variety), and many others.

In recent years some makers of plastic card have switched production to metric thicknesses in keeping with the general tendency to change to metric measurements in industrial production as a whole. A typical major manufacturer of plastic card now lists thicknesses available as ·125mm, ·25mm, ·375mm, ·5mm, ·75mm, 1mm and 1·5mm. These are very roughly equivalent to 8 thou, 10 thou, 15 thou, 20 thou, 30 thou, 40 thou and 60 thou, respectively.

Plastic card is also available sliced into narrow strips and sold in bundles, either assorted in widths or in uniform widths. 0·5mm, ·75mm, 1mm, 1·5mm and 2mm are typical widths. Ministrip or Microstrip are typical trade names. Polystyrene rod of circular cross-section can also be had from hobby shops. 0·75mm, 1mm and 1·25mm are commonly available diameters, but some firms make plastic rod of even finer sizes.

ADHESIVE

The principal adhesive for plastic card is, of course, plastic cement (also known as polystyrene cement) of which there are various types. The modeller should appreciate this and know when to use each for work in hand. There are three basic cements; the thick, somewhat stringy variety, which if used in delicate work is not only clumsy but dangerous. This should only be used for sticking the thicker varieties of card (60 thou) when a strong joint is required. The middle range is thinner and is useful for a variety of tasks but, like the thicker type, it can be dangerous if used in overlarge quantities, for plastic cement 'sticks' plastic by dissolving it. The thick cement takes quite a long time

to completely dry and if it is in contact with the thinner card (5 or 10 thou) it will undoubtedly cause warping and wrinkling. The fact that this middle range cement takes some time to dry is an advantage in many cases because where adjustment of components is necessary (eg, lining up struts, etc), a quick drying cement is worse than useless. The final type is the very thin highly volatile cement which is usually supplied in bottles. This is essential when sticking the very fine card and thin sprue. This is sometimes better known under trade names like MEK or Mekpak, or as 'liquid cement'. It is best applied with a brush but care should be taken to see that the minimum amount is used for in quantity it too can cause irreparable damage to plastic. Bottles of thin cement should not be left without the stopper in place for any length of time, for apart from the damage it can do if it is accidentally knocked over the fumes which issue from the fluid can be harmful in normal domestic surroundings. It is possible to stick balsa wood or other thin and light materials to plastic using plastic cement provided that the wood has been coated beforehand with thin plastic cement *which has been allowed to dry*.

Other adhesives can be used and in some circumstances they may be desirable. These include some contact glues but they should be used with care for they also act on the plastic. Light materials such as foil can be attached with varnish but this is discussed in the Special Finishes section. Of special note are adhesives of the 'universal' type (UHV is an example) which sets transparent, and the various makes of 'Five Minute Epoxy', a recently developed adhesive which is particularly useful for joining normally 'incompatible' materials.

SPRUE

Most plastic modellers will be familiar with the uses and applications of heat-stretched sprue. As it is mentioned throughout this book it is appropriate to deal with it now in this introduction to plastic card modelling. Sprue is actually the waste material in plastic kits but it can also be produced from thin strips of plastic card. It is a somewhat loose term, but covers the 'trees', stalks or runners on which the kit components are moulded. If a section of plastic sprue is gently heated it will soften and it can be stretched to quite extraordinary lengths. A piece one inch long can be stretched out to four or five feet and in some cases longer. The variation is due to the slightly different qualities of plastic used by the kit manufacturers; some will not draw out at all but merely bubbles and burns before disintegrating whilst other plastics tend to break up into multiple strings, so that it is a case of experimenting with different pieces from different makes of kit. The colour of the plastic sprue also has some effect on its suitability for pulling, for it appears that certain dyes effect the plastic. Silver and white plastic invariably pulls very well, the coloured plastics vary, some blacks are superb but others will not pull at all.

The best heat source is a clean flame such as a gas jet, but as this is not always practicable, the flame from a small spirit lamp (of the kind sometimes found in boy's chemistry sets) is the best. If one can not be obtained it is very easy to make a lamp from a small bottle with a metal screw top through which a hole is punched. The wick can either be purchased or made from very thick string. As a last resort – and in general it usually suffices – an ordinary domestic candle can be used. The piece of sprue should be held in the flame and revolved to ensure even distribution of heat. If it is held too long it will bubble and burn and be too soft for stretching, unless an almost hair fine stretched sprue is required, but this is difficult to use because even the lightest touch of cement will dissolve it. The sprue should be withdrawn from the heat just when the middle becomes very shiny and almost runny in appearance. It should then be slowly stretched and the thickness watched. After some experience it will be possible to almost control the thickness, the basic routine being that for fine sprue it is stretched straight after removal from the heat. For thicker sprue a small time lag should occur and the pull slower. The stretched sprue in either case should be allowed to hang vertically for about ten seconds (to harden) before being laid on to a table for cutting into suitable lengths. It may be necessary to produce more than twice the amount required and this is not unusual, for total control of the quality and thickness of sprue can never be achieved. However, this is of little importance since it costs nothing to produce and the average kit supplies enough basic material to supply yards of the stuff.

To obtain a fairly thick sprue eg, (for metal struts or undercarriage members) it is necessary to start with a thicker piece of plastic. At this point it is well to note that the cross section of the stretched sprue will be the same as the cross section of the original piece. The value of this can at once be seen for if sprue of streamlined section is required the original piece is suitably carved and sanded to this shape and the result will be streamlined flying wires. Flat section sprue can be produced by cutting fine strips from the edge of a sheet of plastic card (no thinner than 40 thou) and treating in the same way as described above.

Sprue can be used for everything that wire was used for in the past. It is cheap to produce, is light, can be made reasonably rigid, and sticks easily. In many cases it requires no painting for a piece of sprue can be selected of the colour required, bearing in mind that the stretched sprue will come out a little paler than the original colour.

The basic material therefore are the plastic card, the adhesive and sprue. Before embarking on any modelling venture it is *essential* that the properties, limitations and capabilities of the basic materials should be fully understood and modellers should practice with material to fully understand the medium. Nobody in his right mind would attempt to build, say, a simple structure such as a garden shed without obtaining some advice or studying the basic structure and the materials before commencing work. However, even at the level of model aircraft some have sailed gaily into the building of a model without understanding the material beforehand and the result has been disappointment.

Practice, practice and practice. Do not be afraid to waste a couple of sheets of plastic card in learning about it. Once an understanding of the medium is gained the job is half done.

PLASTIC CARD TECHNIQUES

For the sake of convenience the aeroplane will be considered as three units namely the fuselage, the wings and tail assembly, and the other components (undercarriage, struts, etc).

Fuselage: For plastic card modelling the form of fuselage construction for all models can be classified as follows:

(a) *Skeletal and partly covered:* Most aeroplanes prior to 1910 (eg, Bleriots, Voisins and Demoiselles).

(b) *Simple Box:* Many early aircraft (Moranes, Fokkers, Nieuports, etc).

(c) *Built-up Box:* Commonest type for construction including most aeroplanes from 1914 to 1930s.

(d) *Moulded Monocoque:* This term refers to the method used in making the *model* fuselage and not necessarily to the method of construction used in the original aeroplane. It is suitable for all models where considerable double curvature is required.

(e) *Double Shell Monocoque:* This is merely an extension of the technique mentioned above and allows for a second skin to be attached to the thicker inner skin. The thin skin can carry finer detail and is especially useful for models larger than 1:48 scale.

(f) *Flat Cut-out:* This is a rather specialised form where the fuselage can be drawn out on flat card and by a system of scoring and folding is made up into a three dimensional fuselage. It can only be applied to a limited number of cases but it has the advantage that surface detail such as stitch or lacing lines, small rivets and panelling can be accurately formed, and because the fuselage is all one piece there is greater strength especially as the single skin is formed around a strong skeleton.

Whilst the different types are defined above, in practice there are many cases when a combination of one or more systems can be used in one fuselage such as a simple box with moulded components added or a flat cut-out allied to a moulded unit. There is a further variation which can be used for 1:48 scale models but is particularly suitable for certain larger scale models and that is the use of thick sprue stringers (or strips of the thicker card) covered with one of the plastic coverings as used by the buildings of flying models. In this case the construction is very similar to that of the full size aircraft and allows a great deal of scope for fine detail. Let us now consider each type of construction in more detail.

Skeletal and partly covered: This type of fuselage (or nacelle in the case of pushers) is made by imitating the construction of the original. The longerons of most of the early aeroplanes were square in cross-section and can be reproduced by using suitably shaped sprue or finely cut strips of the thicker plastic card. The vertical and cross members however, were not always square and this should be checked by referring to photographs. The longerons and cross members should always be painted before assembly and allowed to dry, the paint being scraped off on the areas where joints will occur because the cement will not stick to paint. The commonest woods used for aeroplane construction in the days when wood was the main medium, were as follows:

Spruce: Of clear silver grain commonly used for spars, ribs and struts.

Ash: Whilst stronger than spruce was not used so much due to its greater weight which was an important factor in the early days of flying.

Hard Pine: Being a tough uniform wood it was frequently used for longerons.

Walnut and Mahogany: Used almost exclusively for propellers.

Cedar: Was often used as planking for hulls or floats, receiving many coats of spar varnish in the early days or clear dope later.

Hickory: Famous for its springiness and toughness frequently formed the units where these qualities were required, eg, tail skids, king posts and control levers.

An easy way of finding out the true colours of these woods is to buy the packs of veneers used in the hobby of marquetry. Not only will the colour be seen but the veneer can in some cases be used in the model keeping in mind that the wood used in the full size machine would appear darker due to protective varnishes. Some of the veneers have a miniature grain; large grains should not be used. In a later section it will be seen how fine veneer can be used to make propellers.

In the construction of the fuselage the two sides should be made first and great care must be taken to see that they are identical as the whole alignment will depend on this. The simplest way to ensure this is to cut out both sides roughly and stick them together with the minimum of cement or a small piece of double sided adhesive tape, and complete the final shaping and sanding with the two sides as one unit. They are later separated and the two will be identical.

Various methods were used in the early days to hold the wooden framework together and in the case of the skeletal fuselage model these features must be reproduced or at least suggested. One of the arts of modelling is to suggest certain things where it is not possible to actually reproduce them. The lacing lines along the corners of the rear fuselage of the Bristol F2B for example can be very well suggested by merely scribing a pattern on to thin plastic card.

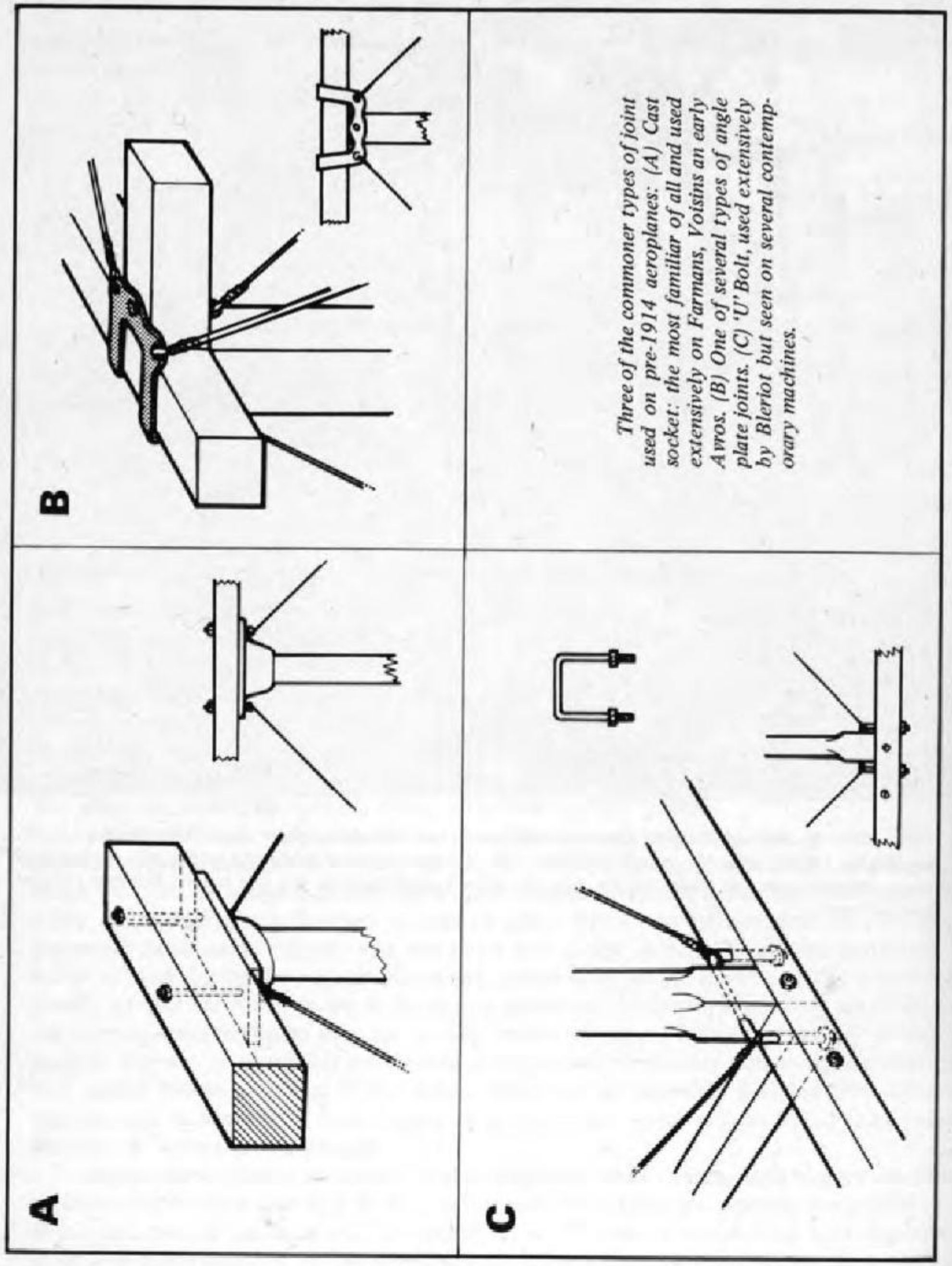
Metal angle plates and cast sockets were the main types of fitting used in airframe construction. These being supported by the multiplicity of bracing wires both internal and external. In 1:48 scale and below the metal sockets, etc, can be represented by applying aluminium paint whilst small pieces of 5 thou card can be used to suggest reinforcing pieces or angle irons. The 'sockets' were either in their original finish of cast aluminium or were protected by a coat of enamel (blue in the case of several French machines or black to suggest 'Japaning') a very common form of metal finish in the early days. It is still seen today on cheap door bolts and similar fittings.

The halves of the fuselage should be joined together at the tail first and checked for alignment. When the joint is firm the cross members of the nose should be attached so that the fuselage is now held firmly at both ends. All the other cross members or formers can now be added. If the fuselage is partly covered the fabric skinning or plywood can be represented by thin plastic card, being attached after the fuselage skeleton is completed. The edges are refined by rubbing lightly with 'wet and dry' paper.

Models of very early aircraft can be made to look very attractive and are always popular perhaps because they have an earthy appearance about them. The amount of detail that can be added is considerable mainly because most of it was out in the open. A study of photographs will reveal a mass of items which can be modelled or even just suggested. Such items include nuts and bolts, fish plates, reinforced sections bound with twine or wire, lacing, inspection plates and rubber cord shock absorbers. Tail booms of pusher aircraft are made in the same way as longerons. However, when they are made to the correct scale thickness they are usually unable to support the tail assembly without sagging. The way to avoid this is to assemble the booms completely with vertical members *and rigging* before attaching to the wings. When the tail assembly is added they will be rigid enough to support it. Strip plastic card rather than sprue will be found to be more suitable for booms as it is stronger.

Simple Box: This is the easiest and strongest form of fuselage and can be used for models of slab sided and flat backed aeroplanes. It consists of nothing more than the dorsal and ventral surfaces and two sides. As in the case of the skeletal type the sides should be made together and the construction follows that described for the above. When tracing the sides from a side elevation of a drawing the length should be taken from the

Close up shot of Valkyrie monoplane (Type B) of 1911 shows quite clearly the excellent workmanship and finish of early aeroplanes. Note the different types of joints and taping, the rubber cord shock absorbers on the undercarriage and the pilot's dashboard on the left side of the seat ('Flight International').

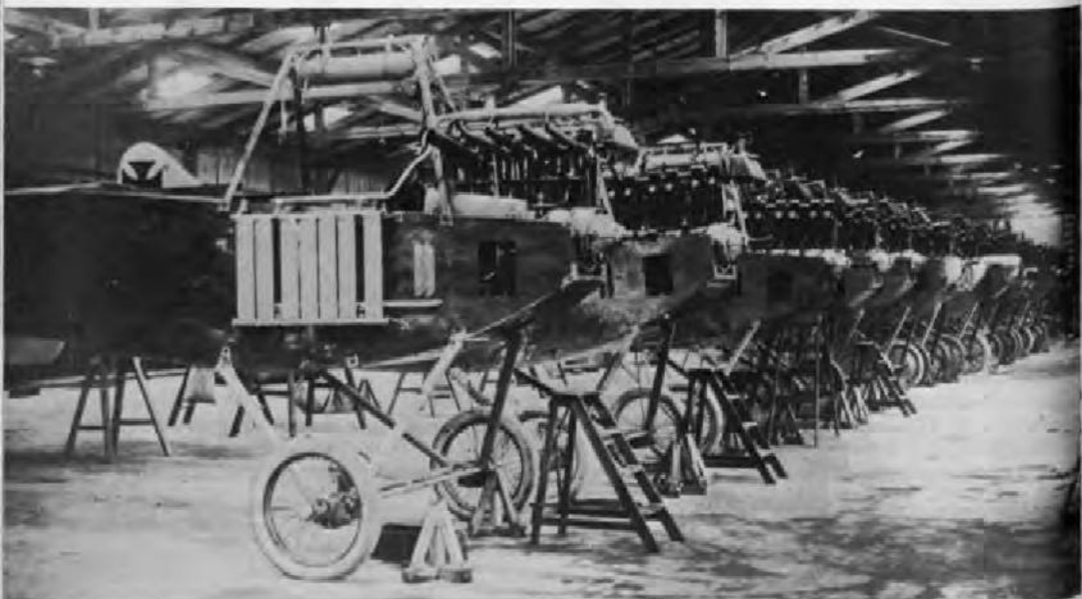


Three of the commoner types of joint used on pre-1914 aeroplanes: (A) Cast socket: the most familiar of all and used extensively on Farmans, Voisins an early Avros. (B) One of several types of angle plate joints. (C) 'U' Bolt, used extensively by Bleriot but seen on several contemporary machines.

ABOVE: Maurice Farman Longhorn nacelle illustrates the 'Skeletal and partly covered' type of fuselage. Such detail as the metal facings to the holes for control wires and elevator rod are important when modelling such aircraft (Real Photographs).

ABOVE: The original Morane monoplane showing the slab sided construction very well. This aircraft would make an ideal subject for simple box construction, note also camber of wing, and completely flat horizontal tail surfaces (elevators only). Anthony Fokker bought a damaged example of this type of machine and produced a virtual copy with his M5 monoplane although he simplified construction considerably and incorporated a better wing section ('Flight International').

ABOVE: Sgt Parkhurst in the cockpit of a BE 2a, in 1913. Fuselage is a perfect example of the built-up box type. Note also that fabric was drum tight over wing ribs (MOD). BELOW: Line up of Hiero engined Albatros C-1s at an Austrian factory. Note typical plywood skinning of nose area surmounted by metal cowling plates. Lateral radiators are seen quite clearly in this view.



plan view otherwise the sides will be too short. A thick plastic card can be used for the sides to give maximum strength. If the fuselage is knife edged horizontally at the tail as in the case of the Fokker monoplanes and the Moranes from which the Fokkers were copied, a spacer can be used as shown in the diagram. The nose spacer is then fixed in place followed by the main fuselage spacers. The number of spacers used depends on the size of the fuselage but there should be at least one between the nose spacer and the cockpit and one between the cockpit and the tail. When all the spacers are in place the fuselage shape is established and firm. The dorsal and ventral surfaces need not be made of the same thickness as the sides thus allowing a thin edge around the cockpit area. A reference to the diagram will reveal how these two surfaces can be positioned quite easily and as the spacers are cut short top and bottom to allow for the thickness of the card, the dorsal and ventral surfaces merely fall into place.

A very good joint can be made by adding a second dorsal and ventral skin of 5 thou card, the edges being refined with 'wet and dry' paper. The result is a quite invisible joint and all joints should be invisible. Remember to detail the cockpit interior before attaching the dorsal surface for this and subsequent types of fuselage construction.

Built-up Box: This is the obvious development of the simple box and is the method used to model the fuselages of a great many aeroplanes of the period covered by this book. In its simplest form it is merely a box with the addition of decking formers (eg, as in the SE 5a or DH 9a). It can be quite complicated with the addition of several items including moulded parts. Indeed, there are times when it is entirely the choice of the modeller whether he uses a built-up box form of construction or a moulded monocoque as described in the next section.

The illustrations show clearly the basic form of construction. If the sides of the rear fuselage are straight in plan view and the upper line of the turtleback is straight in side elevation then it can be made by cutting a segment from a circle of thin plastic card as shown. Stringer lines are represented by scoring the inside of the turtleback lightly. If the curvature is very slight then stronger scoring will produce a slight double curvature. When the construction involves double curvature, a moulded unit is required. The stringer lines can either be represented by sticking in place fine sprue to represent the stringers and painting over with matt white enamel, or they can be scored but not, of course, with a straight edge. A special curved guide must be made from balsa sheet or thick plastic card and used to guide the scoring instrument on the inside of the moulded item. As can be seen from the diagram, the forward sections are modelled by curving a piece of thin plastic card over the former heads. In long fuselages extra sub-formers should be used to maintain shape and give extra support. It is not necessary to measure out these panels exactly, a piece somewhat larger than required is stuck in place. After the cement has completely dried the excess is cut away and the joint sanded over.

Moulded Monocoque: One of the most useful properties of plastic card is the fact that under moderate heat it will soften, and will remain soft long enough to be moulded. This enables the modeller to tackle even the most complex of problems in modelling aeroplanes. To make a mould a balsa 'male' has to be carved and shaped but only to a correct size and contour; there is none of the tiresome filling and sanding that needed to be done in the past with solid models. Some modellers use plastic card as if it were balsa wood, inasmuch as they build up compound curves by sticking together layers of card and laboriously carve and sand it to shape. This appears to be a rather negative approach to plastic card. Moulding is quicker and easier and it can be imagined what amount of work would be required if four cowl rings had to be made in the laminated style, when with moulding only one master need be cut and from it as many rings as required could be produced, all identical and all, like the original, in the form of a thin shell. There would appear to be little value in using plastic card if full advantage is not to be taken of its most valuable property.

Some modellers appear to equate 'moulding' with 'vacuum moulding' (or 'vac-forming') and imagine that some expensive piece of equipment is required. Certainly the vacuum mould is used by some who produce items in quantity but it is not necessary for the system used here which is a straight 'male' and 'female' type of moulding. Indeed the vacuum mould is superfluous unless mass production is intended, for the moulding only produces the shaped shell; all the surface detail is added later. The limitations imposed by the simple method will be explained and can be easily overcome. The only equipment required is a suitable piece of balsa for the 'male' and a sheet or plank of balsa (at least 1/8 inch thick) for the 'female'. The only other item is a heat source such as a gas or electric fire.

The fuselage 'male' mould is carved from a block of balsa made out of two pieces lightly joined together by a few spots of balsa cement. The join represents the centre line of the shape, corresponding with the centre line shown on the plan view of the drawings. This ensures that when the block has been finally shaped it can be split in half exactly down the middle. A handle of some description is fixed to the flat inside of each half and so the two halves of the 'male' mould are created. Carving is not to all difficult and all that is required is a sharp craft knife, or for larger cases a razor blade plane. Checks on shape are made from time to time by using templates as shown in the sketch. These are drawn from the cross sections shown on all model plans. The fuselage block must be trimmed to be a shade smaller than that shown on the model plans to allow for the thickness of the plastic card.

The 'female' mould is merely a plank of balsa large enough to allow at least an inch (25mm) of wood on either side of the cut-out (which is of course the 'female' part of the mould) and several inches at top and bottom. The hole should be exactly the same as the side elevation shown on the drawings and the entry side of the hole should have a rounded edge to allow the softened plastic card to ride over it. A sharp edge will catch the card and cause the mould to be too thin. The thickness of the card to be used depends entirely on the size of the model for example on the author's Overstrand model the card used was 40 thou while for small items, such as airscoops or small fairings, 10 thou can be used. The diagram shows that the 'female' mould has two strengthening strips placed at right angles to the grain. These are very important for if the mould breaks at the point of entry the whole item will be wasted. The area shown by a dotted line is the plastic card placed over the cut-out and held there either by drawing pins or bulldog clips. Before the actual moulding takes place it is advisable to mark the outline of the 'female' mould on the surface of the plastic card (hold it up to a strong light and trace through); this acts as an aiming point, for the moulding must be carried out fairly swiftly.

The card should now be *gently* heated and it should receive even heat. For the smaller items the whole thing can be placed under a kitchen grill; for any larger pieces it may be necessary to hold it vertically in front of an electric fire or gas fire. The moderate heat will produce a gradual softening easily seen for the plastic card starts to sag into the hole. If left under heat too long the surface of the card becomes very shiny which indicates that it is getting too soft. Only practice will teach the modeller to know the right moment. When the sagging has started the 'female' mould and card should be quickly removed from the heat, placed on a firm surface and the 'male' mould pushed through straight and in a decisive manner. It should only go through far enough to produce the full desired shape with a little left over for trimming. Pushing too far will cause the sides of the moulded shape to become wafer thin. If the mould is too thin even then, a thicker card should be used. Modellers should not be discouraged if their early attempts are not successful, the author has been moulding plastic card since it first became available and still reckons on having to do at least two moulds before a good one comes out. When the perfect moulding appears the modeller will feel a form of elation especially if he is used to kits for he will have virtually produced his own custom-built fuselage shell.

After the half shells have been formed the wooden 'male' moulds can be re-inserted in the shells and used as supports and guides whilst trimming and sanding to the centre line. Final trimming to a dead straight line down the centre can be achieved by running the shell containing the half wood fuselage over very fine 'wet and dry' paper. If thick card has been used, then the shells are put together in the same way as those of a plastic kit. The use of supports is recommended, however, especially in the case of the thinner shells. One way of doing this is to use the original balsa fuselage with appropriate areas cut away so that the plastic card actually forms a skin. The illustrations show the stages in the forming of the author's Halberstadt D II. The shells were actually formed from 20 thou card and trimmed as described above. The areas on the wooden fuselage around the cock-pit and nose area were completely cut away to allow for detailing of the cockpit and the insertion of the engine. The advantage of retaining the wooden core is that the fuselage is given great strength and the balsa forms a good bed for struts, etc.

It should be noted that one of the limitations of the 'male'/'female' method of moulding is that the pressure on the softened card is one sided. This means that if a sphere were pushed through a circular hole only one half of the sphere would form. To obtain another half the procedure would have to be repeated. It also means that if a fuselage block were carved to include, say, a wing fillet as in a kit model, the fillet would not be formed whilst a vacuum former would produce this. However, it is easier to make a separate item and stick it on than shaping a wing fillet on to the fuselage block so that the advantage of the vacuum form moulder is lost. A little later in this book a method of producing fillets and streamline units will be described.

Double Shell Monocoque: This is an extension of the method described above and is suitable for some 1:48 scale models, and can be used to great advantage on larger models. All that happens is that the main shell is produced as described, it is then lightly sanded down to slightly reduce its bulk and to provide a slightly matt surface to which a second shell will adhere. The second shell is made by using the original wooden mould *with the first shell still attached*. It is logical to think that the hot plastic card of the thin shell will affect the card of the already formed inner shell and it would unless a special precaution is taken. The whole surface of the inner shell is smeared with a light oil (eg, liquid paraffin, typewriter oil or castor oil). The second shell will form perfectly over the first and will not stick to it. (This system of using plastic 'male' moulds can, of course, be used to produce shapes from items in a plastic kit as shown on the author's models of the Nieuport 24 bis and the Curtiss BFC-2). Two things, however, must be observed; the original wooden mould must be carved proportionately smaller to allow for the double layer of plastic, and the inner shell must be made from fairly thick card (no less than 40 thou). For this reason it is more suitable for use in larger models, also, because the whole purpose of this system is to enable panels and extra detail to be added to the outer thin shell.

The Flat Cut-out: This is a somewhat specialised form of fuselage building and whilst it can often be used in conjunction with another form it is seldom suitable on its own. The advantages are that a certain amount of surface detail such as panel lines, lacing and stitching and rivets can be put on whilst the fuselage skin is flat. A further advantage is that such construction can be quite strong and the basic principal is derived from the cardboard cut-out model. In its simplest form the fuselage is built up with a basic 'spine' of thick plastic card on to which the formers are stuck to give lateral shape. The under surface can also be made from the thicker plastic card sheet so that the framework is not only firm but correctly aligned before the fuselage skin is attached. The spaces in between the formers can be filled at random with chunks of expanded polystyrene (eg, from a ceiling tile) which are virtually weightless but give support to the skin.

The most important thing to remember when using this method is that great accuracy is required when drawing out the design and cutting. The best method of achieving an accurate cut-out is to draw one side and then trace it for the other. Some models can combine this method with another, a good example being the Hawker Hart and its many derivatives. The fore part of the fuselage would have to be moulded whilst the rear section can be easily made from a flat cut-out. A simple example is illustrated using the Hanriot HD-1 as an example. A further development is the combined cut-out and double skin method. This was used on the author's Siskin III model illustrated, the inner skin being of 10 thou card and an outer skin of 5 thou being attached to this. The advantage here is that the thinner 5 thou card holds embossed detail better than the 10 thou.

Wings: Although the thick sectioned cantilever wing appeared as early as 1915 (Junkers J-1) most of the aircraft built during the first three decades of the aeroplane's existence were biplanes with thin aerofoil section wings. The problem in modelling is to reproduce the correct camber and the slightly concave under surfaces of wings of this period. The rib spines on the upper surfaces and the tapes on the under surfaces must also be reproduced and the trailing edges *must* be sharp. This latter point is of particular importance, all too often overlooked by modellers and this includes the older experienced ones as well as the beginner.

The most realistic method of making wings for fabric covered biplanes in 1:48 scale and above is the core and skin method. This is not entirely suitable for 1:72 scale aircraft models but the matter is discussed elsewhere. As the name suggests a 'core' of thin balsa wood is enveloped in a 'skin' of thin plastic card (10 thou for 1:48 scale and larger models). The full procedure is illustrated and all that needs to be added is that every instruction should be followed. When attempting this the modeller should read the text and check with the illustrations to fully understand the method involved so that he can proceed without having to stop to see what he does next. For practice use scrap plastic card or even good quality thin cardboard.

To model a wing where the leading edge is covered with plywood or metal the same procedure is carried out. One might assume that in these cases the rib scoring stage can be modified so that the rib lines are scored short of the leading edge. If this is attempted the wing surface will start to curl because by scoring, the area of the card is slightly increased. As long as the scoring carries over the full width of the wing surface this will even itself out. However, if the scoring is foreshortened the scored area will expand whilst the front unscored area will remain constant. To achieve the smooth leading edge area representing the metal or wood covering the rib spines should be very lightly sanded over with fine 'wet and dry' paper lubricated with soapy water. After this the area should be painted with one coat of enamel and allowed to dry then sanded again.

Some later biplanes had quite thick wings, although fabric covered, which resulted in somewhat blunt wingtips. The method used to reproduce these is illustrated, as also is a moulded wing technique useful for large biplanes.

Modelling the more modern wing which is thick and wood or metal covered is somewhat easier than the fabric variety. It consists of wrapping a skin around a basic balsa wood 'core' or in some cases a skeleton core depending on circumstances. What should be remembered is that the ailerons need to be cut out and there must be some wood underneath the area to be cut. Frise type ailerons need to be treated rather differently and this technique is illustrated.

Wing fillets can be tackled in two ways; one method is to use the moulded system such as described in the section dealing with streamline fairings the other is to build the fillet up with a plastic material such as Polyfilla. In the case of many of the earlier monoplanes in the late 1920s and early 1930s the fillet was often enormous (eg, the Northrop 'Gamma'). It is interesting to note that with modern high speed jets the fillet has almost vanished. When modelling a large fillet plastic putties should be totally avoided partly because it is a rather expensive method (it might take the full tube) but mainly because such a large deep area would mean the putty drying slowly and so acting upon the plastic card underneath causing warping and rippling, even with thick card. Some putties shrink and this causes warping of the wing so that the best material to use is water based patching plaster like Polyfilla, which will not affect the plastic and can be very easily sanded to shape. A thin coat of enamel over the final sanding will seal the filler and will allow a final fine sanding. When using water based fillers it is advisable to roughen up the surface of the plastic card to ensure a better grip. Fine detail on the wing surface such as panel lines or junctions can be applied by gently scribing with a not too sharp blade. The system of the double skin can be used most effectively here for the reproduction of rivet detail. The second skin being 5 thou card stuck to the main skin by the minimum of thin cement applied with a fine brush. The skin should be placed exactly and held at each end with a small piece of adhesive tape. The cement can then be applied between the skins little by little until the whole area is stuck down.

Tail surfaces: Generally speaking these are made in the same manner as the wings but in some cases, especially when modelling early aeroplanes, the balsa 'core' can be dispensed with, the two surfaces being stuck together without any central core at all. Tail surfaces, especially those of the earlier machines were surprisingly thin and the model must reflect this. Those whose modelling experience so far has been confined to building kits, may be subject to certain misapprehensions regarding the structure of aeroplanes. This is reflected in many ways, the two commonest being the lack of appreciation of the sharpness of trailing edges generally and the thinness of tail surfaces. This is caused through familiarisation with kit models rather than a study of photographs of the actual machine which they are modelling.

Whilst the basic structure of aeroplane wings remained fairly constant the leading edges of wings were invariably straight, apart from sweep-back where the leading edges are straight but the wing is built in panels. Tail surfaces, however, frequently had curved leading edges and it is obvious that a modified method of modelling these must be applied. The system is to use two separate skins with a very thin core and this is illustrated. The fairly sharp leading edge corresponds with the shape of the original and is not the great thick blunt leading edge so common on plastic kit models. Elevators and rudders should of course be cut away from the tailplane and vertical fin. The sharp edges should be rounded out by sanding and the items stuck back in place using thin sprue pieces as 'pegs'. Advantage can be taken of the temporarily separated surfaces to fix the control horns made from plastic card or sprue depending upon the design of the original.

Propellers: As it is such a prominent feature of the vintage model it is essential that great care be taken to ensure fidelity when making the propeller. The commonest fault is for the blades to be too thick with blunt edges and not enough taper. 'Chunkiness' should be avoided at all costs. Plastic kit propellers can always be used when available provided that they are big enough, and can be corrected, as reshaping is usually necessary. In the absence of a kit propeller one must be carved from wood or plastic, the word 'carved' being relative for in the case of small propellers for 1:48 scale models, most of the shaping is done with varying grades of fine glass-paper, and small files. The procedure follows that of full size propeller manufacture. The initial block is made from layers of wood or plastic card. The advantage of a block made from laminations of wood is that end product will appear similar in construction to the original. The wooden block is made from thin veneer as used in marquetry, but these will have to be thinned down in order that about 6 - 8 layers can be enclosed within the maximum width of the propeller hub. The layers are stuck together with ordinary wood glue and held in a vice overnight. This is essential as nothing is more frustrating than the propeller coming apart when it is almost completed. The stages of shaping are shown in the diagram, the first rough cutting being carried out with a new blade in a craft knife and all the shaping and finishing with glass-paper. The shaft hole should be burnt through with a hot needle unless a very fine drill is available.

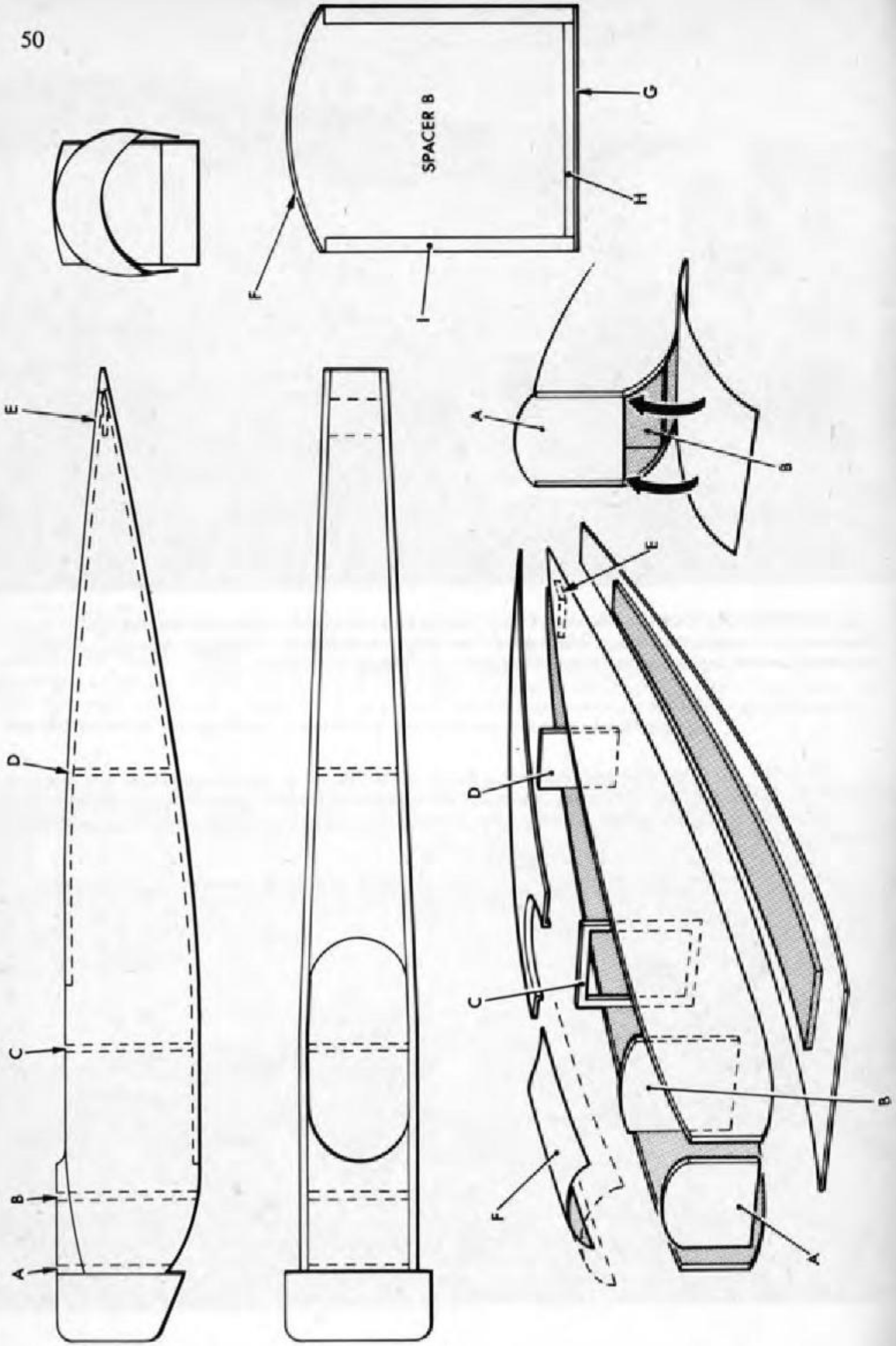
The finished propeller can now be 'weathered' by applying a thin coat of varnish, darkened with brown enamels, and allowed to dry. Final finish is a light coating of clear varnish. If two types of veneer (one light and one dark) are used alternatively when making up the block the typical striated appearance of the German propeller can be created authentically. Making the block out of layers of plastic card has the advantage that it is not susceptible to splintering, and when the 'stain' is applied the divisions between the layers can still be seen, giving a quite realistic appearance. The four bladed propeller is of course more difficult to carve but again the system used to create the original can be applied here. The layers are made up as shown in the diagram with a complete vertical, flanked by two half horizontals, followed by a complete horizontal, flanked by two half verticals, etc. In this way the grain is correct for all four blades and the block is very strong.

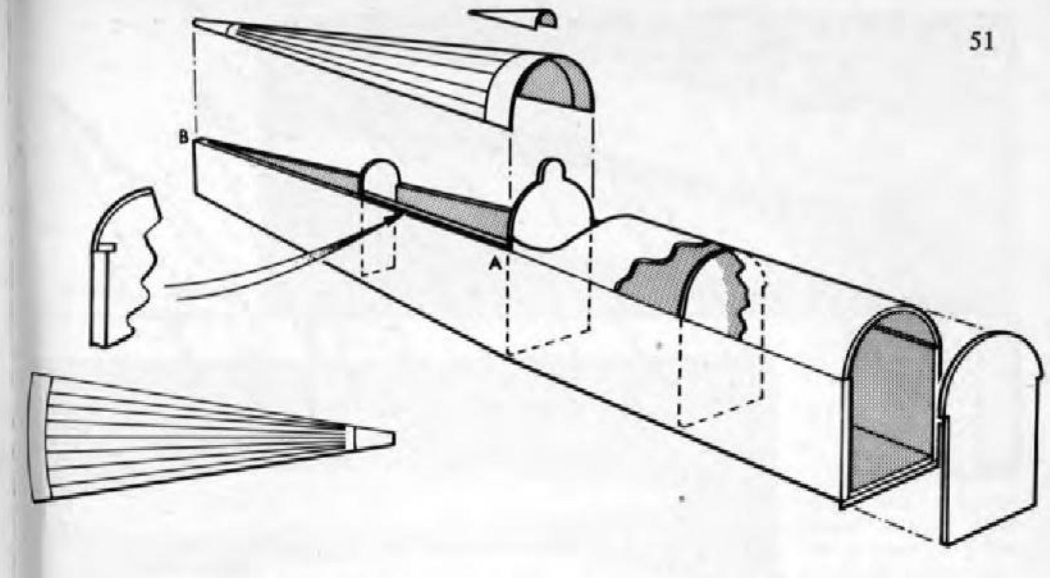
ABOVE: Letov Sm-I, the first Czechoslovak designed military aircraft demonstrates an example of a monocoque fuselage to good advantage. Note dorsal fin and well shaped gunner's cockpit (Z.) Zaroslav). BELOW: Little known Hawker Hawfinch was the ancestor of the famous Fury fighter of the 1930s. Extremely clear photograph here shows a great deal of detail and is a perfect example of the more complicated built-up box. This aircraft demonstrates all the design characteristics and surface detail of the fighter aircraft of all nations during the late 1920s and mid-1930s (Hawker Siddeley).

ABOVE: Cierva Autogyro (Avro built). Fuselage is an ideal subject for monocoque modelling technique. Note the subtle panelling and extremely clean lines. BELOW: An example of a late military biplane, the Vought SBU-1 representing almost the final development of the metal framed fuselage. Note the extremely smooth panels, metal wing fillets and overall superb finish which was typical of US Navy machines of the period. As far as a model subject is concerned, a moulded monocoque with skinning would be the appropriate method of construction (US National Archives).

ABOVE: The prototype Henschel Hs 123 all metal construction and skinned throughout with metal except for control surfaces and parts of the wings; undoubtedly a moulded monocoque subject in model form though a kit by Airfix is available in 1:72 scale (Real Photographs).

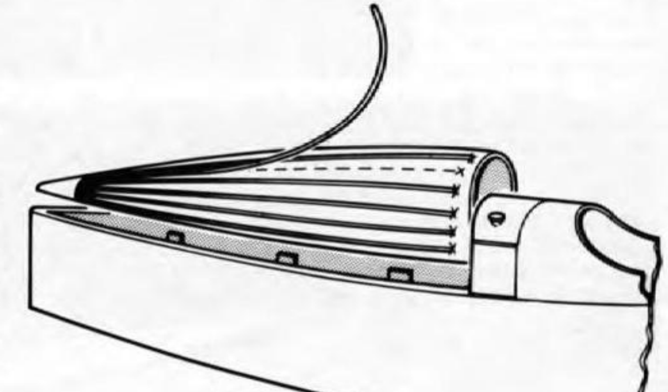
BELOW: An interesting and challenging model subject would be the Vickers Type 151 'Jockey' interceptor fighter of 1932. The project was abandoned after it failed to recover from a flat spin, the pilot bailing out. It is interesting to note the early all metal construction, metal propeller and formidable riveting (MOD).



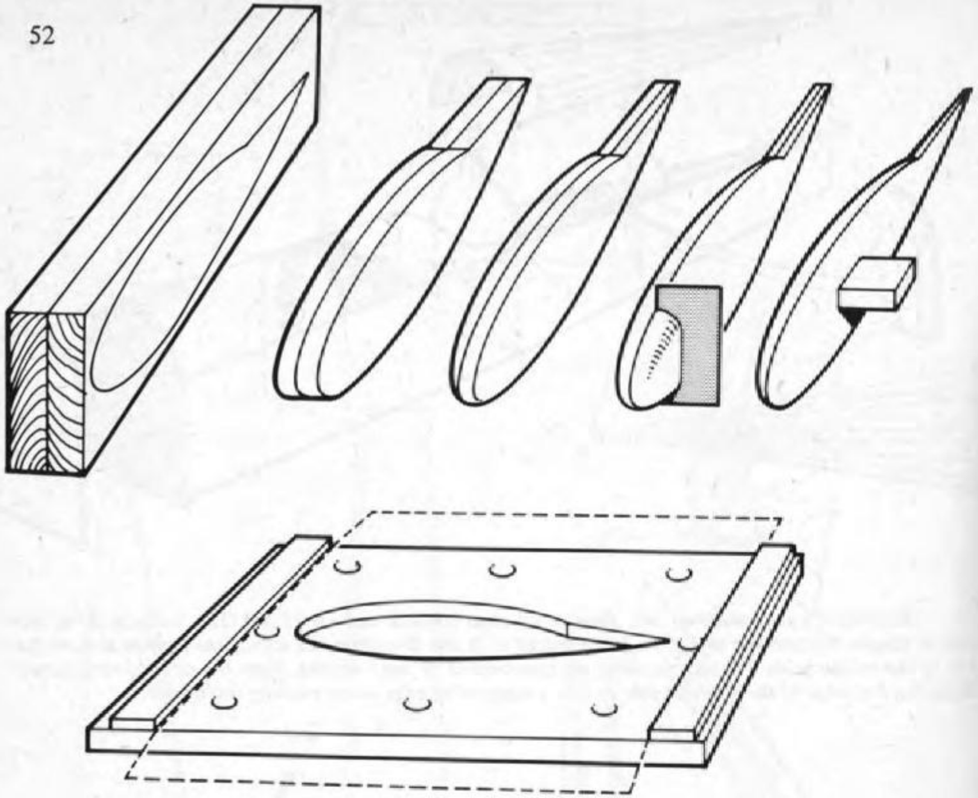


ABOVE: Typical built-up box type of fuselage (in this case an SE 5a). The 'turtleback' in this case is simple because the line A to B is straight as is the line from the top of the former at A to the top of the rudder post. The stringer lines are represented by light scoring. Note the strip of card placed along the top edge of the fuselage side to give a supporting edge when sticking turtleback.

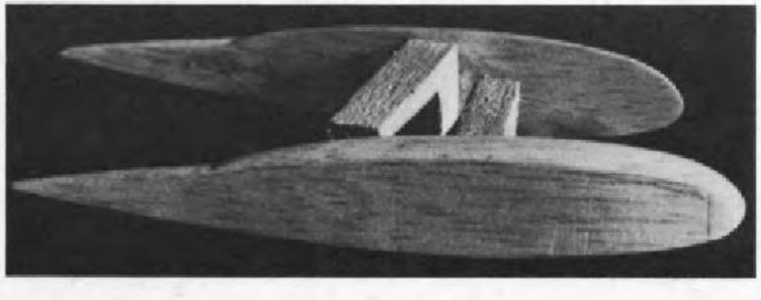
RIGHT: Double curvature turtlebacks have to be moulded unless the surface is only slightly curved, in which case the scoring will produce this, but only to a very limited extent. The stringer lines are made from very fine lengths of heat-stretched sprue stuck on with cement. After drying the whole surface should be painted over with matt white enamel which can later be buffed over lightly with 'wet and dry' paper. Note tabs alongside top edge of side to give support.



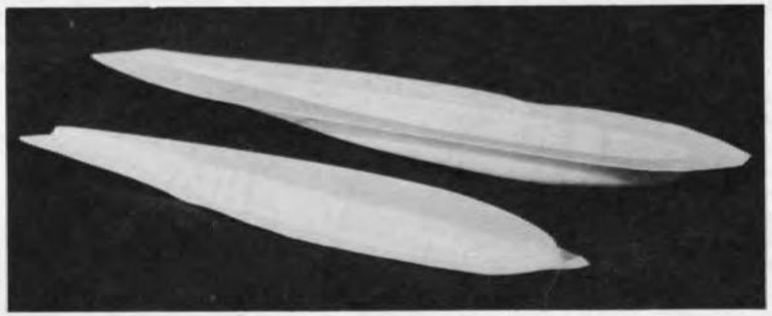
OPPOSITE: Typical simple box type of fuselage (in this case a Morane-Saulinier type L) A, B, C, D and E are the basic formers. Note that C is a skeleton former to allow for the large open cockpit. The dorsal and ventral surfaces are made out of two layers. The thick main layer which fits between the two sides, and a thin outer layer which overlaps, concealing the joint. This can be seen on the right where I is the right side, H is the ventral main surface, G is the thin outer casing. The curved panelling F is merely a piece (oversize) of thin card, stuck over the formers A and B and trimmed after the glue has dried. All edges are refined and joints made invisible by buffing with 'wet and dry' paper.



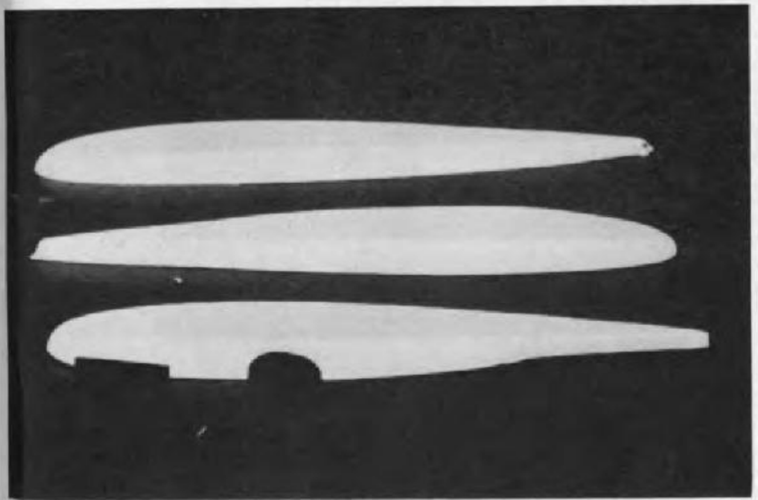
ABOVE: The various stages in the construction of the 'male' and 'female' moulds for the moulded monocoque type of fuselage. Note that the block is made from two pieces of balsa lightly stuck together. The joint being the centre line. This enables the shaped block to be split exactly in half later. Templates must be used throughout to ensure accuracy and allowance must be made for the thickness of the plastic card to be used. The dotted line on the lower drawing indicates the area of the card which must be held in place by drawing pins as shown. Note the cross pieces on the female mould, these will prevent the balsa splitting. When the card is pinned into place it should be held up to the light and the area of the aperture sketched lightly with a pencil. This will indicate on the blind upper surface the precise position where the male mould should be applied.



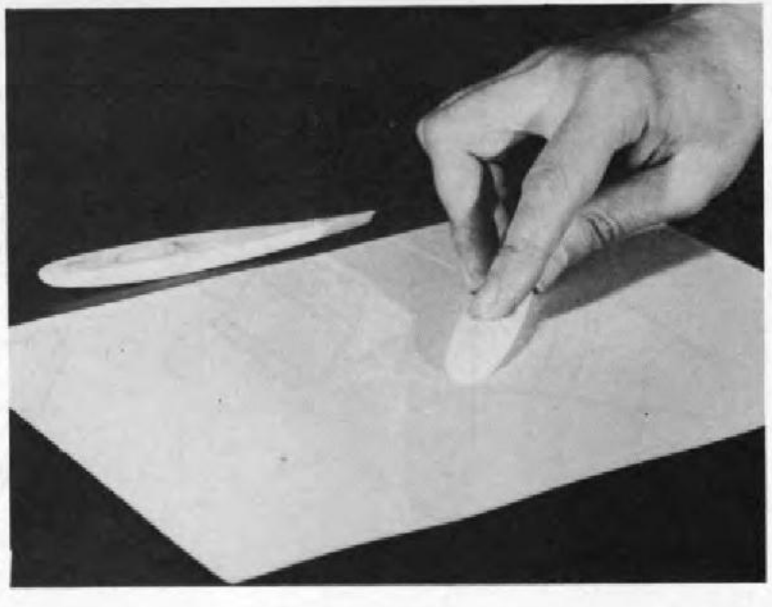
LEFT: The two male moulds with temporary handles, made following the principles shown in the above drawings and explained in the text.



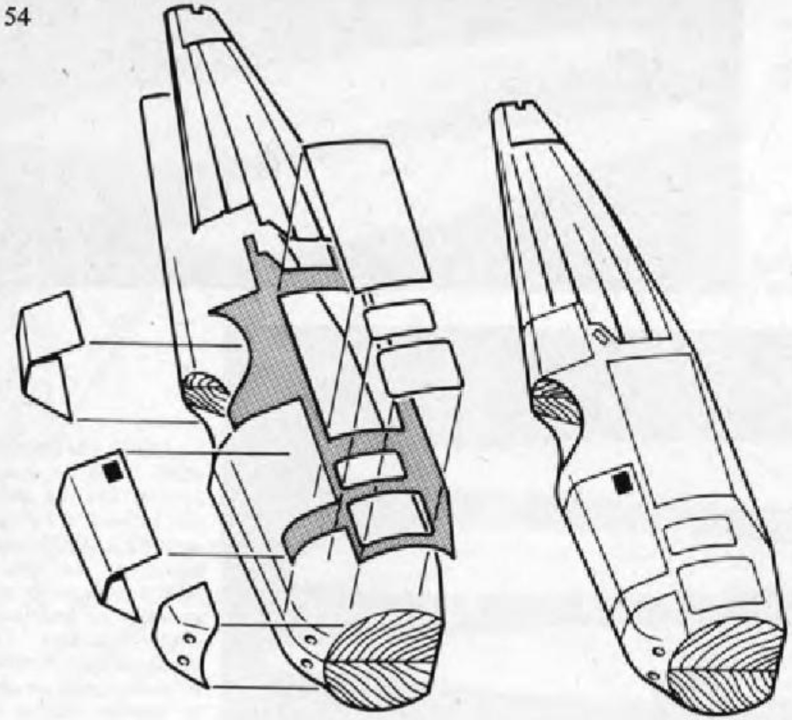
RIGHT: Fuselage shells before trimming.

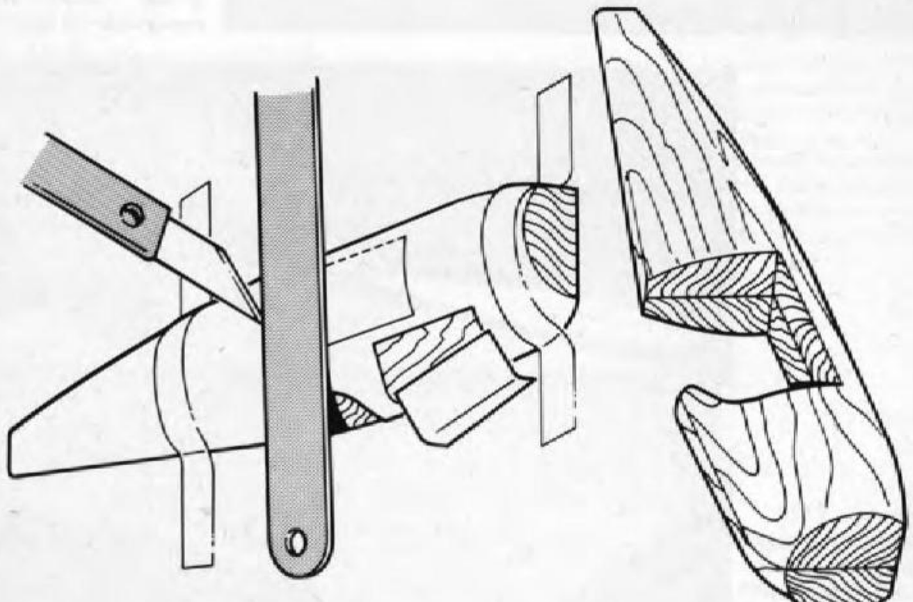


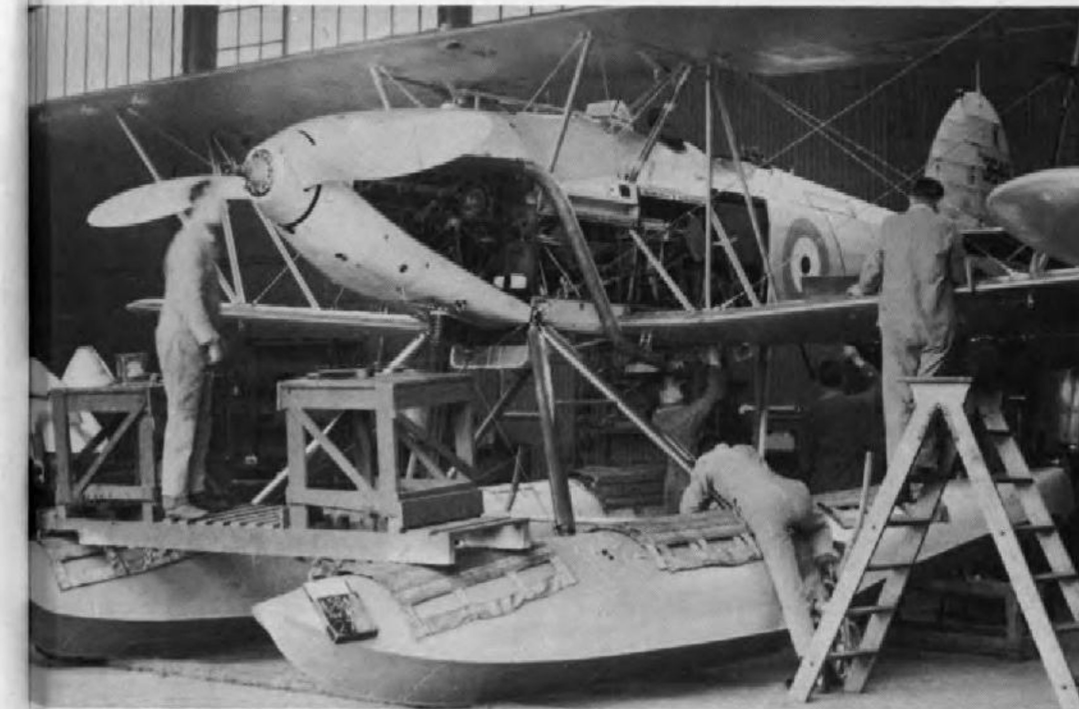
LEFT: The trimmed shells with a spare. Several sets of shells can be made for future use. OVERLEAF: Application of the double shell monocoque in construction of large scale model fuselage. The shaded portion is merely to show the outer shell in greater clarity. In both of these models the original balsa block is used as a core with appropriate cut outs.



RIGHT: The male moulds inserted into shells as guides when trimming and sanding to a finish.



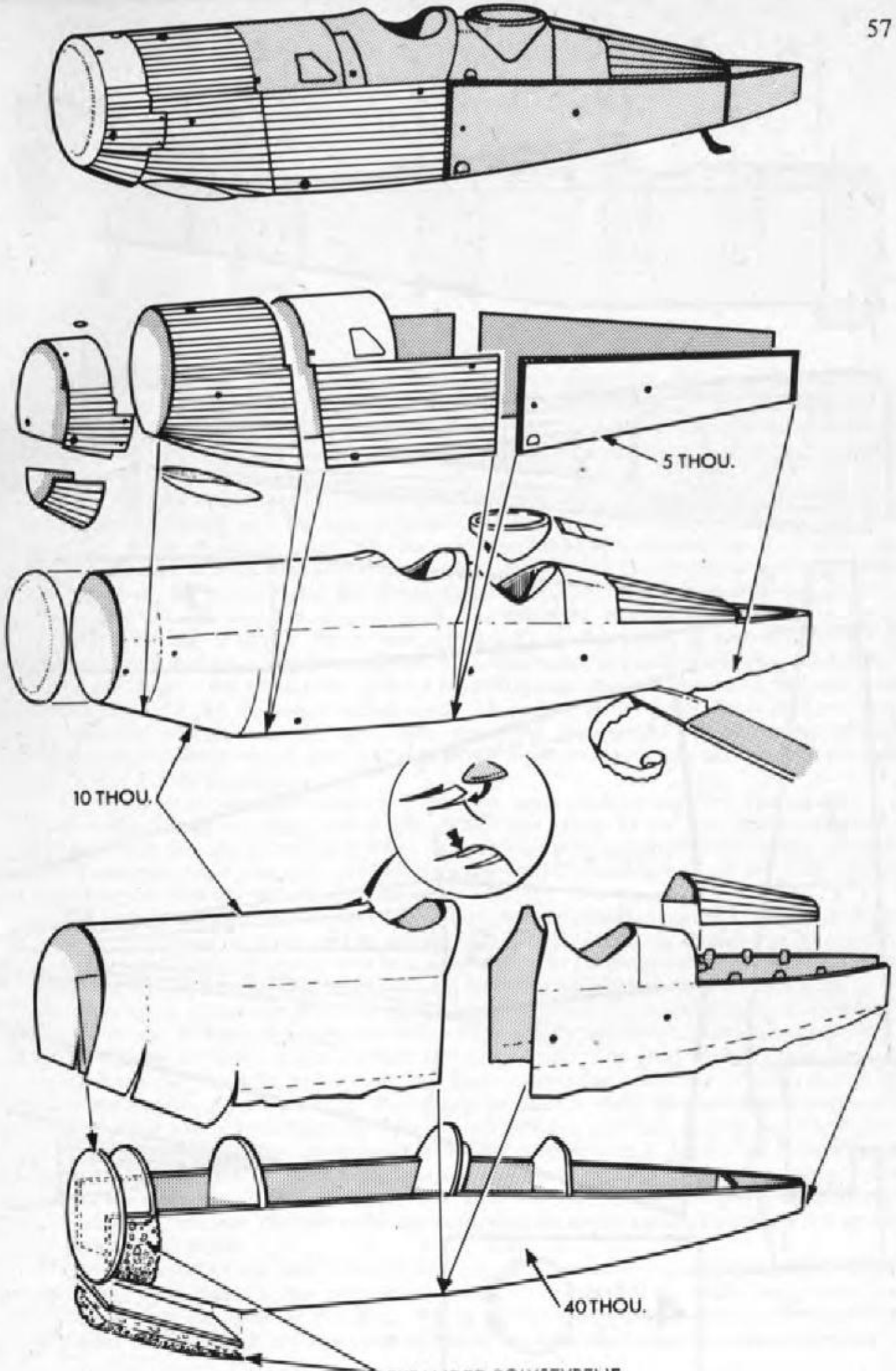


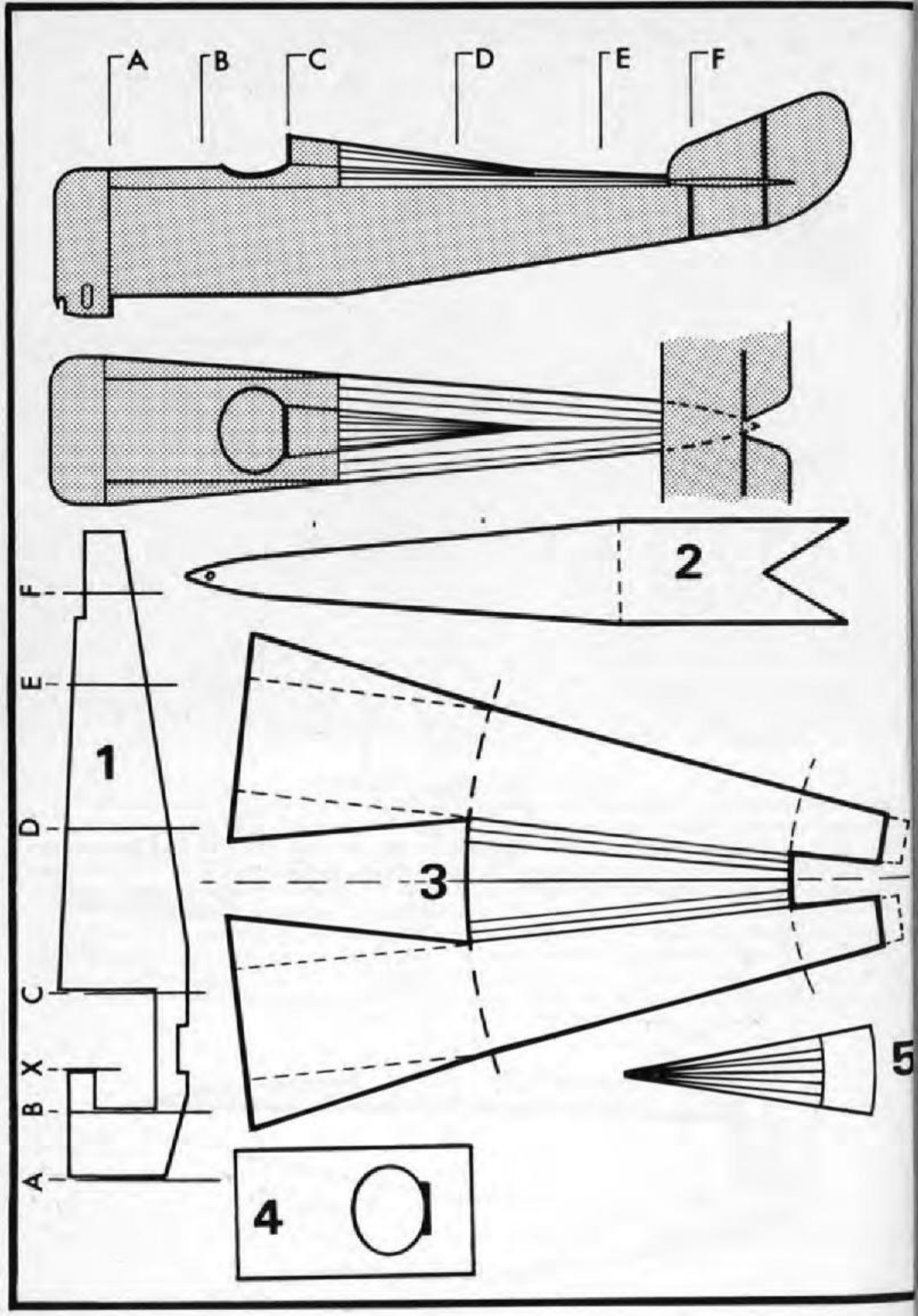


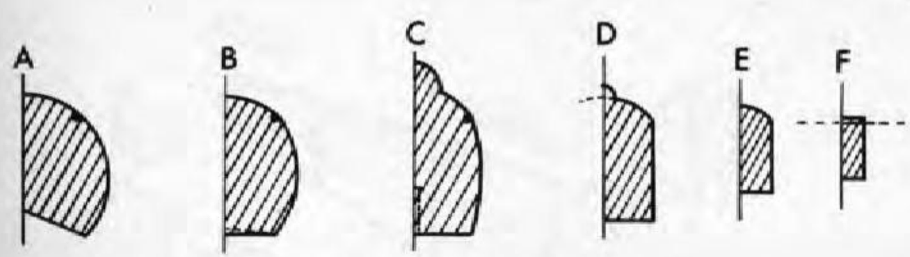
ABOVE: A fine view of a Hawker Osprey undergoing maintenance, circa 1936. Subject would be combined moulded monocoque and flat cut-out as far as model construction concerned or could be completely moulded. Note metal airscrew in this case, panelling, strut and cable attachment points, oil cooler under nose and tight fabric skinning (MOD).

Westland Wapiti in Plastic Card

Westland Wapiti of No 55 Squadron in Iraq, circa 1932 is shown above. RAF machines serving in hot dry areas frequently dispensed with wheel covers to prevent sand and grit accumulating inside the spokes. On the opposite page is a suggested form of construction for a model of this aircraft. By studying the shape of the fuselage the method of construction can be determined and in this case it is a built-up box with 5 thou skinning. It is useful as an example because almost all of the techniques involved with fuselage construction are included here. The method can be applied to 1:72 as well as 1:48. The Lifelike Bulldog kit would supply a Jupiter engine for the larger scale whilst the Airfix Bulldog could do the same for the smaller scale. The typical Wapiti bulge under the fore part of the fuselage could be moulded or, as it is so shallow (especially in 1:72 scale), could be shaped from a double layer of plastic card. Similarly the rounded nose just behind the engine could be so treated.







Hanriot HD 1

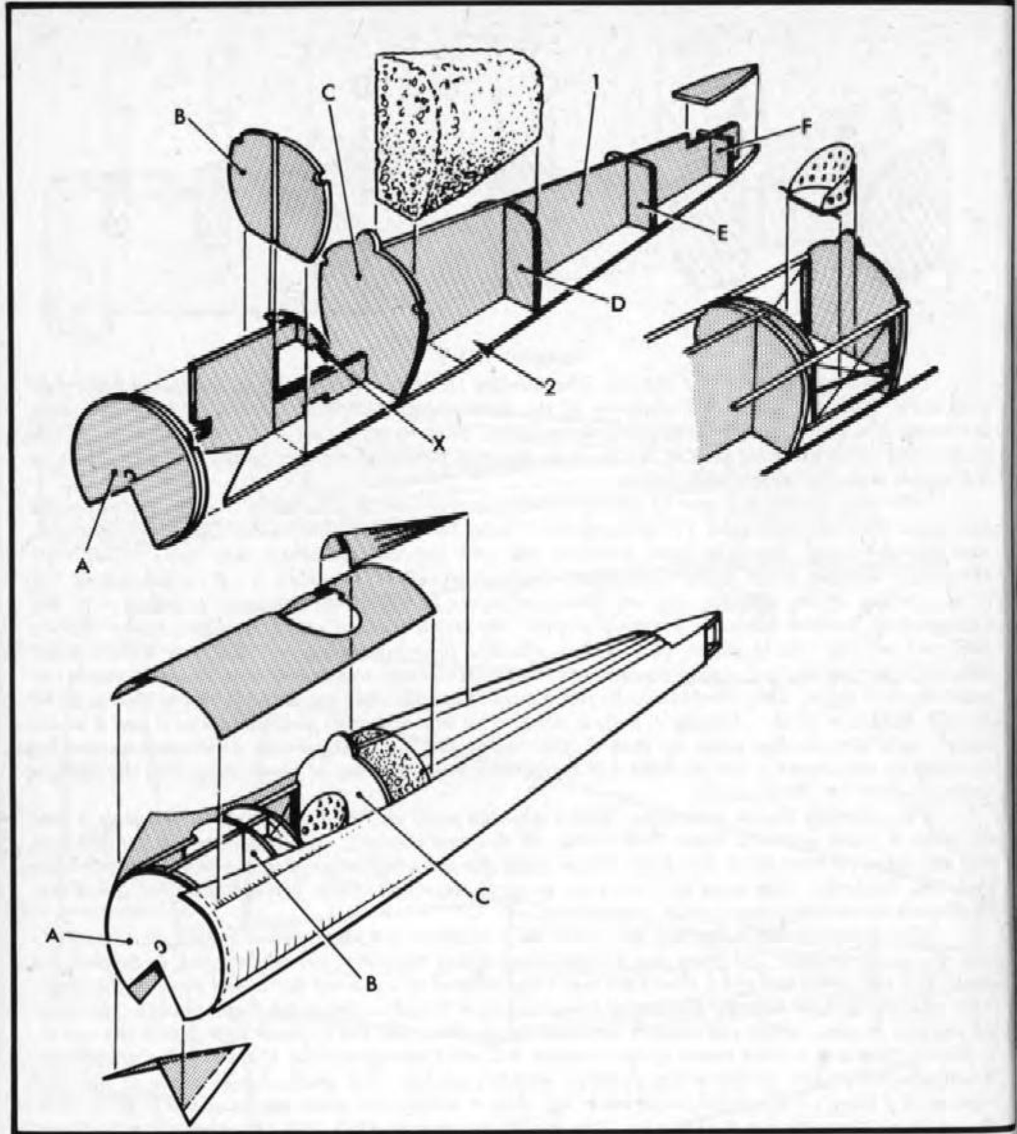
Simple example of a flat cut-out. The fuselage views shown here are of the Hanriot HD 1 in 1:48 scale. Note the shape and contours of the fuselage and especially the straight lines. For these determine if a model can be made using this method. There is no reason why the Hanriot cannot be made using other methods such as the Built-up Box but for demonstration purposes it is used here as it is simple and very typical of its period.

The basic core of this type of fuselage is the spine (1). This is drawn from the side elevation and is at least 40 thou plastic card. The part marked 2 is the base of the fuselage, also drawn from the plan view, but the length should be taken from the side view for obvious reasons. The 'vee' cut-out is for the airflow channel which is found on rotary engined aircraft. The formers A - F are taken from the cross sections of the drawing and are shown as halves because they are made as halves with the exception of A which is almost a complete circle. The idea is that one side is drawn on to the 40 thou card and roughly cut to shape. This is then attached to another piece of card with double sided adhesive tape and the two halves are refined to the correct shape so ensuring that they are exactly the same size and shape. They should also be just a fraction smaller than the drawing on the plan to allow for the thickness of the skinning (10 thou card). The skin is in two parts shown as 3 and 4 in the sketch; note the unusual shape of item 3. The reason for the enlarged side panels can be seen by referring to the assembly sketch. Item 4 is merely the front covering of the decking with the cockpit cut out, whilst 5 is the headrest.

The assembly sketch (next page) shows how the parts are fitted together. The sequence is that the spine is fitted with one major former first (in this case ideally C) and it is then stuck to the base and the other formers stuck into place. When doing this use small amounts of the medium cement for there is a tendency when using the thin type to apply too much and to 'seal off' the joint. Avoid this at all costs for the shrinkage later is quite strong.

The upper assembly drawing shows the main structure almost completed. Note that there are two As, one to support the front part of the skinning and the other, the leading disc, to support the cowl. X is the dashboard and a floor (not seen here) is fixed to the lower horizontal piece of the spine. Also note the slot cut into the bottom of the spine under the place where the floor should go, to allow for the wire or sprue which will support the lower wings. Note also the shoulder high cuts in the rear A, B and C; these are to take pieces of sprue which will not only support the skin but will represent the longitudinal members of the actual fuselage (see side sketch). The great chunky piece of material represents a piece of expanded polystyrene (eg, from a ceiling tile) which can be added to fit in these spaces to give support for the skinning. This should be stuck in place with the minimum of ordinary glue. The cockpit area is furnished with dummy cross members and bracing wires made from sprue as shown and the remaining fittings are inserted before *the skinning process begins. The Hanriot is one of those few aeroplanes which for some reason did not have the very end of the fuselage covered (another example is the Sopwith 1½ Strutter). Note this when the side skin is drawn (see template 3). To support the top of the rear skin just under the horizontal tail surfaces a small section is laid across the rear as shown in the sketch.*

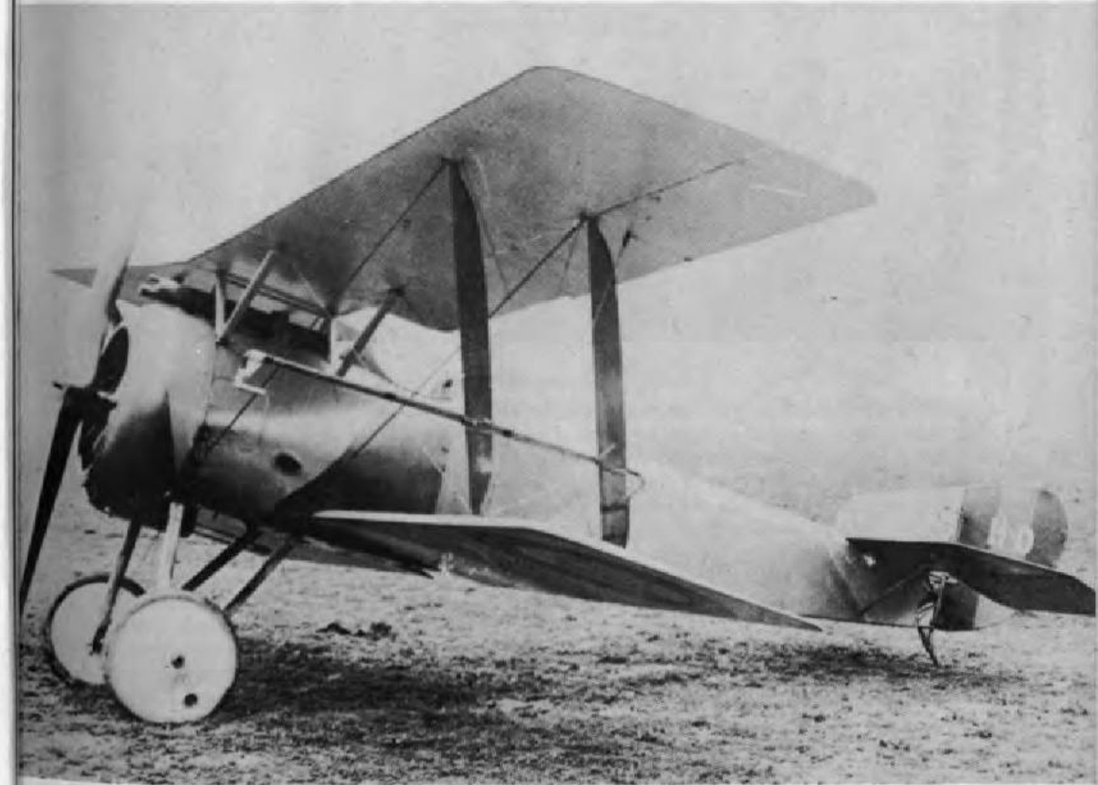
The application of the main skin is simple but great care must be taken to see that it is applied in exactly the right place; in this case the central line of the turtleback (which is of course scored) should line up with the centre of the spine. The skin is stuck with the minimum of cement (medium because quick drying in this case is a nuisance) along the spine and along the joints of the base only.



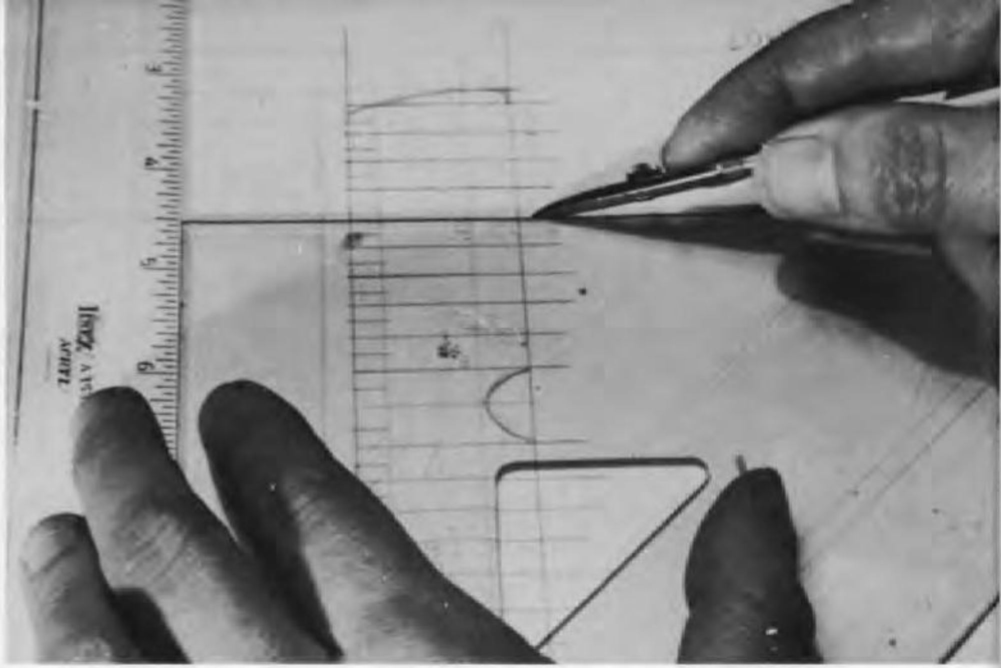
It will now be seen why the front part was widened out for it is almost all required to meet the increasing curvature of the fore part of the fuselage. There will be a little surplus but this is deliberate to allow for trimming. The top decking (4) merely sits on top and is trimmed where necessary, and the final items are the lining of the air channel front-bottom and the headrest.

Do not attempt to do complicated calculations in order to define the actual size and shape of the parts when using this technique. It is all done by rough sketching and dummy templates made from paper. They are roughly cut to shape and then marked with a pencil 'in situ'.

What is important is to see that the layout drawing is correct and even and drawing instruments are required for this. If in doubt always cut them oversize.

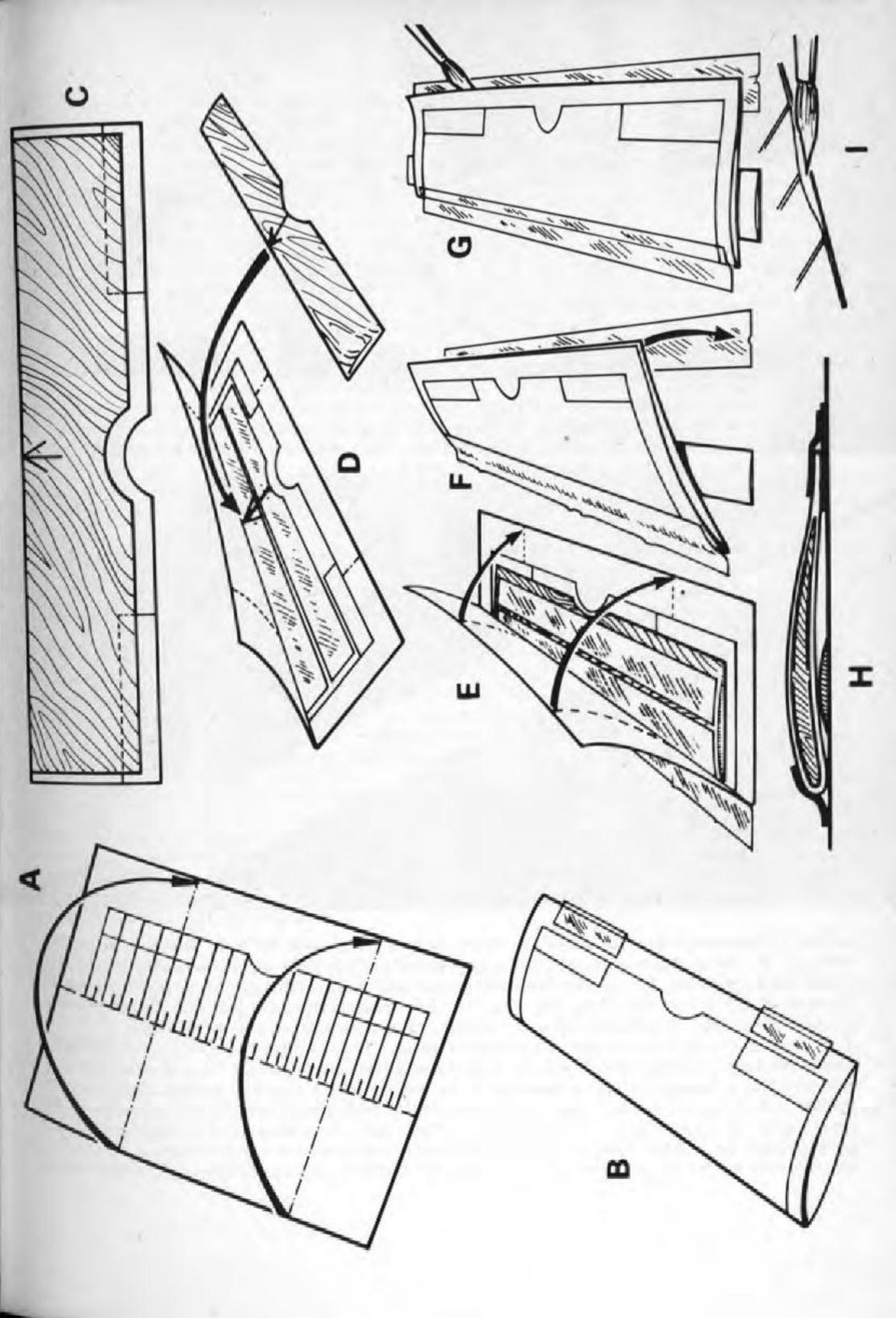


Belgian Hanriot HD-1



Wing Forming in Plastic Card

Choose 10 thou card as the most suitable for all wings made by the folding method for 1:48 or 1:32 scale. Thicker card is difficult to sharpen at the trailing edges and the rib scored lines are not so prominent. The wing shape is lightly drawn on to the card as shown in the photograph above; when doing this add about 1/16th inch to the chord to allow for the camber, this should be added to the true trailing edge as drawn from the working plans. All rib lines and nose rib lines are included in the drawing, as are aileron division lines. The card is then laid on to a perfectly flat and clean surface (eg, several thicknesses of cartridge paper, not a very hard surface such as formica nor a too soft surface such as blotting paper). The rib lines are gently scored with a tool such as an engineering drawing pen as shown in the photograph overleaf. The advantage of using such a pen is that fine equal double lines can be imparted which give the impression of rib tapes on the other side. The ruler, which is the guide for the set square, is best fixed with adhesive tape to prevent it slipping. The scoring carries right across the drawn wing and for the same distance on the other side (the left side in the picture) for two surfaces are being created here. Note that the nose riblets are also drawn over. Do this work slowly for it is easy to make an error and spoil the wing. When all the scoring has been completed hold the plastic card up to the light so that the drawn wing outline shows through and carefully note the main points of the shape so that the card can be reversed and the wing shape accurately drawn on to the other side. This is important for the scored surface is actually the **inside** *of the wing skin and unless the pattern is drawn on the reverse there will be no guide lines to cut when the wing is folded over. All surplus plastic card can be cut away within about 1/2 inch around the wing outline and a ruler laid along the central line shown dotted in drawing 'A' (opposite page). This line of course becomes the wing leading edge and the object at this stage is to gently fold it in preparation for the next step. Do not under any circumstances try to make a tight fold at this stage for the plastic will crack. The fold is lightly made until both edges meet each other as shown in drawing 'B', ensure that the fold is straight by checking that the scored rib lines coincide with each other and put a few pieces of adhesive tape around the join to stop slipping as shown in the sketch. The wing in this lightly folded condition is then sandwiched between two planks of balsa (at least 1/8 inch) so that the leading edge only is seen. This should be placed so that it is in line with the edge of the planks and not sticking out proud (see last photograph). Holding the balsa 'sandwich' firmly between the fingers the front with the exposed leading edge is held*



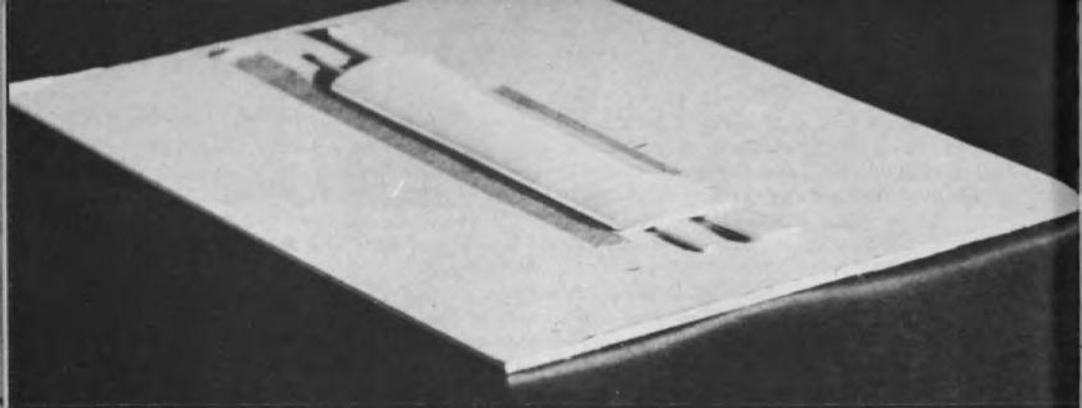
in front of a moderate heat (eg, gas or electric fire or even fan heater at full heat). It should be moved from side to side to ensure even distribution of heat and the two balsa planks meanwhile slowly and gently pressed together. On examination it will be seen that the heat has softened the plastic so that it forms itself into a very tight fold. The wing should be removed from the heat and left in the balsa sandwich for at least 30 seconds to allow for cooling and hardening, it can then be removed.

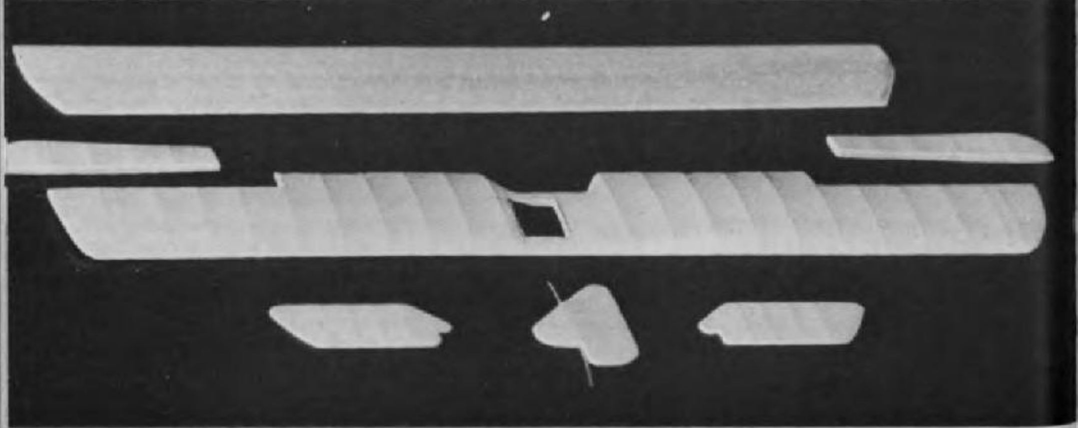
The core of the wing is a piece of sheet balsa about 1/16 (or 1/32) inch depending on the thickness of the wing being modelled. This is cut to the shape of the wing less about 1/4 inch all around (see drawing C). It is shaped like a wing inasmuch as the leading edge is rounded; a rough aerofil shape is formed by sanding, and it is particularly important that the trailing edge including the edge around the central wing cut-out and tips are refined down to a sharp edge; otherwise any corners not removed will show through the finished wing. After shaping, the balsa core is painted with two coats of thin plastic cement which hardens the surface and is allowed to dry. If this is not done the next step will not work.

The principle is, of course, to encase a balsa core in a thin plastic card skin. The core merely gives support and acts as a bed for struts, etc, and a base when the ailerons are cut away. To fix the core inside the wing double sided adhesive tape is used. The core can be stuck in with plastic cement but this has hazards for it is necessary to be very quick and to know exactly how much cement should be used, for if there is any residue left inside the wing it will soften the plastic and cause rippling, sometimes days afterwards. For beginners the adhesive tape method is easier and safe and in fact very efficient for it eventually becomes sealed inside the wing so that it cannot dry out.

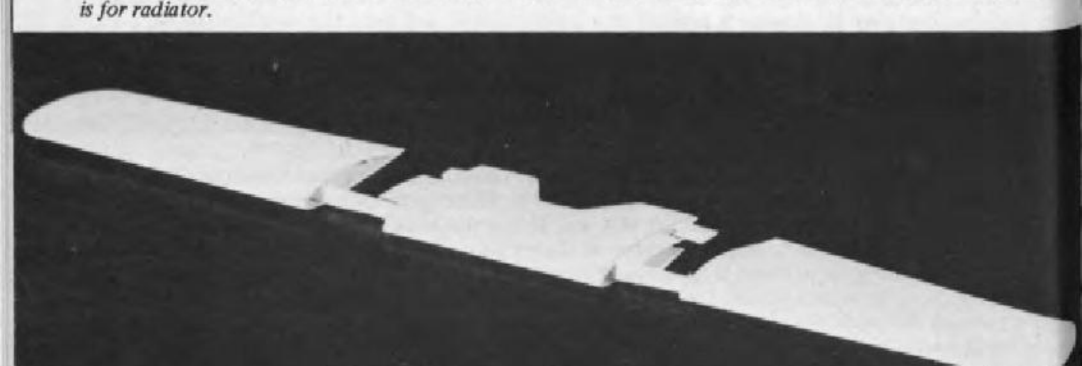
Sketch D shows the wing with its sharp leading edge formed; strips of double sided adhesive tape are placed on to the surface as shown (two strips usually in smaller models). The tape should avoid the wing tips and the wing cut-out. The balsa core is then carefully placed by first lining up on the leading edge. Note that an arrow is marked at the exact centre of the balsa core and another at the same place on the wing so that lining up will be easy. When it is in the correct position with the balsa leading edge well into the fold it is pressed down upon the tape as shown in drawing E. Similar strips of tape are then placed over the top of the balsa core and the upper surface is then carefully brought down on top of it. This is made easier if the leading edge is held down with some normal clear adhesive tape as shown in the sketch. The position as shown in sketch F is now reached; to ensure a correct camber a fine wedge with rounded edges is inserted under the appropriate area and another strip of double sided tape is laid on to the base so that when the wing is lowered the lower trailing edge will be held firm and what is important, straight. At sketch G the lower surface is held down with the tape and the upper trailing edge is now joined to the lower by running a brush with thin cement along it section by section omitting the wing tips and cut-out at this stage. The brush should paint the cement just along the pencilled trailing edge and when it has all been stuck a further length of clear adhesive tape is run along the edge so that we reach the state as shown in sketch H which is a diagrammatic cross section of the arrangement. The wing should be left in this setting stage overnight. The next step is to free it from its 'rig' by first cutting along the drawn trailing edge with a steel rule and a very sharp knife blade (or a new razor blade, single edged). The trailing edge can then be raised and the leading edge freed by removing the holding strip of tape. At this stage check to see that the trailing edge is stuck all along its length. If it is not it will show up as shown in sketch I. A small amount of thin cement can be put inside the inner edge of the hole and the wing immediately placed down so that the edge is on a flat surface; this is important. When all is dry the tips can be stuck together and the cut-out removed with a sharp blade. A thin smear of thin cement will hold this and all edges sanded. The trailing edge should be sanded to a sharp edge by using fine 'wet and dry' emery paper over a balsa block. The final stage is to smooth over the under surface slightly so that the scored lines are flattened out to resemble wing tapes.

The process as described may seem very long and complicated but it is not so. It has taken the author almost as long to describe it in print as it does to do the job once the wing pattern has been scored. As always, it is most strongly recommended that a 'dummy run' be carried out first to learn the hazards; one of the commonest faults is to provide over-generous helpings of cement, resulting in the softening of the thin plastic card. When the knack is learned it will be seen that it is the most effective method of reproducing fabric covered wings and is ideally suited for 1:48 scale and larger, but not for small 1:72 scale models.

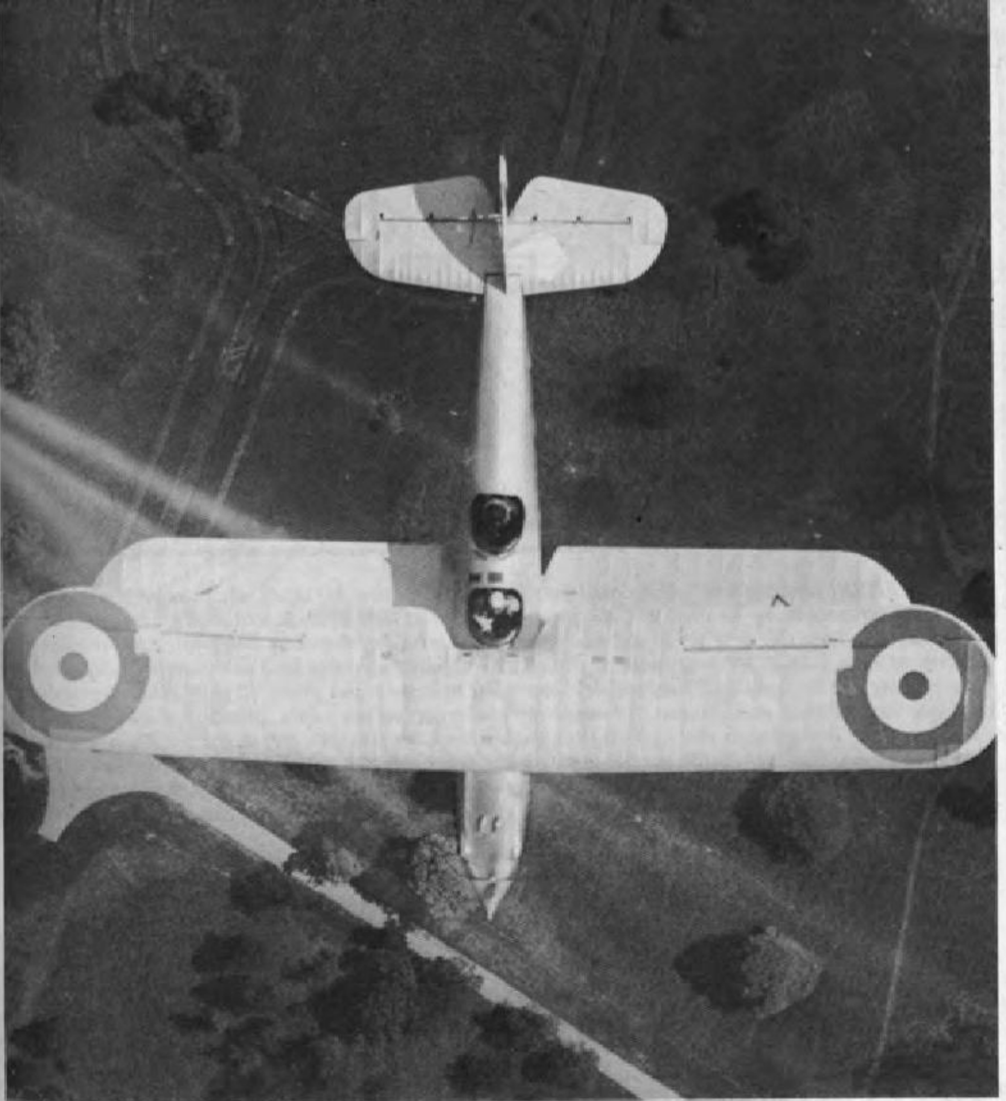




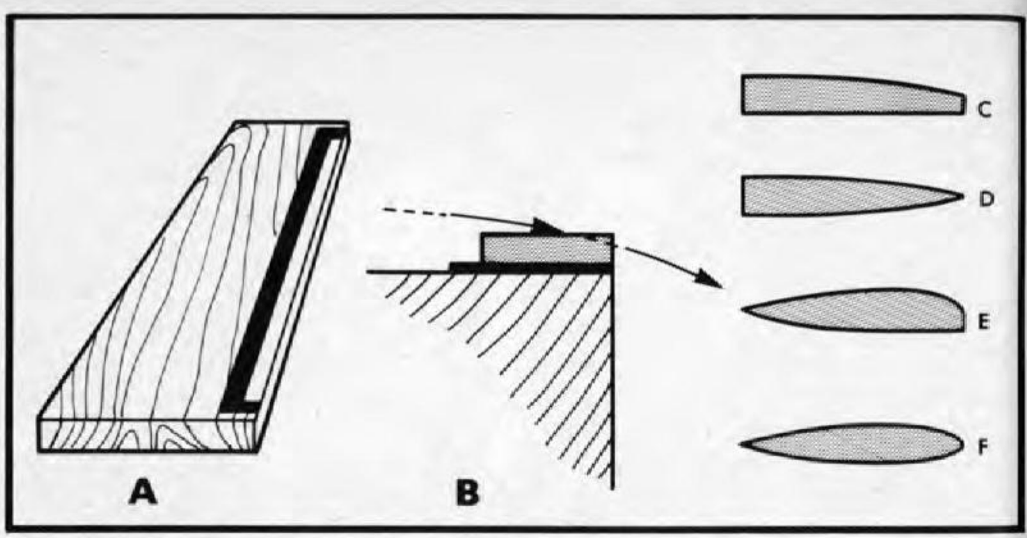
TOP: The lower wing for a Halberstadt D II fixed for overnight drying. Normally the trailing edge is fixed in the same way as the leading edge, however the Halberstadt had considerable 'washout' at both wing tips necessitating the two wedges. ABOVE: Upper wing and tail surfaces for Halberstadt. The balsa core is for the shorter lower wing. The Halberstadt had no fixed tail surfaces. Cut out in wing is for radiator.



Slightly modified procedure for more modern wings (although the one shown here is for 1918 Fokker D VIII. The surface is not scored for ribs as the wing was skinned with plywood. Main support is balsa spar closely following construction of the full-size aeroplane. Wing is made in three sections because of taper from centre section to tips. Note tabs to support and ensure a good joint. Not seen here are balsa wedges inside the outer wing panels to give support when ailerons are cut. Wing tips in this case are quite fine but in later aircraft and larger models the balsa core would have to be inserted as described elsewhere in order to provide 'body' for the tips.

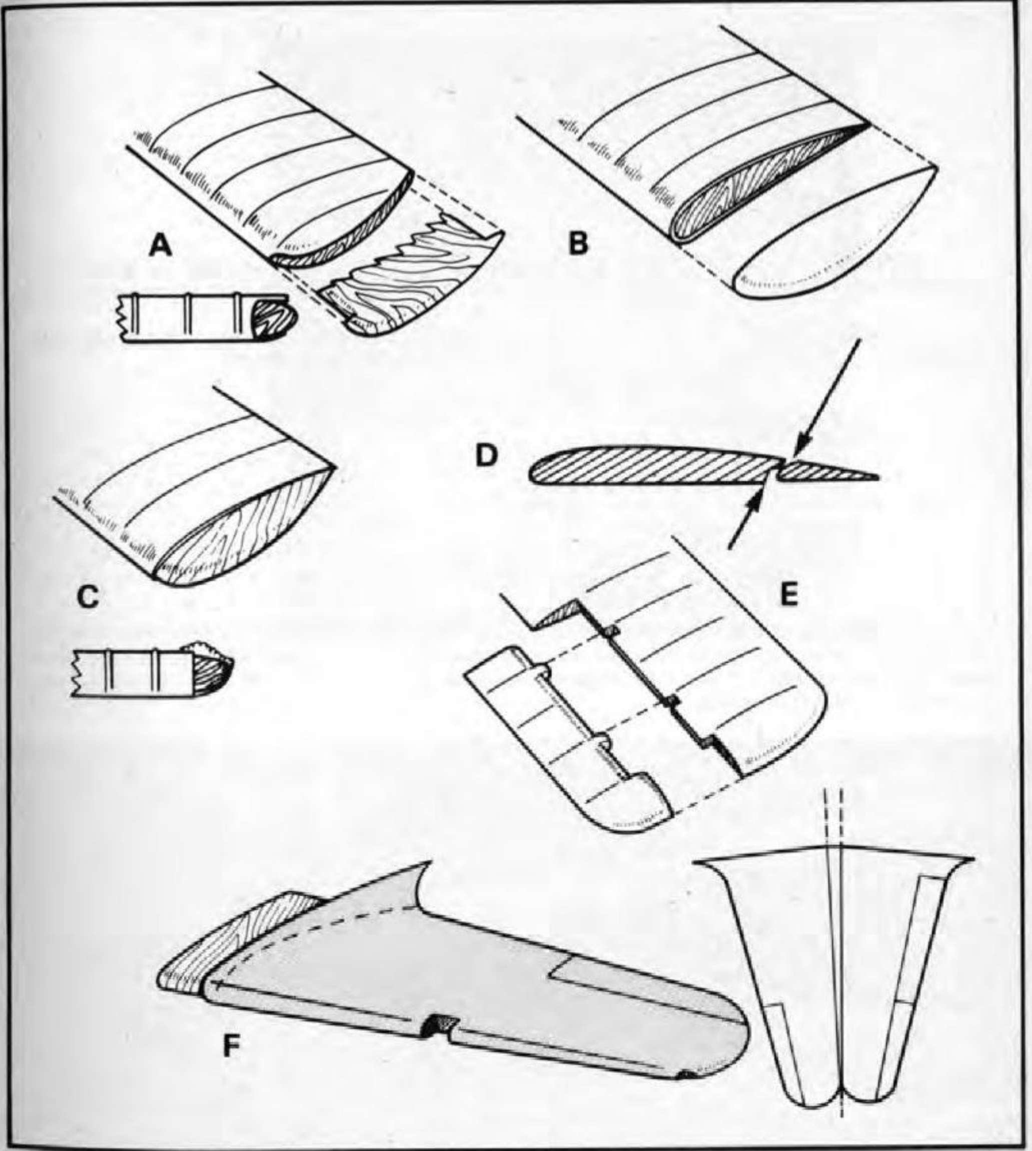


Revealing shot of a Hawker Hart trainer displays rib taping and shape formed by nose rib and tail surface members. Note how the patching by the centre aileron hinges partly overlaps the RAF roundels on the wing top surfaces – also the polished metal of the cowling. The original print is damaged and the blank patch on the tailplane is a photographic defect, not on the aircraft. ('Flight International').



ABOVE: Shaping strip plastic card into streamline section for struts, etc. The strip should be cut from card according to the scale, the finest should be at least 20 thou. Without some support it is impossible to sand the strip for it will buckle so that it is held as shown by being stuck to the edge of a strip of balsa (about 1/4 inch) with a strip of double sided adhesive tape as shown in sketch A. All the shaping can be done with 'wet and dry' paper but in larger scales where 40 to 60 thou card is used a blade can be used as a scraper to remove the major part of the waste. Sketch B shows the cross-section of the arrangement and indicates the angle of sanding. The first step is the shaping of the long curve as shown in sketch C. To do the same on the other side the strip is removed from the adhesive tape and reversed so that the shape as shown in sketch D is obtained. The strip is then removed and replaced so that the short curves can be shaped as shown at E until the final shape is that shown in sketch F.

OPPOSITE: Wing tips and modern cantilever wings: most of the early aeroplanes including those of 1914-1918 had thin wings and the two thicknesses of 10 thou card as previously described are quite adequate to represent the tips of these. Some later machines had fairly thick wings and in a scale of 1:48 and larger it is necessary to 'beef-up' the tips to give correct scale appearance. Sketch A shows one method where the balsa core is extended to the end (indeed in the rough stage, beyond the end) of the tip. The cuts as shown allow the balsa to extend a little beyond the leading and trailing edges. The small side sketch shows the view from the front; the upper and lower surfaces are stuck on to the core and the plastic card and balsa are shaped and sanded as one unit. Sketch B is another method for use with larger biplanes; the balsa core is cut somewhat longer than the span so that the tips can be shaped. The wing surfaces end at a convenient rib line and the tips are cut off. The balsa tips are then used as 'male' moulds for plastic card tips. This is particularly suitable for the larger models (eg, a 1:48 scale Short Singapore). Sketch C is yet another method where the balsa core is cut to the correct length but the wing surfaces fall short. After the surfaces are firmly fixed to the core as previously described the 'step' is covered liberally with filler and when dry sanded down. Sketch D shows the cross-section of a wing with Frise type ailerons; as far as the model is concerned these are a little difficult for the width of the aileron on the upper surface is less than the width on the under

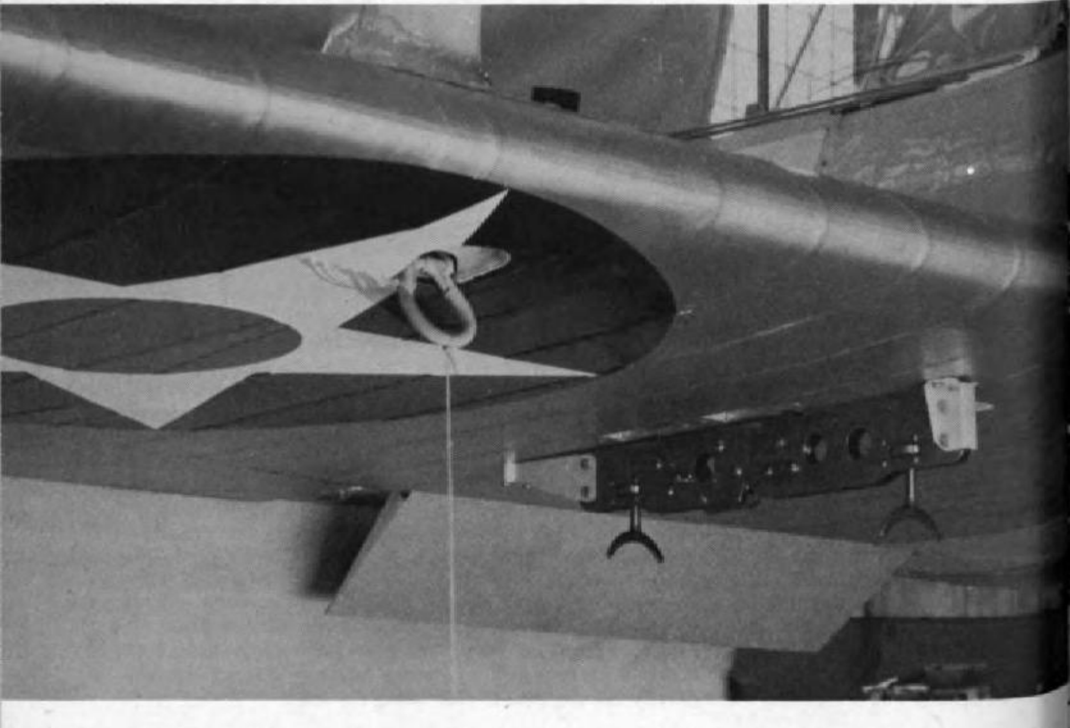


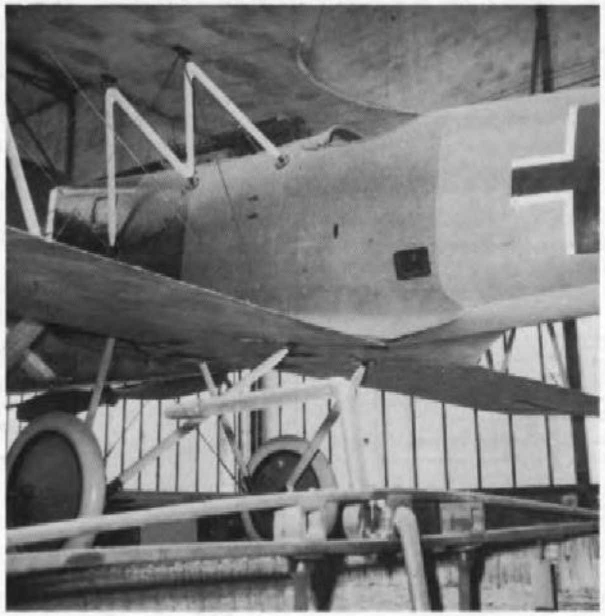
surface. The object is to cut diagonally but not in one slice. The cut on the upper surface should be at an angle but only deep enough to cut through the plastic card. The under surface cut is carried out in the same manner, the aileron being gently snapped off. The sharp edges should be rounded off and the aileron refitted with sprue plugs. Sketch E shows a typical balanced aileron, to cut the short step a long wedge shaped cutting blade is required. The hinge lugs are pieces of thick plastic card cut and shaped and added separately, fitting into slots made with a file. Sketch F illustrates the classic wings of the cantilever monoplane period. A balsa core is used as before and the wing can often be made from one sheet of plastic card as shown in the small sketch. Variations occur when the leading edge is broken by a centre section. Dihedral when it occurs is made merely by cutting half way through the balsa core and bending. The bend being made firm by running glue to filler along the crack.

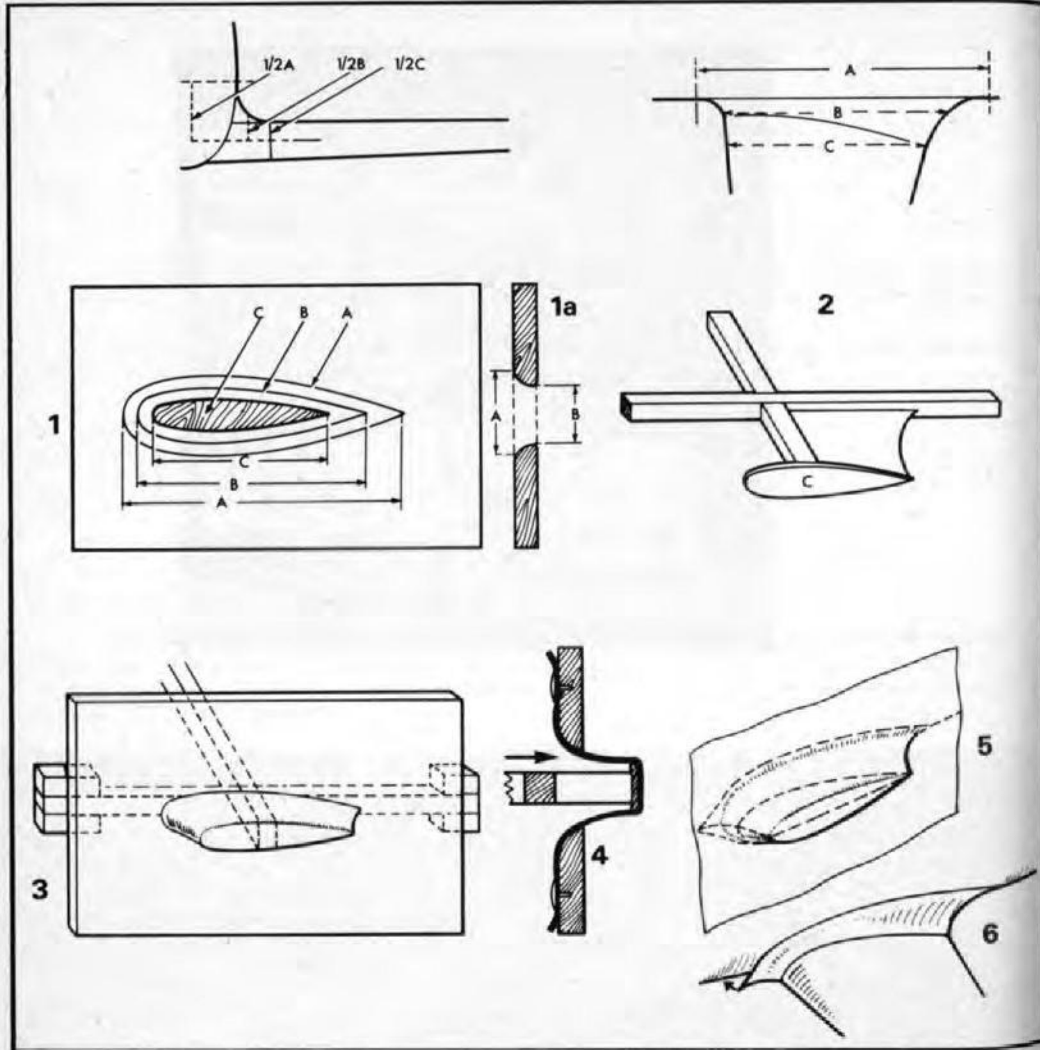
OPPOSITE PAGE: TOP, Pfalz D XII in Musée de l'Air shoes that streamlined fillets were used to good effect in W.W.1. Note particularly the sharp trailing edge and delicate strut attachment points.

OPPOSITE PAGE: BOTTOM, Prototype Boulton Paul Defiant illustrates classic low wing monoplane layout of W.W.II with stressed metal skin and prominent fillet (MOD).

BELOW: Close-up of under surfaces of Vought SBU-1 wing displays quite clearly the typically flat surface broken only by the rib tapes. Note deckhold loop and its apperture, and also the bomb rack. The leading edge of this wing is aluminium covered but note how rib tapes go all the way around (US National Archives).

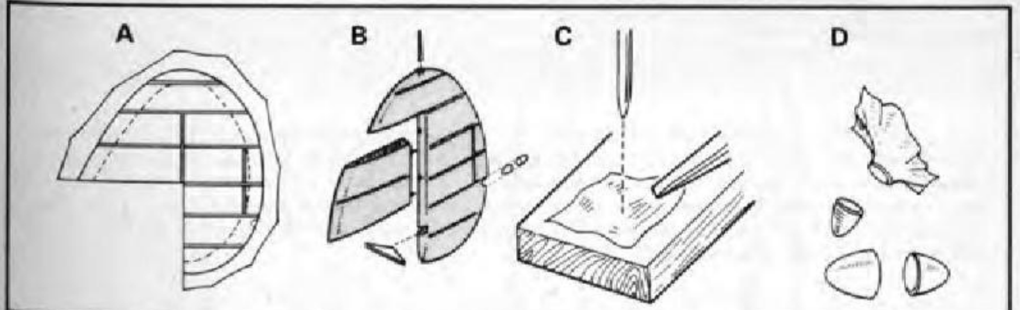






ABOVE: Making fairings and fillets in plastic card; such items can of course be made by filling and sanding but in many cases, especially with the larger scales, a moulded item is superior and this is especially true when several fairings of the same size are required. The sketch takes a typical cantilever monoplane of the late 1930s when large wing fillets were common. The first drawing represents the front view of the aircraft at the port wing root; the second drawing shows in plan view the various measurements that will be used in the process which follows. The principle is to make a streamlined fillet by merely pushing a cross section through a 'female' mould, the natural action of the heated plastic forms the shape. This method can be very successful but there is much trial and error before the technique is completely mastered. The 'female' mould is shown in sketch 1; the moulded article provides the fillets for both wings so that the mould is actually a double mould, the top half representing the left wing fillet and the bottom half (inverted) the right wing fillet. The final moulded shape is cut in half. The length A is determined by measuring the full length of the fillet along the side where it joins the fuselage (see top right drawing). The depth is twice the height of the fillet as shown in the front view (top left). This is not the size nor shape which is cut out of the 'female' mould, the size and shape of the cut is determined by using the measurements half way between the fuselage joint and

spot where the fillet reaches on the wing. This is the form B. Note sketch 1A which is an end elevation of the 'female' mould and it will be seen that the entry hole on the left has started as shape B but has widened out by cutting and sanding to a larger entry hole. This is to enable the plastic to form a rounded shape when passing through. Sketch 2 shows the 'male' mould; the actual former on the end is the shape C which represents the size and shape of the fillet at its outside limit (see top two sketches). The web behind the former merely ensures a correct 'tail' to the fillet and the cross member ensures that it only passes through to the correct depth. Should the above appear confusing, look at sketches 3, 4 and 5 and it will be seen what happens when the moulding is made. Sketch 4, in particular, shows the action clearly (this is in cross-section). The thick black line represents the plastic card. After forming, the fillet is trimmed (note extra bit left on at nose of fillet) and then cut carefully in half to form two fillets. The nose piece is used to pass under the leading edge of the wing joint and the under surface can either be filled or skinned over with 5 thou card. Any gaps can be filled and sanded. In its simplest form this technique is ideal for making small fairings around undercarriage members or struts, as in remodelling the Lindberg Curtiss BF2-C.

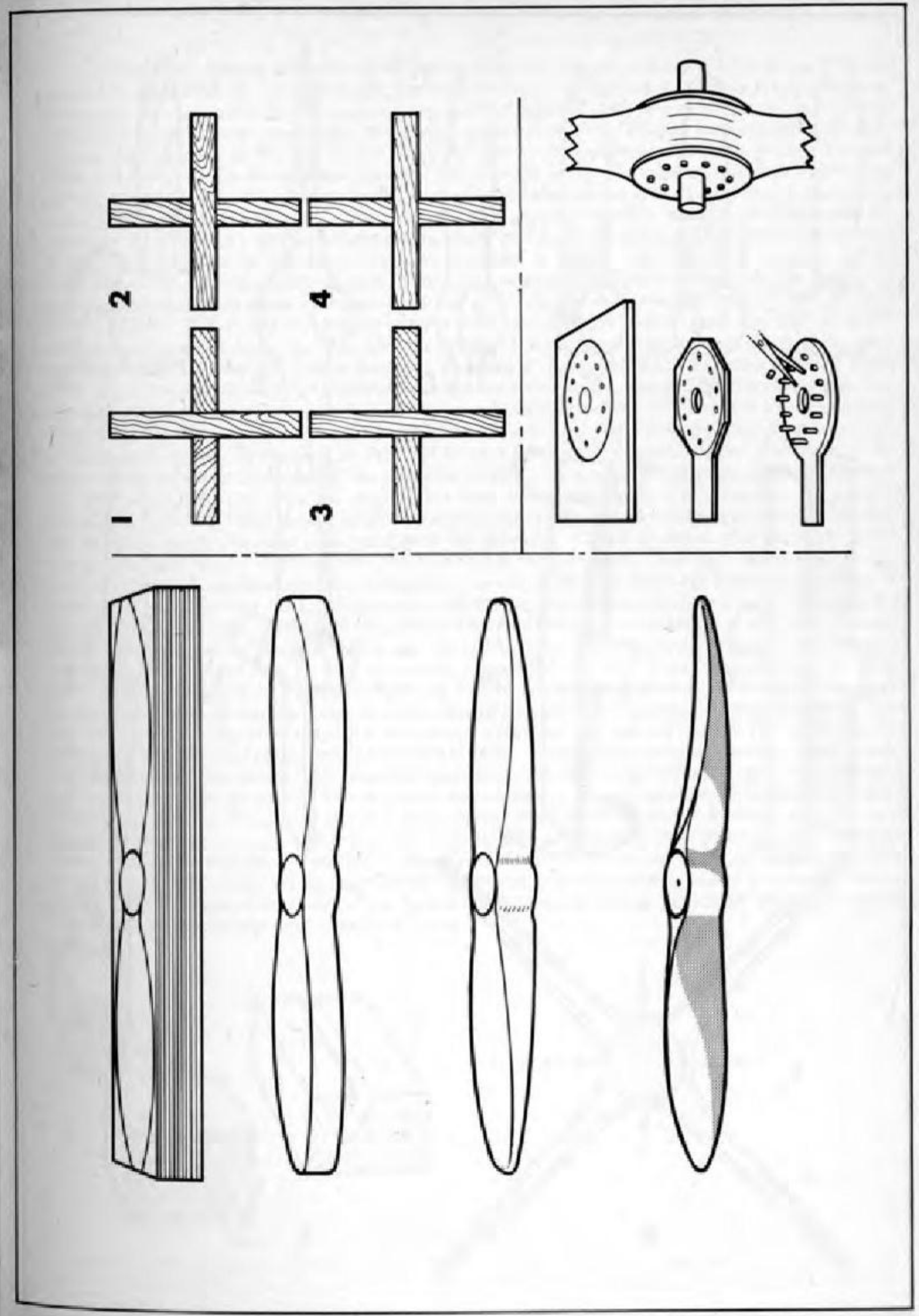


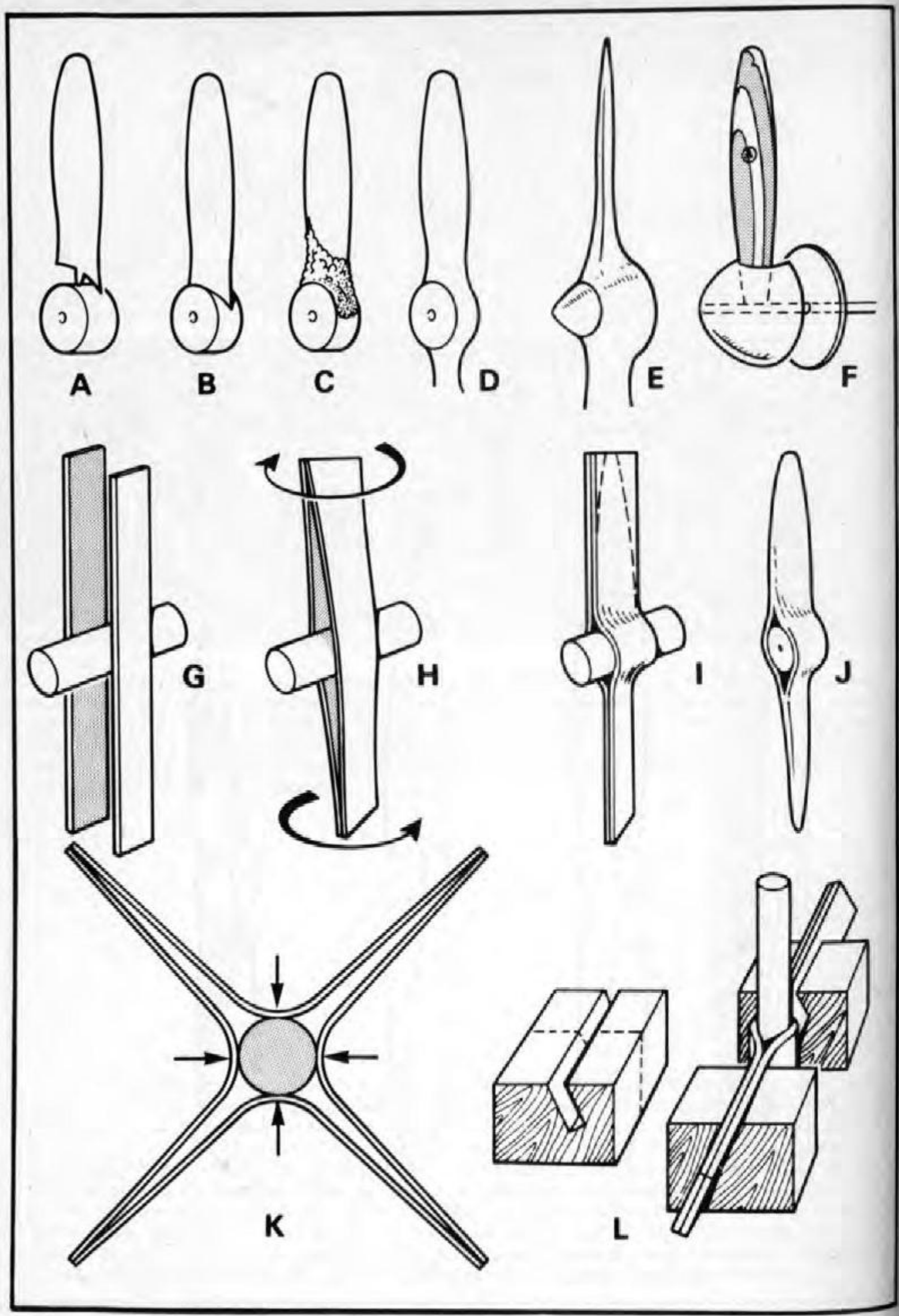
ABOVE: Vertical and horizontal tail members can be made in the same way as wings, however, when the leading edge is curved the item is made from two pieces of plastic card as shown in sketch A where the outline is traced on to the card complete with rib lines. The outer rough line shows the area to be cut away. The dotted line shows the area of the balsa core whilst sketch B shows the general development of a typical vertical fin and rudder group. The cut away of the rudder from the vertical fin must be carried out with a very sharp blade. The 'leading edge' of the rudder is then sanded to the shape shown and joined to the vertical fin with plastic sprue pins.

Sketches C and D show methods of making such small items as tail lights and wing navigation lights. The 'male' mould is merely a wooden toothpick with the end blunted somewhat. A piece of thin acetate sheet is heated whilst held by a pair of tweezers. When it sags it is quickly laid over a piece of soft balsa wood and the 'male' mould forced down upon it. The 'male' mould will form the shape by sinking into the soft balsa and with practice three or four mouldings can be made with one heating of the acetate. Sketch D shows how the moulded shape first appears and the actual light cover cut away. The torpedo shaped navigation lights can be made by sticking two halves together; if one is cut a little shorter than the other it is possible to make the front part fit into the rear. It goes without saying that a mounted magnifying glass is required to shape and assemble these small items.

ABOVE: The propeller on a 1910 Avro 'D'. By this time propeller making had become a very skilled trade and many were masterpieces of the carpenters' art. Detail of Green engine piping is well shown here as is the tubular radiator. Streamlining was a refinement yet to come, the main thing was to get an engine reliable enough to get the aircraft in the air and keep it there for a while. Green built some of the most successful of the pre-1916 engines which were used extensively in Britain prior to the Great War ('Flight International').

OPPOSITE: The various stages in making a propeller using wood or plastic card. The most important thing to remember is to ensure that the laminations are firmly stuck together. For final shaping a set of fine files is invaluable. At top left is shown the stages in making up four bladed propeller. (1) First layer consists of one vertical and two half horizontals. (2) Second layer reverses the procedure. (3) and (4) The following layers: note the direction of the grain when wood is used. At top right can be seen the stages in making the boss plate. When the initial small holes are made with a hot needle, they are refined with a fine rat tail file. The small pieces of heat-stretched sprue representing nuts and bolts should be cemented so that the 'bolts' pass right through the boss. Later, when completely fixed, the under surface can be sanded smooth. An alternative method for producing the small discs is to utilise a leather punch. The disc can be held by sticking it to a piece of clear adhesive tape.





OPPOSITE: Making propellers from plastic card; alternative methods. The techniques shown here are suitable for 1:48 and other scales, particularly for 1:72. Sketches A - D show the development of a typical wooden airscrew. The boss is a slice of round section sprue or a tight roll of 5 thou plastic card. It can also be made from balsa. The blades are cut from 10 or 20 thou card depending on scale and are stuck in place at the appropriate angle and left to dry overnight. The bases of the blades are filled out with Polyfilla or Brummer Stopping and allowed to dry thoroughly. The final shaping and refining is carried out with sandpaper only, the propeller being given a coat of dark brown enamel as a primer and then sanded with very fine 'wet and dry' paper. Propellers made in this way have the advantage of having very fine and sharp blades which is as it should be for the real thing was thin and sharp, unlike the heavily oversize parts often supplied in plastic kits. Sketch E shows a typical streamlined-boss propeller which is made in the same manner as the previous example, the boss being suitably shaped and the blade base lines being cut at the correct angle (make a dummy card template for the blades). Sketch F is the familiar spinner seen on German Albatros types, etc. The spinner is moulded and two holes are made to take the blades. A shaft from sprue is stuck inside the spinner which can be filled with Polyfilla or Brummer Stopping to take the blades. Note that on many types there was a considerable cut-away behind the blades as shown in the sketch. Sketches G to J show the development of the simplest method of making two bladed propellers. The boss is a length of plastic sprue of correct circular cross-section. It is cut at least 1 inch long. The blades are made from two strips of plastic card (at least 20 thou but 10 thou can be used for small 1:72 scale models). The width of the strips should be about the width of the propeller as shown in a scale drawing side elevation plus half the width again. The two strips are stuck to the boss in the centre as shown in sketch G, making sure that they are parallel. These should be allowed a good time to dry otherwise they may move from their true position during the next phase and spoil the propeller. Sketch H shows that the ends of the 'blades' are now nipped together with the fingers and twisted gently until they tend to stay in the twisted shape. The ends are then stuck together. Cement is then run down the length of the blades as shown in sketch I so that the rough propeller is firm with only a gap at the base shown in black in the sketch. This gap is filled tightly with Polyfilla or Brummer Stopping and allowed to dry for at least six hours. The front part of the boss is then cut off flush with the front of the propeller and the rear part acts as a handle for the final shaping procedure. The propeller is then placed face down on to some fine 'wet and dry' paper and sanded so that the front is completely flattened out; the blades can then be roughly shaped by cutting away first the corners with a pair of scissors and then paring the rest away with a blade. The final shaping is carried out with fine 'wet and dry' paper. The last act is the removal of the rear part of the boss which should be cut cleanly with a sharp blade and a central shaft hole made with a hot needle. This hole does not need to go all the way through but just sufficient to take a piece of sprue as a shaft. The propeller now requires a coat of dark brown primer and is then finished off with the finest 'wet and dry' paper before final painting. Sketch K shows how the same system can be used to make a four bladed propeller, with a view of the front showing the four blades bent at right angles and stuck to the boss at the middle. Sketch L is a simple rig for the propellers whilst drying out. A balsa block has an angle cut as shown and is then cut into halves or quarters and stuck on to a base. The slot should not be too narrow for it is meant merely to support the blades and to ensure that they dry at the same angle to the boss.

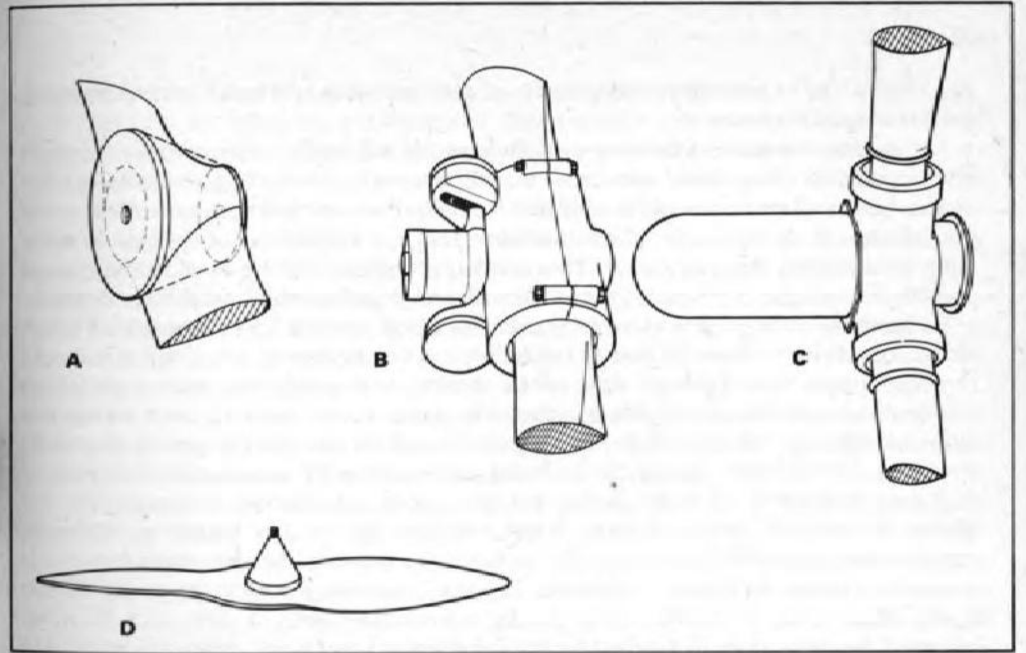
ABOVE: Garuda propeller on a captured Fokker EIII. Note typical 'butter pat' shape of this airscrew used on most of the early Fokkers. The trade mark is a cross patée on a white circular field surrounded by the letters 'Garuda Feldpropeller'. Garudas were made from layers of mahogany.

RIGHT: Striated propeller of Albatross D.V (serial number D2129/17) captured in July 1917. Note trade mark on blade which consists of a capital 'A' superimposed on a white circle with the letters 'XIAL' under the cross stroke of the 'A'.

ABOVE: A good example of a flat conical boss carved integrally with propeller. Early Armstrong Whitworth aircraft used this type of propeller seen here on an Atlas General Purpose machine of No 4 Squadron in the early 1930s (MOD).

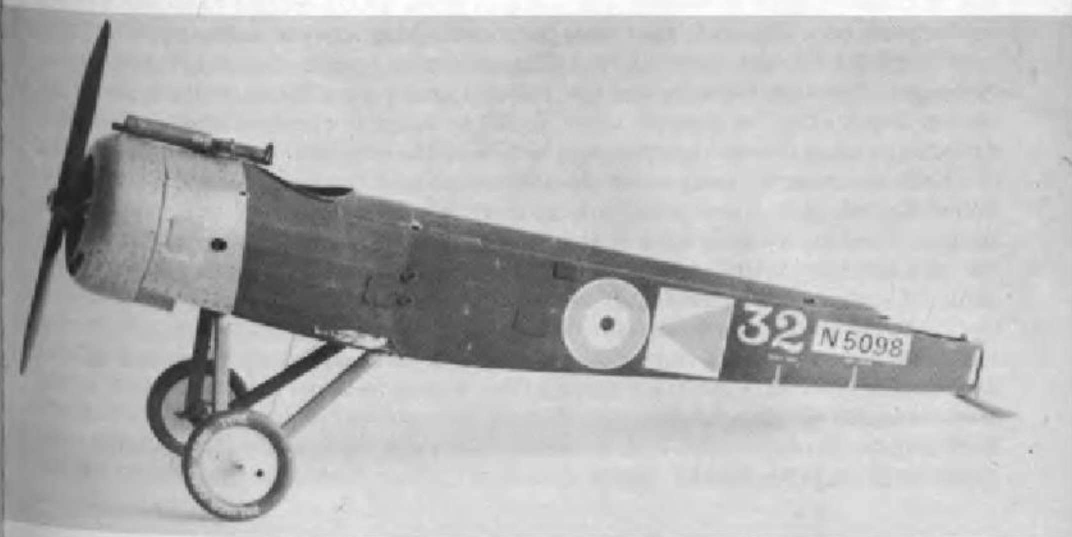
RIGHT: Wolff propeller on AEG GIII. This is the famous No G105 captured on December 23, 1917. The diameter of the Wolff propeller is 10 ft 3·8 inches and is made of laminations of walnut and mahogany making it rather dark in appearance. Radiator was of vertical tube type with adjustable shutters in front (Imperial War Museum - Q55028).

ABOVE: Typical metal propeller of the 1930s is shown here on a Curtiss 02-C1. The trademark indicates that it is a Standard Steel Propeller; note usual US Navy painted tips (from tip in: red, yellow and blue). 'Standard' trademark is dark red ellipse, with yellow lettering and yellow propeller. This type of propeller was used extensively by US aircraft in the 1930s (Smithsonian Institute). BELOW: Author's fine model of the Curtiss BFC-2 in 1:48 scale carries a propeller similar to the type shown above.



Some typical propeller bosses of the period 1925 to 1935: (A) Wooden airscrew with tapered boss. (B) Two bladed airscrew with variable pitch gear. (De Havilland type showing counterweight bracket and thrust assembly.) (C) Hub of three bladed Rotol type showing deep domed housing for reduction gear. (D) Early type of flat pressed metal airscrew (seen mainly on Continental aircraft of the late 1920s and early 1930s).

BELOW: Close up of Sopwith 1½ Strutter to show moulded cowl, engine (Airfix Bristol Bulldog engine with alterations) propeller and undercarriage. 'Palmer Aero Cord' marks are from Letraset sheet (small instructions and patent group at bottom), washed over with very thin grey paint (otherwise the white will be too bright).



The system can be used when using layers of plastic card as it is easier to cut strips than cut out a series of crosses.

An easier method of building propellers which is suitable for certain cases is where the original had a large hub, sometimes shaped in a part cone to help streamlining. The system here is to make two identical blades from 40 thou card and then stick them to the hub which is made separately. The blades when firm can be filled out at the base by using filler as shown in the illustration. This system, of course, can be used in the case of propellers carrying spinners whilst the modern all steel propeller is built from separate items.

Many wooden propellers were fitted with metal covered tips, the shape of which varied considerably. These of course can be reproduced by careful painting but it should be remembered that although these metal sheaths were made from such materials as copper, brass and other malleable mixtures, the characteristic lustre of these metals was soon lost through weathering so the impulse to use bright metallic paints should be restrained. The metallic enamel can be toned down a little by adding a small amount of dark grey and, when the paint is dry, use the carbon rubbing system described in the section dealing with special finishes. Many propellers, particularly French and German, carried a manufacturer's trade mark in the form of a transfer (the early word for what is now more commonly known as a decal). This was invariably placed in the centre of each blade. Whilst it is not possible for this to be reproduced exactly in 1:48 scale it can be suggested by using parts of Letraset (or similar dryprint) sheets (eg, white full stops) and with the aid of a fine mapping pen and black ink. Serial numbers were sometimes apparent, usually near the boss and these can be added to the model propeller by using the very small white trade and patent lettering and numbers at the bottom of most Letraset sheets. The numbers are frequently punctuated by diagonal strokes which follows the propeller serial number as well.

Quarter (1:48) scale is large enough for the propeller boss plates to be represented by more than just a blob of silver paint. Boss plates changed little in appearance whilst wooden propellers were in use. They consisted of a flat steel disc (of dull metal appearance, not chromium plate!) perforated with a ring of holes for the holding bolts and a larger central shaft hole. The shaft sometimes protruded a long way and was sometimes fitted with 'dogs' for use with Hucks starters. The creation of a plastic disc of such small size is not such a formidable task as it might at first appear to be. The illustrations show the various stages, using the principle which should be adopted whenever small components are being made, a 'handle' is left on the item until the very end. The small holes to take the bolts are made by using a very warm (not too hot) fine needle and they are made before the hub plate is cut away from the sheet. A simpler but less effective plate can be made by punching small discs out of plastic card with a leather punch, and then suggesting the nuts and bolts by impressing a needle through one side. This makes a 'pimple' in the card, the needle not being pushed all the way through. This is done with a cold needle.

The modern all metal propeller is comparatively easy to make, two or more blades being cut from plastic card thick enough to produce the shape which becomes circular in cross section near the boss. The method is the one used whenever several items are to cut from card and all must be identical. The requisite number of layers are lightly stuck together and the item shaped as one unit (this, of course, refers to the main outline). The items are then separated and shaped individually. The cylindrical centre section can be made from sprue the shaft hole being made by the hot needle method.

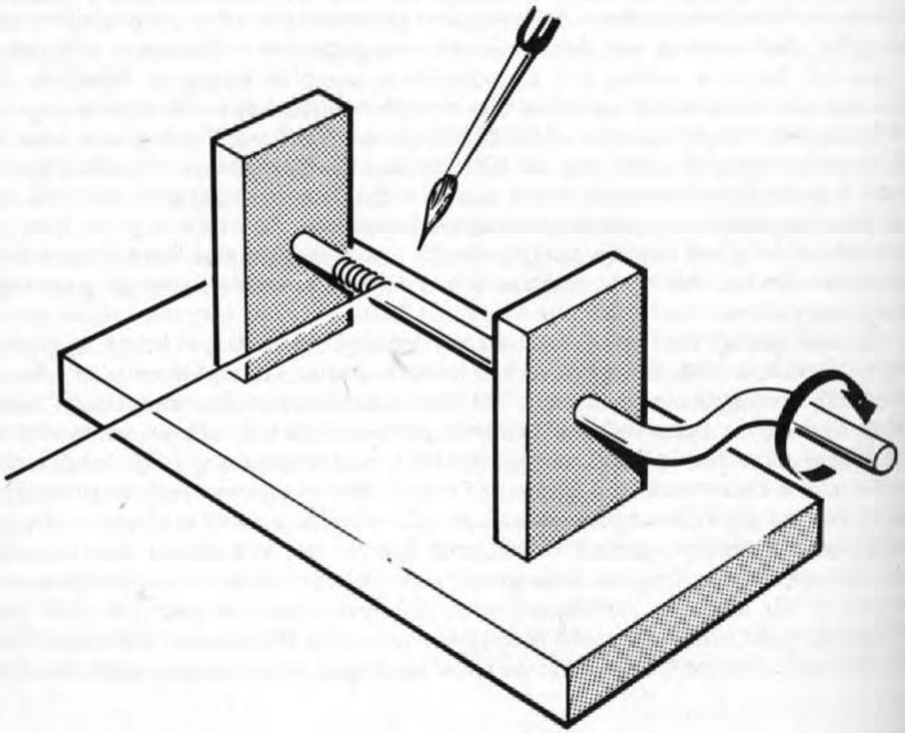
Spinners are made by moulding and they are quite easy to do. In some cases the carved fuselage should include the spinner and this can be used as the male mould. Otherwise it must be carved separately in which case it is easier to start with dowel, and balsa dowel is the easiest to carve. It is available from shops selling materials for flying models. A lathe is, of course, invaluable but by fixing the block on the end of a drill and inserting the drill into the jaws of a hand drill which is fixed in a vice, a simple but effective 'lathe' can be provided, the main shaping being done by varying grades of sand-paper on a block.

Engines: The profusion of detail which existed around the nose area of the earlier aeroplanes can easily be reproduced in 1:48 scale. Up until the early 1920s engines of the inline type were frequently partly exposed (in earlier days they were often totally exposed). Lines of cylinders or just the heads could be seen, also exhausts, inlet pipes and rocker arms and the items associated with the cooling system. The air cooled rotaries and radials were either totally exposed or enclosed in some form of cowling.

For literally generations, model engine cylinders have been made by wrapping black thread around a core, regardless of the scale. Apart from 1:72 models this system can still be used effectively except that cotton is not satisfactory for any semblance of reality and black or silver sprue can be substituted. Old habits and the plastic kit have left many modellers with the impression that cooling gills (for that is what the binding is supposed to represent) are large and thick. In some kit engines in 1:48 scale only about six gills are present on each cylinder. In fact the thickness of the gills on a cylinder reduced to 1:48 scale is very slight indeed. This is where fine heat-stretched sprue is very useful for whilst the old system of winding is still employed the material is a fine shiny sprue 'thread' in black or silver finish to suit the colour of the original. The method used is to build a cylinder mill which is nothing but a crudely built winch as illustrated. When the first results are seen the modeller may think that the 'gills' are too fine but he should forget kit models and refer to photographs of actual engines or to the real things seen in some aircraft museums. To give some idea, the RAF 1a engine which powered the BE 2c had 23 gills to 7 inches of cylinder, and at the outside circumference of the gill it was 1/16 inch thick! Doubters should try reducing this actual size to 1:48 scale. Of course the ideal way to reproduce the gills is to place one tiny disc on top of another, each alternate disc being of a smaller size but this is not practicable in 1:48 scale or smaller, although quite easily done in larger scales.

A more perfect method of simulating cylinder gills is to wrap a length of sprue (it must be circular in cross section) with the finest fuse wire. Great care must be taken to see that the binding is close and tight. The bound sprue is then laid in a 'trough' which need be nothing but a groove forced in a small piece of thick balsa. This is not to stop the sprue rolling about but to stop it sagging, for the bound sprue resting in its trough is then placed under a kitchen grill and allowed to remain there under moderate heat for about one minute. The grill is then turned off and the sprue must be allowed to remain untouched until it has completely cooled off (allow a full five minutes at least) and then drop it in some cold water. What happens to the sprue under the heat whilst it is bound tightly with fuse wire is that it softens considerably whilst the wire expands slightly. The soft sprue then fills the gaps between the wire binding and as it cools off it retains that shape. When the wire is later removed the sprue has the *inside* impression of the binding which is a sharp

BELOW: Cylinder mill; this need be nothing but a crude 'knock-up' made from balsa wood. The principle is the same as that described elsewhere for making small coiled springs but the tension required for the springs is not necessary here. One end of the sprue is stuck to the core and allowed to become firm. A few turns are made to get the sprue in position and then the tight turns are started. After about 5-6 turns the loops should be pushed close together with the fingernails and the turns continued, stopping after every 5-6 to close up the loops. Watch carefully for the end of the sprue slipping through the fingers and when it is near, stop winding and fix the end in place with a drop of cement and hold it until it is firm. It is safer to put a piece of adhesive tape over to make sure, otherwise if it comes loose the whole coil unravels itself. To fix the coil to the core the thinnest cement is used. The core is wound fairly fast and the brush, loaded with thin cement is allowed to skim the surface for the full length of the coil. This imparts a very fine deposit of thin cement over the entire coil which dries quickly. Leave it for a short while to completely set and then check for areas where the coil may be slipping and touch up with cement. It does not matter if in one or two places the coil is spoiled for these sections can be discarded when the coil is cut into lengths to represent the cylinders.



Forming cowls is a very easy matter with plastic. At left are seen the balsa male mould made from a piece of balsa or hardwood dowl and shaped correctly, the balsa female mould, and the moulded product before trimming. Note that the male mould has a small pin inserted at the dead centre of the circle. When the cowl is moulded, this pin causes a tiny nipple to be formed which is used as a guide for the dividers when cutting the apperture. The cowl is replaced on to the male mould for support, and a pair of dividers are used as shown above to describe a circle of the correct diameter (actually just a tiny bit smaller to allow for cleaning up the cut with 'wet and dry' paper later). No attempt should be made to cut the circle out in one go, the dividers should be revolved several times so that the disc practically drops out. Other cut outs in the cowl such as those on some rotary engined aircraft should be made by making holes at the extremities of the cut out and then cutting the sides with a blade.

On this page can be seen (above) the actual cowl moulding process in operation, with ordinary office spring clips holding the plastic card in place over the 'female' mould. In this instance the cowl from a kit, fitted over suitable dowelling, is being used for a 'male' mould. At right can be seen the moulds, a moulding, and a completed cowl.

outer perimeter. The reader should try to imagine this and the principle will be understood. It will be seen that without the supporting trough the sprue, despite the wire binding, will sag. This method takes some time to prepare but the effect is quite startling. The great advantage apart from the fact that it is more like the real thing is that extra shaping can be done without any danger of the binding of the other method coming adrift.

Aeroplanes with inline engines call for more work from their modellers for there is a radiator, its piping, and more often than not a number of louvres of varying shapes and sizes. The illustrations show how these items can be made but the very small louvres can best be made from short length of sprue ensuring that they are correctly lined up when stuck to the surface. The radiator must be complete with its up and down water piping and overflow pipe. The piping, also the fuel lines, can easily be made from heat-stretched sprue but copper wire can sometimes be used with some advantage. The only difficulty is that it is not always easy to stick it to plastic. Intake pipes can usually be made solid from sprue but exhaust pipes must have open ends. A solid ended exhaust pipe on a 1:48 scale model is not very satisfactory. The illustrations show the different types of exhaust, and also how the pipe can be made. The tubing is supplied by the empty ink containers of ball point pens. It should be noted that due to the different qualities of the plastic used by the pen manufacturers, some plastic is more suitable than others. It is a case of trial and error. It is quite possible to install plugs and leads on cylinders and they do tend to make the engine more detailed. The simplest way is to draw a length of white sprue, paint all except a small section at one end in black, bend the white end over with tweezers and stick this to the cylinder. The remaining 'lead' is then trimmed to the required length.

When building up radial or rotary engines the crankcase can be made from a sprue wheel left over from a kit, with the outside perimeter flattened. This ensures that a perfectly circular base is provided for the cylinders and a separate front plate can be fitted to hide the wheel. The central hole for the propeller shaft is, of course, already provided in the wheel.

Cockpits and Interiors: It goes without saying that there is little point in furnishing detail which cannot be seen when the model is finished. However, when it comes to modelling the cockpit it is surprising how much detail which should be seen is not depicted in kit-built or scratch-built models. The tendency in the past was for a seat, rough dashboard and something representing a control column. Now, with all the reference material available there is no excuse for skimping this most vital area. The cockpit is the focus of attention as far as the viewer is concerned. At any exhibition of model aircraft people will always peer into the 'office'. There is one thing that should be mentioned at this point, and that is that whilst it is very desirable to obtain good pictures or diagrams of cockpit layouts it is not always possible to do so especially with the less well documented aircraft. There is one type of modeller who will take the search for reference material to the extreme and will not even attempt a model until every area has been covered by photographs or drawings. In a sense, he is almost as bad as the man at the opposite end of the scale who does little or no research. The tendency of the former is to continually search for photographs until the search itself becomes an end in itself, the model never being built. It must be recognised that in many cases complete coverage cannot be achieved in which case the modeller must use his powers of improvisation which, after all, is one of the chief characteristics of the true modeller. If detail on a dashboard cannot be found an improvised fascia should be made by reference to those of contemporary aircraft.

The inner sides of the cockpit are very important, especially in slab sided aircraft models with large cockpits, as a great deal can be seen. Stringers and cross bracing should be represented by pieces of heat-stretched sprue, and care should be taken to include any extra members which support instruments and controls. The inner surface should also be painted to represent the material used in the construction of the original which could be fabric, plywood or metal. Whilst the colour of the paint used in later aircraft, is known, the modeller should use his imagination as far as earlier machines are concerned. Plywood covered areas remain merely varnished whilst fabric should be painted the same colour as that of the outside with a small amount of brownish-grey added. Neutral tints are best as they are vague and do not look wrong in most circumstances. Dashboards vary enormously and in the earlier days they did not exist at all. Instruments, such as they were, were attached to any convenient member and were frequently sited outside the cockpit area altogether.

The illustrations show how different types of instrument panels can be made and a representative selection of instruments.

The padding around the cockpit edge or 'coaming' varies according to the period and type of machine. On some very early aeroplanes it was either absent or considerably exaggerated. During the 1914-1918 war the typical coaming consisted of strips of leather enclosing some type of padding material, the leather strip being tacked down to a wooden framework. Later, the covering was one piece and occasionally was riveted down, depending on the base material. Many primary training machines had substantial padding, especially around the forepart of the cockpit rim for obvious reasons. Good examples of this can be seen in photographs of the Tiger Moth and the Consolidated NY-2 trainers. Due to the many unfortunate injuries sustained by pilots during the 1914-1918 period, padded blocks were also fitted to the butts of machine guns which, because of the need to clear blockages, etc, were placed very close to the cockpit (indeed, in some cases they were virtually in the cockpit).

Old traditional techniques and the plastic kit are once again guilty of perpetuating the mythical cockpit coaming which usually appears as if an inflated inner tube of a cycle wheel had been fixed around the cockpit. The coaming should be slight and unobtrusive and apart from the cases where the original had a very bulky coaming the following procedure will suffice. The rim of the cockpit should be lightly sanded to ensure that it is smooth and the fuselage painted in its finished colour. Using a fine brush, the rim inner surface and the small area of the outer surface should be painted with a thick line of dark brown or dark grey enamel (black should never be used, but see section on finishing for further comment on this). This should then be allowed to dry which, because it is thick, will take several hours. As it dries the paint will contract and then a second coat is applied. This is in turn allowed to dry and the final coat applied. This last coat can be a little thinner and semi-matt. When this has dried the paint will have built up into a moderately bulky rim which will also tend to wrinkle slightly thus giving the impression of the leather binding. The strips of leather can be represented by very lightly cutting through the painted coaming with a sharp blade, and studs or tacks can be marked on with a mapping pen. A heavier coaming can be represented by using heat-stretched sprue and sticking it

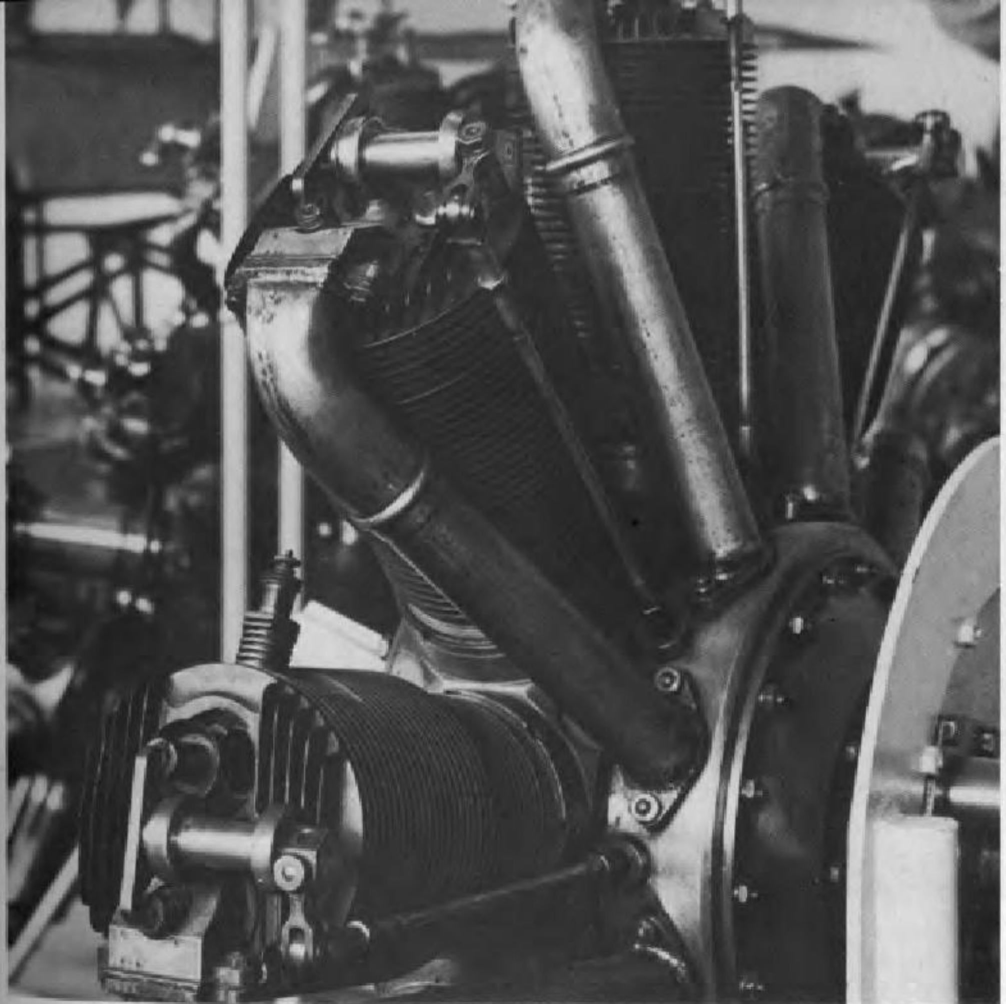
VICKERS VILDEBEEST: Note prominent collector ring and exhaust pipe of Pegasus engine arrangement typical of the period. Also many other details (FLIGHT INTERNATIONAL).

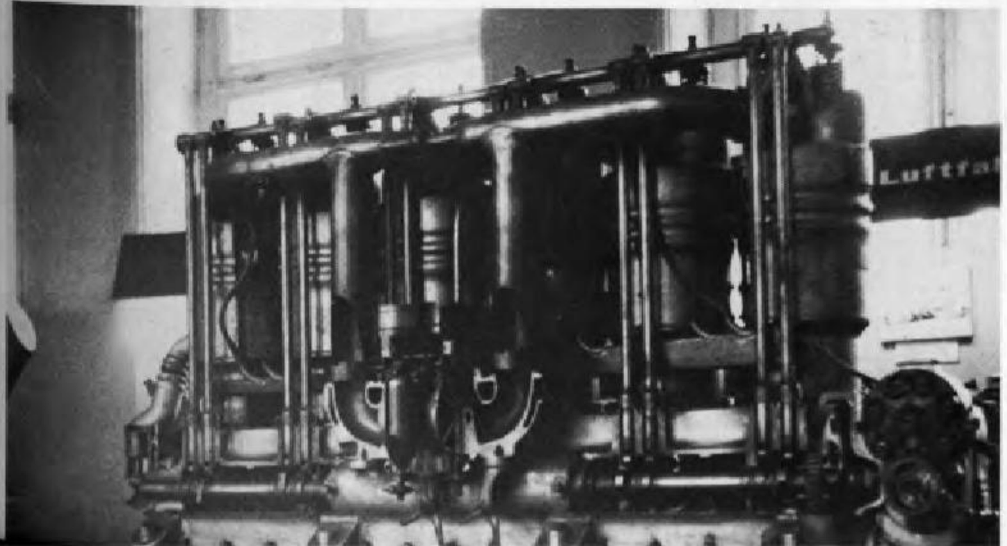
LEFT: Albatros CIII nose showing to very good advantage the mixture of plywood and metal common to many German aircraft of the Great War period. The synchronising gear can also be seen here as can the typical spring clip fastenings for the panels.

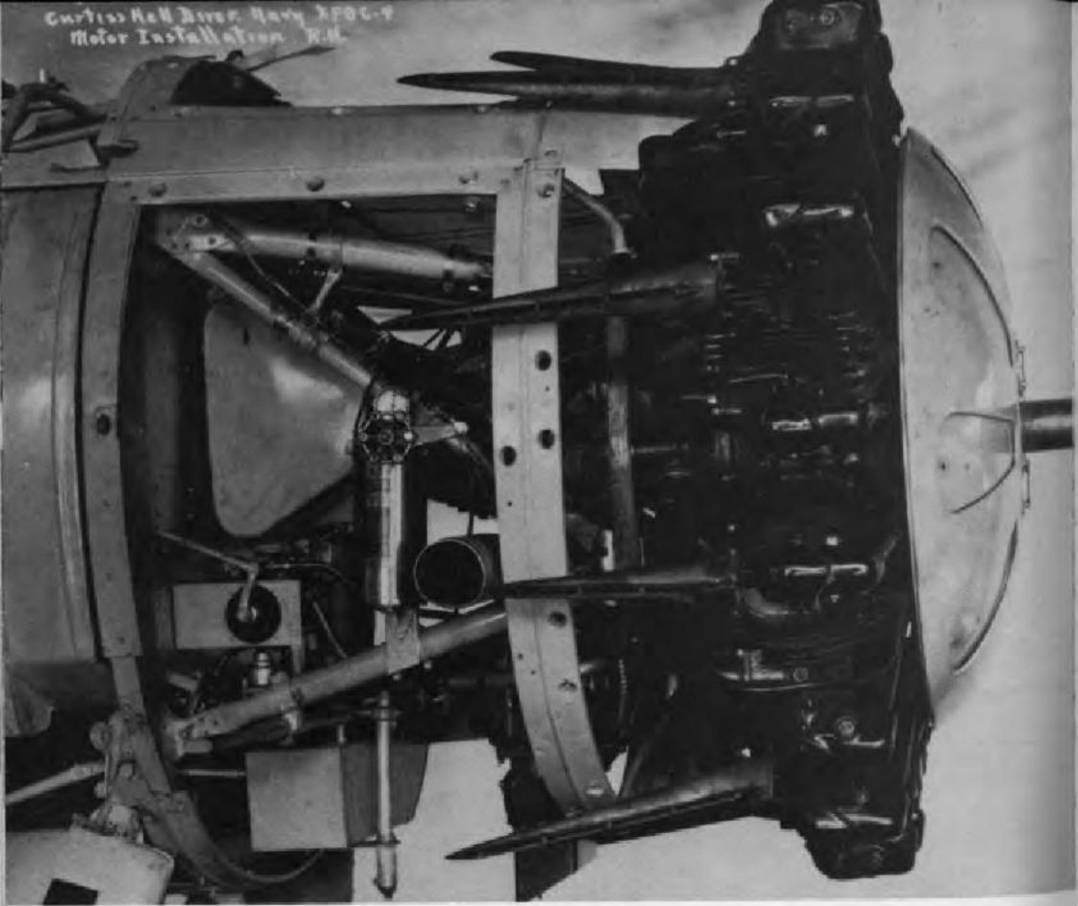
RIGHT: Back of Oberusel rotary engine in Science Museum, London. Model rotaries should always be made to revolve with their propellers. Basic components such as intake tubes, rocker arm gear and rods can be built into 1:48 scale models.

RIGHT: Nose of Breguet 14 shows typical louvred panelling common on many aircraft with nose radiator (IWM-Q58354).

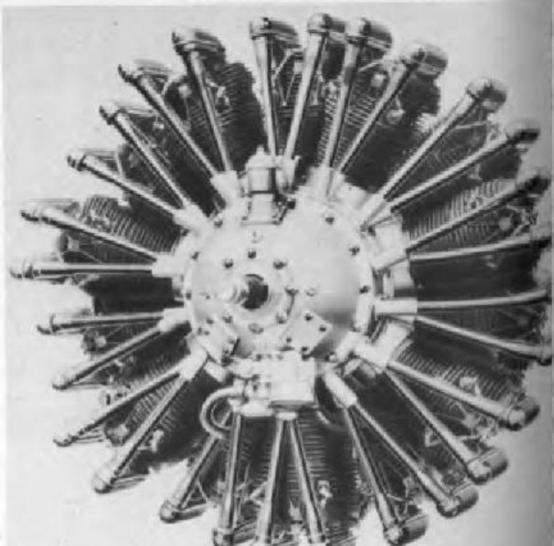
OPPOSITE PAGE: 145 HP Hiero engine in Vienna Technical Museum, with intake side shown here (cut away in places for demonstration), displays typical layout of most vertical engines of the 1914-1918 period and for some years later. As early engines were usually partly exposed it is necessary to build quite a lot of detail into them.



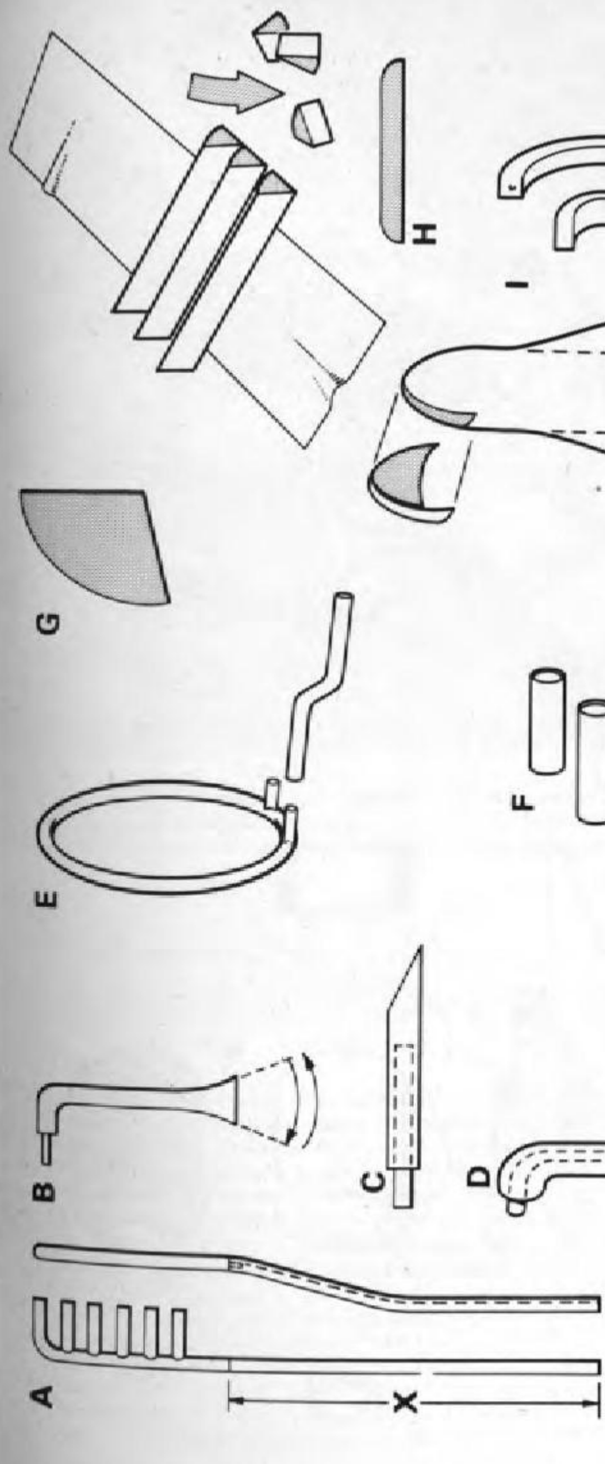




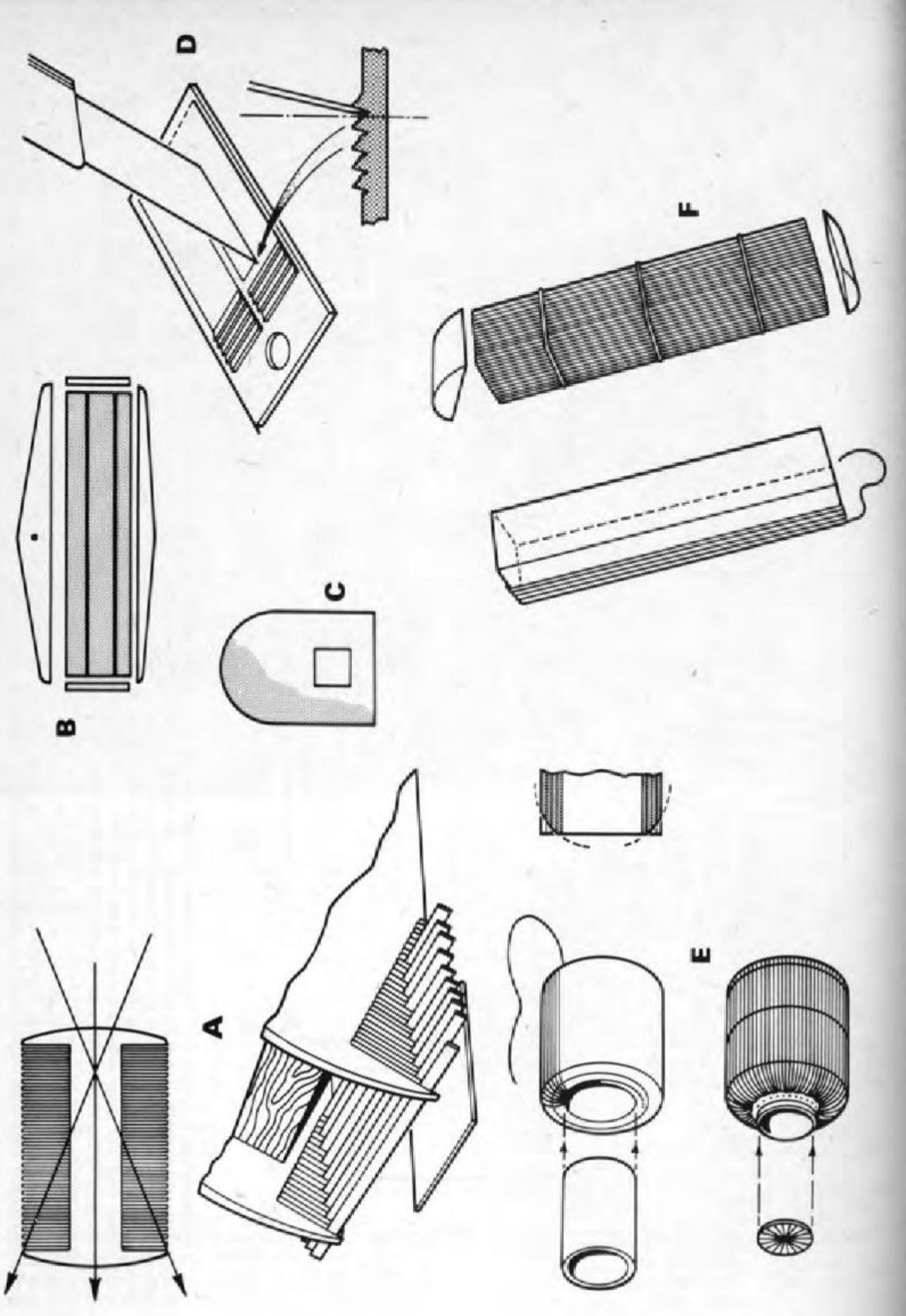
ABOVE: Typical of radial engines of the mid-1930s is this Pratt and Whitney R-1340-88 fitted to a Curtiss F8C-4. Note bayonet type exhaust pipes and engine front plate with louvres closed (US National Archives).



RIGHT: Armstrong Siddeley Jaguar III radial, is a good representative of a double banked cylinder design. It was a very much used engine which went through many phases of development throughout the late 1920s to the mid-1930s.

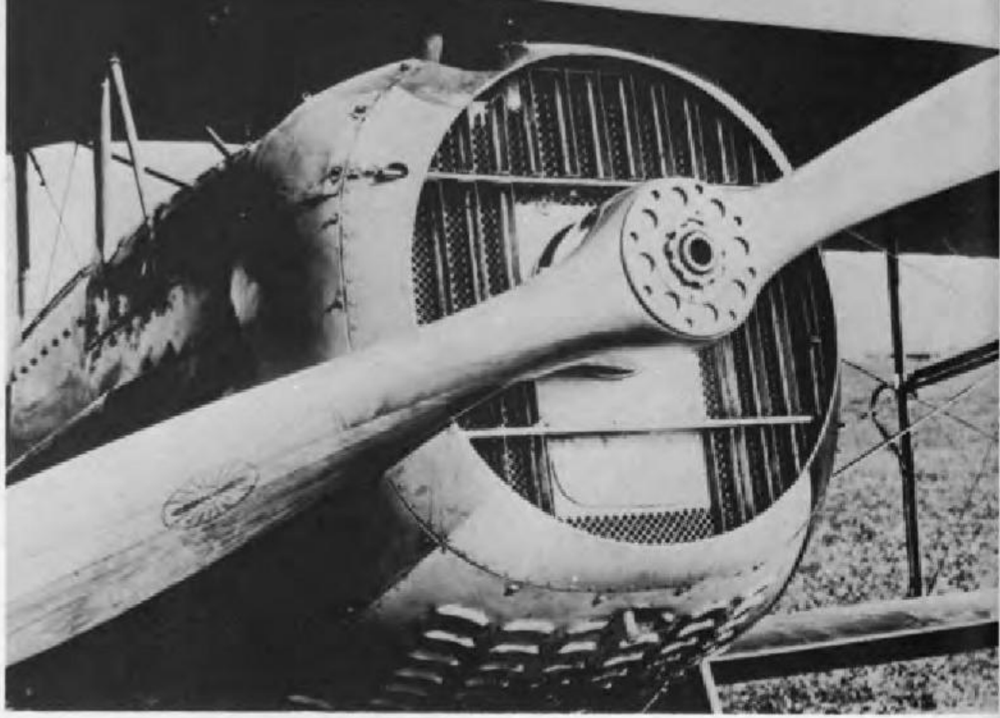


Exhausts and Louvres: *(A) Typical exhaust system and pipe. Outlets and first part of pipe made from sprue. Second part (section marked 'X') is hollow tube made from stretched ball point pen ink tube. After ink residue is removed the tube can be stretched in the same way as ordinary polystyrene although a little care is required as it tends to be more brittle. Very fine hollow tubes can be made this way. (B) Bell mouthed exhaust pipe also made from ink tube but not drawn too fine. The 'mouth' can be stretched a little with gentle levering. Note the sprue 'plug' inserted at the top end, as ball pen tube plastic (not the same as polystyrene) does not stick well with plastic cement. (C) Simple short exhaust outlet tube with angle cut. (D) Saxophone type made as B but with soft wire core inserted to maintain shape. (E) Collector ring and stubs to take hollow exhaust pipe. (F) Short plain exhaust outlets are merely pieces of tube fixed over sprue stubs. (G) Small louvres are best made solid. A piece of thick sprue is shaped to the cross-section shown, and drawn. Pieces are then placed on clear adhesive tape to hold them in position whilst cutting to correct length and the ends are rounded. These can be stuck on to surface flat or rounded. (H) Shows the correct shape looking into the 'mouth' of the louvres. (I) Small louvres or scoops can be made from thin plastic card with only a 'male' mould as shown. Other type of scoop requires small 'male' and 'female' moulds to incorporate the lip.*

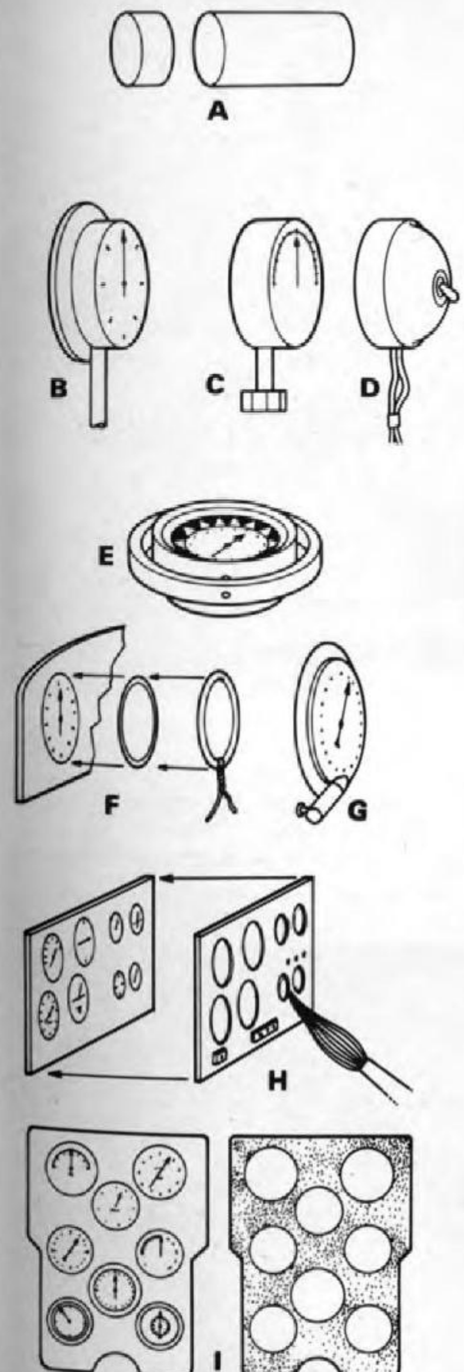


ABOVE: Author's neat model in 1:48 scale shows a multi-louvred radiator in the wing top surface made as detailed opposite. Note also the laminated propeller and the meticulously detailed engine. This is a Halberstadt D II, illustrated also in other pictures.

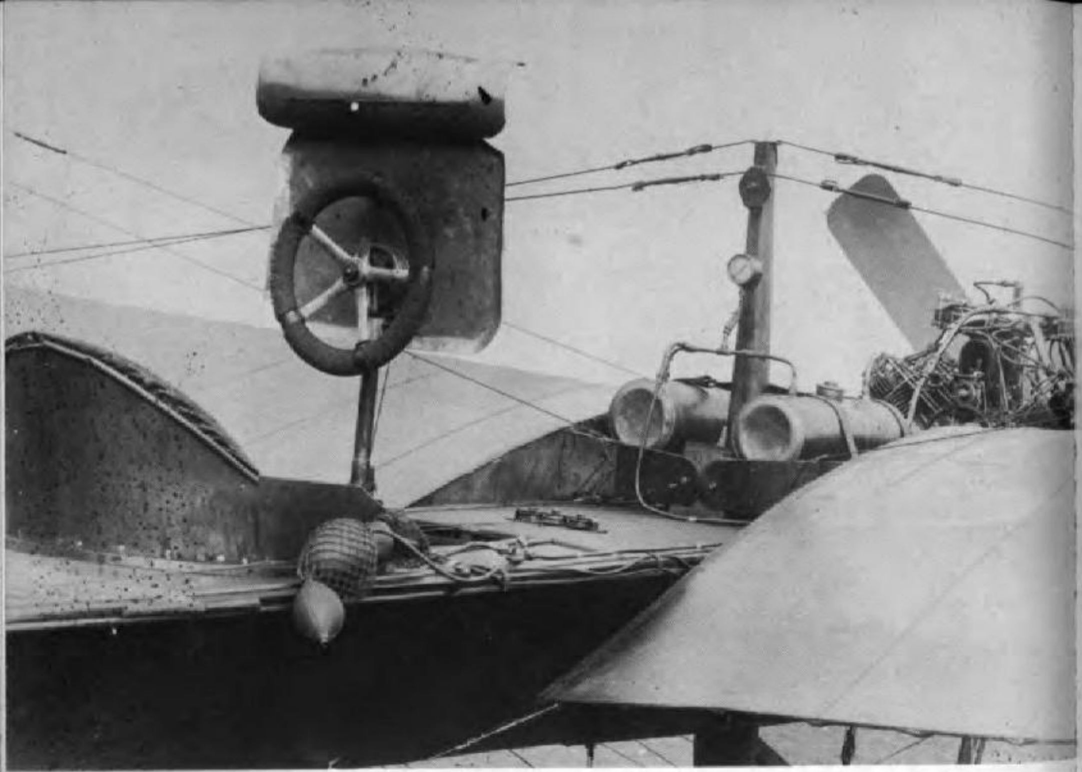
OPPOSITE PAGE: Ways with radiators. (A) An effective method of lining up radiator shutters is to cut an ordinary plastic comb (the double sided 'dust comb') as shown, and place a balsa spacer between the two triangular pieces. The shutters must be of equal width but of any length, and are slotted in the appropriate spaces between the teeth of the comb. The receiving surface is then coated with glue and the whole unit lowered into place and left to dry. The edges can be trimmed later. (B) Common type of radiator used by German aircraft mainly in later stages of the Great War, although seen as late as the mid-1920s. A rectangular of plastic card bound with nylon thread or fine sprue. (C) Car type of radiator; plastic card former covered with mesh. Best adhesive for this is plain varnish allowing at least an hour to dry before trimming. (D) Multi-louvred radiator cover common on German 1914-1918 aircraft; plastic card carefully cut with **sharp** *knife as shown. Painted with brassy paint and rubber over with pencil carbon. Note the hole for the overflow pipe. (E) Lamblin radiator used by many aircraft from 1918 to mid-1920s. This is a roll of thin plastic card, with edges rounded and thread wound around. A second cylinder is inserted as a core and the whole is painted with varnish to deal and fill gaps. Paint matt black-red. (F) Long box radiator is merely an open ended box wound with thread. Note the end pieces (this type was installed on the Voisin).*



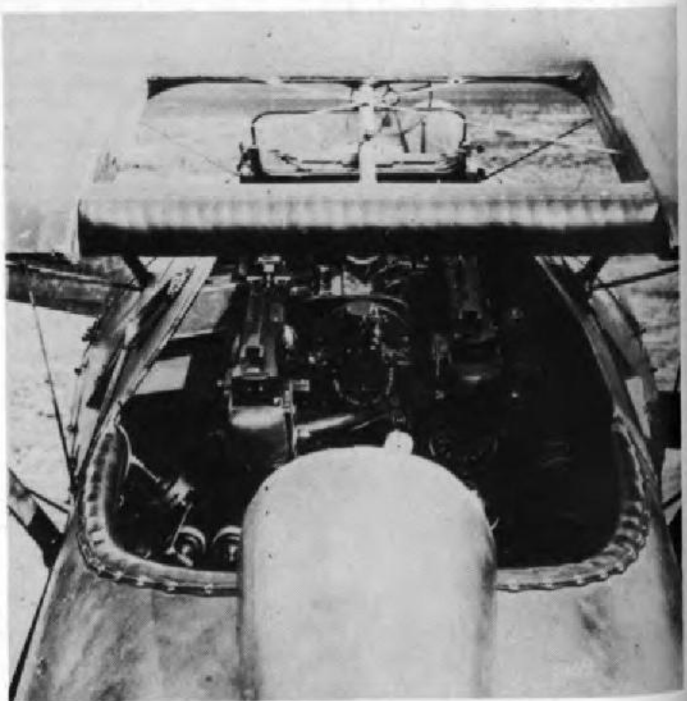
ABOVE: Close up of nose of SPAD XII shows radiator shutters in detail and meshwork behind. The propeller was geared as a 37 mm Peteaux gun fired through the hollow shaft. The SPAD XII carried a solitary Vickers gun for firing sighting bursts for the cannon. The tremendous recoil and slow rate of fire made this arrangement unpopular. BELOW: Wing mounted radiators should be visible on the under as well as upper surfaces of wings, as shown on this Albatros C.V (serial C1394/17) in May 1917.



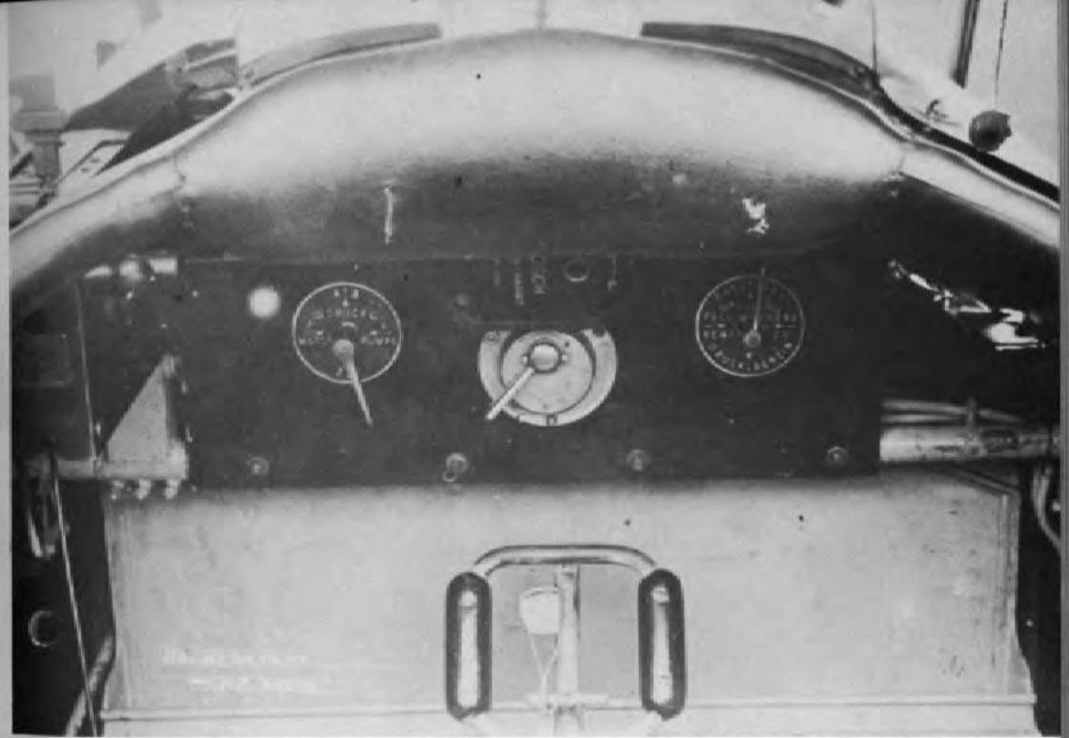
LEFT: Instruments in the early days were made by manufacturers who supplied equipment to the engineering trade generally, and some of the fittings would have looked more at home in a ship's engine room than on an aircraft. Most dials were heavy squat cylinders encased in brass. A simple way to represent these is to take a length of white sprue from a kit, ensure that it is circular in cross-section and paint it with 'brass' enamel. When dry, 'slices' can be cut off as shown at (A). These should be mounted on to a disc to form a flange plate and a and a conduit tube is fitted as shown at (B). (C) is an independent standing dial with nut and (D) is a typical domestic type electric switch with brass cap which was used until the mid 1930s on some dashboards. (E) is a typical aviation compass. (F) A method of modelling a dashboard when instruments are inset with black painted or brass rims is to use the white full stops from Letraset or similar dryprint transfer sheets. The black rim is a 'O' from Letraset superimposed over the white disc. Brass wire tightened around a former of suitable size and cut off at the bottom will provide a perfect ring which can be stuck over the white disc with varnish. The varnish giving the impression of a glass facing. (G) Early instruments were illuminated by small bulbs in holders fixed at the side of the instrument. (H) Later type of dashboard with instruments let into wooden fascia panel. Instruments are drawn on a rear panel of plastic card. The front panel is perforated to match the rear panel and painted to represent wood. Rims are then painted lightly with black or brass enamel. A panel of transparent plastic card can be inserted between the two to represent glass fronts. (I) Panel of Boeing F4B-4 made in the same way as (H) but the fascia is black crackle finish. Some 1:72 and 1:48 scale kits of recent issue include dummy dashboards on the decal sheets, as do some commercial decal sets.



ABOVE: Cockpit of 1910 Martin Handasyde monoplane illustrates the sparseness of the early cockpit. All that can be seen is a fuel pressure gauge and two rubber bulbs for pumping up pressure in the fuel tanks. The 'tea tray' on the control column was an optimistic attempt to protect the pilot from oil thrown back from engine ('Flight International').

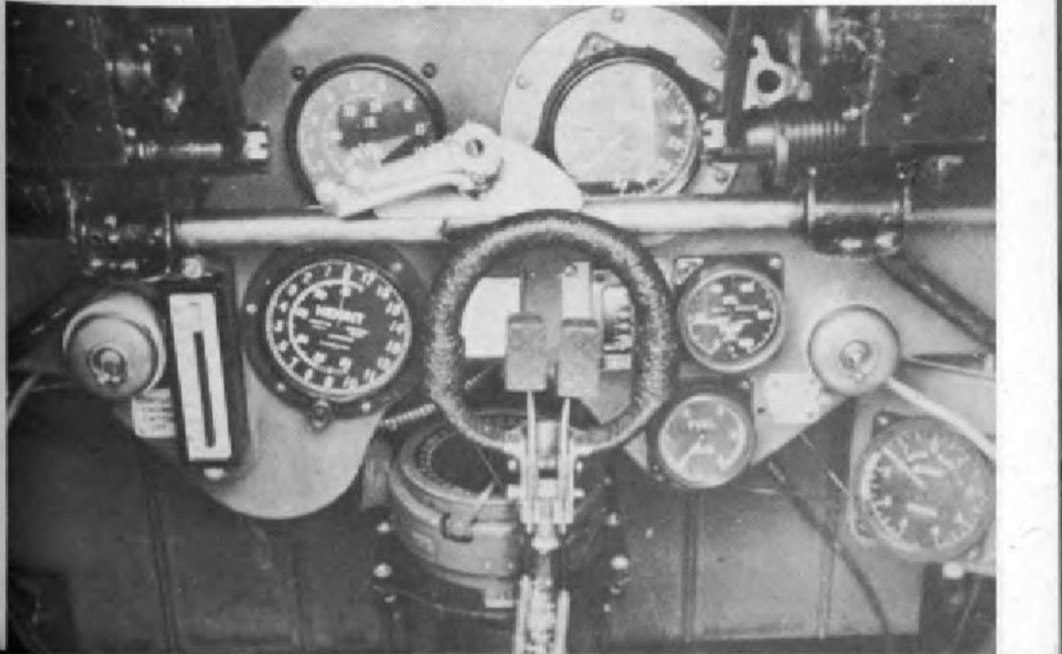


RIGHT: Typical crowded cockpit of Sopwith Salamander of 1918. Note space taken up by gun butts (Imperial War Museum-Q63829).



ABOVE: Cockpit of Halberstadt D II (Argus engine) of 1916 shows rudimentary dashboard. It was by no means uncommon for certain instruments to be mounted outside the cockpit altogether at this stage.

BELOW: Dashboard of Hawker Fury in 1935 appears somewhat crowded, partly due to the fact that the gun butts still protrude into cockpit, a hangover from Great War days when it was essential for the pilot to be able to clear jammed guns (MOD).



ABOVE: Pilot's compartment of Handley Page V/1500 is typical in layout of large multi-engined aircraft of the late 1914-1918 war years and early 1920s (MOD).

BELOW: Port side of pilot's cockpit in a DH 9a. Note unpainted wooden sides, breech of Vickers gun, top of basket seat, and small lights on dashboard (Imperial War Mueseum-Q63803).

around the edge of the cockpit. This will not look right until it is sealed with a coat of paint and it is essential to use heat-stretched sprue of 'scale' thickness if the result is to look completely accurate.

Pilots' seats are almost a study in themselves but there are roughly three different types. In the pre 1914 period they varied a great deal, for in those days virtually everything was experimental. There was the wicker garden chair variety (in the first De Havilland machine it *was* a garden chair with cut down legs). The obvious advantage of these was the fact that they were quite strong and fairly light. However, there were also some extremely elaborate constructions in plywood and aluminium with padding that closely resembled that of the contemporary horse hair sofa, buttons and all. Some form of standardisation was achieved during the 1914-1918 war with variations on the 'bucket seat' which was at least an improvement on the bare wooden cross plank provided for the observer in early Bleriots. The final phase came with the introduction of the parachute, especially the rear slung type on which the pilot sat during flight. This necessitated the inclusion of a well to accommodate the bulky pack, and this form of metal seat, with many modifications and improvements, varied little throughout the 1930s and 1940s, and is basically the type in use today in many types of aircraft.

The observer's or rear gunner's seat was much more varied and many types were designed in an attempt to provide something that would meet the requirements of the job; these included defending the aircraft (ie, standing up to fire a gun at various angles), bomb aiming, photographing and operating wireless gear. Developments included folding seats and swivelling seats (like piano stools) known as capstan seats, whilst some gunners were not provided with seats at all.

Some machines had duplicate sets of instruments fitted in the rear cockpits, and others had just a socket for a control column and little else. The rear cockpit was often cluttered up with such items as wireless gear, ammunition drums (usually held in racks), very pistols, and cartridges, some photographic gear and, in some German and Austro-Hungarian machines, bombs in tubular racks also took up space. Seat and safety belts can be added but it should be remembered that in many cases the belts were attached to formers behind the seat and when the pilot cast off his belt it sometimes slid back behind the seat and was not seen. Early belts were usually webbing affairs with brass buckling and fittings which held the pilot across the lap only. Later, harnesses with shoulder straps were used and these were sometimes made in leather.

Surface Details: The surface of an aircraft fuselage usually includes a wealth of detail, most of which can be reproduced on a scale model. The important thing to remember is to keep the detail *in scale* and in some cases this means merely suggesting it. Many models seen by the author have been spoilt because this is not observed and oversize components can 'kill' any scale appearance. Plastic kits are very often guilty of this, with machine guns sitting on the fuselage like howitzers and tyres more suitable to a farm tractor. Fuselage detail includes lacing and stitching (the former used for inspection panels), tacks, rivets, metal reinforcing strips (sometimes used in connection with lacing), fishplates and reinforced 'eyes' for control cables. Later aircraft with metal covering have many panels sometimes held with screws but also with various types of clips, some resembling the type of fastener seen on suitcases. Certain parts of the engine or other items required streamlined fairings pressed out of metal and there are many different

TOP: Familiar stitch lines on Bristol F2B. In this case the metal foil system can be used to great advantage, even the studs down the centre of the strips can be reproduced (IWM-Q11996). ABOVE: Martinsyde Scout shows the three basic materials of aircraft of this period, aluminium, plywood and fabric. Notice typical Martinsyde fishplates (IWM-Q65878).

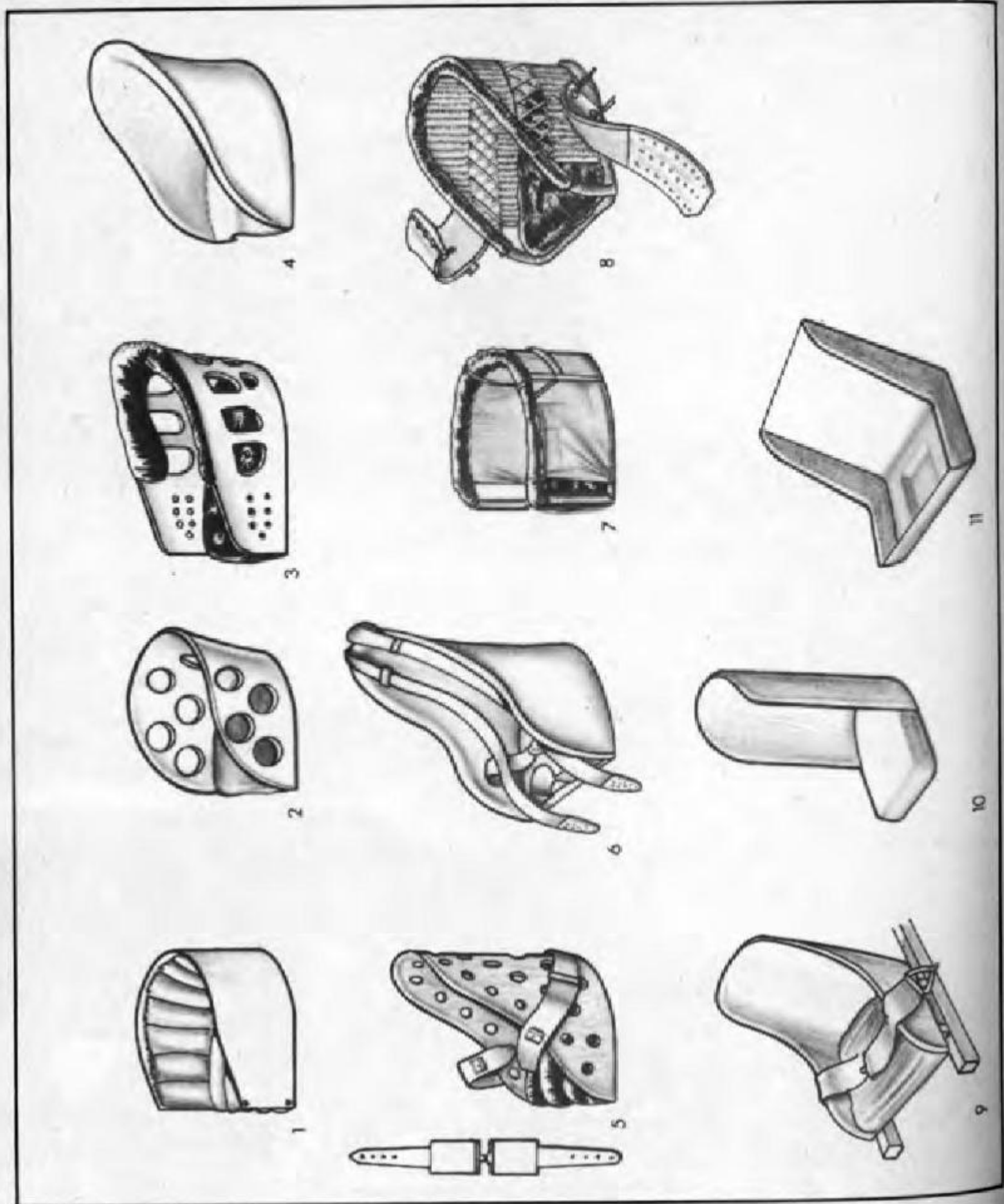
types of holes in a fuselage such as those near the engine for the insertion of starting cranks, drain pipes, exhaust outlets, breathing tubes, etc. There are also holes, sometimes with covers for fuel tank inlets, for supporting brackets (rear lower fuselage), slots at the junction of the tailplane and fuselage on aircraft with adjustable tail surfaces, and appertures in the belly for cameras, sometimes bombs, and occasionally flares. Steps were frequently provided and later aircraft had these inset on the side of the fuselage fitted with a spring cover in some cases.

On the plastic card model, holes are best made by burning with a warm needle initially and opening out with files. The warm needle method has the advantage of forming a crater around the hole which is perfect for representing the reinforcing around control cable eyes in fabric. The forcing of a hole with a cold needle can be dangerous as it compresses the plastic around the hole and invariably leads to a split. Panelling can be represented by either scribing with a needle or by merely sticking a piece of 5 thou card on to the surface. The advantage of this is that rivets or studs can be represented by 'pimpling' (or embossing) the thin card before it is attached. It should be noted that a great deal of the panelling on early machines was not flush with the fuselage skin. Streamlined bulges are easily made by moulding, and small apperture covers such as flare shoot covers can be made by punching small discs from plastic card with a leather punch.

Wing walks varied according to the period and the type of machine. In early days they were strips of plywood tacked over the ribs with supporting members underneath. The walk itself was often covered over with fabric but later, with sheet metal. In some cases the surface of the metal was roughened to prevent slipping and usually the area was painted dark grey, a habit that persists even today in some cases. Some large biplanes of the 1914-1918 war and later required fitters and mechanics to walk out on to the wing surface for maintenance and repair purposes. The areas which were strengthened to take weight were marked in a variety of ways. Black lines, or a series of black rectangles, were painted over the surface of the wing where reinforcing had been added. Some large RAF machines had the walking areas represented by black footprints which surely left little room for error. Wing walks can, of course, be represented by thin card, scored lightly if the pattern of the original demands it, or by using strips of the rough surface silver paper found in some cigarette packets. This is best stuck to plastic or painted surfaces by applying a thin coat of matt varnish to each surface and bringing them together just as the varnish becomes tacky.

Struts: Although vintage models have a great attraction for modellers, many are discouraged from attempting them because of the mass of wiring and what might be termed 'struttage'. The fact is, of course, that it is just this kind of detail which makes the vintage model such an eye catcher and rigging need not be the bogey that it appears to be if a little care is taken and a little patience is exercised. Struts includes interplane, centre section, undercarriage members and supporting pieces, usually around the tail area. In early machines there were structures placed above the fuselage on monoplanes, known as the 'cabane', to support wing cables and warping gear, whilst a similar structure was carried underneath in some cases and biplanes, especially those with a large overhang of the upper wing, sported king posts to support cables to strengthen the wing. Pusher aircraft are renowned for the often elaborate system of tail booms sometimes with horizontal and vertical cross members. The struts were made from wood in most of the early machines,

ABOVE: Surface detail on the Armstrong Whitworth Argosy airliner of Imperial Airways in the mid-1920s is shown well here, as is the undercarriage. Note also the external control wires ('Flight International'). OPPOSITE, TOP: Flush riveting lines on the Dornier DO-X can be depicted on plastic card by adapting a small cog wheel from an old watch and running it along a steel rule, or by 'embossing' with a pin point ('Flight International'). OPPOSITE: Short Scylla airliner of mid-1930s shows corrugated covering and drum tight fabric skinning of wings. Note engine and propeller detail.

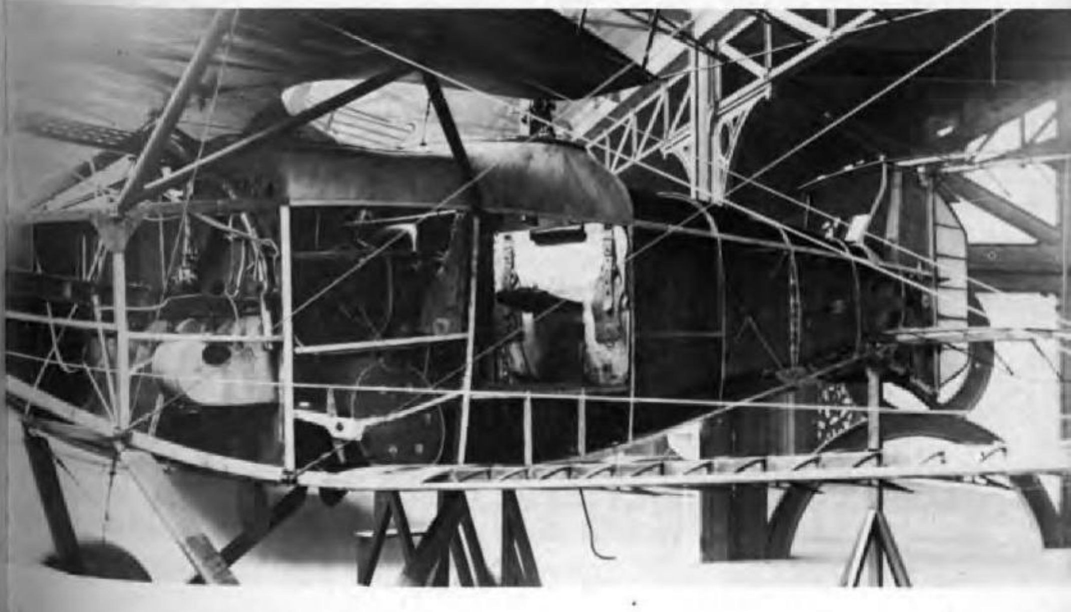


Pilots' Seats

(1) 1910 Hanriot seat is metal backed and well padded. (2) 1911 Graham White perforated aluminium seat with squab. This is the commonest type of seat for the period and with slight variations was fitted to large numbers of aircraft during the period immediately prior to 1914 and was used on some aircraft well into the war period. (3) 1913 Bristol Coanda monoplane seat, a de-luxe version of 2. (4) Pressed metal seat of Sopwith Tabloid of 1914 is typical of seat used during early days of the Great War, and appears to be one of the earliest types of standard fittings, as such seats were also fitted to some Avro 504s, Bristol Scouts and Caudrons. (5) Perforated metal or plywood seat fitted to large

numbers of Allied aircraft during the 1914-1918 war. The example shown here is fitted with the French type of safety belt; one long strap passed around the back of the seat and had a buckle on both ends. The front strap had a release catch in the centre and tongues at each end which fitted into the buckles on the back strap, thus allowing adjustment to be made. The seat was made of aluminium even when the rest was made of plywood. (6) The German equivalent to 5 was made from aluminium and sometimes covered with fabric. The type used on two seaters when the pilot sat on top of the fuel tank was shorter backed than on the scout version. Typical harness shown here consisted of two main shoulder straps attached at the rear to a fuselage cross-member. (7) Short backed metal tubular seat from Austro-Hungarian Berg scout; similar type was also fitted to Phoenix and Brandenburg types. The seat illustrated here has fabric covering but sheet aluminium (perforated) was also fixed to the tubes. Austrian pilots used safety straps similar to the German type and were fixed to fuselage cross-members by powerful springs. (8) The famous British basket seat used in many aircraft of different types from 1916 onwards. The safety belt is the standard type used on RFC and RAF aircraft (and some foreign types) until the mid-1930s. Strap was made from heavy webbing faces with leather at the ends. (9) Wooden backed, metal seat fitted to Curtiss JN 4D. Seats of this type were fitted to many aircraft until the advent of seat parachutes. (10) Stark seat fitted to Fokker CV in late 1920s. From the 'Spin' onwards, Fokker aircraft were notorious for limited attention paid to refinements or pilot's comfort. (11) Metal seat fitted to Bristol Bulldog represents the type of 'well' seat which was designed to accommodate parachute. This design hardly changed in its basic layout until the advent of the ejector seat. Similar types, with variations in shape, were fitted to many World War 2 fighters.

BELOW: Detail of fuselage of German Hannover CL IIIa. Subject is essentially a monocoque as far as a model would be concerned (as indeed was the original which was beautifully made by skinning plywood over main stringers as seen in photo). Note internal detail of back of observer's cockpit with hinged seat and pilot's seat placed in the usual German fashion on top of the main fuel tank ('Flight International').



but steel tubing appeared before 1914 and was used in the construction of some aircraft during the 1914-1918 war. A later development was to make the main member from metal and provide a streamlined fairing from wood (sometimes balsa wood). Struts were sometimes bound with tape but otherwise were merely varnished. Steel struts can, of course, be made easily from heat-stretched sprue and the section on sprue deals with this method including the streamlined section variety. The heavier wooden struts can also be made from thicker sprue but there is a more satisfactory method of providing a large number of struts all exactly the same width and thickness. The illustration shows how these can be made from plastic card cut into strips and shaped on a balsa block. Wooden struts were frequently clear varnished which resulted in the warm slightly orange colour of spruce; others were doped the same colour as the machine generally. In the inter-war years RAF machines had their struts painted black at the extremities, possibly to hide the handprints of ground crew when the machine was landing or being manoeuvred on the ground or carrier deck.

The attaching methods of struts to the airframe varied, the commonest one being a form of socket holding the end of the strut allied to a screw of fishplate attachment. The ends of the struts therefore were sheathed and this should be represented by painting with silver, darkened by the addition of black to give a gunmetal appearance (or use 'gunmetal' paint). Some companies put their trade mark on struts in the form of a transfer (eg, Sopwith) which can be represented in the same way as that mentioned previously for propellers. Sometimes serial numbers can be seen near the strut roots and these can be at least represented by careful work with a mapping pen.

Axles are seldom the simple cross member they appear to be in some photographs. The need for some kind of shock absorbing became apparent in the earliest days of aviation and the earliest forms of shock absorbing was the use of binding with elastic cord and coiled springs. These systems with various modifications such as split axles and slotted vees lasted until after the Great War when various oleo systems came into general use. The cord used was 'Bungee' or something very similar. This type of cord in which elastic is interwoven with cotton is still in use today for many things and is white in colour so that when modelled it should be painted light grey although it was often saturated with mud and oil in use. The binding of the axle is so characteristic that it must be included on the model. Grey sprue can be used but it must be held with cement at every turn or it will unravel. Another method suitable for 1:48 scale and larger is to use fuse wire first drawn cold and then painted pale grey. When the paint is dry it can be wound around the axle and it holds in place without any adhesive. It will need to be touched up with paint after binding.

With regard to undercarriages the modeller should decide whether he wants the undercarriage in the 'ground rest' position or 'in flight' position, for on many aircraft there is a considerable difference. Most model drawings show the two levels but it is quite apparent that some modellers do not appreciate this and wonder why their model looks as if it is standing on its tail.

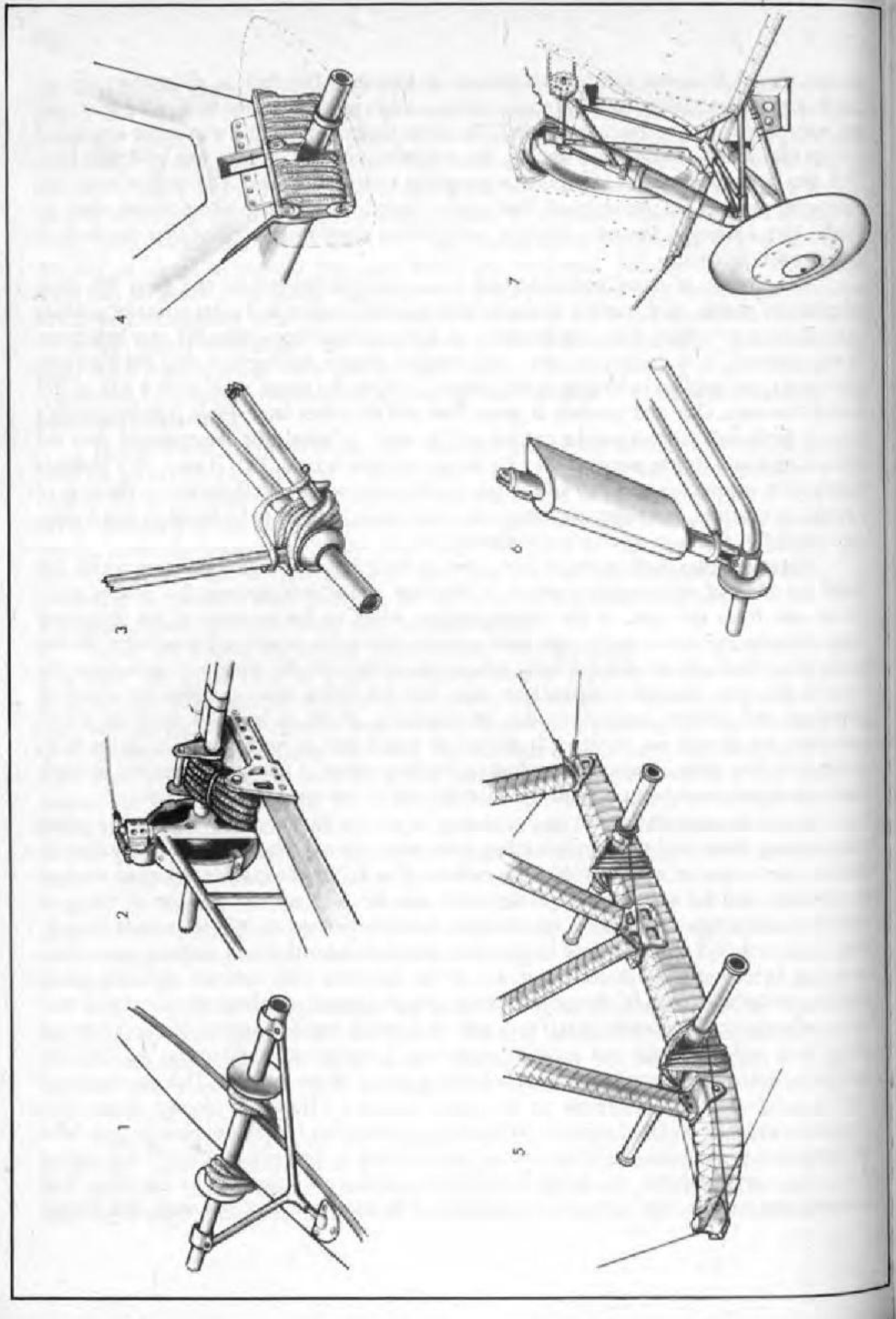
Rigging: Without a doubt the rigging of biplanes is the greatest deterrent to many modellers, yet with modern plastic materials this is now a comparatively easy procedure. It is still very time consuming but good models are not built overnight. The traditional method of rigging biplanes was to use thread which tended to be hairy in texture. Even waxed thread becomes hairy when kinked or knotted. The fact is, of course, that in earlier days the modeller had little choice of material to work with, and thread was virtually the only alternative to the use of wire. The other method of rigging was to use lengths of florists wire which was rigid and straight, the end being inserted in holes and held with glue. This was far superior as no looping or unsightly knots were seen. The author used fine fuse wire, pulled cold and snipped into correct lengths and placed into position, even on plastic kits. However, the wire is heavy and did not always stick well so that the method had severe limitations.

The system of using heat-stretched sprue has now proved far and away the most suitable for plastic card models. Sprue is light and easily stuck and costs virtually nothing to produce. It is so light that it can be stuck on to painted surfaces using the very minimum of thin cement. It is drawn into very thin straight lengths making sure that the thickness is constant, and applied in lengths to the model, holding the sprue 'wire' with a pair of flat ended tweezers. One end is stuck in place first and the other later. Final trimming with a pair of small nail scissors can be carried out 'in situ'. It should be remembered that the sprue is rigid and its use assumed that the wing structure is rigid. This is easy with biplanes which have more than one pair of interplane struts per wing bay. However, in the case of a single set of struts, and especially where the lower wing has had to be made in two halves, care should be taken to see that no movement occurs.

There are two main types of wire used in wing bracing; the flying wires which run from the tops of the interplane struts to the base of the fuselage and the landing wires which run from the tops of the centre section struts to the bottoms of the interplane struts. It is better when rigging with rigid sprue to invert the model and attach the *landing* wires first. When the model has been righted the weight of the wings will now cause the landing wires to become comparitively taut and the flying wires can then be attached. Although the cement appears to dry immediately, allow at least 15 minutes before attaching the second set of wires. It should be noted that in many cases the flying wires are double. The wires are usually attached to the strut where it joins the wings but in many cases the attachment point is some distance inboard of the wing/strut junction.

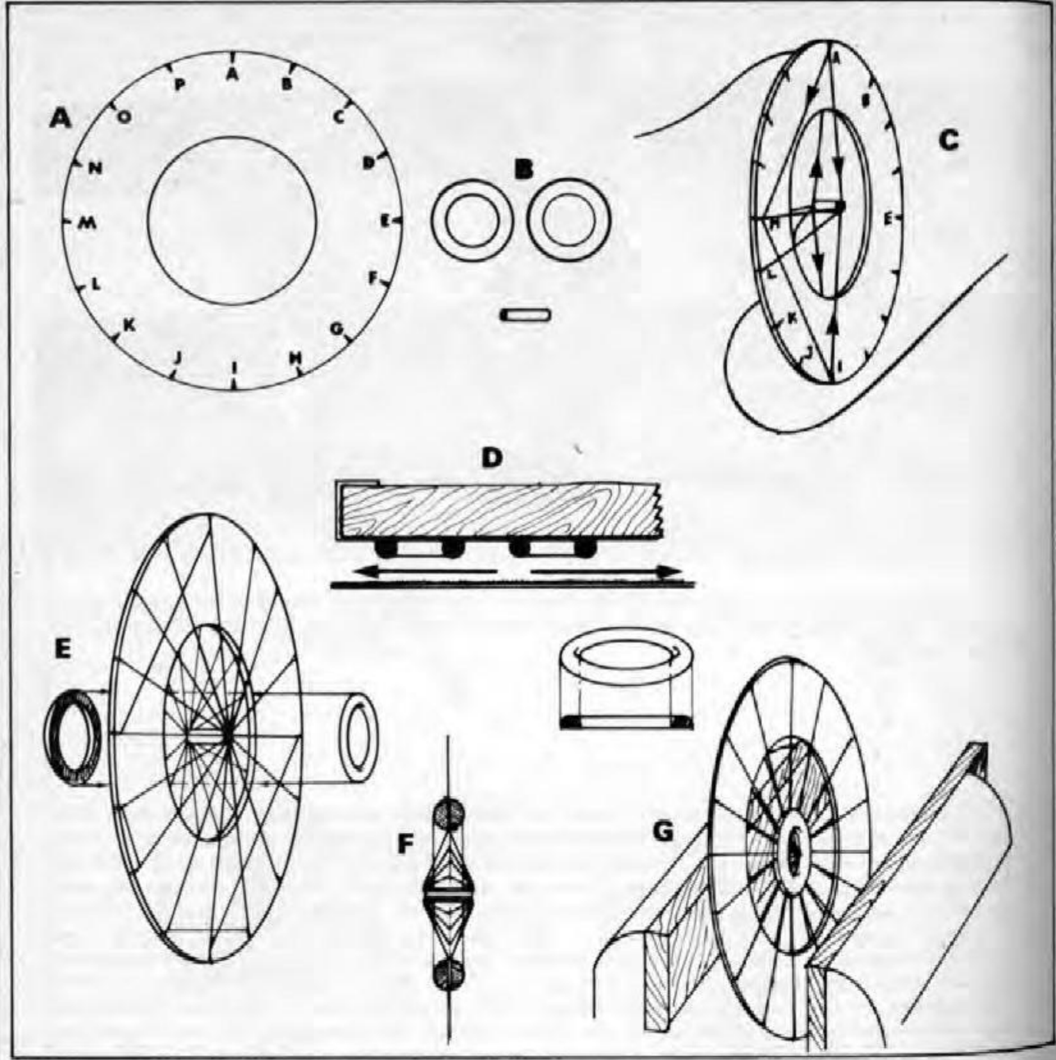
Fine heat-stretched sprue can, of course, be used in the same way for control cables and bracing wires, and the simple holding joint using the minimum of cement is infinitely better than a clumsy hole drilled in the surfaces. For 1:72 scale models the sprue method is supreme and for all 1:48 scale models it is also the best system. The use of nylon or similar materials for rigging is not recommended for plastic card models for several reasons. The first is that it must be used in the old method of knotting and looping, sometimes resulting in an unsightly double knot. It can not be stuck with ordinary adhesive which underlines the advantage of the sprue method, and the dangerous thing about nylon is that it is partly elastic. This means that if it is used in a strong wooden or even plastic kit model it can look quite neat and taut but the contraction is considerable and unless the structure of the model is exceptionally strong it will pull it out of shape entirely. This characteristic was demonstrated most forcibly to the author when a Lifelike kit model of the Avro Triplane, which was rigged entirely with nylon, pulled taut literally exploding in a mass of struts and wings quite suddenly without any warning in the early hours of the morning!

On many biplanes the flying and landing wires were supported at the place they crossed with a stay in the form of a metal tube, or in later cases with a streamlined fairing.

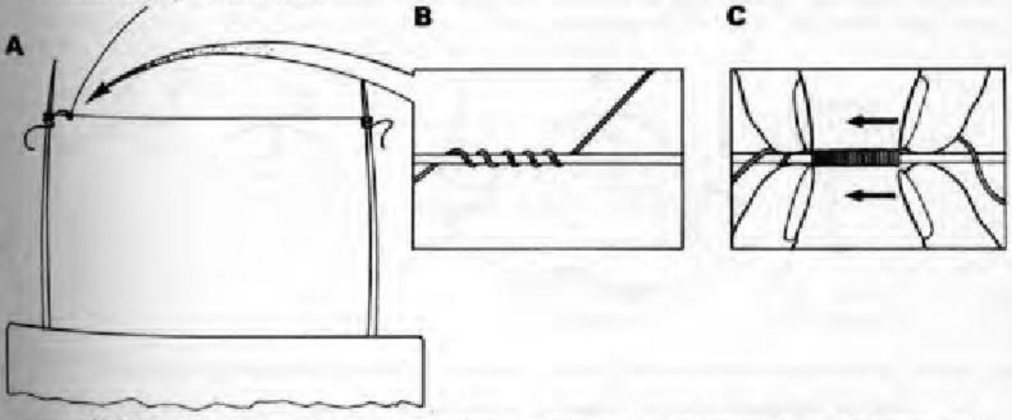


Heavily 'trousered' undercarriages were one way of achieving streamlining in the mid 30s before efficient retractable systems were evolved. Nose view of French Lioré et Olivier 206 bomber of 1936 shows these well.

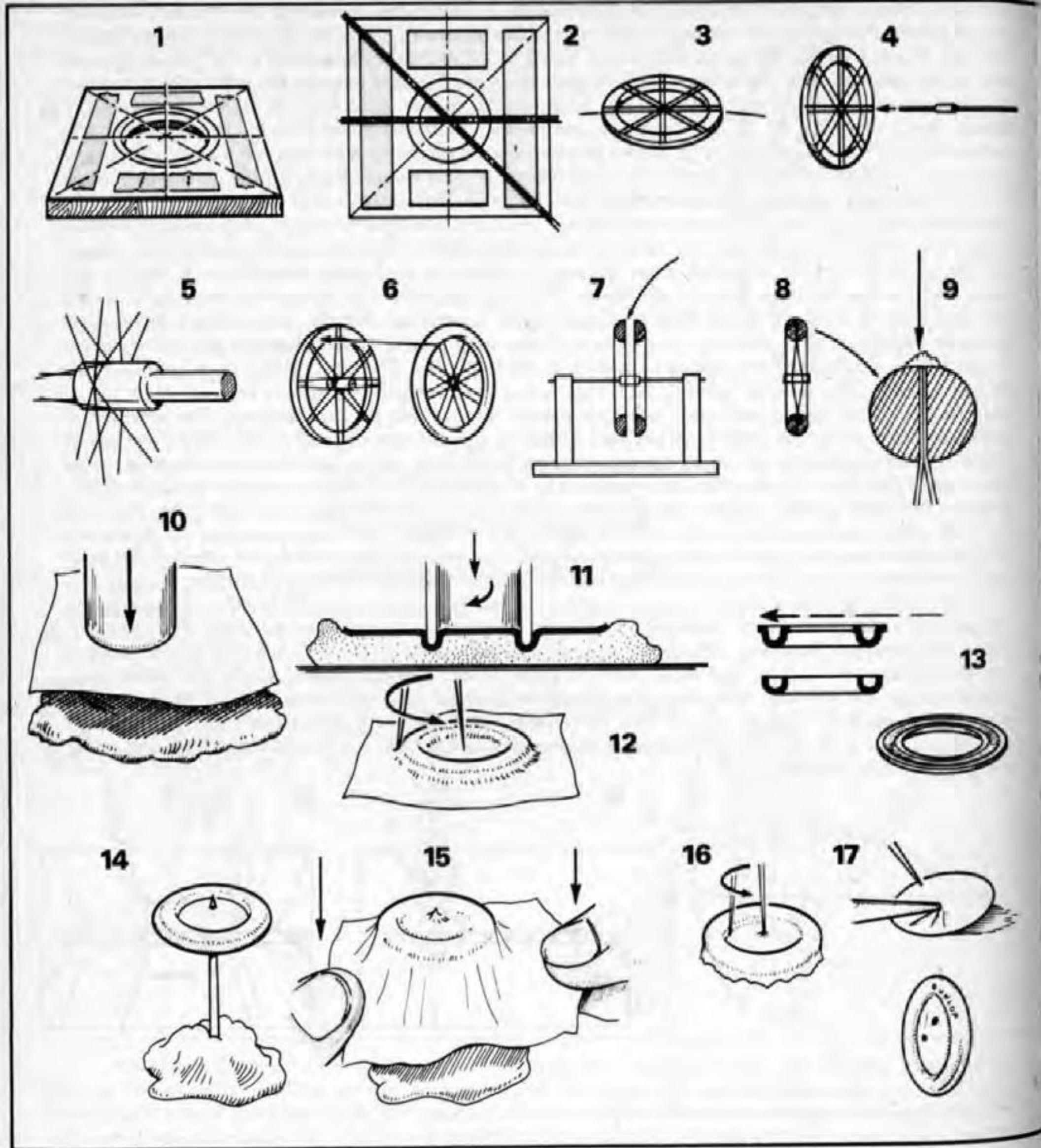
OPPOSITE PAGE: Representative types of undercarriage and springing methods from 1909 to 1935. (1) Farman twin wheel type. Wheels were mounted on a stub axle which was bound to a long skid with rubber cord. This type of structure was used on many types of machine right up to 1918. The binding allowed considerable movement of the axle in all directions which was essential when the aerodromes were more often than not, farmer's fields. Also the inherent strength and flexibility of this type undercarriage was probably one of the features that made the Farman Longhorn and Shorthorn suitable as trainers. (2) Complex springing and brake drum on Bristol Coanda monoplane of 1913. Despite the popular legend that aeroplanes up to the 1930s were made from string and sticks held together by glue, manufacturers and designers were producing beautifully finished components and well constructed aeroplanes before the 1914-1918 war within the limits of the material and techniques available. (3) This was the commonest form of undercarriage used in the 1914-1918 period and for some years to follow. The simple vee struts had a fixed cross member and axle lashed to it with rubber cord. The example shown is the Albatross D I but general design changed little with other aeroplanes and other nationalities. (4) Heavier development of (3) for larger aircraft. Type shown here is on the DH 4. The dotted line indicates a streamlined metal cover plate. Large German aeroplanes towards the end of the war had undercarriage systems like this but shortage of rubber resulted in the substitution of a system of coiled springs showing great ingenuity and anticipating future developments. (5) Double axle (four wheel) undercarriage member of the huge Caproni C3. Note binding of members with fabric tape, overpainted with dope. (6) Typical split axle type of chassis of the late 1920s (example shown here is on the Blackburn Bluebird). The typical feature of this type is the compression chamber. Rubber did not vanish completely from undercarriage springing systems when the cord binding system was superseded. Rubber washers in tubes were sometimes used and such rings were used in conjunction with oleo systems, before the oleo spring and oleo pneumatic systems came into general use. (7) Retractable (or 'retractile', a term used in the 1930s) undercarriage of the Grumman J2F. This particular lateral retraction system was used successfully by the Grumman company in a whole series of amphibians and fleet fighters right up to the Wildcat of World War 2 vintage. It was used on many other types of amphibians, being ideally suited for this purpose.



ABOVE: The spoked wheel, or rather the wheel where the spokes are not covered over, is an essential item when building certain vintage models. It is also a most attractive and eye catching feature of a model but the difficulties involved in making such a wheel with a diameter of only about half inch is enough to put even experienced modellers off the subject altogether. The systems illustrated have been evolved after a great deal of trial and error and have proved to be the simplest and most effective. The finished product can represent exactly some spoked wheels, but can represent all others with a little variation. It is not until a subject is studied that its complexity becomes apparent; this is particularly so in the case of wheels. There were parallel spokes, cross over spokes, radial spokes and some other variations, and a study of perambulator or motorcycle wheels can give some idea of the problems involved. The first method shown above requires a template cut from thick plastic card. (A) with a series of notches cut all the way around at even distances. For making all types of wheel twice the number of notches should be cut as in the diagram which is kept simple for clarity. The other components are two plastic rings and a hub (B). Small plastic curtain rings made from polystyrene or nylon are available from chain stores or haberdashers and these have been found to be ideally suited, although in the smaller wheels a ring has to be made from sprue softened by steam or hot water and coiled around a rod of the correct size – or use the moulded method. The hub is made from stretched ink tube from a ball point pen as described previously. A bulky knot is made at one end and the other end is passed through the notch at 'A' at the top of the corner (C). The thread is led down and passed through the hub and taken up to the rear of notch 'A'. It is then led down left to 'M' passed through and taken down to 'I' at the bottom. It is brought up from 'I' passed through the hub and taken down to the rear of 'I' (follow the arrows). The four vertical spokes now hold the hub in position. The thread is now led back to 'M' and passed to and through the hub coming back to the rear of 'M'. It is taken down to 'I' again and then to 'E' where the procedure is repeated. When the vertical and horizontal spokes are in place the hub is 'fixed', and when repeating the process all around the clock, care must be taken to apply even and firm pressure to ensure that the hub stays central. The thread must not be pulled too tight as this will cause too much tension which will be disastrous later. Only enough pressure should be applied to ensure that the thread is in a straight line. A variation on this pattern is to stagger the spokes as follows. In the early stages instead of taking the first spoke down from 'A' back to the rear of 'A', it can be taken back to the rear of 'B', thence down to and through the front of 'J' to the hub and back to 'I', and so forth. This first stage is now completed. The plastic rings (two are required for each wheel) are then stuck on to a piece of balsa using double sided adhesive tape; this is merely to hold them whilst they are sanded to half their thickness (D). The result is that they become a pair of half wheels. The object is to stick these two halves together with the spokes between them (E). If polystyrene wheel halves are used, ordinary plastic cement will do this satisfactorily; however, if nylon or other plastic is used a special mix of plastic cement and chips of plastic card dissolved in liquid cement will do the job. In all cases to ensure a better joint and to stop the spikes slipping out of place, both flat faces of the wheel halves should be roughened. One wheel half should be stuck lightly in place first with plastic cement. The adhesive should then be liberally applied to the inside flat faces of both wheel halves putting most of the adhesive on the outer perimeter for when the halves are forced together any excess on the inner perimeter will ooze out into the inside of the wheel and is most difficult to remove later. The two halves can usually be stuck together with finger pressure initially (F), but this is only to ensure that they are correctly placed. The whole assembly is then placed between the jaws of a vice (faced with cardboard to prevent marring the wheels) and left there overnight (G). When it is removed the outer threads are snipped carefully close to the tyre, a line of plastic putty is run around to seal the joint and when this is dry the surface is lightly sanded. The wheel is now completed except for painting. The whole ring should be painted with matt dark grey (or in the case of some earlier models, medium grey or even dirty white) and the rim is painted in either dull silver or shiny black. The most effective and accurate method is to mount the wheel on a vertical pin and rotate the wheel holding the brush still.



ABOVE: With the system illustrated above it is possible to produce coil springs of very small diameter indeed. A shows two vertical stays fixed in a vice (two files are ideal as the serrations prevent the tense forming wire from slipping). The forming wire should be strong and for this reason fuse wire is unsuitable. Steel or brass wire is ideal, the essential thing being that it will not snap under moderate pressure. The thickness depends upon the size required for the completed spring. The wire forming the coil is attached to one of the uprights and then wound around forming wire closely as shown at B. After about a dozen loops have been made the coil should be compressed with the finger nails as shown at C. Fuse wire being soft remains in close compressed position and any length can be cut off. The important thing to remember with this procedure is not to try to wind too long an initial coil before compression, as buckling is liable to happen.



ABOVE: Alternative method of making spoked wheels and wheel discs. Whilst this method is quicker than that previously described it requires great care and patience. Plastic cement of the thin variety is the normal adhesive but for beginners it is best to use matt varnish. This takes a long time to dry but will not affect the plastic which in this case is very fine sprue. Sketch 1 shows a balsa former made from about 1/8 inch sheet with a circular hole cut in the centre slightly larger than the wheel so that it can be used for various sized wheels. Placed on top and held with double sided adhesive tape is a plastic card template as shown in sketch 2. The hole is cut just a fraction larger than the wheel and is traversed by a series of lines, verticals, horizontal and two diagonals. Sketch 1 also shows tape placed on the card so that all the lines are covered. The half wheel as described in the preceding description is dropped in the 'well' in the plastic card and fine sprue lengths are placed as shown in sketch 2 one on each side of the guide lines allowing a narrow space (about 1/32 inch for small wheels) between them.

The tape, of course, holds them in position. When they are all placed in position they are stuck to the wheel half by dabbing with adhesive and allowed to dry (at least one hour in the case of varnish). A razor blade is used to cut the 'spokes' just outside of the wheel and the wheel half drops out of the former. The surplus spoke ends are trimmed off (sketch 3) and the boss is inserted as shown in sketch 4. The boss can be a piece of tubing as previously described with a length of wire inside merely to hold it. The 'boss' is then inserted in the middle of the spokes as shown in sketch 5 which will bow out a little as intended. Still leaving the boss on a wire for convenience the whole central area is now smeared with adhesive so that the spokes will stick to the boss (if the drawn out ball point pen plastic is used, matt varnish is best for this job). Allow to dry and meanwhile prepare the second wheel half in the same way as the first. When this is trimmed it should be mounted on the boss and stuck a short distance from the first half, again the distance depends upon the scale and size of the wheel but in small wheels it should be about 3/32 inch. Before leaving it to set as shown in sketch 7, the second half should be turned so that the spokes are not exactly opposite the spokes of the first half as shown in sketch 6. When the wheel is finished the impression will be that there are about twice as many spokes as there actually are. The two halves are then drawn together as shown in sketch 8 but before doing so adhesive (as described in the previous method) is applied to the inner, outside perimeter. It is not necessary in this method to press the halves together in a vice. The space between the wheel halves is filled as shown in sketch 9 and finally sanded. When making this type of wheel the boss and 'tyres/rim' can be pre-painted whilst the spokes can be made from black or silver sprue. One method of producing wheel halves is to mould them by using a suitable piece of metal tubing (obtainable from shops dealing with model ships or locomotives) and rounding off the edge with a file and emery cloth. The principle is to force the tube down on to some heated plastic card (at least 20 thou) which has been dropped on to a mound of Plasticine as shown in sketch 10. Sketch 11 shows the effect in cross-section. Sketch 12 shows the moulded piece having the main waste area cut away with a pair of dividers. Sketch 13 is a cross section of the moulded wheel half, showing the direction of sanding to remove the inner waste ring and then the final shape. This type of construction is not so long as it may seem and the advantage is that it is possible to run off as many as required and being plastic card it will stick very well. Sketch 14 shows a typical kit wheel mounted on a toothpick and stuck into a base of Plasticine. The object is to make a convincing wheel disc by merely heating a piece of 5 or 10 thou plastic card and drawing it over the plastic wheel. The kit wheel must be painted over with thin oil before doing this. *Sketch 16 shows the dividers being used to cut out the disc and 17 the embossing of the 'spoke' lines with a sharp edge and scribing tool. The spokes should* not *be drawn too heavily.*

When this is applied to the model do not attempt to stick it in place with plastic cement for the risk of dissolving the fine sprue 'wire' is great. Also, because of the tendency of plastic cement to contract when dry, the sprue is easily pulled out of true. The stay is merely painted with thin matt varnish and laid into place. When the varnish dries it will be quite firmly held with no danger of distortion. When wires or cables enter the fuselage, holes should be made to take them with the warm needle method.

To round off this section on fine heat-stretched sprue rigging it should be noted that sprue is quite unpredictable as far as drawing is concerned. Sometimes the sprue has a permanent curve in it and this should not be used. A certain amount of tension can be obtained by sticking one end of the sprue and leaving it to dry. By using tweezers, the other end can be *very gently* pulled and stuck to the other terminal. The principal however is that the sprue is installed in straight rigid lengths.

Fairings and Fillets: Although streamlined fairings and fillets appeared during the Great War (eg, on Pfalz Scouts) it was not until many years later that such refinements became commonplace. Apart from fillets around wing joints already mentioned, there were smaller fillets around the bases of tail units, undercarriage legs, at the junction with the fuselage, and around the joints of some struts. Small fillets can be reproduced by merely painting around the joint with enamel (make sure that the joint is firm or closed or the paint will merely fall into any recess), but larger ones require special techniques and the simplest is to build up the fillet with a filler and sand. Plastic card offers another alternative and that is the moulded fillet which is illustrated.

Small Fittings: Apart from certain finishes, metal foil can be used to advantage in some cases to represent detail. On some earlier machines (eg, Nieuport Scouts) inspection areas were laced up and the lacing holes were reinforced by thin metal strip which stood proud of the surface. Such lines of lacing can be represented by scoring the pattern on to thin foil, then carefully cutting it into strips of the requisite length and sticking into position with clear varnish. It is later painted over. Another use is somewhat more limited; some manufacturers placed a nameplate on their machines in the form of embossed lettering. The obvious example is Armstrong Whitworth but Morane Saulnier also used this type of trade mark. Metal foil will hold ten embossed letter perfectly and form them a little better than thin plastic card which tends to 'dish' out a little. The author has also used this technique when applying the manufacturer's name plate to a Fiat engine.

Pitot tubes and radio aerial masts can be modelled from fine sprue and any cables leading from them ought not to be ignored. The typical 'two fingered' plate which attached pitot tubes to the wing strut is merely painted on.

External Loads: Military aircraft are undoubtedly more popular with modellers than civil because of the large amount of extra detail and equipment they carry. This is not untrue today when the mass of offensive and electronic equipment can make even a modern jet attack aircraft look like a Christmas tree. In earlier days, items were literally stuck on to the aeroplane in the most convenient place with little regard to appearance and even less to the problem of drag. Apart from ordnance, military aeroplanes by the end of the Great War, and for many years after, were loaded up with extra items which makes them very attractive propositions from a modeller's point of view whatever the crews thought about them at the time.

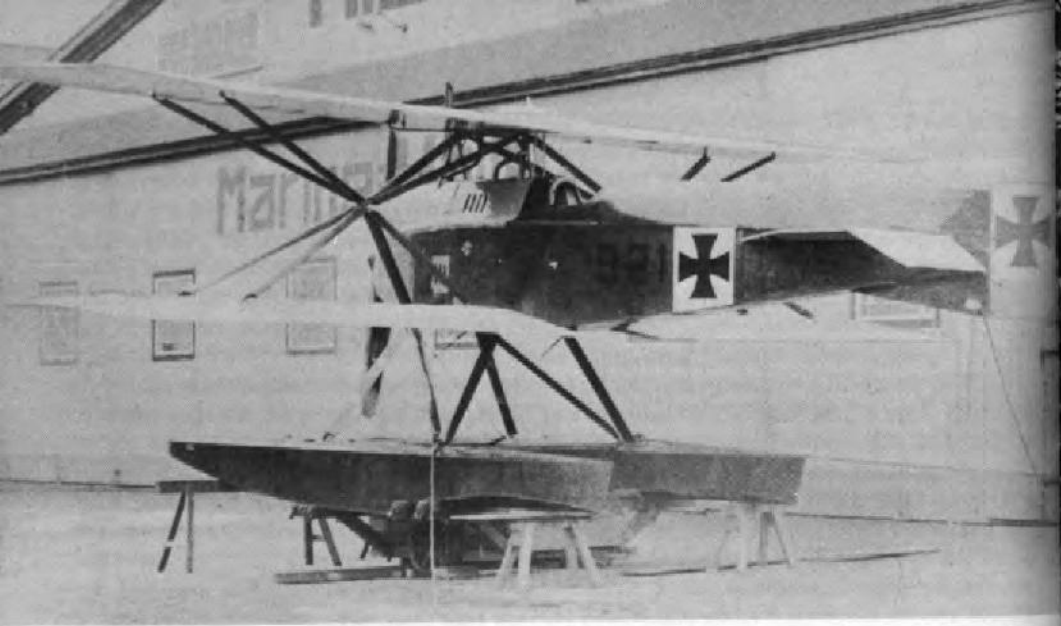
The possibilities of aerial photography had been very apparent even before 1914 and in the early days of the war cameras were either hand held or fixed in a somewhat crude fashion on to the side of the aircraft. The increasing size and efficiency of the camera eventually resulted in their being accommodated inside the fuselage, holes being cut in the floor and sometimes being provided with sliding panels. Night flying required extra equipment in the form of landing lights on the wings, and dashboard illumination. Flares were also carried either in external racks or inside, being shot through tubes in the fuselage. Some aeroplanes carried headlamps and these and the other items all required power to run them. This power was provided by wind driven generators usually in the form of an egg shaped structure with small wooden propellers.

The possibility of using aeroplanes to carry food supplies had been considered in the early days of the war and an attempt had been made to supply the besieged garrison at Kut with this method. However the BE 2c type of machine used was quite incapable of carrying much food and there were no proper containers for carrying such stores at this time. After the war, RAF units in the more desolate and arid areas of the Middle East were supplied with special racks for carrying supplies and luggage. Some aeroplanes were modified to carry stretcher cases, sometimes in a very rough and ready form on the upper rear longerons of the fuselage.

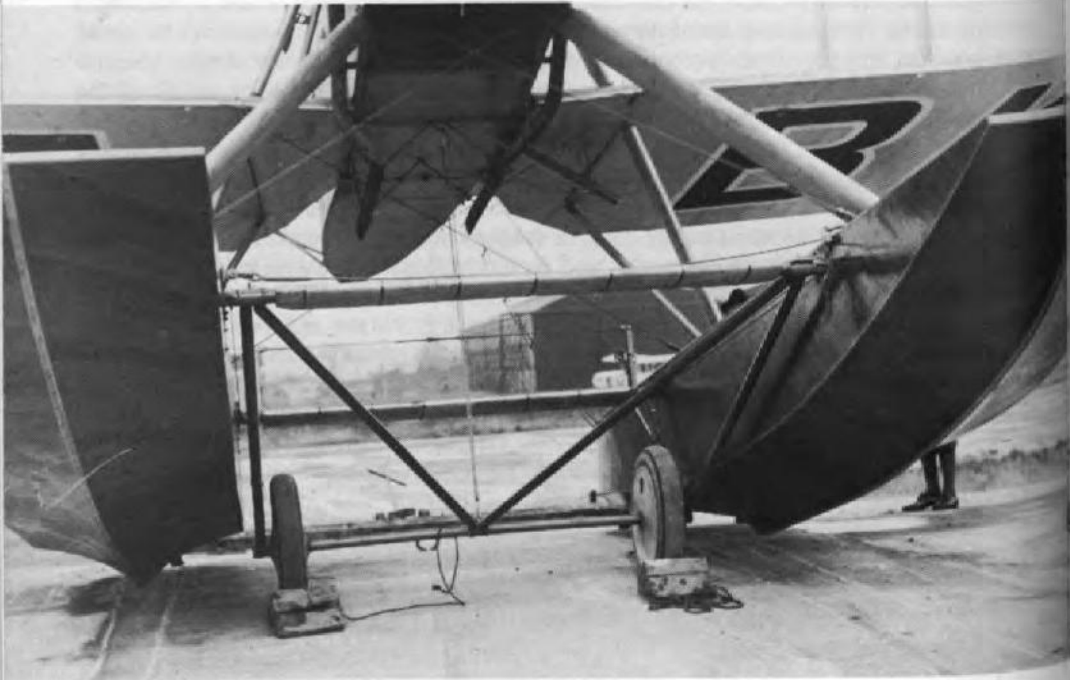
Other items of equipment piled on to military machines included winches for towing targets, belly hooks for picking up messages, landing hooks on shipboard aircraft which also carried either/or catapult spools and flotation and hoisting gear (the latter usually on the upper wing centre section), spare wheels, radio equipment, extra radiators (essential in tropical areas), extra or enlarged fuel tanks and, in the case of large flying boats, sea gear consisting of anchors, bollards and sometimes spare propellers.

Despite the attractions of the military machine the modeller would be missing a great deal if he overlooked some of the civil aeroplanes and those who have never attempted a civil model should certainly consider doing so, if only to enjoy the change of mind involved. Some civil aircraft, particularly in the old days, carried some or all of the external details outlined above.

All of the extra detail mentioned can be made from sprue and plastic card and requires no special instructions as the method should be now obvious to anyone whose modelling activities have taken him to this stage of work. One final word, use fine sprue where light construction is indicated. Aim for delicacy and always remember that painting adds extra bulk. Though this section – and its illustrations – deals mainly with models made wholly from plastic card, nearly all the techniques are equally applicable to those whose work is restricted to detailing or converting plastic kits in any scale, where applicable.



ABOVE: Wooden pontoon floats typical of floatplanes from 1910 to late 1920s. Aircraft here is a Hansa Brandenburg KDW Scout. BELOW: Ultimate development of the wooden pontoon seen here on Blackburn Dar (Civil) in 1924, shows extremely fine workmanship and high gloss finish ('Flight International').



ABOVE: All metal float on Short Sarafand represents type used until virtual demise of flying boat in recent years. Note metal skinning of hull and sharp trailing edge of wing even on a very large machine such as this (Short Bros). BELOW: Modern floats fitted to a Fairey Swordfish. There is quite a large amount of surface detail on floats which should be reproduced in a 1:48 scale model such as the old Merit kit. More particularly, note the lugs, panels and sea rudder detail (MOD).

ABOVE: Author's model of Halberstadt D II in 1:48 scale (Lt Höhndorf's machine, Jasta 4). Details of the building of this model are described in the text and another picture appears elsewhere in the book. The engine is fully detailed with valve springs and exhaust and cooling pipes. The propeller in this case was carved from laminated veneer. The fuselage was actually moulded in two halves but could also have been a built-up box. The turtle back is a good example of the double curvature moulding with fine sprue stuck on and painted over to suggest stringers. The wings of this aircraft had wash-out on the tips and this is reproduced on the model. BELOW: Author's model of Travel Air 2000 in 1:48 scale. The model represents a machine fitted with Hispano Suiza engine and painted to represent a Fokker D VII for the film 'Men With Wings' made in 1938. The fuselage could be made up in several ways but in this case was a flat cut-out. Model has spoked wheels made with the nylon thread method described and illustrated in this book.

4: Models in Smaller Scales

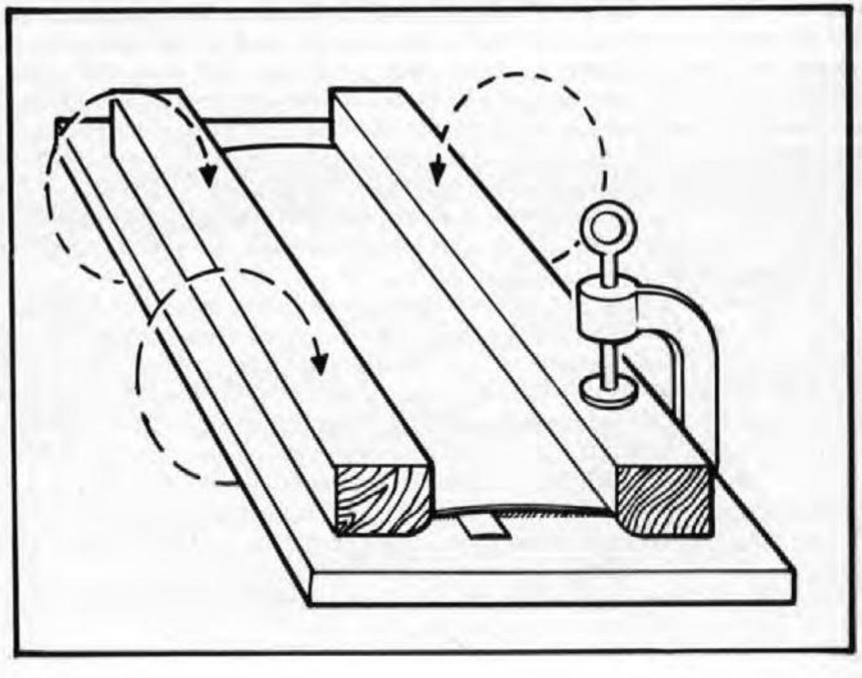
VIRTUALLY all of the techniques described in this book are applicable to the smaller scale of 1:72 (or even 1:100 or 1:44) with some exceptions. Of necessity, some detail is best omitted in these smaller scales unless the modeller has the skill of a miniaturist combined with that of a master watchmaker. Nevertheless it is perfectly possible to detail the cockpit of a tiny 1:44 scale fighter made from a kit and it has been done, albeit in simplified form.

The system of the core and skin method for wing construction is not suitable for 1:72 scale models except when building large biplanes. The skin method using 10 thou card results in a trailing edge which is too thick for the small model and an alternative technique can be employed. The wing is cut from a sheet of 20 thou (or 40 thou depending on the model) and shaped in the manner previously described by sanding with a block. With plastic card this is easy, and the old danger of the wing splitting as it does with balsa is avoided. The trailing edge can be brought down to almost a razor thin appearance, the final finishing being carried out with 'wet and dry' paper liberally lubricated with soap. To obtain camber, and it should be noted that camber on a small scale is very limited, the wing can be bent very slightly and placed on a former made from spare balsa plank as shown in the illustration. Strips of balsa are then placed along the leading and trailing edges and the entire unit plunged into a pan of hot water (it need not be boiling) for about ten seconds and then withdrawn and held under a cold tap. The wing will retain the camber when cold. The former need not be made for one wing only, for it can be used over and over again. Hardwood is, of course, more durable than balsa and is more suitable for the permanent rig. After the camber has been formed the wing ribs can be made from sprue as shown, the tapes on the under surface being lightly scribed with a razor blade. The ailerons are cut out last and stuck back in place, after the necessary rounding off their leading edges. Other surfaces are made straight from sheet card and the construction is straightforward.

An alternative technique is to shape the wing as described above, but cover the top surface with a 5 thou plastic card skin as previously described for improving kit models. This requires great care when handling the adhesive but a slightly better appearance of wing ribbing is the result. Wings with sweep back of course have to have the panels made separately. Dihedral is achieved by lightly cutting across the chord and manually forcing the bend. If done gently, and the initial cut is not too deep, the dihedral will form easily and the open crack underneath can be filled in the usual way. The wing is too thin to allow holes for struts, but the location must be made by scratching some mark which can be seen after painting. The paint must be removed from this area before the struts are put into place.

Some early 1:72 scale kits still on the market and depicting post-1936 fighters with retracting undercarriages, had the wheel wells marked on the under surface of the wings and not actually cut out. Where the wing comes in two pieces, upper and lower, it is possible to cut out the wheel well area within the moulded marks by drilling and cutting before assembly takes place. Where the wing is in one piece, one way out (though it is 'cheating' to a purist) is to paint the wheel well area in grey. Though not very desirable this is the only really practical solution on some tiny 1:44 scale models where there are no wheel wells and the wing moulding is itself very thin.

BELOW: Forming camber on 1:72 scale wing (solid plastic card construction). Wing is first shaped and sanded and then put in the rig illustrated. This need be nothing but a 1/4 inch balsa base with two pieces of 1/2 inch square top pieces. A thin wedge with rounded edges (avoid corners at all costs) is placed under the wing about one quarter of the chord width from the leading edge, and the leading and trailing edges are forced down as shown. The top pieces are held firmly in place with small 'G' clamps at least two per side but this number can increase with larger wings. The entire rig can then be dropped into a pan of hot (not boiling) water and left there for about ten seconds and then withdrawn and run under a cold tap. Note that the inside corners of the top pieces are rounded off. The rig can be made from hard wood and used over and over again. The wedge should be very fine unless a model of an early aeroplane, with a considerable camber is being modelled. Some later biplanes had such a slight camber that it is not necessary to carry out this procedure at all. An exaggerated camber can look as bad as a zero one so careful checking of drawings and photographs should be carried out.



5: Painting and Finishing

THE modeller today is more than well provided for with the large and excellent range of paints, brushes, decals, etc. made by several firms and available from model shops. This is, of course, all ancillary to the plastic kit industry and is very much to the good. Nevertheless the advice given to modellers 40 years ago still stands today; a selection of good quality brushes is required together with cleaners and thinners. All surfaces should be clean which, with the plastic card or polystyrene kit model, means swabbing it with a thick brush and warm water to which a little detergent has been added. Another old axiom still holds true and that is that two thin coats are not the same as, and are better than, one thick coat. Metallic paints, especially silver, must be applied in two thin coats although the temptation to almost flood the surface is great especially as it looks very smooth and solid whilst it is wet. The aftermath is in the drying when all kinds of disasters occur, including rippling. It is a false economy to buy cheap brushes; only the best quality water colour brushes are really suitable for good class work and they last a long time despite many cleanings, without hairs coming out. Art supply shops sell brushes of the best quality, superior to those commonly sold in model shops.

Other items should be included in the list of finishing requisites; one is a matting agent (such as is made by Humbrol) which should be used most sparingly for over use will result in the paint not only assuming a streaky washed out appearance but sometimes being so insecure as to flake off by almost blowing upon it. The matting agent is very useful if used sparingly. It should only be used when a really matt surface is required and this is rather seldom. Instructions for mixing are given on the tube and may vary from maker to maker. Matt varnish is a very useful material and can also be purchased from art shops. The major model paint makers (eg, Humbrol, Airfix) also make it. It can tone down too glossy surfaces (wait until the surface is *absolutely dry* before applying the varnish) and can fix decals or dry print transfers firmly in place. The American firm of Testor makes matt varnish (and gloss) in aerosol form, as do some other firms. While fine for Model AFVA and the like, it can be risky using this on model aircraft. A realistic surface can be realised by buffing with a clean soft piece of rag. This is ideal for 1914-1918 aircraft where the aim should be not too matt nor too much gloss. If the paint is applied so that it dries velvety it can be lightly buffed and a slight delicate sheen arises. The buffing should be carried out both spanwise and chordwise on the wings and tail surfaces and it helps to highlight the rib lines in a very subtle way.

There is an 'art' in finishing a model. This is not a pun; it is meant literally, for there is a technique well-known to professional modelmakers, scene painters and others whose work is to a certain extent concerned with the gentle craft of illusion. To put it into simple terms, if a modeller were to build a 1:48 scale aircraft and by chance he was given a sample of the paint used on the original full-size aeroplane he might imagine that it would be authentic. Indeed there are many who will swear by their colour chips and charts and nothing will convince them otherwise. The harsh fact is that the hypothetical model mentioned above would be incorrect. The reason for this is subtle, and may seem strange, but it is nevertheless true, for not only must the model be scaled down in size but the *colour must also be scaled down.*

To give a simple example: if a modeller paints part of his creation pure white and other parts pure black because the original used these colours (speaking non-scientifically, for white and black are not colours) these extremes will shine out and upset the balance of the remainder of the model. In art, pure white is never used nor is pure black; it is always off white and very dark grey. Anyone who has seen a portrait painted by a poor amateur may have been struck by the unnatural eyebrows or eyelashes because the artist has used pure black instead of dark grey, similarly the teeth will look unnatural for the same reason; indeed, toothpaste advertisers use this false coloration on posters to attract attention to the teeth.

When it comes to colours a similar subtlety should be employed; a brilliant red should be toned down as should a bright yellow. When one looks at a 1:48 scale model and the eyes are only 12 inches away this is the equivalent of looking at the full-size machine at a distance of 48 feet. For colours become more subdued at a distance. If the modeller finds this confusing all he needs to know is that a little subtlety is a good thing when painting. This is apart from all the other things which affect aircraft finishes such as wear and weathering, etc. The other extremes, gloss and matt should also be treated in the same way for the same reasons.

THE AIRBRUSH

To those who have never used an airbrush it appears as the answer to all their finishing problems, but nothing is farther from the truth. The fact is that an airbrush used correctly can impart a superb finish but to obtain this, great care is required on surface preparation for the airbrush will pick up even the tiniest flaw and magnify it. It requires an absolutely clean surface and if a complicated colour scheme is necessary a great deal of time taken up with masking. There is a certain skill in using this most delicate of instruments; a lack of concentration can result in a disaster. Nevertheless nothing can equal the airbrush in its ability to disperse paint in an even manner and as far as metallic paints is concerned it is perfect.

A great deal of work, however, is left for the brush, for painting small detail and filling in and the airbrush is no substitute for the brush but is an excellent accompaniment. It should be said that a model can be finished with brushes alone but not with an airbrush alone. The stumbling block is the fact that an airbrush of the best quality is an expensive investment, even though special airbrush sets for modellers are available over a range of prices. But the cheapest airbrushes are fairly simple items with limitations, and if you get an airbrush at all get the best you can afford. The reason is that the true airbrush, which is no bigger than a fountain pen, is a precision instrument. It is the normal commercial spray gun refined to miniature proportions and as such it is not cheap nor can it be. Beware of anyone offering cheap airbrushes. In recent years aerosol propellant 'bombs' have become available which do away with the need to have a compressor, but you still need to keep on buying new 'bombs' to keep your airbrush in operation.

Despite any advice offered elsewhere to the contrary, the pressure cans of paint supplied by manufacturers for domestic painting work are not the equivalent to an airbrush and they are highly dangerous as far as a small delicate model is concerned. The great feature of the airbrush is that the fine spray can be controlled and this is all important. For those who wish to go into the question of airbrush operation there is at least one good book available from an American manufacturer (Paasche) called *How to paint with Air* which covers airbrush techniques in general in great detail (not specifically for modelling) and other books and magazine articles have covered airbrush work for modellers.

METAL FINISHES

Part of the art of modelling is to make one material look like something else. By careful finishing, a block of wood can be made to look like a steel ingot. As far as model aircraft are concerned the finishes required are metal, wood and fabric.

Metal finishes can be imparted by careful use of paints. However, the metallic paints used without any treatment look rather brash and unrealistic. To obtain a sheen which is applicable to any of them the carbon rubbing method can be used. This consists of nothing but rubbing a soft (2B or 3B) pencil on to a piece of 'wet and dry' paper and then picking up the carbon on a fingertip. This can then be smeared on to the painted metallic surface and lightly buffed. A large amount of carbon will result in a slightly oily surface which is ideal in some circumstances, but it should be noted that like all things it must be used in moderation. It will highlight surface detail such as rivets or panel lines and if buffed well it will not come off. If it has to be removed some warm water and detergent will do this. An exact gunmetal appearance can be achieved by painting the item medium grey and scribbling all over it with a 2B pencil then buffing (though Humbrol and some other paint makers now offer ready-mixed 'gunmetal' paint).

Metal finishes can also be obtained by using actual metal in the form of kitchen foil which is inexpensive and very adaptable. Certain metallic finish sheets are available under trade names like Metalskin or Baremetal but in the author's own experience these have not proved to be suitable for his purposes and no great improvement over kitchen foil. It is emphasized that this is the writer's own opinion based on his own experience. For some modellers (and some types of model aircraft like modern jets) these proprietary products may well be ideal. Such things as the commercial metal finish products tend to appeal to the plastic kit modeller because they are 'instant'; in other words they simply have to be cut out and have their own adhesive backing. However, in true modelling many things are not 'instant' – they have to be worked out and created by the modeller himself. The result is infinitely more satisfying. What the modeller should do is to learn to distinguish between what is realistic and what is pretty and eye-catching in appearance. The author has seen at least one model of an Avro 504K with a chromium plated cowl and even a Fairey Flycatcher with chromium plated wings. What looks pretty to the layman might turn the stomach of an aviation enthusiast.

Kitchen foil as preferred by the author is used in small sections where there is double curvature or a complicated surface. It is placed over the area and lightly pressed down to ascertain the size. It is then cut oversize and stuck to the surface with clear varnish, preferably matt. The knack is to paint both surfaces and then bring them together when the varnish becomes tacky which might only be about a minute later. It is then pressed down and gently buffed. Leave it for a while and then buff a little harder and it will stick quite firm. If an error is made it can easily be removed by peeling off and the varnish brushed away with a little thinners. (Anyone using a commercial metal finish skin will find it difficult to remove and use again after it has been buffed down). The surplus foil is then trimmed with a new craft knife blade and the next piece of foil is butted on to the first piece.

Kitchen foil is brighter on one side than the other, the dull side should always be placed on the outside for the bright surface is too shiny for realism. In any case the matt surface can be brightened up a little by polishing. Note that any seams on the model should be well and truly smoothed over and care should be taken to see that there are no little lumps in the varnish before use. It should be said that the author has used foil since the days before kitchen foil became available and when wrappings from chocolate bars were utilised instead. He has used it on cardboard models, hardwood models, balsa wood models and on plastic and it has always worked satisfactorily, but it is emphasized that it is not a quick procedure.

Another advantage of the kitchen foils is that it can be machined in the same way as the original. During the earlier days of aviation it was quite common to see machined metal panels, especially on German aircraft. The machining appears as whorls and good examples are seen on the cowl of the Fokker E series and for a later example, Colonel Lindberg's Transatlantic Ryan. This is achieved by folding a piece of fine 'wet and dry' paper until a point is achieved (rather like a paper dart). The surface of the foil, after it has been stuck to the model is then 'machined' by merely working the point of the paper in little circles keeping a regular pattern. The reader should try this on a piece of foil first to see the result. After machining, the area is too bright and must be toned down by painting over with a very light coat of thinned out matt varnish. The appearance when the varnish dries is astonishing in its resemblance to the original article. Streaks such as stress lines seen on many early metal covered aircraft are easily reproduced by sanding the surface with fine 'wet and dry' paper, with water lubrication, keeping the strokes strictly parallel.

Metallic paints such as copper and gold can be used effectively to suggest piping but should be toned down, the copper by adding some red and dark grey to imitate the appearance of exhaust pipes. A fairly good brass can be obtained by mixing gold and a little yellow and silver; after applying, use the carbon rubbing method. Some paint makers now offer ready mixed 'brass' and 'bronze' colours in their ranges.

WOOD

Wood finishes are easier but care must be taken to check the correct colour. As is mentioned earlier, actual wood in the form of veneer can sometimes be used especially if it has a miniature grain, otherwise paint must do the job. Graining is simple and consists of painting a base colour, usually a pale brown and allowing it to dry. The second colour, a darker brown, is then merely smeared over the surface of the base colour and the finger can be used to rub in the graining effect, the lines on the finger pad being just the right size. In some areas where there is not room for the finger method a brush must be used. The tendency to work the top colour too long must be avoided for it will dry in lumps and spoil the effect. Wood was always varnished and the correct finish for bare wood

surfaces such as floats, hulls and some fuselages is a medium gloss.

RUBBER AND TYRES

Rubber is an easy material to represent in paint; the only thing that confuses some is the colour to be used. In the earlier days an off white rubber was used for tyres and this is sometimes seen in photographs of early aircraft. The correct colour here is a pale dove grey, not solid but with a little darker grey worked in here and there to suggest wear. Later the tyres were in the familiar dark grey and this is the colour to aim for in a semi-matt finish. Some paler colour should be worked in around the rim to suggest wear and soiling. It adds a great deal of realism. The old question of whether the wheel should be flattened out at the bottom to suggest the weight of the aeroplane pressing down is one entirely up to the modeller himself. However, like other things it should be done with moderation if done at all. The fact is that up until the time of the introduction of the larger low pressure tyres there was little flattening to be seen for the typical early narrow tyre was pumped up to a fairly high pressure and the weight of the aircraft was not all that great in those days. Nevertheless a very slight flattening can be effective or the model can be stood on a base such as a plastic ceiling tile which can have small grooves forced into the surface to take the model wheels.

WEAR AND TEAR

A visit to the Imperial War Museum in London is an education for the modeller for many reasons and one of the author's constant pleasures is to view the ship models for a lot can be learned from them regarding the modelling art itself. There is a fine model of the old oil tanker *San Demetrio* which was built especially for the film of the same name way back in the early 1940s. As this model was meant to represent the full-size ship after it had been on fire all the damage and scorching was represented in a most realistic manner. Other models of great interest are the ship models of the late Norman Ough. Whilst Ough does not show damage his ships have an incredible realism not only because they are so accurately detailed but because of the finish. An ordinary modeller would have painted the hulls a flat, featureless grey and everything else would be painted in the same manner so that the finished produce would resemble those spiritless models of ships and airliners seen in the windows of travel agents. The thing about Norman Ough is that he loved and understood warships and this is seen when the models are viewed. There is a *subtle* (again that word) variation of colour, small patches of subdued red to indicate re-painting with red lead paint, a slight difference of shade and texture here and there, and the whole has to be seen for it is difficult to describe. The whole point of this preamble is to indicate that 'wear and tear' like stains and repair patches were not invented by the plastic aircraft modeller, but as far as aircraft models are concerned such variations in finish were never seen on aeroplane models until the plastic model aircraft hobby gathered momentum in the 1960s.

The traditional aeroplane model as seen in many museums is smooth, clean, trim and immaculate in paintwork and looking every inch a model. The other extreme these days is the model built by the man who thinks that 'wear and tear' is the thing, and whose model has paint worn off in all the likely and unlikely places, exhaust burns running back over the full fuselage length, and oil stains all over. Perfection lies between these two extremes and such adornments should be added with care and careful planning by which is meant reference to photographs. There is a terrible tendency to be avoided and that is for the modeller having applied his first exhaust burn to be impressed with it that he cannot control himself. This is no exaggeration, and it is an urge to be controlled, for without a doubt this kind of realistic finish can make the model extremely interesting or it can ruin it.

Such finishes are, of course, only applicable to machines in both world wars or major campaigns like Vietnam for, whilst photographs of racing aeroplanes and airliners can be seen where there are some oil stains and soot, there is usually plenty of time to clean them and such finishes should be avoided in these cases. Conversely, the expensive (full-size) airliners of recent years have tended to see maximum utilisation to earn their keep and are often seen dirtier than airliners of the last generation.

As far as the Great War period is concerned there is a great deal of scope for a realistic finish, for machines never remained in their manufacturer's bright and shiny finish for very long. One has only to think of the conditions under which military aeroplanes operated in those days to understand why. Hangars of a permanent nature were rare overseas and to some extent at home bases in England or Germany. Many aircraft were exposed to the elements for long periods on airfields which had been pasture meadows just a short time before. As anyone knows who has done any camping, the grass soon gives way to mud. Engines frequently exuded oil; indeed, rotary engines threw hot castor oil in all directions and photographs of wartime machines illustrate this point well, the whole front end of some aircraft being completely saturated and stained. Oil was also thrown back on to centre section struts and undercarriage members and, of course, the poor pilot. On under surfaces, mud or dust settled on to the oiled fabric and stuck there. As it could only be removed by washing with boiling water it sometimes remained for some time, for the cleaning procedure was quite lengthy. Although regulations in the Royal Flying Corps stated that aeroplanes were to be cleaned after each flight the conditions under which many squadrons operated made this regulation quite impracticable. The machines probably got a brief rub down with attention being paid to the more important areas.

Exhaust stains were not so common mainly because the exhaust pipe was usually led well away from the fuselage. This was to prevent the crew being affected by the fumes but also because the areas around the exhaust outlet were usually wood and fabric. There are photographs, however, showing slight staining over the top wing of some German machines (eg, Albatros CIII).

Mud is usually restricted to the undercarriage area, the wheel discs, usually nothing more than fabric discs laced into position were frequently stained. However, mud would not be allowed to remain long or accumulate around the working parts of the axle or vee, so that great piles of debris are quite inappropriate.

Other marks and stains include areas around filling cocks and handling marks especially around the base of the rear fuselage. Such marks are those seen whenever the human hand (especially a rather oily one) grips the same area over a period of time. A damaged machine might require a part to be completely replaced or merely a patch. Bullet holes were patched over with a piece of fabric overpainted with the base colour of the machine. This would appear as a small area (usually square on British machines) in a

slightly richer colour than the surrounding surface. Photographs indicate that German and French machines used circular patches, (probably pre-cut) rather like bicycle tyre patches which appeared as slightly brighter discs surrounded by a darker ring. This applies to clear doped machines, later the patches were painted the general colour of the machine.

There is a point which is frequently overlooked by colour fanatics as far as colours are concerned and that is the fact that colour fades if exposed to strong light (by which is meant good sunlight) for any length of time. This is not so common today with all the modern technological developments in paints and finishes but it was quite true as far as the Great War period and after was concerned. A couple of patrols in strong French summer sunlight was enough to start the fading of pigments and this varied according to the colour. Reds soon lost their penetrating brilliance and became more 'brick red' in appearance, blues faded considerably becoming very pale and washed out whilst whites became darker, virtually a creamier shade. All the bright colours suffered and the finish that suffered the most was the German printed pattern fabrics. Older readers might recall how early cotton printed dresses or shirts soon faded. As far as the German fabrics were concerned there was the additional drawback that by the time they appeared, Germany was suffering from a shortage of raw materials so that the dyes used were inferior in quality. The overall impression was a vague greyness not a rich surge of colours as suggested by some artists of recent years.

When a new aeroplane left the factory in the 'stick and string' days the fabric was drum tight and as far as the wings and tail surfaces were concerned it remained so for sagging fabric here would affect the control of the machine. The fuselage however was not so important and fabric sagging and warping was very common. This was especially true of machines in the Middle East or Africa where climatic conditions played havoc with not only fabric but woodwork and wiring. Shrinkage was common, and rippled surfaces were often seen when lacing had been drawn tight to overcome the warp. If well done, an area of warped or sagging fabric can give a model a very authentic appearance and at the same time, considerable character. Warping was seldom seen where the fabric was stretched over stringers (eg, turtlebacks) it was most common on side panels which were flat.

Staining and oil streaks are easily applied to a model with a fine brush, the paint being well diluted with thinners. Oil streaks, which were most common along the belly of the machine should be painted as fine *straight* irregular lines using a thinned down dark brown. It should be remembered that the slipstream was responsible for the extent of these streaks so that they must be straight. The area behind rotary engines, aft of the metal panelling, was usually wood covered with fabric. This received its share of oil and can be represented by brushing the area with thinners first and then whilst the surface is still wet, adding some dark brown, spreading it around evenly and fading out the edges. This should never be done until the base colour has completely dried.

Handling marks can be treated in much the same way with care to see that they are only suggested. Replacement parts such as new elevators or ailerons are easily reproduced by painting the part in a slightly richer colour than the rest of the machine to suggest newness. Patches can be applied by carefully painting small squares or rectangles in a richer colour, as mentioned above, with a little gloss added. Mud can be represented by mixing medium brown with a little yellow, not in a solid colour but by dabbing patches and allowing it to partly mix. This is best applied to the perimeter of the tyres but other common areas are around the axle and lower undercarriage members and the tail skid. Try to locate a photograph if possible and copy from this rather than leaving too much to the imagination.

Fabric warping and wrinkles can easily be simulated in plastic card by merely 'engraving' the warp with a blunt instrument such as an empty ball point pen. This can be carried out on the 5 thou card when double skinning is being used, or the entire fuselage side of a built-up box can be covered by a 5 thou skin which can include the wrinkles and warps. Try producing warps and wrinkles on a piece of scrap plastic card before applying the technique to the model. When applying the embossed skin to the main fuselage side it may tend to dish out. This can be counter-acted by applying some thin cement and then immediately pushing the skin down. If the cement slightly softens the thin card it can add to the realism of the wrinkle.

MARKINGS AND INSIGNIA

This subject is covered today by a multitude, indeed one might say a super abundance, of publications of varying degrees of accuracy. In their wake there has appeared an equal abundance of decal sheets, one of the side effects of this has been that some modellers have been so keen to apply them that other aspects of the art have been somewhat neglected. There is little point in assembling a model which has correct colour scheme and authentic markings if the structure of the model itself is inaccurate. The point of this is to make clear that whilst coloration and markings are a vital part of modelling they are only a part of the whole. This is a book about modelling and the concern here is to discuss methods of making insignia and markings for the commercial decals available today mainly covering the World War 2 period (with a few exceptions) where the vintage aircraft modeller is comparatively poorly served. What few decals there are available for vintage models are mostly in 1:72 scale so that the builder of larger models has no option but to make his own, which in a way is a good thing.

Solid colour decal sheets which are used principally by flying model aircraft builders are very useful. They are, when purchased, fairly thick and shiny but a smooth gentle sanding with dry 'wet and dry' paper will not only reduce their thickness but will impart a matt surface. They can then be cut to shape with a sharp blade or, in the case of discs or circles, cut out by scribing lightly with compasses. The drawback is that the solid colour sheets are limited in colour range, usually red, white, blue, yellow, green and black.

Another valuable source are Letraset and similar makes of dryprint transfer sheet, by which is meant not only the ones now produced with aircraft markings on them but the huge range of commercial alphabet sheets available. Modellers should try to obtain dryprint makers' catalogues and he will see that many sheets can be used straight off, the lettering being exactly what is required or very close. Apart from this some dryprint characters can be cut by reversing the sheet and very gently cutting away the character on the dull side of the sheet. The cross patée insignia on the author's Halberstadt model was made by cutting out the two arms of the cross from a large size 'L' on a Letraset sheet, using a single-edged razor blade and compasses. The very small print at the top and bottom of Letraset sheets is invaluable (as suggested earlier) for small lettering such as the white manufacturer's name on tyres or 'lift here' marks. It is suggested that a mounted magnifying glass be used when working with these tiny letters. Cheat lines and other similar markings can be obtained from the special dryprint sheets containing nothing but black or white lines, whilst other sheets have whole ranges of numbers, dots, circles, dashes, squares, etc., all of which can be used to advantage. One firm, Blick, does small economical sheets, some intended specially for miscellaneous model work. Letraset also produce solid colour sheets but the most useful as far as the modeller is concerned is the 'Dry Colour Sheet' which is nothing but a sheet of colour (there is quite a range) of very fine film similar in nature to the normal Letraset character. From this can be cut various shapes but there is a little art in doing this. The shape must be cut out by scoring with a sharp instrument on the shiny side, the opposite one to that which holds the film. A piece is cut away containing the scored pattern and then turned over so that the film holding side is face up. The waste area around the pattern is now removed and this is not too difficult as it lifts off easily (the author uses a wooden toothpick). The pattern is then turned over again with the film side down on to the greaseproof backing sheet. Like all Letraset material it should be loosened by gently scribbling over with a suitable instrument such as an empty ball point pen. Care should be taken not to overdo this or it will detach itself prematurely. The pattern is then carefully laid over the surface on the model and rubbed over so that it detaches itself from the carrier on to the model.

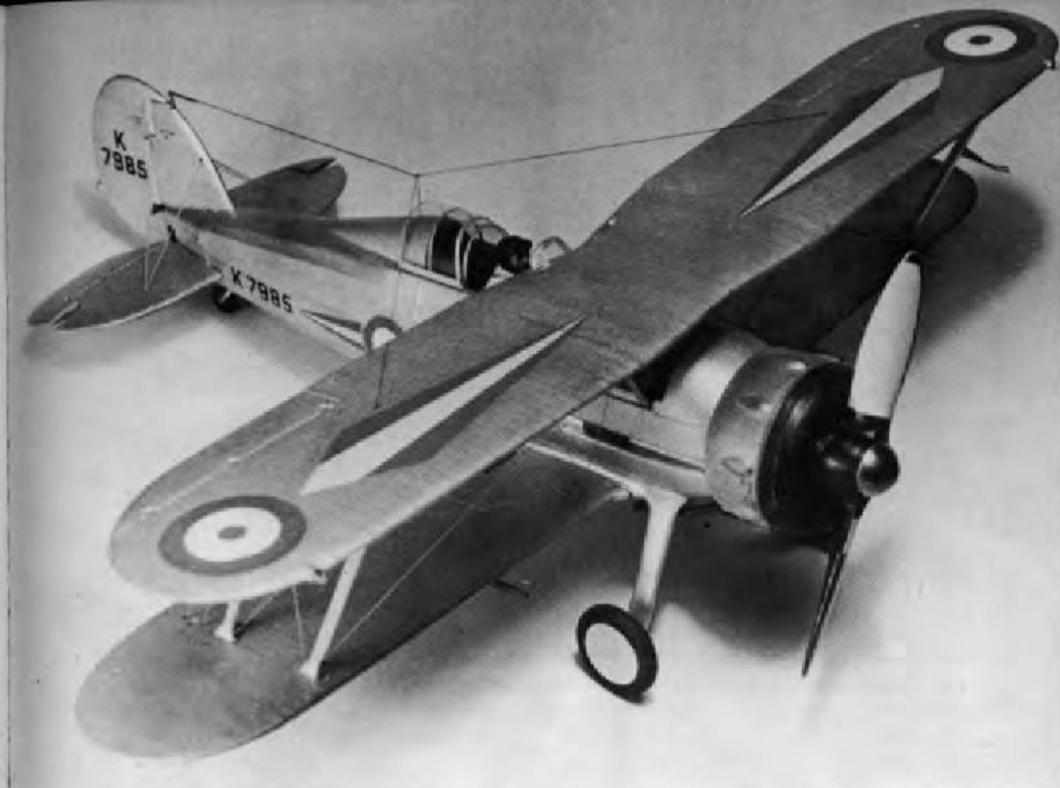
The various dryprint systems are undoubtedly the most superior method of applying markings, especially the solid colour sheets, and so fine the edge is virtually non-existent. Even the finest decals still have an edge and the carrier is always visible. Decals are also unable to follow some detail even when firmly pressed into place whilst dryprint transfers can be persuaded to follow every contour without any 'skinning' over at all. Dryprint transfers can easily be removed by looping a length of clear adhesive tape around the finger and touching the dryprint with it. The print will rise with the adhesive on the tape which will pick up even the small fragments which have broken off.

The author has been using dryprint transfers as a source of marking detail since the first ones appeared on the market (from the Letraset firm) which is a long time now. It is somewhat surprising to find even now how few other modellers seem to use it extensively. There is some difficulty at first until the properties of the material are understood but once the knack has been learned there is no difficulty. The knack is learned by experiment; like all other techniques it is not 'instant' and this again is where the modeller who has only built plastic kits direct from the box is at a disadvantage. On several occasions such modellers have informed the author that they have tried dryprint transfers but have had no success. Usually they have tried once and given up. On more than one occasion the author has had one of his models on display and has been asked where the decals came from. On being informed that the 'decals' were cut from commercial dryprint transfer sheets the onlooker has been mildly amazed but not so amazed as the author has been on finding that commercial 'brain washing' has gone so far that many modellers think that all markings must be waterslide decals and that the idea of making one's own markings is pure fancy! One last tip – some dryprint transfer makers produce small sample sheets which are sometimes to be had free from stockists (mainly art and stationery supply shops), and these are ideal for trying out techniques.

There is still some room for a little brush work, usually in tidying up areas and the mapping pen can still be used to advantage with black and white ink. When writing small characters modellers should get used to having a magnifying glass, mounted on a stand between their eyes and the model. It will help enormously, reduce eye strain and result in neater work. Stamp shops and instrument shops sell a range of these at reasonable enough prices. If you cannot afford a proper glass on a stand, then, at least invest in a cheap hand-held magnifying glass which is better than nothing at all.

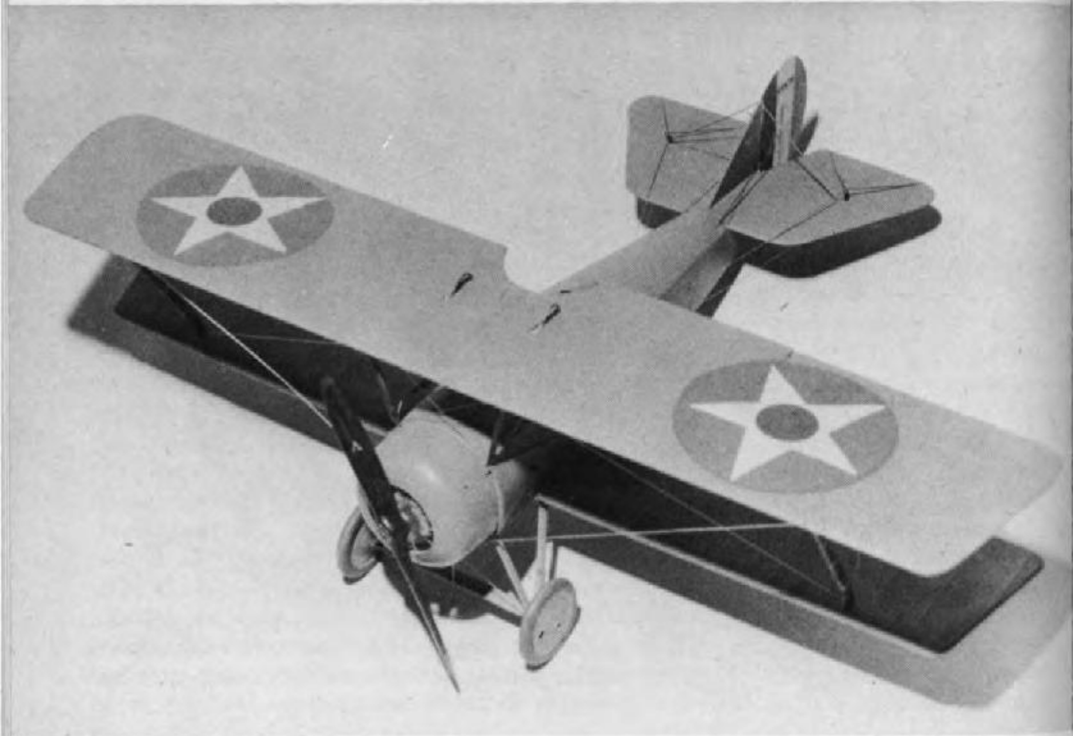
RESEARCH

Most books dealing with modelling subjects stress the importance of research and note taking as an adjunct to successful modelling. It is assumed that the modeller who is reading this book will be keen enough already to be aware of the necessity for careful research. This ranges through scrutinising plans, reading articles, seeking out colour schemes, checking technical facts, and, where possible, studying the subject to be modelled at a museum (if an example exists). If you have any sort of camera, use it where allowed. Public libraries are usually accessible to most modellers, and books can be consulted there (or borrowed). Specialist museums almost all have libraries where books, photographs and documents can be studied (usually by prior appointment). There are, of course, several specialist aviation and modelling magazines, and specialist societies like IPMS (covering models in plastic in general) and Cross & Cockade (which specialises in the study of 1914-1918 period aircraft). Details of these and many others are given in the specialist monthly magazines. By all means keep a note-book to record any facts or references you come across – even for models you may only as yet by contemplating for future attention – and many keen modellers keep scrapbooks or folders in which to store cuttings or recorded notes. The research can often be just as absorbing as the modelling – indeed sometimes more so!



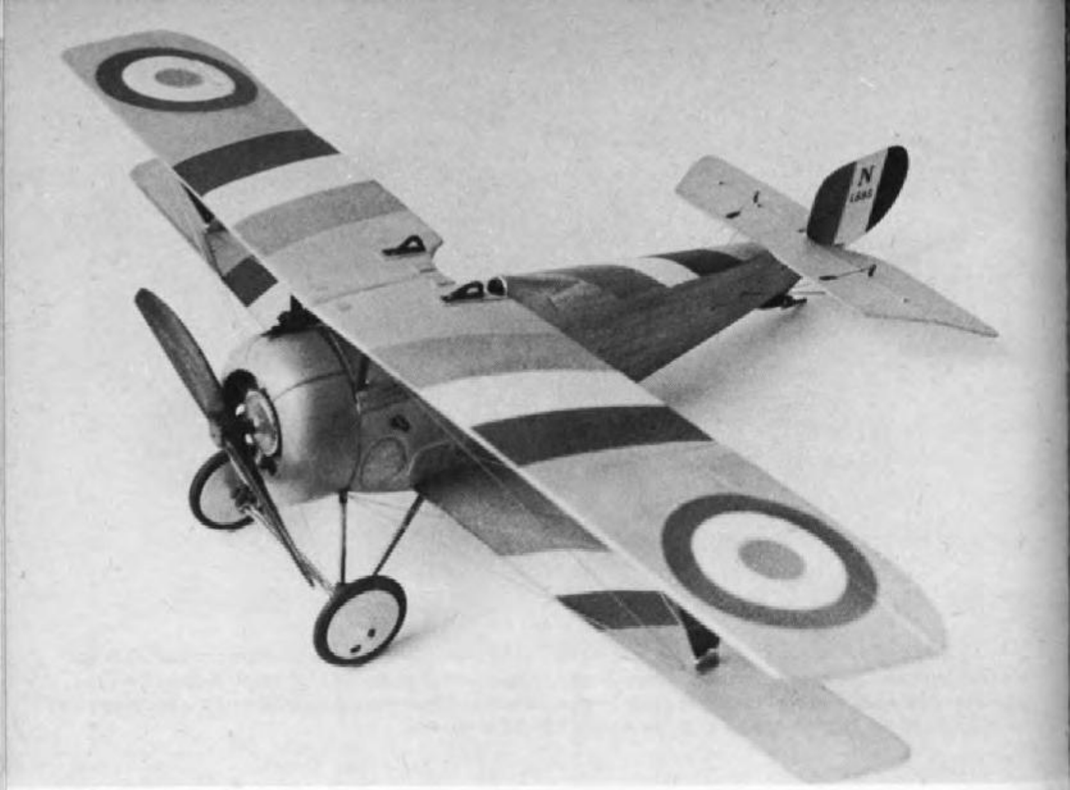
ABOVE: Author's model of 1:48 scale Gladiator built from a Lifelike (formerly Inpact) kit. The kit is one of a very fine group produced in this scale. No correction was needed and extra work consisted of replacing certain parts and refinement of others. The propeller was sharpened and the rear edge of the cowl reduced as suggested in the text. The ends of the exhausts were bored to a short depth sufficient to give the impression of hollow pipes. The junction of the undercarriage legs with the fuselage required much filling and shaping and the cockpit canopy is made entirely from thin acetate sheet to replace the transparency supplied in the kit. Framework on the canopy is painted decal, cut into fine strips. The trailing edges of the rudder and elevators were sharpened and the two items separated from the fixed members. This required careful cutting with a sharp blade. The shape of the ailerons and the hardness of the plastic precluded the cutting away of these components but a cut was made in the groove and the inner edges of the ailerons were cut right through. Landing and navigation lights were made from moulded acetate sheet as described in the text. The cockpit side panel was cut away as shown and fixed in the open position.

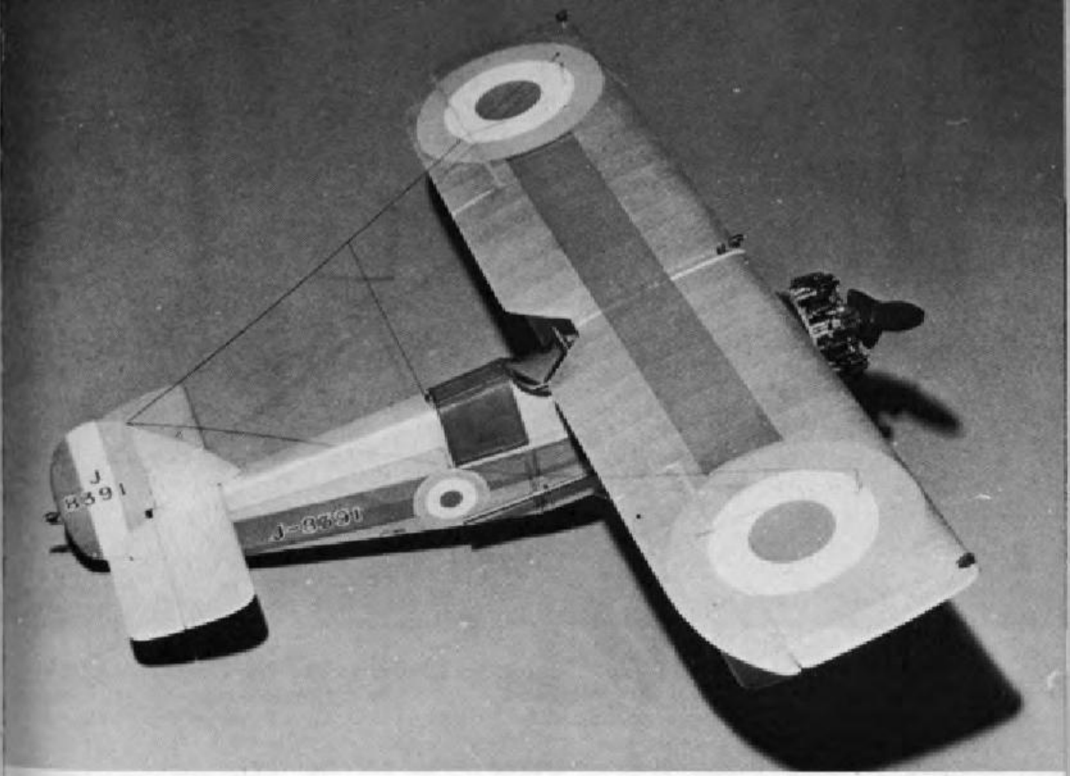
FOLLOWING PAGE: Author's model of Thomas Morse S4C in 1:48 scale. This is a typical built-up box model with a moulded cowl. This particular model was fully described in **Aeromodeller** *magazine of April 1969.*

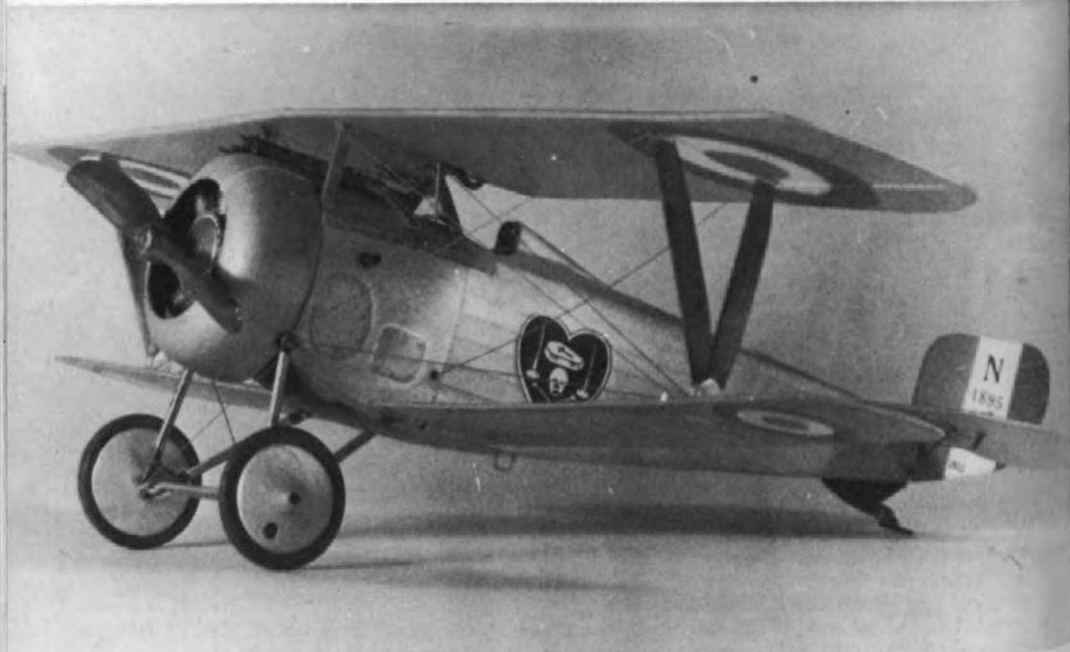


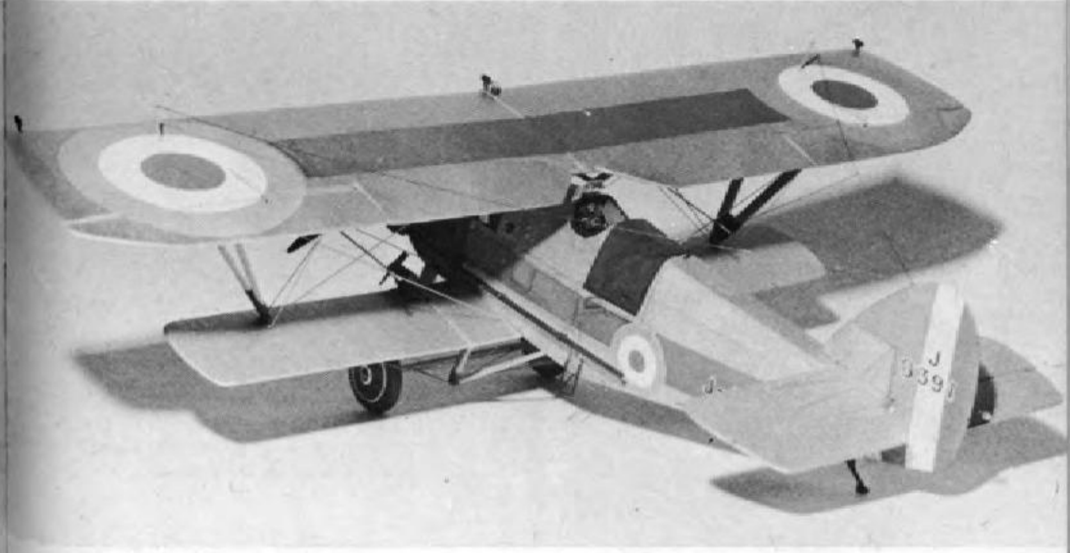
ABOVE: The author's model of a Avia BH 33 in 1:48 scale. This is another typical built-up box model although simpler than Thomas Morse. There was a great deal of work required on the engine on this model, otherwise it was quite straightforward. A complete description of the building of the model and the aircraft appeared in the April 1970 **Scale models.**

FOLLOWING PAGE: Author's model of Nieuport 24 bis (Nungesser's machine) in 1:48 scale. This was originally a Hawk kit of the 17c but a great deal of replacement was required. The only items of the original kit used in the final model were the fuselage which was re-skinned as described in the text, and the wheels. The kit propeller proved to be too weak and a new one was made from plastic card. The wings and tail assembly are made as described on the text and the cowl was moulded using the original kit cowl (which had been slightly reshaped and reduced with sanding) as a male mould. This model and the Thomas Morse and Voisin models shown in this book were all damaged when a shelf fell on them. They are all shown here as rebuilt illustrating the resilience of plastic card.

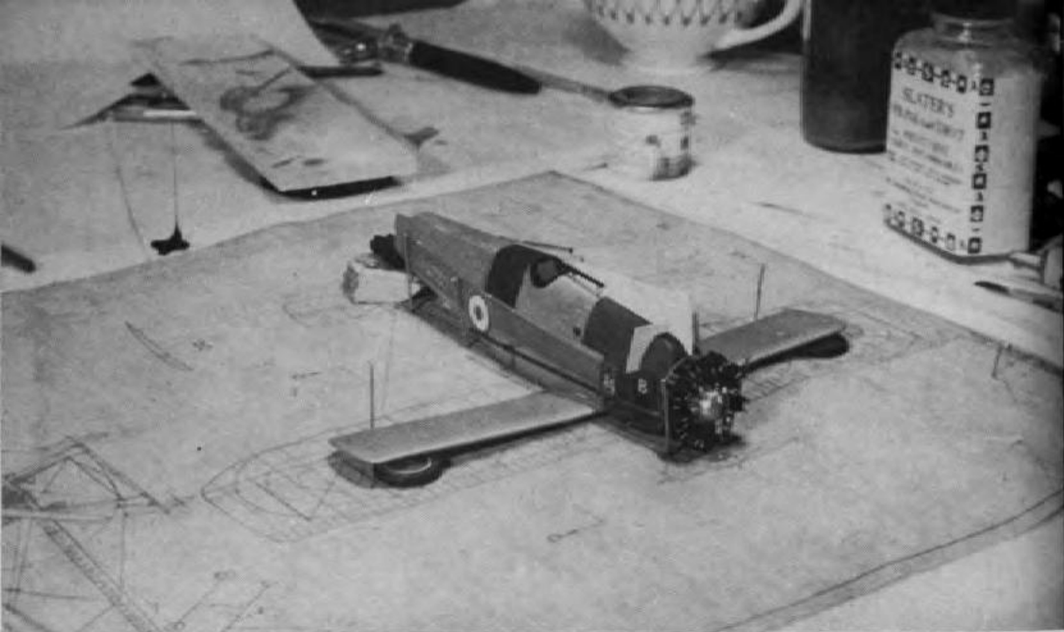








This beautifully made 1:48 scale Armstrong Whitworth Siskin is shown under construction on another page and aspects of its building are described in the text.



ABOVE: A simple rig to ensure correct setting up of wings and fuselage. This is the author's Siskin model being assembled. Note that the plan is laid on to a plastic ceiling tile and held in position with pins (or toothpicks). This ensures that the wings are correctly lined up and that the lower dihedral is correct. Note the simple plastic card support on top of fuselage to receive the upper wing. After the upper wing was fitted the support was merely cut at the rear end with scissors and it fell away.

OPPOSITE PAGE: TOP, Author's 1:48 model of Morane Saulnier "N" the fuselage of which was a flat cut-out. The wings are 5 thou.

BOTTOM: Author's odd ball, a 1:72 Buffalo made from old Revell kit. Many improvements are included and some genteel weathering can be seen.

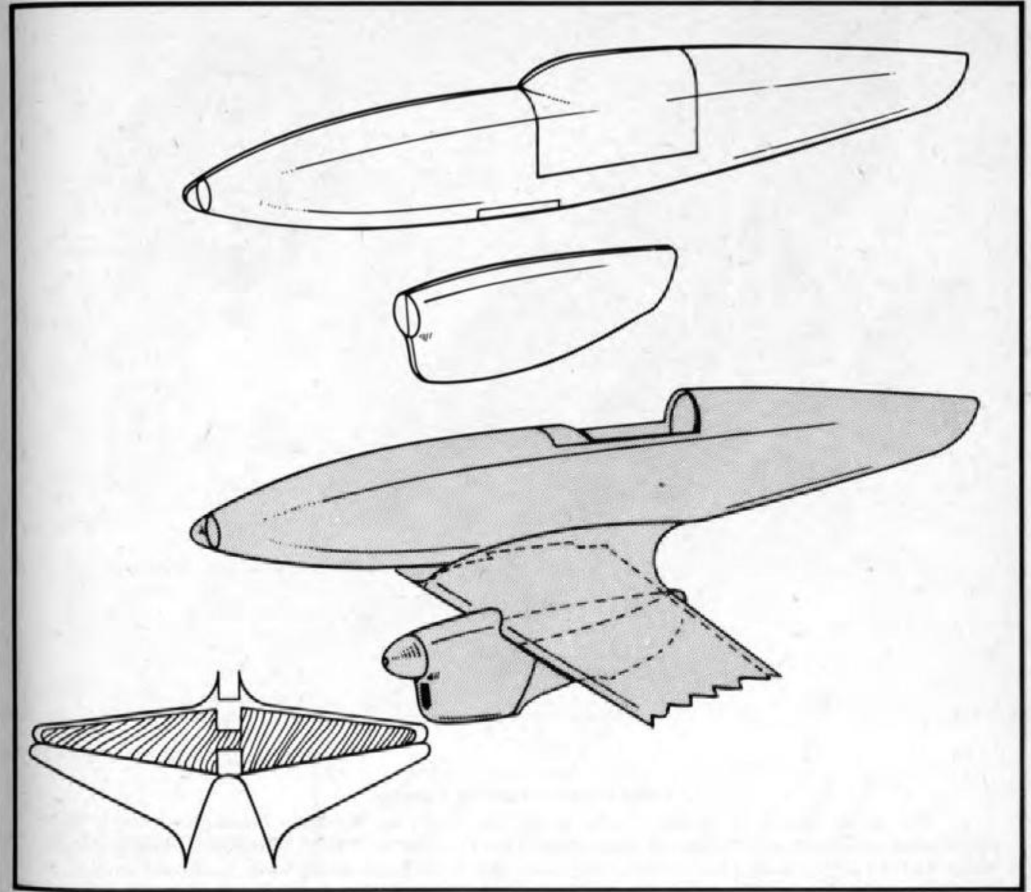
De Havilland Comet Racer

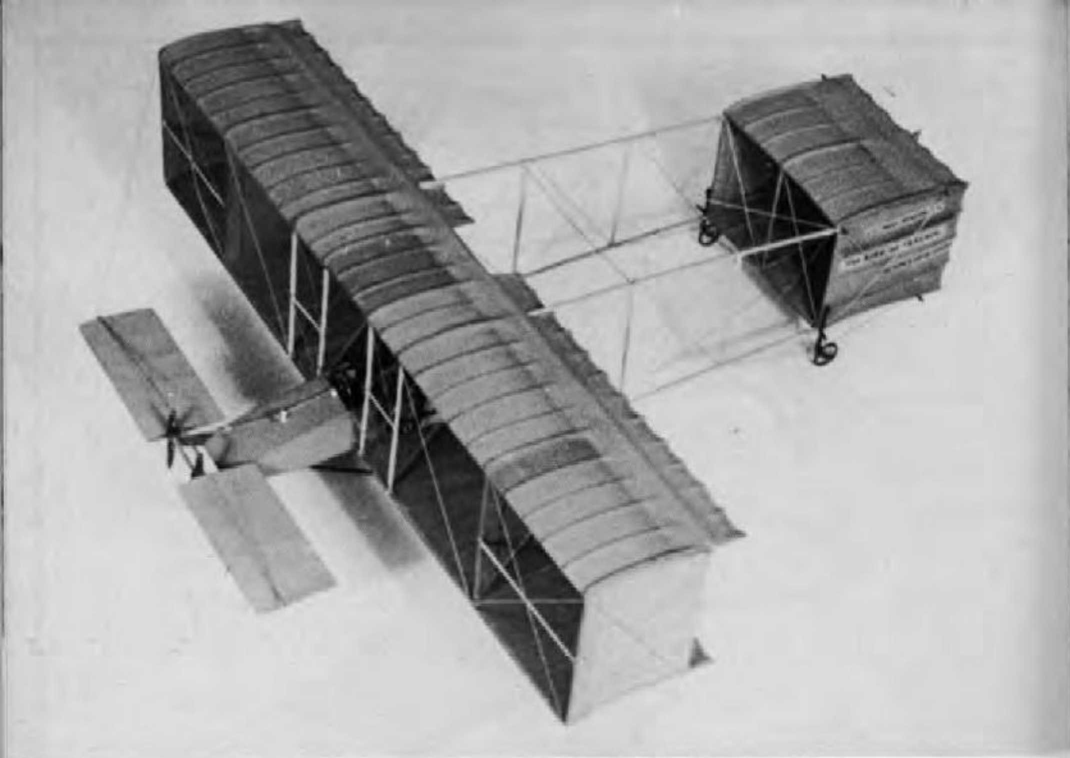
Technique shown here is the most suitable one for more modern aircraft involving a moulded fuselage. Note that the cockpit canopy is carved integrally with the fuselage. It is cut away after the fuselage halves have been moulded and the canopy is moulded separately using acetate sheet, obtainable from most shops specialising in artist's materials. The framework of the canopy is made by painting the fuselage colour (in this case red) on to a piece of scrap decal sheet, ideally black or grey for this original colour will be seen on the 'inside' of the framework. After the paint has completely dried, very thin strips are cut away using a razor blade and steel rule. These are then applied as framework.

Note the gap in the belly to accommodate the wing centre strip and the nose cut away to take the landing light. The cut away cone is used to mould the light cover. The original wooden fuselage block with the above mentioned parts cut away is then used as a central core for the fuselage. It need only be stuck in place with a few dabs of ordinary glue.

The nacelle block is carved as shown, the two nacelles being moulded from the same block and later cut to fit on to the wing. Note cut-out underneath for undercarriage and the aperture in front for engine cooling. The spinners are moulded separately from a specially cut piece of balsa dowl.

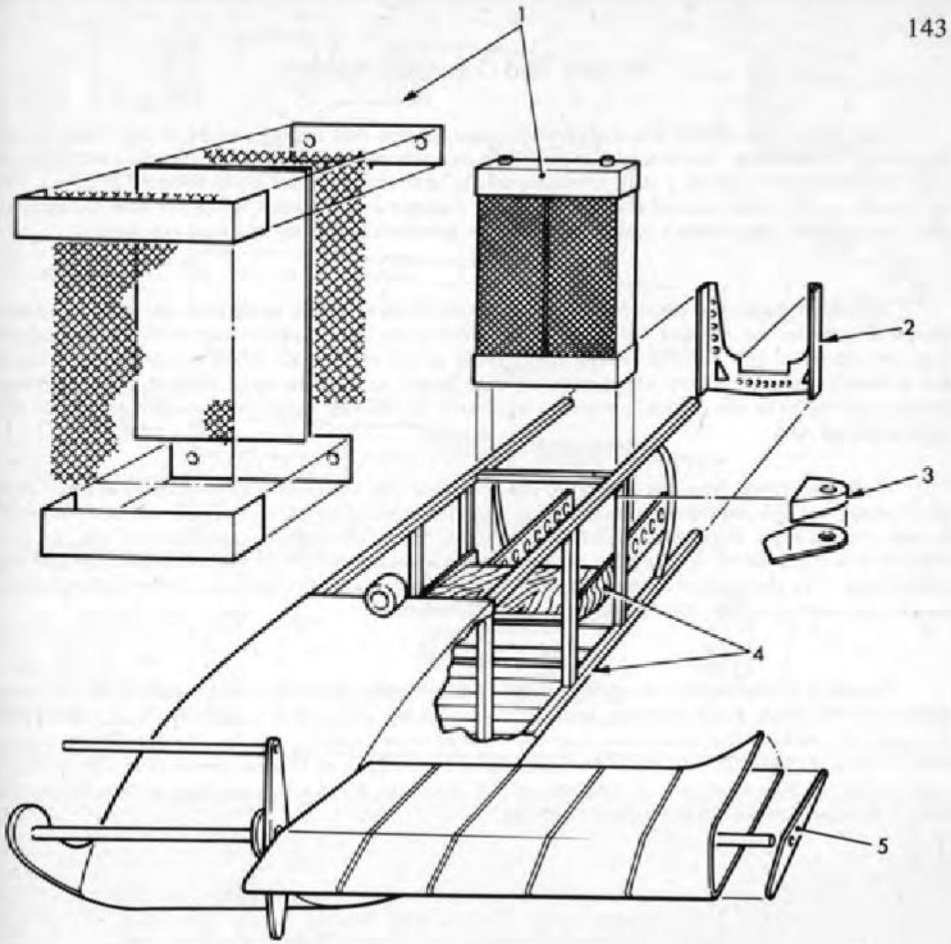
The wings in this case are made from one sheet of plastic card as shown in the small sketch. Careful measurement is required here but always cut a little over and sand down. The central core is balsa, roughly shaped – note that the centre section is cut down to fit into the slot on underside of fuselage. Wing fillets can either be moulded as described elsewhere or made by applying liberal amounts of Polyfilla, allowing to dry and then gently sanding to shape.

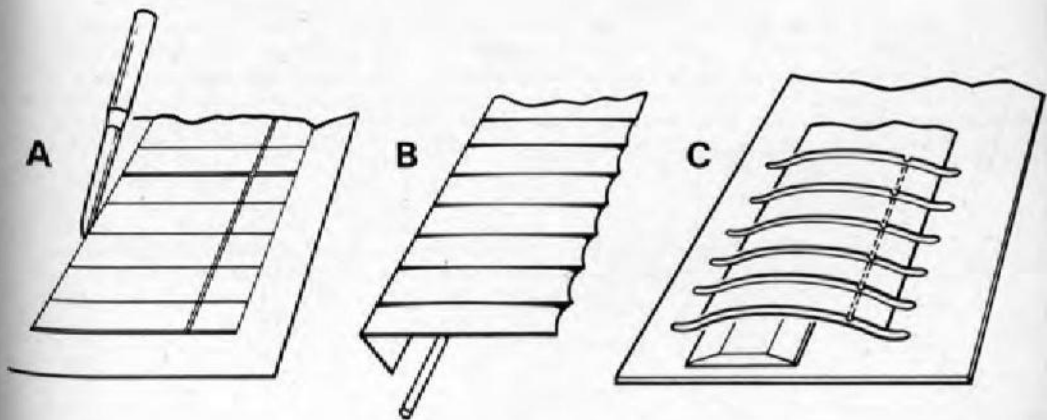




1909 Voisin 'Bird of Passage'

One of the late Lord Brabazon's machines, this model was made by the author entirely from plastic card and sprue, and includes a fully detailed ENV engine with valve springs and plugs and leads. Wings and tail surfaces were made from transparent plastic card and sprayed which allowed them to be slightly translucent thus suggesting the single covering of fabric. The method used is also described in the main text. All wheels are spoked and are made using the sprue spoke method. This model won the IPMS National Competition in 1968. The drawings on page 143 shows technique used when making the model: (1) Radiator construction from 40 thou plastic card and fine copper wire mesh. (2) Rear engine support plate made from 10 thou plastic card perforated before cutting away from main sheet. (3) Undercarriage lugs and stops for springs (made from sprue). (4) Seat and side stays made from thin veneer as were the duckboards which formed the floor in the nacelle. (5) The elevator was covered with fabric on both surfaces represented here by 10 thou card. Note that entire nacelle is built up from strips cut from 40 thou plastic card and built up as the original was. The front 'fabric' cover was made from 5 thou card. Note perforated girders which support engine made from 20 thou card again perforated before cutting away from main sheet. (A) Outline of wings and ribs marked lightly on transparent plastic card. (B) Wing cut away and leading edge formed by folding (the Voisin wings had only one layer of fabric fixed to the **bottom** *of the wing ribs which were covered in a fabric sleeve. The leading edge was formed by merely folding the fabric over the leading spar and stitching it to the underside). Note that wing rib lines have been scribed slightly but that ribs are made from triangular cross-section heat-stretched sprue and all fitted individually in place as shown at C. The wing is then 'set' over a suitably shaped former so that when all the ribs are dry the wing shape will be retained. The dotted line near the trailing edge shows the notches to be made in the ribs to accommodate the rear spar.*





Boulton Paul Overstrand bomber

This particular model was awarded the cup for the best aircraft model in the 1968 Model Engineering Exhibition, the first plastic model to win this prize. The fuselage is quite a complicated shape as shown and involves a large moulding of the basic skin to which other skins are attached. The top sketch A shows the general shape of the basic fuselage and the areas which are later cut away to allow for cockpit, rear gunner's compartment, lower gun area, bomb bay and nose gun turret.

Sketch B shows the main fuselage skin (from 30 thou plastic card) with the areas cut away. Sketch C indicates the skinning (10 thou card) applied to the main shell (all areas shown with diagonal lines are skinned). This involves straight line scoring of the top rear to simulate fabric over stringers and a dotted 'pimple' pattern along edges of side panels to simulate large stitches. The bomb bay fairing underneath in the original aeroplane was made by covering metal stringers with fabric and this again is scored card.

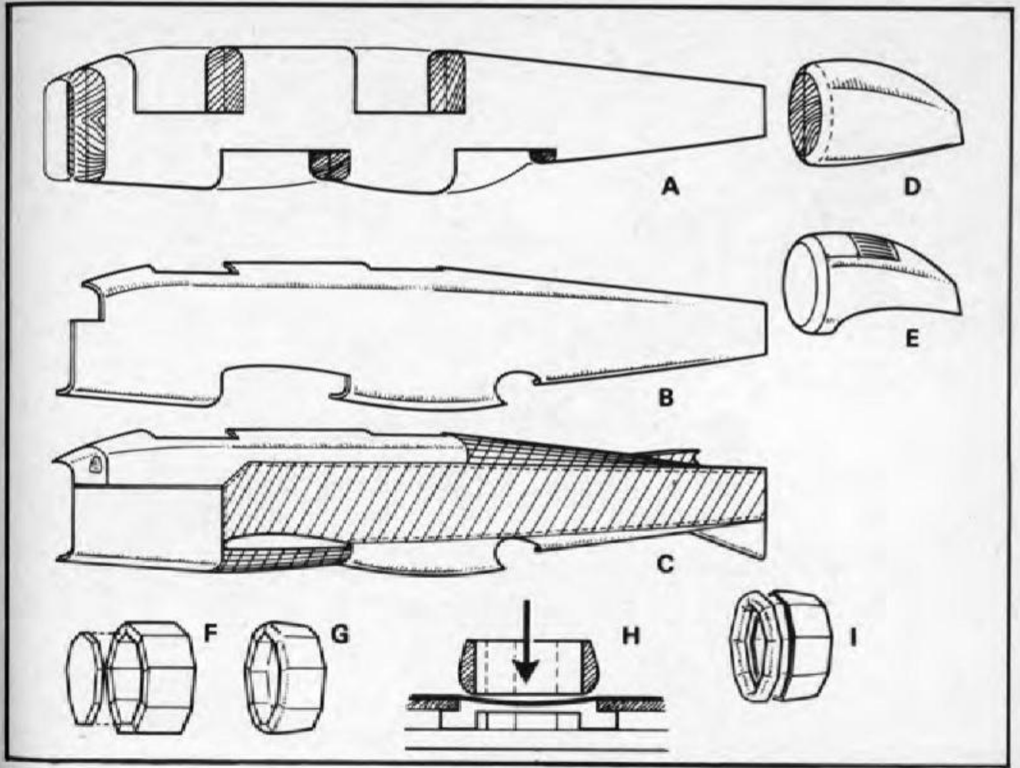
Note the curved panel on the top of the nose area. The sketch shows the fuselage as a half shell but in actual fact this panel is made in one piece from transparent plastic card. There is a small window, as seen, and to make this as neat as possible the whole panel was made from transparent material. The window area was masked by applying pieces of decal sheet cut to correct shape and painting over the whole panel. The decal sheet is then carefully removed very soon afterwards by lifting with a piece of double sided adhesive tape, thus avoiding spoiling the edges.

Sketch D is the engine nacelle block and E the moulded halves brought together and cut away to fit on to the wings. Extra panelling includes the ridged top plate which is actually an oil cooler. This was made by sticking fine sprue to a piece cut from an extra moulded nacelle. The nacelles are indeed covered by a second thin skin made by moulding extra shells from 10 thou plastic card. The joints of metal panel can then be accurately reproduced. To obtain the top double curvature section the nacelle block is pushed through a female mould 'top first'.

Sketch F shows the special mould made to reproduce the angular cowls of the Overstrand. This is made from pieces of 1/8 inch balsa with a sheet inserted into the middle to act as stiffener and to maintain correct shape. Another piece of the same size is cut from balsa at the same time.

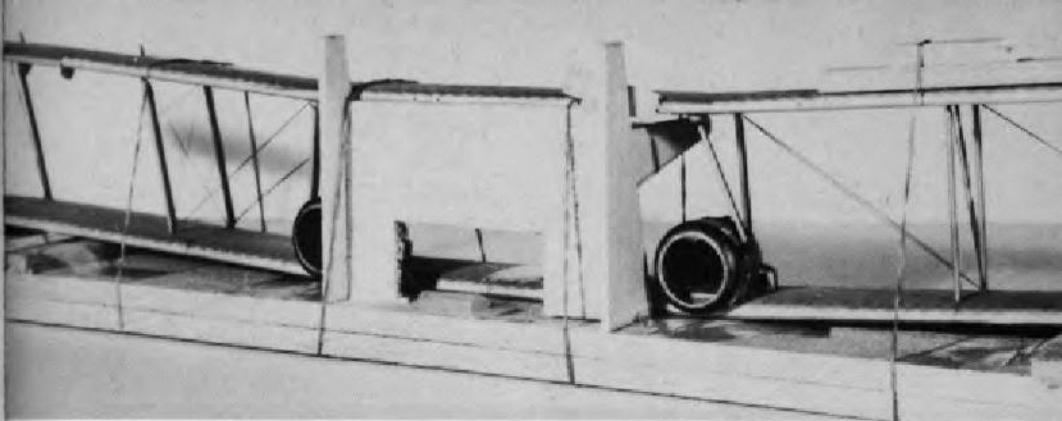
Sketch G shows the cowl block shaped and sanded. Sketch H is a side elevation showing the action of moulding. The front rim of the actual cowling is a collector ring for the exhaust system so that it is fairly thick. In sketch H the cowl block is pressed down on to the heated plastic card laying on the 'female' mould. The 'female' mould is raised on to some pieces of scrap balsa and the second nonagonal shape is placed directly below so that when the cowl block comes through the 'female' mould forming the outer shape, the nonagonal block will enter the front of the cowl block and form the inside of the collector ring.

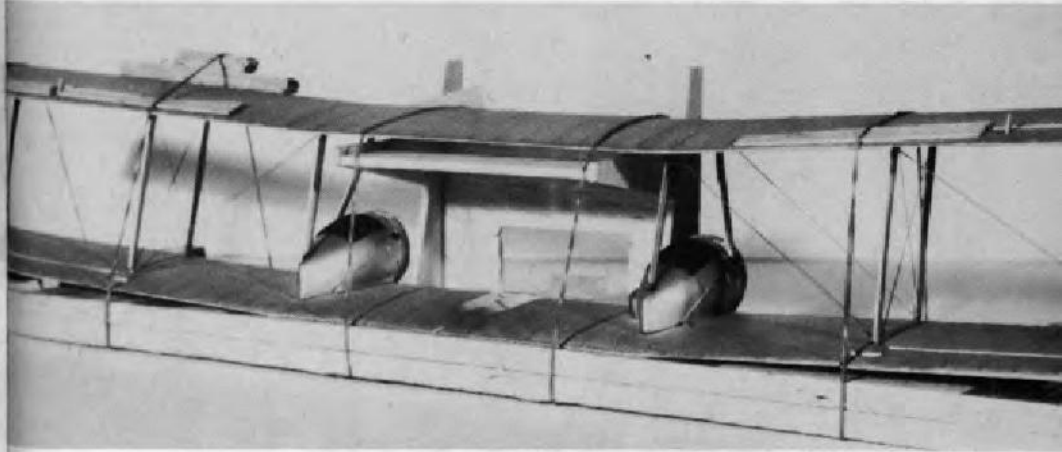
Sketch I shows the cowl ring which has been cut down and sanded straight fitting on to the rear part of the cowl formed by pushing the rear of the cowl block through the 'female' mould.



When assembling the larger biplanes a jig of some sort is essential. The photographs show a very simple but effective structure built from balsa. Note the use of elastic bands (not too tight - merely firm) to hold wing in position. Note also the small moulded streamlined fairing at the junction of the leading nacelle 'Vee' struts with the under surface of the top wing. Note that in this case the lower wing is all one piece so as to fit into cut-out in belly of fuselage. The wing structure was completely assembled before fitting to the fuselage. When placed in position the lower wing was fixed firmly in place by inserting two small brass wood screws. The lower part of the wing slot is taken up with the bomb bay.

The substantial wings of the Overstrand are made in yet another variation of the moulding technique. The original wings are thick, with blunt tips and are in three panels, ie, centre section and two outer sections. The wing ribs of each section are set at right angles to the leading edge. *The photograph shows that a single shaped block is made of a wing section, the 'ribs' are merely substantial cotton thread wound around the block, the nose riblets passing through holes. Fine notches are cut into leading and trailing edges to ensure that thread does not slip but after winding it is held in place by painting with enamel. The block is cut about one inch longer than the section and the tips are correctly shaped. Six mouldings are run off as shown (about eight are safer in case of accidents). Each moulding represents a wing section so that two are cut at both ends to form the upper and lower centre section whilst two have their left tips cut away to form the right wing sections and the remaining two have their right tips cut away to form the left wing sections. Note that the moulding only provides the* top *surfaces of the wings. Each wing has a balsa core and the under surface is merely plain sheet, with 'rib tapes' scored. Double sided adhesive tape is used as in other wings but the leading and trailing edges are sealed with careful application of thin cement.*





The author has been an ardent modeller for nearly forty years, specialising in warships and aircraft and was the first modeller to win the Class Championship Cup for a plastic model aircraft at the Model Engineering Exhibition in 1969, and for a plastic ship model in 1973. Not only first with these two models but so far the only modeller to achieve this distinction.

This book is distinguished in that it deals with the techniques of building models from basic material and as such the first to really detail the building of models from plastic as distinct from assembling kits. When plastic became readily available Harry Woodman experimented and finally developed many techniques which have proved extremely successful and will be invaluable to the enthusiast modeller.

Price

L.6500

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