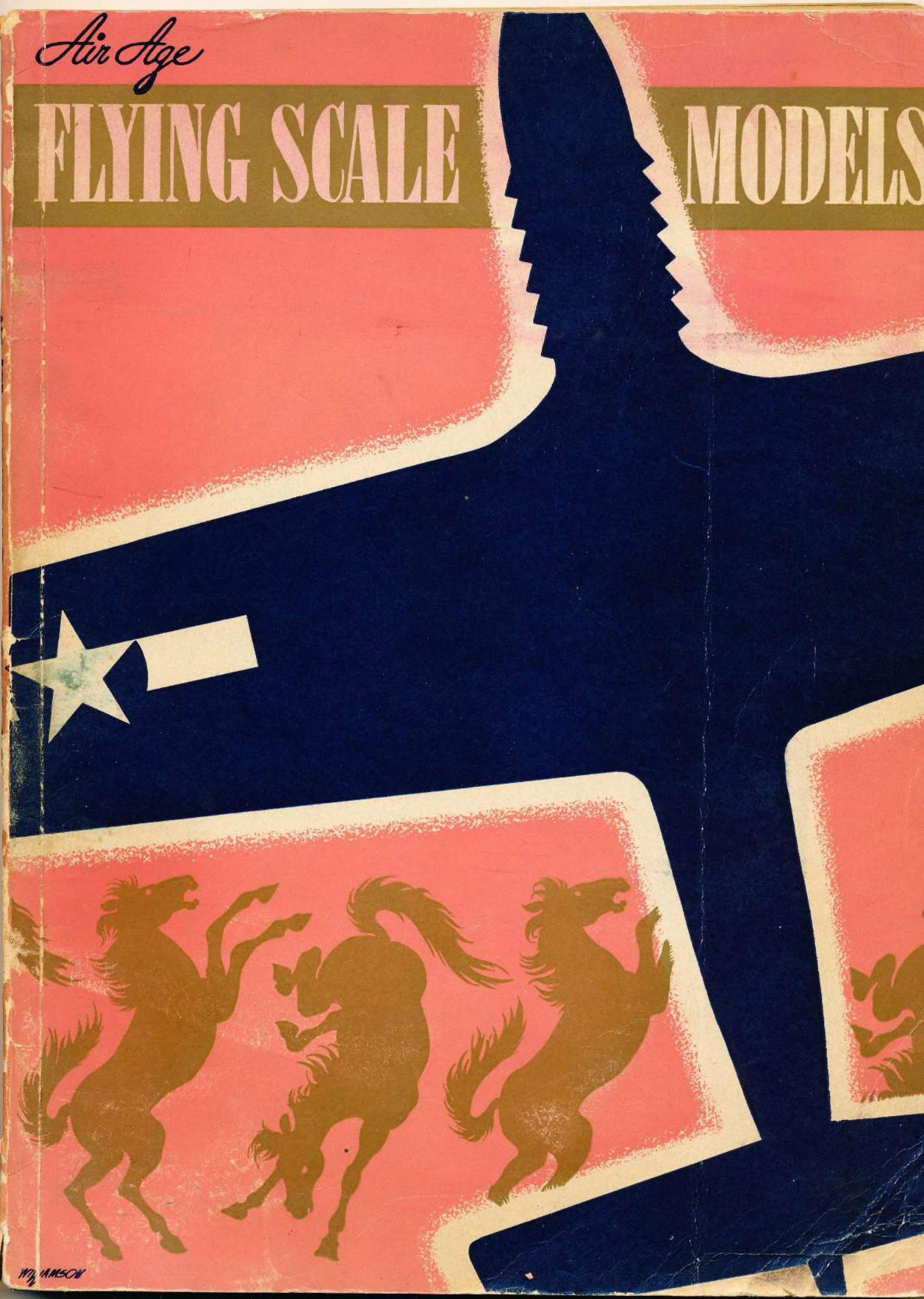
Air Age

FLYING SCALE MODELS



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AIR AGE

Flying Scale Models

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AIR AGE INC.

Aviation Magazine and Book Publishers since 1929

551 FIFTH AVENUE • NEW YORK 17, N. Y.

PRINTED IN THE UNITED STATES OF AMERICA

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16 Flying Scale Models

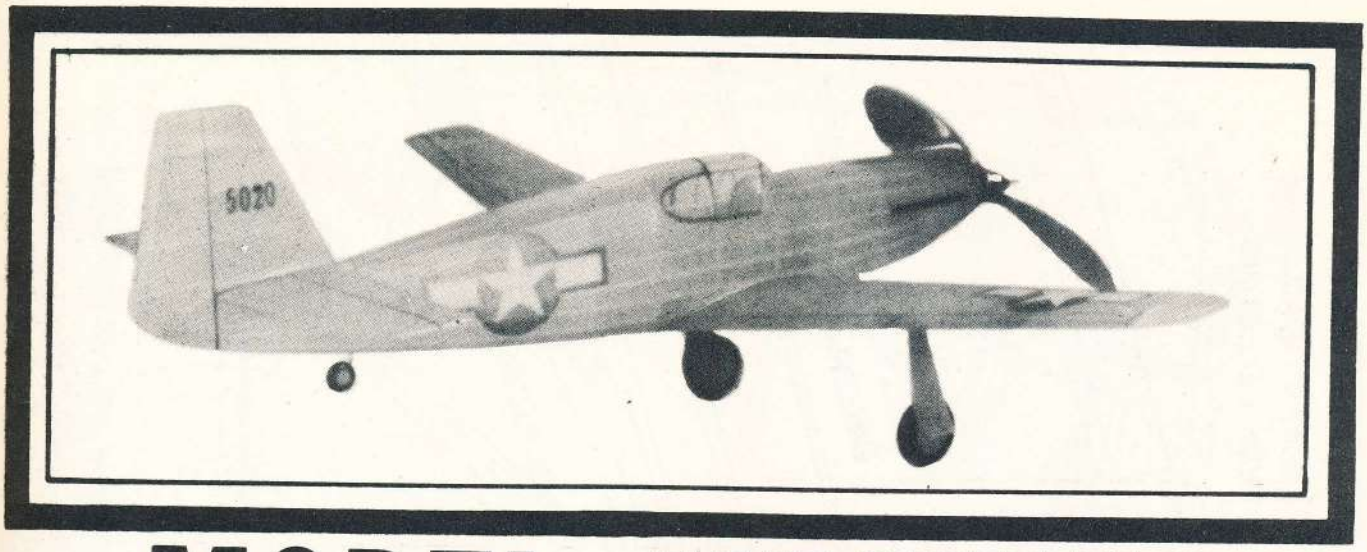
INTRODUCTION

The flying scale model builder has two objectives: he aims for an exact replica of a life size plane — and flight.

This twin goal imposes a greater task on him than on other modelers — for, whereas the contest builder seeks only good flying characteristics, and the solid scale modeler is solely interested in detailed accuracy, the flying scale designer and builder must weld these complex and divergent objectives into a single, integrated structure. This demands both the aerodynamic study of the contest winner, and the painstaking art of the detail craftsman. Only when these ingredients are properly proportioned and mixed does the master flying scale model emerge . . .

A highly specialized field invariably requires the services of highly specialized experts. Flying scale model design and construction has three leaders in this field: Earl Stahl, Sidney Struhl and Herbert K. Weiss, men with a total of 50 years' experience in flying scale work exclusively. It is the efforts of these three specialists that has been carefully culled for inclusion in this volume . . .

All these AIR AGE FLYING SCALE MODELS are war planes, a representative collection of those fighters and bombers now making the headlines. Sleek, colorful and deadly in appearance, they are a challenge to the beginner and expert alike — the plans plus skillful construction and careful flying will place today's proud weapons of Airpower in the palm of the builder's hand.



MODEL MUSTANG

by **EARL STAHL**

THE North American P-51B *Mustang* is an ideal layout. It is a modeler's dream; its racy appearance and its favorable design makes it highly satisfactory for a scale model with good flying qualities.

The plan is for a balsawood model, but if the builder is unable to obtain sufficient balsa for the whole job, pine or similar material may be substituted without impairing the model's flying ability.

Conventional construction methods are followed. Be sure to do the work neatly and accurately, and exercise care to cement all joints firmly. Where pine or other such wood is substituted, the thickness of the part should be reduced since the material is stronger.

CONSTRUCTION—Full size plans are presented, and with the exception of one wing and stabilizer half, no redrawing will be necessary; work right over the plan to simplify and speed construction. Make the wing first. It is built in two halves which are later joined. Ribs Nos. 1, 2, 3 are 1/16" thick balsa while the others are 1/32". Cut and sand the ribs carefully to exact shape. The leading edge and spar are cut from sheet balsa and are tapered as indicated. Assemble the parts over the plans using pins to hold them in place; cement the joints solidly. Trim the leading and trailing edges as well as the 1/8" sheet tips roughly to shape; then sand the whole structure.

Use of the keel and bulkhead method simplifies the fuselage construction. Cut two of each bulkhead from 1/16" sheet. To assemble, pin the top and bottom keel in place on the side view and attach the half bulkheads. Add the side keel, and when this structure is dry remove from the plan and add the remaining bulkheads and keel. Now place the 1/16" sq. stringers starting nearest the side keel; be careful to keep from disaligning the frame by adding a stringer to each side at the same time. Cut the notches as required, and be careful to align them perfectly.

At the recess for the wing, curved pieces of 3/32" sheet are required. They are similiar to the center keel in shape and they should fit the curvature of the wing neatly. Two pieces of 1/4" sheet cemented together form the nose block; roughly cut it to shape before cementing to bulkhead No. 1. Note that the center of the nose block is cut out to receive the nose plug. In the rear where the rubber holding bamboo pin is mounted, attach the hard 1/16" sheet retainers. For the curved windows behind the pilot's cockpit a frame is required; it is carved from several pieces of sheet balsa.

On the real P-51 a radiator is mounted under the belly. This was eliminated on the original model in the interest of better flights. Those desiring maximum scale will want it, however, therefore crossections are shown. It may be of built-up construction or hollowed out from a solid block of balsa. It is best to leave the radiator off until the wing has been covered and is assembled to the fuselage.

Rib construction of the stabilizer and rudder is shown in the sketch. Make flat frames of each (the stabilizer is built in one piece) using 1/16" thick stock for the outlines and 1/16" sq. for spars and ribs. When these flat frames are dry, remove from the jig and attach 1/16" sq. strips to both sides of each rib. These are later cut to the streamline shape shown. Trim the leading and trailing edges to conform to the rib shape.

A simple but highly practical landing gear is featured. Using .040 music wire, bend the front view as shown by the full size plan; then bend the top of the wire so that it joins the rib and spar as shown. Be sure to make a right and left leg. Using a needle and thread, bind the wire to the structure and sew right through the rib. Cement the thread and adjacent areas thoroughly to strengthen the structure. Wheels may be purchased but it is a simple task to make them from laminated sheet balsa. Fix bearings to both sides of each wheel so they will revolve smoothly and accurately. Other details of the landing gear will be completed later.

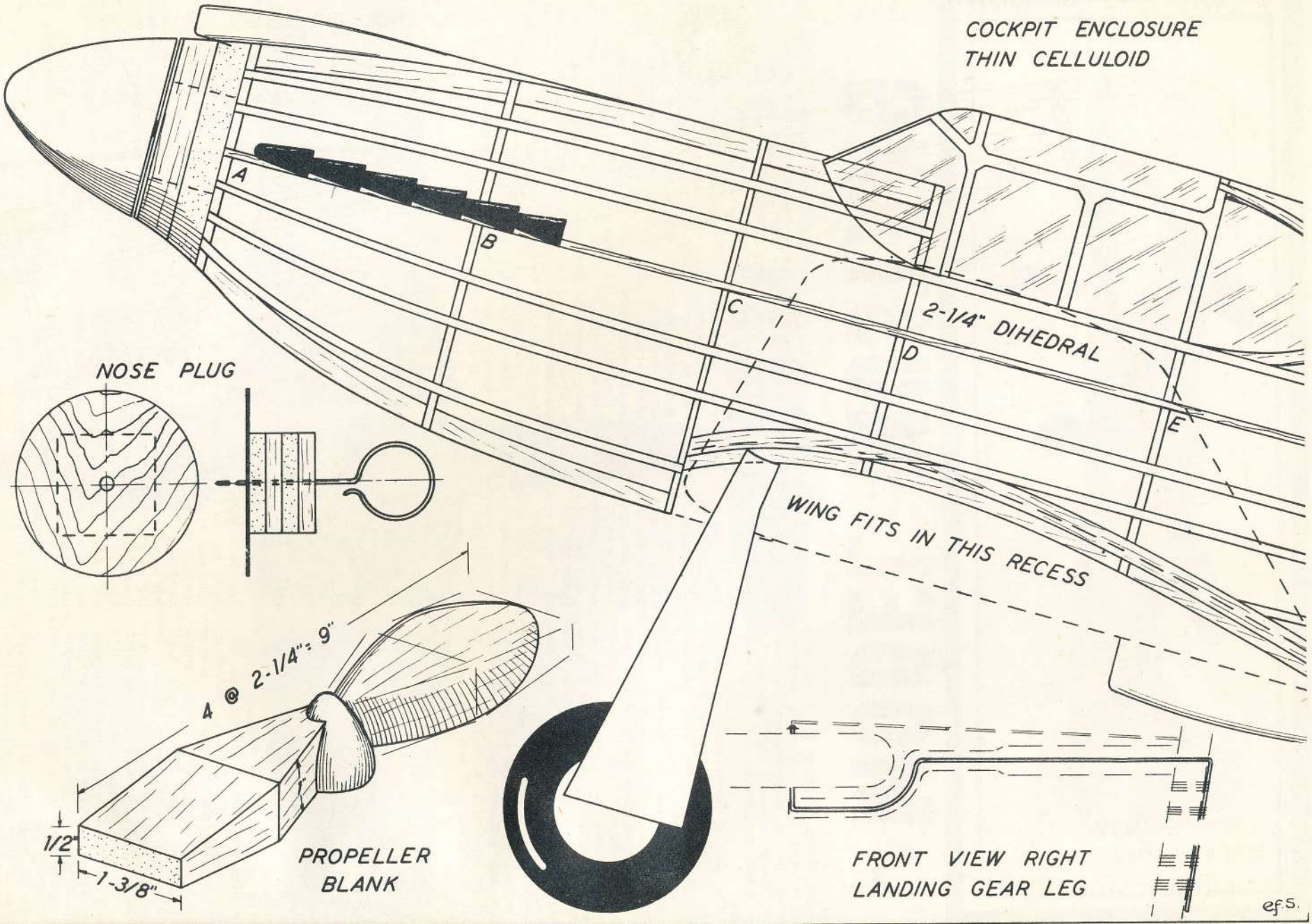
A hard balsa or soft white pine propeller is recommended. Cut the blank to the shape and dimensions shown. It is best to make the spinner separate. Drill the tiny prop shaft hole first, then cut away the back surface of the blank until the camber is as desired. Now cut away the front until the blades are of the desired thickness. Round the tips and reduce the depth of the hub as indicated. Blades are brought into balance by sanding. The spinner is soft balsa and may be made in several pieces to fit, or as one unit and notched to fit over the hub.

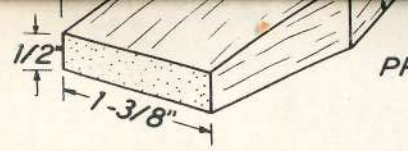
The nose plug is detailed on the plan. It consists of 1/32" plywood disk backed by several laminations of 1/8" sheet. Drill the hole through it slightly to the right so there will be a few degrees of right thrust. Washers are cemented to both the front and back to fix the line of thrust. Music wire .040 thick is used for the propeller shaft. For best flights a freewheeling gadget that will permit the propeller to spin freely in the glide is recommended.

Before the frames are covered they must be sanded to perfection or else a good job can not be made. Colored tissue is suggested and it may be attached to the frames by banana oil or light dope. Use a separate piece of tissue for both sides of each wing and stabilizer half. For the fuselage numerous small pieces neatly lapped will be required to avoid unsightly wrinkles. Water spray the covering lightly to tighten it. Fix the flying surfaces in a level position while drying so they will not warp but do not apply any dope until later.

Assembly of the parts must be done with accuracy. First fit the wing within the recess and cement it fast. Align the stabilizer with the wing and then finish the area from fuselage to it with scraps of balsa and tissue. Attach the rudder perpendicular to the stabilizer, off-setting the front of it about 1/32" for a right turn. Now one or two coats of light dope can be brushed on the covering to tighten it.

Addition of the various details completes the construction. Thin celluloid is used for the cockpit enclosure; it may be obtained from cleaned photo film. Structural details of the enclosure are represented by thin strips of black tissue doped to the celluloid. Finish the landing


COCKPIT ENCLOSURE
THIN CELLULOID
A
B
C
D
E
2-1/4" DIHEDRAL
NOSE PLUG
WING FITS IN THIS RECESS
4 @ 2-1/4" = 9"
1/2"
1-3/8"
PROPELLER
BLANK
FRONT VIEW RIGHT
LANDING GEAR LEG
ef.s.



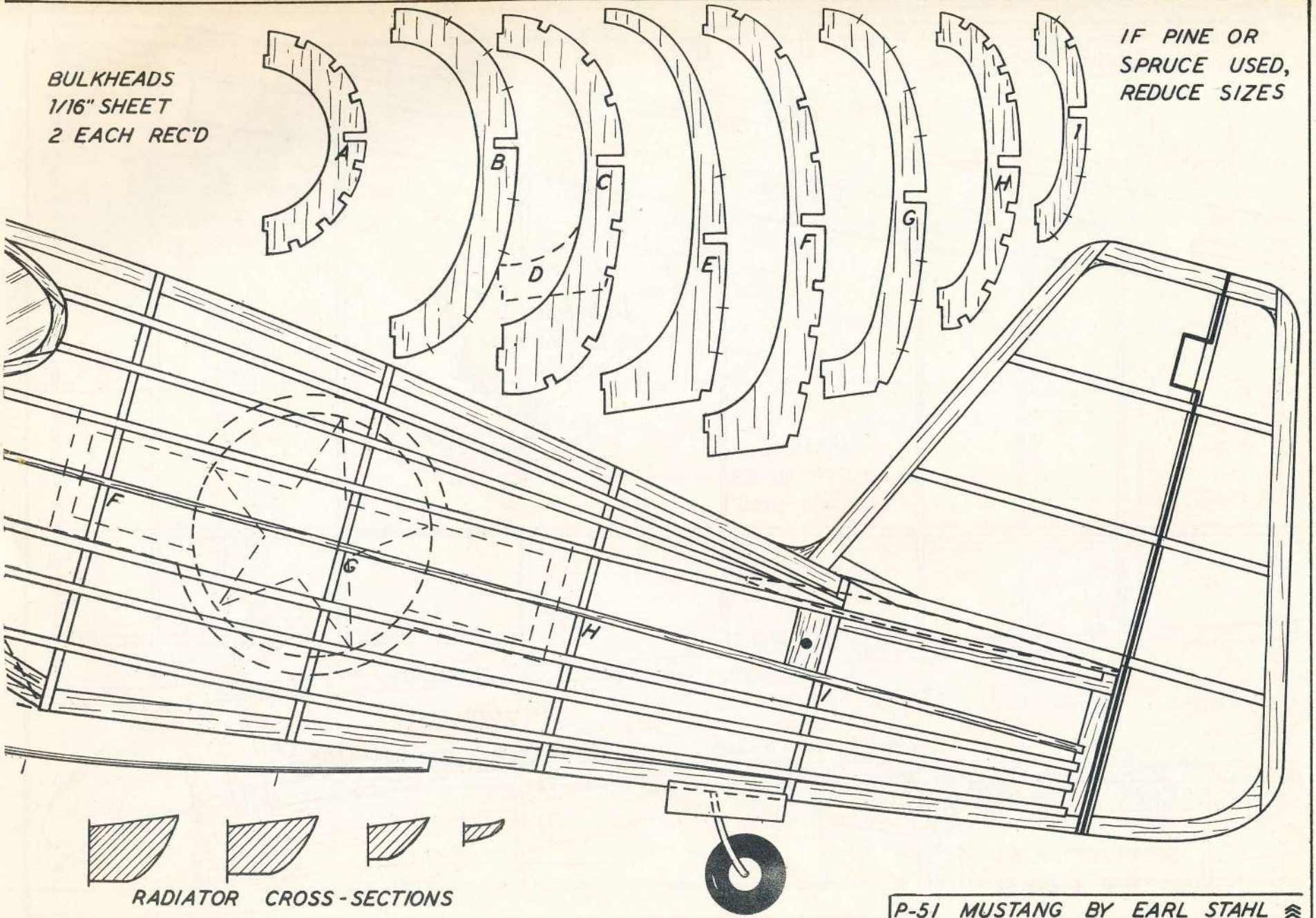
PROPELLER BLANK

FRONT VIEW RIGHT LANDING GEAR LEG

ef.s.

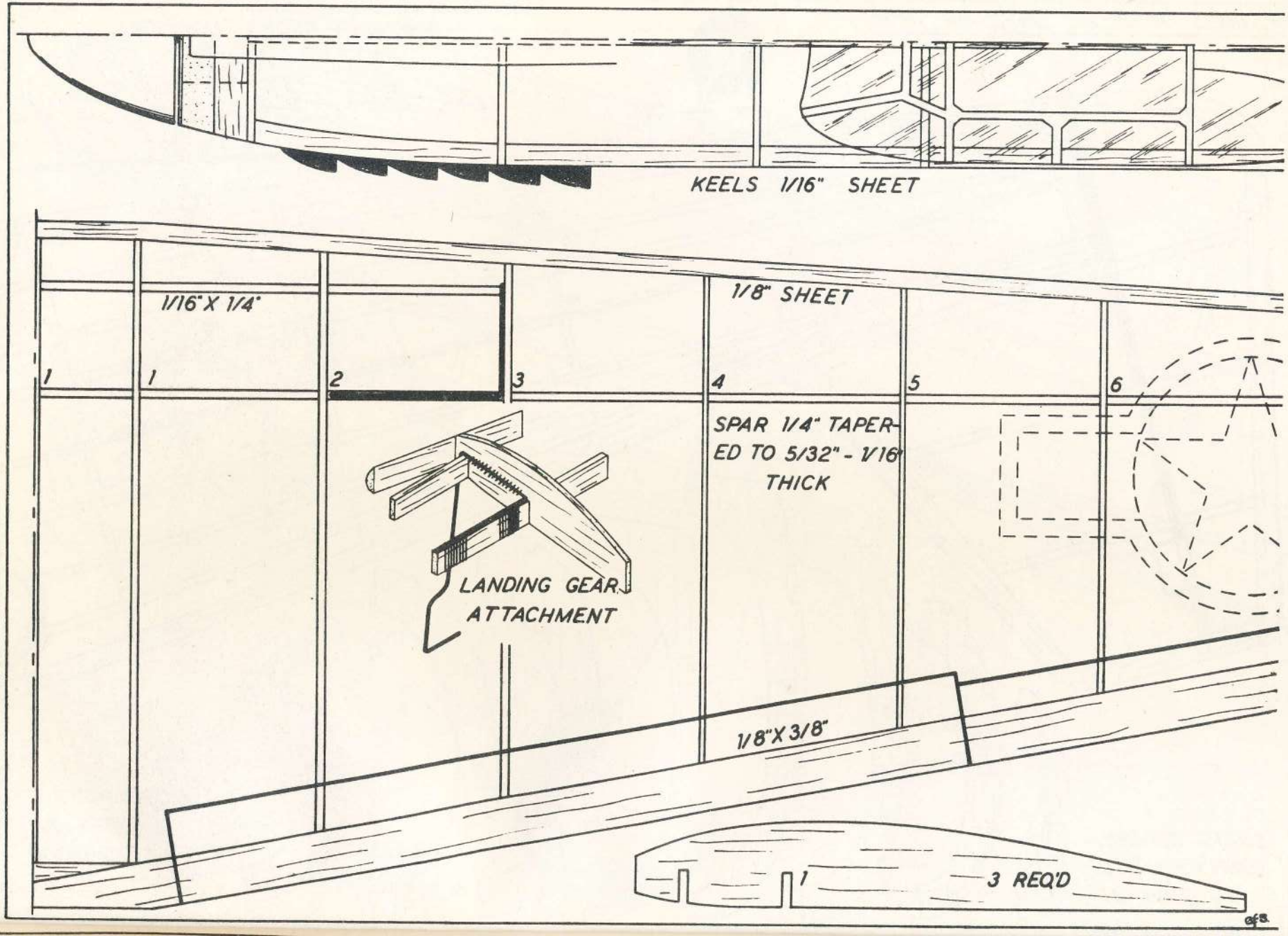
BULKHEADS
1/16" SHEET
2 EACH REC'D

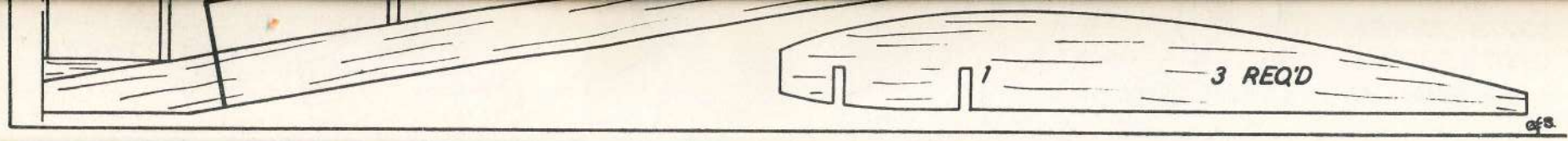
IF PINE OR SPRUCE USED, REDUCE SIZES

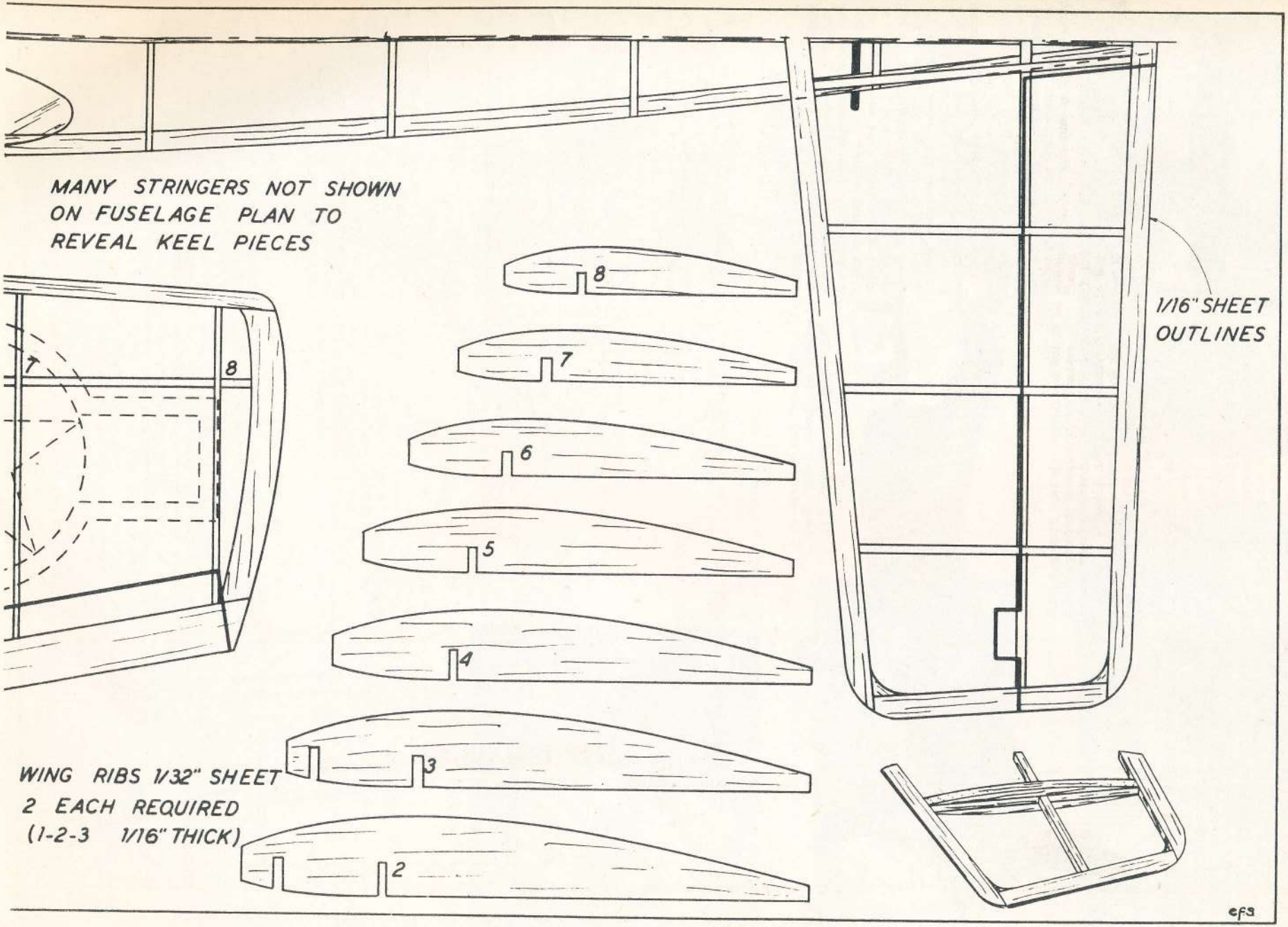


RADIATOR CROSS-SECTIONS

P-51 MUSTANG BY EARL STAHL


KEELS 1/16" SHEET
1/16" X 1/4"
1/8" SHEET
1
1
2
3
4
5
6
SPAR 1/4" TAPERED TO 5/32" - 1/16" THICK
LANDING GEAR ATTACHMENT
1/8" X 3/8"
1
3 REQ'D

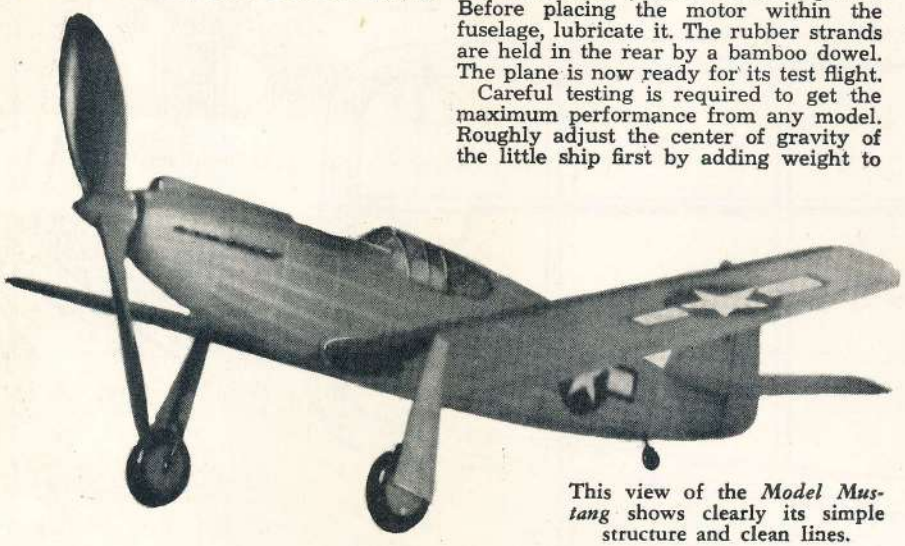

1
3 REQ'D


MANY STRINGERS NOT SHOWN
ON FUSELAGE PLAN TO
REVEAL KEEL PIECES
7
8
8
7
6
5
4
3
2
1/16" SHEET
OUTLINES
WING RIBS 1/32" SHEET
2 EACH REQUIRED
(1-2-3 1/16" THICK)

gear next; rubber or cloth insulating tubing slipped from electric cords, etc., is used to cover the wire landing gear legs. Wheels should be painted before they are held to the axles by drops of solder. The cover that closes the recess once the landing gear is retracted on the real plane is represented; it is made from 1/32" sheet. Attach it in such a manner that the strut is free to spring and thus absorb shock. If a radiator is used it should be attached now. Details such as exhausts, air scoop, tail wheel, etc., are made from scraps and they go a long way to enhance the appearance of the model. Naturally all exposed wood parts should be painted.

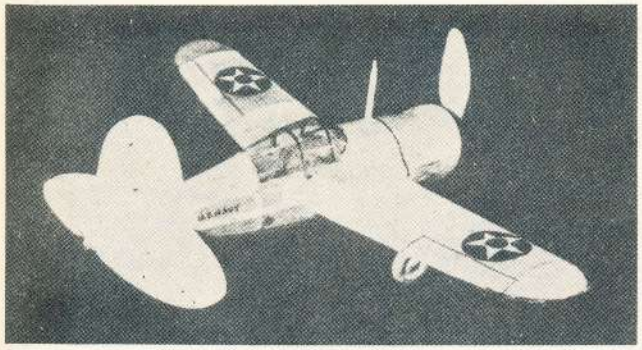
FLYING—Depending on the finished weight of the model, 10-12 strands of 1/8" flat rubber will be needed for power. Before placing the motor within the fuselage, lubricate it. The rubber strands are held in the rear by a bamboo dowel. The plane is now ready for its test flight.

Careful testing is required to get the maximum performance from any model. Roughly adjust the center of gravity of the little ship first by adding weight to the nose or tail to bring it into balance when held at the wing spar. Then make any further weight adjustment by gliding from shoulder-height. If it stalls, add weight to the nose. If it dives, remove weight or add a bit to the tail.

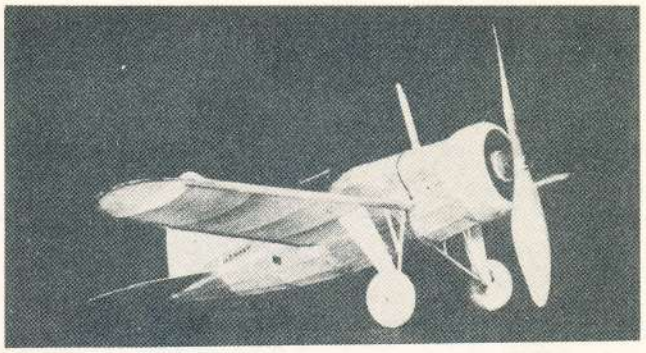


This view of the *Model Mustang* shows clearly its simple structure and clean lines.

First power flights should be made with just a few turns, and as the performance improves and confidence is gained, increase the power. Tilting the thrust line down will eliminate a tendency to stall under power, while right or left thrust will control the amount of circle. Once flights are satisfactory, use a mechanical winder to store up maximum power. The original model flew best when it was adjusted for a large left circle under power and a sweeping curve to the right in the glide.

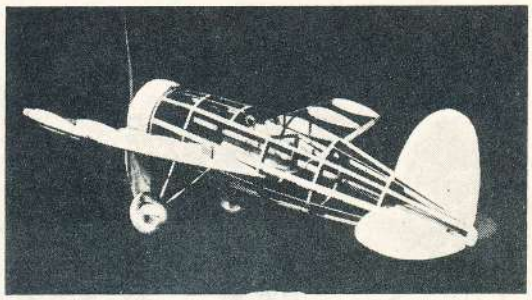


Simple to build, yet very realistic



A large prop and clean lines insure fine flights

BREWSTER FIGHTER



The fuselage frame is easy to build

By HERBERT K. WEISS

A SLEEK navy fighter is the Brewster XF2A-1, a thick-bodied, mid-wing fighter of the Gee Bee school of design.

Your fleet of models would not be complete without a flying replica of this remarkable stubby battler. Here's how you can build one in a very short time. If you have not built many flying scale models before, this is a very good one with which to begin.

The model has been somewhat simplified in the interests of flying ability, but still retains all the characteristic features of the real ship.

Wing

Begin with the wing which is made in one piece. Cut out two of each size ribs from 1/32" sheet balsa and assemble the wing over the plan. To make the left half, simply pin a piece of blank paper at the lower margin of the plan and draw in the left panel with the aid of a ruler, so that you will have a layout for the whole wing. Cut the leading and trailing edges to shape after the cement has dried and add the bamboo wing tips. Crack the spars just outside rib 1 and then recement them to give the wing the correct amount of dihedral.

Fuselage

Cut out two halves of each fuselage bulkhead from 1/16" sheet balsa and cement the halves together. Cement bulkheads B and C to the wing center section as shown on the plan. Add the two main 1/16" x 1/8" side stringers, and cement bulkheads A, E and F to these. Top and bottom stringer of 1/16" square balsa are now put in place, and finally the thin 1/32" square bamboo stringers which absorb the stresses of head-on impacts.

Now bend the cockpit frames from 1/32" square bamboo. The plan shows the correct number, but for such a small flying model the builder will probably prefer to simplify the arrangement as shown in the pictures of the test model.

Cowl

The cowl may be made in a number of ways. The method shown on the plan of assembling it from circular rings cut from 1/8" sheet balsa is probably the simplest. Hollow out the inside further after the rings have been cemented together, and sand the outside smooth.

Tail Surfaces

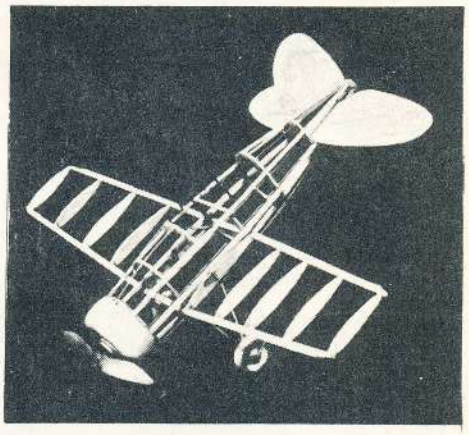
Trace the outline of the tail surfaces on 1/32" sheet balsa and cut them out with a sharp razor. Sand smooth on both sides and add the stiffeners to the stabilizer. Cement the stabilizer in proper position on the fuselage. Add the rear hook at this time. The prong projects through the side of the fuselage so that it is not necessary to poke around inside the fuselage in trying to find the hook when installing a new rubber motor.

Covering

Cover the model using small pieces of tissue for the sharply curved portions of the fuselage. It is a good idea to cover one longitudinal segment between two stringers at a time. White tissue can be used for lightness, or the proper colors for a navy ship can be used, that is, all silver except the top of the wing which is yellow.

Landing Gear

The test model is shown with a duplication of the old Brewster style landing gear. The production model of the real ship has a much simpler arrangement, consisting of a single strut from the fuselage and the heavy fairing over additional struts running up to the wing. Make the inner strut as shown on the plan, from a single piece of .028 wire cemented to bulkhead B as shown. Slip a piece of 1/16" aluminum tubing over the wire, then bend the axle and add the wheel. Cut the outer fairing from thin cardboard (a penny postcard will do) and cement it in place. Balsa may be used, but the cardboard allows the gear to move up and down freely to absorb landing shocks.



Simple construction graces the wing and tail

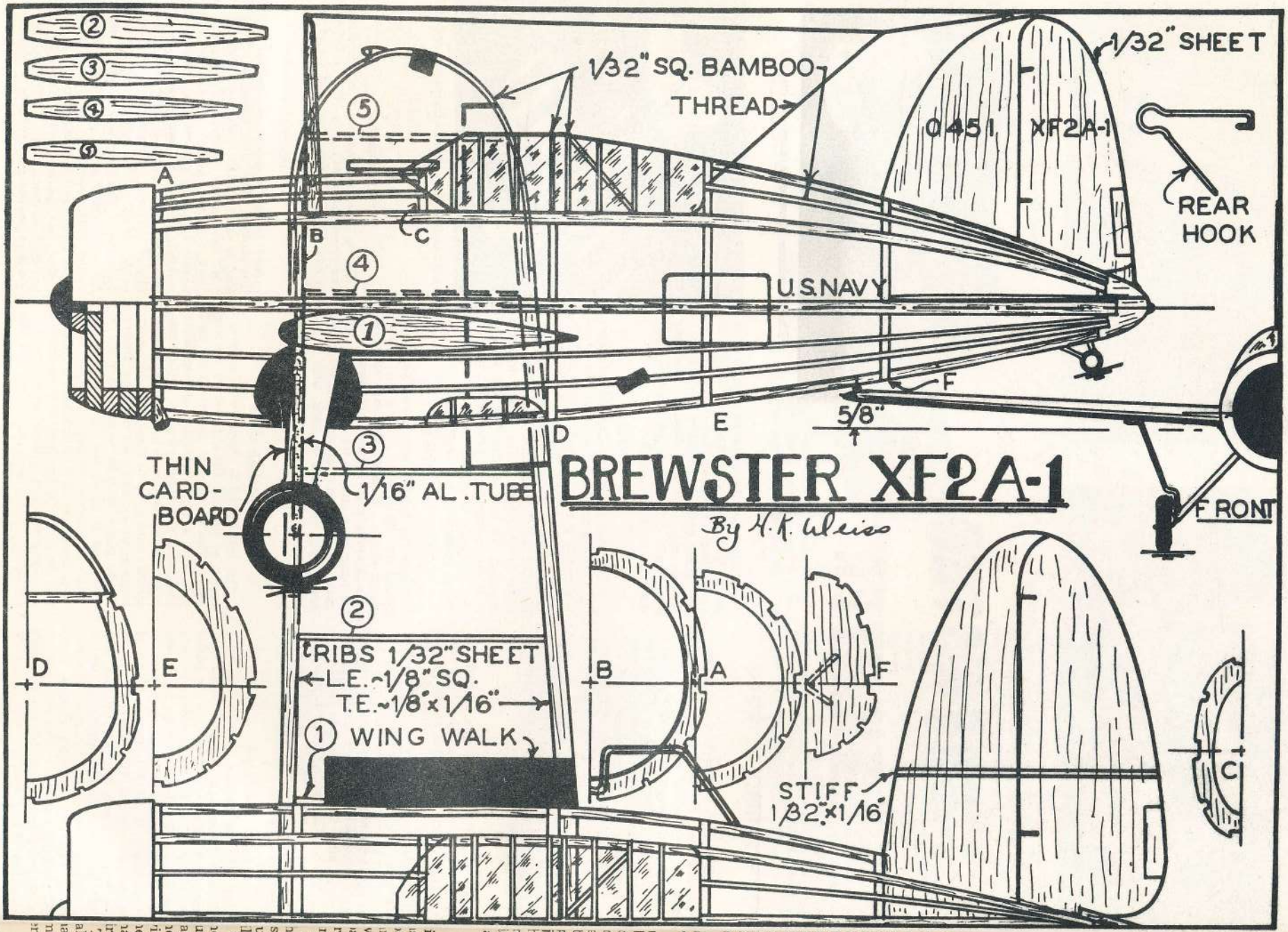
Propeller

Carve a propeller from a block of medium hard balsa 4-1/2" x 7/16" x 1-3/16", or use any low pitched prop of about that size that you have on hand.

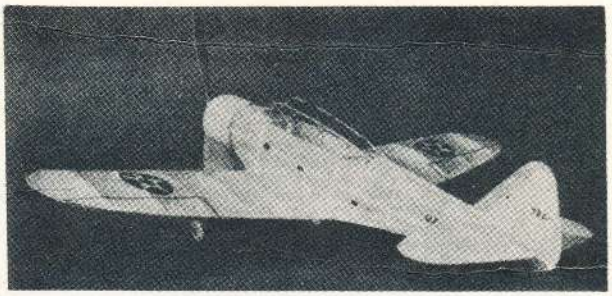
Flying

Add as much detail as desired; cover the cockpit with thin celluloid and the ship is ready to fly. Use two strands of 1/8" flat rubber with about an inch of slack. If the model is slightly nose-heavy, bend up the trailing edge of the stabilizer. If it is very nose-heavy, remove the cowl and hollow it out until the model balances at about the wing midpoint. If the model stalls, bend the trailing edge of the stabilizer down. Correct for spiral diving by applying opposite rudder. If necessary, warp the trailing edge of the inside wing down.

Our test model proved very fast and covered a great deal of ground in an average twenty second flight. The model is very rugged and can be flown outdoors with great success.


1/32" SQ. BAMBOO
THREAD
1/32" SHEET
0451 XF2A-1
REAR HOOK
U.S.NAVY
5/8"
THIN CARD-BOARD
1/16" AL. TUBE
BREWSTER XF2A-1
By H.K. Weiss
FRONT
RIBS 1/32" SHEET
L.E.-1/8" SQ.
T.E.-1/8"x1/16"
WING WALK
STIFF 1/32"x1/16"

DOUGLAS TORPEDO BOMBER



Intriguing details give a realistic appearance

By
HERBERT K. WEISS

ONE of the Navy's best torpedo planes was the Douglas TBD-1 flying under a double classification, the TBD-1 carries either bombs or a torpedo at an estimated top speed of 235 mph. Since the ship is used aboard carriers, space is an important factor, and the wings of the TBD-1 fold up and in on themselves from a chord about midway to the tip. The experimental version of the torpedo-bomber had a straight cockpit housing, but the accepted version has had the housing humped, probably to accommodate the directional loop of a radio antenna. The engine is a Twin Wasp of 850 horsepower.

Because of the comparatively small size of the model, there are certain points which must be stressed in construction:

Sand the fuzz off all balsa used in the model before using it; the frame will be lighter, cleaner and stronger. Use plenty of cement; the small additional weight is negligible against the gain in ruggedness and freedom from warping. Keep the tail of the model light; every weight you put on the nose for balance will mean just that much more weight that the ship has to carry, and it's a small ship! And remember, a little mistake on a small ship is equivalent to a pretty big one on a large model.

Wings and Tail

Make the wing first, as it's used as a jig for the fuselage. The frame can be assembled on the plan, if the left wing panel is traced on another sheet of paper and pinned down in its proper place. The wing is built in one piece. Put waxed paper over the plan, pin the leading and trailing edge in place, and add the ribs and wing tip.

Use plenty of cement. The bamboo for the wing tip can be bent over a flame, or, as it is very thin, it will bend easily without heating and can be tied in place with silk thread while the cement is drying.

When the frame is dry remove it from the waxed paper and with a razor blade cut loose surplus cement and any waxed paper which may have adhered. Crack the spars just outside rib 1 and give the wing 3/4″ dihedral at each tip. Re-cement the spars, and when the cement is dry shape the leading and trailing edge to airfoil shape with a razor and sandpaper.

Trace the tail surfaces on 1/32″ sheet balsa and cut them out. The stabilizer is made in one piece. Sand the pieces smooth. Cement the 1/32″ x 1/16″ stiffeners on top of each side of the stabilizer.

Fuselage

Cut two halves of each bulkhead from 1/16″ sheet. As the fuselage must stand handling do *not* substitute 1/32″ sheet. Cement the halves together, using small lengths of 1/32″ square bamboo across the grain to stiffen the assembled bulkhead crossways at the joint. Cement bulkheads C and D to the wing center section in the position shown on the plan. Now cement the 1/8″ x 1/16″ main side stringers to these bulkheads, and add the remaining bulkheads to the 1/8″ x 1/16″ stringers, being careful to keep the bulkheads lined up correctly. Complete the fuselage frame by adding the 1/32″ square bamboo stringers, formers B and D, and the 1/16″ square balsa top and bottom stringers. The tail post is 1/16″ x 1/8″ balsa.

Cowl sections are round, so that the diameter of the cowl formers can be taken from the plan and the sections drawn on sheet balsa with a dime compass. Cover the cowl with 1/32″ sheet balsa, and sand the whole cowl after assembly until it is smooth. A small hardwood nose plug is used and can be obtained at any model counter.

The plan shows the correct number of cockpit formers; some may be omitted for simplicity. Make the formers from 1/32″ square bamboo.

Assembly and Covering

Sand the fuselage and wing carefully so that there will be no projections to spoil the covering. Cover the model carefully with white tissue, using small strips on the curved parts of the fuselage. The landing gear is attached to the wing before covering, and the tissue is cut to fit. All wire parts are .028 wire.

Spray the model lightly with water, and when it is dry, sand off the fuzz which will appear at the leading and trailing edges of the wing and at sharp corners on the fuselage. Give the model one coat of clear dope which has been mixed with thinner in about a half to half ratio. Dope the cowl and other parts, but *do not dope the tail surfaces.* Sand any roughness which may appear, and then cement the tail surfaces in place. To insert the stabilizer, slit the tail post with a razor, push the stabilizer into position and cement it, then re-cement the tail post.

Add as much detail as may be desired. The model has a standard navy insignia, including stars on top and bottom of each wing tip.

Propeller

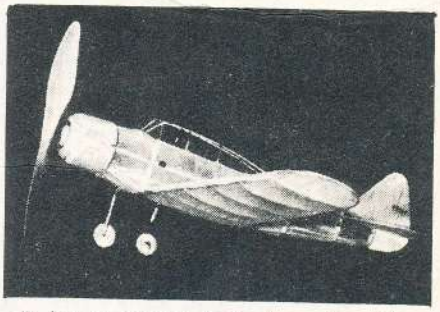
Carve the propeller from hard balsa, using a block 4-3/4″ x 7/8″ x 1/2″, or use any medium pitch prop of that size that you may have. *Do not use a high pitch prop*, for the torque will make the model difficult to control laterally.

Flying

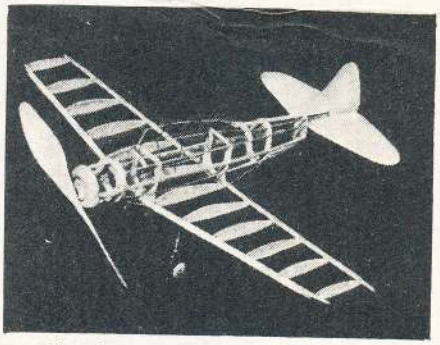
The model should balance just about right if hardwood wheels are used. Test it by gliding it. If it stalls check the tail attachment, and if there is any perceptible negative incidence cut the stabilizer loose and readjust it to zero incidence. If the model still stalls, sand the tail surfaces. Add weight to the nose only as a last resort. If the model dives warp the elevators up slightly or use lighter wheels.

If the model spiral dives under power, warp the trailing edge of the inside wing down slightly.

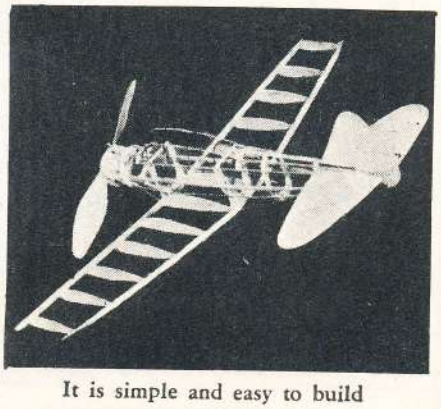
Use two strands of 1/8″ flat rubber, lubricated, with about a half inch of slack. For long flights after the model is adjusted, use a winder.



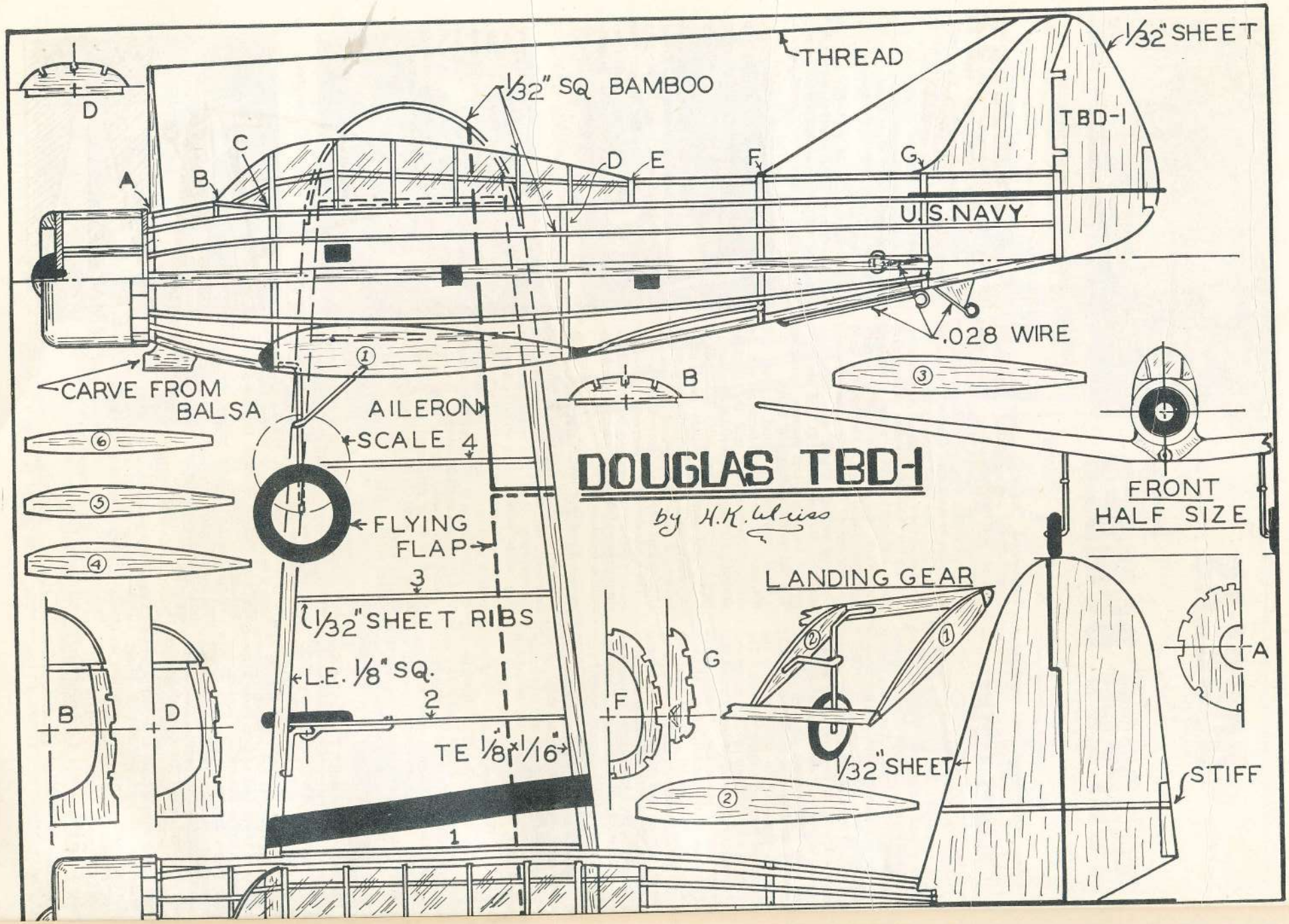
It has a comparatively large "prop"



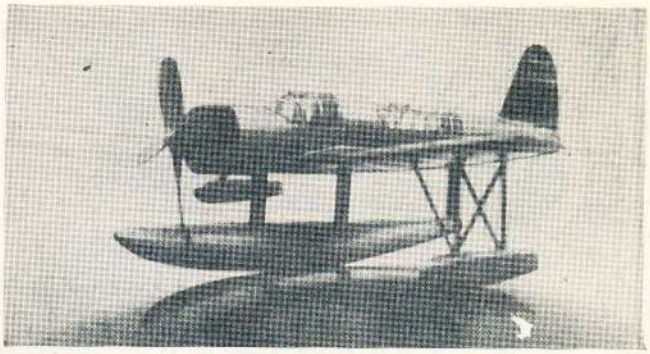
The framework is well designed



It is simple and easy to build


THREAD
1/32" SQ BAMBOO
1/32" SHEET
TBD-1
U.S.NAVY
.028 WIRE
CARVE FROM BALSA
AILERON
SCALE 4
FLYING FLAP
1/32" SHEET RIBS
L.E. 1/8" SQ.
TE 1/8" x 1/16"
DOUGLAS TBD-1
by H.K. Ulriss
FRONT HALF SIZE
LANDING GEAR
1/32" SHEET
STIFF

As a display scale model it is intriguing



As a flier it is realistic and thrilling

A FLYING SCALE NAVY SCOUT

By HERBERT K. WEISS

A Model That is "Different"— Easy to Build with Excellent Flying Qualities and Good Looks —with Pontoons It Takes Off from Snow or Water

In full flight immediately after the take-off

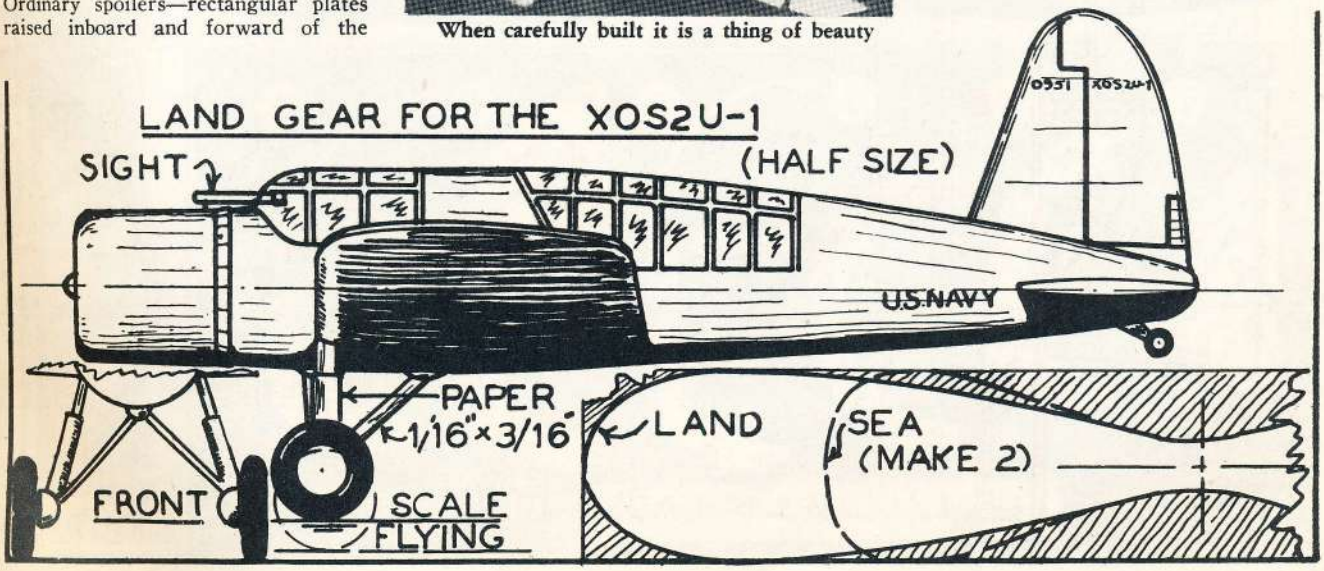
When carefully built it is a thing of beauty

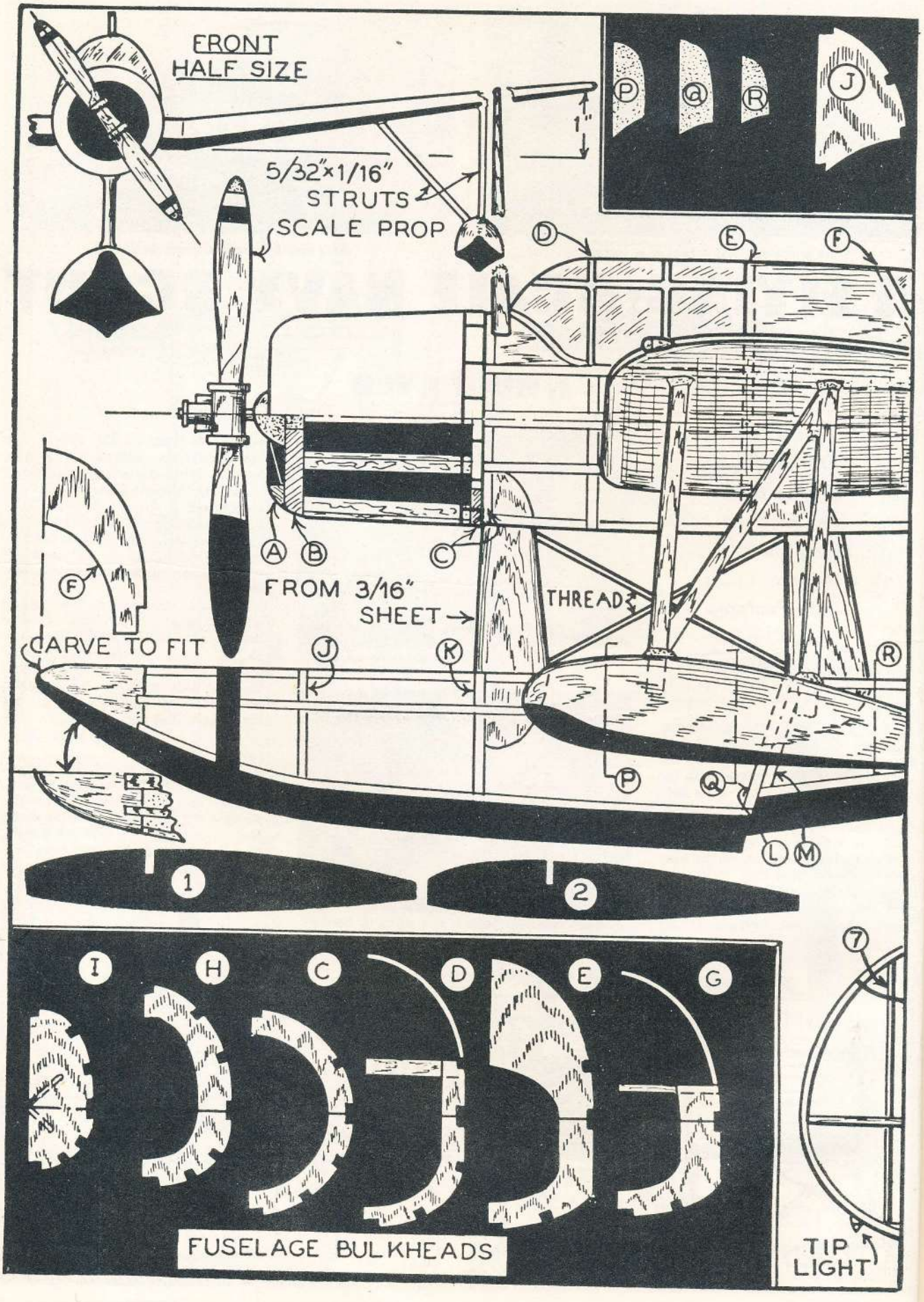
THE WING span of the observation-scout XOS2U-1 is only 36 feet, less than three feet greater than the length of 33 ft. 10 in. True, with the resulting small wing area, simple flaps weren't enough; so the designers of the XOS2U-1 added "drooping ailerons," and let the ailerons themselves jack up the lift coefficient of the wing a few decimals. And then, to improve lateral control, spoilers were added. Ordinary spoilers—rectangular plates raised inboard and forward of the ailerons to interrupt the airflow—are not satisfactory because the airflow tends to break irregularly over them.

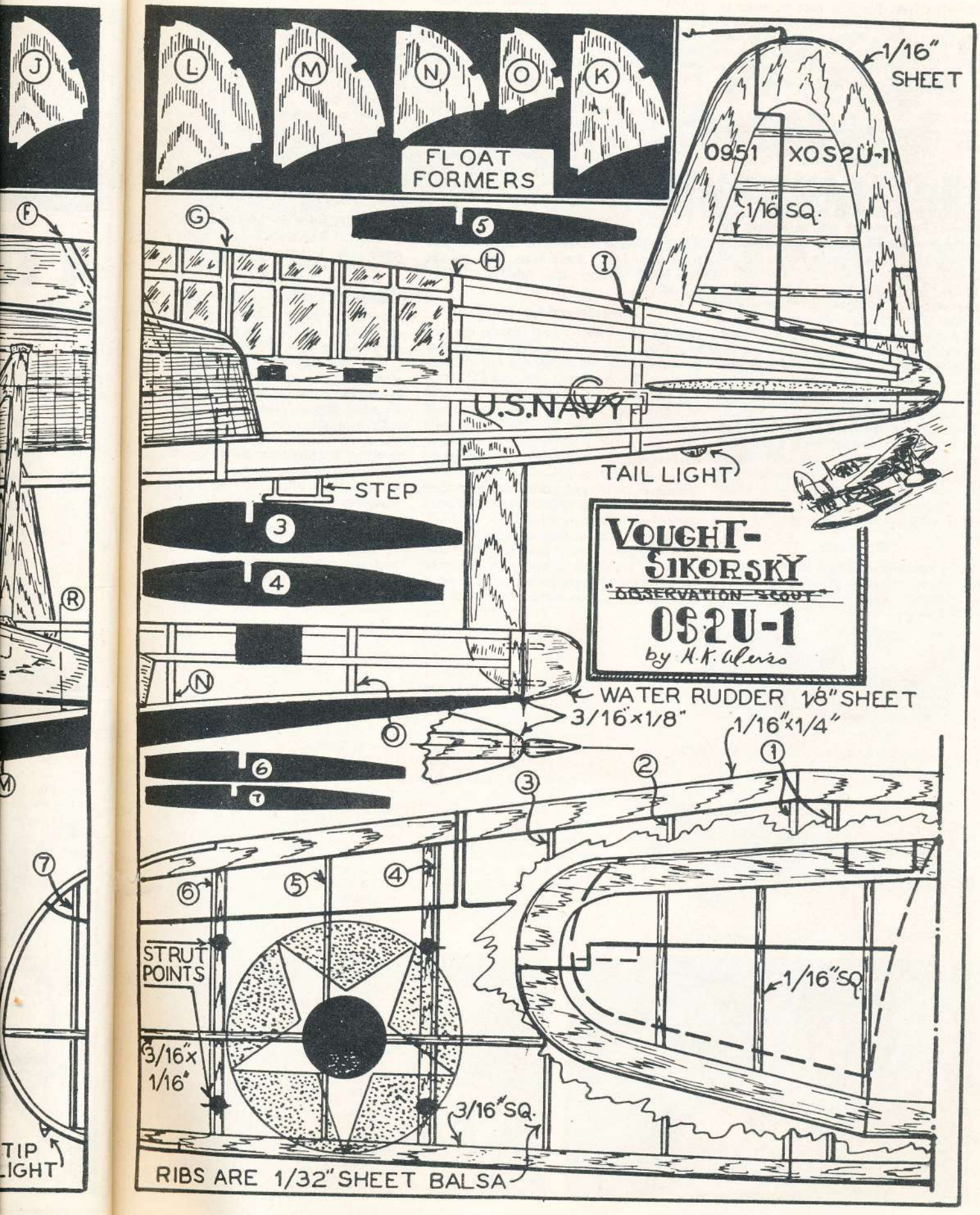
But the Vought-Sikorsky spoilers, as patented by United Aircraft, have a saw-toothed edge, radically modifying the character of the disturbed airflow and making all the difference between successful and insufficient control.

The little scouts have been tested with land gear and pontoons. They're low powered planes, 400 hp Wasps sit in their cowls, but the smooth spot-welded aluminum alloy construction, the low weight (4,764 lbs. seaplane, and 4,542 lbs. landplane), plus the very small wing area, indicate that the XOS2U-1 is the fastest plane in its class in the world.

And so to our model. We present plans for both the land and seaplane version, so you can take your choice. Because it's lighter, the wheeled model will perform better. On the other hand, there's something about the lines of a seaplane that gets you. So make up your mind. We chose the seaplane.




FRONT
HALF SIZE
5/32"x1/16"
STRUTS
SCALE PROP
1"
P
Q
R
J
D
E
F
A
B
C
FROM 3/16"
SHEET
THREAD
F
CARVE TO FIT
J
K
R
P
Q
L
M
1
2
I
H
C
D
E
G
FUSELAGE BULKHEADS
7
TIP
LIGHT


J
L
M
N
O
K
FLOAT FORMERS
1/16" SHEET
0951 XOS2U-1
1/16" SQ.
F
G
H
I
5
U.S.NAVY
TAIL LIGHT
STEP
3
4
R
N
VOUGHT-SIKORSKY
OBSERVATION SCOUT
OS2U-1
by M.K. Alexis
WATER RUDDER 1/8" SHEET
3/16"x1/8"
1/16"x1/4"
O
6
T
M
1
2
3
4
5
6
7
STRUT POINTS
3/16"x 1/16"
1/16"SQ.
3/16"SQ.
TIP LIGHT
RIBS ARE 1/32" SHEET BALSA

Wing

In either case, the first part to make is the wing, as its center section is used as a jig for the fuselage. Make the wing in one piece, as shown on the plan. Tips are 1/16" square bamboo. The bamboo can be easily bent by holding it in the lighted end of a cigarette. The strut braces are 1/16" square balsa. Give the wing an inch dihedral under each tip and cement all joints firmly.

Fuselage

Cut two halves of each former from 1/16" sheet balsa and cement the halves together, with a thin splint of balsa or bamboo across the joint. For a smooth job, only mark the position of stringers and cut the notches as you assemble the fuselage, to insure that all will fit.

Cement formers D E and G to the wing center section in the position shown. Add the two 1/8" x 1/16" side stringers and to these cement the remaining bulkheads. Top stringer is also 1/8" x 1/16", but the bottom stringer is 1/16" x 1/4" to provide strut room. Attach the remaining 1/16" square stringers, build up the cowl and cement it in place.

The cowl and the hood between cockpits may be either "filled-in" with 1/16" soft sheet balsa, or covered with 1/32" sheet. On the test model, the whole fuselage and main pontoon was "filled-in" with 1/16" sheet, giving it a very fine appearance, without adding excessive weight.

Pontoons

Tip pontoons are carved from soft balsa according to the shape given by the outline and templates. They may be hollowed out for lightness. Top stringer of the main float is 1/4" x 1/16" balsa. Cement float bulkheads to this, then invert and pin the assembly flat to the workbench to hold the shape while the remaining stringers are cemented in place. Bottom stringer is 1/8" x 1/16" and the wide stringers are 1/16" square.

The whole float should be covered with 1/32" sheet balsa, or "filled in" with 1/16" soft balsa. The main struts are cut from 1/8" sheet balsa and sanded to streamline section. Cut slots in the fuselage keel stringer and the top pontoon stringer to pass these main struts.

Tail Surfaces

Cut the tail surfaces to outline shape from hard 1/16" sheet balsa, then cut out the inner outline, and substitute 1/16" square ribs.

Assembly and Covering

Cover the whole model, except for the top of the wing which is yellow, with silver tissue. Cement the floats and tail surfaces in place. There is only one cockpit former —a bamboo outline at bulkhead "D." All of the others are painted on the celluloid with silver dope, and then outlined in India ink. Spray the model lightly with water, and when this has dried give the model two coats of thin colored dope, silver on the silver tissue and yellow on the yellow. Balsa parts should have three or four coats, sanded smooth between coats.

Paint or cement four stars on the wing in the proper places. Outline control surfaces in India ink. Finish with the many minor details, such as step, radio mast, lights, identification numbers, water rudder and others which can be obtained fr photographs of the real ship.

Propellers

The seaplane has a four-bladed prop hard balsa with stub blades. It's made fr two 2-bladed props, each carved from block 5/8" x 1" x 4". This prop will the ship, but if you're willing to sacrifi a little scale resemblance, you can obta much longer flights by lengthening the t front struts of the main float so that t nose of the ship cocks upward, allowing much larger and more efficient prop to used. Use about four strands of 1/8" ru ber with 2 inches slack.

Prop block for the landplane is 6-1/2" 1" x 5/8". The scale prop is built up fro scrap balsa to agree with the plans.

Flying

Glide the model first. If it dives, war the stab's trailing edge up a trifle. If stalls, add weight to the nose. Correct fo spiral diving by applying opposite rudde

Try powered flights in tall grass. Fo water take-offs, make sure that the mode is perfectly adjusted; first, by hand launched flights. Then wind it to capacit with a winder. Set the model gently o the surface of the water, being careful no to douse the pontoons, as the added weigh of water clinging to them may interfer with the take-off. Then thrust the mode smoothly forward, so that it is riding on it step as it leaves your hand. It should the lift smoothly from the water and fly. If i is sluggish in rising make sure that th pontoons are not waterlogged, add mor rubber, or as a last resort, substitute a pro peller of low pitch.

Realistic in appearance and powerful in flight

The SPITFIRE

FLYING MINIATURE

Build and Fly This High-Performance Exact Scale Model of One of Britain's Most Deadly Fighters

By EARL STAHL

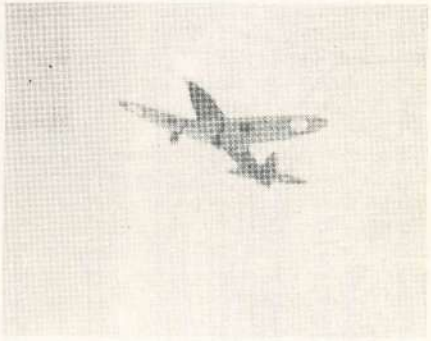
THE geographic location of England makes it most vulnerable to attacks from the air, and as a means of defense the interceptor-fighter planes have been developed. These venomous single-seaters operate at close range and it is their military duty to sweep raiding aircraft from the sky. Such planes as the famous Hawker "Hurricane" and the "Spitfire" are designed to rocket skyward at an astonishing rate, be fleet enough to overtake the swiftest invader, possess a great degree of maneuverability and finally be deadly enough to promptly dispose of the luckless victim.

The Vickers-Supermarine "Spitfire" is not a new design; the first of this type being tested in 1936. Production difficulties plagued volume construction, however, and it was only recently that complete squadrons of "Spitfires" were in service. Of all-metal construction, this aerial terror is not only one of the world's best performers but it is also one of the most attractive. A liquid cooled Rolls-Royce engine of 1030 horsepower pulls it along at a maximum speed of 367 miles per hour—its diving velocity exceeds even that of the famous Curtiss 75-A for it is said that a "Spitfire" attained a speed of nearly 700 miles per hour in a similar plunge. Eight Browning machine guns jut from the wing's leading edge making it one of the heaviest armed single-seaters. Squadrons of these fiery fighters are constantly in readiness to intercept Nazi trespassers.

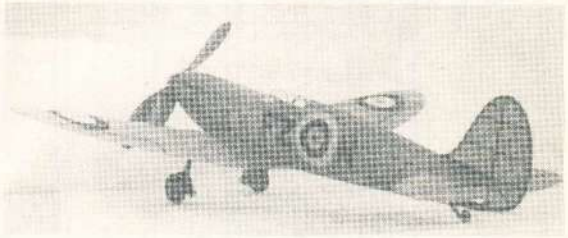
The model retains the attractive appearance and streamlines of the original and an effort has been made to simplify the manner of construction as much as possible while still retaining the desired features. The satisfaction it is sure to afford, whether on display or in flight, will more than compensate for the time and effort expended on its construction. After becoming familiar with the plans and the procedure of construction, you may start to build the—

Fuselage

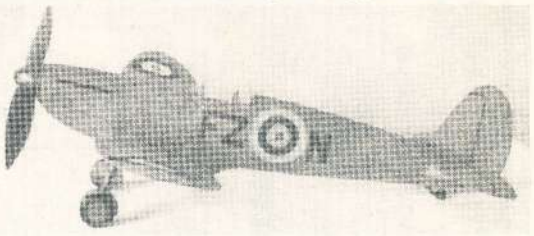
The fuselage is constructed about a top and bottom keel. To obtain the shape of the keel pieces it will be necessary to trace the top and bottom outlines of the side view. A depth of 3/16" will be about right and the keels should be cut from 1/16" sheet balsa. The bulkheads are cut from 1/16" sheet also; two of each type are needed. Cut only the notches shown;—the purpose of this is to aid in properly aligning the stringers. Enough of the bulkheads have notches cut in them to insure proper spacing of the stringers and it will be a simple matter to cut the remaining ones as needed. Pin the keel pieces into position over the side view and cement half of the bulkheads to place. Remove from the plan and add the remaining formers. Next the 1/16" square middle stringers are added to each side. Exercise caution to avoid pulling the fuselage out of line. Once a stringer is secured to one side of the structure always attach



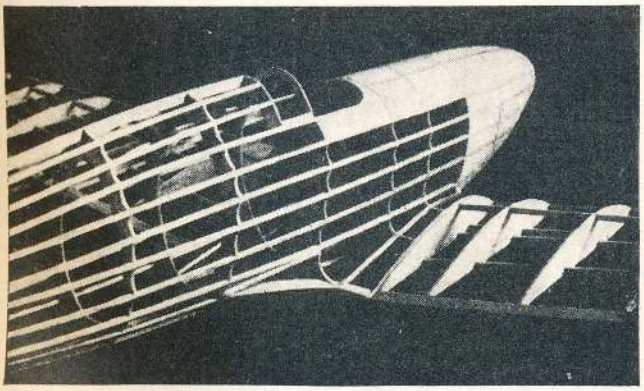
A fine stable flier



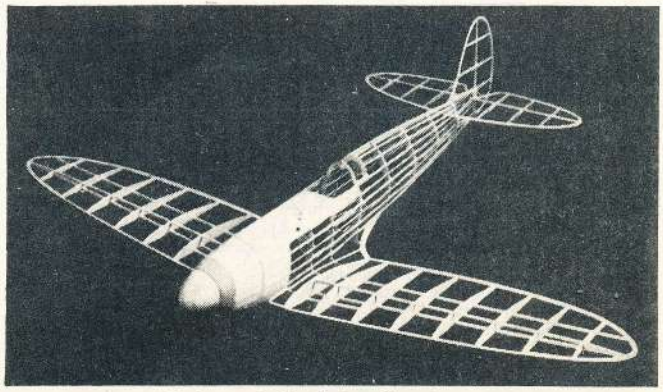
Careful decoration improves appearance



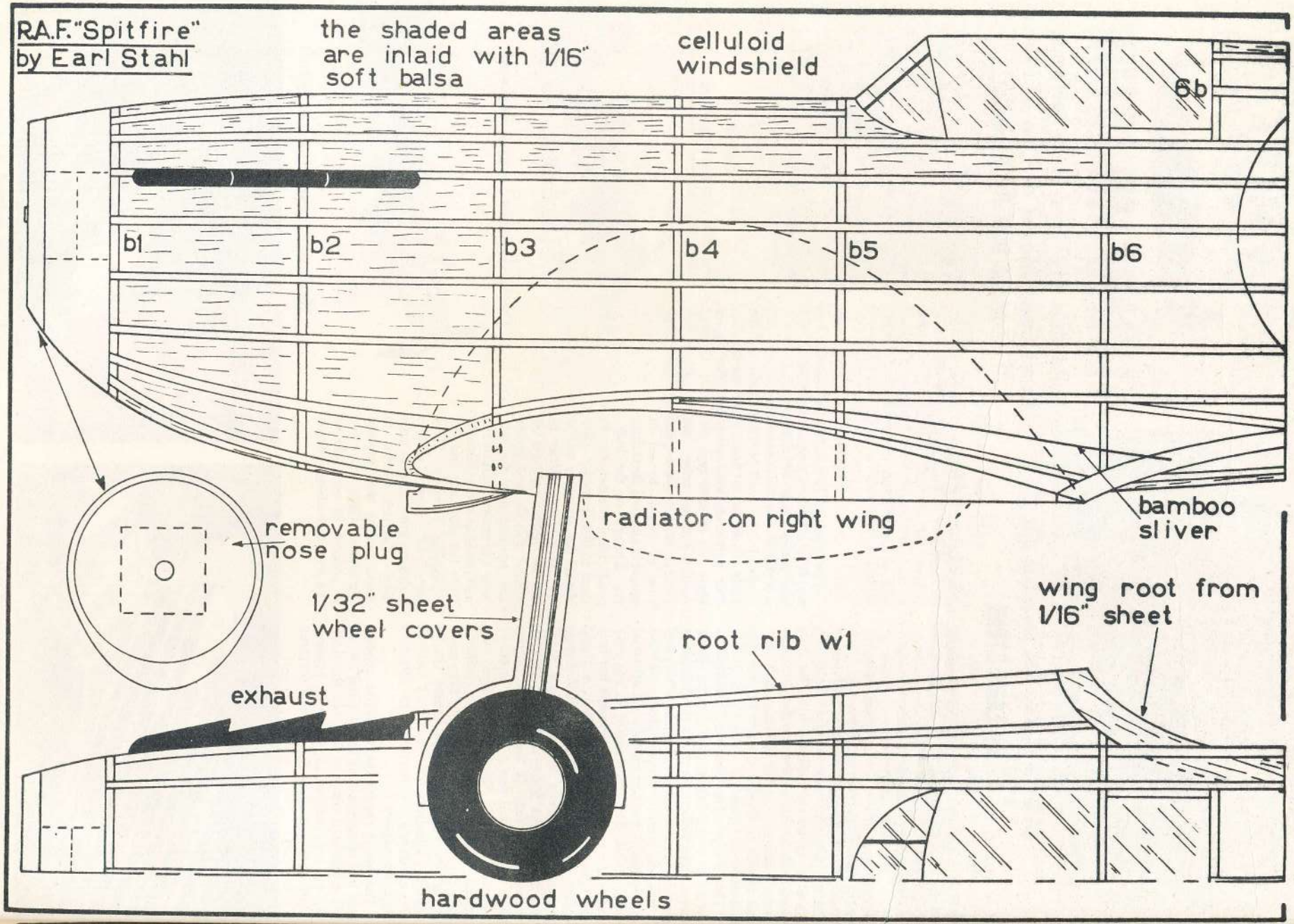
The large propelier gives long flights



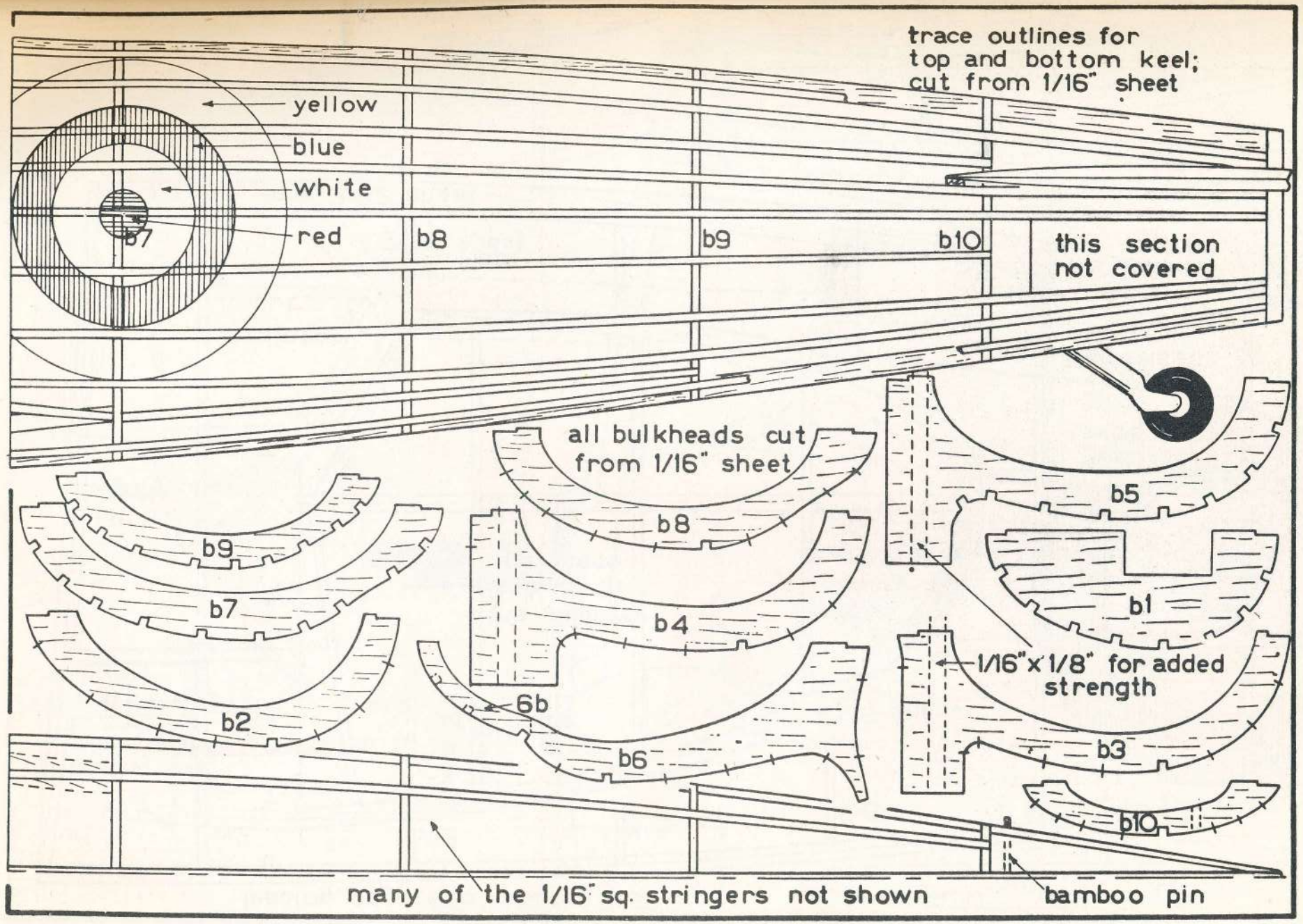
This close-up shows refinement of detail

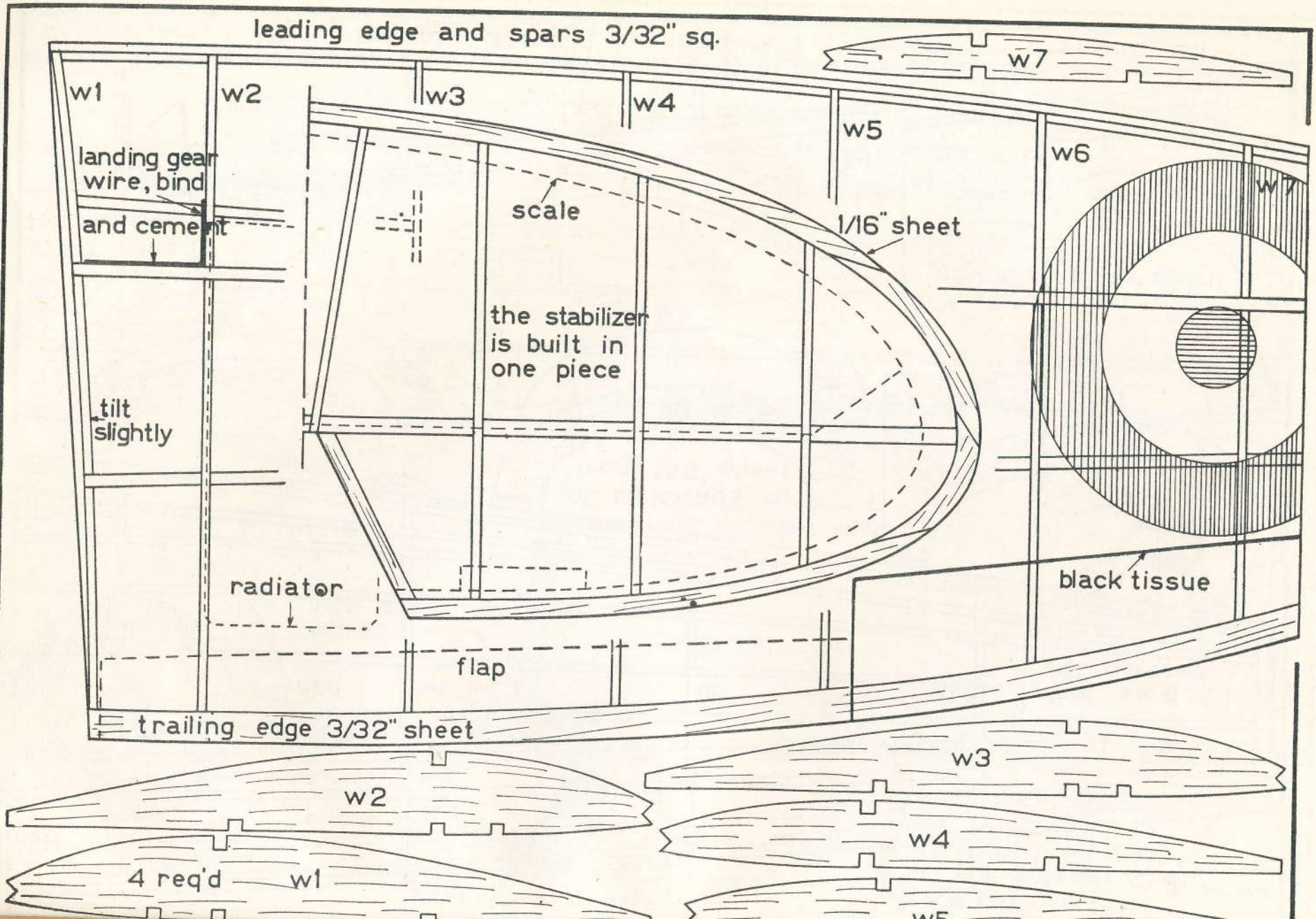


It is carefully designed and strong

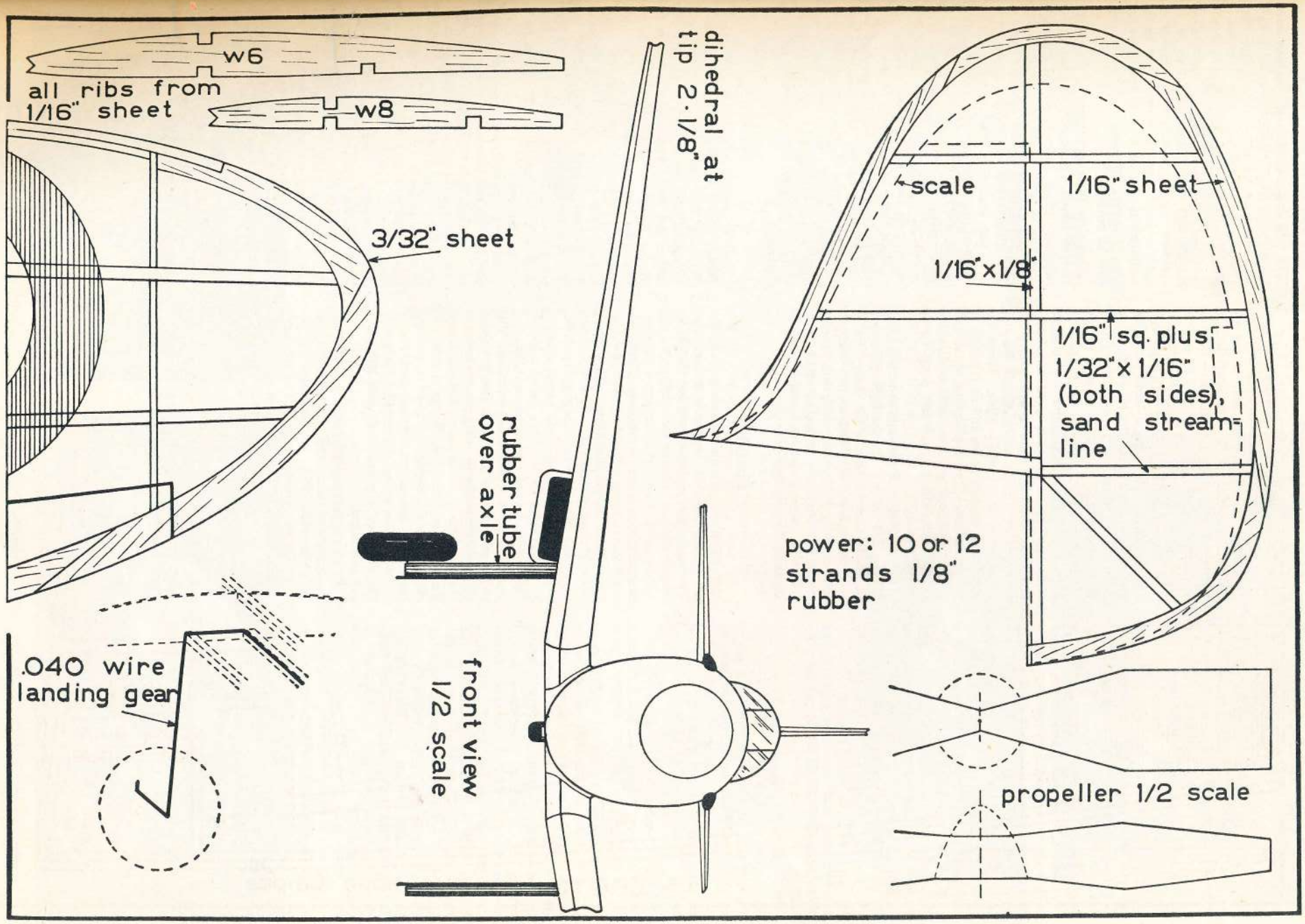

R.A.F. "Spitfire"
by Earl Stahl
the shaded areas are inlaid with 1/16" soft balsa
celluloid windshield
6b
b1
b2
b3
b4
b5
b6
removable nose plug
radiator on right wing
bamboo sliver
1/32" sheet wheel covers
wing root from 1/16" sheet
root rib w1
exhaust
hardwood wheels

hardwood wheels




leading edge and spars 3/32" sq.
w1
w2
w3
w4
w5
w6
w7
landing gear wire, bind and cement
scale
1/16" sheet
the stabilizer is built in one piece
tilt slightly
radiator
flap
black tissue
trailing edge 3/32" sheet
w2
w3
w4
4 req'd
w1
w5


w4
4 req'd
w1
w5


w6
all ribs from 1/16" sheet
w8
3/32" sheet
dihedral at tip 2-1/8"
rubber tube over axle
front view 1/2 scale
.040 wire landing gear
scale
1/16" sheet
1/16"x1/8"
1/16" sq. plus 1/32"x 1/16" (both sides), sand streamline
power: 10 or 12 strands 1/8" rubber
propeller 1/2 scale

one to the corresponding position of the other side. Check continually to assure a properly aligned structure.

The nose of the original model was "filled-in" with 1/16" soft sheet balsa. This is not a difficult job but it does require time and patience. Cut individual pieces of balsa so they will fit snugly into each open space between the stringers and bulkheads. When dry the whole nose is thoroughly sandpapered to a smooth, pleasing shape. Cut the nose block from a 1/2" thick block and cement it to place. It is advisable to lightly cement the 1/8" nose plug fast, too, so the entire nose can be shaped attractively.

Cement a "w-I" rib to each side of the wing root, being careful to make the angle of incidence identical to that of the plans. The trailing edge of the wing root, cut from 1/16" sheet, is trimmed to the correct size and glued to place. Brace the root bulkheads with pieces of 1/16" x 1/8" hard balsa as indicated by the dotted lines on the bulkhead patterns. 3/32" square pieces are fitted between the root rib and the fuselage to form the leading edge. A 1/8" thick false rib is fitted against the fuselage by the "cut and try" method—it extends from the leading edge to bulkhead number b-3. Several lengths of thin bamboo may be attached to the bulkheads to help round out the wing root.

Prepare the fuselage for covering by thoroughly sanding the whole structure. For the best covering job only those members of the fuselage which run from nose to tail should touch the paper, so use a piece of sandpaper wrapped about a pencil or similar round object to scallop the bulkheads.

Wing

Since the wing is elliptical in plan-form, all of the ribs in each half are different. Select a sheet of soft grade balsa for all of the ribs except "w-1" and "w-2" which require a stronger variety. Cut the required number of ribs and sandpaper them smooth. Notches must be cut with accuracy to insure a neat job when completed. The wing's trailing edge is cut from 3/32" sheet; the tips likewise. Select hard 3/32" square spars since they must resist the shock of landings. Assemble the parts directly over the plans and cement the joints firmly. When dry, the halves are removed from their jigs, trimmed and sandpapered to their final shape.

Tail Surfaces

The Spitfire's tail surfaces haven't sufficient area to insure stable model flights so we have enlarged them to more suitable proportions. Build the stabilizer in one piece for greater strength. Outlines of the stabilizer and rudder are cut from 1/16" sheet; ribs are 1/16" square. Additional strips are cemented to both sides of the ribs and when dry they are cut to a streamline shape.

Propeller

In all probability your Spitfire will need some extra weight in the nose to help balance the long tail moment arm, so we advise the use of a white pine propeller. A hardwood prop, while a bit more difficult to carve, will take more abuse. Lay out the blank, as indicated, on a block 9" x 1 1/2" x 1". Cut the blank to shape with a jig saw, etc. and then carve a right hand propeller. Finish the back face of the blades first and then reduce the front face to the proper thickness. Shape the blades so they resemble the wood props used on early Spitfires. (Latest models of this fighter are equipped with three-blade constant-speed metal-propellers.) The huge spinner will easily hide a free-wheel device which should be used to improve the model's glide. Make the spinner from hard balsa and fit it neatly to the prop hub. The application of several coats of clear dope with light sanding between each will prepare the prop for a smooth finish.

Remove the nose plug and cement a block 1/4" x 5/8" x 5/8" to the back so it will fit neatly into the hole in the nose. Drill a hole through the plug and cement washers to both sides so the prop shaft will revolve smoothly. Bend the propeller shaft from .040 wire; several washers will be needed between the prop and nose plug.

Covering

Cover the whole model with colored tissue to help keep the weight at a minimum. The model pictured is all red but the planes at war are camouflaged with dull green and brown paint. Cover the fuselage first, using banana oil to fasten the tissue. Numerous small pieces must be used to prevent wrinkles. Trim the surplus paper with a sharp razor blade and then carefully over-lap the next piece. It is not necessary to attach the paper to all of frame—just apply adhesive to the outsides of the area being covered. Cover the top of the wing with several pieces, if necessary, to avoid wrinkles. The under-surface of the wing is covered from the third rib to the tip, only, since the landing gear must be attached to the spars once the model is assembled. Spray a fine mist of water on the covered parts to tighten the tissue; pin the wings and tail surfaces to a flat surface to keep them from warping. Do not dope the covering until the parts are assembled.

Block the fuselage into a level position so the model can be assembled accurately. Attach the wings first; do not spare the cement for the wings are subject to the force of landings. Check to ascertain that the incidence of each wing panel is the same. The tips should be raised 2 1/8" for the correct dihedral. To attach the stabilizer it will be necessary to cut the tail-post and bulkhead number 10 in order that they can be sprung apart far enough to admit the stab. Cement the rudder on and check for correct alignment. The landing gear struts should be bent to shape and attached; the plan shows how the .040 music wire is formed so as to join the spars and second rib of each wing. Draw a front and side lay-out to aid in bending the wire accurately and be sure to make a right and left strut. Use strong silk thread and neatly bind the struts to the spars. Once the alignment is satisfactory apply several coats of cement over all the buildings as well as the adjacent spars and ribs. The remaining uncovered parts should now be covered.

Complete the construction by adding the various details. The cockpit enclosure is thin celluloid; paper patterns should be shaped correctly before the celluloid pieces are cut. Rubber tubing of the correct size makes excellent covers for the landing struts, but if it is not available, bond paper should be wrapped into tubes of the correct size. One or two coats of clear dope are brushed on the covering; do this in a dry room to avoid "blushing." Check continually to prevent warping of the flying surfaces. Thin strips of black tissue should be doped to the covering to represent the control surfaces. The insignia used on the original model was made from colored tissue, too. Exhausts, tail wheel, wheel well covers, a radio antenna and numerous other details should be added to enhance the appearance of your miniature.

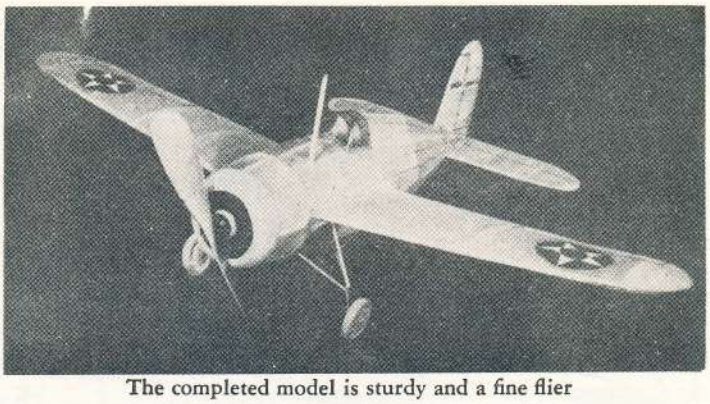
Flying

Ten or twelve strands of 1/8" brown rubber should be used to power this model. To many this amount of power may seem excessive, but the resulting zip and climb makes the model just that much more realistic. Lubricate the rubber and then remove the excess so the sides of the body will not be splashed. Attach one end of the motor to the prop shaft and with the aid of a weighted string drop the other end through the fuselage. A 1/16" round bamboo pin holds the motor in the rear. Your replica of this famous fighter is now ready for its test hop.

Select a grass-covered field and a calm day for the test flights. Balance the model by the wing tips—it should rest with the nose pointing down at a shallow angle. If any weight must be added, it will probably be needed in the nose. Try a few shoulder-height glides; it may be necessary to shift the center of gravity a bit to obtain the desired results. Wind the rubber motor about 50 turns and launch. It should climb a few feet and then glide smoothly to earth. Warp the stabilizer, if necessary, to correct any undesirable attitudes. Should the model bank excessively, "wash-in" the wing tip which is on the inside of the turn. Gradually increase the number of turns once the adjustments seem satisfactory. Stretch the rubber and use a mechanical winder for best flights. Exercise your best judgment in the construction and flying of your Spitfire and you will be rewarded with an attractive, fine performing model.

GRUMMAN WILDCAT

Build This Flying Replica of A Navy Fighter



The completed model is sturdy and a fine flier

By HERBERT K. WEISS

Large tail surfaces insure great stability

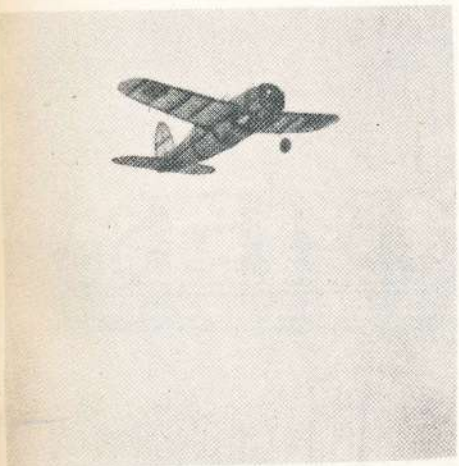
FIRST OF THE line of Twin Wasp powered, mid-wing flying-powerhouses to reach the public eye was the XF4F-2, for which plans are here presented. Since the XF4F-2 was put through its paces the design has been carried still farther with the object of improving the stability and performance.

Out of the spin tunnel, in which dynamic models are spun to determine the effects of design changes on recovery characteristics, came the discovery that rectangular wing tips and a squared rudder allowed the XF4F-2 to pull out of a spin in fewer turns. Careful wind tunnel tests indicated the desirability of a huge spinner over the prop hub to complete the fuselage lines. And so, in the process of development, the F4F lost its graceful tip shapes and acquired a "nosey" aspect, resembling less a graceful winged teardrop than a vicious flying bullet.

With a 1050 hp Pratt & Whitney Twin Wasp engine, the model is rated at 330 mph top speed, 295 mph cruising, and it possesses a normal flight range of 1100 miles.

Worthy of note are the sharp narrowing of the fuselage fairing behind the pilot, to improve vision to the rear on each side; the neat row of belly windows which eliminate the blind spot which has been a dangerous disadvantage of many mid-winged fighters, and the fully-retracting landing gear.

Our model is of the earlier XF4F-2; the experimental ship with its round wing tips and rudder. Simply built to attain lightness for good performance, this model Grumman has turned in many long stable flights of average half-minute duration. Modellers desiring to reproduce the latest square-tipped model may easily perform the conversion with the aid of photographs of the latest design.



In full flight it is most realistic

Wing

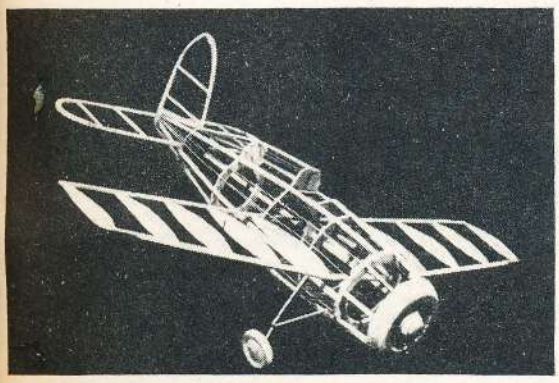
Construction is begun with the wing, which is assembled in one piece for strength. Sufficient ribs are shown on the drawing for a scale model. The ribs which are not numbered are made by cutting out two of the next largest and cutting one down slightly to fit. A flying model can dispense with these alternate ribs for lightness.

To obtain a drawing of the left half of the wing, place a sheet of white paper under the plan with a sheet of carbon paper under both, face up. Then trace the drawing, the carbon duplicate will be reversed; that is, opposite to the right half, and may be attached to the right wing panel layout at the center line to give the complete wing layout. Put waxed paper over the plan and assemble the wing frame on it. Cut the leading and trailing edges to airfoil section after assembly. Bend the wing tips from 1/16" square bamboo by holding close to a lighted cigarette. Bamboo tips are preferable to balsa ones on a flying scale model because they absorb landing shocks better. Crack the spars just outside Rib 1 and recement them to give the wing the proper amount of dihedral.

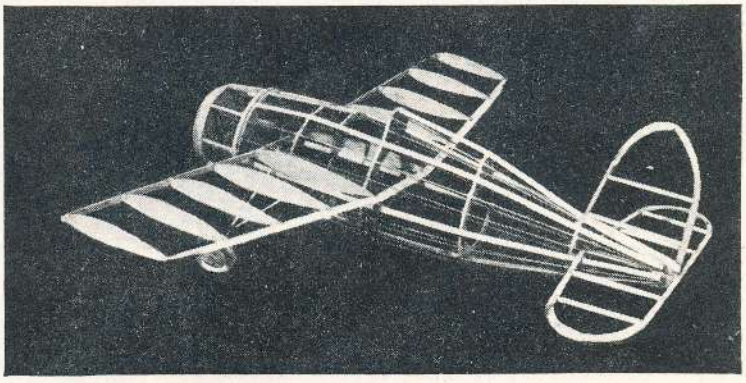
Fuselage

Cut out two halves of each bulkhead and cement the halves together. Bulkheads D, E, F, Fa, G, H, and J are 1/16" sheet balsa, and A, B, C, a, and b are 1/8" sheet balsa, Cement bulkheads F and G to the wing center section as shown and attach the two main 1/8 x 1/16" side stringers.

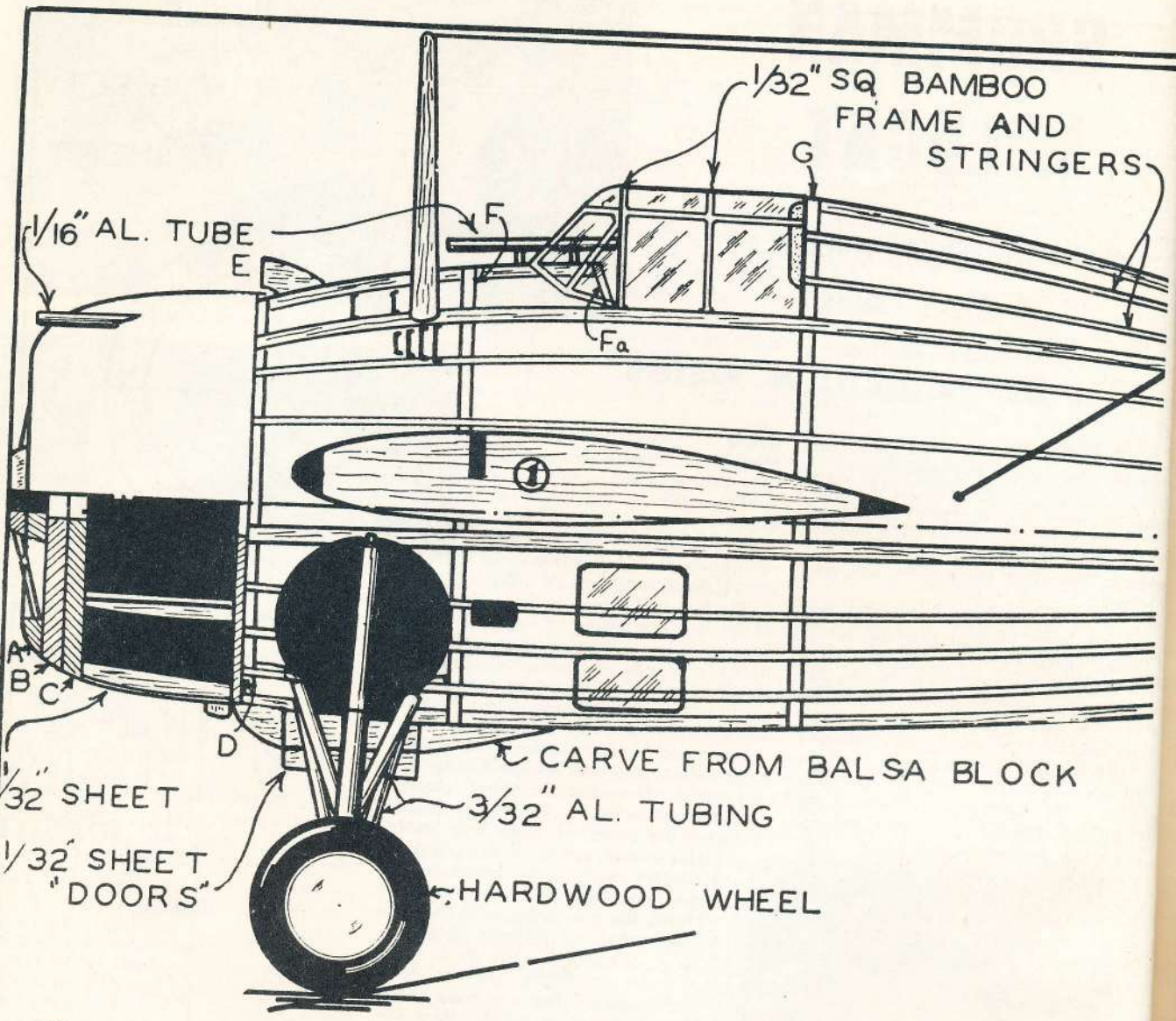
Add the top and bottom stringers and the two which run along at the cockpit edges. These are also 1/8" x 1/16" balsa. The remaining stringers are 1/32" square bamboo. If the builder wishes primarily a non-flying scale model, these may be replaced by 1/16" square balsa. However, the writer has found that in a flying scale model, the use of bamboo stringers gives the fuselage a



The completed frame is realistic in detail

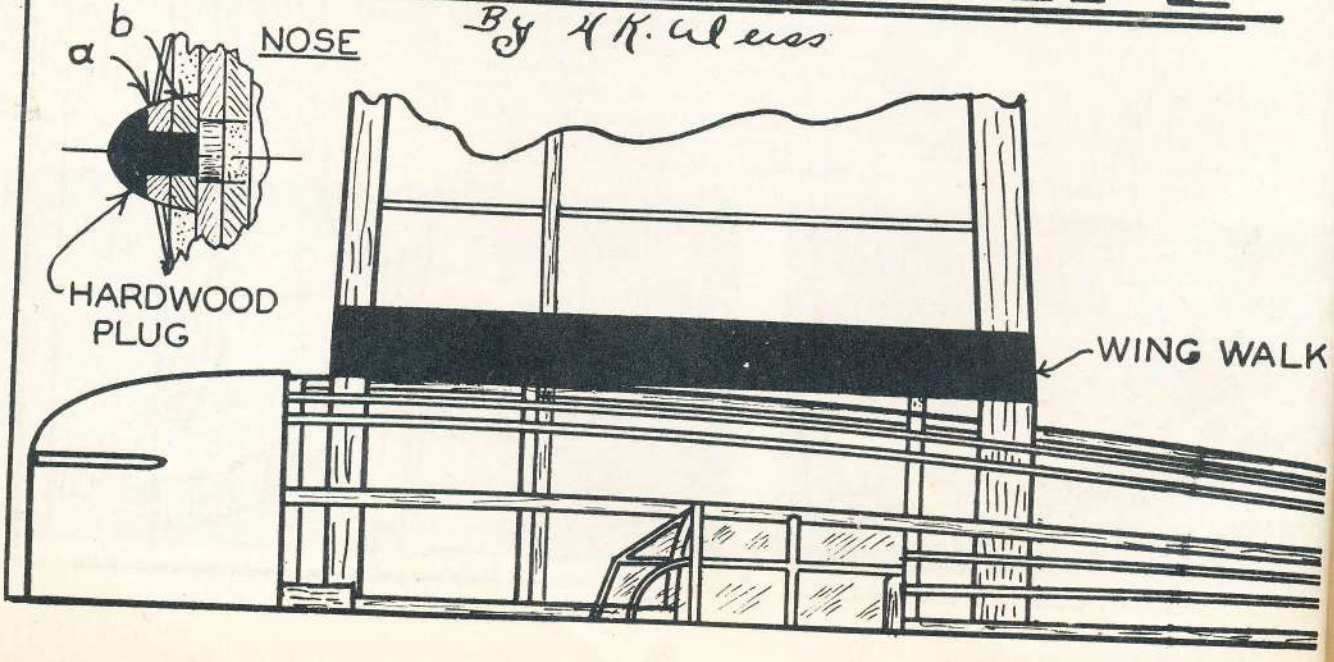


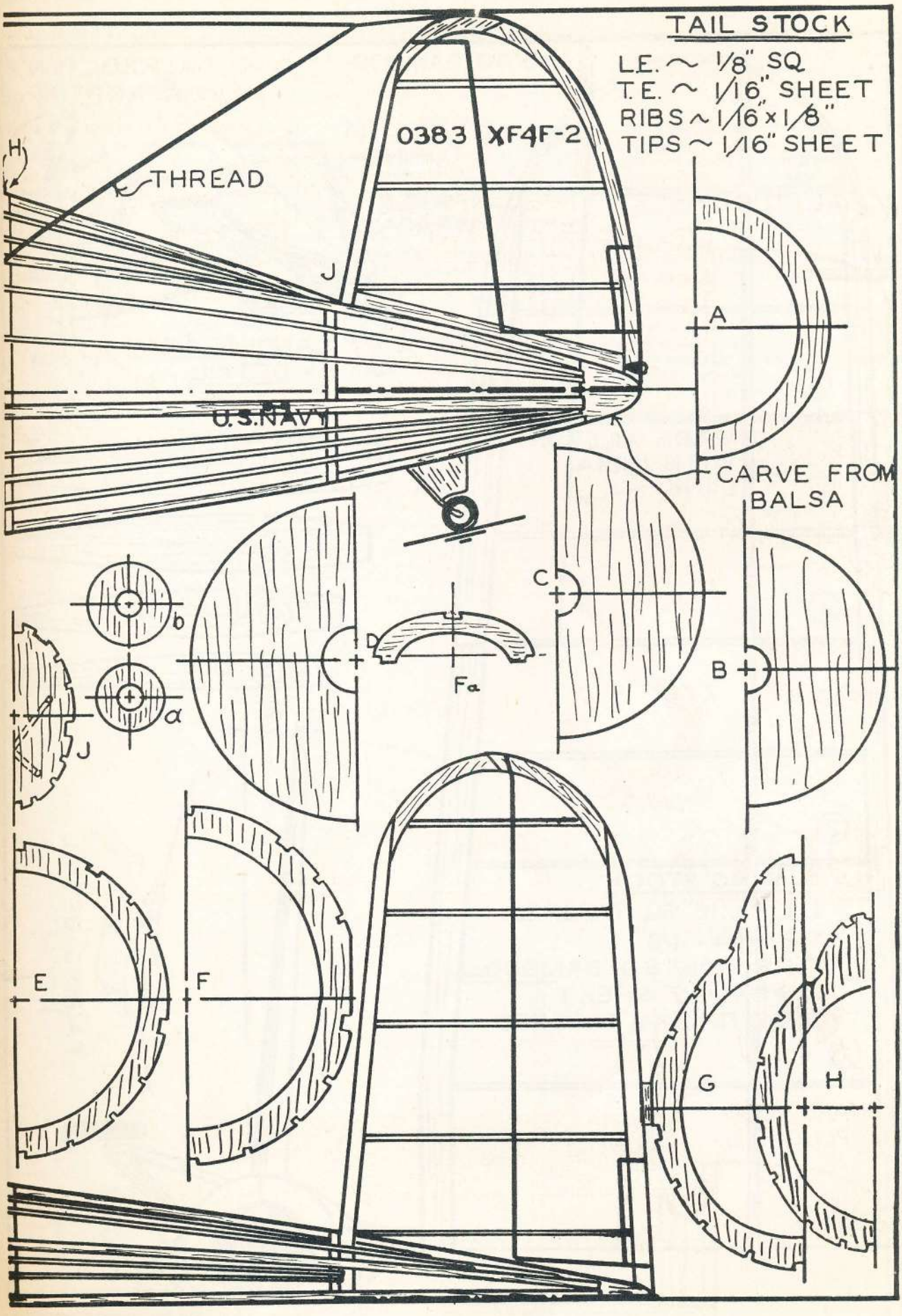
The structure is simple and can be quickly and easily built

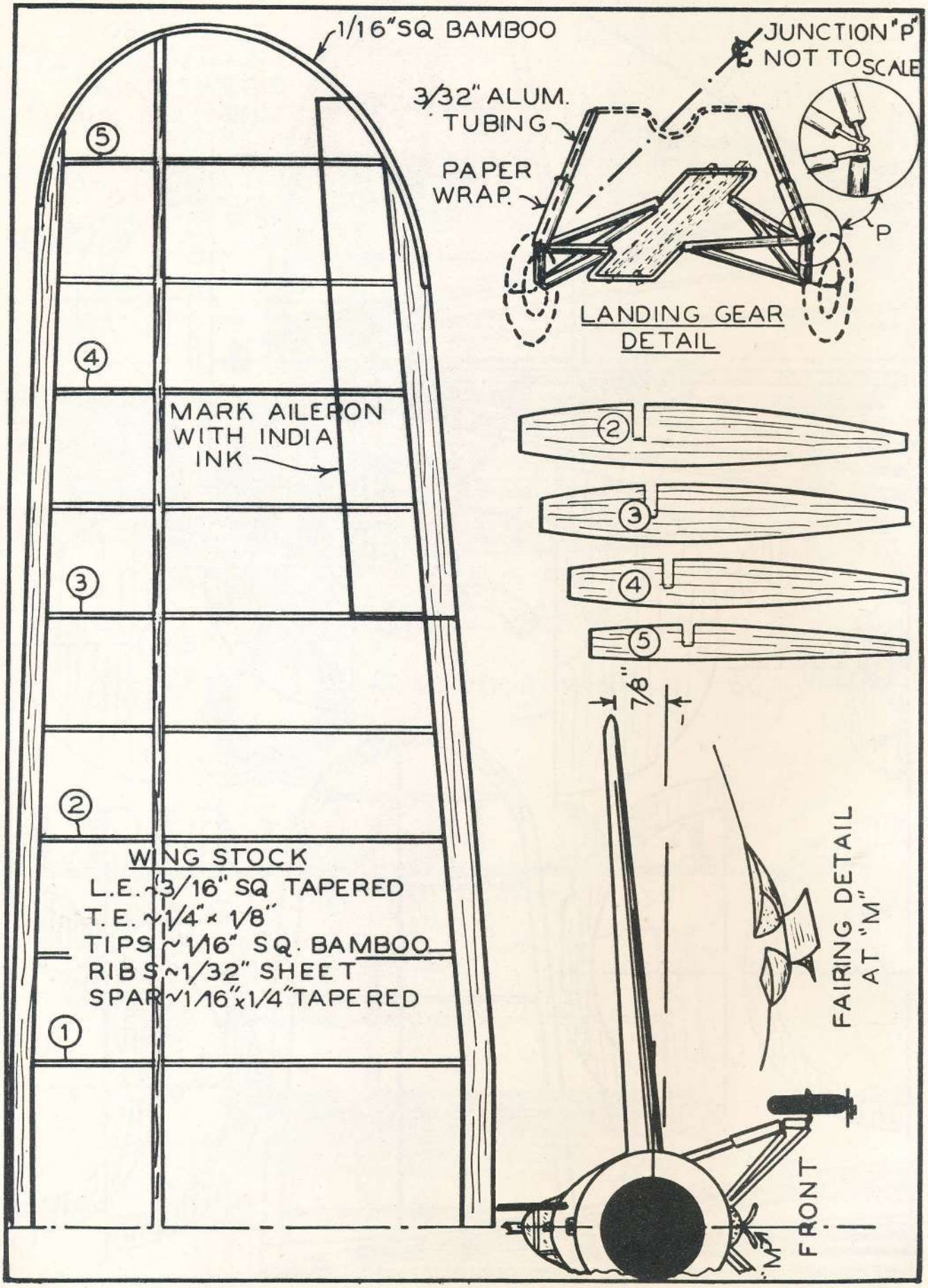


GRUMMAN XF4F-2

By H K. Weiss




TAIL STOCK
L.E. ~ 1/8" SQ.
T.E. ~ 1/16" SHEET
RIBS ~ 1/16" x 1/8"
TIPS ~ 1/16" SHEET
0383 XF4F-2
H
THREAD
J
U.S.NAVY
A
CARVE FROM BALSA
C
B
D
Fa
b
a
J
E
F
G
H


1/16"SQ BAMBOO
JUNCTION "P"
NOT TO SCALE
3/32" ALUM. TUBING
PAPER WRAP
P
LANDING GEAR DETAIL
MARK AILERON WITH INDIA INK
WING STOCK
L.E. ~3/16" SQ TAPERED
T.E. ~1/4" x 1/8"
TIPS ~1/16" SQ. BAMBOO
RIBS ~1/32" SHEET
SPAR ~1/16" x 1/4" TAPERED
7/8"
FAIRING DETAIL AT "M"
M
FRONT
1
2
3
4
5

surprising amount of resilience and he has yet to see a model employing this type of construction with the familiar accordian-folding nose that so often follows vertical dives.

Tail Surfaces and Cowl

The tail surfaces are of standard construction. The stabilizer is built in one piece for stiffness. Sand the leading and trailing edges to airfoil section after assembly. The cowl is built up in the usual manner from 1/8" and 1/16" thick balsa rings. Cover it with 1/32" sheet balsa.

The cowl on the test model was covered with tissue for lightness, but if the ship finally needs more weight at the nose, the balsa covering is a convenient way of adding it.

Landing Gear

Details of the landing gear attachment are shown on the drawings. The struts are 3/32" aluminum tubing over .028 music wire. The wire going through the long strut is continuous through the 1/8" x 1/16" side stringers and is looped at the center to avoid the rubber motor. The upper set of the short struts contains the wire which, as shown in the detailed drawing, is cemented to bulkheads D and F. To hold it in place, cement two 1/8" x 1/16" braces between the bulkheads and over the wire as shown.

Covering

Cover the model carefully with tissue, using thin longitudinal strips on the fuselage. If a colored model is desired, the authentic navy colors are all silver with the top of the wing chrome yellow.

Spray the model lightly with water and allow it to dry. Tack down, with clear dope, the loose edges of tissue that appear. Then give the whole model a coat of thin clear dope, or if colored tissue has been used, add a coat of thin dope of the same color as the tissue.

Add the stars on top and bottom of each wing tip, paint the wheel wells black and add the control outlines and lettering with India ink. Add fairings, cockpit covering, radio mast and tail wheel.

Propeller

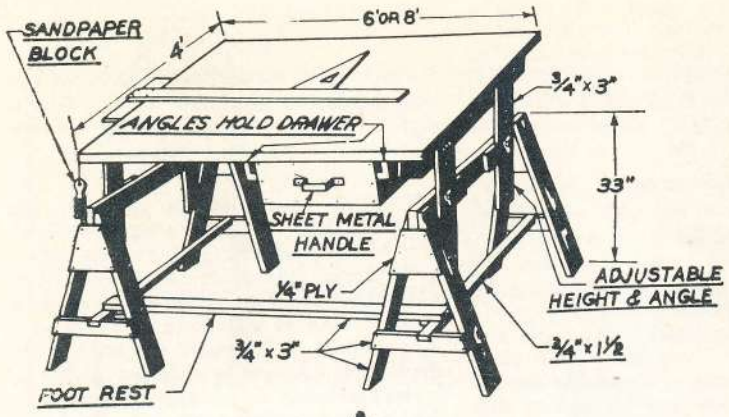
Carve the propeller from a block of medium-hard balsa 6" x1 1/4" x 1/2". Give it two coats of silver dope, sanding between coats.

Flying

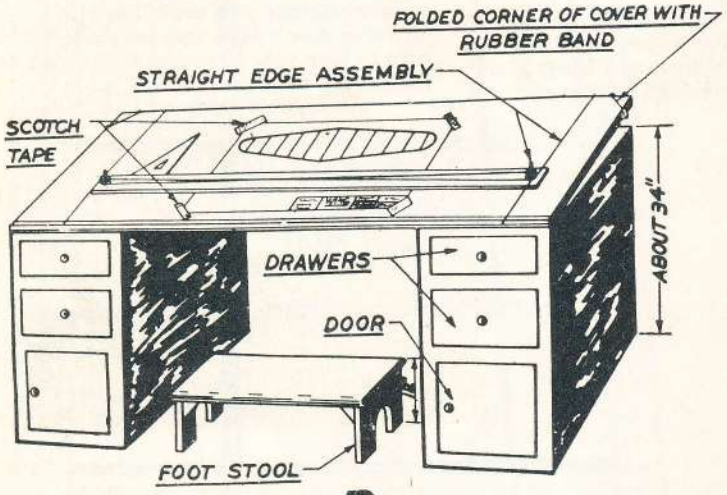
Glide the model, adding weight to the cowl if it stalls. Then try a powered flight. If the model stalls, warp the rudder slightly in the direction in which the model tends to turn. It is better to let the model climb in a spiral than to add down-thrust to prevent stalling. If the model still stalls, warp the trailing edge of the stabilizer down. To correct for spiral diving, apply opposite rudder or warp the inside wing's trailing edge down.

Flight performance depends, of course, on how carefully your model has been built. If you've done a light, true job you'll find it hard to keep your Grumman from flying at least thirty seconds.

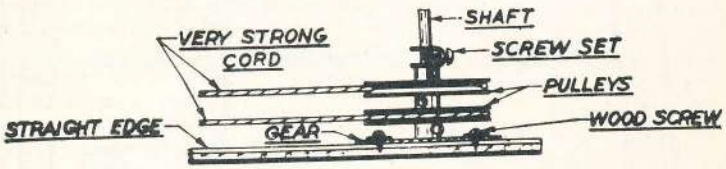
PLANE TIPS I



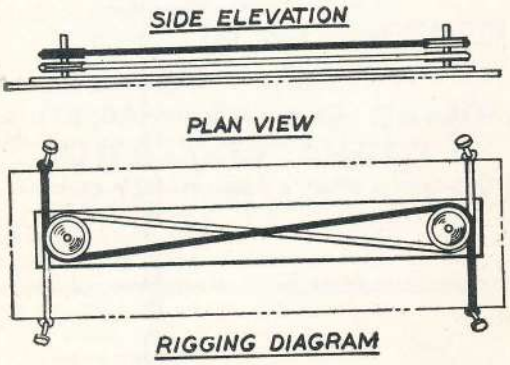
A

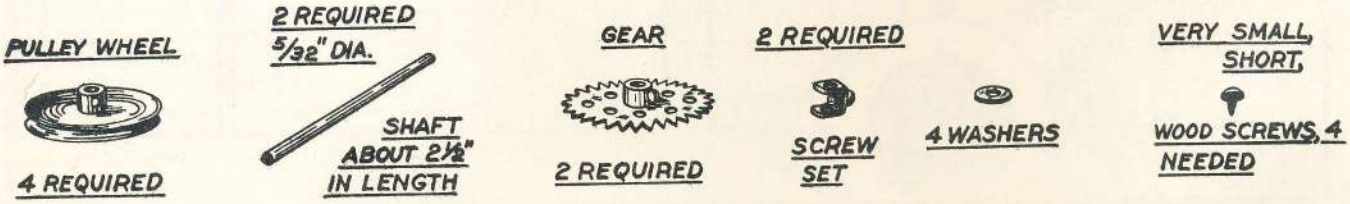


B



SIDE ELEVATION OF PULLEY ASSEMBLY AT ONE END OF STRAIGHT EDGE





THE ideas presented on this page are not theory, but have been taken directly from engineering departments during the present national emergency. Knowledge of short cuts in general practice is not taught in schools, yet it is very important to the model builder who hopes for an engineering career. These hints also are valuable to the adult engineer . . .

Advanced model builders and aeronautical engineers are not satisfied with the usual small drafting board used in schools. Here is shown a large board, A, which is economical to construct.

To build models on the same table lay a 3/8" plywood sheet over the drawing table to prevent damage to the surface. Plywood in about 5 laminations makes a fine, economical drawing board. White pine about 1" thick is also often used.

Incidentally, never use thumbtacks to secure a drawing because the holes in paper tear, slipping the paper out of line. Moreover it is impossible to make a good drawing on tracing paper over thumbtack holes, necessitating a new board eventually, so why not use Scotch tape and preserve the smooth surface?

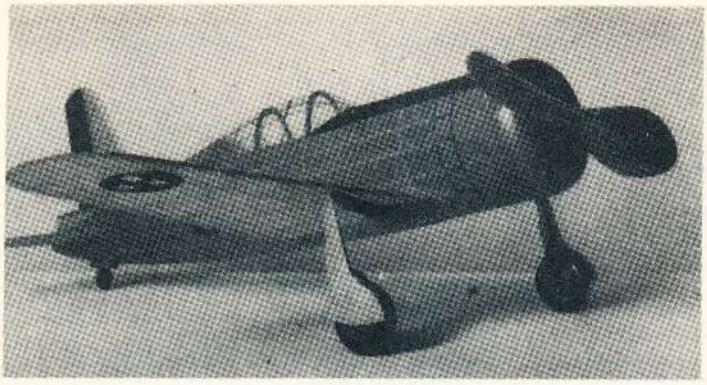
To keep the board clean engineers always cover it with cheap wrapping paper, secured at the edges with Scotch tape. The tape must be lifted and tightened to take out wrinkles which form every few days. To prevent wrinkles, tape paper at bottom edge of board, bend top corners under and tape rubber bands to the turned under-corners of the paper. Stretch the other ends of the rubber bands over the top of the board and secure underneath with thumbtacks. These rubbers always keep the paper tight and smooth.

A simple straight edge consists of a T-square without the head. From an old Erector set obtain 2 short axles, 4 pulley wheels minus the set screws, 2 cog wheels with set screws, 4 short wood screws and washers and 2 screw sets for the shaft ends. These parts are shown below.

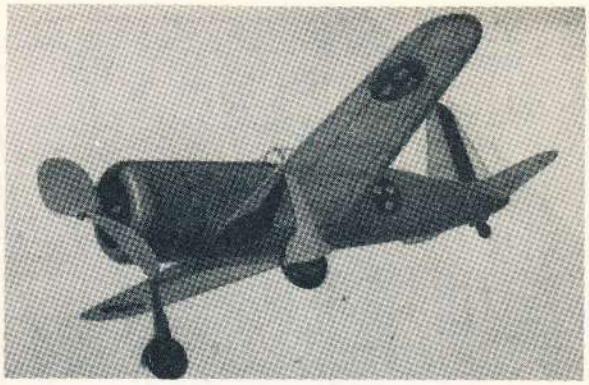
The drawing board, B, is the type usually found in aircraft factories. A board is laid across two sets of drawers. Because it is necessarily high, a foot-stool or crosspiece is used with a drafting stool. Left edge of board is machine-planed to make a straight edge for a T-square. Many use a tilted table to get closer to all parts of the drawing with less back strain; others like a flat table to prevent tools from rolling off.

Height of drafting board should be 4" less than waist high; with this height one can stand comfortably and lean over to draw any place on the board. Large boards not only accommodate large drawings but also provide space for your tools. Simple equipment can be made for the average model builder with limited facilities. He can pick up some cheap 5-ply plywood, say 3'-6" x 4'-0" (with left edge planed), place it on a card table and use a T-square or rig up a straight edge from scrap material, an Erector set, or from ready-made parts purchased from a drafting supply store.

Two cords are tied to brads at the lower edge of the drawing board; cord going up over one pulley and under the other one as shown. Line up straight edge approximately, pull cords quite tightly and tie to brads at top. Cord must not go from an upper pulley to a lower pulley—a twisted straight edge results. Large T-squares are inaccurate and hard to handle. The straight edge is simple to assemble and more accurate than the T-square. The straight edge remains parallel to the board's edge as it moves up and down because one pulley at each end uses the same cord.



The completed model, realistic in detail



The wide tread helps take-offs and landings

The Vultee Vanguard

How to Build a High Performance Flying Scale Model of Uncle Sam's Latest Fighter

Here's the little plane climbing skyward. It's attitude denotes stability and grace

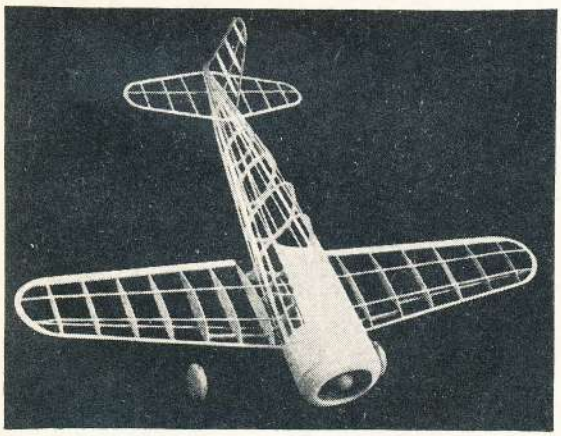
By EARL STAHL

THE Vultee Vanguard 48C is one of the most beautiful airplanes ever designed and looks like what a pursuit plane "should look like." Although never given the opportunity to prove itself in battle it will always be a favorite design for the model builder. The AAF has purchased several known as the Vultee P-66.

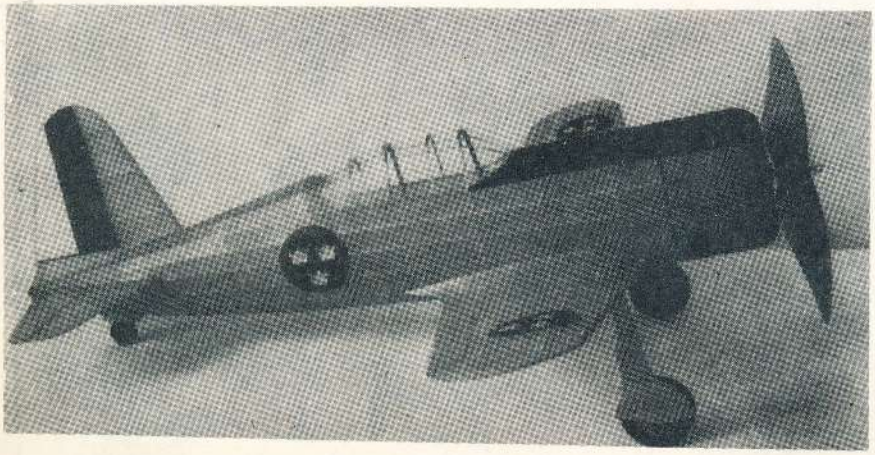
Upon its introduction it was one of the fastest and most heavily armed fighters in the world and it was designed expressly for "serviceability," with large panels, easily removable, giving access to armament, controls and installations. It can be stripped down for servicing in two minutes flat, and gun barrels can be changed without removing the guns. In addition to heavy armament, a series of small bombs may be carried, making it one of the world's first fighter-bombers.

When powered by a double-row Pratt and Whitney Wasp engine this single seater has a maximum speed of 358 m.p.h. Its cruising speed is 316 m.p.h., and it lands at 73. The fuel load of 240 gallons is sufficient to keep the plane in action about 2 1/2 hours.

The model has been accurately reproduced and is worthy of any effort expended on its construction. It is not only attractive as a display model but it is also a speedy, stable flyer. A small amount of wing area and the large fuselage naturally limit the model's capacity for making flights of long endurance; however, it will afford real satisfaction with the many realistic flights it is sure to make.



The structure is simple but strong

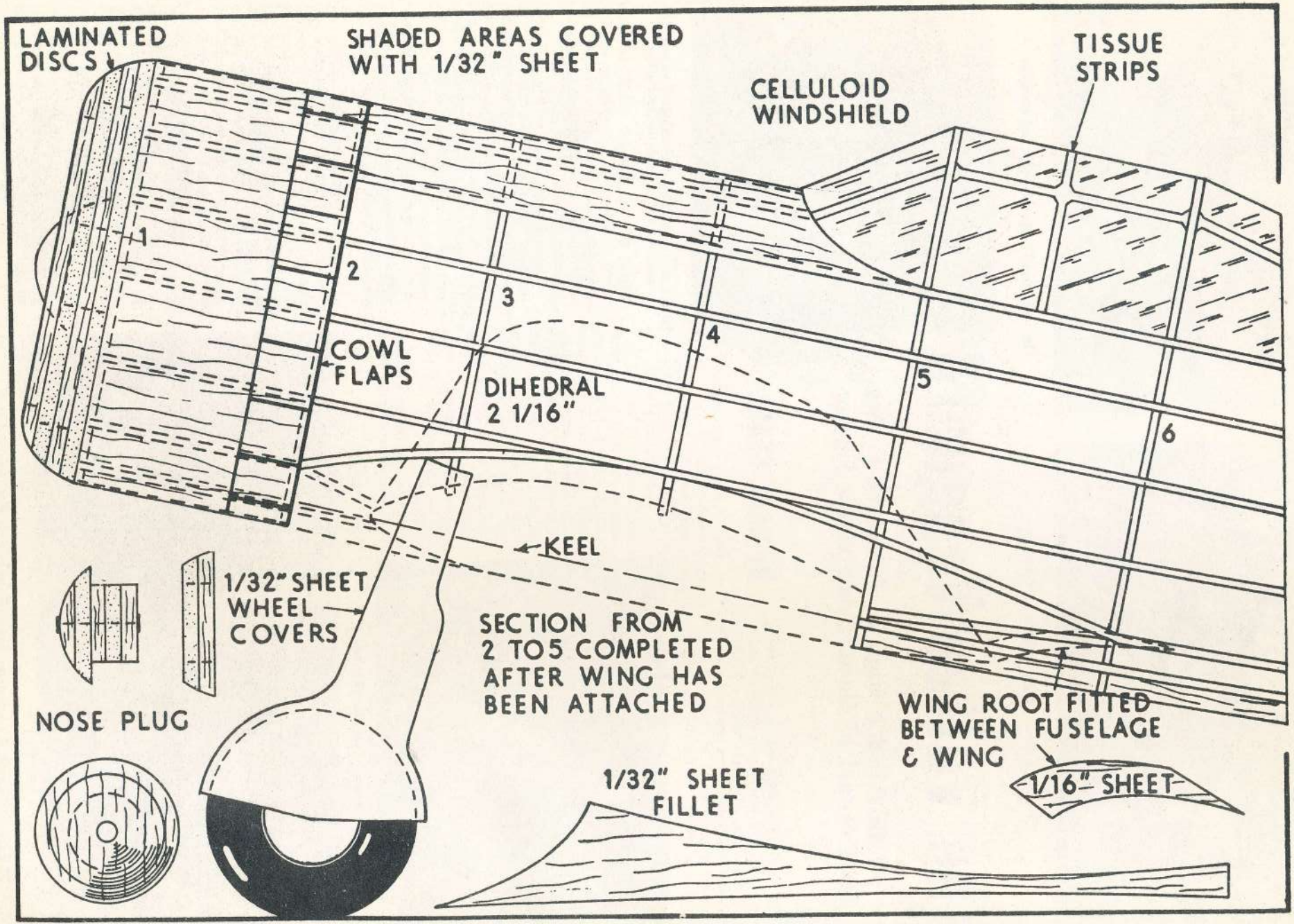


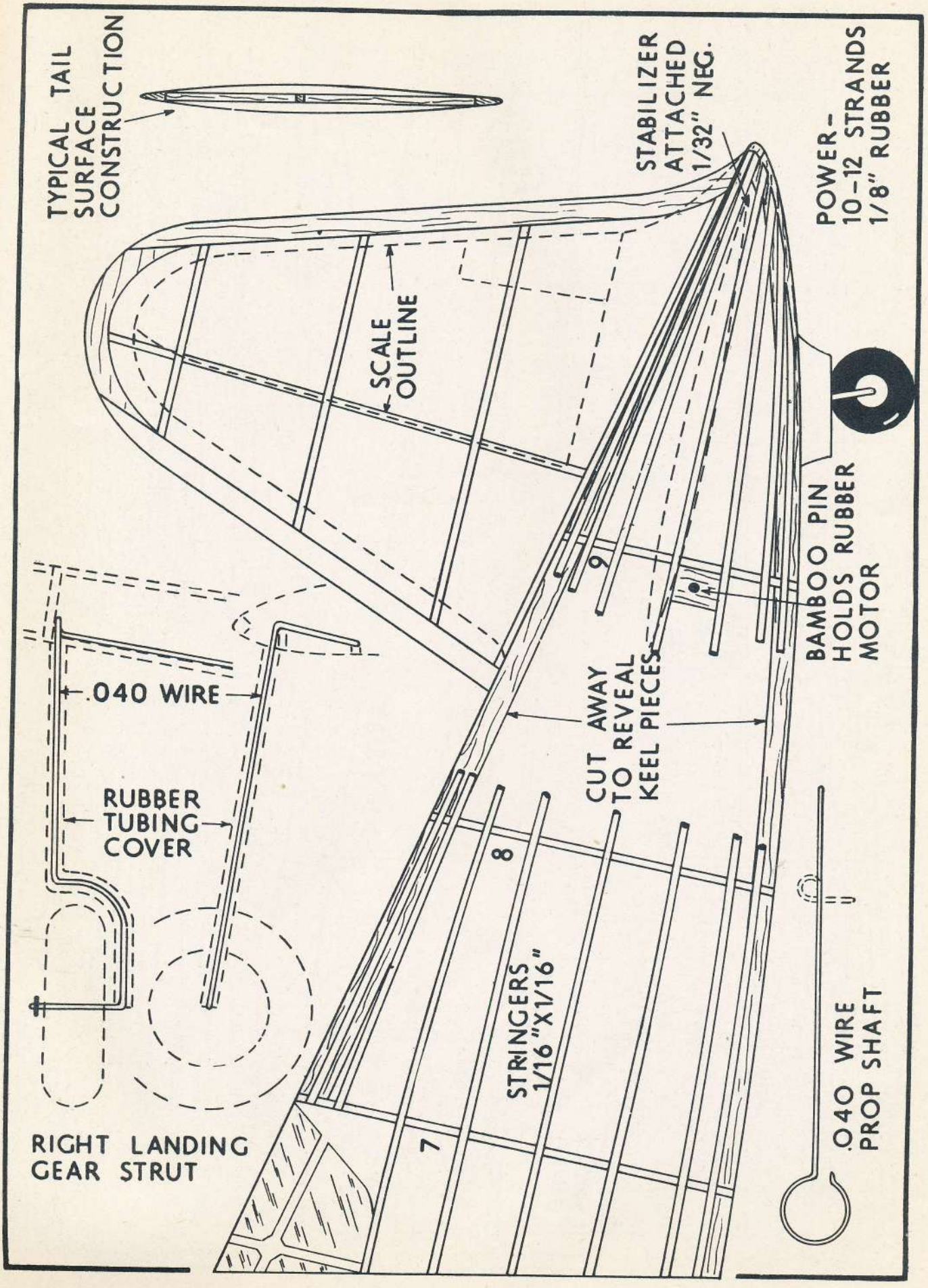
The large, high-pitch prop gives fine performance to this beautiful ship

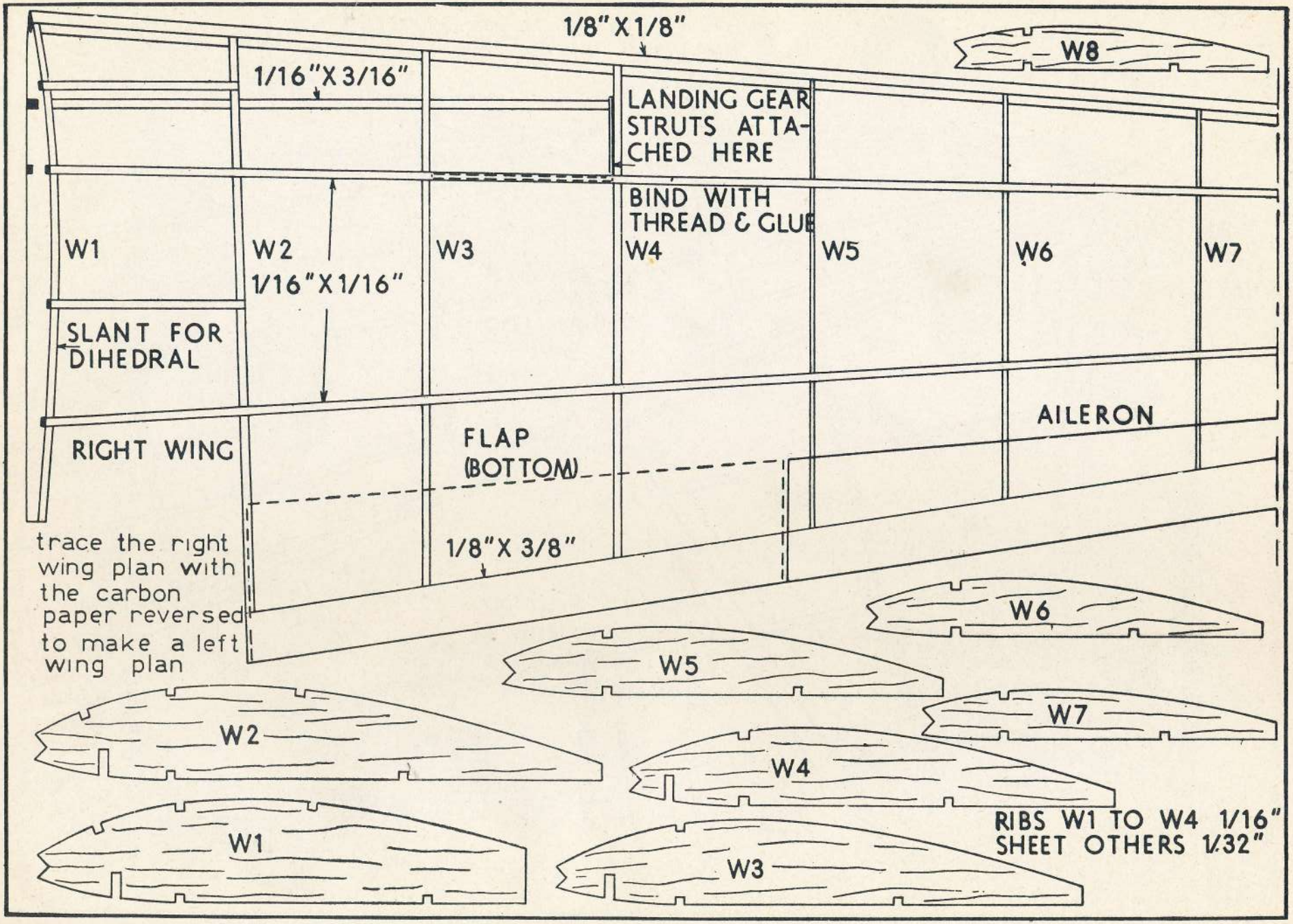
Fuselage

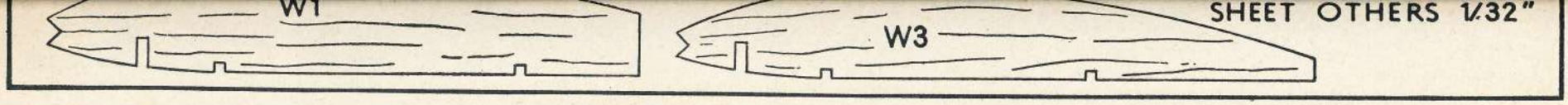
Begin the construction by making the keel pieces. Trace the top and bottom outlines of the side view to get the correct shape; the bottom keel is a continuous piece extending from nose to tail and the top keel is two separate pieces. Average depth of the keels is about 3/16"; they are cut from 1/16" sheet balsa. Bulkheads are shown full size on the plan and they, too, are cut from medium grade 1/16" balsa sheet. Two of each are required. It will be noticed that only a few of the bulkheads have notches for all of the stringers. Cut out the notches shown and mark the positions of the others which will be cut later.

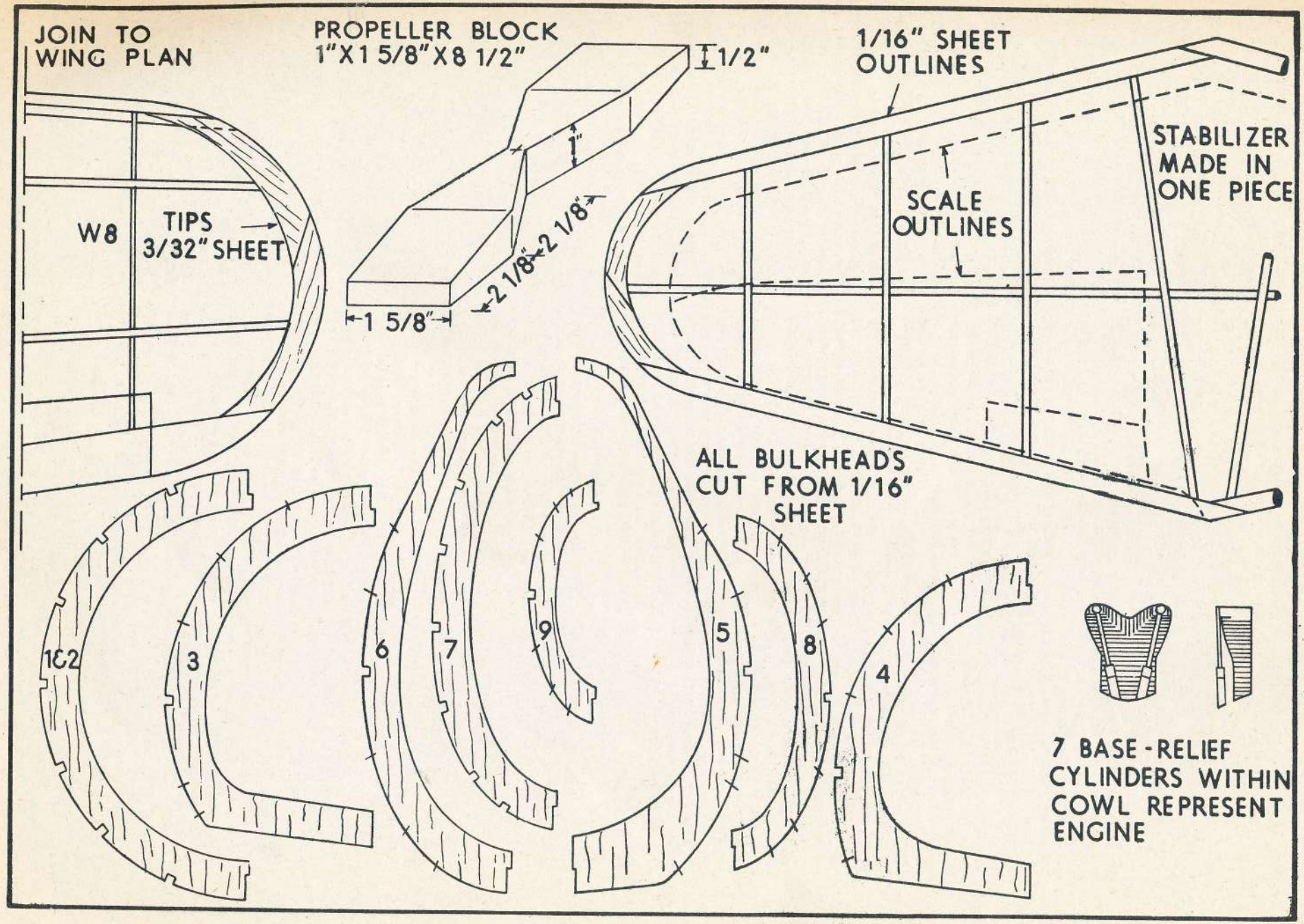
Pin the keel pieces into position over the plan and begin actual assembly of the fuselage. Temporarily cement a piece of 1/16" x 3/16" balsa between the top keels to join them at the opening created by the


LAMINATED DISCS
SHADED AREAS COVERED WITH 1/32" SHEET
CELLULOID WINDSHIELD
TISSUE STRIPS
1
2
3
4
5
6
COWL FLAPS
DIHEDRAL 2 1/16"
KEEL
1/32" SHEET WHEEL COVERS
NOSE PLUG
SECTION FROM 2 TO 5 COMPLETED AFTER WING HAS BEEN ATTACHED
WING ROOT FITTED BETWEEN FUSELAGE & WING
1/16" SHEET
1/32" SHEET FILLET


TYPICAL TAIL SURFACE CONSTRUCTION
STABILIZER ATTACHED 1/32" NEG.
POWER- 10-12 STRANDS 1/8" RUBBER
SCALE OUTLINE
BAMBOO PIN HOLDS RUBBER MOTOR
9
.040 WIRE
RUBBER TUBING COVER
CUT AWAY TO REVEAL KEEL PIECES
8
STRINGERS 1/16"X1/16"
7
RIGHT LANDING GEAR STRUT
.040 WIRE PROP SHAFT


1/8" X 1/8"
W8
1/16" X 3/16"
LANDING GEAR STRUTS ATTACHED HERE
BIND WITH THREAD & GLUE
W1
W2
W3
W4
W5
W6
W7
1/16" X 1/16"
SLANT FOR DIHEDRAL
AILERON
RIGHT WING
FLAP (BOTTOM)
1/8" X 3/8"
trace the right wing plan with the carbon paper reversed to make a left wing plan
W6
W5
W7
W2
W4
RIBS W1 TO W4 1/16" SHEET OTHERS 1/32"
W1
W3


W1
W3
SHEET OTHERS 1/32"


JOIN TO WING PLAN
PROPELLER BLOCK 1"X1 5/8"X8 1/2"
1/2"
1"
2 1/8"
2 1/8"
1 5/8"
1/16" SHEET OUTLINES
STABILIZER MADE IN ONE PIECE
SCALE OUTLINES
W8
TIPS 3/32" SHEET
ALL BULKHEADS CUT FROM 1/16" SHEET
1&2
3
6
7
9
5
8
4
7 BASE-RELIEF CYLINDERS WITHIN COWL REPRESENT ENGINE

cockpit. Cement half of the bulkheads to their respective positions and when dry remove from the plan and attach the remaining ones to the other side. Align the bulkheads accurately so they are exactly perpendicular to the keels. Cement the two 1/16" square stringers to each side where the notches are provided, being careful not to draw the fuselage out of line. Place the remaining stringers, cutting the notches as required with a sliver of a razor blade. Once a stringer is attached to one side, always place another in the corresponding position of the other side. After the stringers are all attached, the temporary brace at the cockpit as well as the portion of the bottom keel between section 2 and section 5 should be removed.

The engine cowl and top of the fuselage back to the cockpit are covered with 1/32" sheet. Make a paper pattern of the cockpit shape and cut the sheet balsa accordingly before cementing to place. Pins and rubber bands will help keep the sheeting in place until the cement is dry.

The cowl front is made from four discs of 1/8" thick balsa which are cemented together. The back disc, adjacent to bulkhead No. 1, is solid except for the 5/8" hole for the nose plug; other discs have the centers removed to the extent indicated on the plan. Cement together with the grain of each opposite that of the adjacent discs. Attach the unit to the first bulkhead and when dry, roughly cut to shape. Finish by sandpapering the cowl and sheet balsa covering. Details of the nose plug are indicated. The removable nose plug should be made to fit neatly to the crank case which is cemented within the cowl front.

Tail Surfaces

Construction of the tail surfaces is easy. Both the stabilizer and rudder are built in a similar manner. In the interest of greater strength the stabilizer is built in one piece. Outlines are cut from 1/16" sheet and the ribs and spars are 1/16" square strips. When dry, the frames are removed from the plan and very soft pieces of 1/16" square cemented to both sides of the ribs. These are cut to a streamline shape when the adhesive has hardened. Trim and sandpaper the surfaces to the final shape. Surfaces constructed in this manner are light yet sturdy.

Wing

It is necessary for the wing to be of strong construction since the landing gear is attached to it. Make a left wing plan so both halves of the wing can be assembled directly over full-size plans. Ribs W1 to W4 are cut from medium grade 1/16" sheet while W5 to W8 are 1/32" sheet. Pin the ribs to place over the plan and attach the spars and leading and trailing edges; however, the spar to which the landing gear struts are attached is not placed in position until the dihedral has been added. Center ribs W1 should be slanted so the dihedral will be correct when the wings are joined. Tips are cut from 3/32" sheet. Join the wings solidly using plenty of cement; dihedral should be 2 1/16" at each tip. Attach the 1/16" x 3/16" hard balsa spar and reenforce the joint necessitated by the dihedral. Trim and sandpaper the entire wing.

Landing Gear

A landing gear of the type used on the "Vanguard" always presents a problem to the model maker. However, the landing gear developed for this model is easy to make, accurate in appearance and it will take all the abuse the model can give. .040 music wire is used and the top is bent in such a manner as to join the lower wing spars and rib No. 4. Make a right and left strut. With thread bind the struts to the spars and then use a needle and sew right through rib No. 4 and about the wire. Apply several coats of cement to the thread wrappings and adjacent areas. The rubber tubing covers are not slipped on until the wing has been covered.

Wheels may be purchased or they can be made from laminations of 1/8" thick balsa. Cement washers to both sides of each wheel so they will turn freely and accurately.

Propeller

Select a very hard balsa block 1" x 1 5/8" x 8 1/2" for the propeller. Drill the tiny hole for the prop shaft and then cut out the blank as indicated on the plan. Carve a right hand prop. Finish the back surface of the blades first, then cut away the front until the blade thickness is as desired. Reduce the thickness of the hub and round the tops of the blades in a manner similar to the prop in the photos. Sand to a final, smooth shape. Apply several coats of clear dope with light sanding between each. Cement washers to both sides of the prop shaft hole and then apply color dope.

The prop shaft is bent from .040 music wire. Slip the nose plug which was made previously, and propeller, in place with several washers between them. If a free-wheel device is to be used, the end of the shaft is bent as indicated; otherwise the end of the shaft is bent at a right angle and forced into the hub. The loop at the front of the shaft serves as a place to hook a mechanical winder.

Covering

First step in preparing for a fine covering job is to thoroughly sand every bit of the frame work to remove all flaws and roughness. Since only those members of the fuselage which run from nose to tail should touch the covering, it is necessary to sand the bulkheads to a scalloped shape. This is done with a piece of fine sandpaper wrapped about a pencil or similar round object.

Colored tissue is used for all of the covering and decorations. Red and black with blue and yellow trim is the color of the plane shown in the photographs. Cover the wing first, using banana oil or light dope to stick the tissue to the frames. Wings are covered from the second rib to the tips. Attach only the extremities of the area being covered. Tips require separate pieces to help avoid wrinkles. Tail surfaces are covered in the same manner. Since the fuselage is circular in cross-section, it is necessary to use many small pieces of tissue to help prevent unsightly wrinkles. The cowl and other sheet-balsa-covered parts are tissue covered, too. Spray the covering with water and pin the surfaces to a level position to keep them from warping. The clear dope is NOT applied to the covering until later.

Assembly

Following is the recommended procedure for assembling the Vanguard: Cement the wing to the position indicated on the plan; if the structure has been reproduced accurately, the angle of incidence will automatically be correct. Finish the under section from wing to fuselage with pieces of 1/16" square. Wing root pieces are cut from 1/16" sheet and they are cemented between the wing and fuselage. The 1/32" sheet fillet pieces are shown on the plan. This pattern indicates the shape of the fillets on the original model but most models will vary somewhat so paper patterns should be made to fit your model exactly before the sheet balsa ones are cut. Once the fillets are cemented to position, the several small openings at the junction of the wing and body should be "filled-in" with scraps of soft 1/16" sheet. Sand smooth and cover the fillets with colored tissue. To set the stabilizer in position it will be necessary to temporarily cut the rear of the fuselage and bulkhead No. 9 attaching the stabilizer at a slight negative angle. The rudder is attached exactly perpendicular to the stabilizer, and it is off-set 1/16" to counter-act torque. Small tissue fillets at the tail surfaces will enhance the model's appearance. Moisten any wrinkle and permit to dry before applying a coat of clear dope to the entire model.

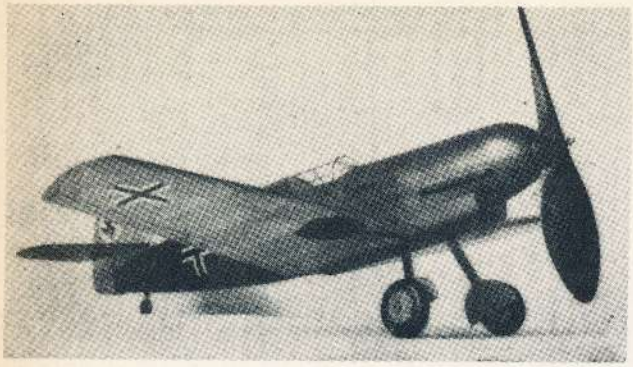
Addition of the various minor details completes the construction. The cockpit enclosure is made from thin sheet celluloid. Make accurate patterns before cutting the celluloid; avoid cement smears when cementing to place. Slip the rubber tubing (as used on electrical appliances, etc.) on the wire struts. Wheels are held to the axles by washers soldered to place. The wheel covers are cut from 1/32" sheet or stiff paper; they should be covered with colored tissue to match the other parts. Seven base-relief cylinders are cemented within the cowl to represent the twin-row Wasp. Color the cylinders and cowl front black. Control surface outlines are black tissue strips, as are the cowl flaps. The Swedish insignia on the original model was made with black tissue, too. A tail wheel and other details found on photos of the real ship can be incorporated to make your Vanguard more attractive.

Power for our model is supplied by 10 or 12 strands (5 or 6 loops) of 1/8" flat, brown rubber. Hook the motor to the prop shaft and drop the other end through the fuselage. It may be necessary to remove a small portion of the covering in order to get the strands in position to be held by the removable bamboo pin. The model Vanguard is now ready for its initial flights.

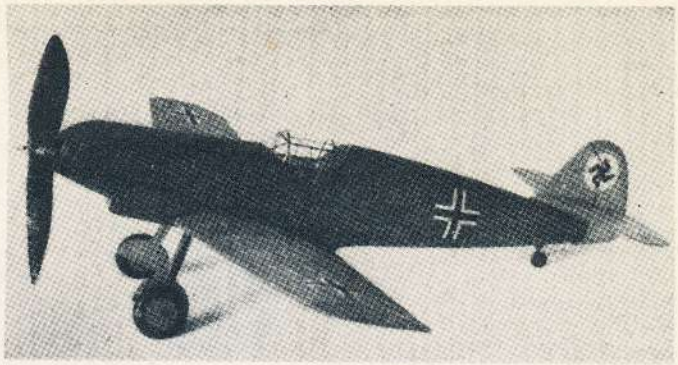
Flying

Select a calm day and a grassy field for the first tests. First, try a few hand glides to ascertain the correct balance; a small weight in the nose or tail will correct any tendency to stall or glide too steeply. Once the balance seems right, wind the motor a few turns and launch. The flight should be smooth without a tendency to bank excessively. Tilt the nose plug right or left to control the circle; a bit of down-thrust will remedy a stall while under power. Gradually increase the number of turns and make any further adjustments. Stretch the rubber and store up power with a mechanical winder for maximum flights.

The author's ship was thoroughly tested and proved to be a good flyer. It is, however, sensitive to every adjustment so any change must be made with skill and care.



Carefully designed for flight yet realistic in appearance



The sleek lines and large propeller give it flight efficiency

A Flying Messerschmitt Pursuit

By EARL STAHL

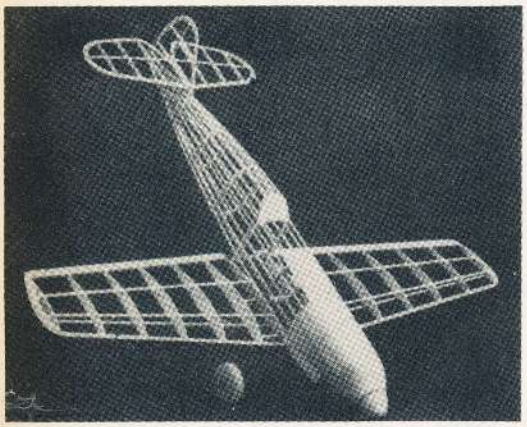
FOREMOST fighting plane of Germany's potent air force is the deadly Messerschmitt Me-109, a single-place, low-wing monoplane of all-metal construction. Only the Focke-Wulf Fw-190 equals its speed, range and fire-power; and latest versions mounting rockets are considered the most deadly fighting plane of the *Luftwaffe*. One of the smallest of the fighter planes, it is characterized by blunt, square lines, straight wing tips and an awkwardly sprawling landing gear, all making for simplicity of mass production. In the air, however, it is a merciless, powerful foe.

The latest version is capable of more than 400 miles per hour, which compares favorably with the latest Royal Air Force and Army Air Force fighter planes teamed against it.

However, one of the greatest assets of a pursuit ship, maeuverability, is apparently lacking. Reports from the "front" indicate that superior maneuverability of the British "Hurricanes" and "Spitfires" has proved to be the decisive factor in many encounters with the Messerschmitts. In France, the American-built Curtiss Hawk, while somewhat slower, was especially effective against its less maneuverable foe.

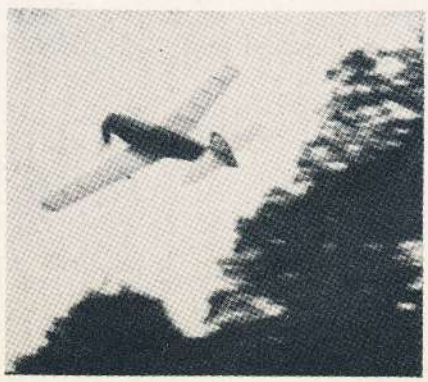
Various combinations of armament have been found on planes that were shot down Some planes have as many as eight machine guns while others employ an aerial cannon in combination with several guns. An armor protected cockpit and self-sealing fuel tanks afford a degree of protection for the pilot.

Your fleet of models will not be complete without a miniature Messerschmitt Me-109. The plans which accompany this article will enable you to construct an attractive, authentic model with a minimum of labor. Flight performance of the model shown in the photographs is remarkable for this type plane, for despite the low-wing, pursuit design, the model has made many stable, realistic flights—and it has never crashed. Standard construction methods are used throughout. However, it is advisable to thoroughly study the plans and instructions before starting to build.



Light and carefully detailed construction

In full flight, "going places"

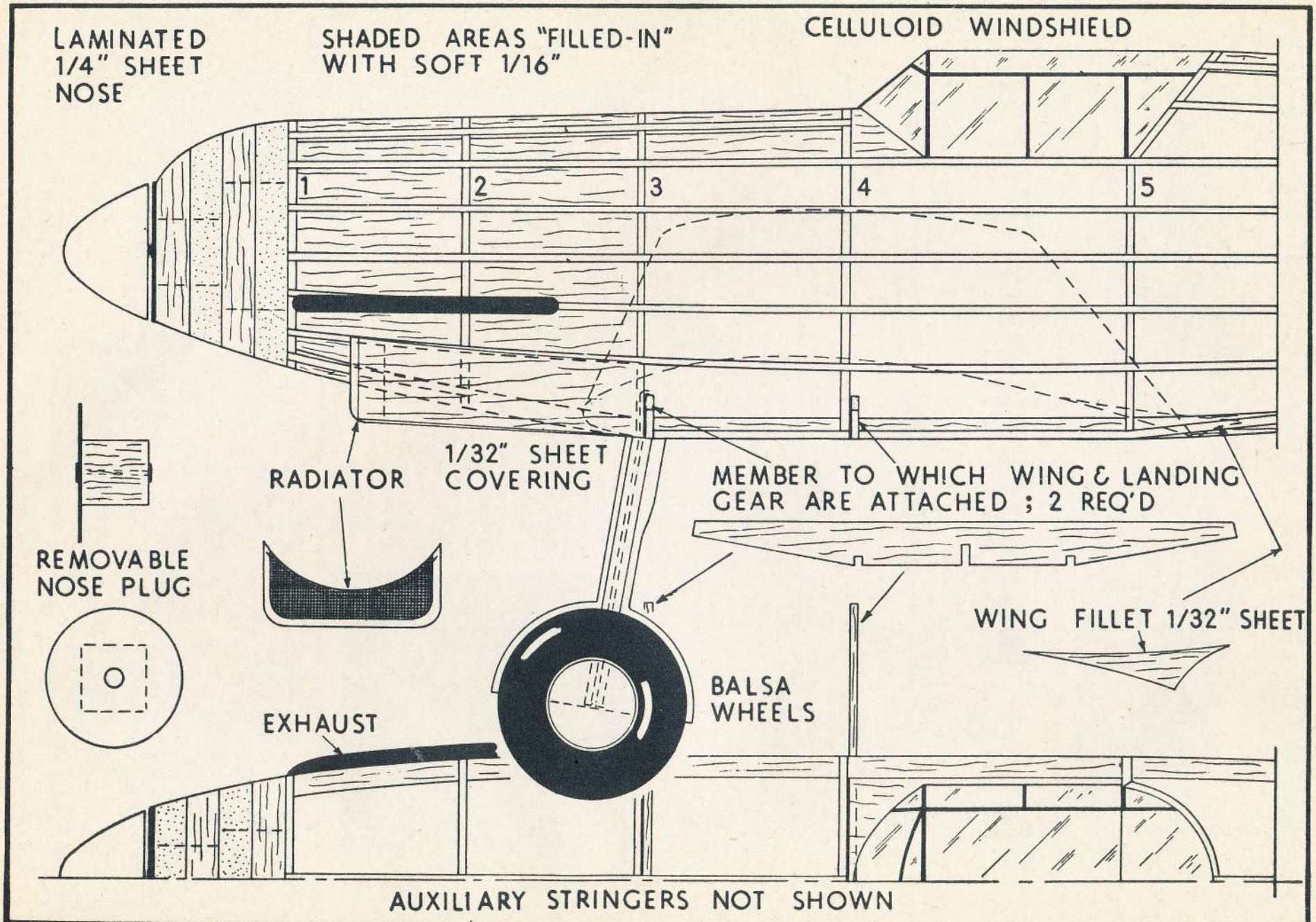


It banks with precision

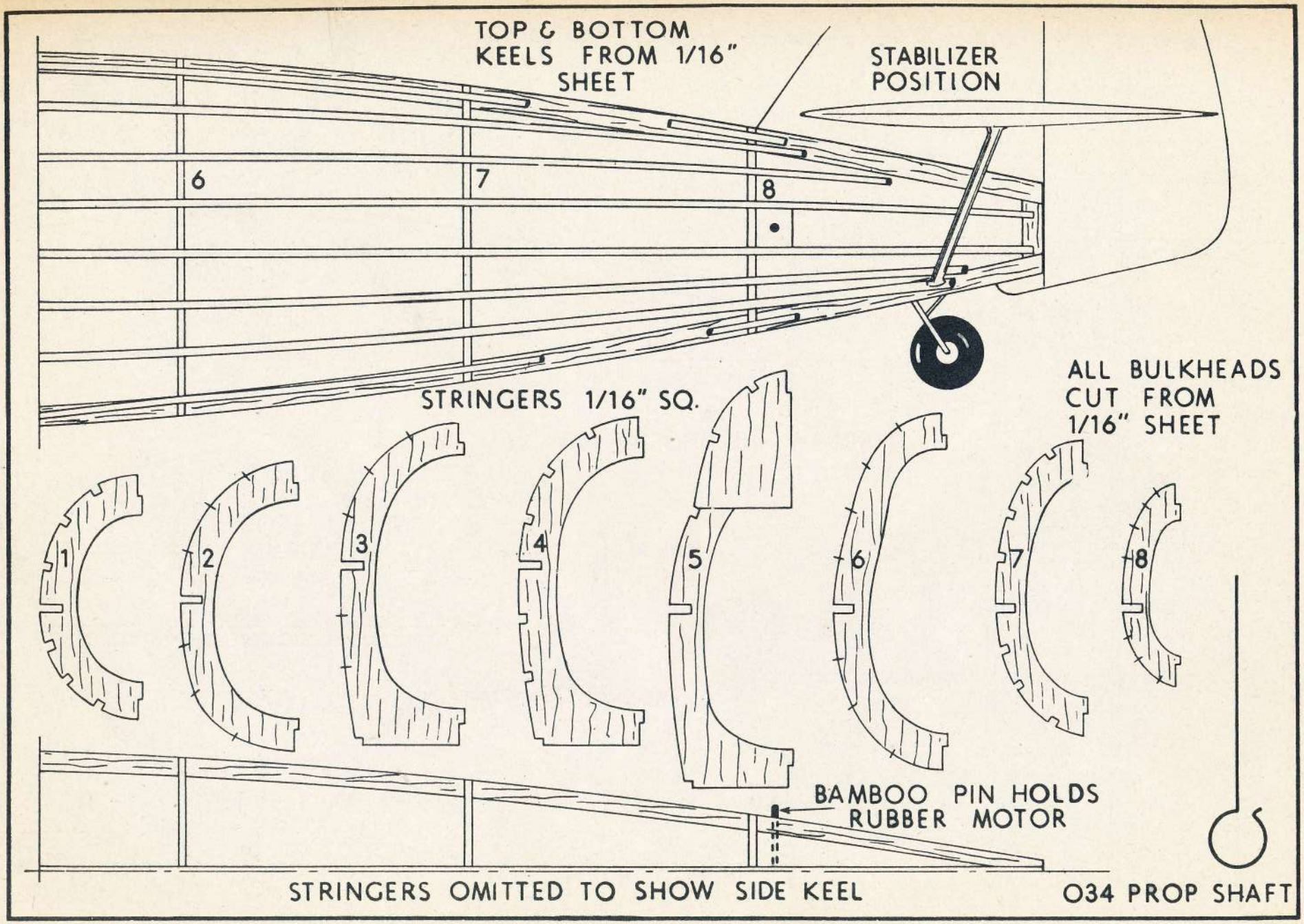
Fuselage

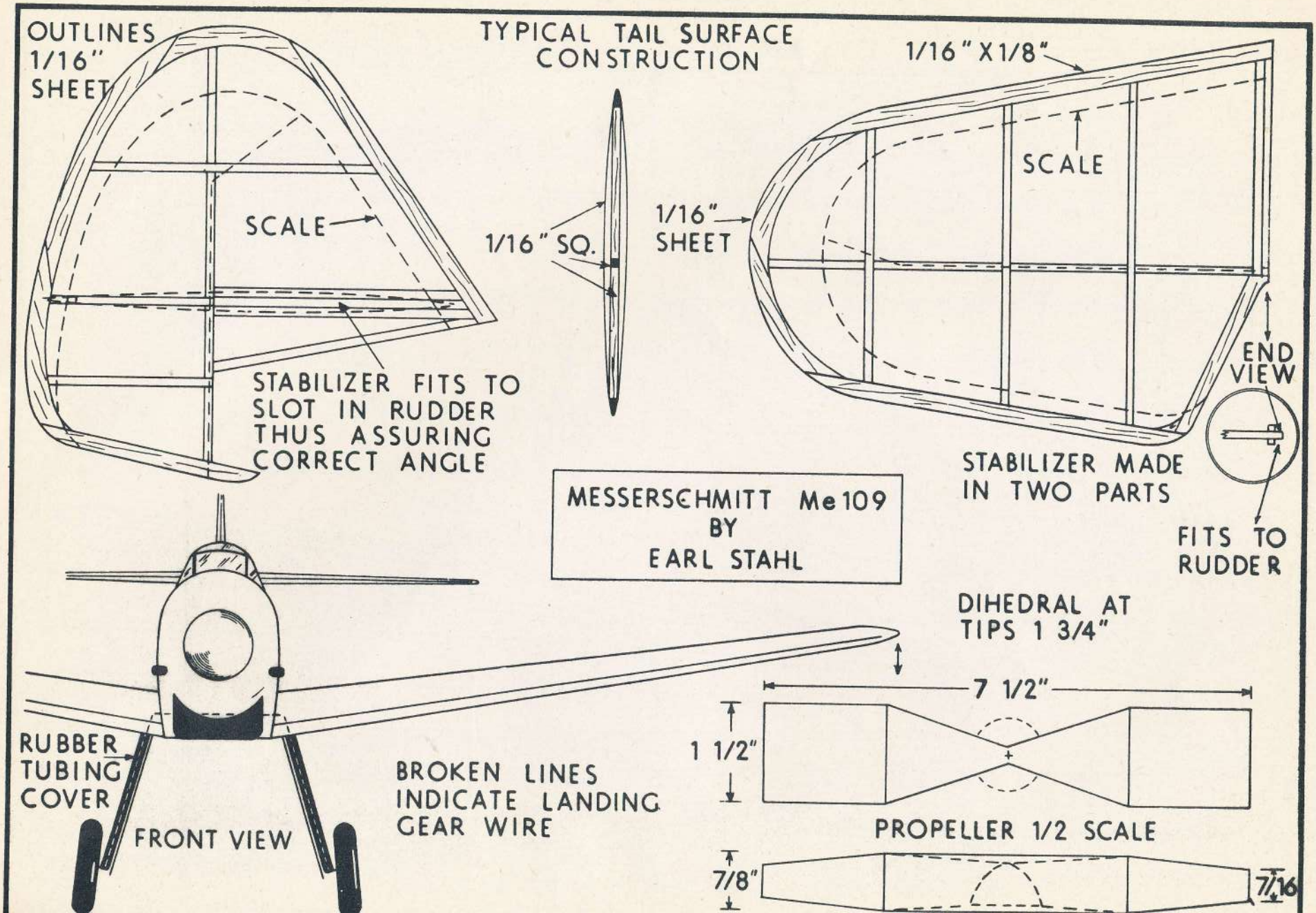
Construction is begun with the fuselage. Trace the top, bottom and side outlines of the fuselage on a sheet of paper to obtain the correct shape of the keel pieces. Lightly cement the paper patterns to a sheet of medium-grade 1/16" sheet and then use a sharp razor blade to cut them out. Bulkheads also are cut from 1/16" sheet; cut only those notches shown, others are marked but they are cut later as needed. Pin the top and bottom keel pieces over the side view and cement half of the bulkheads to their respective positions. It will be noticed that bulkhead No. 5 is cut and then recemented at the angle shown. Attach one of the side keels after making certain that the bulkheads are aligned correctly. Remove this portion of the body from the plan and place the remaining bulkheads and the other side keel. Stringers are light-grade 1/16" square strips. As the work progresses, it will be necessary to cut many of the notches for the stringers; use a razor blade that has been broken to a sharp point for this operation. Once a stringer has been attached to one side always place another in the corresponding position of the other side to avoid pulling the body out of line. Pieces of hard 1/16" sheet cemented between the stringers provide the anchorage for the bamboo pin that holds the rubber motor in the rear.

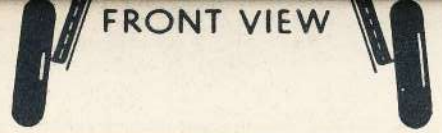
As indicated on the plan, the front portion of the fuselage is "filled-in" with pieces of very soft 1/16" sheet. Individual pieces of balsa are cut so as to fit snugly within the space between the formers and stringers. An exception is that section of the nose over which the radiator is later placed. The extreme front of the nose is shaped from four pieces of sheet that have been cemented together. As shown, the center of the nose piece is cut out to receive the nose plug. Cement this nose block to former No. 1 and when dry cut and sand the entire fuselage front to an accurate, smooth shape. Make the radiator front from 1/4" sheet; the shape is indicated on the first page of plans. Very soft 1/32" sheet is used to complete the radiator


LAMINATED 1/4" SHEET NOSE
SHADED AREAS "FILLED-IN" WITH SOFT 1/16"
CELLULOID WINDSHIELD
1
2
3
4
5
RADIATOR
1/32" SHEET COVERING
MEMBER TO WHICH WING & LANDING GEAR ARE ATTACHED ; 2 REQ'D
REMOVABLE NOSE PLUG
WING FILLET 1/32" SHEET
BALSA WHEELS
EXHAUST
AUXILIARY STRINGERS NOT SHOWN

AUXILIARY STRINGERS NOT SHOWN

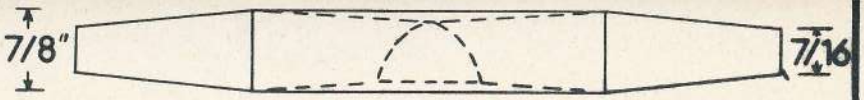


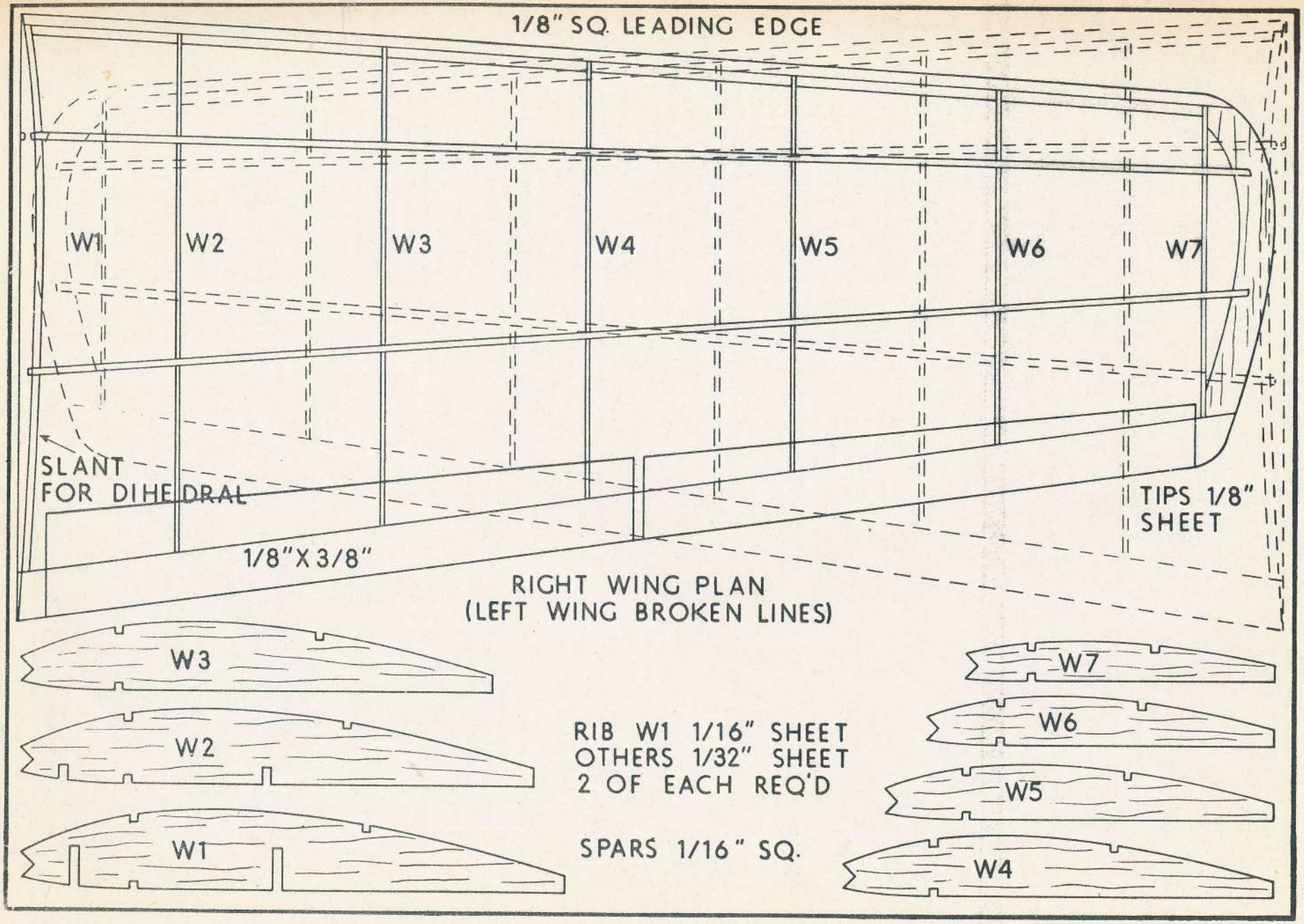

OUTLINES
1/16"
SHEET
SCALE
STABILIZER FITS TO
SLOT IN RUDDER
THUS ASSURING
CORRECT ANGLE
TYPICAL TAIL SURFACE
CONSTRUCTION
1/16" SQ.
1/16"
SHEET
1/16" X 1/8"
SCALE
END
VIEW
STABILIZER MADE
IN TWO PARTS
FITS TO
RUDDER
MESSERSCHMITT Me 109
BY
EARL STAHL
DIHEDRAL AT
TIPS 1 3/4"
RUBBER
TUBING
COVER
FRONT VIEW
BROKEN LINES
INDICATE LANDING
GEAR WIRE
7 1/2"
1 1/2"
PROPELLER 1/2 SCALE
7/8"
7/16



GEAR WIRE

PROPELLER 1/2 SCALE





which extends back to bulkhead No. 3.

Special members to which the wings and landing gear are attached are cut from hard 1/16" sheet; two are required. They fit over the bottom keel and stringers and are cemented to the backs of formers No. 3 and No. 4. These members serve the purpose of providing a sturdy mount for the wings and landing gear and they are designed to assure the correct wing incidence and dihedral.

The wire landing gear should next be formed. To insure accuracy a full-size lay-out of the gear should be made. Note that the wheels toe out at an angle of about 5 degrees; also notice how the struts sweep forward when viewed from the side. Bend the struts from a single piece of .040 music wire. The struts are attached to the member provided for that purpose by binding with thread. Apply several coats of cement to the thread wrappings and over the wire and surrounding wood parts. A wire landing gear of this type, if carefully made, will take all of the punishment normal flying can give it. The strut covers and wheels are attached later.

Wing

Both the right and left wing panels are shown full size on the plan. 1/32" sheet is used for all of the ribs with the exception of W-1 which is cut from 1/16" thick stock; two of each are required. Cut the ribs and sand them smooth. Notches for the spars and leading edge must be cut with accuracy to insure a neat job when completed. Assembly can be done directly over the plans. Pin the ribs to position and then cement the leading and trailing edges and the 1/16" square spars to place. Tips are made from 1/8" sheet. When dry, remove from the jig and cut and sand the edges and tips to their final shape.

Tail Surfaces

To improve the flying qualities of our model it has been necessary to increase the area of the tail surfaces. Both the stabilizer and rudder are constructed in a similar manner: A complete frame is made first, using 1/16" sheet for the outlines and 1/16" square strips for the spars and ribs.

When dry, this frame is lifted from the plan and then very soft 1/16" square strips are cemented to both sides of each rib. These pieces are cut and sanded to a streamline shape once the cement has hardened and the leading and trailing edges are sanded to blend with the streamline shape also.

Covering

To properly prepare for a neat covering job the entire frame must first be sanded thoroughly to eliminate all flaws and roughness. Our original plane was colored deep blue and red with black and white trim; however, the real war planes are camouflaged. Colored tissue is best suited for this job since it is both attractive and light in weight. Cover the fuselage first; grain of the paper should run from nose to tail. Banana oil or thin dope is used to stick the tissue to the frames. Numerous small pieces of paper must be used to prevent wrinkles but the individual pieces should be lapped neatly. The nose and other wood parts should be covered with tissue also. Cover the wing and tail surfaces using a separate piece of tissue for each side of each unit; grain of paper runs spanwise. Bottom of the wing from W-1 to W-3 is not covered at present. Tips, etc., require individual pieces, too. The parts are lightly sprayed with water to tighten the tissue but they are not doped until the model has been assembled.

Assembly

The various parts are now assembled. Fit the notches of the first two ribs of each wing panel to the special wing mounts. If the structure has been made with accuracy, the incidence of each side will be exactly the same and the wing tips will be elevated to the correct dihedral. In the event that a small error is apparent, the structure can be altered slightly to obtain the desired alignment. Once the position of the wings is satisfactory, they are cemented fast. Tissue is next applied to the uncovered sections of the wings The small 1/32" sheet wing fillets are placed in position; it is advisable to make a paper pattern fit exactly to your plane before cutting the ones from sheet balsa. Once the fillets are in place, they are covered with tissue of the same color as the fuselage. The small opening between the wing and fuselage on the undersection is simply covered with tissue. Off-set the rudder so the model will glide in right circles; tissue fillets are used at the junction of the fuselage and rudder. The plans show how the stabilizer halves fit to the slot in the rudder. Cement the stabilizer parts to place. Check continually to assure correct alignment of all parts. Thin balsa or bamboo struts are used to brace the stabilizer. Moisten any wrinkles in the covering and permit to stretch tight before applying a coat of clear dope to the entire model.

The numerous small details are completed next. Rubber tubing of about 1/8" diameter is slipped over the landing gear struts. Balsa wheels of the correct diameter can be purchased or they can be made from laminated discs of balsa. Cement bearings to each wheel so they will revolve smoothly and then color dope the centers and tires. A small washer soldered to the end of each axle holds the wheels in place. Covers, which hide the landing gear, when retracted, are made from 1/32" sheet and they are covered with colored tissue to match the wing covering. The cockpit enclosure is made from thin celluloid. Make paper patterns of the correct size before cutting the celluloid; avoid cement smears. Frame outlines of the enclosure are represented by thin strips of tissue doped to place. Control surface outlines are thin strips of black tissue that have been doped to the surfaces. Other markings such as the swastika—National Emblem of Germany—the crosses, etc., are made from colored tissue. Addition of a tail wheel, exhaust ports, radiator detail and the numerous other details will improve the model's appearance.

Propeller

A hard-balsa block 7/8" x 1-1/2" 7-1/2" is required for the propeller. Sha the blank as shown and then carve righthand prop. Cut the back face of t blades first; a bit of under camber desirable. Reduce the front of the blad to the desired thickness. Shape of t blades can be determined from the photo Apply several coats of clear dope with lig sanding between each to produce a smoo finish. Make the spinner in two piec and cement to the sides of the hub. It advisable to use some simple free-whee ing device to help improve the glide. washer is glued to the back of the pr peller to make it revolve freely.

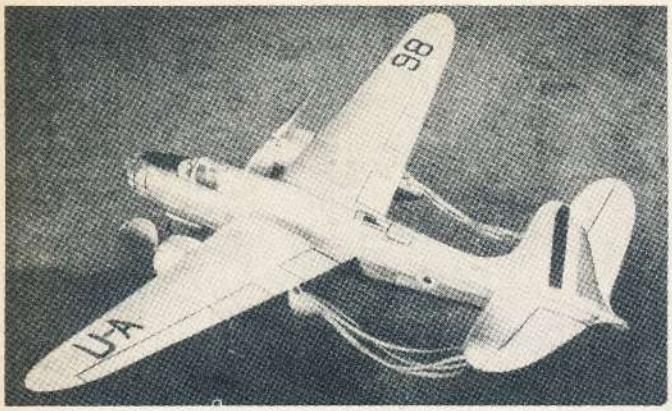
The removable nose plug is shown o the plan. A disc of 1/32" plywood is use for the front portion and a piece of ver hard balsa for the back. Drill a sma hole through the center and cement wash ers to both sides to fix the line of thrus .040 music wire is used for the propelle shaft. Slip the nose plug, several washer and the propeller on the shaft in the orde given. If a winder or free-wheel devic is to be used, bend a loop in the end of th shaft; otherwise bend the end at a righ angle and force into the hub.

Eight to ten strands (four or five loops of 1/8" flat, brown rubber are used t power our model Messerschmitt. Lubri cate the rubber strands and then wipe of the excess to prevent splashing the side of the body. Hook one end of the loop to the prop shaft and drop the other end through the body. It may be necessary to remove a small portion of the covering in the rear to aid in fitting the bamboo pin into position to hold the rubber strands.

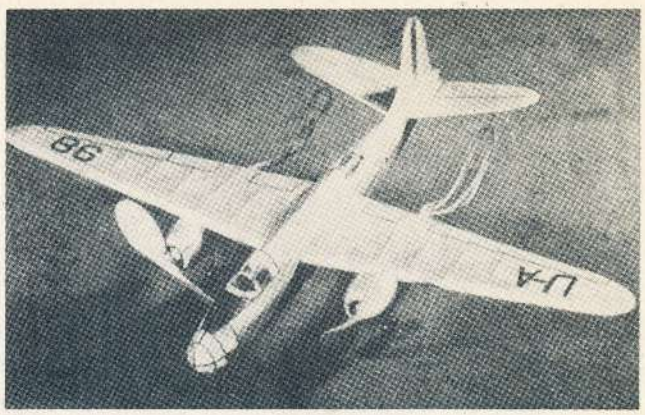
Flying

It is, indeed, very seldom that a model will fly perfectly from the start, so it is evident that the success of any model is usually determined by the builder's ability to analyze and correct improper flight attitudes. Now, that statement does not infer that this model is especially hard to adjust and fly; for on the contrary our Me-109 was made to fly excellently with but a few minor adjustments.

The following suggestions can be made to aid in making your ship fly properly: To begin with, your testing grounds should be free from trees and other "model catchers" that might damage the plane before it has had an opportunity to demonstrate its ability. A field with tall grass or deep weeds is best. Try a few shoulder-height glides to detect any error in balance. In all probability a small weight in the nose will be required to obtain the desired results. Wind the rubber motor about 50 turns and try a power flight. Right- or left-thrust will make the model circle as desired and a slight amount of down-thrust will correct a tendency to mush or stall while under power. Gradually increase the number of turns as the flights become more satisfactory. Stretch the rubber strands about 2-1/2 times normal length and use a mechanical winder for real flights. Our test model was adjusted to fly in a large left circle while under power and it glides to the right. It is capable of making flights of nearly a minute.



A fine flyer; just like the full-size plane



Twin motors give a long and steady flight

A Flying Twin Motor DOUGLAS DB-7

By SIDNEY STRUHL

The three-wheel gear gives smooth landings

WE PRESENT the Douglas Attack Bomber DB-7.

This is a twin-engined all metal monoplane high speed attack bomber, with many advanced design features incorporated into it, such as dihedral in the stabilizer and tricycle landing gear.

The Douglas DB-7 is called the "Boston Bomber" by the British.

Power is supplied by two Pratt & Whitney SGR-1830-SC3-G "Twin Wasp Seniors" developing 660 horsepower for cruising, 910 horsepower for climbing and 1065 horsepower for take-off. The motors drive Hamilton Standard Full Feathering Automatic Controllable Pitch propellers of 12 feet diameter.

The DB-7 has a wing spread of 61 feet, 4 inches and is 46 feet long. Gross weight is 16,280 pounds. 2350 pounds of bombs may be carried. The top speed is 349 miles per hour and the cruising speed is 312 miles per hour. While the landing speed of 72 m.p.h. may seem high, it must be kept in mind that, with a tricycle landing gear, landing gear speeds of 120 m.p.h. are perfectly safe.

After closely studying this ship you will find that it very admirably lends itself to a flying scale model. The general set-up of the job though quite speedy, has remarkable stability; due to the large tail surfaces and dihedral in the stabilizer. Even with the dihedral in the stabilizer, there is not the slightest tendency for the model to rock during flight. The two high-pitch props pull the plane up in a climb that would put the "big job" to shame! The props rotate in opposite directions to eliminate torque. Careful construction and design have kept the weight down to a mere two ounces. Now let's get down to actually constructing the Douglas Attack Bomber DB-7.

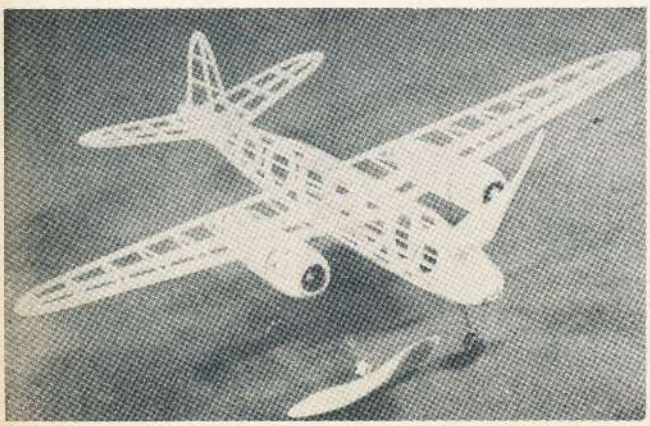
Fuselage

In constructing a fuselage such as this one it is best to use the half-shell method. First attach the fuselage drawings so that they line up perfectly. Before going any further, we should say that all the wood used in the construction of the DB-7 should be of the lightest grade obtainable. That does not mean the soft spongy grade.

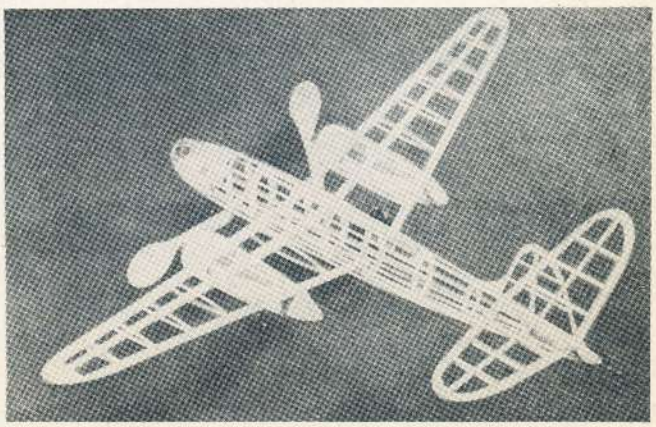
First cut out all fuselage bulkheads from 1/16" sheet balsa. Only half the bulkheads are shown on the plans, thus if will be necessary to make two each of those shown. Bulkheads B, C, D, E and F are all the same shape, so you make 10 of these.

Pin the bulkheads in their proper positions on the plans, making sure that they are at right angles to the working surfaces. Now pin the 1/16" square hard balsa stringers in place directly on top of the bulkheads and cement them very securely. Trim the ends of the stringers flush with Bulkhead A-A. Note that one stringer ends at Bulkhead H-H and one at I-I.

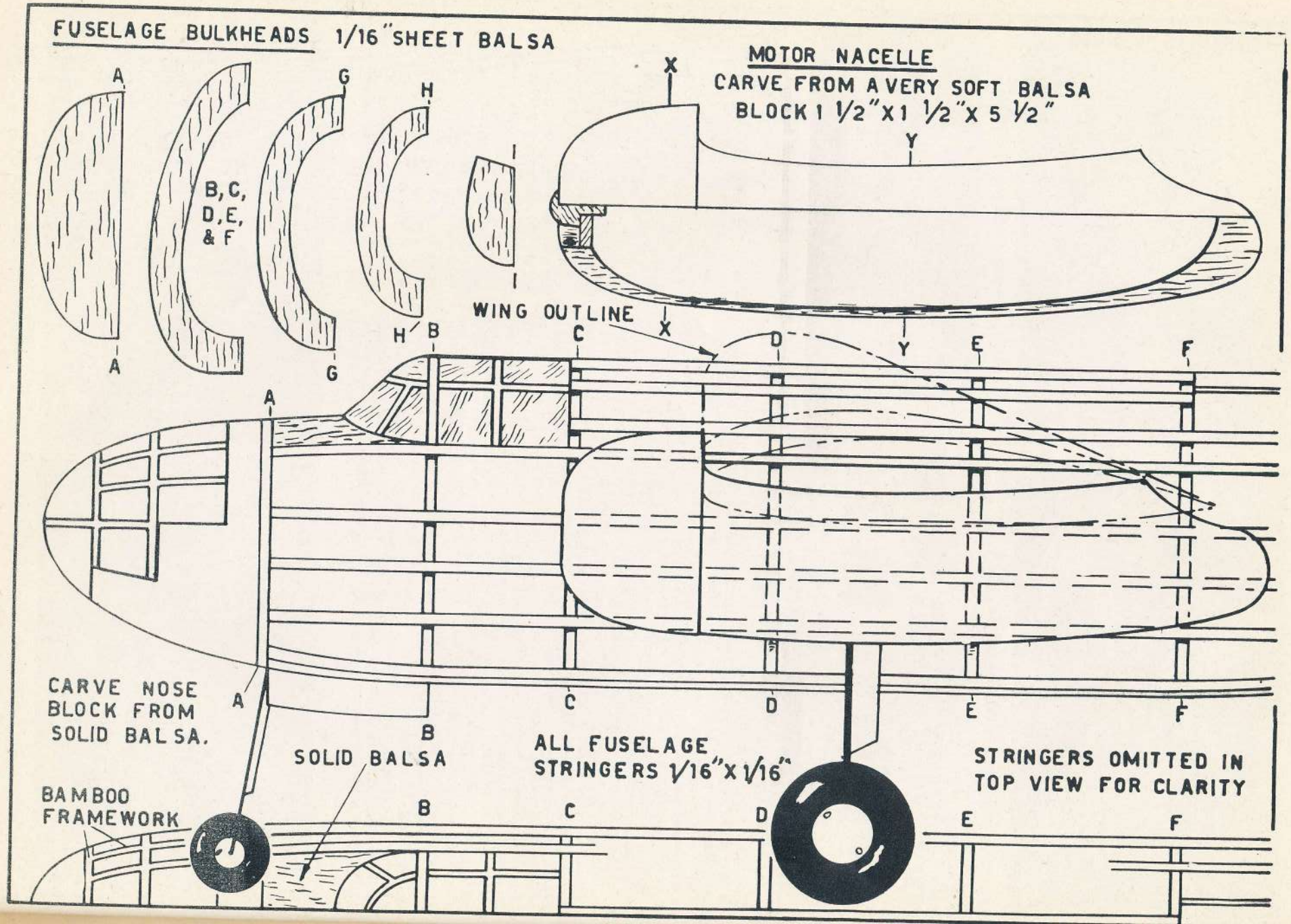
After the cement has set on the framework remove the framework and glue the other half of the bulkheads to their respective first halves. Add the stringers to this

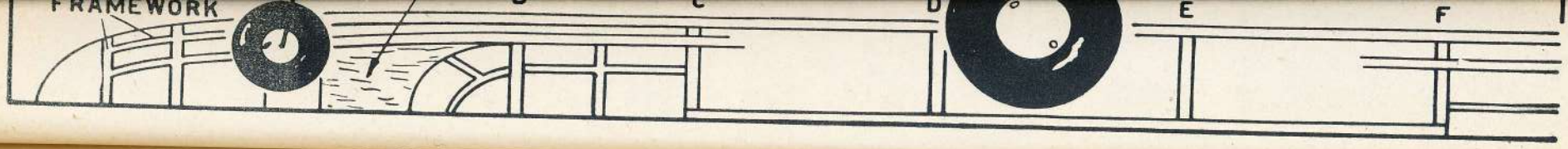


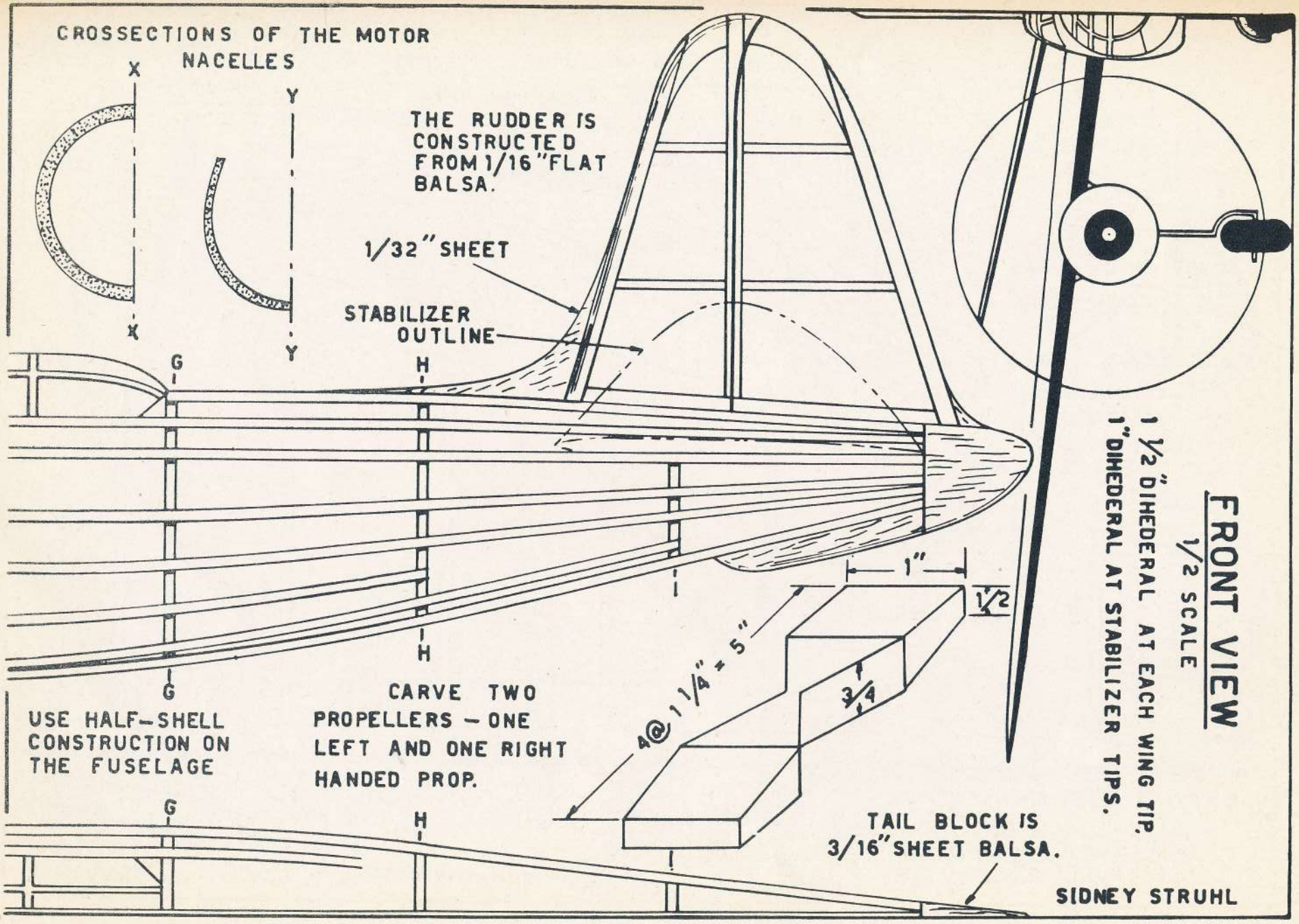
The frame is simple but sturdy. Propellers are removable

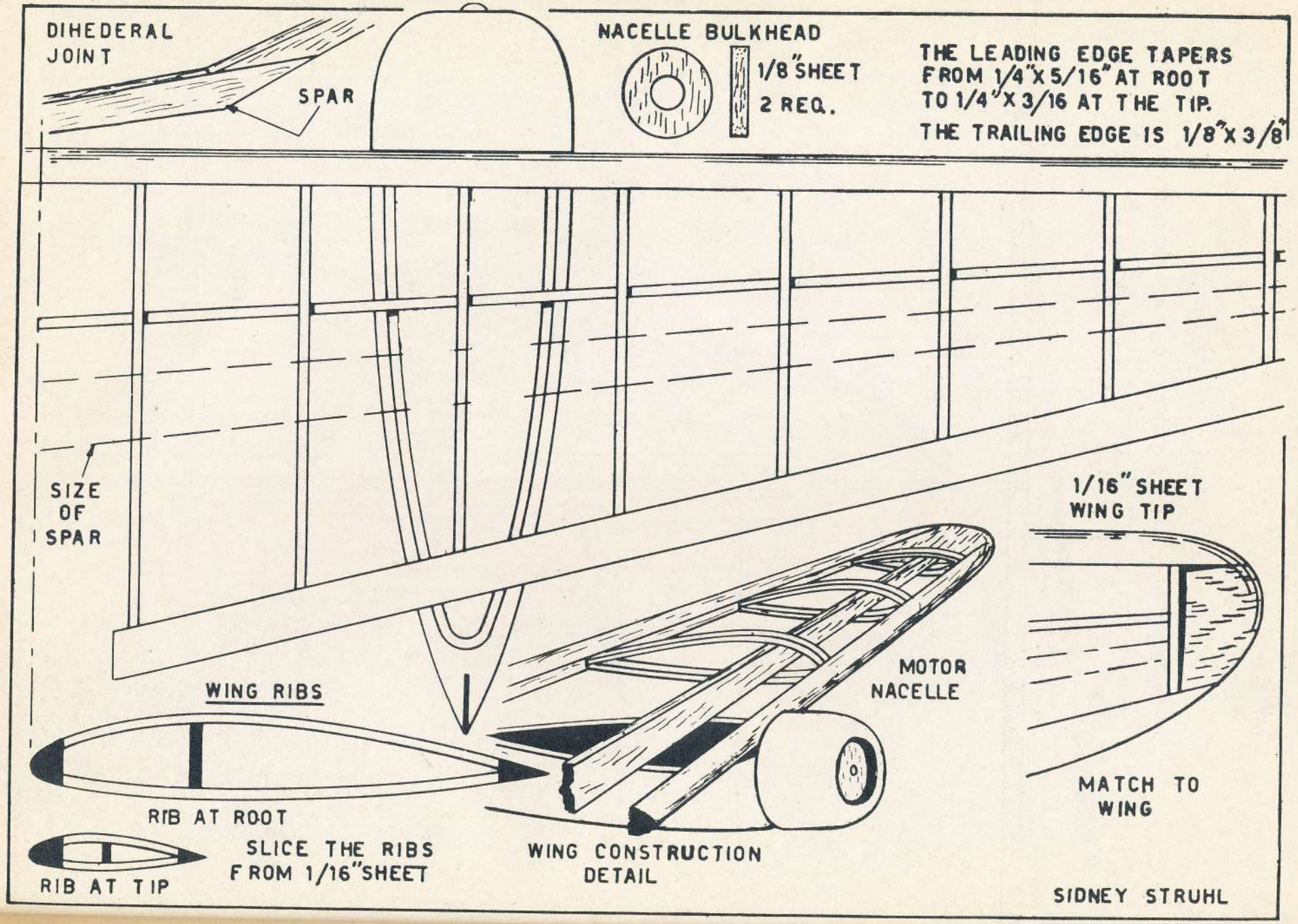


The motor nacelles are easily detached


FUSELAGE BULKHEADS 1/16" SHEET BALSA
A
A
B, C, D, E, & F
G
G
H
H
I
I
MOTOR NACELLE
CARVE FROM A VERY SOFT BALSA BLOCK 1 1/2" X 1 1/2" X 5 1/2"
X
Y
WING OUTLINE
X
Y
B
C
D
E
F
A
A
B
C
D
E
F
CARVE NOSE BLOCK FROM SOLID BALSA.
SOLID BALSA
ALL FUSELAGE STRINGERS 1/16" X 1/16"
STRINGERS OMITTED IN TOP VIEW FOR CLARITY
BAMBOO FRAMEWORK
B
C
D
E
F


FRAMEWORK
D
E
F


CROSSECTIONS OF THE MOTOR NACELLES
X
Y
X
Y
THE RUDDER IS CONSTRUCTED FROM 1/16" FLAT BALSA.
1/32" SHEET
STABILIZER OUTLINE
G
H
G
H
USE HALF-SHELL CONSTRUCTION ON THE FUSELAGE
CARVE TWO PROPELLERS - ONE LEFT AND ONE RIGHT HANDED PROP.
1"
1 1/2
4@ 1 1/4" = 5"
3/4
G
H
TAIL BLOCK IS 3/16" SHEET BALSA.
FRONT VIEW
1/2 SCALE
1 1/2" DIHEDERAL AT EACH WING TIP.
1" DIHEDERAL AT STABILIZER TIPS.
SIDNEY STRUHL


DIHEDERAL JOINT
SPAR
NACELLE BULKHEAD
1/8" SHEET
2 REQ.
THE LEADING EDGE TAPERS FROM 1/4"X 5/16" AT ROOT TO 1/4"X 3/16 AT THE TIP.
THE TRAILING EDGE IS 1/8"X 3/8"
SIZE OF SPAR
1/16" SHEET WING TIP
WING RIBS
MOTOR NACELLE
RIB AT ROOT
MATCH TO WING
RIB AT TIP
SLICE THE RIBS FROM 1/16" SHEET
WING CONSTRUCTION DETAIL
SIDNEY STRUHL

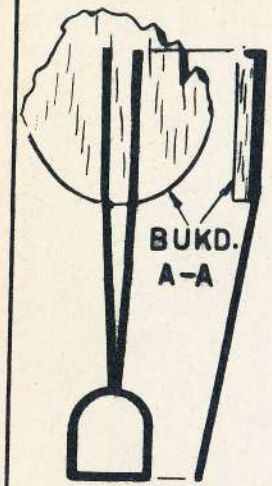
RIB AT TIP

SLICE THE RIBS FROM 1/16" SHEET

WING CONSTRUCTION DETAIL

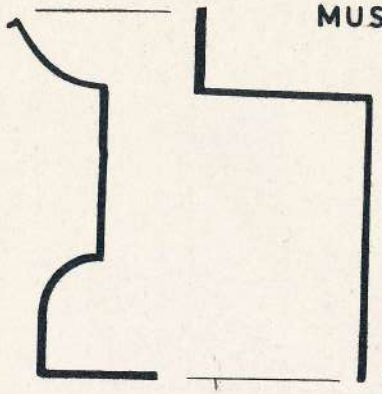
SIDNEY STRUHL

LANDING GEAR

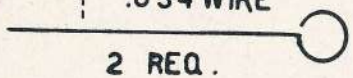


FRONT STRUT
1 REQ.

BEND ALL LANDING GEAR STRUTS FROM .038 MUSIC WIRE

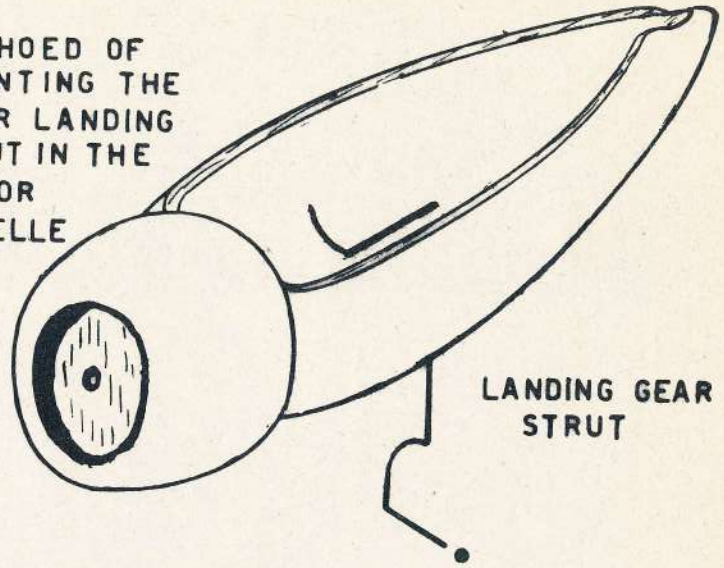


REAR STRUT
2 REQ.



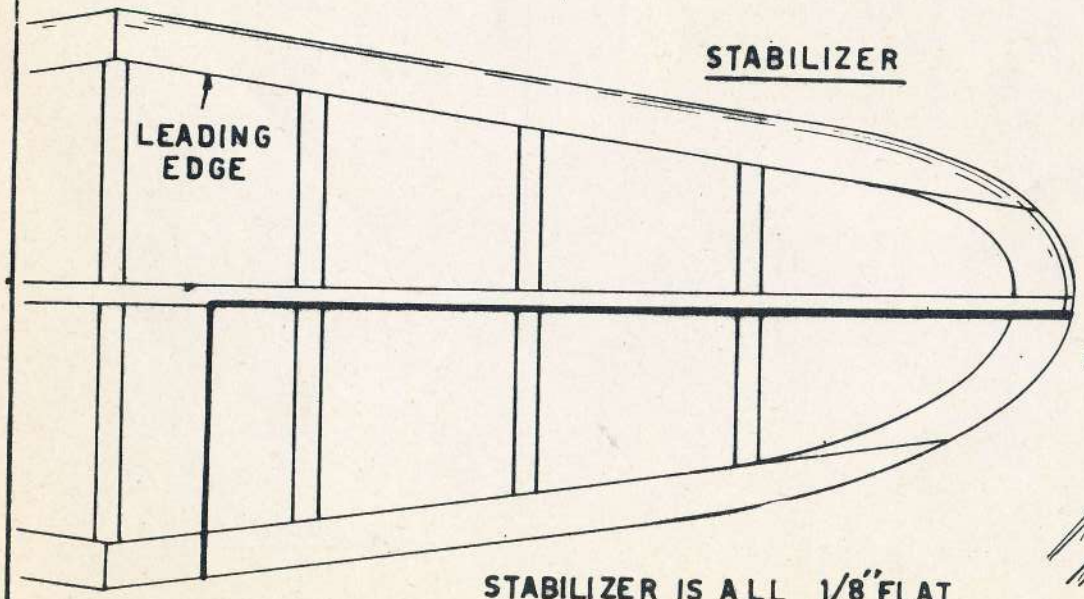
2 REQ.

METHOED OF MOUNTING THE REAR LANDING STRUT IN THE MOTOR NACELLE



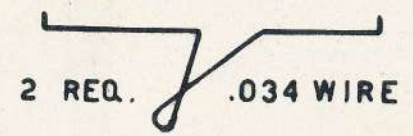
LANDING GEAR STRUT

STABILIZER



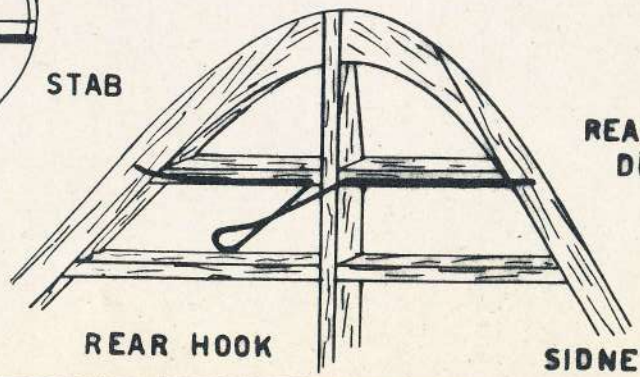
STABILIZER IS ALL 1/8" FLAT SHEET BALSA

REAR HOOK



2 REQ. .034 WIRE

STAB



REAR HOOK DETAIL

REAR HOOK

SIDNEY STRUHL

side of the fuselage. Shape the tail block from 3/16" sheet balsa and glue in place, bringing the rear of the fuselage stringers flush with its edges.

Shape the nose block from a soft balsa block and cement in place. The bamboo framework should be bent and shaped from 1/32" square strips and glued in place; the design is shown in the plans. The pilot's inclosure and rear gunner's cockpit is made in the same way. These may now be covered with thin celluloid. The nose will require small pieces of celluloid because of the compound curves there.

Bend the front landing gear strut from .038 music wire to the shape shown in plans, insert a celluloid 5/8" diameter wheel in place and then cement it with several coats to the rear of bulkhead A-A. A small piece of balsa is cemented behind bulkhead A-A to help shape the front of the pilot's cockpit.

Wing

You will have to trace and then invert the wing plan shown to get the left wing panel.

Make a cardboard template of the wing rib at the root. With this template slice from 1/16" quarter-grained sheet 18 upper ribs of 1/16" square and 18 lower ribs of 1/16" square. Shape the leading edge from 1/4" sheet and the trailing edge from 1/8" sheet and pin them in place. The trailing edge will have to be blocked up 1/8" to fit in the airfoil contour.

Now glue the top ribs in place, but to the leading edge only. After the cement has set trim the trailing edges of the ribs so they fit to the trailing edge. After the cement has set well, remove the wing from the plan and attach the lower parts of the ribs in the same manner. Cut the wing spar from 1/16" sheet to the shape shown by the dotted lines in the plans; slip the spar in place through the ribs, cementing each rib to it. The wing tip is shaped from a solid piece of 1/16" sheet balsa.

The ends of the leading edge and wing spars should be cut to the required angle so that they fit together inside the fuselage with necessary dihedral angle of 1 1/2" under each wing tip. The wing should be glued in place before it is covered. You will note in the side view that the wing position is given very clearly.

Motor Nacelles

The two motor nacelles are shaped from solid, very light and soft balsa and then hollowed to the necessary thickness.

Two balsa blocks 1-1/2" x 1-1/2" x 5-1/2" will be required. First trace the top view onto the blocks, then shape with a sharp knife. Trace the side view onto the block and shape. The nacelle is then trimmed with a razor to the required cross section.

Finish the job with fine sandpaper. Now split the nacelle down the top so that you will have two sides. Hollow these two halves with a knife, razor, and sandpaper till the walls are about 3/64" thick in the center and slightly thicker at the front, as shown in the plans. The two hollowed-out halves may now be cemented back together again; giving them two coats of clear dope. Sand with 10-nought sandpaper.

Cut out the two nacelle bulkheads from hard 1/8" sheet balsa, drill a hole for the nose bearing and then cement in place. Bend the landing gear struts from .038 music wire to the required shape shown in the plans and cement the strut very firmly to the nacelle. You will note that the wire runs through the floor of the nacelle, along the floor and then half-way up the side for added security.

Either balsa or celluloid wheels of 1 1/8" diameter are held on the axles by a drop of glue at the end of the wire.

The finished nacelles are not cemented in place on the wings until the wings are completely covered.

Tail Surfaces

The tail surfaces are very easy to construct; the rudder is built from all 1/16" flat stock. The spars are 1/16" x 1/8" strips and the ribs are 1/16" square strips. The tip is cut from 1/16" sheet balsa. Pin all the members in place and cement them carefully. Make sure when you remove the rudder from the plans that there is no warp; if there is, steam it back to shape.

The stabilizer is built in the same manner as the rudder, with the exception that all the stock used in the stabilizer should be 1/8" flat. You need a strong stabilizer because it has to carry the load of two motors on it.

The stabilizer has 1" dihedral at each tip.

Bend two rear hooks from .034 music wire and cement them to the last outer ribs at the stabilizer tips. The hooks are glued to the bottom of the stabilizer, by the way, and not the top.

Propellers

Two propellers are required. They should be carved so that one is right-handed pitch and the other left-handed pitch, "to do away with" torque and thus save you a major adjustment problem. The props are of rather high pitch for a flying scale, but they give a marvelous performance.

The blocks are 3/4" x 1" x 5" and should be shaped to the blank shown in the plans. The wood may be light grade because you need have no fear of broken props on this job; the tricycle landing gear and the propeller positions take care of that. The props should be covered in the conventional way, with the hubs about 1/8" thick and the tips tapered to 1/32" in thickness.

Two prop shafts of .034 wire are bent to shape, slipped through the hardwood nose bearing, a few copper washers and then inserted into the prop hub, bent at right angles and cemented to the prop. Give the prop hubs several coats of cement just to "make sure." The two props are now treated with clear dope in the same manner the nacelles were.

Covering

The author covered his DB-7 with the new Silkspan; regular tissue paper may be used however. The stabilizer should be attached to the fuselage before it is covered.

Trim a piece of covering to the shape of the fuselage, wet it thoroughly with water then place it on the fuselage and smooth out all the wrinkles. Then run clear dope over the extremities. The do will penetrate and act as a good adhesiv Repeat for covering the other side of t fuselage.

The wing is covered in the same wa but extreme care must be used at t fuselage and wing joint to insure a goo and clean job. Separate pieces must be us to cover the wing tips. Cover the rudd and stabilizer in the same manner as t wing.

After the covering and dope have drie spray on a coat of water to tighten an loose spots. After the water dries appl one thin coat of clear dope with a brus When the clear dope has dried apply tw very thin coats of silver dope to give tha aluminum finish; use just enough silve dope to give the job a solid color; fo while silver is the lightest of colored dope nevertheless too much will add unneces sary weight to model.

All of the exposed wood parts, as th props and nacelles, are also given two coat of silver dope.

All details, such as the elevators, fin an flaps, are shown by doping thin strips o black tissue paper to the surfaces. Either British or French insignia may be applied The inside of the motor cowls are painted black.

Flying

Each prop of your DB-7 should be turned by four strands of 1/8" flat brown rubber. Two "S" hooks will be needed to attach the rubbers to the rear hooks. Attach the rubber motors to the S hooks, drop the hook through the opening in the nacelle bulkhead, through the nacelle and out of the small hole at the rear of the nacelle. Then connect the S hook to the rear hook. The prop shafts are now slipped on the motors.

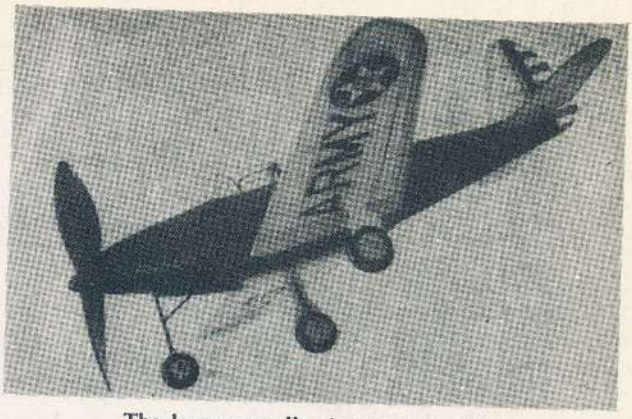
Flying your plane is definitely a two-man job; you will need a helper to hold the ship by the props while you wind the ship with a double winder. Another reason for using props of opposite pitch is because all double winders turn in opposite directions.

Before any flights are made test your ship for the gliding angle by gliding it over some tall grass. The author had to add a little modeling clay to the nose for perfect balance; you will probably need to do the same, due to the weight of the motors being so far back.

Now that you are ready for your first flight have your helper hold the ship by the props, then attach the S hooks to the winder and give the motors about 75 turns for a test flight. Your ship should climb a bit then settle in a long glide and come in for a perfect landing. If any adjustment is needed at this point do so by changing the angle in the stabilizer. The model should balance right on the rear landing gear strut mark.

When fully wound, the DB-7 takes off like no bomber ever did and climbs at an amazing angle. Some of you old timers who can still remember the climb on the old twin-pushers know what we mean. After the power is spent, your model will go into a very flat and fast glide. The landings are a treat to see; the ship just seems to slide in on its three wheels. Well, we won't say any more except, you build the ship and just wait and see!

A fine performer with the sleek lines of the large plane



The large propeller insures long flights

THE AIRACOBRA TAKES WING

By EARL STAHL

THE Bell P-39 "Airacobra," U.S. Army pursuit, is one of the swiftest and deadliest fighters ever to take to the air.

Most prominent of the many unusual features of the P-39, as it is designated by the U.S. Army Air Corps, are the tricycle landing gear and location of the engine behind the pilot's cockpit. Use of the three-wheel retractable undercarriage allows the ship to make use of small airports, which is an important factor in wartime operations.

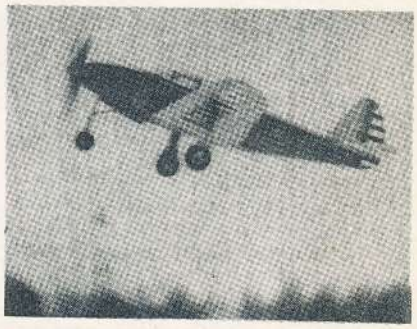
The Allison liquid cooled engine is located in the middle of the fuselage, at the position of the center of gravity, and the propeller is driven by a long shaft which passes beneath the pilot's feet. This concentration of weight near the center of gravity aids in making the ship more maneuverable. The fact that the engine is not in the nose permits convenient installation of the heavy armament.

The P-39 is heavily armed; poking out of the ship's bullet-shaped nose is a 37 millimeter cannon which fires one pound shells. Also located in the nose are four machine guns synchronized to fire through the whirling propeller blades.

Another unique feature is found in the cockpit arrangement. To enable the pilot to "bail-out" in the event his plane is disabled, this fighter is equipped with two doors that fall away from the fuselage when a button is pushed.

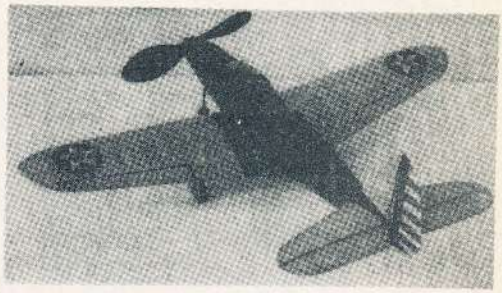
Performance of the "Airacobra" is indeed remarkable. The top speed is reported to be over 400 miles per hour and the ship can reach an altitude of nearly seven miles. Landing speed is quite slow for this type plane, for it "comes-in" at 70 miles per hour—about the same speed as a Douglas or Lockheed transport. The fuel load of 140 gallons is sufficient for a flight of 1560 miles.

The proportions of the real plane make possible a graceful model with excellent flight char-

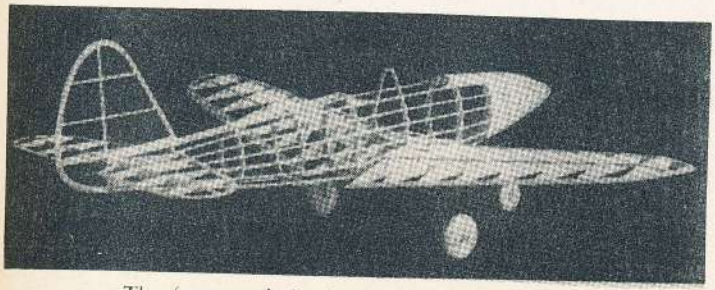


It is a beautiful flier

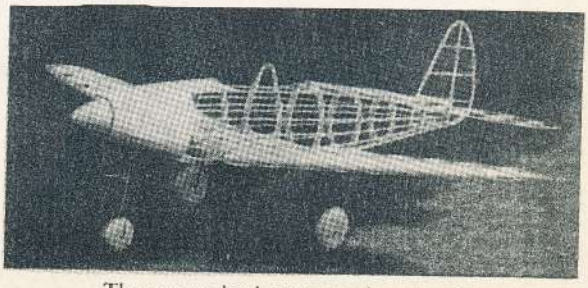
Decorations make it realistic



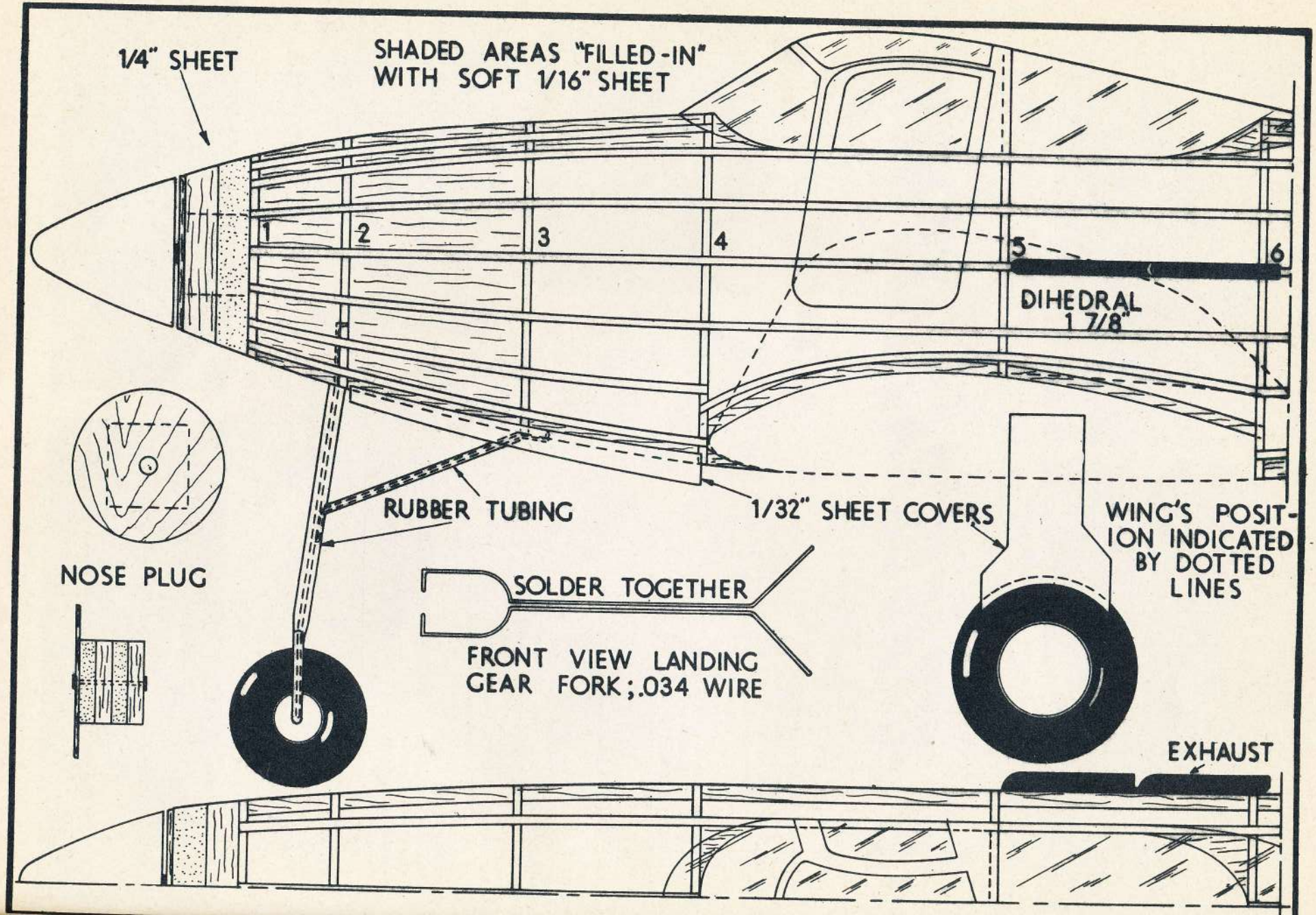
A large stabilizer makes it stable

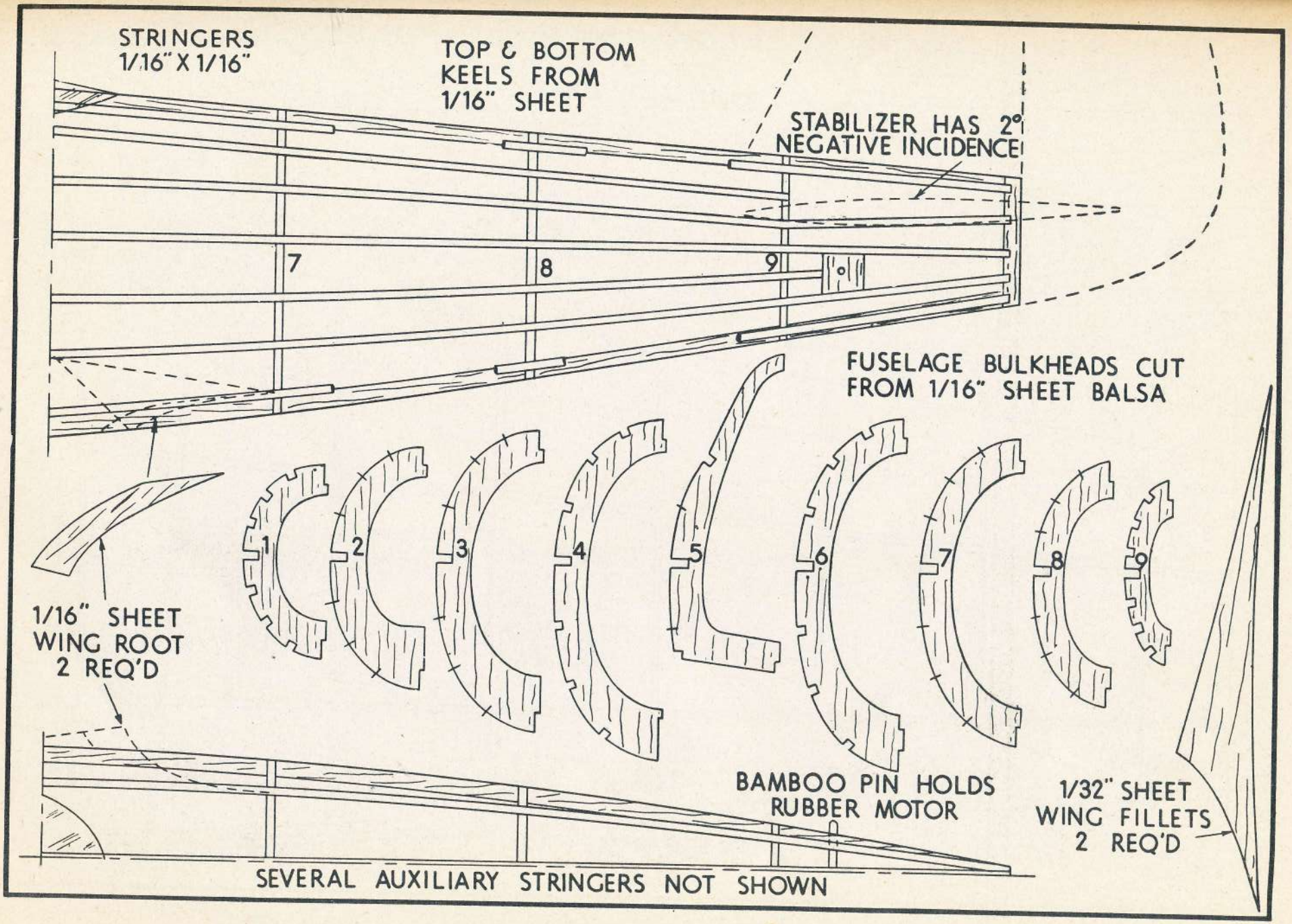


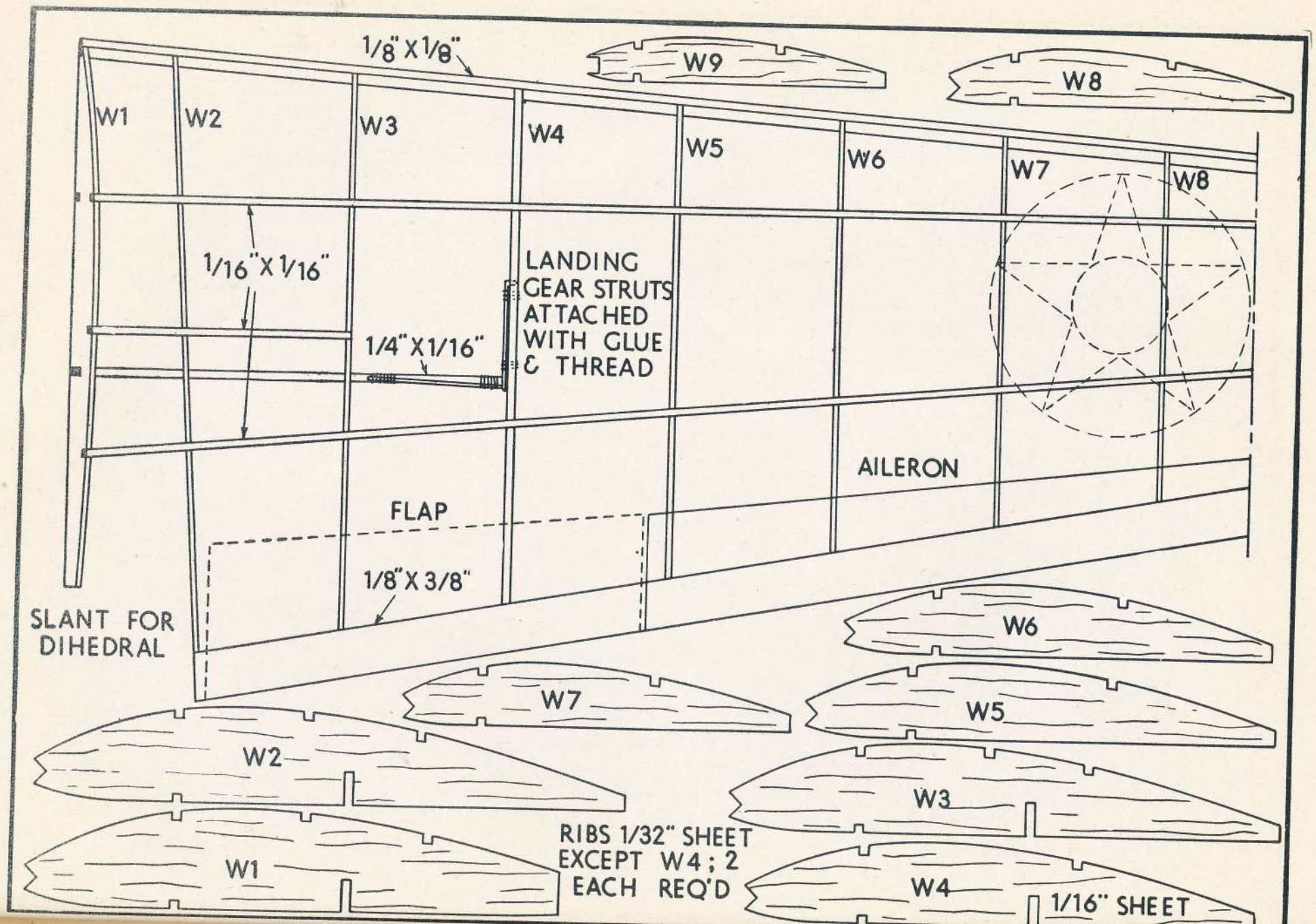
The framework is simple, light and sturdy

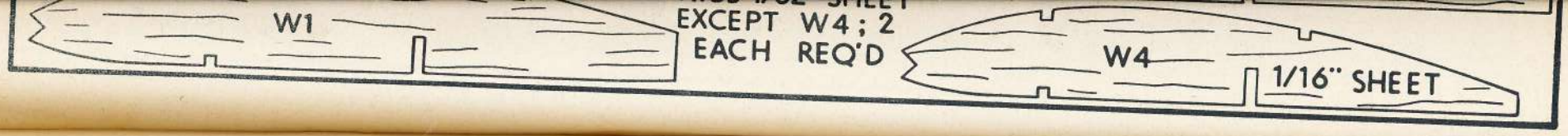


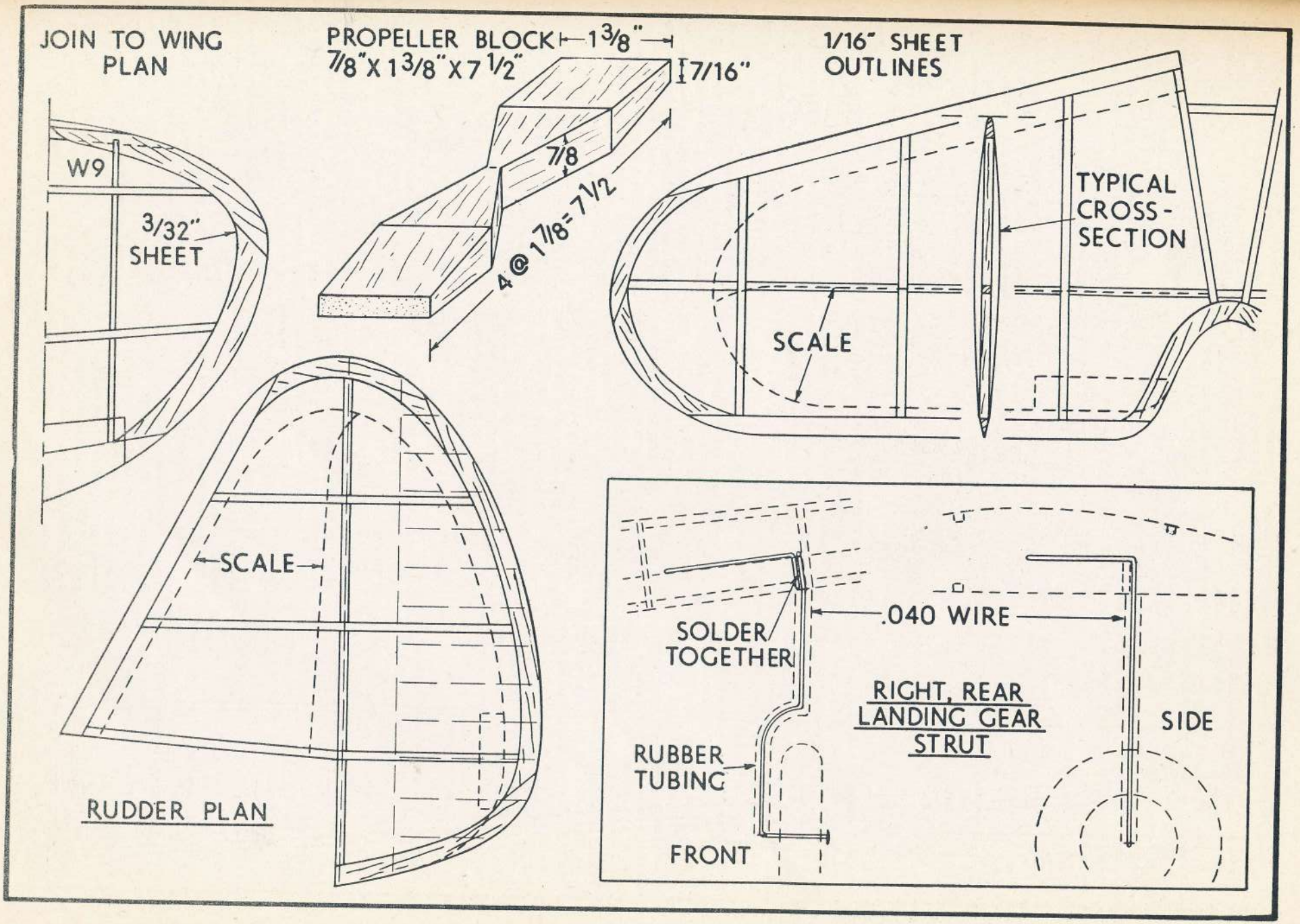
The nose wheel protects the propeller


1/4" SHEET
SHADED AREAS "FILLED-IN" WITH SOFT 1/16" SHEET
1
2
3
4
5
6
DIHEDRAL 1 7/8"
RUBBER TUBING
1/32" SHEET COVERS
WING'S POSITION INDICATED BY DOTTED LINES
NOSE PLUG
SOLDER TOGETHER
FRONT VIEW LANDING GEAR FORK; .034 WIRE
EXHAUST


STRINGERS
1/16" X 1/16"
TOP & BOTTOM
KEELS FROM
1/16" SHEET
STABILIZER HAS 2°
NEGATIVE INCIDENCE
7
8
9
FUSELAGE BULKHEADS CUT
FROM 1/16" SHEET BALSA
1
2
3
4
5
6
7
8
9
1/16" SHEET
WING ROOT
2 REQ'D
BAMBOO PIN HOLDS
RUBBER MOTOR
1/32" SHEET
WING FILLETS
2 REQ'D
SEVERAL AUXILIARY STRINGERS NOT SHOWN


1/8" X 1/8"
W9
W8
W1
W2
W3
W4
W5
W6
W7
W8
1/16" X 1/16"
LANDING GEAR STRUTS ATTACHED WITH GLUE & THREAD
1/4" X 1/16"
AILERON
FLAP
1/8" X 3/8"
SLANT FOR DIHEDRAL
W6
W7
W5
W2
W3
W1
RIBS 1/32" SHEET EXCEPT W4 ; 2 EACH REQ'D
W4
1/16" SHEET


W1
EXCEPT W4; 2
EACH REQ'D
W4
1/16" SHEET


JOIN TO WING
PLAN
PROPELLER BLOCK 1 3/8"
7/8" X 1 3/8" X 7 1/2"
7/16"
7/8
4 @ 1 7/8 = 7 1/2
1/16" SHEET
OUTLINES
W9
3/32"
SHEET
TYPICAL
CROSS-
SECTION
SCALE
SCALE
RUDDER PLAN
.040 WIRE
SOLDER
TOGETHER
RIGHT, REAR
LANDING GEAR
STRUT
SIDE
RUBBER
TUBING
FRONT

acteristics. Despite the low-wing, pursuit design, the little ship is capable of making stable, efficient flights of surprising duration. When being flown from a smooth, level surface, the tricycle landing gear enables the model to make extremely realistic take-offs and landings. The model, because of its snappy appearance and interesting construction, will provide many hours of enjoyment both in building and flying.

After becoming familiar with the plans and procedure of construction, you may start to build the—

Fuselage

Use of the keel pieces cut from sheet balsa simplifies the fuselage construction and aids in making the structure more accurate. Trace the top, bottom and side outlines on paper, to obtain the correct shape of the keels. Average depth of the keels is about 5/32"; lightly cement the paper patterns to 1/16" sheet balsa and then use a sharp razor blade to cut them out. The section between bulkheads No. 4 and No. 6 does not have any support at the cockpit but a curved piece conforming to the wings' shape is placed at the bottom, as shown. Bulkheads also are cut from 1/16" sheet; two of each are required. It will be noticed that only a few of the bulkheads have notches for all the stringers. Cut out the notches shown and mark the positions of the others, which will be cut later as needed.

Pin the keel pieces into position over the plan to begin actual assembly of the fuselage. Cement half the bulkheads to their respective positions; align the bulkheads accurately so they are exactly perpendicular to the keels. Attach one of the side keels and when the cement has hardened remove from the plan and add the remaining bulkheads and the other side keel. Stringers are light-grade 1/16" square strips. As the work progresses it will be necessary to cut many of the notches for the stringers; use a razor blade that has been broken to a sharp point for this operation. Once a stringer has been attached to one side, always place one in the corresponding position on the other side, to avoid pulling the body out of line. Pieces of hard 1/16" sheet cemented between the stringers provide the anchorage for the bamboo pin that holds the rubber motor in the rear.

As indicated on the plan, the front portion of the fuselage is "filled-in" with pieces of very soft 1/16" sheet. Individual pieces of balsa are cut so as to fit snugly within the space between the formers and stringers. An exception is the several sections at the bottom into which the front landing gear fork is fitted; leave these sections open as they can be finished later. The extreme front of the nose is shaped from two pieces of 1/4" sheet that have been cemented together. As shown, the center of the nose block is cut out to receive the nose plug. Cement this nose block to former No. 1 and when dry cut and sand the entire fuselage front to a smooth shape.

Tail Surfaces

Construction of the tail surfaces is simple; both stabilizer and rudder are constructed in a similar manner. The stabilizer is built in one piece so a complete plan must be made; build directly atop the plans. Cut the outline shapes from 1/16" sheet and pin them to place over the plans. Spars and ribs are 1/16" square stock. When these flat frames are dry remove them from the plan and cement soft 1/16" square strips to both sides of the ribs; these strips are later cut to a streamline shape. Trim and sand the stabilizer and rudder to complete their construction.

Wings

The wing must be of sturdy construction since the rear landing gear struts are attached to it. Ribs are cut from 1/32" sheet with the exception of W-4 which is 1/16" sheet; two of each type rib are required. Notches for the spars and leading edge must be cut with accuracy to insure a neat job. A full-size left wing plan must be made so the parts can be assembled directly over the plans. Sizes of the various spars are noted on the plan. The 1/16" x 1/4" spar to which the landing struts are attached is not placed until the dihedral is added. The wing halves should be joined together accurately and solidly; dihedral at each tip is 1-7/8". Now attach the 1/4" deep spar and reinforce the junction necessitated by the dihedral. Trim and sand the leading and trailing edges as well as the tips to correct finished shape.

Landing Gear

The landing gear as developed for this model is not difficult to construct yet is both accurate in appearance and extremely rugged. Let's complete the front strut first. It is made from .034 music wire. Two pieces are bent to conform to the shape shown on the plan and are then soldered together. The third wire, which braces the front fork, is shaped as shown on the side view and it, too, is soldered to place. Attach the gear to the fuselage structure by sewing the wires, using needle and thread, to bulkhead No. 2; bind the rear brace to the keel. Check for correct alignment and then apply several coats of cement. Finish the nose by "filling-in" with 1/16" sheet.

Construction of the two rear landing gear struts is also detailed; they are fashioned from .040 music wire. Two separate wires are needed for each unit—be sure to make a right and left strut. Solder the parts together and then attach them using thread and plenty of cement. Use a needle and sew right through the rib and about the wire. If properly made, this landing unit will really "take it." Rubber tubing covers and other details are not added until the model is covered.

Wheels are made from laminated discs of sheet balsa; all are 3/8" thick. Bearings should be cemented to the sides so they will revolve accurately and smoothly

Propeller

A hard balsa block 7/8" x 1-3/8" x 7-1/2" is required for the propeller. Shape the blank as shown and then carve a right-hand prop. Cut the back face of the blades first; a bit of under-camber is desirable. The prop blades shape can be determined from the photos. Apply several coats of dope after they have been sanded smooth. Shape the spinner and then notch it to fit accurately over the propeller hub. It is advisable to use a free-wheel device to help improve the glide—hide it within the spinner. A washer is glued to the back of the prop so it will revolve freely. Color dope to a nice finish.

The removable nose plug is shown. A disc of 1/32" plywood forms the front while the back is laminations of balsa. Fix the line of thrust by cementing washers to the front and back of the plug. For the propeller shaft use .040 music wire. Place several washers between the propeller and nose plug.

Covering

To properly prepare for a neat covering job the entire frame must first be sanded thoroughly to eliminate all flaws and roughness. Our test model is colored to conform to the regular U.S. Army color scheme—the fuselage is blue, flying surfaces are yellow, details are black. Some of the real "Airacobras" are all silver in color while newest ones are camouflaged with a dull, dark color above and light color below. Colored tissue is best suited for this job since it is both attractive and light in weight. Cover the fuselage first; grain of the paper should run from nose to tail. Banana oil or thin dope is used to stick the tissue to the frames. Numerous small pieces must be used to prevent wrinkles but the individual pieces should be lapped neatly. The nose and similar parts should be covered with tissue, too. Cover the wing and tail surfaces using an individual piece for each side of each unit; grain of the paper runs spanwise. Tips, etc., require separate pieces of tissue also. The parts are lightly sprayed with water to tighten the tissue but are not doped until the model has been assembled.

Assembly

The various parts should now be assembled. Slide the wing into the recess between bulkheads No. 4 and No. 6; if the structure has been reproduced accurately, the incidence will automatically be correct. Check carefully for correct alignment and then cement the wing fast. Wing root pieces are cut from 1/16" sheet balsa and are fitted between the wing and fuselage. Fillets are cut from very soft 1/32" sheet. The pattern shown indicates the fillets' shape on the original model but since most models will vary a little, paper patterns should be cut to fit YOUR model exactly before the sheet balsa ones are cut. Once fillets are cemented to place, the several small openings at the junction of the body and wing should be "filled-in" with scraps of soft 1/16" sheet. Sandpaper smooth and cover the fillets with blue tissue. It will be necessary to temporarily cut the rear of the fuselage to admit the stabilizer which is attached at the exact angle shown. Offset the rudder a bit to counteract torque. Tissue fillets are placed between stabilizer and rudder. Any wrinkles in the covering should be moistened with water and permitted to dry before the entire model is given a coat of clear dope. Dope should be applied in a dry room to minimize the chance of "blushing."

Addition of numerous details completes

the construction. The cockpit enclosure is made from thin celluloid. Shown on the plans is the scale shape for the windshield, but since it would be so difficult to reproduce it exactly to scale, it is recommended that the rounded section be eliminated and the enclosure be made as shown in the photos. Make paper patterns before cutting the culluloid and avoid cement smears when cementing to place. Rubber tubing of about 1/8" diameter is slipped over the rear landing gear struts. To cover the front landing strut it will be necessary to split the tubing and then recement it once it is in place; tubing of smaller diameter covers the back brace and fork portion of the front strut. Wheels are held to place by washers soldered to the rear struts—spring the fork apart to admit the front wheel. Wheel covers are cut from 1/32" sheet and covered with colored tissue to match the other parts. The stars, rudder stripes, U.S. ARMY, etc., are all made from colored tissue and the effort required in making them will be amply repaid by the snappy appearance they add to the model. Control surfaces, flaps and the door are outlined by thin strips of black tissue. Exhaust ports, wing walks and other details found on photos of the real ship can be added.

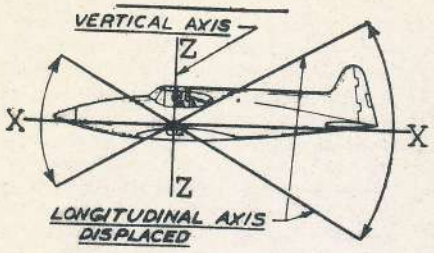
Flying

Eight or ten strands (four or five loops) of 1/8" brown rubber should be used to power this model. Lubricate the rubber and then wipe off the excess to prevent its splashing on the fuselage sides. Attach one end of the motor to the prop shaft and then drop the other end through the fuselage. It may be necessary to remove a small portion of the covering to aid in fitting the bamboo pin into position to hold the rubber strands.

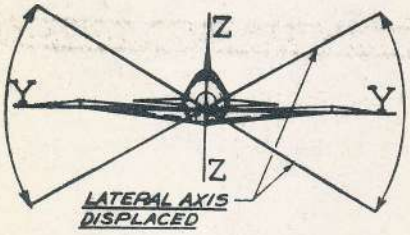
Probably the most important single factor in obtaining fine flights from any flying scale model is patience. A well-built model, if properly handled, will provide many realistic flights with little or no damage to the model itself. It is important that the glide be reasonably good before any power flights are attempted. Select a grassy field for these tests. Try a few shoulder-height glides and, if necessary, add a small corrective weight to the nose or tail to obtain a smooth flat glide. Try a few power turns once the glide seems okay; minor adjustments may be made by slightly warping a wing tip or the stabilizer, as the case may be, but correction for serious misadjustments should be made at the nose plug. Right- or left-thrust will control the size of circle while under power, and slight down-thrust will iron out a stall. A mechanical winder should be used for maximum flight performance.

Our "Airacobra" is not only pleasing to the eye from the standpoint of appearance but it is a capable flyer. This little ship is a stable, consistent performer and it makes a picture when in flight. You are bound to find that the distance covered is far more than might be expected for this type of ship.

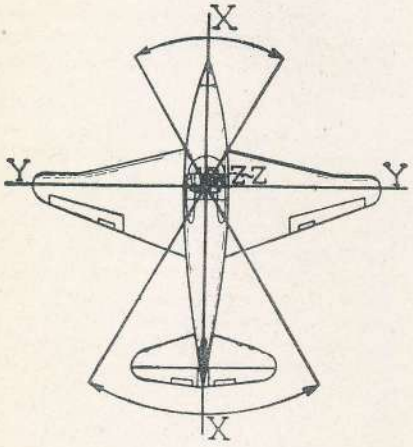
PLANE TIPS II



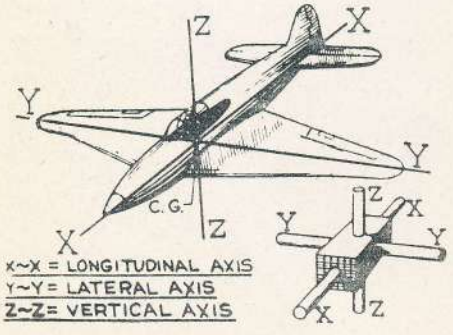
When an airplane is too sensitive to "pitching" (nosing up and down) it is said to be unstable longitudinally.



When an airplane is too sensitive to "rolling" (wing tip low or high) the plane is said to be unstable laterally (the lateral axis is moved out of horizontal position rotating about the longitudinal axis).



When an airplane is too sensitive to "yawing" (turning to right or left) the plane is said to be unstable directionally (the lateral axis and the longitudinal axis are displaced rotating about the vertical axis).



Stability Definitions

Automatic Stability—Stability depending upon movable control surfaces automatically operated by mechanical means.

Catastrophic Instability—A rare case, in a steep dive, in which the airplane may become entirely unmanageable, and even go so far as to become inverted while diving.

Dynamic Stability—The resulting stable position of an airplane produced by the oscillating air pressures set up by the fuselage (for example) rotating into an unstable position. Stability is restored after a series of air pressure oscillations.

Inherent Stability—Stability of an aircraft due solely to the arrangement of its fixed parts. The force which causes it, when disturbed, to return to its normal attitude of flight without the use of controls.

Neutral Stability—A neutrally stable airplane is one which, if once displaced from a state of steady flight, will not return to its original flight attitude, but will seek a state of steady flight in any new flight attitude. If the c.g. (center of gravity) is located in a central or neutral position no unbalanced forces exist. A neutrally stable airplane would, therefore, obviously crash.

Pendulum Stability—Stability due to a pendulum's center of weight acting at considerable distance below the center of lift. A parasol monoplane or plnotype wing mounted model airplane has marked pendulum stability because the c.g. is a considerable distance below the wing which lifts.

Editor's Note:—A low c.g. is one of the commonest ways of gaining longitudinal, or fore and aft stability, and works well on all *light slow* planes. However when the c.g. is low on heavy rubber or gas models great care must be used to have the c.l.a., or center of side projected area, on or below the line drawn through the c.g. parallel with the thrust line. The c.l.a. may be slightly above the c.g. but when far above, induces spiral diving, unless the ship is overpowered and adjusted when it flies under power so the nose points upward at all times. Under these conditions it spirals, but instead of diving, spiral climbs. If the nose of this type of ship drops below the horizontal flight position it spiral dives. In other words, a high c.l.a. such as will exist on very high-pylon models induces a spiral tendency. If any means are used to keep the nose pointed upward continually there will be no bad results, otherwise crashes will inevitably result.

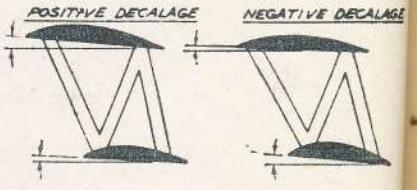
At best this is a precarious situation inasmuch as there is no assurance that a model, even when adjusted for a steep climb and with a powerful engine will continually point its nose skyward. Several times at the Nationals, flights have been witnessed where a model had been adjusted for climb but due to air conditions nosed down into horizontal flight. In all such cases the model went into a tight spin or spiral dive. This was due to skidding on turns, producing a sudden pressure above the c.g., throwing the plane over into a steep bank and with ever-increasing speed this disturbing moment built up until the plane crashed.

Corrections for spiral diving can be easily made, even in the case of high-pylon models, by giving negative thrust (that is, slanting the thrust line downward at the nose), and by placing the fin area well below the thrust line. This lowers the c.l.a. and induces a roll in turns that resists spiralling.

Another good way to correct spiral instability is to increase the dihedral, provided that in doing so steps are taken to *lower the c.l.a. on a level with the c.g.* Merely increasing the dihedral without taking this latter precaution usually doesn't improve spiral stability and may increase spiral instability. The area of the fin relative to the dihedral is an important factor. If the fin is too large, spiralling will result.

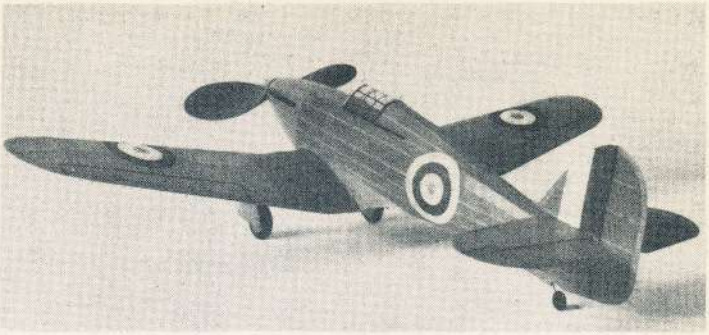
Static Stability—If a disturbed position of the airplane is corrected by an unbalanced force such as the c.g., the airplane is considered to be statically stable.

Longitudinal Dihedral—Angular difference between stabilizer incidence setting and wing incidence setting. If stabilizer has greater incidence than wing, the difference in angular settings is negative.



Decalage—The angular difference in incidence setting of the wings of a biplane. It is positive if upper wing has greater incidence.

Realistic and exact in every line



A remarkable flier though simply constructed

HAWKER "HURRICANE"

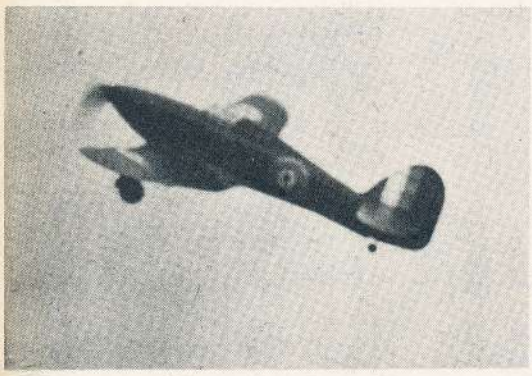
How You Can Build a Fine Flying Replica of Britain's Famous Fighter

By EARL STAHL

Insignia is very effective

THE Hawker *Hurricane*, famed British fighter, won the "Battle of Britain" hands down and thus, it is believed, saved the world from the dictators. In Africa, *Hurricane* "can-openers" armed with 40 mm cannon received Gen. Montgomery's thanks for making his historic victory possible. Now overshadowed by its young nephew, the *Typhoon*, the *Hurricane* is still blasting the enemy around the four corners of the globe.

Latest versions are capable of nearly 400 miles per hour and carry two heavy bombers in the *Hurribomber* version. Types fitted with deck arrestor gear are known as *Sea Hurricanes* and many are operating from escort carriers along the Allied supply routes to England.



Just like the big ship in flight

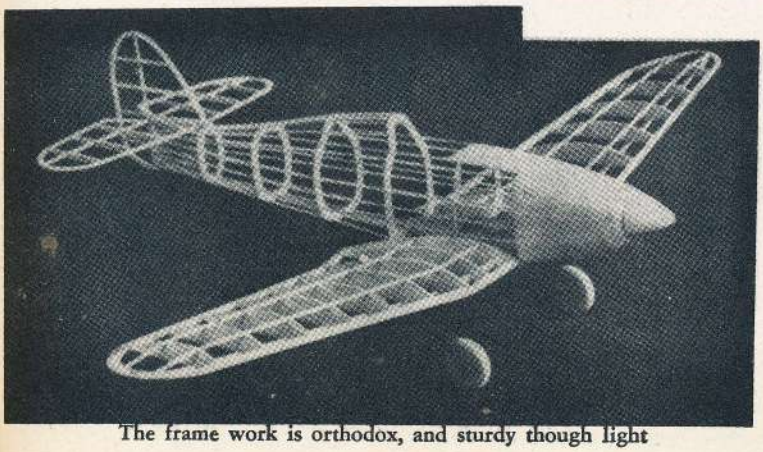
Various combinations of armament, eight machine-guns of .303 caliber, four cannon of 20 mm bore or two cannon of 40 mm bore are used, each designed for a specific job.

The model described here is a speedy flying reproduction of its capable prototype. Because of sleek lines and interesting construction, it will provide many hours of enjoyment both in building and flying. Construction is not difficult; study the plan thoroughly and read the instructions before beginning actual work. Build directly over tracings of the plans and be sure to cement all joints firmly.

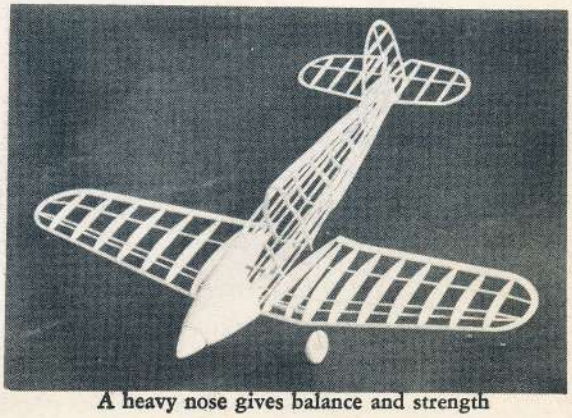
Fuselage

To simplify construction and alignment, the keel and former method is used. Obtain the keel pieces' proper shape by tracing the side view top and bottom outlines on a sheet of paper—depth of each keel piece is about 5/32". Cut out the paper patterns and then lightly cement them to 1/16" sheet balsa so they can be cut out. The side keel shape is indicated on the top view; two are required; they also are cut from 1/16" sheet. The various fuselage formers are shown on the plan; two of each type will be needed. Medium grade 1/16" sheet is used for them. Cut only the notches indicated; other notches should be marked and then cut later as required.

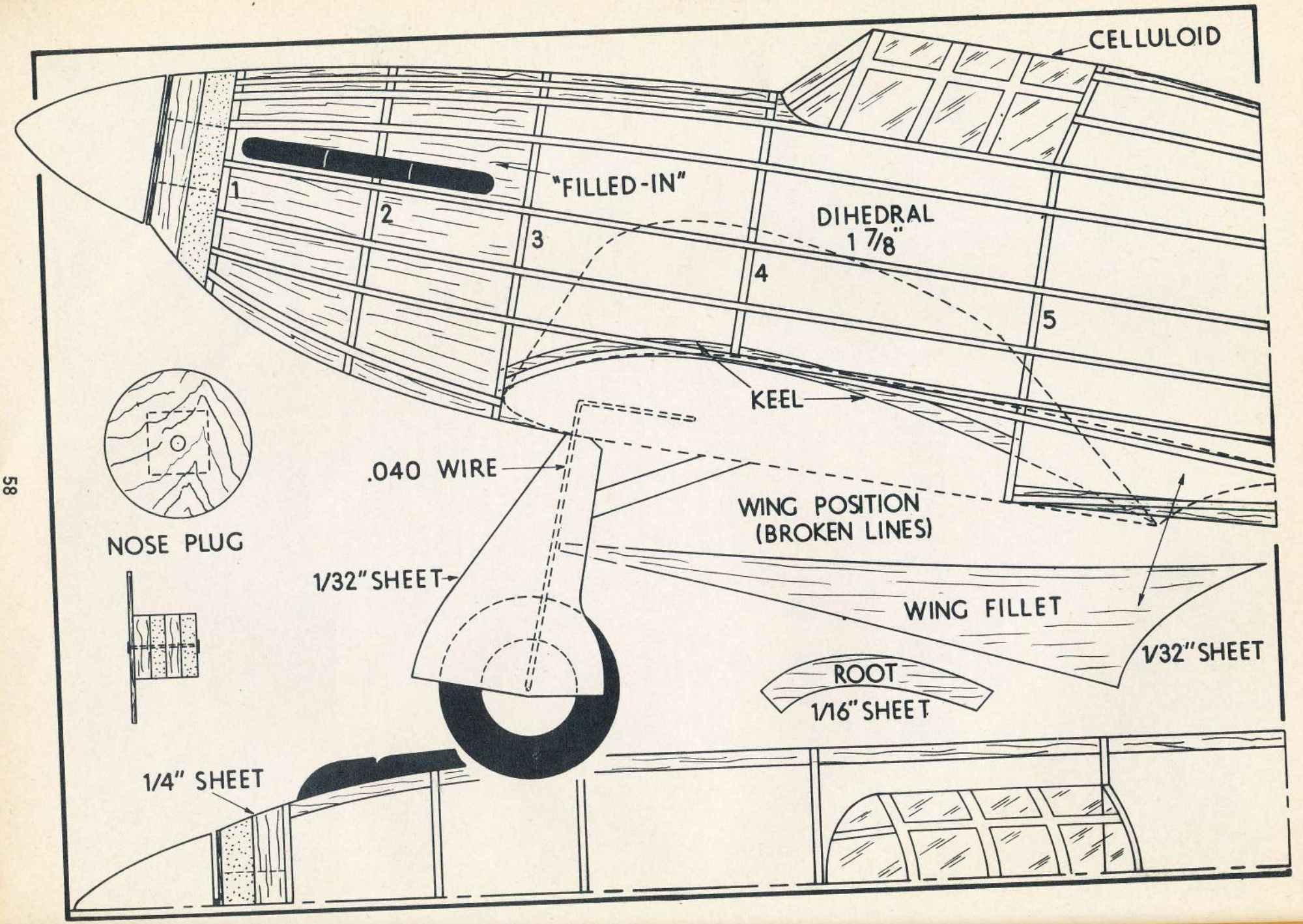
Pin the top and bottom keels to place over the side plan and then cement half the formers to their respective positions. Attach the side keel after checking each former for

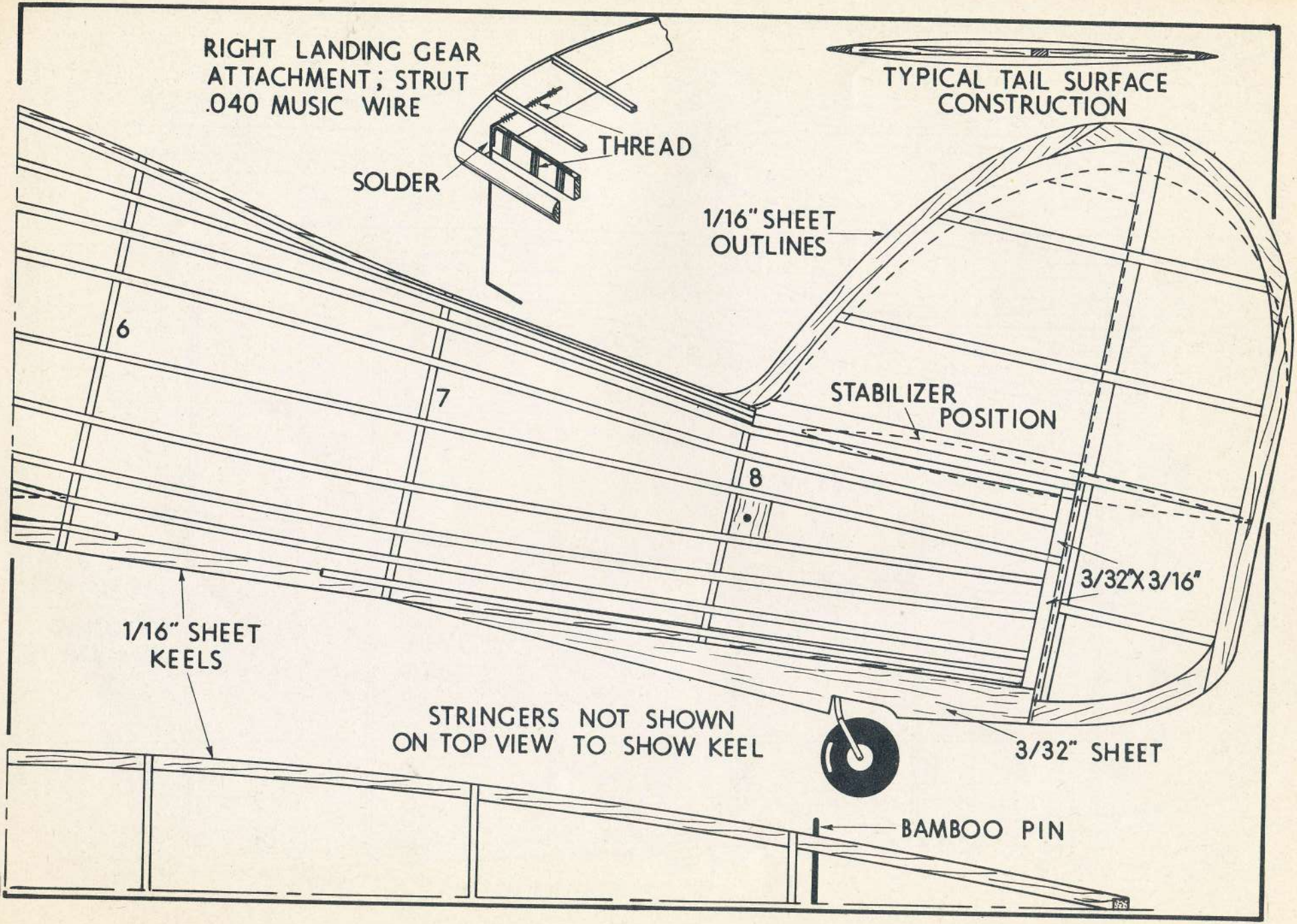


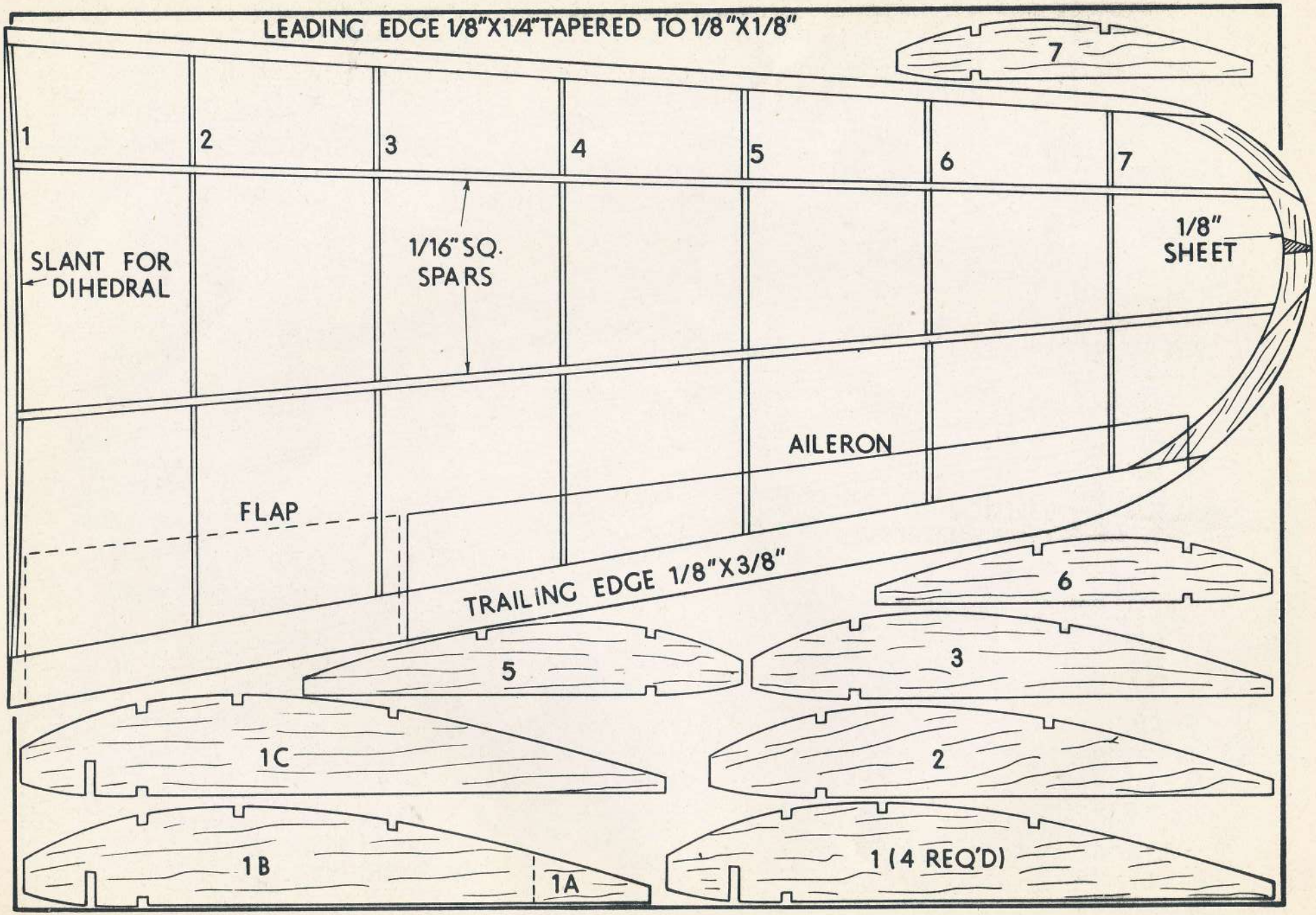
The frame work is orthodox, and sturdy though light

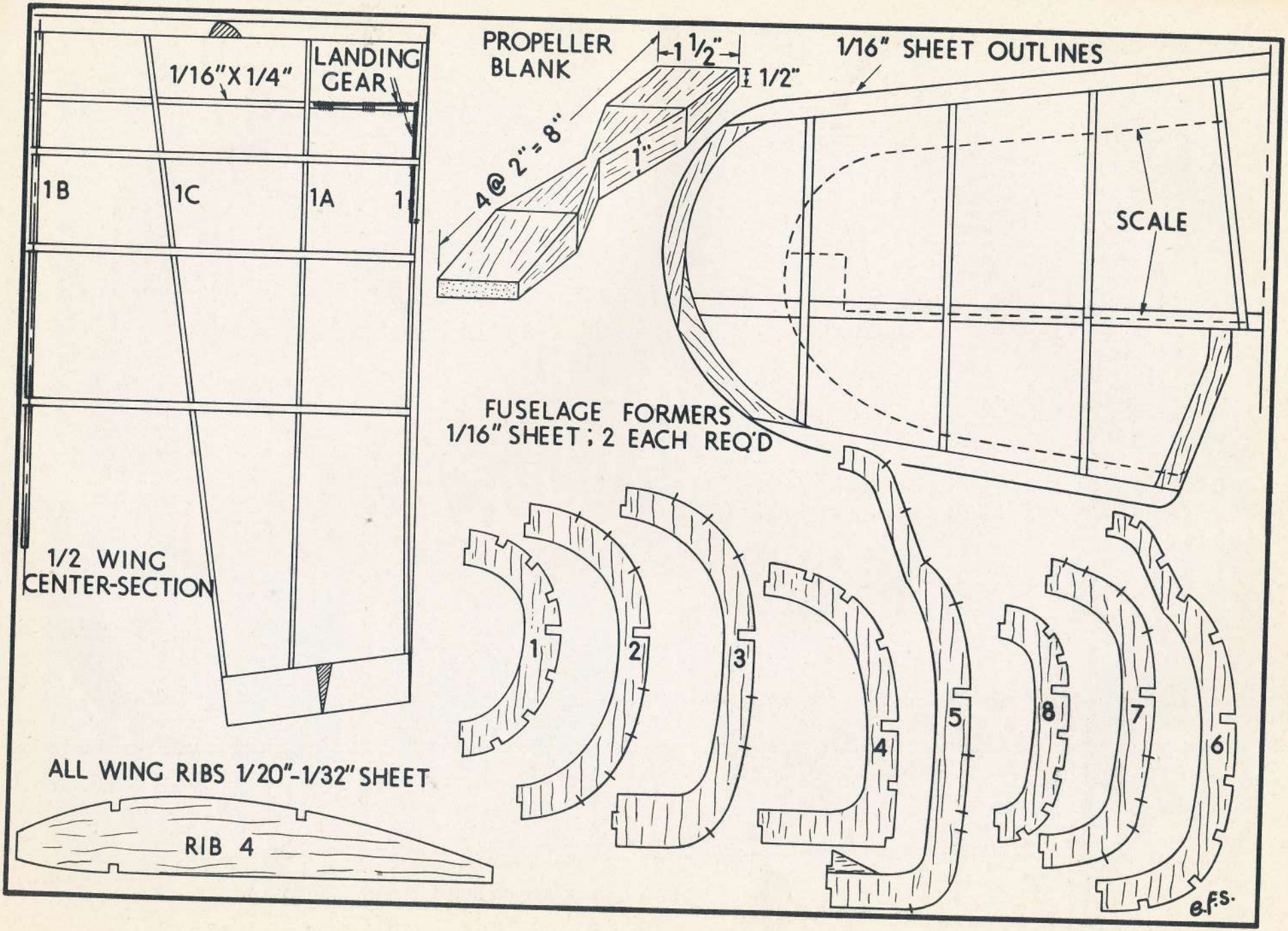


A heavy nose gives balance and strength


CELLULOID
"FILLED-IN"
1
2
3
4
5
DIHEDRAL
1 7/8"
KEEL
.040 WIRE
WING POSITION
(BROKEN LINES)
NOSE PLUG
1/32" SHEET
WING FILLET
1/32" SHEET
ROOT
1/16" SHEET
1/4" SHEET


RIGHT LANDING GEAR
ATTACHMENT; STRUT
.040 MUSIC WIRE
THREAD
SOLDER
TYPICAL TAIL SURFACE
CONSTRUCTION
1/16" SHEET
OUTLINES
6
7
8
STABILIZER
POSITION
3/32"X 3/16"
1/16" SHEET
KEELS
STRINGERS NOT SHOWN
ON TOP VIEW TO SHOW KEEL
3/32" SHEET
BAMBOO PIN


LEADING EDGE 1/8"X1/4"TAPERED TO 1/8"X1/8"
7
1
2
3
4
5
6
7
SLANT FOR DIHEDRAL
1/16" SQ. SPARS
1/8" SHEET
AILERON
FLAP
TRAILING EDGE 1/8"X3/8"
6
5
3
1C
2
1B
1A
1 (4 REQ'D)


1/16"X 1/4"
LANDING GEAR
1B
1C
1A
1
1/2 WING CENTER-SECTION
ALL WING RIBS 1/20"-1/32" SHEET
RIB 4
PROPELLER BLANK
1 1/2"
1/2"
4@ 2" = 8"
1"
1/16" SHEET OUTLINES
SCALE
FUSELAGE FORMERS
1/16" SHEET ; 2 EACH REQ'D
1
2
3
4
5
8
7
6
e.f.s.

correct alignment. When dry, remove this simple frame from the plan and attach remaining formers and side keel. Stringers are medium grade 1/16" sq. strips. As work progresses it will be necessary to cut many notches for the stringers; use a razor blade that has been broken to a sharp point for this operation. Once a stringer has been attached to one side always attach one to the other side's corresponding position to avoid pulling the structure out of line. Small pieces of hard 1/16" sheet cemented between stringers in the rear serve as the anchor for the rubber motor.

"Filling-in" the nose with balsa, as shown, effectively represents the metal cowl of the real ship. Use soft 1/16" and 3/32" stock, as required, and cut the individual pieces to fit snugly within the spaces between stringers and formers. When dry, cut and sand the entire nose to a smooth, accurate shape. The extreme front part of the nose is cut from 1/4" sheet that has been laminated together. Notice the nose block center is cut out to receive the removable nose plug. Cement the block to former 1 and then shape it to blend with the nose.

Wing

The wing is constructed in three parts; plans for the right wing and half the center section being given. Prepare complete plans for the center section and left wing so parts can be assembled over them. Two of each type ribs, with the exception of 1 and 1-B, are required; ribs are cut from 1/32" or 1/20" sheet. Notches for the various spars must be cut with accuracy to insure a neat job. Leading edges of the outer sections taper from 1/8" by 1/4" to 1/8" sq.; taper the trailing edges to correct crosssection before pinning them to place over the plans. Assembly the various parts directly on the plan, using pins to hold them in place until cement has hardened. The end ribs of each section should be slanted a small amount so the dihedral angle will be correct when they are joined. Tips are cut from 1/8" sheet and cemented to place. Trim the edges and tips to shape and then cement the three units solidly together with 1-7/8" dihedral at each tip.

Landing Gear

The landing gear, as used on this model, is sturdy yet easily reproduced. Check the various plans and photos for details. Two pieces of .040 wire are required for each strut and these are soldered together to form a strut as shown by the perspective; be sure to make a right and left unit. Attach the gear to place with thread wrappings about the 1/4" deep spar, and by sewing with a needle and thread right through the ribs and about the wire. Thoroughly cement thread bindings and all adjacent areas.

Wheels may be purchased or they can be made from laminated 1/8" sheet of the hardest variety. They are 3/8" wide. Cement washers to both sides of each wheel so they will turn freely and accurately.

Tail Surfaces

As is usually true of fighting planes, the tail surfaces are too small to insure stable model flights, so surfaces' proportions are enlarged a small amount. Both stabilizer and rudder are constructed in like manner and while only half the stabilizer is shown, it is constructed in one piece. First build complete frames using 1/16" sheet for the outlines, 1/16" x 1/8" strips for the spars, and 1/16" sq. pieces for the ribs. When these assemblies are dry, they are removed from the plans and 1/16" sq. strips are cemented to both sides of the ribs. These pieces are later cut to form the streamline rib shape. Trim and sand the frames to complete the construction.

Propeller

For best flight performance the model must be equipped with an efficient propeller. Select a hard block 8" x 1-1/2" x 1". Drill the tiny hole for the shaft and then cut the blank as shown. Cut the back face of the blades first; a bit of undercamber is desirable. The blades shape can be determined from the photos. Apply several coats of dope with light sanding between each to get a smooth finish. Shape the spinner from soft balsa and then notch it to fit accurately over the hub. A free-wheel device, if used will improver the glide—hide it within the spinner. A washer should be cemented to the back of the prop to permit it to revolve freely. Color dope to a nice finish.

The removable nose plug is shown. A disc of 1/32" plywood forms the front portion while the back is laminations of 1/8" sheet balsa. Drill a small hole through the center and cement washers to both sides to fix the line of thrust. Bend the prop shaft from .040 music wire. Several washers should be placed between the prop and nose plug to reduce friction.

Covering

For finest appearance a smooth, attractive covering job is necessary. Before starting to cover, work over all the frame with fine sand paper and remove all flaws and roughness. On the fuselage only those members which run fore and aft should touch the covering, so lightly sand the formers to a slightly scalloped shape to aid in making a better job. Colored tissue is used for the covering, attached to the frame by light dope or banana oil. The model pictured is colored all red but ships at war are camouflaged in greens and browns.

Cover the fuselage first, using numerous small pieces to help prevent wrinkles; lap each piece neatly. The nose and similar wood parts are tissue covered, too. Use a separate piece of tissue for top and bottom of each section of the wing and tail surfaces; it is not necessary to attach the tissue to all the adjacent frame. Wing tips, etc. require individual pieces. Once all parts are covered lightly spray them with water to tighten the tissue, but do not apply any dope until later.

Now, to assemble the various parts: Fit the wing into the recess and cement it fast; if the structure has been reproduced with accuracy the angle of incidence will automatically be correct. Finish the undersection from wing to fuselage with pieces of 1/16" sq. Wing root pieces, as shown, are cut from 1/16" sheet and attached between wing and fuselage. Fillet pieces, to be cut from 1/32" sheet, are shown on the plan. The pattern indicates the fillets shape on the original model but since most planes will vary a little, paper patterns should be cut to fit your model before sheet balsa ones are cut. Once they have been cemented to place, the fillets are covered with colored tissue, as is the uncovered portion under the wing. The stabilizer is attached in position shown and at angle indicated. Off set the rudder a small amount so the model will glide to the right. Check and recheck tail surfaces for correct alignment. Tissue fillets are placed between the stabilizer and rudder. Any wrinkles in the covering should be moistened with water and permitted to dry before the entire model is given a coat of dope. If a small quantity of the same color dope as tissue is added to the clear dope, it will give an attractive finish.

There are numerous other details that should be added before the model can be considered complete. The cockpit enclosure is made from thin celluloid. Make paper patterns by the "cut and try" method before cutting from celluloid; be sure to avoid cement smears when attaching to place. The structural detail is made by doping thin strips of black tissue to the transparent enclosure. Two pieces of 1/8" rubber tubing (as used on electrical appliances, etc.) are slipped over the vertical portion of the landing gear wires. Wheels are colored and then held to place by washers soldered to the axles. The outer landing gear covers are cut from 1/32" sheet and then covered with colored tissue to match the plane. The red, white and blue British insignia on the original model was made from colored tissue. Control surface outlines, flaps, etc. are thin strips of black tissue doped to the covering. Make the small sub-rudder and tail wheel from sheet balsa. Exhaust stacks and other details found on photos of the real ship can be added without harming the model's flying ability.

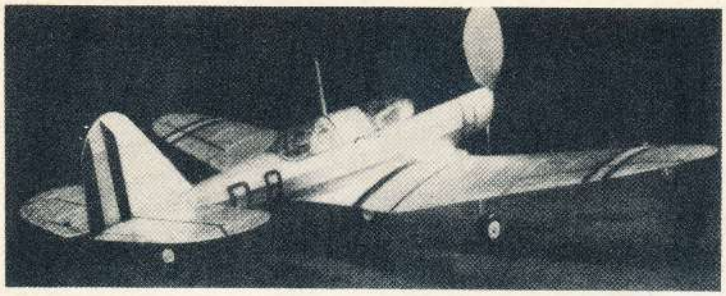
Our model is powered by 10 strands (5 loops) of 1/8" flat, brown rubber. Hook the motor to the propeller shaft and then drop the other end through the fuselage. It may be necessary to remove a small portion of the rear covering to get the strands in position to be held by the removable bamboo pin. The model Hurricane is now ready for its initial flights.

Flying

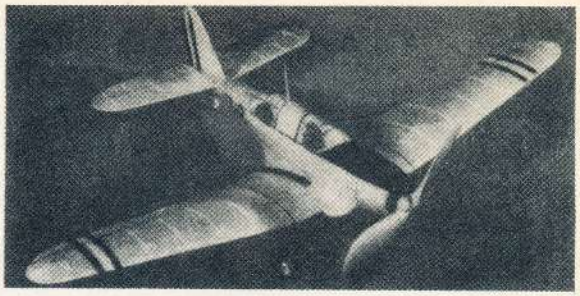
Test the model over deep grass but if none is available make first flights R.O.G. with a few turns. In all probability the ship will be slightly tail heavy; if so, add a small amount of weight to the nose. As correct balance is obtained, increase the number of turns. Off-setting the thrust line to the right or left will aid in controlling the amount of circle in either direction. For maximum flight performance, stretch the rubber motor and wind with a mechanical winder.

The Hurricane is a trim little craft, light in weight and speedy in flight. It should make a worthwhile addition to any builder's collection.

Happy landings!



A beautifully realistic scale plane that you will be proud of



An unusual flier with large propeller and stabilizer

A Flying Douglas Attack Bomber

If You Want
A Fine Flying
Modern Low-Wing
Warplane Model
— Here It Is

By SIDNEY STRUHL

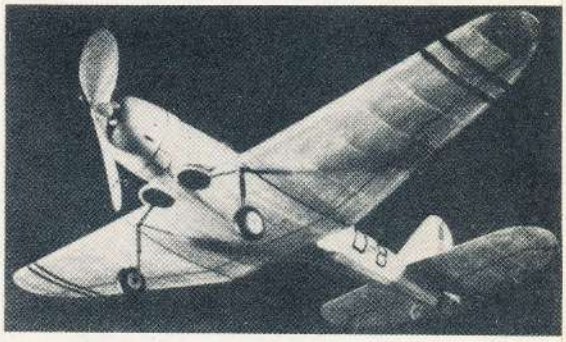
THIS flying scale is the Douglas 8A-5 Attack Bomber. It is characterized by its high performance and all metal construction. It is a low-wing full cantilever single motor two-place attack bomber, powered by a Wright Cyclone air cooled motor of 1,000 rated horsepower. The top speed of the ship is 268 miles per hour which is pretty good if you consider its weight and type. The absolute ceiling is 29,680 feet; rate of climb, 1460 feet per minute and service range, 1450 miles. The Douglas is one of the most heavily armed attack bombers in the world; in the bottom of the fuselage are four rows of twelve bombs, of the twenty-five pound fragmention type.

As a model, the Douglas 8A-5 has been accurately reproduced and if plans are followed you will "wind up with" the most stable low-wing flying model you have built. After experiments on many low-wings the author has at last struck upon a formula that will produce the same type flying in a low-wing scale model as in the good old parasol standbys. Briefly some of these features include enormous tail surfaces (in relation to the wing area); the stabilizer is actually 35% of the wing area in the flying version of the 8A-5. A streamlined airfoil section is used to cut down the drag below the thrust line, thus aiding climb and reducing any diving tendencies. A wide-blade small-diameter propeller is used to cut down torque, yet not thrust. There are many other innovations which will show up when you launch your Douglas Attack Bomber on its maiden flight. So how about getting busy just to prove that we aren't kiddin' you?

Fuselage

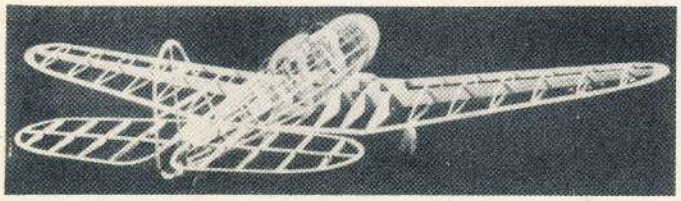
The first thing to do in the fuselage construction is match the magazine pages so that plans are lined up perfectly. Cut all the fuselage bulkheads from light grade 1/16" sheet balsa. You will notice only half the bulkheads are shown so it will be necessary to trace and then invert the tracings to obtain the other half. After the bulkheads are cut to shape they are glued in the proper position on the 1/16" x 1/8" hard balsa longeron designated by the term 'line-up' longeron. This longeron is used as a jig to start the fuselage assembly. After the cement has set add the 1/16"

In flight, very stable with steep climb



Very realistic when carefully decorated

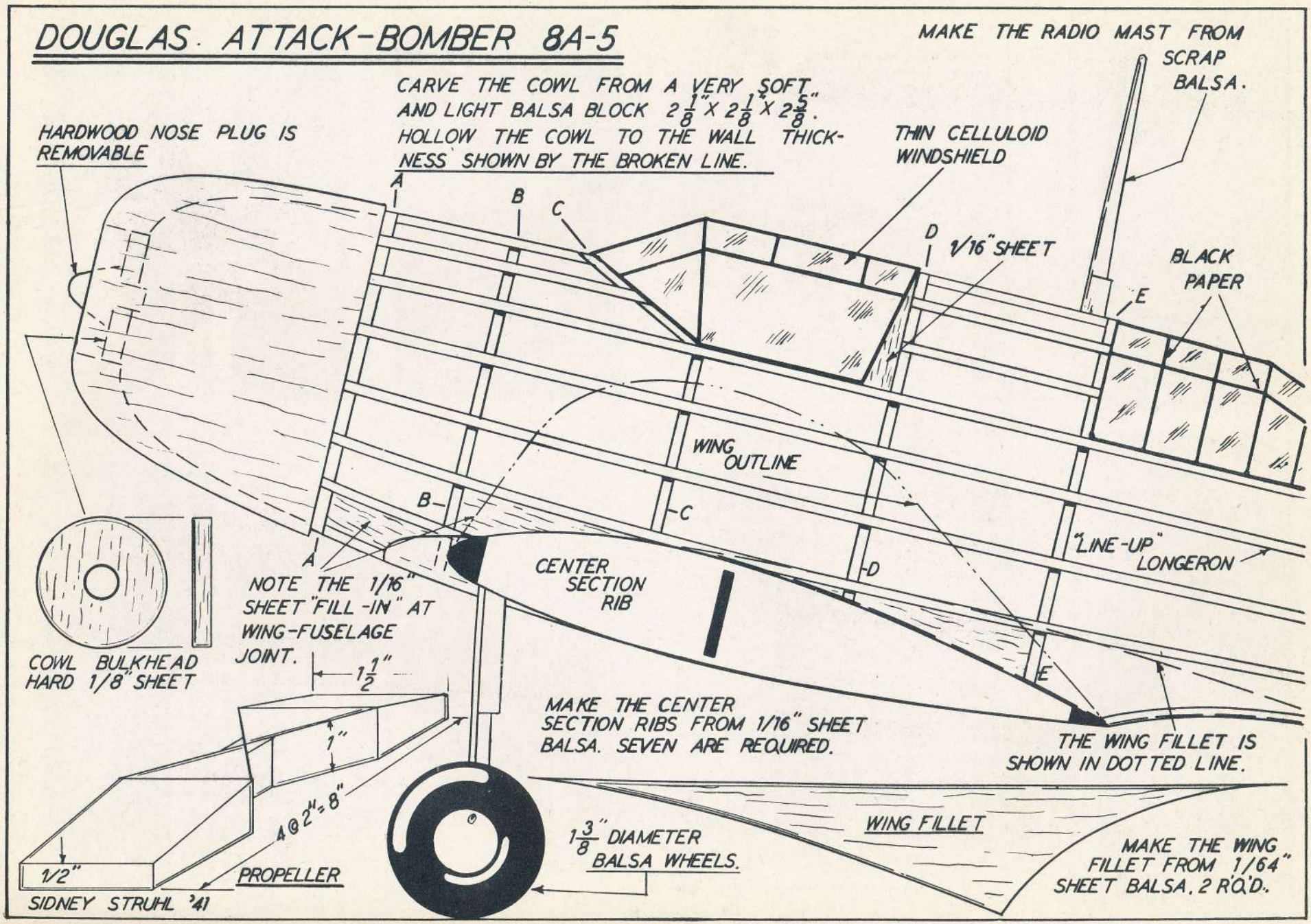
The wings are made as units and then assembled by slipping them over the main spars and cementing



Note the large tail surfaces and "strip" ribs

Frame is very lightly built, like the full scale ship

DOUGLAS ATTACK-BOMBER 8A-5



1/2"

PROPELLER

SIDNEY STRUHL '41

BALSA WHEELS.

MAKE THE WING FILLET FROM 1/64" SHEET BALSA. 2 R'Q'D.

FUSELAGE BULKHEADS

ALL OF 1/16" SHEET BALSA.

C-C

D-D AND E-E

F-F

G-G

B-B

A-A

NOTE THE 1/16" X 1/8" "LINE-UP" LONGERON.

D-D ENDS AT BROKEN LINE

H-H

I-I

1/16" SHEET "FILL-IN"

SCALE OUTLINE

BLACK PAPER

F

G

1/16" SQUARE STRINGERS

F

H

I

H

BEND THE REAR HOOK FROM .034 MUSIC WIRE.

G

INSTALLATION OF REAR HOOK IN H-H.

H-H

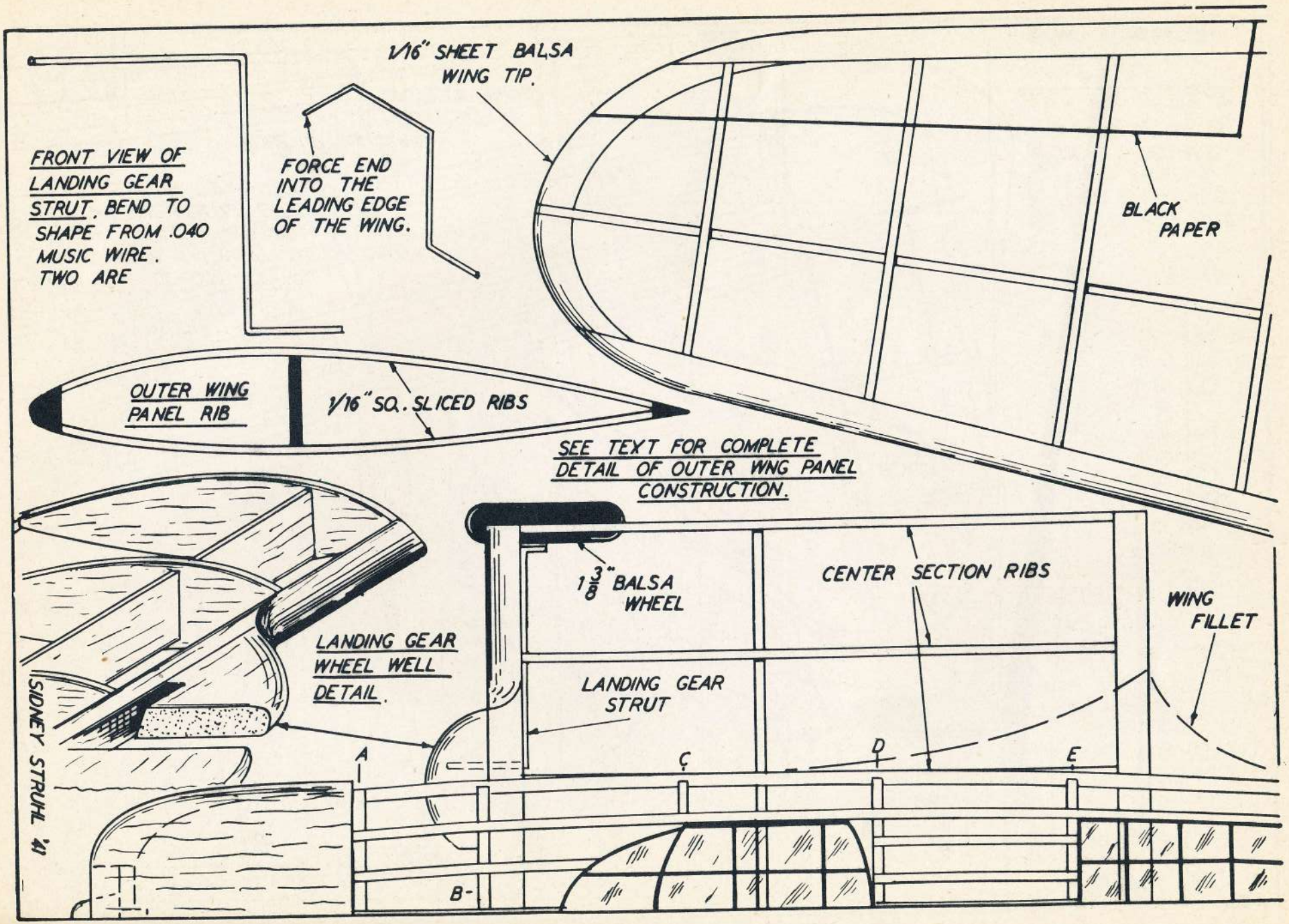
BALSA TAIL WHEEL.

FRONT VIEW

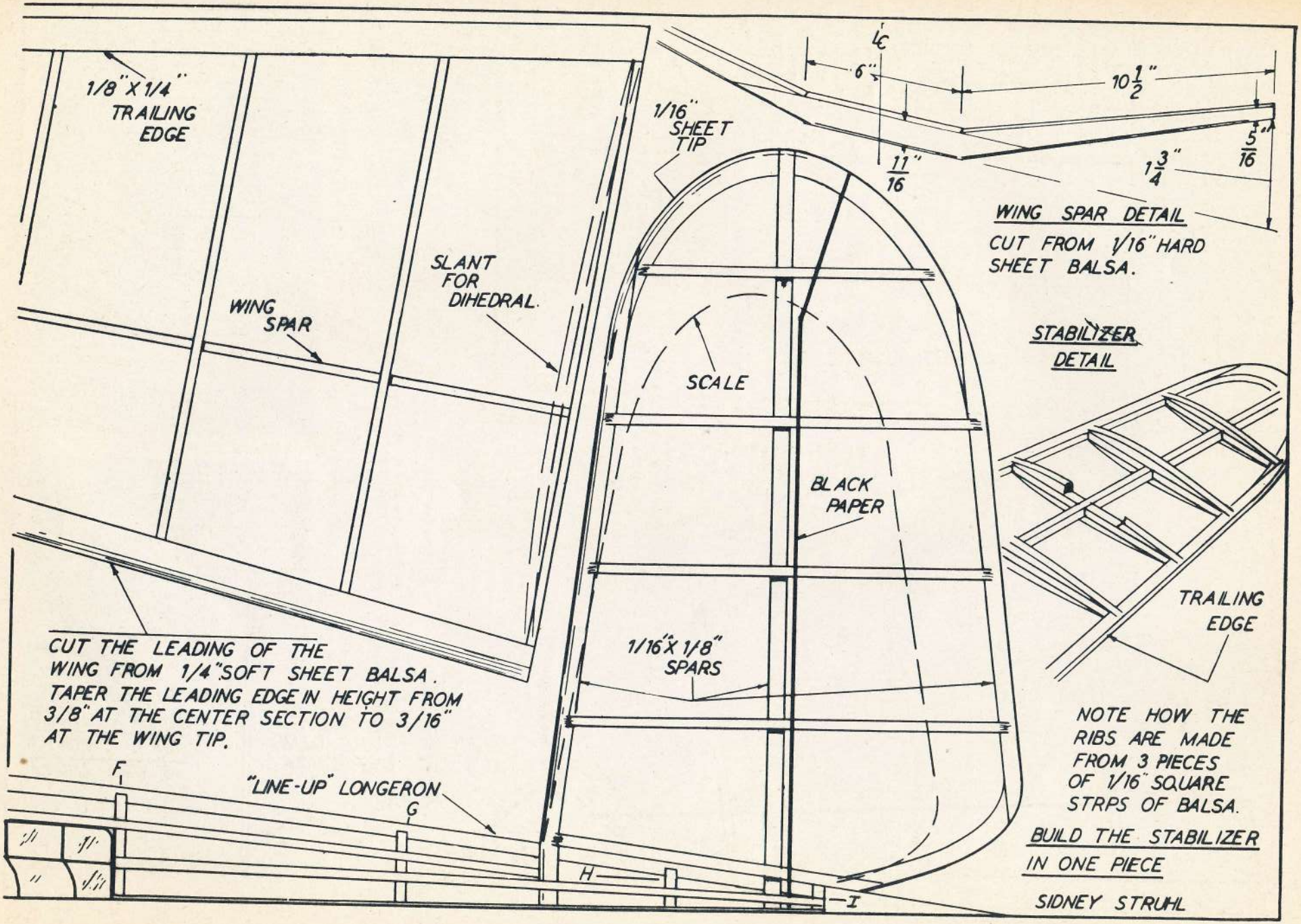
1/2 SCALE

1 3/4" DIHEDRAL

SIDNEY STRUHL '41


1/16" SHEET BALSA WING TIP.
FRONT VIEW OF LANDING GEAR STRUT. BEND TO SHAPE FROM .040 MUSIC WIRE. TWO ARE
FORCE END INTO THE LEADING EDGE OF THE WING.
BLACK PAPER
OUTER WING PANEL RIB
1/16" SQ. SLICED RIBS
SEE TEXT FOR COMPLETE DETAIL OF OUTER WNG PANEL CONSTRUCTION.
1 3/8" BALSA WHEEL
CENTER SECTION RIBS
WING FILLET
LANDING GEAR WHEEL WELL DETAIL.
LANDING GEAR STRUT
A
C
D
E
B
SIDNEY STRUHL '41


B-


1/8" X 1/4"
TRAILING
EDGE
WING
SPAR
SLANT
FOR
DIHEDRAL.
CUT THE LEADING OF THE
WING FROM 1/4" SOFT SHEET BALSA.
TAPER THE LEADING EDGE IN HEIGHT FROM
3/8" AT THE CENTER SECTION TO 3/16"
AT THE WING TIP.
F
"LINE-UP" LONGERON
G
H
I
1/16"
SHEET
TIP
SCALE
BLACK
PAPER
1/16" X 1/8"
SPARS
LE
6"
10 1/2"
11/16"
1 3/4"
5/16"
WING SPAR DETAIL
CUT FROM 1/16" HARD
SHEET BALSA.
STABILIZER
DETAIL
TRAILING
EDGE
NOTE HOW THE
RIBS ARE MADE
FROM 3 PIECES
OF 1/16" SQUARE
STRPS OF BALSA.
BUILD THE STABILIZER
IN ONE PIECE
SIDNEY STRUHL

square stringers as shown in the side view. Notice that some bulkheads have notches to accommodate some stringers, while the majority of them do not. Where the bulkheads are not notched the stringer is glued directly on top the bulkhead edge. Note bulkhead C-C is cut in two and forms the dashboard of the front cockpit. Bend the rear hook from .034 music wire and glue it firmly in H-H. Now add the 1/16" sheet fill-in between the stringers at the wing-fuselage and stabilizer-fuselage joints. This is to add to the strength and ease of covering.

The cowl is now carved to shape from a very soft balsa block 2 1/8" x 2 1/8" x 2 5/8". The front of the cowl is a perfect circle while the rear has the same general cross section of bulkhead A-A. Hollow the cowl to thickness shown in the plans and then cut out and add the hard 1/8" sheet cowl bulkhead. Better use several coats of cement at this joint.

Add the 1/16" sheet filler in front of bulk-head D-D. The windshields may now be added; merely form the thin celluloid to shape by rolling it between your fingers. Make the tail from scrap balsa and a piece of wire and cement in place. The hardwood removable nose plug should be made to fit neatly into the cowl bulkhead.

The fuselage is now sanded very lightly to remove any bumps that would impair the covering.

Tail Surfaces

The construction of the tail surfaces is very simple; both the stabilizer and rudder are built in a similar manner. The stabilizer should be built in one piece however.

The leading and trailing edges are 1/16" x 1/8" strips of balsa. The stabilizer spar is 1/16" x 1/8" while the rudder spar is 1/16" square. The ribs are all 1/16" square. When the cement has set, the frames are removed from the plans and soft pieces of 1/16" square are cemented to both sides of the ribs. These are then sanded to a streamline shape after the glue has set. Sandpaper the tips to a streamline shape, too.

Wing

You will have to trace the wing plan shown and then invert it to obtain the left plan.

The wing spar should be built first and then the wing is built upon the wing. Build the spar from 1/16" sheet balsa to the size shown in the plans; be sure you cut the correct angle on the spars to obtain the necessary 1 3/4" dihedral. Cut 7 center section ribs from 1/16" sheet as shown in the side view. Slip these ribs over the center section of the wing spar; glue them in proper positions. Add the 1/8" x 1/4" trailing and the leading edge of 1/4" x 3/8" soft balsa.

Make a cardboard template of the outer wing panel rib. With this template slice 14 upper and 14 lower ribs 1/16" square from 1/16" quarter-grained sheet balsa.

Cut the leading edge from 1/4" sheet balsa and pin it along with the trailing edge upon the plans. Now add only the TOP ribs, cutting their trailing edges to meet the wing taper. After the cement has set remove the frame from the plan and add the lower ribs in the proper positions. Slip the wing onto the spar and cement each and every rib to the spar. Use several coats of cement at the leading and trailing edges dihedral joints. Cut the wing tip from 1/16" sheet balsa and cement in place.

Carve the landing gear wells from scrap balsa to the shape shown in the plans; you will notice there is a small slot for bulkhead B-B to slip into.

Bend two landing gear struts from .040 music wire to shape shown. The strut is anchored to the leading edge by forcing the end into the landing gear well through the leading edge. Use many coats of glue on this joint. A small block may also be added to back up the joint, as may be noted from pictures of the framework. Another trick is to bind the joint with thread.

The wheels may either be purchased or made from laminations of 1/8" sheet balsa. Cement washers to both sides of each wheel so they will turn freely and true.

Propeller

Carve the propeller from a medium hard balsa block 1" x 1 1/2" x 8". First drill the prop shaft hole and then cut out the blank as shown on the plans. Carve a right-hand propeller. First finish the back of the blades completely and then cut away the front to the thickness required. Use plenty of sanding to obtain a real smooth finish. Apply several coats of clear dope.

Bend the prop shaft from .040 music wire and slip the nose plug and propeller with several washers between them; then bend the shaft end at right angles and force into the hub.

Covering

Sand every bit of framework to remove any flaws and rough spots.

The author used Silkspan for covering his model; however you may use tissue if you prefer.

The wing should be covered, using clear dope as an adhesive. The wings are covered in the conventional manner, applying the adhesive to the extremities only. Separate pieces will be needed for the tips. The tail surfaces are covered in the same way.

If tissue is used many small pieces of paper will be needed to cover the fuselage but if you use Silkspan the fuselage may be covered in with only two pieces. When Silkspan is wet it may be moulded around compound curves with ease. Spray the covering with water and allow to dry. One or two clear coats of dope may now be brushed upon the covering.

Cement the stabilizer and then the rudder in their proper positions. Small strips of tissue may be doped over the joints to form small fillets. The wing is cemented in place very securely, using plenty of cement at the various joints.

Complete the construction by adding the various details. Thin strips of black tissue should be doped to the covering, representing the control surfaces. The insignia used on the original model was cut from colored tissue and then doped to the covering. Exhausts, tail wheel, painted wheel wells, radio mast and numerous other details should be added to enhance your Douglas 8A-5's appearance.

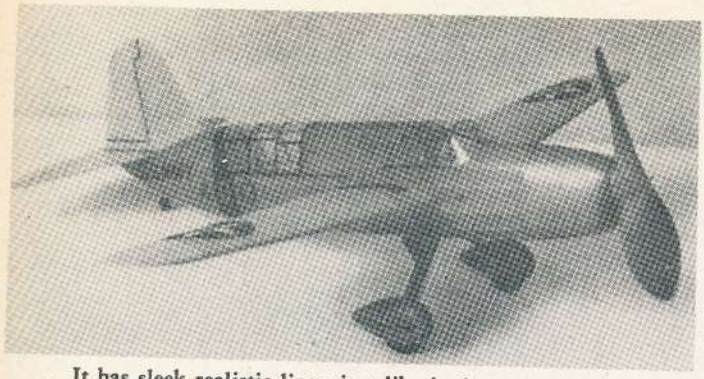
Flying

Six to eight strands of 1/8" flat brown contest rubber should be used to power your attack bomber, depending on the weight of your individual model.

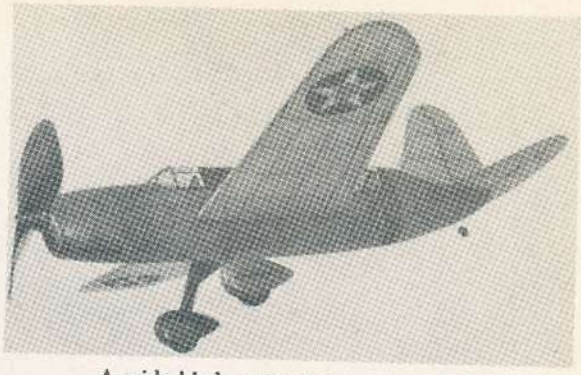
Give the propeller a few turns and hand launch the model over deep grass, if possible. A small lead weight in the cowl will conteract any stalling tendencies. Should your model be nose heavy add a small weight to the tail. Warping the tail surfaces is not advisable as they may change from flight to flight. Once balance is obtained, increase the turns gradually feeling out the characteristics of your own ship.

The original model balanced very neatly on its first test flight; the climb was fast and the glide was a real "floater" due to the large stabilizer.

Keep 'em flying!



It has sleek realistic lines, just like its large counterpart

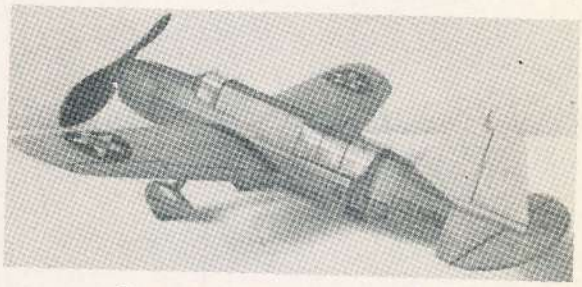


A wide blade prop gives plenty of climb

CURTISS SCOUT

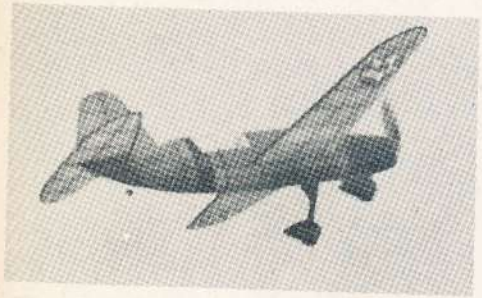
By EARL STAHL

Cockpits for pilot and observer are enclosed



Large tail surface gives steady flight

HERE IS a scout-observation plane, the U.S. Navy's trim little Curtiss SO3C-1. As such it is designed to perform the various duties required of planes operating from cruisers and battleships. It can be used either as a landplane or seaplane; its chief function, however, being that of a catapult launched seaplane.

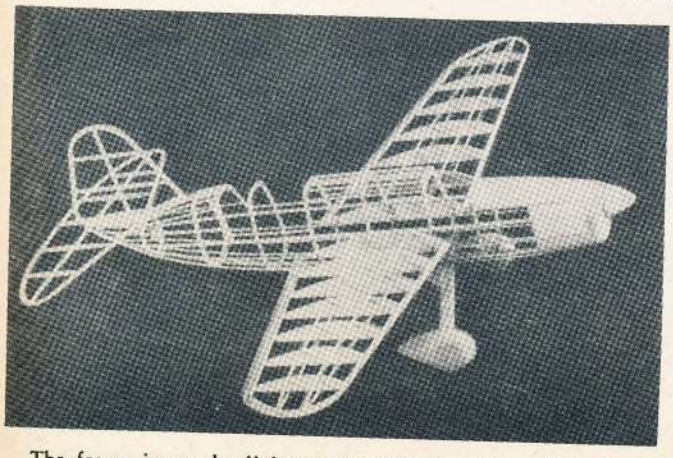


In full flight—most realistic

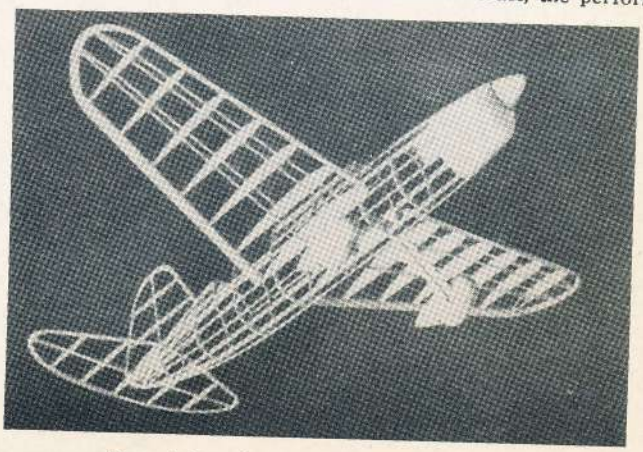
Frequently referred to as the "eyes of the fleet," it is the military mission of these ships to direct the fire of battleships' big guns and conduct long range scouting activities in search of enemy surface vessels and submarines. In addition to these tasks the "S-O" planes lay protective smoke screens around friendly naval craft and even engage in light bombing and fighting activities.

In design the SO3C-1 is a two-seater, mid-wing monoplane. An inverted, air-cooled Ranger 12 cylinder engine of 520 horsepower is installed. With the exception of the fabric covered tail surfaces, construction is all metal. As a landplane, the ship is equipped with a fully faired, non retractable landing gear; when being used as a catapult launched seaplane, a large single main float and two small wing tip floats are installed.

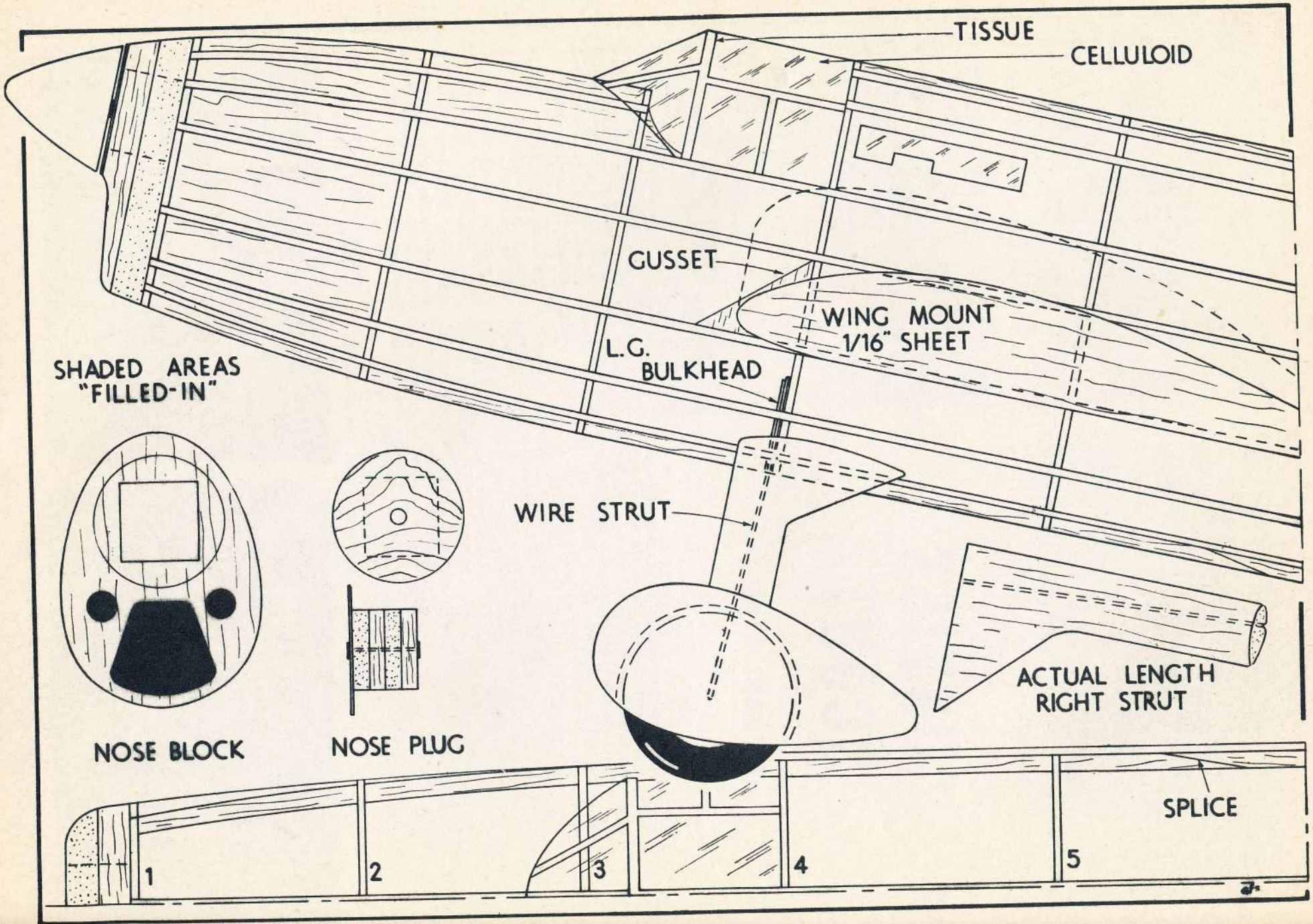
Compared with modern shore or aircraft carrier based aircraft, the perform-

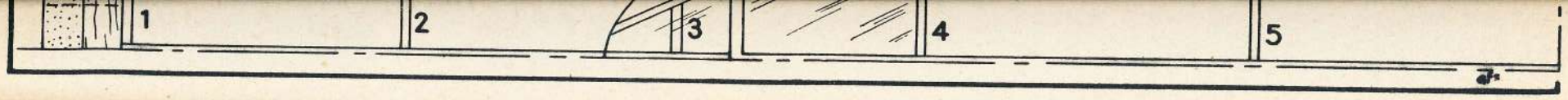


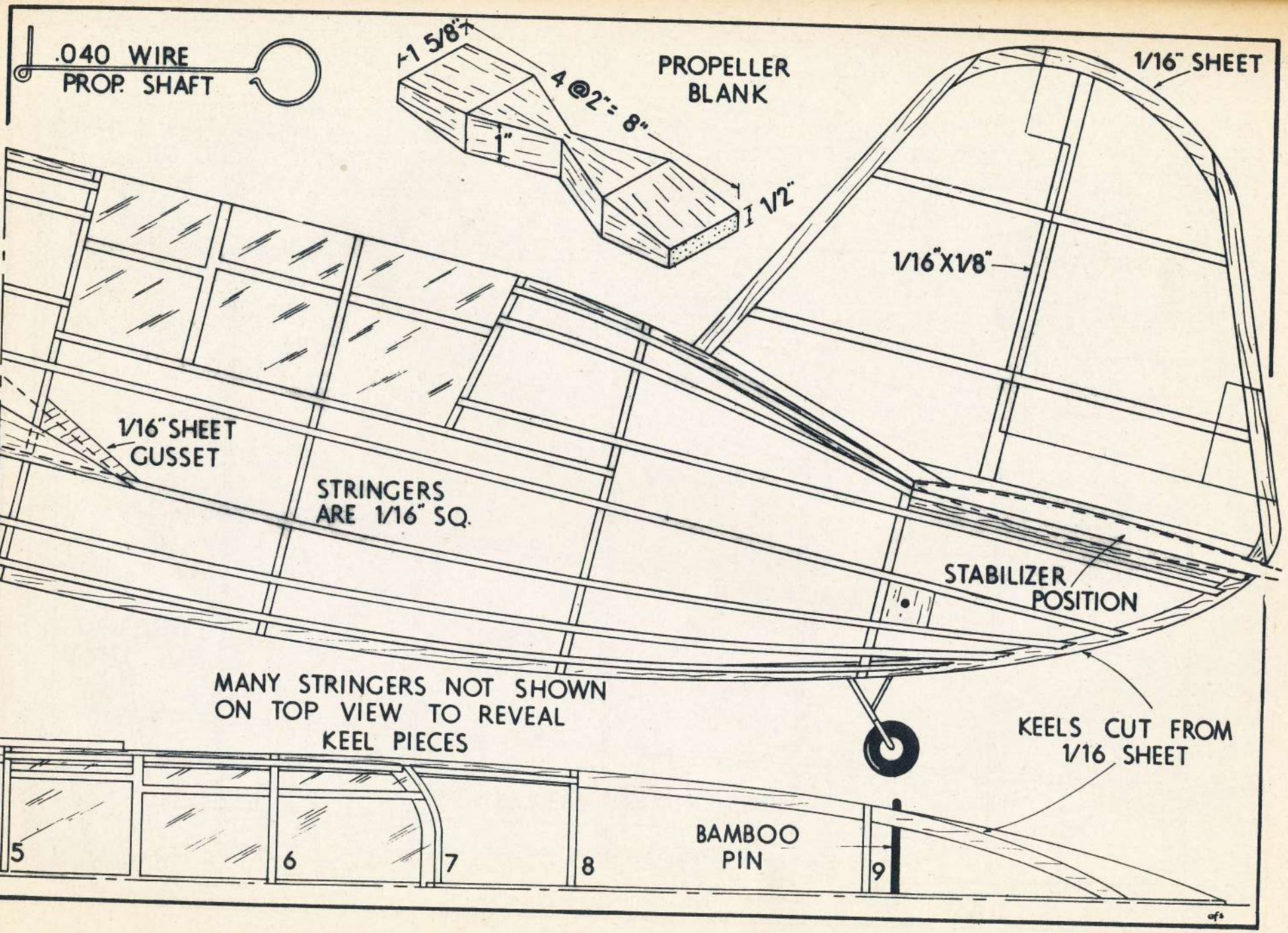
The frame is sturdy, light yet flexible, to withstand shocks

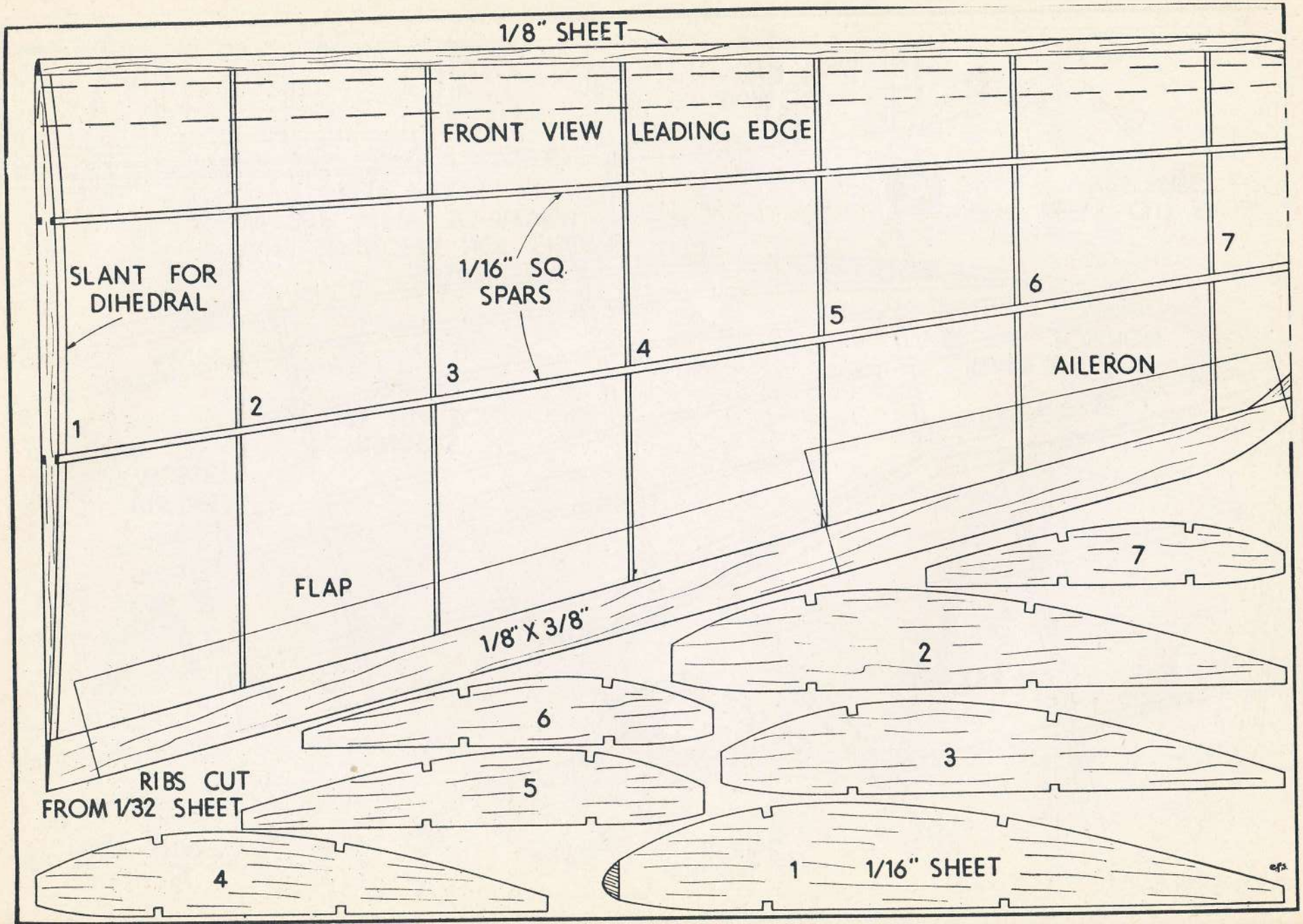


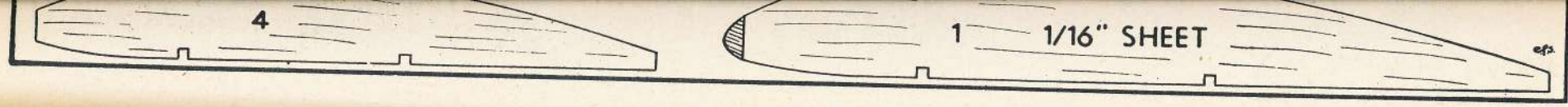
The reinforced nose helps to prevent damage

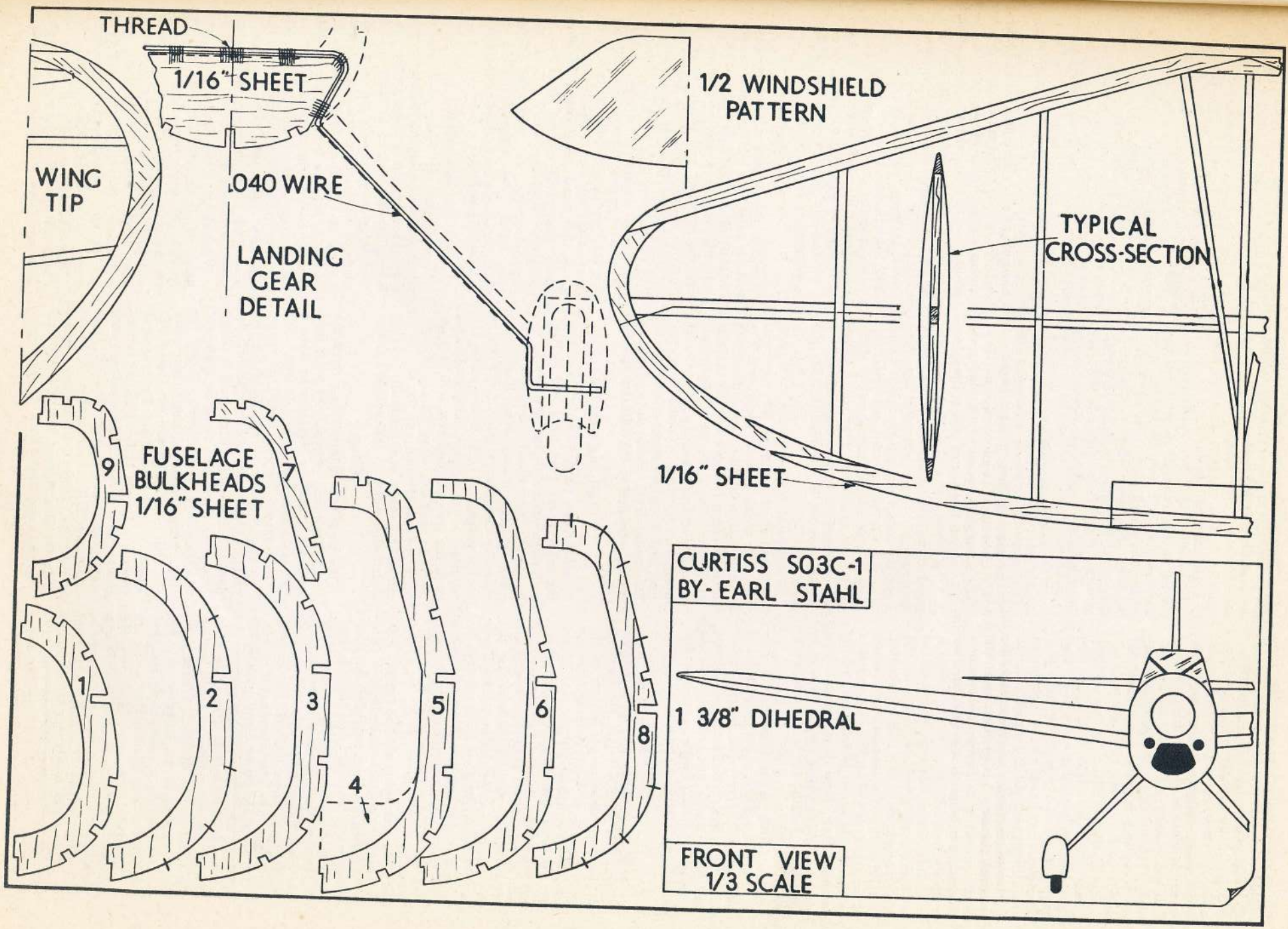

TISSUE
CELLULOID
GUSSET
WING MOUNT
1/16" SHEET
L.G.
BULKHEAD
SHADED AREAS
"FILLED-IN"
WIRE STRUT
ACTUAL LENGTH
RIGHT STRUT
NOSE BLOCK
NOSE PLUG
SPLICE
1
2
3
4
5


1
2
3
4
5


.040 WIRE
PROP. SHAFT
1 5/8"
4 @ 2" = 8"
1"
1 1/2"
PROPELLER
BLANK
1/16" SHEET
1/16"X1/8"
1/16" SHEET
GUSSET
STRINGERS
ARE 1/16" SQ.
STABILIZER
POSITION
MANY STRINGERS NOT SHOWN
ON TOP VIEW TO REVEAL
KEEL PIECES
KEELS CUT FROM
1/16 SHEET
5
6
7
8
BAMBOO
PIN
9


1/8" SHEET
FRONT VIEW LEADING EDGE
SLANT FOR DIHEDRAL
1/16" SQ. SPARS
1
2
3
4
5
6
7
AILERON
FLAP
1/8" X 3/8"
RIBS CUT FROM 1/32 SHEET
7
2
6
3
5
4
1
1/16" SHEET


4
1
1/16" SHEET


THREAD
1/16" SHEET
WING TIP
.040 WIRE
LANDING GEAR DETAIL
1/2 WINDSHIELD PATTERN
TYPICAL CROSS-SECTION
1/16" SHEET
FUSELAGE BULKHEADS 1/16" SHEET
9
7
1
2
3
4
5
6
8
CURTISS SO3C-1
BY- EARL STAHL
1 3/8" DIHEDRAL
FRONT VIEW
1/3 SCALE

ance is not startling; nevertheless it is considerably improved over that of the old Vought "Corsairs" and Curtiss "Seagulls" (SOC-1) formerly assigned to this task. Top speed is in the neighborhood of 200 m.p.h. while cruising speed is 146 m.p.h. Specially designed slots and flaps keep the landing speed at less than 60 m.p.h. The fuel load of 199 gallons should give a cruising range of more than 1,000 miles.

The Curtiss SO3C-1 is not heavily armed. An electrically controlled machine gun is located in each wing half just outboard of the propeller arc. The observer is provided with a single gun which is exposed when the panels to the rear of his cockpit are lowered. Racks for small bombs may be installed under the wings and when being flown as a landplane, a small torpedo may be carried beneath the belly.

Because of its ideal proportions and relatively simple structure, the SO3C-1 is readily adaptable for a flying scale model. Our little ship is a faithful reproduction of the prototype and for that reason makes an interesting model to build and fly. If carefully built from the accompanying plans, this little naval scout will take to the air as readily as "a duck takes to water."

Construction of the model is not difficult; before work is started, the pages of plans should be properly joined. Select all balsa wood carefully so the structure will be as strong and light as possible. Cement all joints firmly checking frequently for correct alignment.

Fuselage

The keel and bulkhead method of construction is employed for the fuselage. Exact size bulkheads are shown on the plan; two of each are required (except No. 5 of which four are needed). They are cut from medium grade 1/16" sheet. Cut only those notches indicated; others will be cut later as required. Four keels are necessary: the top, bottom and the two side ones. The side keels are clearly shown and shape of others is obtained by tracing the top and bottom outlines of the side view—average depth is about 5/64" and they too are cut from medium 1/16" sheet.

To begin assembly pin the top and bottom keels to position over the side view. Next cement half the bulkheads to place in a vertical position. Add the side keel and check for correct alignment. When dry, remove from the plan and add the remaining bulkheads and side keel to their respective positions. Check and recheck the structure to be certain that it is true.

Stringers are rather hard grade 1/16" square stock. Attach those nearest the side keels first; add a stringer to each side at the same time to avoid pulling the structure out of line. Where there are no notches in the stringers, they are easily cut using a razor blade that has been broken to a sharp sliver.

"Filling-in" the nose adds to the strength and attractiveness. The area shown lightly shaded on the plan is to be fitted with individual pieces of soft 1/16" or 3/32" balsa neatly cut to fit snugly between the stringers and bulkheads. Cement two pieces of 1/4" sheet together for the nose block; cut to outline shape and remove the square section into which the nose plug fits. Roughly cut to shape and then cement the nose block to bulkhead No. 1. Cut and sand the entire nose to a smooth, accurate shape.

As shown, 1/16" sheet gussets are cemented to the fuselage to reinforce the wing mount. Cut two rib shaped wing mounts from hard 1/16" sheet and cement them to place with their base exactly parallel to the stringer; cement very firmly. The 3/32" thick blocks in the rear which hold the bamboo pin can be added also.

Landing Gear

To prevent damage to the model the landing gear must be able to absorb all shock encountered in normal flying. First make a complete pattern of the wire strut, then bend to shape from .040 music wire. A 1/16" sheet former is made, as indicated in the landing gear detail; it should fit snugly within the wire strut top. Cement the former to bulkhead No. 4 and then slip the wire over it and attach by sewing with needle and thread. Make the fairing struts from 3/16" sheet. They are of streamline cross section and have a shallow groove in the back to hide the wire strut.

Wheel pants and wheels are made from laminated sheet. Remove the centers of the inside pieces to admit the wheels. Cement the parts together and then cut to shape; looking from the top the shape is streamline. Sand the pants thoroughly and apply several coats of dope for a nice finish. Each wheel is made from two discs of 1/8" balsa cemented cross-grain. The fairing struts, wheels and wheel pants are not attached to the wire struts until later.

Tail Surfaces

Tail surfaces constructed in the following manner are both light and strong; both rudder and stabilizer are made similarly. Working directly over the plans, make complete frames using hard 1/16" sheet for the outlines, 1/16" x 1/8" strips for the spars, and 1/16" square pieces for the ribs. When dry, lift these flat frames from the plan and add soft 1/16" square pieces to each side of each rib. To complete the construction cut the ribs to a streamline shape and finish the leading and trailing edges to the indicated shape.

Wing

The wing is of multiple spar construction. Since only one half the wing plan is shown, it will be necessary to make a full scale drawing of the left wing. All ribs except No. 1 are cut from 1/32" sheet; two of each are required. Sand the ribs smooth and then accurately cut the notches. The leading edge shape is shown in broken lines over the wing plan—cut two from 1/8" hard sheet. Taper the trailing edges before pinning to place over the plan. Wing tips are cut from 3/32" stock; the pieces should be assembled directly over the plan. Pin the various parts to their respective positions; then cement all joints firmly. The spars are hard grade 1/16" square strips. When the cement has hardened, lift the wing halves from the plan and cut and sand the leading edges and tips to their finished shape.

Propeller

The propeller blank is shown in perspective on the plan. Select a hard balsa block 8" x 1-5/8" x 1"; accurately cut the blank to indicated shape. Drill the tiny hole for the shaft and then start to carve a right hand propeller. Finish the back surface of the blades first; a bit of undercamber should be sanded in each blade. Cut away the front face until the blades are of the desired thickness. Shape the blade outline similar to that in the photos. Sand with rough and then fine sandpaper until the blades are perfectly smooth and in balance. Carve the spinner in two parts from soft balsa and then cement to the hub sides.

Nose plug details are given. The front disc is cut from 1/32" birch plywood while the rear portion is laminated squares of 1/8" sheet. The plug fits neatly to the nose block. Cement washers to the front and rear of the plug to fix the line of thrust.

Bend the prop shaft from .040 music wire. Slip the nose plug, several washers and the propeller on the shaft in the order given. Bend the shaft front end to suit the free-wheel gadget being used. A loop in the end into which a winder hook can be attached is recommended.

Covering

Prepare the frames for covering by working over the entire structure with fine sandpaper. The author likes to sand the bulkheads to a scalloped shape so only the stringers will touch the covering; this aids in making a better job. Regular colored tissue is used and thin dope or banana oil is used for adhesive. Use a separate piece of tissue for each side of wing halves, rudder and stabilizer tips, etc., require individual pieces. When covering the fuselage it will be necessary to use numerous small pieces to work around the curves without wrinkles: lay the pieces of tissue neatly. Cover the balsa nose, etc., too. Spray the covered parts lightly with water to tighten the tissue but do not apply dope until the ship has been assembled.

Assembly

Your model is now ready to be assembled; let's complete the landing gear first. Flow cement into the groove in the fairing struts and then fit them over the landing gear wires—do not attach the struts to the fuselage structure, however. A strip of silk cloth over the strut and wire will keep it from becoming loose. Next cover the struts with tissue to match the fuselage. Cement washers to the sides of the wheels before coloring the centers and tires. Place the wheels within the pants and slip both on the axle; attach firmly with cement.

Windshields come next. Obtain very light celluloid, especially for the rear cockpit. No frame other than that shown on the plan is needed; simply form the culluloid by rolling between the fingers then neatly attach with cement. From windshield pattern is given. Structure of the real plane's windows is represented by tissue strips doped to place.

Since the plans were drawn, it was found that for best flight performance the stabilizer front should be lowered 1/32

to give it a slight negative angle. Cement both stabilizer and rudder to place; offset the rudder a bit for a right turn in the glide. Check the tail surfaces for correct alignment. Small tissue fillets neatly doped to place will improve the model's appearance.

Scrape all tissue away from the wing mounts before cementing the wings fast; use plenty of cement. Make the incidence of each wing exactly as shown. Wing tips are elevated so the dihedral at each tip will be 1-3/8".

Addition of the various minor details completes the construction. One or two coats of thin dope should now be brushed on the whole model; if a bit of colored dope is added to the clear liquid, it will make a better job. Of course the propeller, wheel pants, etc., must be color doped; use several coats with light sanding between each for the best job. The stars, U.S. Navy and other details are made from colored tissue. Ailerons, flaps, elevators and such details are represented by thin strips of black tissue neatly doped to the covering. Add a tail wheel, cowl details, antenna and similar items to suit your ability and ambition and your SO3C-1 is completed.

Flying

Depending on the model's weight, eight strands of 1/8" rubber or six strands of 3/16" rubber will be required for power. Lubricate the strands, hook them to the prop shaft and then drop the other end through the fuselage. As shown, a bamboo pin holds the motor in the rear. If necessary, remove a small portion of the covering to aid in getting the motor in place. Incidentally, small slits should be cut in the fuselage covering at the point of landing gear attachment so the struts can spring backward without damaging the covering.

In all probability your Curtiss will need a small corrective weight in the nose or tail to bring the model into balance; our own ship needed a tiny piece of lead in the nose. Make first flights over a grassy field to prevent damage while necessary adjustments are being made. First adjustments should favor the glide, then offset the thrust line to correct the power flight. A sliver of wood at the top of the nose plug, tilting the thrust line down, will in all probability "iron out" a stall, while right or left thrust, as needed, will control the amount of circle. Gradually increase the number of turns as flights improve. Stretch the rubber motor two to three times normal length for best flights.

Our test plane proved to be a realistic performer. However, like most models of combat planes, it is sensitive to all adjustments which therefore must be made with care. The model pictured climbs in a large left circle at a steep angle and fast rate of speed—it really seems to inherit some of the real plane's "zip." In the glide it descends in easy right circles. After many flights our Curtiss SO3C-1 remains undamaged except for a few patches in the covering. Many happy landings with your little naval scout!

PROPS— TUBULAR METHOD

A novel but accurate way to make propellers

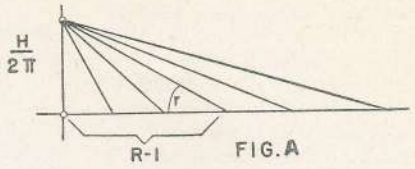


FIG. A

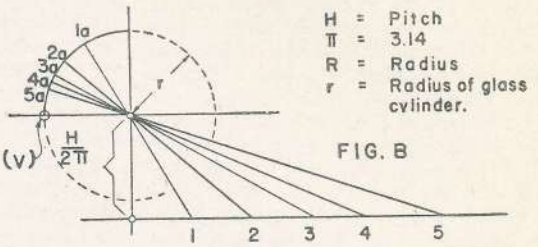


FIG. B

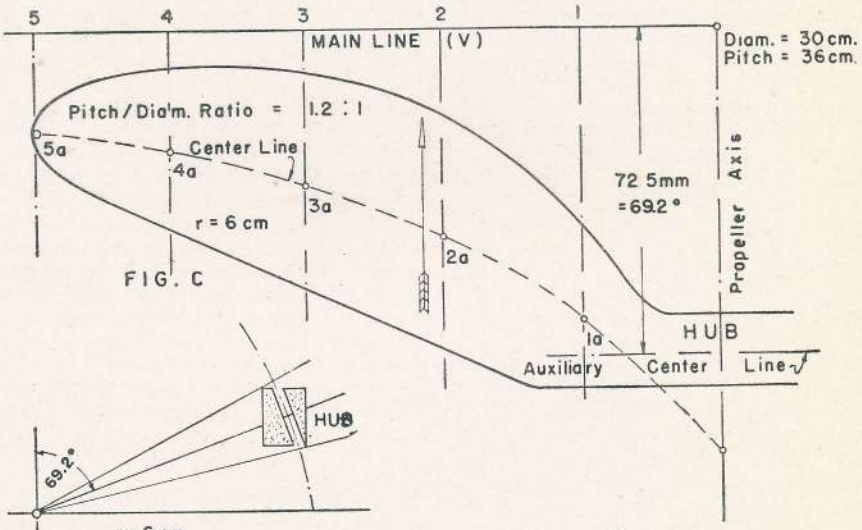


FIG. C

FIG. D

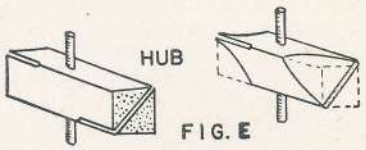


FIG. E

THIS tubular method of making propellers is the result of many experiments; found to be most accurate. Due to its simplicity as well as uniqueness, it will provide many interesting and instructive moments.

Figure A is a familiar sight to every modeler who has ever built his own propellers; it shows the correct angles of the blade at various stations. With a given diameter-pitch ratio the vertical line has a length of $\frac{\text{pitch}}{2.\pi}$ while the horizontal line has the length of one blade.

In Fig. B we have a similar scheme, but this time suitably arranged for a cylindrical propeller. The circle (cylinder seen from above) has a given diameter of 12 cm in this case—but of course any other may be chosen. (Inches equal $\frac{\text{cm.}}{2.54}$ The drawing is self-explanatory.

The distances from the vertical "V" to the stations 5a-1a, which can either be measured with a compass or a flexible scale, are shown in Fig. C, as the *centerline* of our new blade. The outlines of the blade, as shown in the sketches, have been found by experiment and are correct in every respect, so that copying or drawing to scale will save effort.

The method of finishing the outline near the propeller axis is done somewhat by the old "cut and try" method, but it is very important to fix the *centerline* of the inner end of the blade, which will be cemented into the hub later. This auxiliary centerline is important because it is the only means of calculating the correct angle of the slots of the hub, which give the required pitch to the blades. The angle in question is found as follows:

Divide the distance of the auxiliary centerline to the main line, V, by the radius of the cylinder and multiply the result by 57.3. For actual construction take a cylinder of glass (12 cm in this case) and cover it with three or four sheets of thin plywood or perhaps balsa (0.6 mm), with a thick layer of cement between each sheet and the grain running up and down only (don't cross-grain!). Wind the wet tube tightly with rubber bands and allow some 24 hours or more for drying. After the cylinder is thoroughly dry draw some vertical lines on the wooden cylinder, lines which must be absolutely parallel to the longitudinal axis of the glass cylinder—otherwise the pitch will be incorrect.

Now make a suitable copy of the drawing in Fig. C on transparent paper with outlines, hub end and auxiliary *main line*, and transfer it to the wooden cylinder, using the auxiliary main line as a guide for coincidence with the vertical lines on the cylinder. When transferring the drawing to the cylinder keep in mind that the curved part of the blade forms the leading edge! You get left or right-handed propellers by merely reversing the drawing.

After drawings have been transferred, slide the wooden cylinder off the glass, cut out the blades and round off the leading edge, and taper the blade to the trailing edge. The blades can now be cemented to the hub, which consists of a quadrangle block of hardwood or hard balsa. The hold for the propeller shaft must be drilled in, as well as slots for the blades; a job that must be done with great care and accuracy. Check several times, while the cement is setting, by letting the prop spin.

The blades having been cemented firmly into the slots, you now sand down the excess wood of the hub so that it gives a fillet effect. Now dope the whole thing several times, with intermediate sandings and your queer-looking but very efficient propeller is ready for testing.

PILOT THIS MODEL HAWK P-40D

by **EARL STAHL**

THIS IS the famous Curtiss "Hawk" P-40D, which, with its counterpart, the British "Kittyhawk," are versions of the well known P-40 of the Army Air Forces and the "Tomahawk" of the Royal Air Force. They are speedier, with improved all-around performance, greatly increased firing power and more protective armor.

The maximum speed of the Allison powered version compares with the "Spitfire's" 367 mph. A similar but later model, the P-40F, with an American made Rolls Royce "Merlin" engine is even faster.

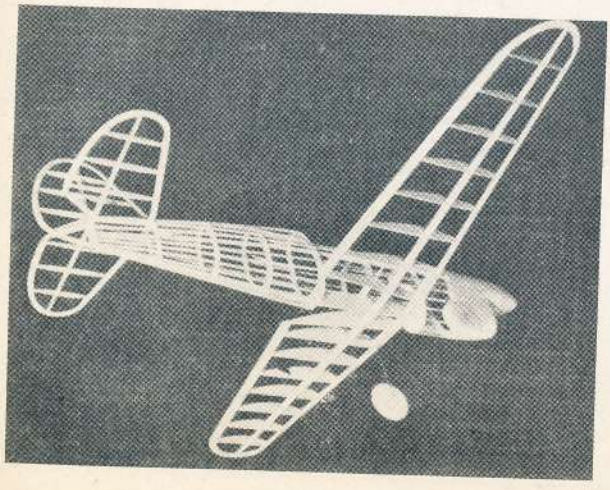
Every flying scale builder will want for his fleet a replica of this famous fighter which has the same fine characteristics as the real ship. Its appearance is unequalled, the construction easy and in performance compares favorably with any similar ship—a picture on display or in flight. Standard construction methods are used throughout, nevertheless, it is advisable to study the plans and instructions thoroughly before building.

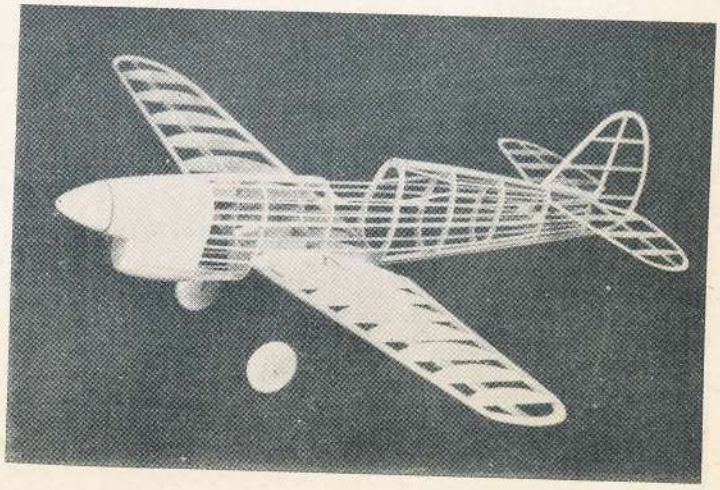
(Above) The model in action gives many thrills; an actual flight picture

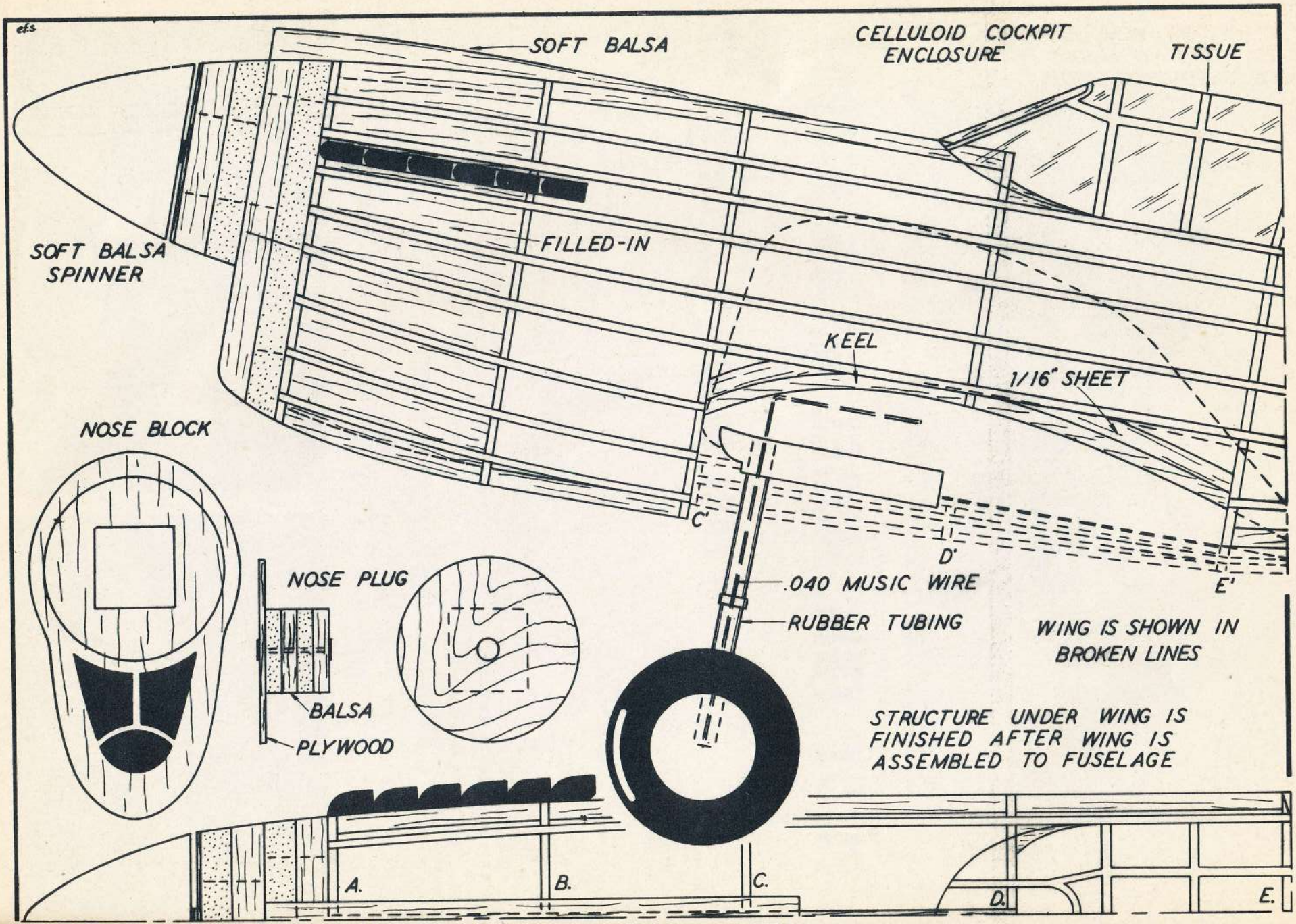
(Below) The frame—simple light and strong—ready for the covering

CONSTRUCTION—Use of keels, cut from sheet balsa, simplifies assembly of the fuselage and aids in making the structure more accurate. Trace the top, bottom and two side keels on 1/16" sheet balsa and then with a sharp razor blade cut them out. The section between D and E has no support at the top (cockpit opening) but a curved piece conforming to the wing upper surface is placed at the bottom as indicated. Bulkheads also are cut from 1/16" sheet and two of each are required. Notice that not all bulkheads have notches for stringers; cut out the notches shown and mark the positions of others which are cut later as needed.

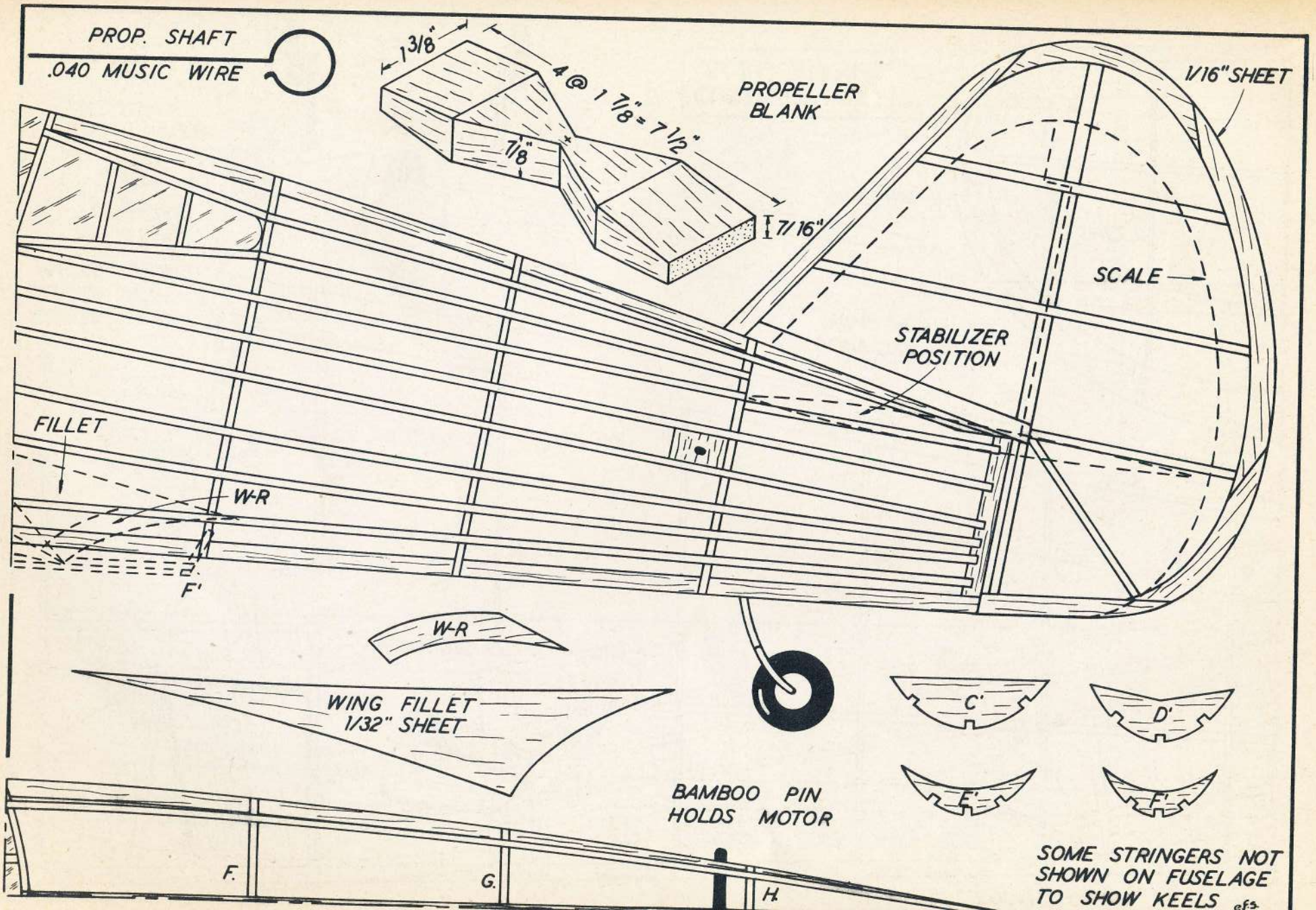
Pin the keel pieces over the fuselage plan to begin actual assembly. Cement half of the bulkheads to their respective positions, aligning them so they are exactly perpendicular to the keels. Attach a side keel and, when the cement has hardened, remove this frame from the plan and add the remaining bulkheads and keel. Stringers are medium

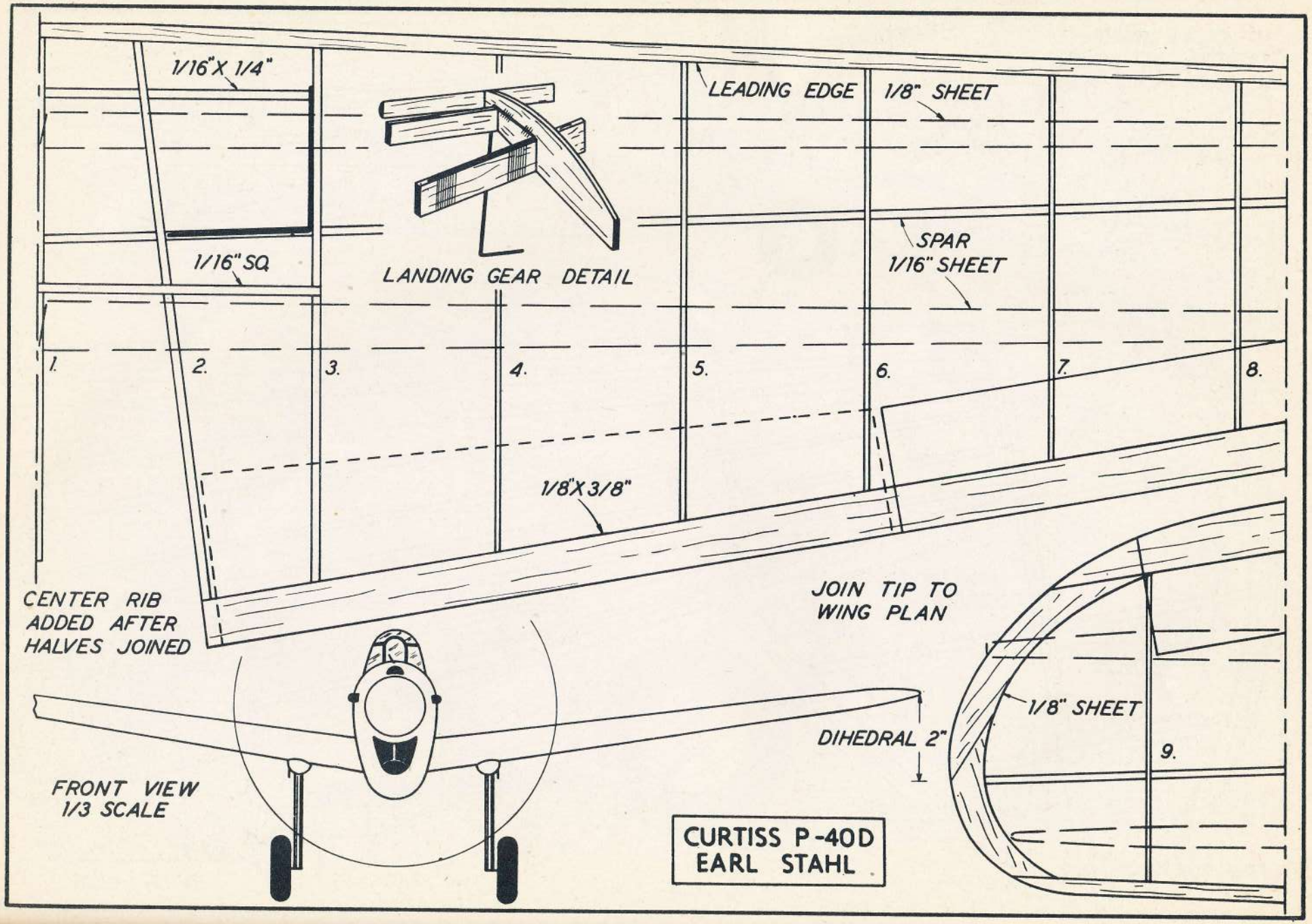




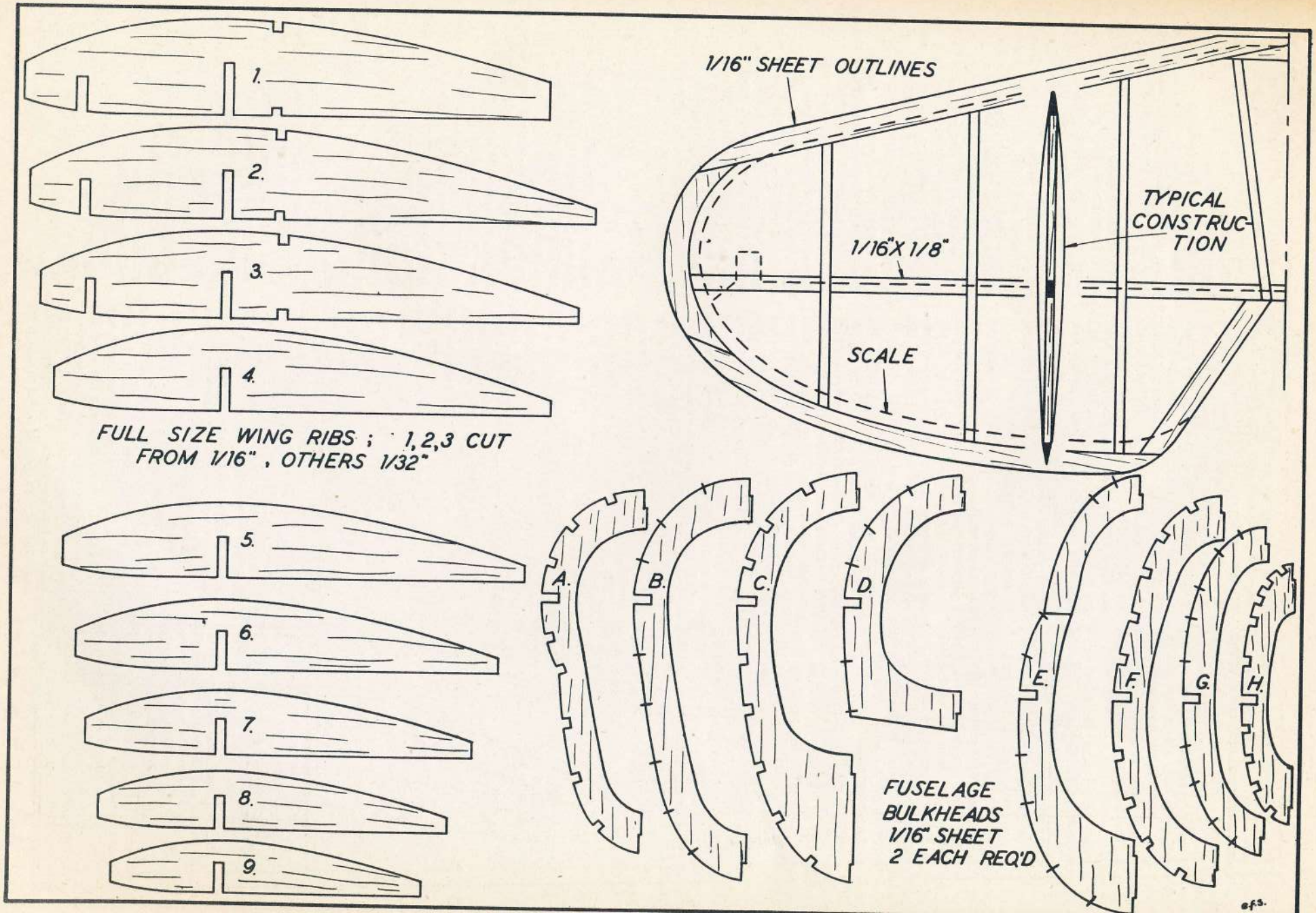

SOFT BALSA
CELLULOID COCKPIT ENCLOSURE
TISSUE
SOFT BALSA SPINNER
FILLED-IN
KEEL
1/16" SHEET
NOSE BLOCK
C'
D'
E'
.040 MUSIC WIRE
RUBBER TUBING
WING IS SHOWN IN BROKEN LINES
NOSE PLUG
BALSA
PLYWOOD
STRUCTURE UNDER WING IS FINISHED AFTER WING IS ASSEMBLED TO FUSELAGE
A.
B.
C.
D.
E.


A.
B.
C.
D.
E.


PROP. SHAFT
.040 MUSIC WIRE
1 3/8"
4 @ 1 7/8" = 7 1/2"
7/8"
7/16"
PROPELLER BLANK
1/16" SHEET
SCALE
STABILIZER POSITION
FILLET
W-R
F'
W-R
WING FILLET
1/32" SHEET
C'
D'
E'
F'
BAMBOO PIN
HOLDS MOTOR
F.
G.
H.
SOME STRINGERS NOT SHOWN ON FUSELAGE TO SHOW KEELS


1/16"X 1/4"
LEADING EDGE
1/8" SHEET
SPAR
1/16" SHEET
1/16" SQ.
LANDING GEAR DETAIL
1.
2.
3.
4.
5.
6.
7.
8.
1/8"X 3/8"
CENTER RIB
ADDED AFTER
HALVES JOINED
JOIN TIP TO
WING PLAN
1/8" SHEET
9.
DIHEDRAL 2"
FRONT VIEW
1/3 SCALE
CURTISS P-40D
EARL STAHL

CURTISS P-40D
EARL STAHL



grade 1/16" sq. strips. Using a razor blade that has been broken to a sharp point, cut the necessary notches for stringers as the work progresses. Once a stringer has been attached to one side, always place one in the corresponding position of the other side to avoid pulling the body out of line. Pieces of hard 1/16" sheet cemented between the stringers provide the anchorage for the bamboo pin that holds the rubber motor in the rear.

As indicated on the plan, the front portion of the fuselage is filled-in with pieces of very soft 1/16" sheet. Individual pieces of balsa are cut so as to fit snugly within the space between the bulkheads and stringers. The extreme front of the nose is shaped from four pieces of 1/4" laminated sheet balsa. Broken lines indicate how the nose is hollowed to receive the nose plug and for lightness. Cement the nose block to the front bulkhead and, when dry, cut and sand the entire fuselage front to a smooth, accurate shape. Where the wing fits in, curved 1/16" thick pieces are cut to fit exactly to the airfoil shape.

It is necessary for the wing to be of strong construction since the landing gear is attached to it. It will be necessary to make a drawing of the left wing so both halves can be assembled directly over full-size plans. Ribs 1, 2, and 3 are cut from 1/16" sheet while the others are 1/32" sheet. Sand them carefully to exact shape and size and cut the notches for spars. Spars and leading edge are cut from sheet stock as indicated and the trailing edge is a tapered 1/8" x 3/8" strip. Tips cut from 1/8" sheet are assembled over the plans. Use pins to hold the various pieces in place until the cement has set. Join the wing halves with 2" dihedral at each tip; then add the single center rib and the several short 1/16" sq. spars. Next attach the 1/4" deep landing gear spar and reinforce the joint necessitated by the dihedral angle. Finish the wing by cutting and sanding edges and tips to conform to airfoil shape.

The landing gear struts are fashioned from .040 music wire. The wire is bent in such a manner as to join the spars and rib 3 as detailed on the drawings. Be sure to make a right and left strut. With thread bind the struts to the spars and then use a needle and sew right through rib 3 and about the wire. Apply several coats of cement to the thread wrappings and adjacent areas. Incidentally, the rubber tubing covers are not slipped on the struts until the wing has been covered.

Using a sharp razor blade and sandpaper, wheels can easily be made from laminated discs of hard balsa. Washers or other bearings cemented to the sides will make them revolve freely and accurately.

Tail surfaces come next and both stabilizer and rudder are of similar construction. Make complete frames using 1/16" sheet outlines, 1/16" x 1/8" strips for spars, and 1/16" sq. pieces for ribs. When dry, remove these frames from the jigs and attach 1/16" sq. strips of soft balsa to each side of each rib. Ribs are later cut and sanded streamline and the leading and trailing edges are tapered to conform to the rib shape.

For best flight performance your "Hawk" must have an efficient propeller. Select a hard block and cut out the blank as shown. Drill a hole for the shaft, then start to cut away the back surface of the blades; a bit of undercamber is desirable. Now cut away the front of the blank until the blades are of the desired thickness. Round the tips and reduce the depth of the hub. Use rough and then fine sandpaper to finish the job and bring the blades into balance. Apply several coats of clear dope with light sanding between each to smooth and toughen the wood. Shape the spinner from a light grade balsa block, then notch it so it will fit neatly over the prop hub. Before the spinner is permanently attached, the free-wheel gadget should be considered and if none is being used, the propeller shaft must be securely anchored.

The removable nose plug is made of laminated squares of hard 1/8" sheet with a plywood disc at the front. Drill the hole so the thrust line will tilt slightly to the right for proper circle under power. Washers cemented to the front and back of the plug will fix the line of thrust.

COVERING AND ASSEMBLY—Do not be fooled by the pictures of the uncovered structure, the model is not assembled before covering. We always lightly fix the various units together for photographs, then take them apart again. First step in preparing for a neat job is to thoroughly sand the frames to remove all flaws and roughness. Since only those members of the fuselage that run from nose to tail should touch the covering, it is best to sand the bulkheads to a slightly scalloped shape; this can be done with a pencil or other round object covered with fine sandpaper.

Colored tissue is used for all covering and decorations. Dull brown or olive with light blue undersurfaces is the usual color of Army fighters. Cover the wing first, using light dope or banana oil to stick the tissue to the frames. Wings are covered from the second rib to the tips. Attach only the extremities of the areas being covered. Incidentally, tips and similar curved parts require separate pieces to help avoid wrinkles. Tail surfaces are covered in the same manner as the wing. Since the fuselage is of a rounded cross-section, it is best to use many small pieces of tissue to prevent unsightly wrinkles from spoiling the job. The cowling and similar wood parts are tissue covered too. Lightly spray all covered parts with water, then pin the wing and tail surfaces to a flat surface to keep them from warping. Clear dope is not applied to the covering until the model is assembled.

The author followed this procedure to assemble his P-40D: First the wing is secured to the fuselage; if the frames have been made with accuracy, this is easy for they will fit together exactly. Secure the wing's position with plenty of cement. The structure shown under the wing in broken lines is next made. Formers are cut from 1/16" sheet to the shape shown and stringers are 1/16" sq. medium stock. Wing root pieces W-R, also cut from 1/16" thick balsa, are fitted from the wing's trailing edge to the fuselage. Since each model will vary a bit, it may be necessary to change the length of these pieces—this is also true of the 1/32" sheet wing fillets. Finish the wing-to-fuselage and under-the-wing details by covering with colored tissue to match the other covered parts. To set the stabilizer in position, the rear of the fuselage must be cut and then recemented; be sure to note the slight negative angle of the stabilizer. When cementing the stabilizer fast, off-set it about 1/16" for a right turn. Tissue fillets between the tail surfaces will enhance the appearance. Moisten any wrinkles and permit to dry before applying a coat of clear dope to the entire model.

The numerous minor details are finished next. Rubber tubing of the correct diameter is slipped over the wire landing gear struts and then painted black. Paint the wheels before placing them on the axles; washers soldered to the ends hold them in place. Covers which hide the undercarriage, when retracted, are made from balsa scraps—check photos of the model and real plane for more details. The cockpit enclosure is made from thin celluloid. It is best to make paper patterns before cutting the celluloid and be sure to avoid cement smears when gluing to place. Frame details of the cockpit are represented by thin strips of colored tissue doped to place. The stars, U.S. ARMY and similar details are made from colored tissue and the effort required in making them will be amply repaid by the snappy appearance they add to the model. Control surface outlines are represented by thin strips of black tissue doped to the surfaces. Addition of the tail wheel, exhaust ports, radiator detail, wheel wells and numerous other items will aid greatly in making your model more attractive without harming the flying ability. Naturally the propeller, nose block and any other uncolored parts should be painted to match the models covering.

FLYING—Eight to ten strands of 1/8" brown rubber will be needed to power our model "Hawk." Lubricate the rubber strands and then wipe off the excess to prevent splashing the fuselage sides. Hook one end of the loop of strands to the propeller shaft and drop the other ends through the body. It may be necessary to remove a small portion of the covering in the rear to aid in fitting the bamboo pin into position to hold the strands.

If possible, test hop your little pursuit over a grassy field on a calm day to keep from damaging it before necessary adjustments can be made. It is important that the glide is reasonably good before any power flights are attempted so try a few shoulder-height glides, adding weight to the nose or tail to obtain the desired smooth, flat descent. A few turns on the rubber motor can be tried once the glide seems okay. Minor adjustments can be made by slightly warping a wing tip or the tail surfaces but correction for serious misadjustments should be made at the nose plug. By off-setting the thrust line to the right or left, size of circles under power can be controlled and slight down-thrust will iron-out a stall. Gradually increase the number of turns making any further adjustments. For maximum flight performance, stretch the rubber and store up power by using a mechanical winder.

Exercise your best judgment in the building and flying of your "Hawk" P-40D and you will be rewarded with an attractive, fine performing model. Many hours of enjoyment are in store once the plane is completed.

Complete instructions and plans to build and fly the Taylorcraft U. S. Army cooperation plane

HEDGEHOP WITH THE "GRASSHOPPER"

by **EARL STAHL**

ONE of the big surprises of this war has been the tremendous success of the "Grasshopper Fleet", thousands of familiar light planes formerly flown by operators from every airport in the nation. The "Grasshoppers" first proved their worth during war games held in several states prior to Pearl Harbor.

Operating under simulated war conditions, the "grasshopper fleet" proved that lightplanes are indispensable in modern warfare. Flown by civilian pilots, these planes proved their adaptability for all kinds of observation work, personnel carrying, directing traffic and troop movements, even picking-up and delivering messages, maps, and materials in flight.

To further prove their value the "grasshoppers" repeatedly flew from seemingly impossible areas. In Louisiana army engineers prepared landing spots measuring a mere 400 ft. long and 100 ft. wide—and without considering wind direction. Obviously larger, faster planes could not use such bases, but these lightplanes in hands of skilled pilots made numerous takeoffs and landings. It was all in a day's work for pilots to land on highways, sometimes in open spaces between moving convoys, to complete a mission or possibly borrow a few gallons of gas. During maneuvers in Texas one pilot made several landings on the up-slope of a high mountain, then taxied around the gravel ledge rim, and took off on the down-slope.

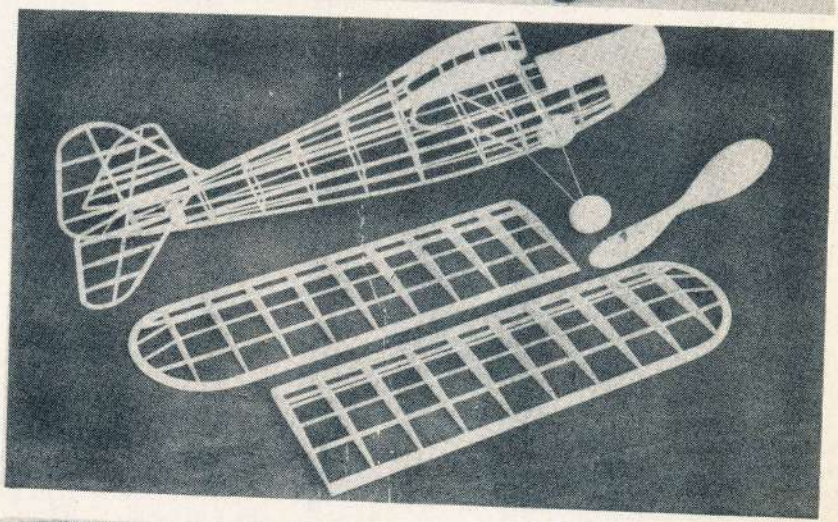
"Grasshoppers" used in the war games were identical with ships available to civilians, all being converted tandem trainers powered by Continental 65 hp. engines. The only important additions were radio transmitters and receivers.

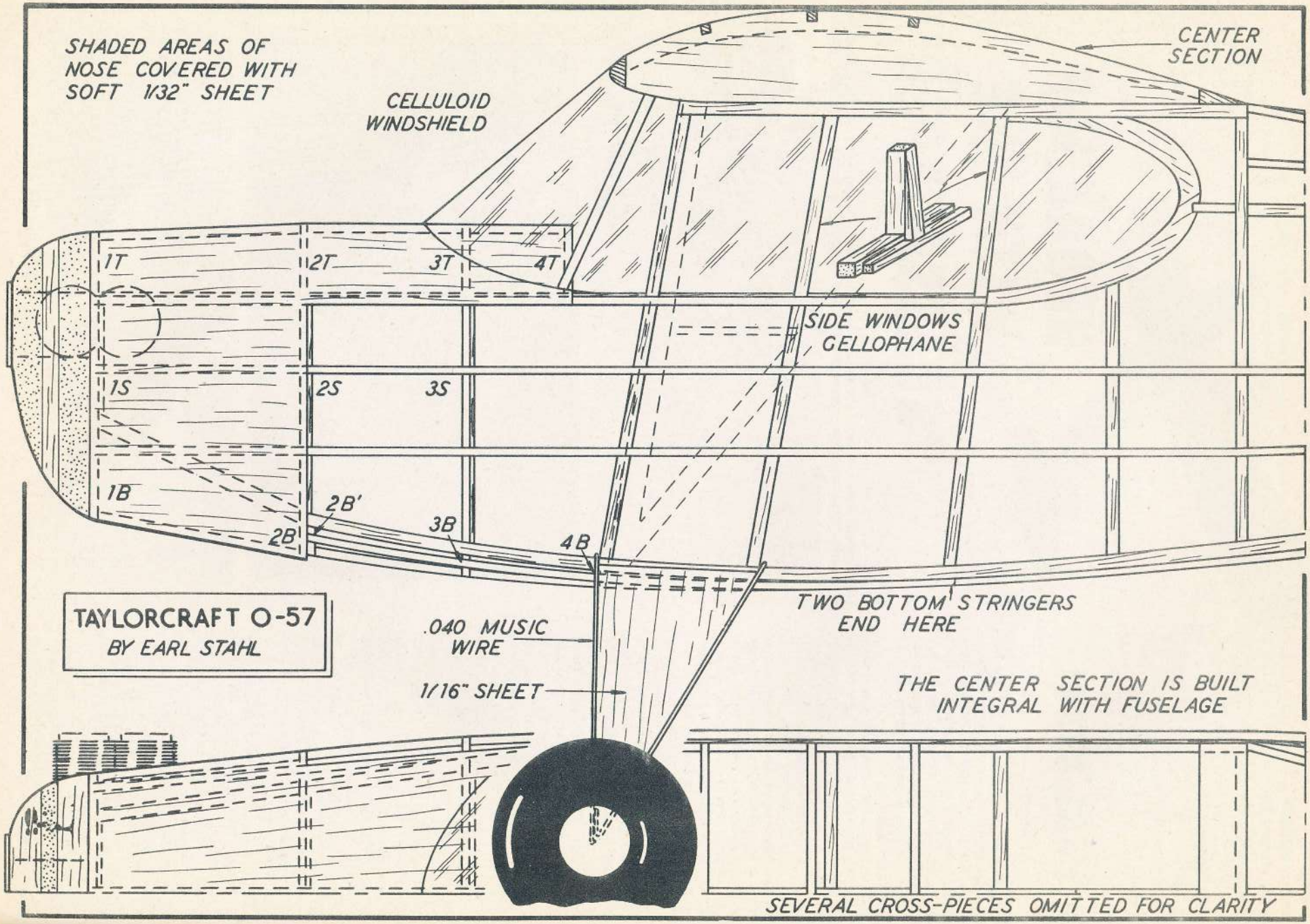
But now there are no more "war games," only total, all-out offensive on every front aimed to smash the Axis. And the Grasshoppers are doing their share of the smashing.

For our model we have selected the Taylorcraft trainer, known in the Army as the 0-57. This plane is similar in appearance, construction and performance to other tandem trainers on the market. Available with Continental, Lycoming or Franklin engines of 65 hp., the commercial version performs as follows: Top speed, 102 m.p.h.; landing speed, 35 m.p.h.; climb 600 ft. per min.; cruising range, 300 miles on 14 gallons of fuel.

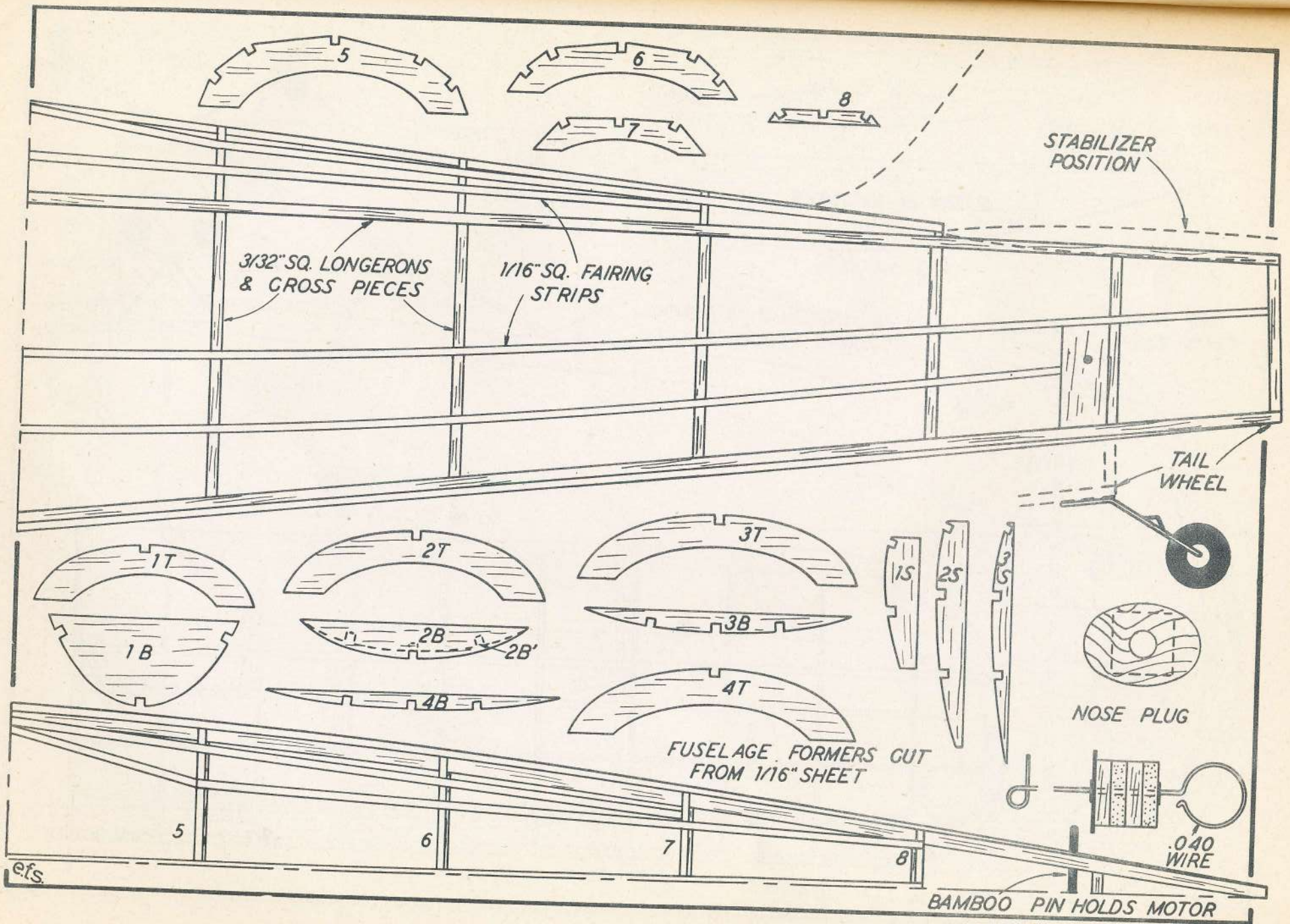
The model has the same fine characteristics as the real ship: construction is easy and flight performance is matched only by attractiveness.

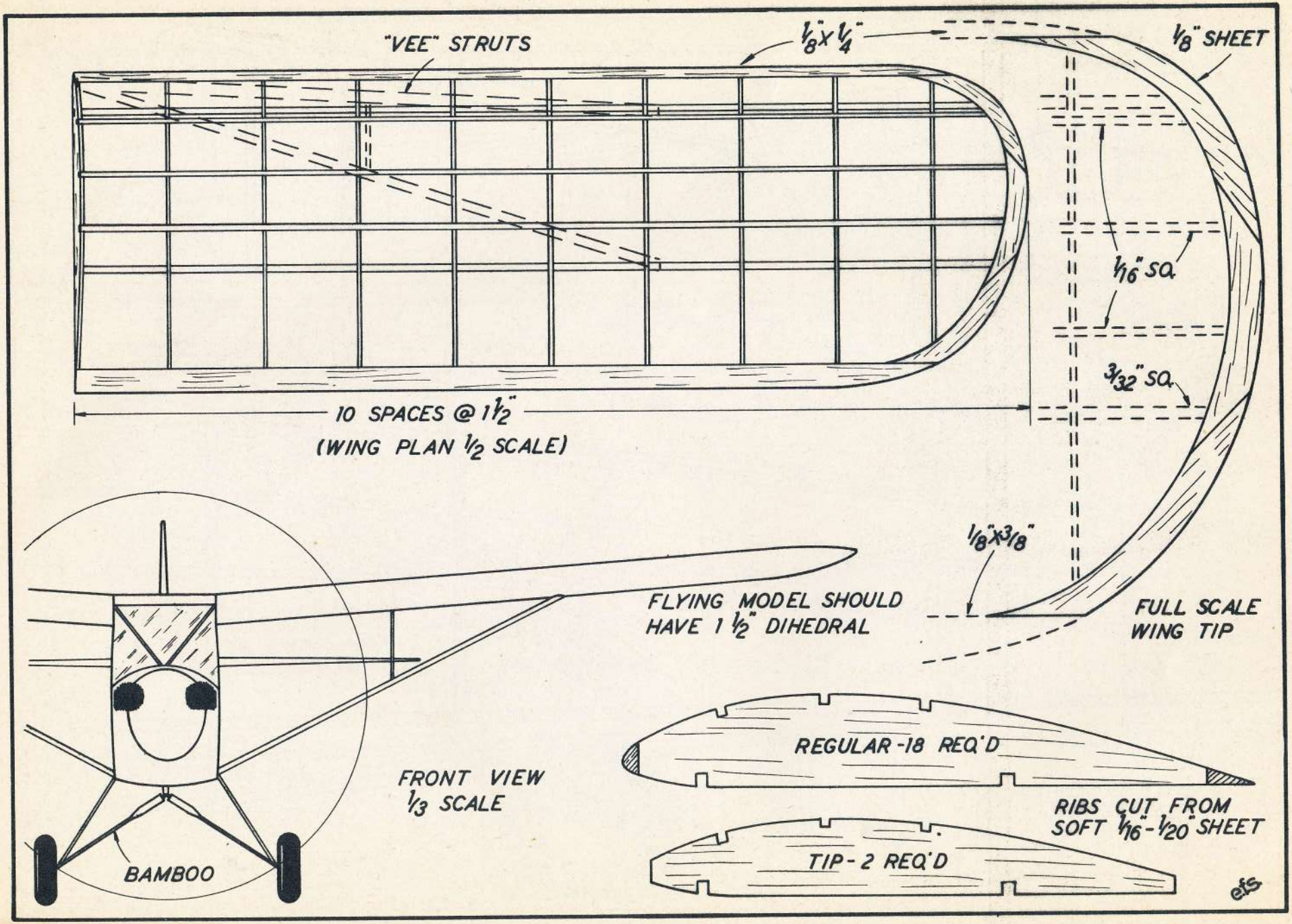
A small scale replica of the Army's latest airplane. Parasol wing and long fuselage make it an excellent contest model. The structure is simple, light and strong

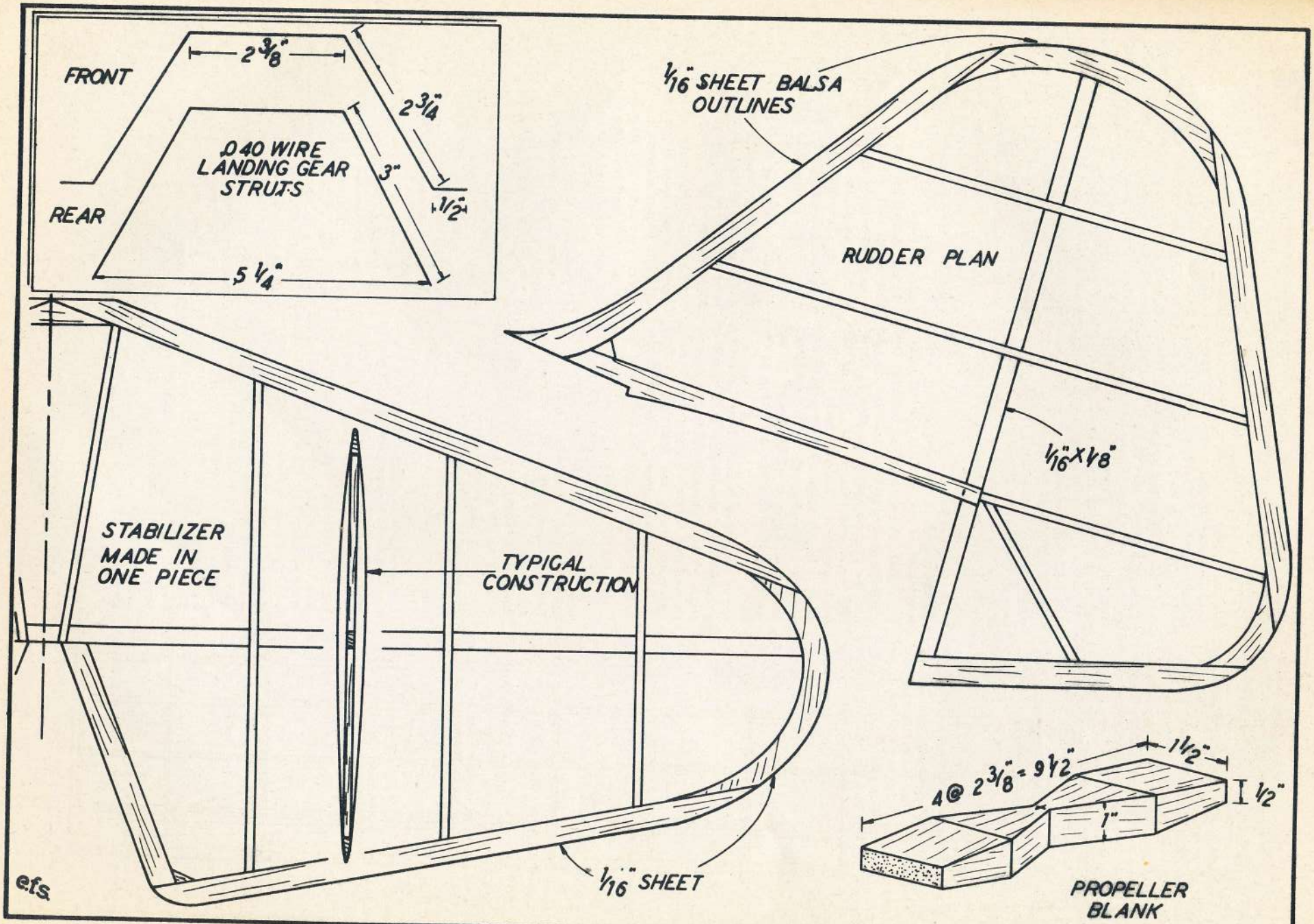



SHADED AREAS OF NOSE COVERED WITH SOFT 1/32" SHEET
CELLULOID WINDSHIELD
CENTER SECTION
1T
2T
3T
4T
SIDE WINDOWS CELLOPHANE
1S
2S
3S
1B
2B'
2B
3B
4B
TAYLORCRAFT O-57
BY EARL STAHL
.040 MUSIC WIRE
1/16" SHEET
TWO BOTTOM STRINGERS END HERE
THE CENTER SECTION IS BUILT INTEGRAL WITH FUSELAGE
SEVERAL CROSS-PIECES OMITTED FOR CLARITY


SEVERAL CROSS-PIECES OMITTED FOR CLARITY


5
6
7
8
STABILIZER POSITION
3/32" SQ. LONGERONS & CROSS PIECES
1/16" SQ. FAIRING STRIPS
TAIL WHEEL
1T
1B
2T
2B
2B'
4B
3T
3B
4T
1S
2S
NOSE PLUG
FUSELAGE FORMERS CUT FROM 1/16" SHEET
.040 WIRE
BAMBOO PIN HOLDS MOTOR
5
6
7
8
etc.


"VEE" STRUTS
1/8"x1/4"
1/8" SHEET
1/16" SQ.
3/32" SQ.
10 SPACES @ 1 1/2"
(WING PLAN 1/2 SCALE)
1/8"x3/8"
FULL SCALE
WING TIP
FLYING MODEL SHOULD
HAVE 1 1/2" DIHEDRAL
FRONT VIEW
1/3 SCALE
BAMBOO
REGULAR - 18 REQ'D
RIBS CUT FROM
SOFT 1/16" - 1/20" SHEET
TIP - 2 REQ'D
ejs


FRONT
2 3/8"
2 3/4"
.040 WIRE LANDING GEAR STRUTS
3"
1 1/2"
REAR
5 1/4"
1/16" SHEET BALSA OUTLINES
RUDDER PLAN
1/16"X1/8"
STABILIZER MADE IN ONE PIECE
TYPICAL CONSTRUCTION
1/16" SHEET
4@ 2 3/8" = 9 1/2"
1 1/2"
1 1/2"
1"
PROPELLER BLANK
e.f.s

CONSTRUCTION. — Before starting the fuselage plans should be joined; incidentally, if you do not want to mar your magazine, make tracings of the plans on semi-transparent paper.

First make the fuselage underframe, of 3/32" sq. balsa longerons and cross-pieces, indicated by light shading. Make two side frames, one atop the other for identity; the cement will probably cause them to stick together but they can be separated by a razor blade. When dry, invert the side frames over a complete top view plan and join with 3/32" sq. cross-pieces at the cabin. Next pull the backs together and add remaining cross-pieces in the rear. Crack longerons just in front of the cabin to pull sides together, as shown. Check continually for correct alignment.

The various fuselage formers are shown; cut from each medium grade 1/16" sheet. Cut the notches shown and cement to place. Stringers are medium hard 1/16" sq. strips; fit in the notches and cement fast. From the cabin back stringers are cemented directly to the sides of the under frame. Center section ribs, cut from 1/16" sheet, are shown; two are needed with a third center cut as shown by the broken lines. Cement them to top longerons, against the inner edge leaving a 1/32" ledge on which to later rest the wing panels. Finish around the cabin by adding the wedge-shaped pieces. The curved back windows are cut from 1/16" sheet.

Cover the nose with soft 1/32" sheet, but before installing remove the cross-piece centers under the upper formers on the nose so they will not interfere with the rubber motor. Use the widest sheet available; cement it to the entire adjacent frame using pins and rubber bands to hold it in place until dry. Extreme front of the nose is a solid block or laminations, as shown. Roughly cut to shape, cut out hole for the nose plug, then cement to the fuselage front. When dry, cut the block to a smooth shape, then sand entire nose to shape.

Bend the two landing gear struts to shape and size shown from .040 music wire, attach to fuselage by neatly binding with thread and then applying several coats of cement. Join bottoms of the struts by soldering or with thread and cement. The 1/16" sheet fill-in can be cut and fitted but should not be attached until the fuselage is covered; the center struts likewise.

Make full size plans of the right and left wing halves so parts can be assembled directly over them. Using the patterns given, cut 18 of the regular and 2 of the tip ribs from soft 1/16" or 1/20" sheet. Pin all like ribs together and sand to uniformity, then cut the notches with accuracy. Pieces for the tips are cut from 1/8" sheet and assembled over the plan. Taper the 1/8" x 3/8" trailing edges before pinning to place over the plan. Pins keep the ribs in position. Spars are hard balsa; the uppers being 1/16" sq. while the lower are 3/32" sq. Leading edge is 1/8" x 1/4" Tilt the inner ribs a bit for correct dihedral. Cement all joints firmly, remove from plans and finish the leading edges and tips by trimming with a razor and sandpapering.

Tail surfaces come next; both stabilizer and rudder are of similar construction. Make complete frames using 1/16" sheet outlines, 1/16" x 1/8" strips for spars and 1/16" sq. pieces for ribs. When dry, remove frames from the jigs and add 1/16" sq. strips to every side of each rib. The ribs are later cut and sanded to streamline shape indicated. Taper leading and trailing edges to match the ribs.

To obtain fine flights from any flying scale model the propeller must be efficient. Select a hard block of proper dimensions and cut the blank to shape shown. Drill the tiny hole for the prop shaft, then carve a right-hand propeller, by cutting away the back face of the blades until there is about 1/16" undercamber in each. Make each surface smooth and uniform with sandpaper. Blade thickness is then easily determined as the front is shaved away. Thin the blades as much as possible, still retaining desired strength. Round the tips like the prop shown in the photos. Carefully sand and balance the prop as the final operation. Several coats of light dope, if lightly sanded between each, will produce a smooth surface. A free-wheel gadget to improve glide should be attached to the front and a bearing to the back.

The nose plug is made from laminated squares of 1/8" sheet with a 1/32" plywood front. Test flights of the original model showed that several degrees of both right and down thrust are desirable, so drill the hole in this manner. Cement washers to the front and back to fix the thrust line.

COVERING AND ASSEMBLY—Before the frames are covered, they must be lightly but thoroughly sanded to remove all flaws and roughness. Colored tissue is used, banana oil or light dope is the adhesive. Cement cellophane to side windows before covering the fuselage. While performing the latter use numerous small pieces, carefully lapped, to avoid wrinkles; also cover the sheet balsa nose with tissue. Each side of each wing half, stabilizer and rudder requires a separate piece of tissue. Tips, etc., require individual pieces, too. Lightly spray all covered parts with water to tighten the covering—do not, however, apply any clear dope until later.

Prepare to assemble parts by completing the fuselage. Cut a windshield pattern from writing paper by the trial and error method; note the windshield extends over the center section to the first cross-member. Once the pattern fits perfectly cut from celluloid and attach with cement. The landing gear fill-in was made previously and is cemented to the wires. Cover the whole landing gear with tissue. The center landing struts are rounded bamboo splints with streamline balsa covers at the top, representing shock absorber covers. Cement the bamboo to the bottom of the struts but not the top so they can spring apart. Wheels can be made from laminated discs of balsa or may be purchased. Cement bearings to the sides of the wheels so they will revolve smoothly, then place on the axles and hold in place with a drop of solder.

Care must be exercised when assembling the surfaces to the fuselage to keep everything in perfect alignment. First cement stabilizer to place; it is parallel to the work bench. A tissue fillet is placed from fuselage to stabilizer before the rudder is set in position. Off-set the rudder about 1/16" for a right circle glide. Wing tips must be dihedraled about 1-1/2" for proper stability. Be sure to attach the wings firmly. Wing struts are shown; assemble and color before cementing to position. The entire model is now given one or two coats of clear dope.

There are numerous minor details added to improve appearance. For the more ambitious builder the four-cylinder engine offers plenty of possibilities for detail. Insignia, letters, control surface outlines, etc., etc., are all made with colored tissue. Tail wheel and similar parts are made from balsa scraps. Additional details can be found on photos of the big "grasshoppers" for those interested in reproducing every item. Naturally any uncolored wood parts should be doped to match the color scheme.

Bend the propeller shaft from .040 music wire. Slip the nose plug, several washers and prop on the shaft in that order, then bend the shaft end as required for the free-wheeler.

FLYING—Depending on the finished weight of the model, ten or twelve strands of 1/8" brown rubber is required for power. Lubricate the strands, hook them on the prop shaft and then drop the other end through the fuselage. As shown, a bamboo pin holds the motor in the rear. If necessary, remove a small section of covering to aid in getting the motor in position.

The Taylorcraft "grasshopper" should balance at a point about 1/2 back along the wing chord. Add weight to the nose if necessary to obtain this balance, since only minor adjustments are made by warping tail surfaces. Glide the model over deep grass making any further adjustments for a good glide.

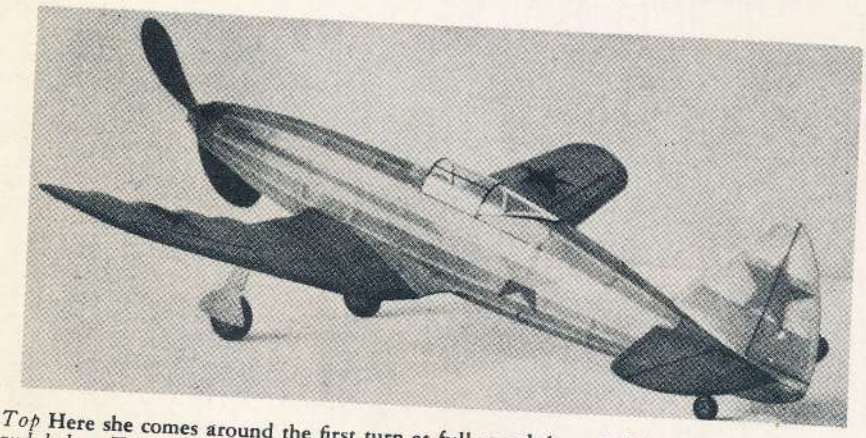
Power flight adjustments are made by off-setting the thrust line. Start with just a few turns—then use more power as justified. Placing a sliver of wood between the tip of the nose plug and the nose tilts the thrust line down, helping to iron out stalls under power. Right or left thrust helps to control the circles.

Once the "bugs" that usually show up in first tests are eliminated, use a mechanical winder to get maximum turns and power from the rubber motor. Take care where you launch your "grasshopper," for the top of a tree or the side of a building is hardly a suitable landing field; you have quite an investment of time and effort in your Taylorcraft—protect it with good judgment!

RUSSIAN FIGHTER

Complete data and plans to construct a flying model of the famous high speed Soviet fighter MIG-3

by **EARL STAHL**



Top Here she comes around the first turn at full speed (a real flight picture). *Above and below* Two views showing its smooth efficient lines and realistic effect when carefully decorated

NEARLY five years of war has proved the Soviets have aircraft of modern design and outstanding performance. Probably the fastest and most formidable fighter of the Red Airforce is the 1-18 or MIG-3 single seater. In appearance it bears a marked resemblance to the early Curtiss XP-37 from which the now famous Curtiss P-40 was developed.

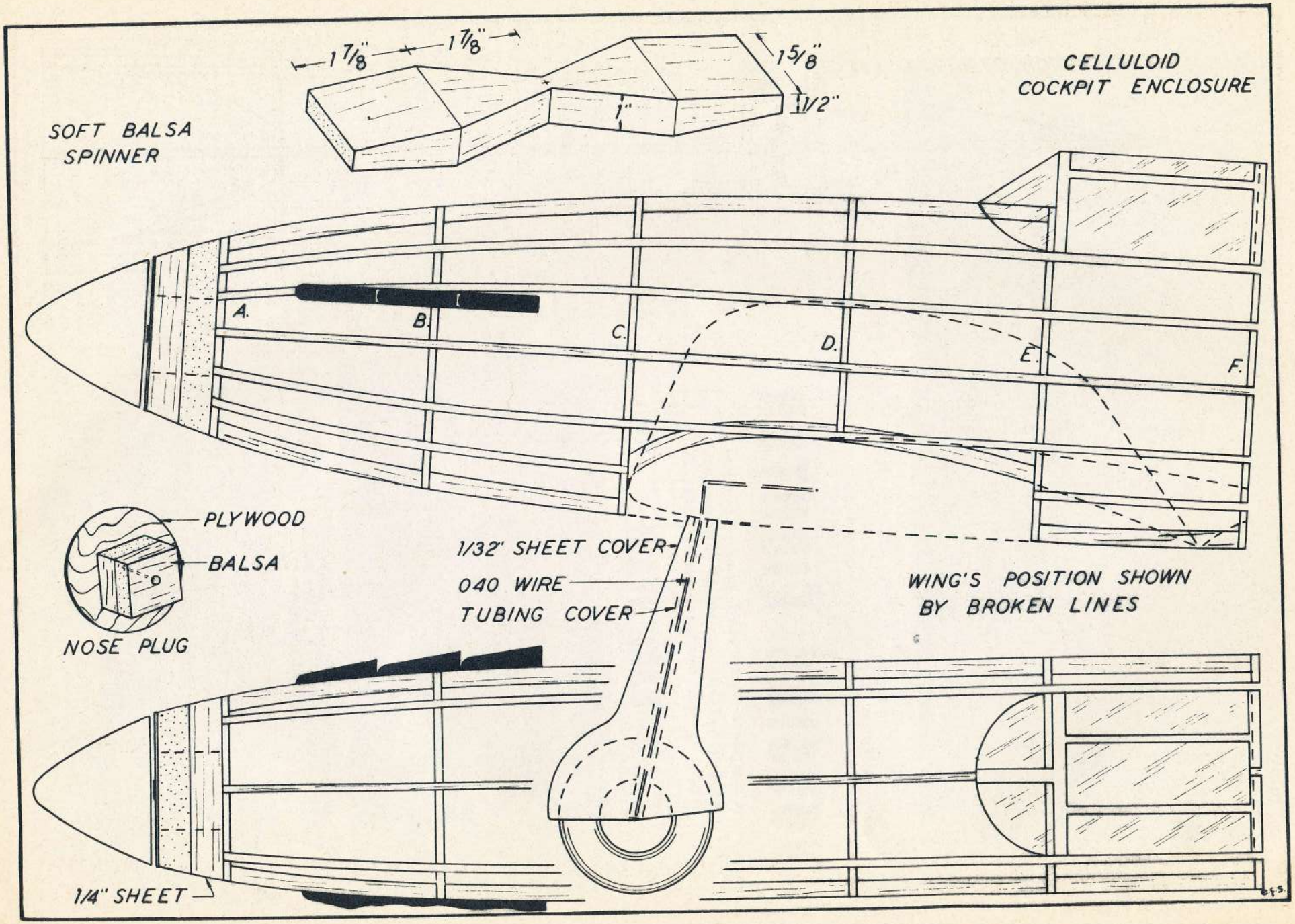
Specific information about all Russian warplanes is a closely guarded military secret, however a few details about this fighter are known. The sleek-lined 1-18 is powered by a 12 cylinder, liquid cooled Mikouline engine of 1,250 hp. which is said to give a top speed of more than 360 mph. at 13,000 ft. Wing span is 36 ft. 6 in.; length 32 ft. and gross weight, 6,200 pounds. Armament consists of four machine guns and two cannon. Construction is unusual in that the forward part of wing and fuselage are metal while remainder of the structure is plywood.

So much for details of the real fighter. The sleek, graceful lines of the 1-18 make it an attractive subject for a flying scale model. Because of its excellent proportions it is ideally suited for flying and the author must add that his 1-18 is without exception one of the best low-wing scale models he has built.

The model is simply constructed in the conventional manner. While the test ship was designed for and incorporated balsa wood in the structure, it is readily adaptable to construction using slightly heavier white pine and basswood now being sold at some model shops. All wood should be selected carefully to assure the lightest, strongest structure possible. In the process of assembly all frames should be made with accuracy and each joint cemented firmly.

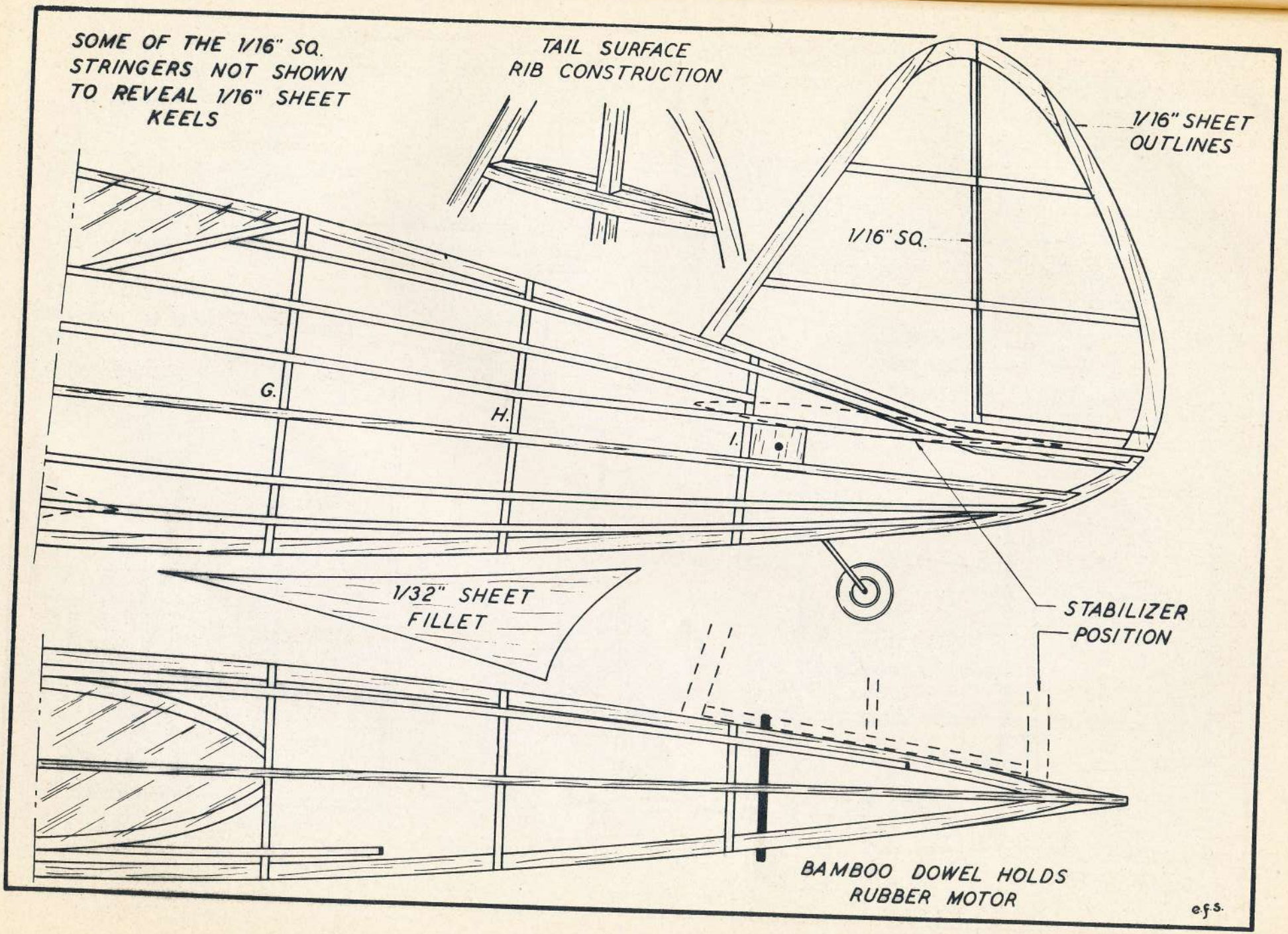
CONSTRUCTION: The manner of fuselage construction calls for use of four keels cut to shape from 1/16" sheet. To obtain their patterns, trace the top, bottom and side outlines of the body. Bulkheads, likewise 1/16" sheet, are cut in accordance with patterns given. Cut only the notches shown leaving the others to be cut as a later operation; their positions should be marked, however, for reference.

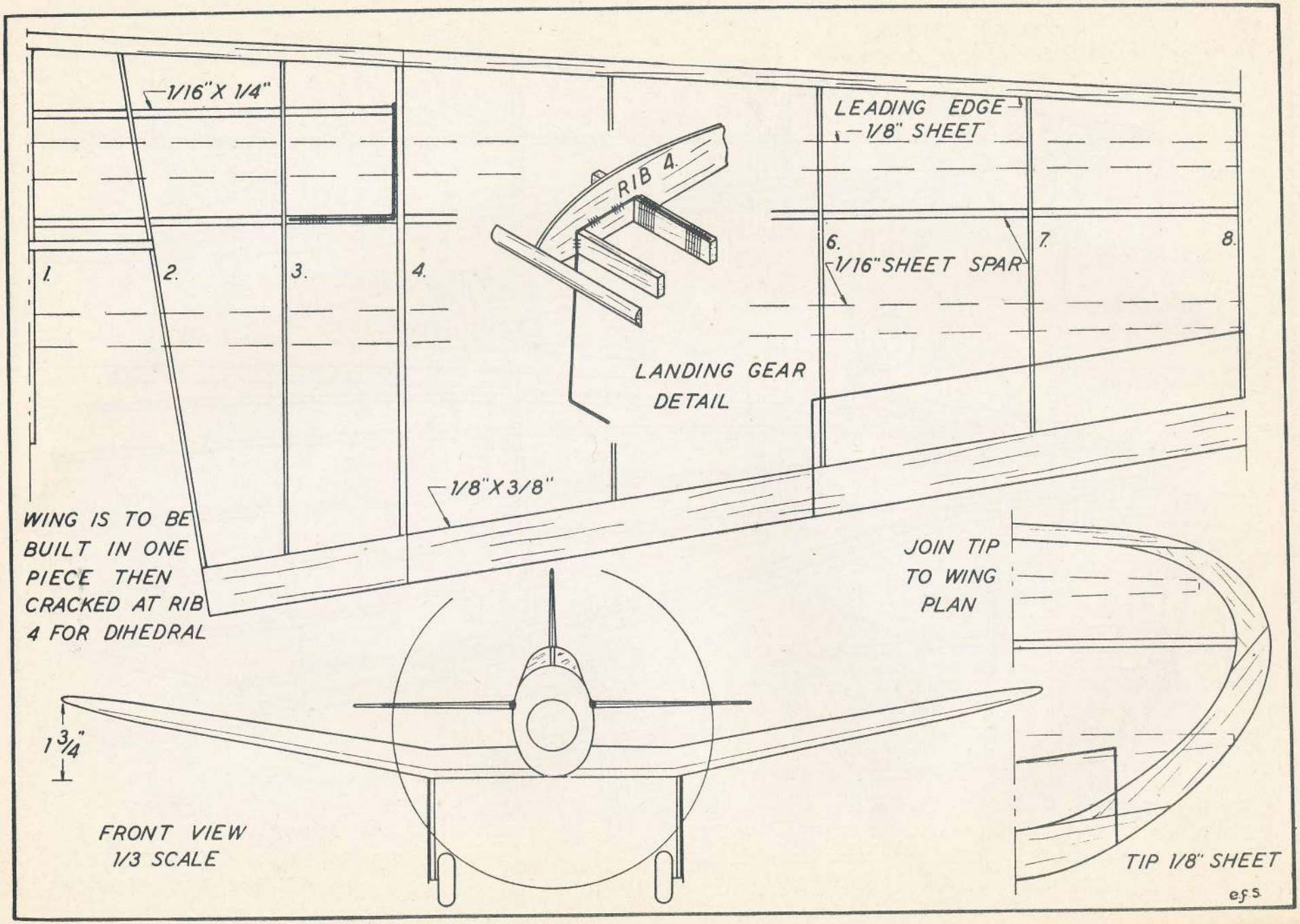
Pin the top and bottom keels to position


1 7/8"
1 7/8"
1 5/8"
1/2"
1"
SOFT BALSA
SPINNER
CELLULOID
COCKPIT ENCLOSURE
A.
B.
C.
D.
E.
F.
PLYWOOD
BALSA
NOSE PLUG
1/32" SHEET COVER
040 WIRE
TUBING COVER
WING'S POSITION SHOWN
BY BROKEN LINES
1/4" SHEET

1/4" SHEET

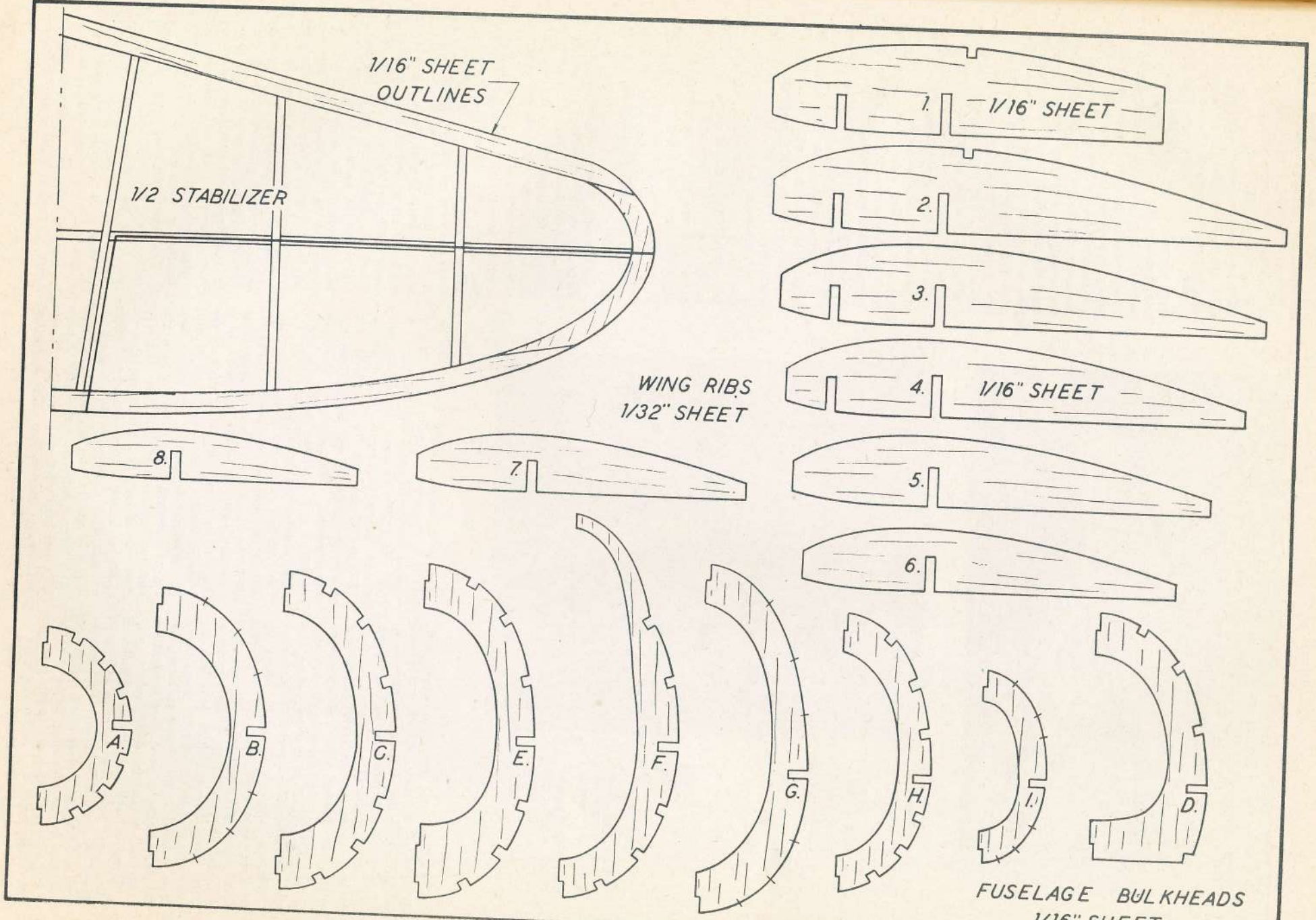
e.f.s.


SOME OF THE 1/16" SQ. STRINGERS NOT SHOWN TO REVEAL 1/16" SHEET KEELS
TAIL SURFACE RIB CONSTRUCTION
1/16" SHEET OUTLINES
1/16" SQ.
G.
H.
I.
1/32" SHEET FILLET
STABILIZER POSITION
BAMBOO DOWEL HOLDS RUBBER MOTOR
e.f.s.

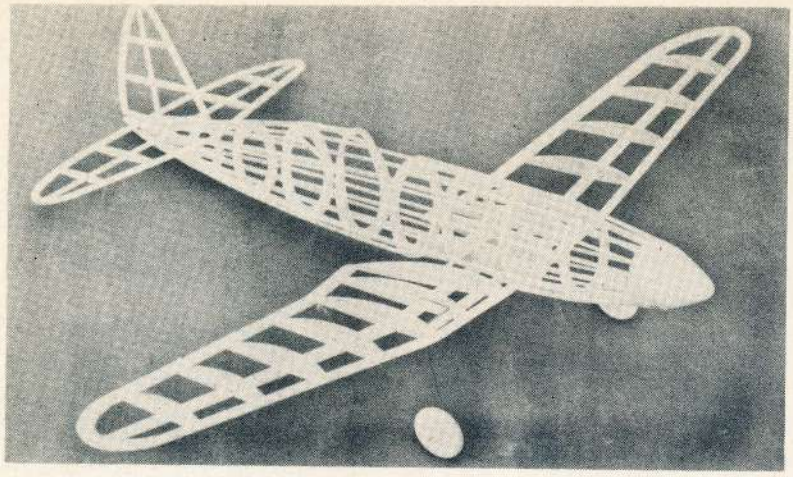

1/16"X 1/4"
LEADING EDGE
1/8" SHEET
RIB 4.
6.
7.
8.
1.
2.
3.
4.
1/16" SHEET SPAR
LANDING GEAR
DETAIL
1/8"X3/8"
WING IS TO BE
BUILT IN ONE
PIECE THEN
CRACKED AT RIB
4 FOR DIHEDRAL
JOIN TIP
TO WING
PLAN
1 3/4"
FRONT VIEW
1/3 SCALE
TIP 1/8" SHEET
e.f.s.

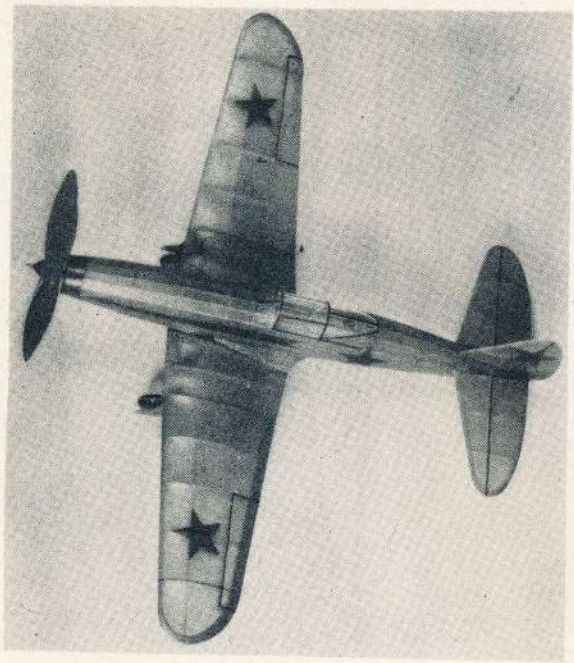
TIP 1/8" SHEET

e f s



e f s





Above The completed framework, light and sturdy

Right Ailerons, elevators and cabin are lined in black

over the side view and then cement half the bulkheads to place. Attach a side keel and then, when dry, remove structure from the plan and add remaining bulkheads and keel. Stringers are 1/16" sq. stock. Attach the ones nearest the side keels first, cutting notches as required. Always attach stringers to corresponding positions of each side at the same time to prevent pulling the body out of line.

Between bulkheads C and E, where the wing fits in, curved pieces are cut from 1/16" sheet and fitted so as to make the fuselage slides fit to the wing curvature. Other items to be assembled to the fuselage are the curved pieces of 1/16" sheet which form the back of the cockpit enclosure and the small blocks of hard sheet stock in the rear which anchor the rubber motor.

The nose block, just forward of bulkhead A, is made from two pieces of 1/4" sheet balsa cemented cross-grain. Cut out the center for the nose plug, then roughly cut to shape before cementing to the nose for final finishing, by using rough and then fine sandpaper.

For those builders using white pine or bass it is suggested the same procedure of construction be followed but bulkheads of 1/32" or 1/20" thickness should be sufficiently strong. Stringers of 1/32" x 1/16" size placed with the narrowest side next to the covering will be of about the same strength, and weight; if this size stringer is not available, 1/16" sq. stock sanded smaller will be all right.

Few details are required to outline the method of constructing the tail surfaces. Study the plans and it will be noted that both stabilizer and rudder are made in a like manner from 1/16" thick stock of the indicated width. Make flat frames of both (the stabilizer is made in one piece) then when the cement has set, remove from the jigs and cement soft 1/16" sq. strips to each side of each rib. These are later cut to the streamline shape indicated and edges are tapered to conform to the rib shape.

If it is necessary to use wood other than balsa for the stabilizer and rudder, it must be remembered that they must be of light but strong construction. To accomplish this reduce the size of the various parts and eliminate streamline cap strips over the ribs. Cement everything well so there will be little tendency to warp.

The wing is easiest assembled in one piece; the builder will have to make a left side plan as there was insufficient room for it on the drawings. Ribs are cut from 1/32" sheet except as noted and two of each is needed except No. 1. Sand them carefully to exact size and cut the notches for spars. Spars and leading edge are cut from sheet stock as indicated and the trailing edge is a tapered strip of 1/8" x 3/8" stock. Tip pieces are cut from 1/8" thick material and are assembled over the plan. With pins hold the various parts in place over the plan until the cement has set. When dry, crack the spar and edges and elevate the tips to indicated dihedral; recement the joints firmly. Finally trim and sand the leading and trailing edges to conform with the airfoil shape.

To keep weight at a minimum the builder using heavier wood will have to use material of smaller crossection, particularly the leading and trailing edges. Ribs should be cut from the thinnest stock and lightening holes at points of little stress will reduce the overall weight.

A landing gear of the type used on the model 1-18 is very rugged yet accurate in appearance; it is easily made from .040 music wire. The top of each strut is bent in such a manner as to join the spars and rib No. 4. Be sure to make a right and left strut. With thread bind the struts to the spars and then use a needle and thread and sew right through the rib and about the wire. Strengthen the whole area by applying several coats of cement. The rubber tubing (or any other kind of tubing) and balsa landing gear covers are not added until later.

Lightweight wheels can be purchased or they may easily be made from scraps of 1/8" sheet balsa that have been laminated together. Washers or bearing should be attached to each wheel so they will turn freely and accurately.

Select a very hard balsa or soft white pine block of the correct size for the propeller. Drill the tiny hole for the prop shaft and then cut out the blank as shown. A right-hand prop is to be carved. Cut away the back face of the blank first until the backs are as desired, then cut away the front until the blades are of the proper thickness. Reduce the depth of the hub and shape the blades in a manner similar to the prop on the original model. With rough and then fine paper sand the propeller to a smooth finish. Shape the spinner from a light grade balsa block, then notch it to fit over the prop hub. Before the spinner is attached permanently, the type of free-wheel gadget to be used, if any, should be considered and provisions made for it. Apply several coats of clear dope with light sanding between each to smooth and harden the surface.

The removable nose plug is shown in perspective. A disc of 1/32" plywood forms the front portion while the back is laminations of 1/4" sheet balsa. Fix the line of thrust by cementing washers to the front and back of the plug.

For the propeller shaft use .040 music wire. A loop to which a mechanical wind-

er can be hooked should be bent on the front of the shaft. Place several washers between the propeller and nose plug to reduce friction.

Work over the entire structure with fine sandpaper to prepare for a neat covering job. Regular colored tissue or Silkspan is used and banana oil or thin dope is the adhesive. Use individual sections of tissue for each flat section of each side of the wing, tips, tail surfaces, etc. In covering the fuselage it will be necessary to use numerous small pieces to work around the curves without wrinkles; the tissue must be lapped carefully to assure a neat job. Lightly spray the covered parts with water to tighten the tissue. The flying surfaces must be supported level while drying so they will not warp.

Assemble the covered parts in this manner: Fit the wing into the recess in the fuselage and cement it fast—if the structures have been made with accuracy, the incidence will be correct. Wing fillet patterns are given and two are cut from 1/32" sheet. They are to fit accurately from fuselage to wing and may need a bit of alteration to fit exactly on *your* model. If the builder desires, the trailing edge of each fillet may be strengthened by laminating another small piece of 1/32" sheet to the underside. Finish the opening from wing to fuselage on the bottom with 1/16" sq. strips and then cover this area and the fillets with colored tissue. It will be necessary to temporarily cut the top keel and last bulkhead to admit the stabilizer which is cemented fast at the angle shown. Cement the rudder to place with a bit of offset to counteract torque. Tissue fillets are placed between the tail surfaces and fuselage. Any wrinkles in the covering should be moistened with water and permitted to dry before the entire model is given a coat or two of clear dope.

Now to add the more minor details. The cockpit enclosure is made from thin celluloid. Make paper patterns of each section of windshield before cutting the parts from celluloid. When cementing to place be careful to avoid cement smears. The structural detail is represented by doping thin strips of black tissue to the transparent enclosure. Rubber (or similar) tubing of the correct diameter is slipped over the vertical portion of the landing gear wires. Wheels are colored and then held to the axles by small washers soldered to the ends. The outer landing gear covers are cut from 1/32" sheet and then covered with tissue to match the rest of the plane. The red Russian star and other decorations can be cut from colored tissue and doped to the covering. Control surface outlines are simply thin strips of black tissue doped to place. Items such as the tail wheel, exhaust, ports, etc., are made from scraps.

FLYING: Our original test model is powered with six strands (three loops) of 3/16" flat, brown rubber. It is best to lubricate the motor before placing it within the fuselage. Hook the strands to the prop shaft and then drop the other ends through the fuselage. It may be necessary to remove a small portion of the covering in the rear in order to get the strands into position to be held by the removable bamboo pin.

Make first flights over soft grass but if none is available, make first tests R.O.G. with but a few turns. In all probability the model will be out of balance so a small corrective weight may be needed. As correct balance and stability are attained increase the number of turns. Off-setting the thrust line will aid in controlling the amount of circle in either direction, and by tilting the thrust line down a tendency to stall can be eliminated. For maximum performance stretch the rubber motor and wind with a mechanical winder.

PLANE TIPS IV

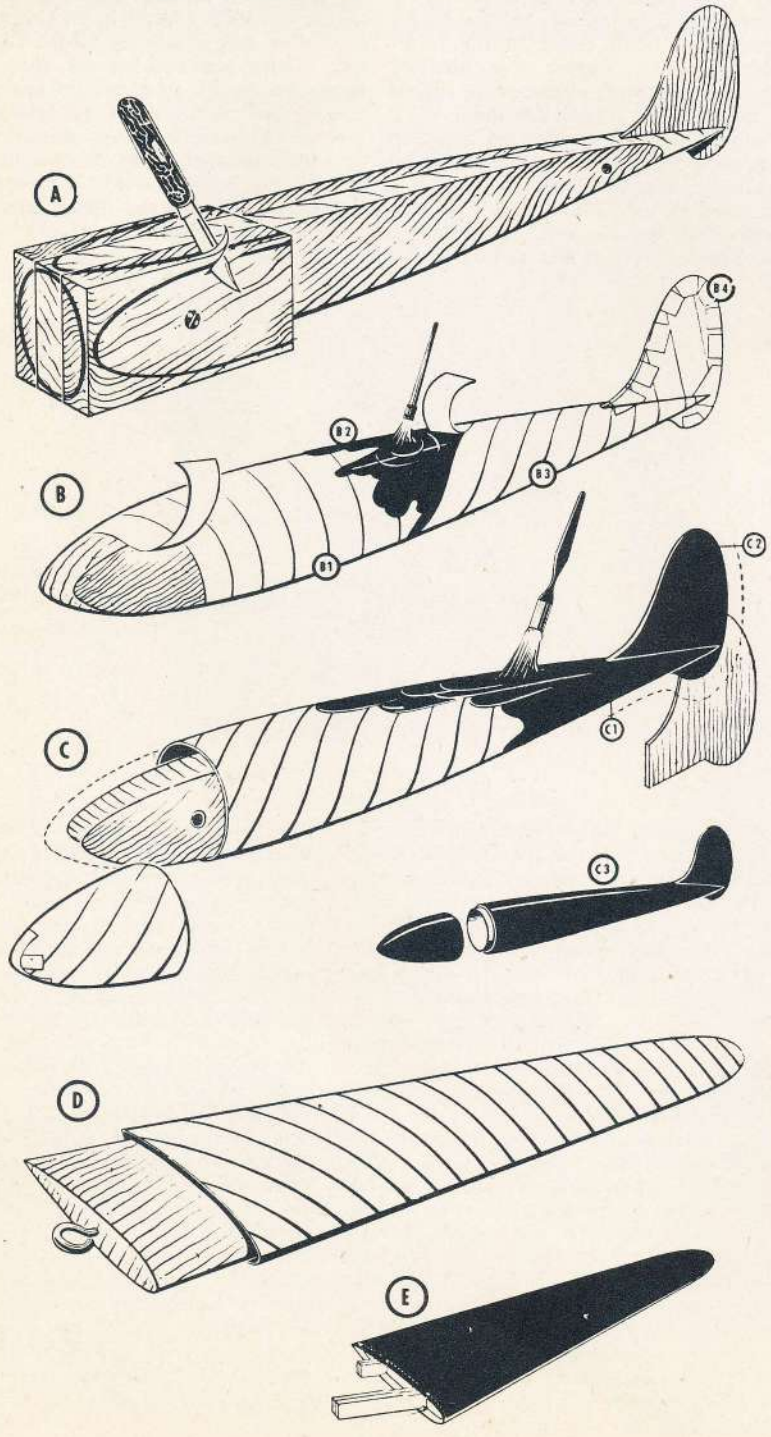
DUE to a shortage of balsa wood thought is being directed toward substitute materials which may prove very successful. Laminated paper models seem to offer great possibilities. Great strength, light weight and streamlining to an unlimited degree are its major qualities. The forms, which can be carved from soft pine or any scrap materials, can be used repeatedly, or finished up as display models. Thus, when your paper model flies out of sight you will have a solid display model to remember it by. Helpful tools include pocket-knife, draw-knife, plane, chisel, brush, pins, sandpaper and drill.

A

Make the fuselage block of three pieces held together with a screw at the nose and at the tail. Slot rear and slide in rudder. Do not secure, but leave in a slip fit. Shape the fuselage, close the surface with shellac or dope, sanding between coats. Finish with wax.

B

Christmas tissue paper, rice paper or old newspaper, cut in 1" strips and dampened slightly, should be carefully wrapped around the fuselage.



B-1. Cover completely. Don't leave any wood exposed. Where there is more curvature use narrower strips. Wipe off excess moisture and let dry.

B-2. Spread on a coat of glue or dope and apply a second layer of strips.

B-3. An excess of glue soaks through the first layer of paper. Use it sparingly.

B-4. Note additional strips of reinforcing which can be applied at weak points.

C

Place model in a warm, dry place and allow to dry thoroughly. Don't dry in an oven or in the sun. Heat applied in this manner may affect the wood form, and possibly split the paper shell.

Select point of greatest crossection and cut through shell. Remove the nose portion. Take out exposed nose screw. Cut small hole at rear of fuselage shell and remove screw. Repair this later. Remove center block first; this allows the other two blocks to slip out easily.

C-1-2. An incision from C-1 to C-2 allows the rudder section to be removed. This cut can be mended with short strips.

C-3. A slight shoulder, possibly 3/4" wide, is made by wrapping a strip around the inside of the shell. The nose can be glued on permanently or fastened with pins to allow future removal.

Complete the laminated paper fuselage with two coats of colored dope.

D

Carve a solid wing from white pine. Fill the wood pores with dope or shellac and sand smooth. The wing is built in halves, with a big screw eye inserted in the end to give something to pull by in removing from the finished paper shell. The shell is applied in narrow strips, several layers thick. One main spar is built, strengthened with dihedral bracers and, after liberal glue application, is inserted in the wing shell. One short, rear center section spar is inserted after the main spar dries.

Use short reinforcing pieces of paper around the wing tips. These should be strong to withstand the impact of bad landings. Cut little V's around the edges of the strengthener strips to facilitate their easy application to the tips.

E

Ribs in short pieces can be inserted at the wing root for added strength. These should be set in at least 1/8" for greatest gluing area. If you like, use a dihedral bracer on only one side of the main spar, as shown. Try using stub spars, too. Let these ex-

tend only about one-half the distance to the tips. Even the main spar can be made of cardboard in channels or Z shapes instead of wood.

Elliptical shaped wings with curved front view and changing rib shapes (from root to tip) are just as easy to cover as tapered wings with straight leading and trailing edges.

F

If your design permits, use an adjustment slot, at least until the proper wing position is found. Then glue solidly and apply wing fillets. The offset wing spar design shown eliminates dihedral bracer but necessitates placing one spar slightly ahead of the other. For a midwing, insert a strong bulkhead with a hole just big enough to amply clear the rubber motor. Cut the wing spars short, and glue and pin securely to the bulkhead.

G

Beef-up. rudder and stabilizer tips with short V-cut reinforcing strips applied around the edges.

Insert the wings in the fuselage slots and bind and glue securely. Temporary or permanent setting is maintained by the rubber strands over the fuselage.

H

Empennage assembly is described in the next paragraph and is shown completed at the left. Small rudders under the fuselage give the whole rudder assembly added strength.

Mount the stabilizer or wing as shown. Use two stub spars on one side, and one on the other. Slide the two half wings together securing with glue, pins and glue, or thread wrapping and glue.

J

J-1. Carve the wheel pant, finish the surface, wax, and cover with strips of paper as shown. Several layers will be necessary.

J-2. Finish wheel pant with colored dope, and remove the wood form with the assistance of a large screw eye.

J-3. The effective shock absorber shown is made by attaching small blocks or pieces of cork at the front and rear of the pant. Solder up the wire frame, pivot it at the back and secure the front with rubber bands.

K

A wire landing strut is easily formed as shown, and wrapped with layers of paper until proper strength is obtained. Generous bands at top and bottom give better support.

Several layers of paper wrapping may be necessary.

L

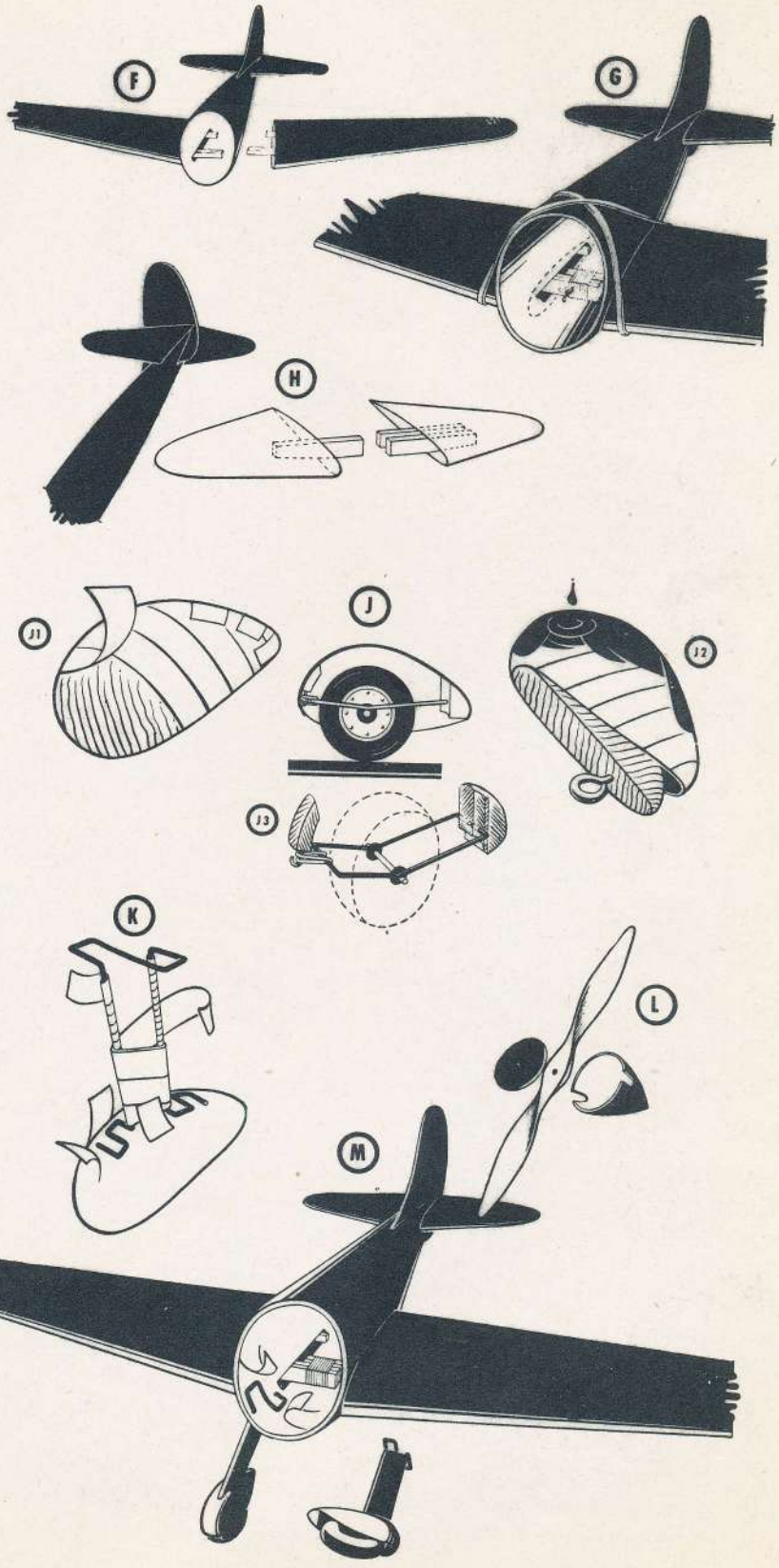
Carve a spinner, or turn one on a lathe. Finish, wax and cover with narrow paper strips. Cut out slots to fit propeller blades snugly. Extend spinner far enough behind the propeller's rear face to set in a circular plate as shown.

M

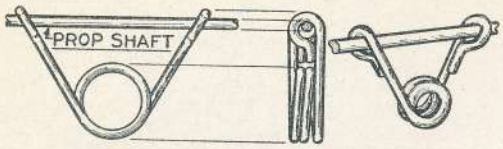
If the landing gear struts are attached to the fuselage, glue the bent ends, inside of the shell and reinforce with a covering of paper strips.

Illustration shows completed landing gear leg ready to be attached as shown at left.

Apply an extra strengthening strip along the trailing edge of the wing to reinforce the joint made by the upper and lower surface.



PLANE TIPS V

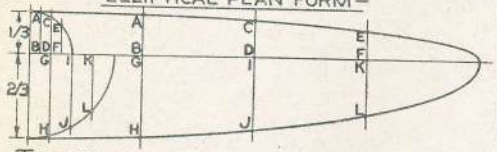


THIS TORSION SPRING FOR RUBBER TENSIONERS IS FAR SUPERIOR TO THE COMPRESSION COIL TYPE MORE OFTEN USED. MAKE THIS FROM LIGHT PIANO WIRE (NO. 10 OR LESS). FORMING THIS SPRING IS SIMPLE IF ROUND-NOSED PLIERS ARE USED.

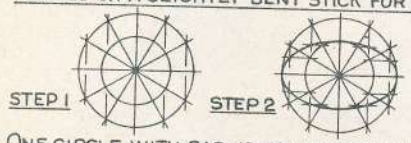
●

SEE COLUMN THREE FOR MORE DETAILS OF THE ELLIPSE CONSTRUCTIONS SHOWN BELOW.

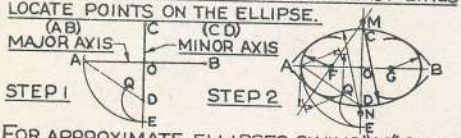
–HOW TO LAYOUT A WING WITH AN ELLIPTICAL PLAN FORM–



THIS WING WAS DESIGNED TO HAVE THE SPAR AND THE CENTERS OF PRESSURE ON A STRAIGHT LINE. SWING ONE ARC WITH RADIUS = 1/3 OF CHORD. SWING SECOND ARC WITH RADIUS = 2/3 OF CHORD. DIVIDE RADII INTO 4, 8, OR 16 PARTS, AND SEMI-SPAN INTO CORRESPONDING NO. OF PARTS. WITH DIVIDERS TAKE DISTANCE "AB" AND LAY OFF ON WING PLAN FORM AS LABELED MARK OFF OTHER POINTS AS SHOWN; COMPLETE WITH FRENCH CURVES FOR THE TIPS, AND MILD SHIP CURVES OR A SLIGHTLY BENT STICK FOR THE REST.



ONE CIRCLE WITH RADIUS EQUAL TO 1/2 MAJOR AXIS. SECOND CIRCLE WITH RADIUS = 1/2 MINOR AXIS. USE 30-60 TRIANGLES TO GET DIVISIONS. IF GREATER ACCURACY IS DESIRED BISECT THE ANGLES SHOWN. WHERE THESE OBLIQUE LINES CROSS THE LARGER CIRCLE DRAW PERPENDICULARS. WHERE THEY CROSS INNER CIRCLE DRAW HORIZONTALS. INTERSECTION OF THESE LAST LINES LOCATE POINTS ON THE ELLIPSE.



FOR APPROXIMATE ELLIPSES SWING "AO" SCRIBE ARC "DE" TO INTERSECT LINE "AD". ⊥BISECT "AQ". WHERE THIS BISECTOR CROSSES THE HORIZONTALS AND PERPENDICULARS LOCATES THE CENTERS OF THE ARCS WHICH FORM THE ELLIPSES. USE DIVIDERS TO TRANSFER "OF" TO "OG" AND "MO" TO "ON"

NOTE: LOOK FOR MORE METHODS NEXT MONTH.

●

SINCE WORKING IN FRACTIONS IS VERY SLOW THESE SHOULD BE CONVERTED INTO DECIMALS. IN THE PROBLEM 7-15/16 × 4-3/8, CHANGE TO DECIMAL EQUIVALENTS (7.937 × 4.375) SIMPLIFY, AS EXPLAINED IN LOWER RIGHT HAND CORNER OF PAGE, (7.94 × 4.38); MULTIPLY TO GET 34.7772, SIMPLIFY (34.8). THE ANSWER SHOULD BE LEFT IN DECIMAL FORM AND MEASURED OFF USING A 6" MACHINIST METAL SCALE (READS IN DECIMAL PARTS OF AN INCH). ALL AERONAUTICAL ENGINEERS USE THIS SCALE BECAUSE ITS EASIER AND MORE ACCURATE. CONVERT ANSWER IF DESIRED.

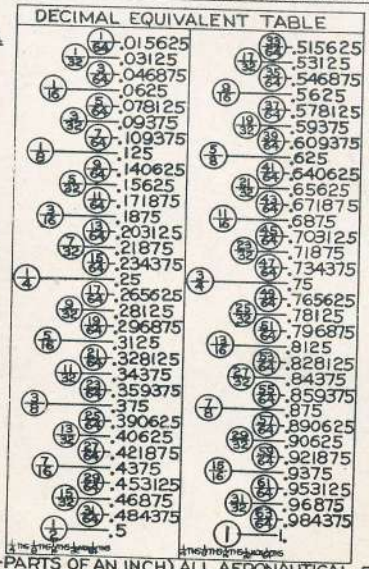
WHEN COMPUTING AREAS, ETC. FOR NATIONAL CONTESTS USE THE DECIMAL EQUIVALENT CHART ON THIS PAGE.

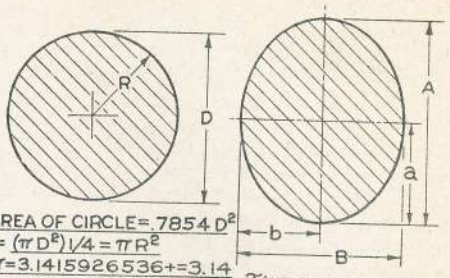
TABLE OF PIANO WIRE SIZES & NOS.

NO. OF GAGE	WIRE GAGE (DIA)	NO. OF GAGE	WIRE GAGE (DIA)
7/0	.003"	18	.041"
6/0	.004"	19	.043"
5/0	.005"	20	.045"
4/0	.006"	21	.047" = 3/64" APPROX.
3/0	.007"	22	.049"
2/0	.008"	23	.051"
0	.009"	24	.055"
1	.010"	25	.059"
2	.011"	26	.063" = 1/16" APPROX.
3	.012"	27	.067"
4	.013"	28	.071"
5	.014"	29	.075"
6	.016" = 1/64" APPROX.	30	.080" = 5/64" APPROX.
7	.018"	31	.085"
8	.020"	32	.090"
9	.022"	33	.095" = 3/32" APPROX.
10	.024"	34	.100"
11	.026"	35	.106" = 7/64" APPROX.
12	.029"	36	.112"
13	.031" = 1/32" APPROX.	37	.118"
14	.033"	38	.124" = 1/8" APPROX.
15	.035"	39	.130"
16	.037"	40	.138"
17	.039"		

PLEASE NOTE THAT COMMON FRACTIONAL EQUIVALENTS ARE GIVEN. VIZ. .063 = 1/16, ETC. THIS ADDITION ENABLES THE BUILDER TO VISUALIZE CLEARLY ALL INTERMEDIATE SIZES.

DECIMAL EQUIVALENT TABLE





AREA OF CIRCLE = .7854 D^2 = $(\pi D^2)1/4 = \pi R^2$

π = 3.1415926536+ = 3.14

USE 3.14 FOR ORDINARY COMPUTATIONS.

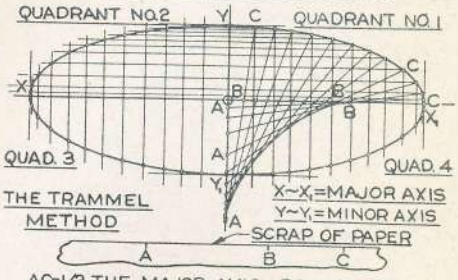
THE ELLIPSE IS THE MOST IMPORTANT GEOMETRIC FIGURE USED IN STREAMLINED MODEL DESIGN. ITS APPLICATION INCLUDES FUSELAGE CROSS-SECTIONS, WING PLAN FORMS, WING TIPS, EMPENNAGE CONTOURS, ETC. SHOWN HERE ARE MOST OF THE METHODS OF CONSTRUCTION AND RELATED FORMULAE. IT IS IMPORTANT THAT EVERY MODEL DESIGNER BE FAMILIAR WITH THESE.

AREA OF ELLIPSE = $1/4(\pi AB) = \pi ab = .7854AB$

AVERAGE CHORD = $\frac{\text{SPAN}^2}{\text{AREA}}$

CIRCUMFERENCE (APPROX.) = $2\pi\sqrt{\frac{a^2+b^2}{2}}$

METHODS OF CONSTRUCTION



THE TRAMMEL METHOD

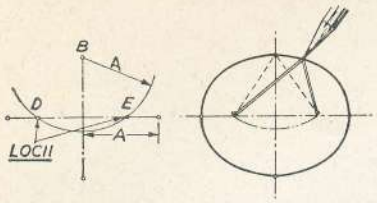
AC = 1/2 THE MAJOR AXIS. BC = 1/2 THE MINOR AXIS. X, IS CALLED X PRIME OR X SUB 1. PLACE PIECE OF PAPER SO THAT POINT C LOCATES ANY POINT ON THE ELLIPSE WHEN POINTS A & B ARE MOVED SIMULTANEOUSLY ALONG THEIR RESPECTIVE AXES, OY, & OX,. THIS PROCEDURE MAY BE REPEATED IN EACH OF THE OTHER THREE QUARTERS (QUADRANTS). AN EASIER WAY IS TO PROJECT THE FIRST POINTS VERTICALLY AND HORIZONTALLY. TAKE DISTANCE FROM POINTS TO AXES WITH DIVIDERS AND LAY OFF IN THE OTHER QUADRANTS. PROCEED AS FOLLOWS: TAKE DISTANCE FROM ALL THE "C" POINTS TO THE AXIS Y–Y, (ONE AT A TIME), AND USE TO FIND POINTS ON ELLIPSE IN QUADRANT NO. 2. TAKE DISTANCE FROM "C" POINTS TO AXIS X–X, AND LAY OFF ON VERTICALS IN QUADRANTS 3 & 4.

●

EVERY MODEL BUILDER SHOULD KNOW HOW TO REDUCE COMPLICATED NUMBERS TO SIMPLE ONES FOR ORDINARY USE. IF THE LAST NUMBER TO THE RIGHT IS 5 OR LARGER RAISE THE NUMBER TO THE LEFT OF IT BY ONE AND KNOCK OFF THE LAST DIGIT.

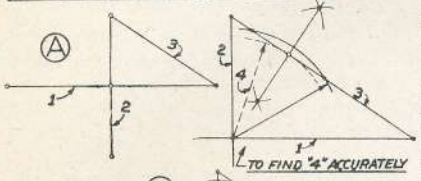
EXAMPLE:

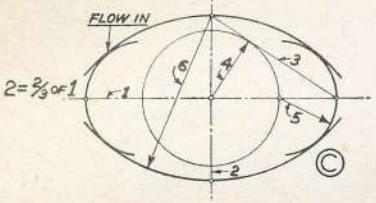
π = 3.1415926536+
= 3.141592654
= 3.14159265
= 3.1415927
= 3.141593
= 3.14159
= 3.1416
= 3.142 — 3.14 SHOULD BE USED FOR ORDINARY COMPUTATIONS.
= 3.14
= 3.1
= 3.



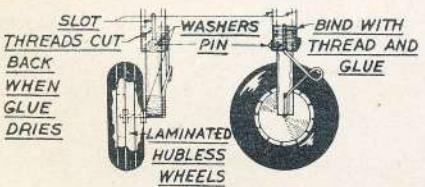
ELLIPSE CONSTRUCTIONS

USING ½ MAJOR AXIS "A" AS RADIUS DRAW ARC FROM POINT "B". PLACE THUMB TACKS OR PINS AT POINTS "D & E" WITH PENCIL AND STRING AS SHOWN, SCRIBE ELLIPSE.



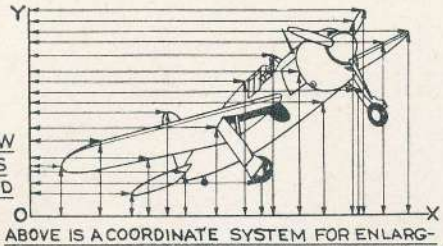


APPROXIMATE ELLIPSE WITH WIDTH EQUAL TO 2/3 OF LENGTH — MADE WITH ARCS. STEPS ARE NUMBERED. ½ OF "2" ADDED TO "2" EQUALS "1". DIAGONAL "3" DETERMINES RAD. "4" WHICH LOCATES THE CENTER OF ARC "5". ARC "6" FORMS LONG SIDES. USE A FRENCH CURVE TO MAKE ARCS FLOW TOGETHER.



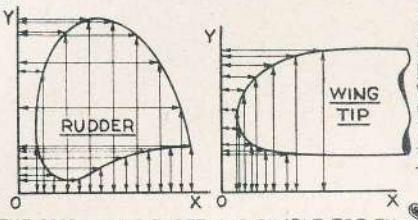
SHOCK ABSORBERS & WHEELS FOR FLYING SCALE MODELS

FORK TYPE, WHEEL ALIGNING GUIDE FOR SCALE MODELS SLIGHTLY REDESIGNED MAKES AN EXCELLENT SHOCK ABSORBER. THE USUAL COIL SPRING IS TOO DIFFICULT TO INSTALL ON SMALL MODELS. THE TORSION SPRING SHOWN IS GLUED AND BOUND WITH THREAD TO A BALSA DOWL LOWER STRUT, FITTED TO SLIDE EASILY WITHIN AN ALUMINUM TUBE, AND TO THE TUBE ITSELF. THIS TYPE SHOCK ABSORBER MAKES POSSIBLE EASY LEVELING OF MODEL (BENDING LOOP WITH PLIERS TO MAKE EACH LANDING GEAR LEG THE CORRECT LENGTH TO MAKE THE WING TIPS LEVEL). WHEN THE WHEEL IS IN THE EXTENDED POSITION A STRUT ALIGNMENT PIN IS PUSHED THROUGH THE DOWL HOLE AT THE BOTTOM OF THE SLOT IN THE TUBE. LIGHT PIANO WIRE SHOULD BE USED FOR THE SPRING. NO. 6 OR LESS, BENT WITH ROUND NOSED PLIERS, WILL DO FOR THE AVERAGE MODEL.



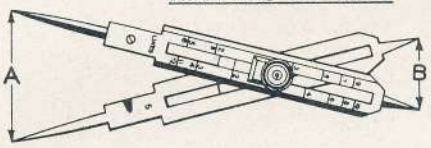
ABOVE IS A COORDINATE SYSTEM FOR ENLARGING PICTURES OR CURVED PARTS ON DRAWINGS.

EVEN A COMPLETE DRAWING MAY BE TREATED IN THE SAME WAY. THIS SYSTEM IS HIGHLY ACCURATE AND IS FAR BETTER THAN THE SQUARING METHOD USUALLY USED. ANY POINT ON THE DRAWING IS A CERTAIN DISTANCE (MEASURED WITH RULER OR DIVIDERS) DOWN TO THE HORIZONTAL LINE, AND OVER TO THE VERTICAL LINE.

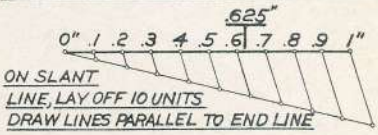


THE COORDINATE SYSTEM IS SIMPLE FOR ENLARGING OR REDUCING CURVED PARTS. FOR ENLARGING A DRAWING ONE, TWO, OR MORE TIMES, DIVIDERS ARE FINE. FOR FRACTIONAL INCREASES, OR REDUCTIONS, PROPORTIONAL DIVIDERS ARE ALMOST INDISPENSABLE. BELOW A PAIR IS SHOWN——

IF THUMB SCREW IS SET AT TWO, A=2B FOR REDUCTIONS, AND B=½A FOR ENLARGING DRAWINGS

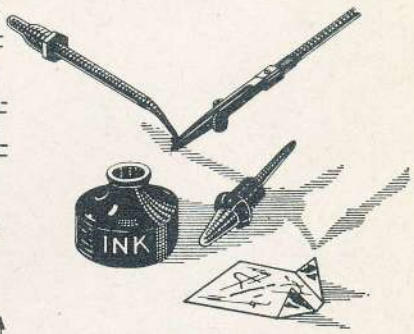


IF NO OTHER MEANS ARE AVAILABLE, AND YOU ARE WILLING TO SPEND THE TIME, ENLARGE OR REDUCE YOUR DRAWING USING A RULER AND MATHEMATICS. LETS TAKE A SIMPLE PROBLEM. YOU'RE ENLARGING THE DRAWING 3 TIMES. THE MEASUREMENT TO BE ENLARGED IS 4½". NEXT WE SET UP A PROPORTION AS SHOWN IN PLANE GEOMETRY. WE SAY 1 IS TO 3 AS 4½ IS TO WHAT? THIS IS WRITTEN 1:3=4½:X OR BETTER STILL—— $\frac{1}{3}=\frac{4.5}{X}$, MULTIPLYING THE "MEANS" TOGETHER (3 x 4.5), AND THE EXTREMES TOGETHER (1×X) AND SETTING THEM EQUAL TO EACH OTHER, WE GET X=13.5". 4½" ENLARGED 3 TIMES IS OBVIOUSLY 13.5". IN MORE DIFFICULT PROBLEMS HOWEVER, YOU MUST USE PROPORTIONS. DOING THIS PROBLEM ON THE SLIDE RULE IS EASIER THAN ANY OTHER. TAKING THE SAME PROBLEM, LOCATE 1 ON THE "C" SCALE DIRECTLY ABOVE 3 ON THE "D" SCALE. IF 4.5 IS LOCATED NOW ON THE "C" SCALE, 13.5 WILL BE UNDERNEATH IT ON THE "D" SCALE. LEAVING THE "SLIPSTICK" SET WITH 1 ABOVE 3 ANY MEASUREMENT TAKEN FROM YOUR DRAWING AND READ ON THE UPPER SCALE "C" WILL BE 3 TIMES LARGER ON THE "D" SCALE DIRECTLY UNDERNEATH. THERE IS NO WORK AT ALL TO THAT; JUST READ OFF THE ANSWERS. CHANGE YOUR FRACTIONS TO DECIMALS, HOWEVER, BEFORE TRYING TO FIND THEM ON A SLIDE RULE. IF THE DRAWING IS VERY LARGE, INSTEAD OF USING THE "L" TYPE BASE LINES SHOWN, USE A CROSS IN THE MIDDLE OF THE DRAWING, MEASURING OUT FROM IT IN ALL DIRECTIONS. ALL THE MEASURING LINES SHOWN DO NOT HAVE TO BE MADE ON THE DRAWING. THESE WERE ONLY SHOWN TO ILLUSTRATE THE SYSTEM.



ON SLANT LINE, LAY OFF 10 UNITS DRAW LINES PARALLEL TO END LINE

IF YOU HAVEN'T A RULER READING IN 10THS OF AN INCH, MAKE YOUR OWN USING ANY PIECE OF PAPER, AND THE SLANT LINE METHOD OF PLANE GEOMETRY, COMMONLY USED IN AIRFOIL LAYOUT. IF MEASUREMENT IS 3.625", MARK OFF 3" WITH AN ORDINARY RULER. THEN USING THE PIECE OF PAPER WITH 1" DIVIDED INTO 10THS, ADD .6" TO 3" PLUS $\frac{25}{40}$ OF .1" (.625" IS SHOWN ON THE SCALE ABOVE).



WHEN INKING, FILL YOUR RULING PEN WITH AN EYE DROPPER. IT IS FAR BETTER THAN THE USUAL TYPE SHOWN ABOVE. SQUEEZE THE EYEDROPPER JUST ENOUGH TO EMIT A SINGLE DROP OF INK. SOME INK COMES IN BOTTLES WITH AN EYE DROPPER TOP. A SIMPLE AND EFFICIENT SUBSTITUTE IS A FIVE CENT EYE DROPPER. THEY CAN BE INEXPENSIVELY REPLACED WHEN AIR LEAKS THROUGH THE RUBBER TOP. TO CLEAN THE PEN WHEN IT GETS CLOGGED HAVE A SCRAP PIECE OF PAPER HANDY WITH ONE OR TWO CORNERS FOLDED UP. SLIDE THE CORNER POINT OF THE PAPER THROUGH YOUR PEN. THE INK, BEING ON THE VERTICAL CORNER OF THE PAPER, WILL NOT RUIN YOUR DRAWING OR DRAFTING BOARD BEFORE IT DRIES. DRAFTING TECHNIQUES AND HINTS GO HAND IN HAND WITH ENGINEERING AND EXPERT MODEL BUILDING, — AND OF COURSE ALL OF YOU WISH TO BE EXPERT MODEL BUILDERS. SHORT CUTS AND IMPROVED METHODS ARE IN USE EVERYWHERE. DON'T FAIL TO NOTICE THEM! YOU'LL BE AHEAD OF YOUR FELLOW MODEL BUILDERS.

PLANE TIPS VII

WHAT'S THE PITCH?

Here is an instrument simplifying measurement of propeller pitch

MOST model props do not have the pitch indicated, and it is quite a job to check the blade angle and determine just what the pitch is, unless one is thoroughly acquainted with the geometry and mathematics involved. Here is a simple instrument which can be "slapped against" any true-pitch prop, and the pitch read directly on the instrument dial. The illustration shows how the instrument is used.

In order to determine the "standard" or "nominal" pitch in feet, blade angles of full size airplane propellers, 8 to 14 feet in diameter, are measured at the "42-inch station." Likewise, model airplane propellers ranging from 8 to 14 inches in diameter can be measured at the "3 1/2 inch station," or 3 1/2" from the center of rotation to determine the pitch in inches.

The drawing shows a perspective view, plan view and side elevation of the instrument. The blade plate, dial plate and pointer are made of wood (preferably hardwood) 5/16" thick, and the shaft of a 5/16" dowel. There is only one critical dimension—3 1/2" between knife edges.

After the blade plate, pointer and dial plate are made to shape shown in the plan view, the plan view may be cut from the drawing and attached to your dial plate with rubber cement, to serve as a dial on your instrument. First, carefully cut out the shaft hole of the plan view to fit your shaft. This accurately spaces the dial graduations from the pointer's center of rotation. The dial, it will be noted, has indicated thereon, in inches, pitch for left-hand (LH) and right-hand (RH) props, direction of rotation being considered when facing the direction of movement of the plane. Three scales are shown, "Geometric Pitch" (GP); "Effective Pitch" (EP); and Miles Per Hour at 4,000 Revolutions Per Minute, regarding which, more later. For the present, we shall deal only with the Geometric Pitch.

The blade plate, pointer and collar are pinned to the shaft with 1/8" dowels after gluing these three parts to the shaft to prevent any play after assembly. The collar, which may be made of wood or metal, should be snug against the bottom of the dial plate, but loose enough to permit the dial plate to turn freely on the shaft and relative to the pointer. The proper amount of play is best secured by using a washer (cut from ordinary writing paper) between the collar and the dial plate, mounting the collar snugly, and then tearing out the washer.

Now that the instrument is assembled the mark on the pointer can be scribed. Place the knife-edges against a true, flat surface and carefully scribe the pointer mark in alignment with the zero mark on the dial plate.

To use the instrument the knife edge of the blade plate is placed against the back (flat face) of the prop blade, and the knife edge of the dial plate is placed against the hub, exactly at the center line of the crankshaft hole. The pitch of the prop is then indicated in inches on the dial plate. Simple, isn't it?

It may be that the face of the prop hub is not at right angles to the crankshaft hole. To secure maximum accuracy, a reading should be taken for each blade of the prop and an average of the two readings used as the final reading. For instance, if one blade reads 7" EP and the other 7 1/2" EP, then the average (7 1/4" EP) should be taken as the final reading.

For the benefit of those who would like to know how the dial graduations are determined, a diagram is included in the drawing at the right of the plan view. In this diagram—

$$ab = 7\pi, \text{ and}$$
$$bc, bc', \text{ etc.} = \text{pitch.}$$

7π is used, because 7 is the corresponding diameter of the 3 1/2" station of a prop, and the base ab of the triangle abc is the circumference of a circle having a 3 1/2" radius. The diagram is drawn so that—

$ab = 7\pi$ inches
$bc = 4$ inches
$bc' = 5$ inches
$bc'' = 6$ inches, etc., using a scale of 1/8 inch = 1 inch

The lines ac, ac', ac", etc., determine the positions of the dial graduations.

A geometrical diagram is also included in the drawing to more clearly illustrate the procedure. A section of the propeller blade at the 3 1/2" station is shown. The angle of its flat face corresponds to the line ac, the plane of rotation being ab. Distance bc is the geometric or true pitch of the 3½" station.

Since—

ab (circumference) $= 7\pi$ (πD or 2πR), and

PROP BLADE ANGLE CHART

RADIUS in inches	PITCH in inches												
	4	5	6	7	8	9	10	11	12	13	14	15	16
1	32.5	38.5	43.7	48.1	51.9	55.1	57.9	60.3	62.4	64.2	65.8	67.3	68.6
2	17.7	21.7	25.5	29.1	32.5	35.6	38.5	41.2	43.7	46.0	48.1	50.0	51.9
3	12.0	14.9	17.7	20.4	23.0	25.5	27.9	30.3	32.5	34.6	36.6	38.5	40.4
4	9.0	11.3	13.5	15.6	17.7	19.7	21.7	23.6	25.5	27.3	29.1	30.8	32.5
5	7.3	9.0	10.8	12.6	14.3	16.0	17.7	19.3	20.9	22.5	24.0	25.5	27.0
6	6.0	7.6	9.0	10.5	12.0	13.5	14.9	16.3	17.7	19.0	20.4	21.7	23.0
7	5.2	6.5	7.8	9.0	10.3	11.6	12.8	14.0	15.3	16.5	17.7	18.8	20.0
8	4.5	5.7	6.8	7.9	9.0	10.2	11.3	12.3	13.5	14.5	15.6	16.6	17.7
9	4.0	5.0	6.1	7.1	8.1	9.0	10.0	11.0	12.0	12.9	13.9	14.9	15.8
10	3.6	4.5	5.5	6.4	7.3	8.2	9.0	9.9	10.8	11.7	12.6	13.4	14.3

bc (pitch) =4,

and since we know from trigonometry that the tangent of angle cab = $\frac{bc}{ab}$ then, substituting values:

$$\tan cab = \frac{4}{7\pi} = \frac{4}{22} = .18182.$$

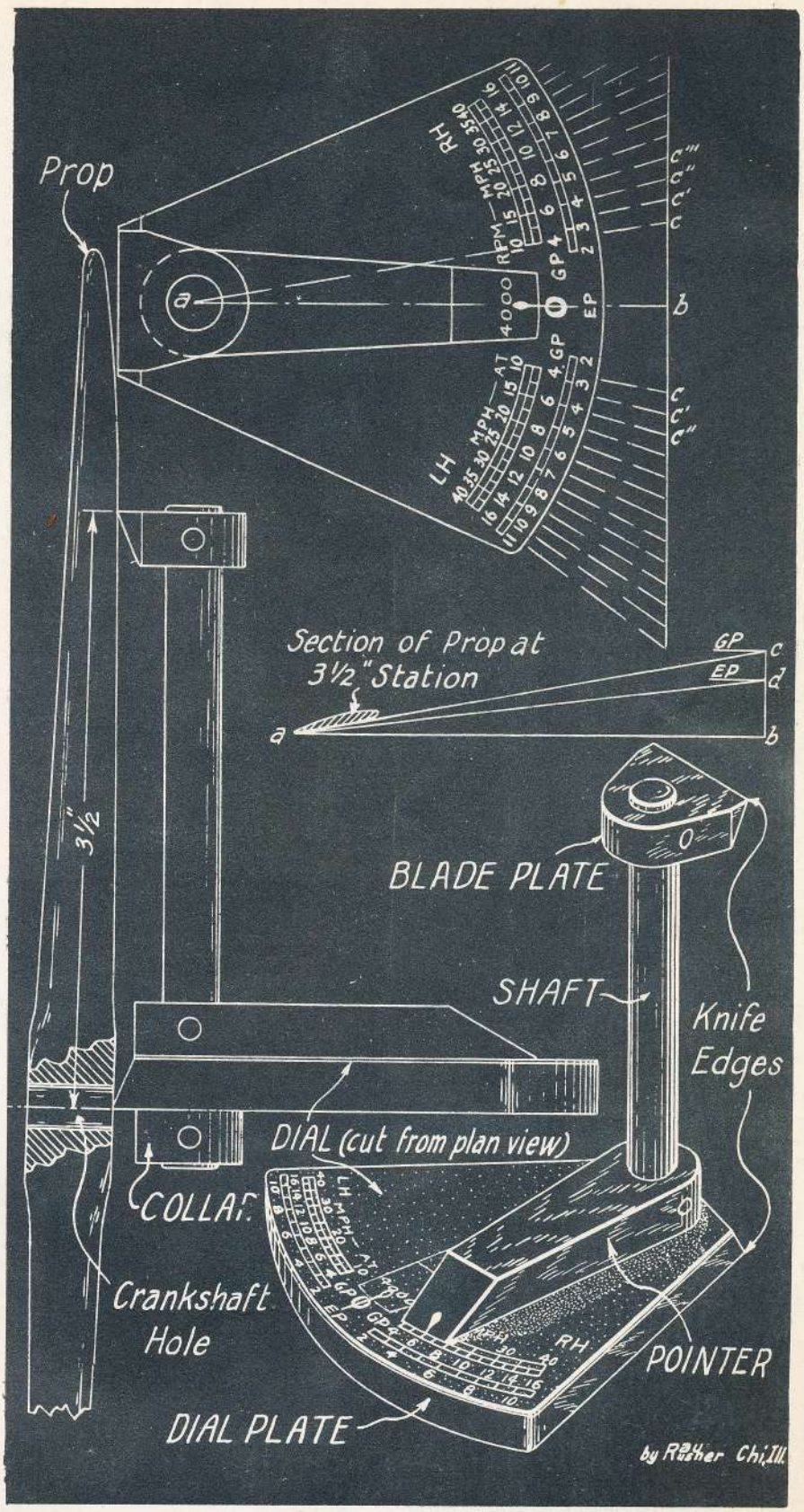
Looking up the tangent of .18182 on a table of values of trigonometric functions, we find the corresponding angle to be 10°, 18.3′, which, to the nearest one-tenth degree, equal 10.3°. The dial graduation No. 4, accordingly, corresponds to an angle of 10.3°, tenths of a degree being close enough for all practical purposes, in connection with prop blade angles. The other angles determined by the above formula are as follows:

Pitch (in.)	5	6	7	8	9	10
Angle	12.8°	15.3°	17.7°	20.0°	22.3°	24.5°
Pitch (in.)	11	12	13	14	15	16
Angle	26.6°	28.6°	30.6°	32.5°	34.3°	36.0°

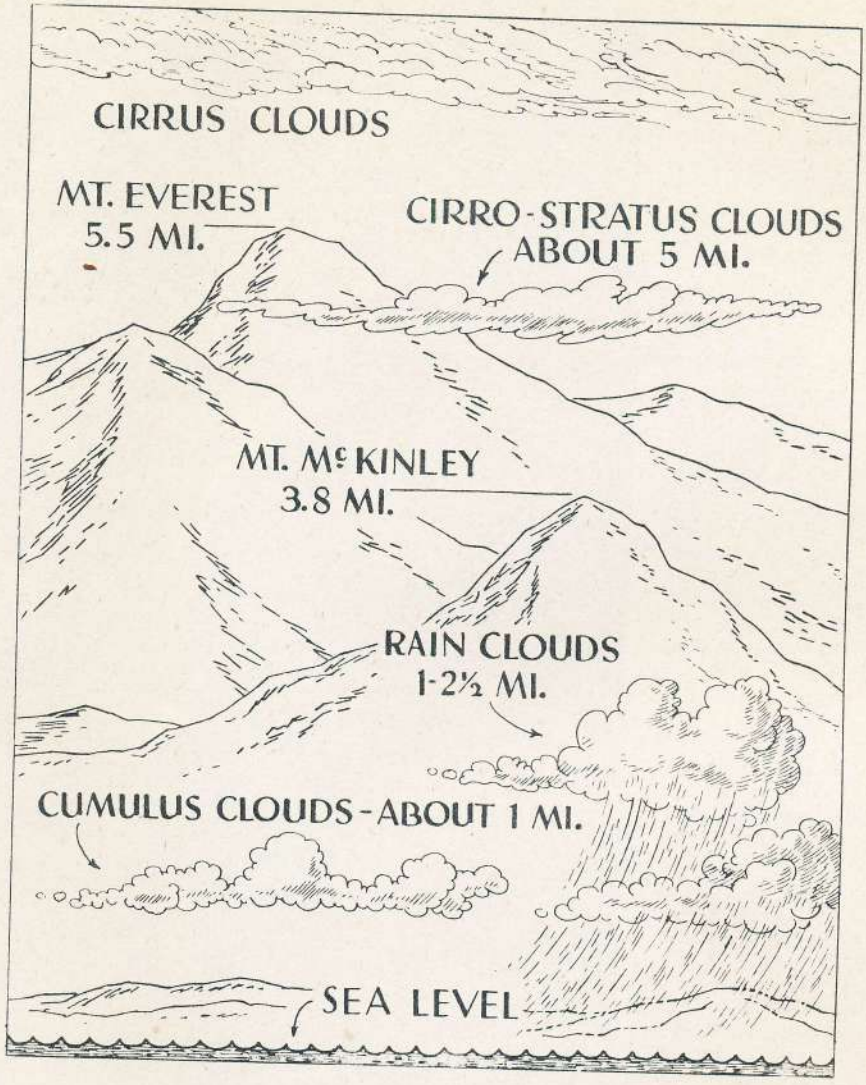
Referring again to the geometrical diagram, point d is placed 2/3 of the way from b to c. Due to the efficiency of model props being only about 66-2/3%, the effective pitch or distance traveled per prop revolution is represented by the length of the line bd, and the effective pitch angle is dab as compared with the geometric pitch angle cab.

Based on an average of 20 mph corresponding to 8″ GP, and on an engine speed of 4000 rpm, a direct reading rpm scale is included on the dial of the instrument. This is convenient for approximate mph determination. For closer calculations, depending on wing load, wing section, camber factor and wing angle of incidence, the Speed and Pitch Table should be used. A different engine speed would also require modification of the mph reading.

The pitch-determining instrument here described includes pitches from 4″ to 16″, which takes care of the propeller range set forth in the above mentioned Article 13. After becoming familiar with the method used for marking the dial graduations, the reader can design an instrument for checking at other stations, such as at the 7-inch station for props ranging from 16″ to 28″ in diameter. The line ab in that case would be 14π instead of 7π, and the knife edges would be spaced 7″ apart. All modelers who want to get the most from their props and determine by experiment the relative merits of props having different pitches, will find this instrument well worth the time spent to make it. Incidentally, if you want to make the instrument "knock-down" for more compactness when not in use, the collar and its 1/8″ dowel pin can be made removable. In that case, the pin should be tapered.



PLANE TIPS VIII

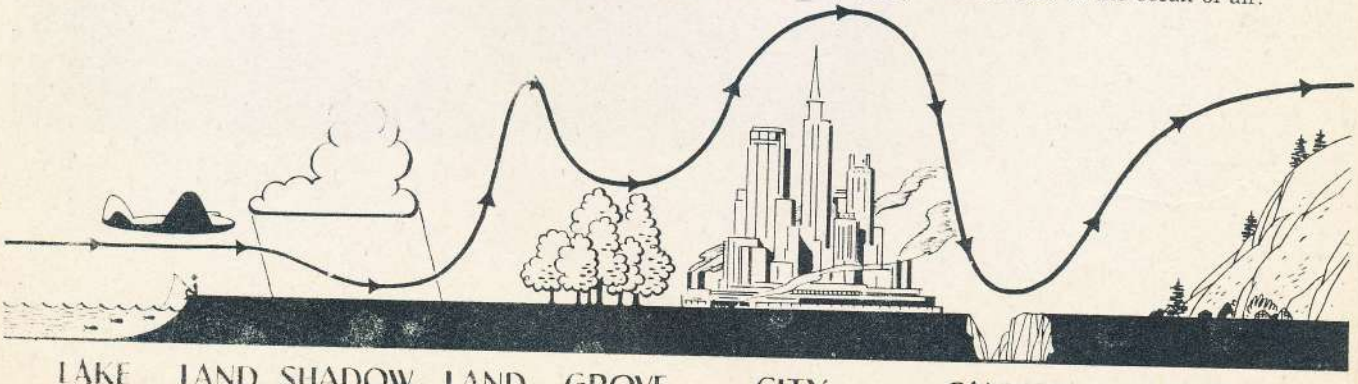


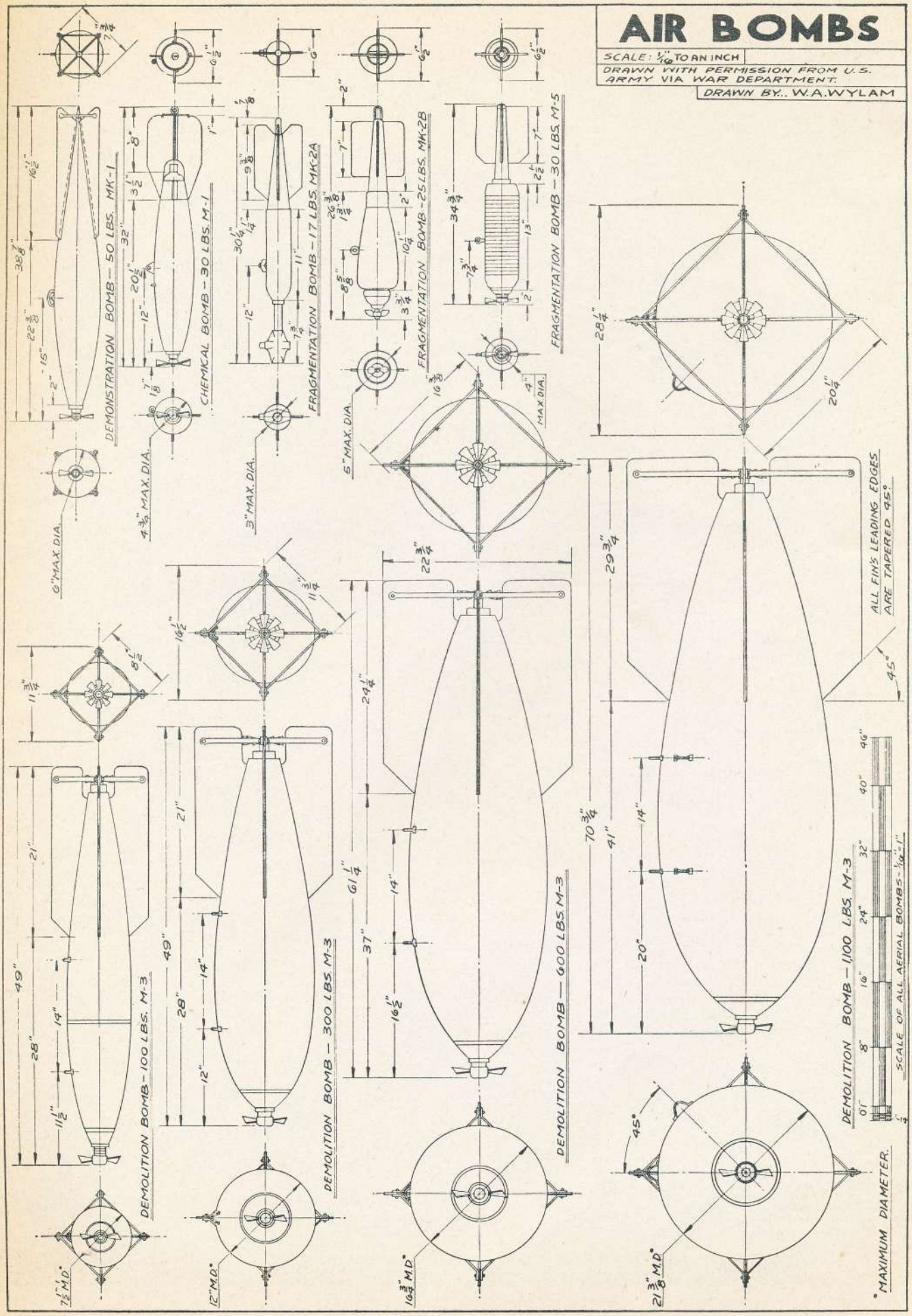
THE uneven contour of the earth, natural or artificial, creates updrafts and downdrafts that bump even the heaviest airliners out of the smooth line of theoretical normal flight. A hill develops an air hump; a cold lake activates a downdraft; the belching chimneys of a city cause a riser—and these extend to a considerable distance above the earth.

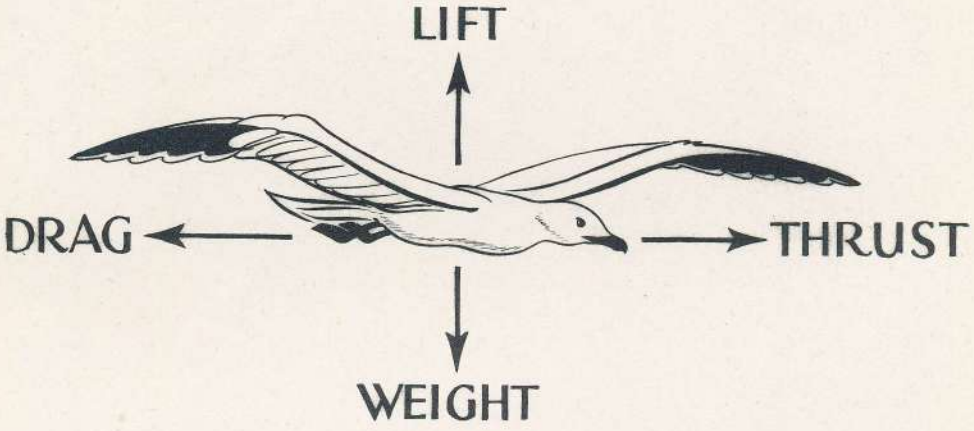
Thermals are frequently capped by cumulous clouds whose buttresses usually indicate ideal soaring conditions. Another indication of good soaring conditions is where prevailing winds strike the face of a high knoll causing an updraft.

But it has been learned from experience that thermals do not depend entirely upon uneven surface contours like hills, cities, woods, etc. A riser may be created on perfectly level ground when temperatures are so high that heat rises from the flat terrain.

The flying scale model builder should learn to recognize thermal conditions, then he will be forewarned before he trusts his aerodynamic argosy to the invisible tides of the ocean of air.




AIR BOMBS
SCALE: 1/16" TO AN INCH
DRAWN WITH PERMISSION FROM U.S. ARMY VIA WAR DEPARTMENT.
DRAWN BY... W.A.WYLAM
DEMONSTRATION BOMB — 50 LBS. MK-1
CHEMICAL BOMB — 30 LBS. M-1
FRAGMENTATION BOMB — 17 LBS. MK-2A
FRAGMENTATION BOMB — 25 LBS. MK-2B
FRAGMENTATION BOMB — 30 LBS. M-5
DEMOLITION BOMB — 100 LBS. M-3
DEMOLITION BOMB — 300 LBS. M-3
DEMOLITION BOMB — 600 LBS. M-3
DEMOLITION BOMB — 1100 LBS. M-3
ALL FINS LEADING EDGES ARE TAPERED 45°
SCALE OF ALL AERIAL BOMBS - 1/16" = 1"
* MAXIMUM DIAMETER.


LIFT
DRAG
THRUST
WEIGHT

An AIR AGE *Publication*