AIR TRAILS

56335-4 VOLUME 3/NUMBER 2 SUMMER/1979 PDC $3.25

Classic Flying Models

100 PAGES OF FUN-FLYING NOSTALGIA MODELS!

AIR TRAILS

Classic Flying Models

VOLUME 3/NUMBER 2
SUMMER/1979

PATRICK H. POTEGA
Advertising Director
7950 Deering Avenue
Canoga Park, California 91304
(213) 887-0550
KAREN R. LAMONTIA
Advertising Coordinator

AIR TRAILS CLASSIC FLYING MODELS is published quarterly by Challenge Publications, Inc., 7950 Deering Avenue, Canoga Park, California 91304. Publisher assumes no responsibility for unsolicited material. All photos, manuscripts and artwork must be accompanied by stamped self-addressed return envelope. Subscription orders and changes of address should be sent to AIR TRAILS CLASSIC FLYING MODELS, Subscription Dept., 7950 Deering Ave., Canoga Park, CA 91304. Allow at least 60 days for first copy of new subscription to be mailed, or for change of address. Include old address, as well as new, and address label from recent issue, if possible. Subscription rates: one year subscription rate for U.S. $9.00; all other countries add $1.50 United States currency. Application to mail at second class postage rates is pending at Canoga Park, California and at additional mailing offices. Printed in U.S.A.

MODEL BUILDING

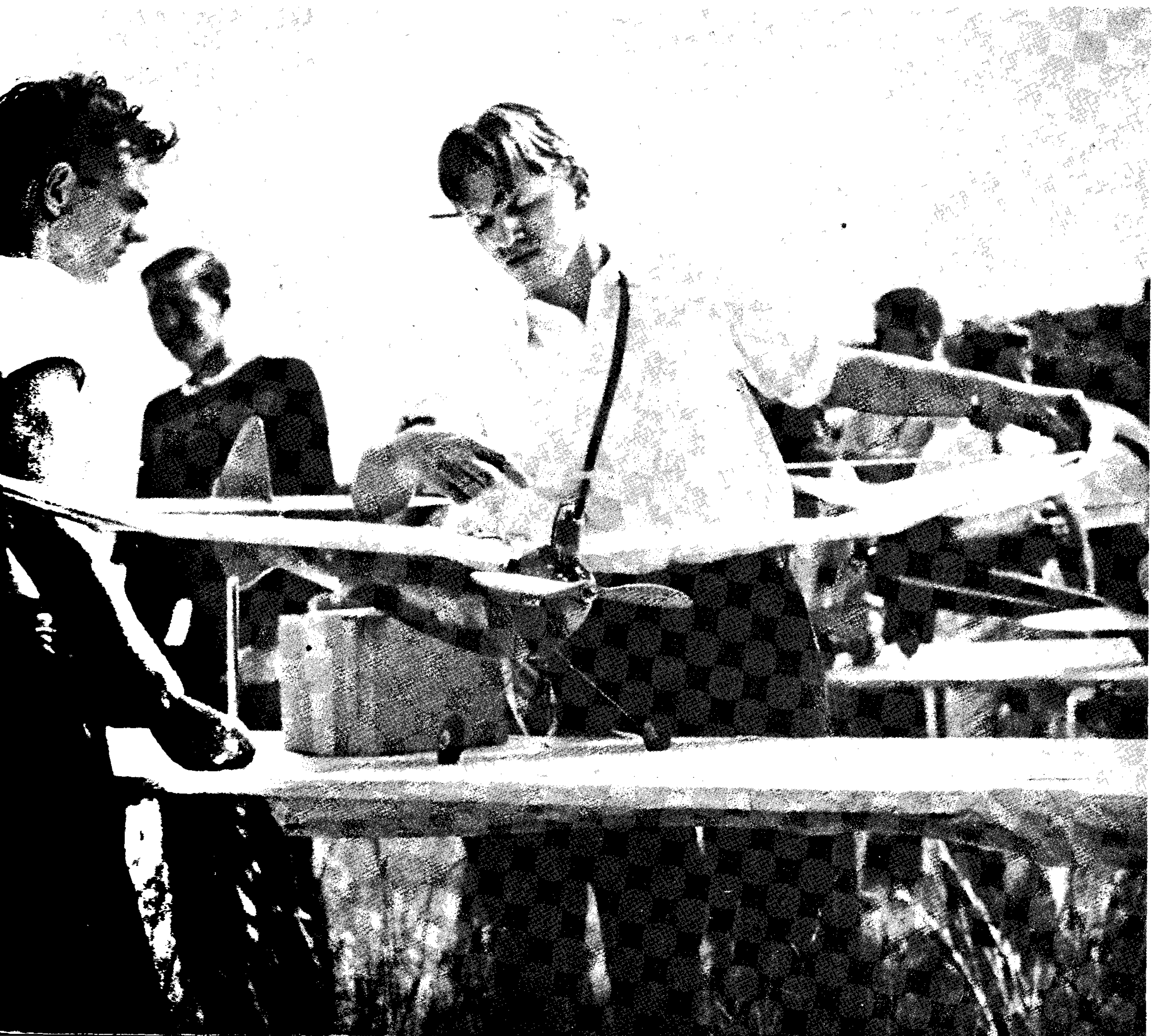
AIR TRAILS MAGAZINE

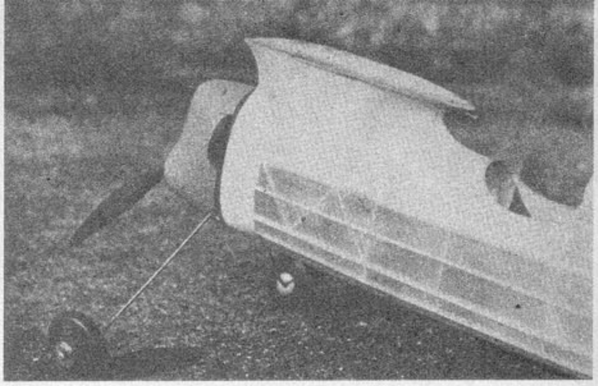
Henry Struck's New Ruler • British Rubber-powered Champ

Nationals Flying Scale Winner • Sectional News • Photos

APRIL 1940

Emblematic of spring activity among model builders everywhere, we show Paul Karnow measuring Charles Elwell's ship for flight competition.





The model is larger, heavier, more detailed. Construction is robust. Wing span is six feet. Note the pylon construction and the position of timer directly beneath the cockpit.

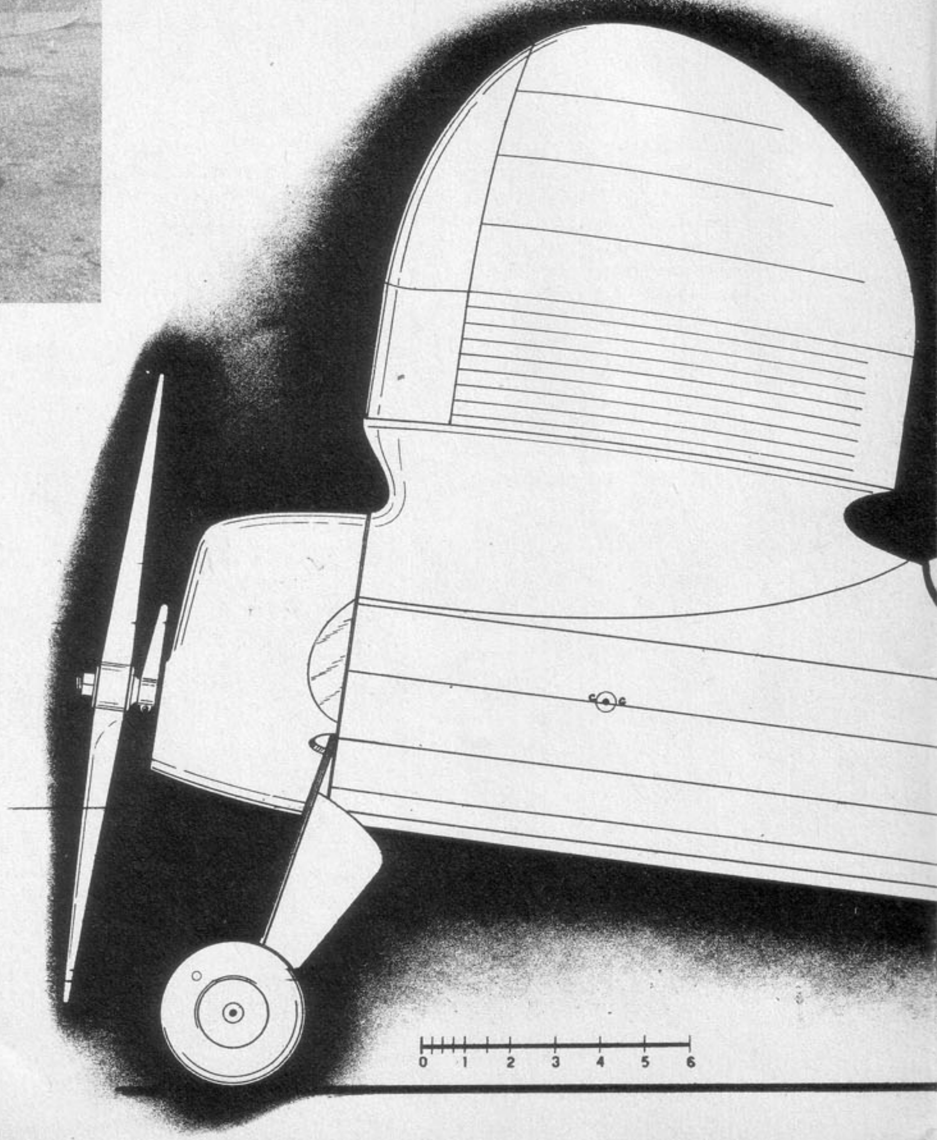
Silk covering of pylon does not tôuch internal framework but forms own natural contour. Realistic cockpit does not affect performance.

THE NEW RULER

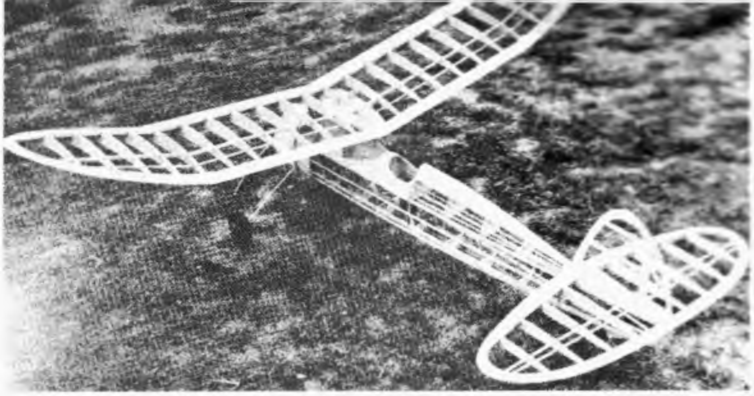
PART ONE

The builder of the Record Hound designs a high-performance ship especially for the 1940 rules. The New Ruler has already set a new N. A. A. record. Watch it!

BY HENRY STRUCK



Entire engine mount, chassis, battery tray, et cetera, is easily detached. Plywood tray is resilient to landing shocks. Notice the timer.



Construction is conventional. Rudder shown was replaced by an aluminum tube one in the plans. Fuselage silk-covered, wings and tail with paper. Wing section N. A. C. A. 6409.

GAS model flying has taken another step forward! Under the official N. A. A. contest rules for 1940 a ship "must weigh at least 80 ounces for every cubic inch of motor(s) displacement." The weight of the model is now controlled by the *power* loading rather than the *wing* loading. To design the best ship for these rules involves the consideration of numerous problems.

Here's our solution—the New Ruler.

With the weight fixed by the displacement of the engine, the first requirement is the selection of the most powerful motor per cubic inch of displacement. The majority of Class C engines range from .55 to .65 cubic inches, indicating keen competition between the manufacturers of these sizes, with the probability of superior products and further development.

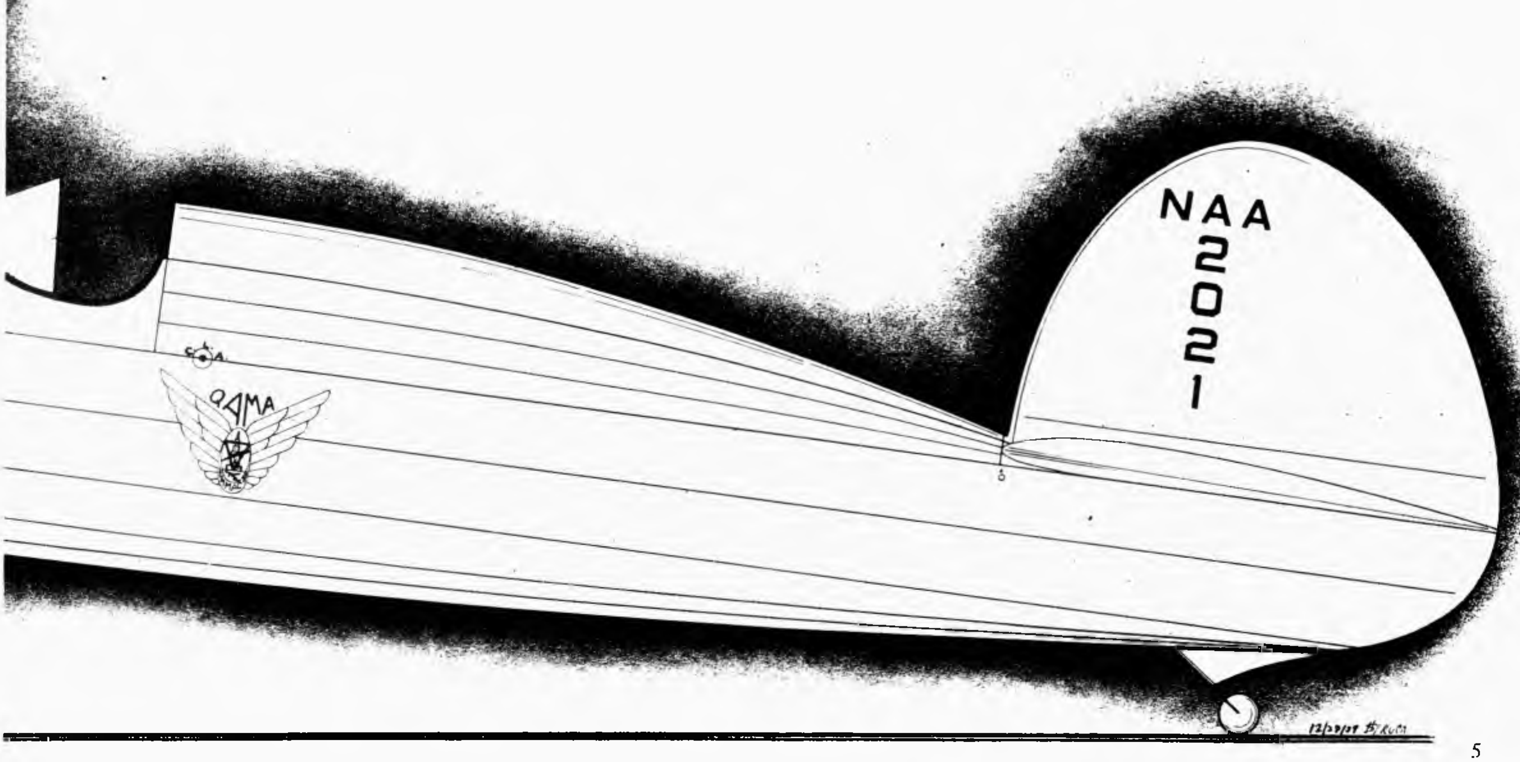
After the powerful engine has given the ship maximum altitude, the duration depends on the ability of the model to soar. The sinking speed—the rate of descent in feet per second—rather than the gliding angle determines the ease with which a "riser" will sustain the model. To obtain the lowest sinking speed the glide should be as flat and slow as possible without mushing or stalling. "Cleanlining"—simplified streamlining—an airfoil efficient at low angles of attack, and the maximum wing area allowed by the eight ounce per square foot wing-loading rule promise best results.

Aerodynamically, stability is most important. A model should climb evenly and in circles to avoid a dip when the engine cuts. During the glide the circle should be constant, without any tendency to waver or "crab." The model should not be critical to adjust, and any slight accidental change in setting should not bring on disaster.

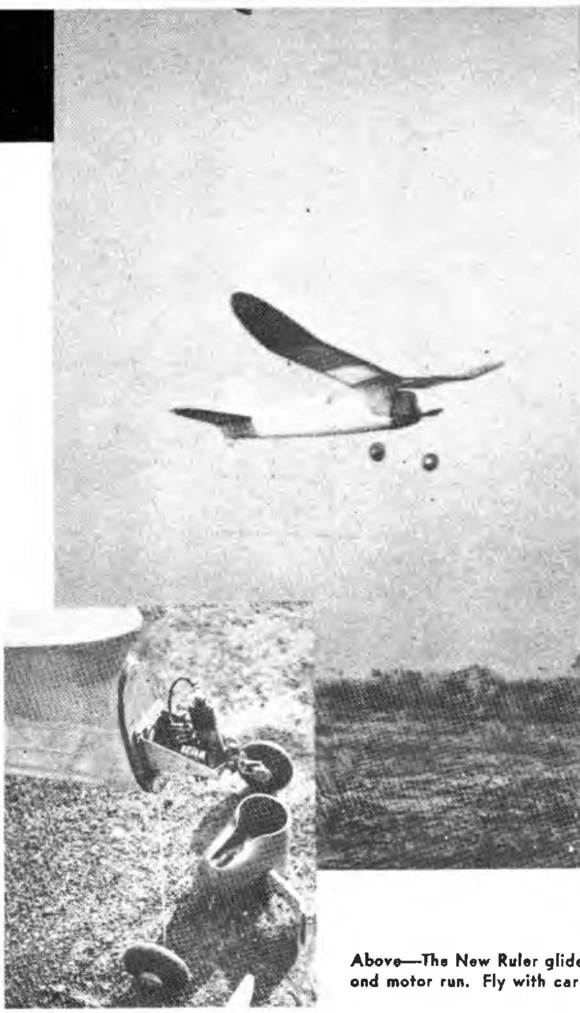
A parasol wing will keep the nose up and magnify the desirable effect of a polydihedral wing. A large lift stabilizer will dampen the nosing-up tendency of the parasol before a dangerous stall results. The area of the rudder and the rear of the fuselage are vital to spiral stability. If the area is too small the ship will whip suddenly into a tight spin. If too large, the ship will tend to remain in whatever position it assumes, with the possibility of either a straight loop or a tightening spiral. From experience we have found the best position of the C. L. A. (center of lateral area) to be about one fourth of the fuselage length behind the C. G. (center of gravity).

The construction of the ship should permit the various structures to be easily lined up without sacrificing cleanlining. Every part should be quickly demountable for transportation and shock absorbing. The entire engine unit should be available for instant checking, including the important flight timer mounted in a handy position, for setting or release, when the model takes off.

All these ingredients have been incorporated into the New Ruler. The consistent performance of the ship has demonstrated them. Powered with a "hot" motor the climb is amazing, turning in an average duration in dead air of 2½ to 3



THE NEW RULER



minutes on a 20-second engine run. But its "riser-haunting" glide minimizes the advantages of even great power, making the New Ruler a constant threat under any conditions

FUSELAGE CONSTRUCTION

The fuselage is built up around an inner frame of ¼" square balsa to simplify alignment. Lay out the side view in full size. The longerons are 2½" apart and parallel. Determine the location of the uprights by consulting the dimension chart given on Plate I. Build both sides at the same time—one atop the other—to assure their being alike. Note that the dimensions are given from the inside of each longeron to the center line to aid in laying out accurate top and bottom views. Therefore the full length of each cross piece is twice the dimension given. Join the sides from Station 1 to 5. Pull the longerons together at the rear, install the stern post and set the frame on the top view. Fit the required cross pieces and complete the bottom in a similar manner. See Fig. 1.

Trace the formers and bulkheads from the full-size patterns given on Plate II onto the stock specified. Lay the ⅛" sheet pylon floor and cement the top formers in position. Insert the turtleback stringers of 1/16 x ¼". Fill in between T 2 and T 3 with 1/16" sheet to form the "box" which is the backbone of the pylon. Add Formers 13 and 14 and the top of 3/16" sheet to complete the outline of the pylon structure. **Attach the side** stringers and the 1/16 x ⅛" beading strips that

Above—The New Ruler glides in for a landing. Struck's model does three minutes plus in calm air on a twenty-second motor run. Fly with care, for this is an easy model to lose. Left—The motor cowl is independently detachable.

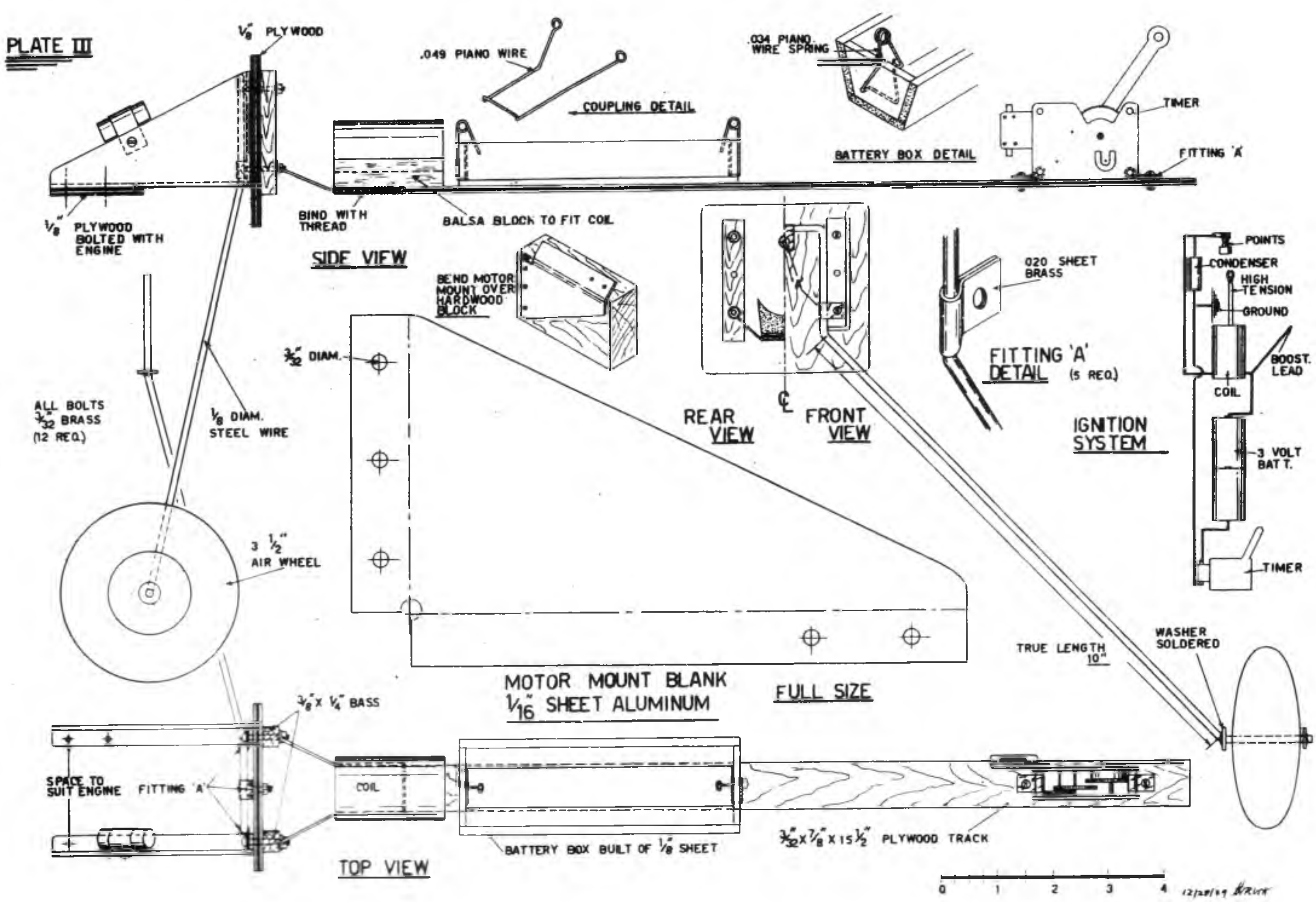
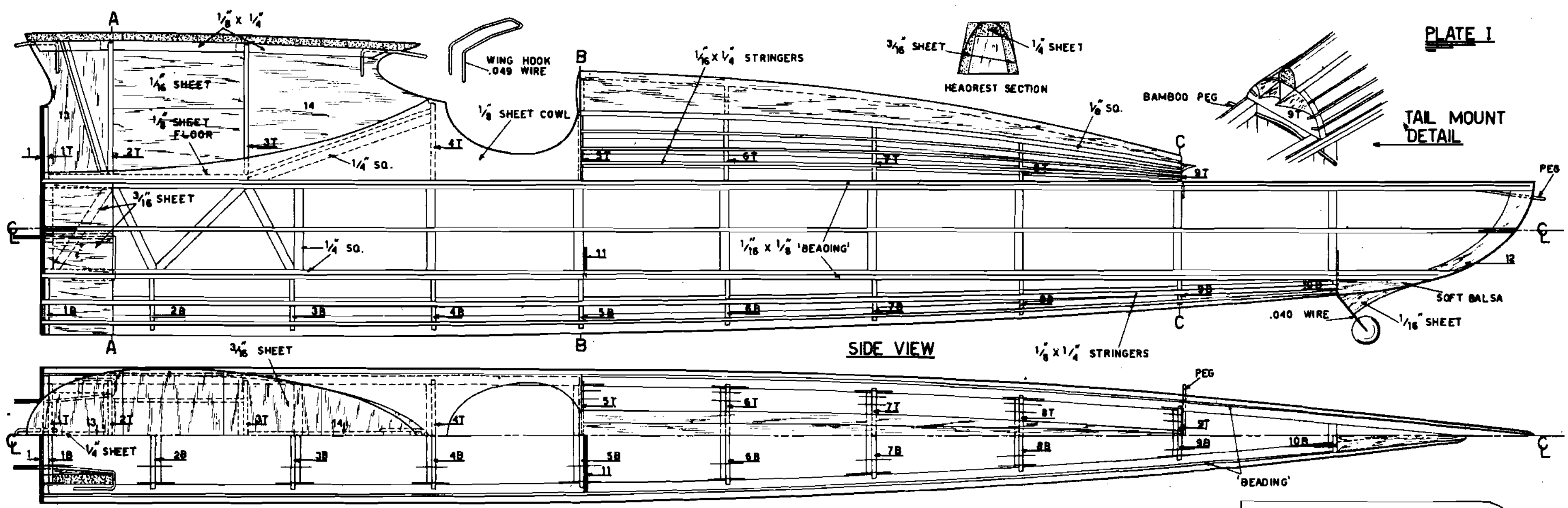
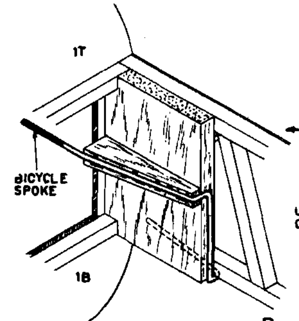
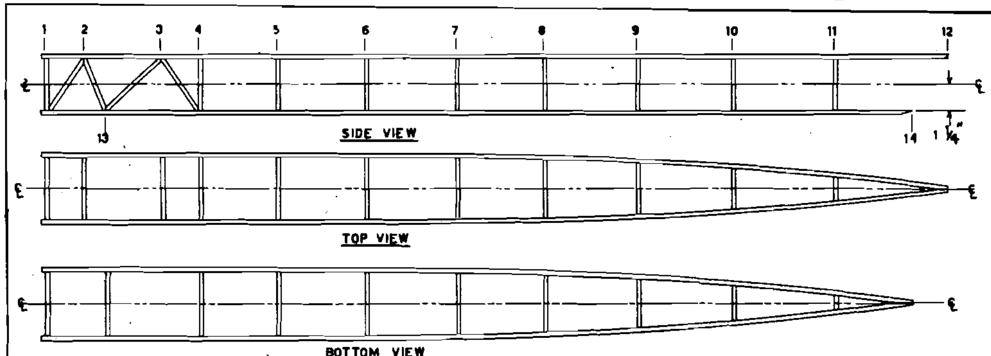


PLATE I



TOP VIEW ABOVE ℄ BOTTOM VIEW BELOW ℄

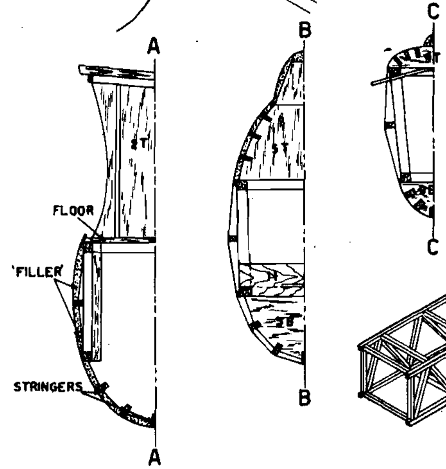




INNER FRAME LAYOUTS

DIMENSION CHART

STATION	DISTANCE BETWEEN	WIDTH OF TOP TO ℄	WIDTH OF BOT. TO ℄
1	——	1 13/16"	1 13/16"
2	2"	"	——
13	1 1/16"	——	1 13/16"
3	2 5/8"	1 13/16"	——
4	1 7/8"	"	1 13/16"
5	4"	"	"
6	4 1/2"	"	1 3/4"
7	"	1 3/4"	1 5/8"
8	"	1 5/8"	1 1/2"
9	4 5/8"	1 3/8"	1 1/4"
10	4 7/8"	1"	7/8"
11	5"	3/4"	1/2"
14	4"	——	1/4"
12	1 7/8"	1/4"	——



FUSELAGE SECTIONS

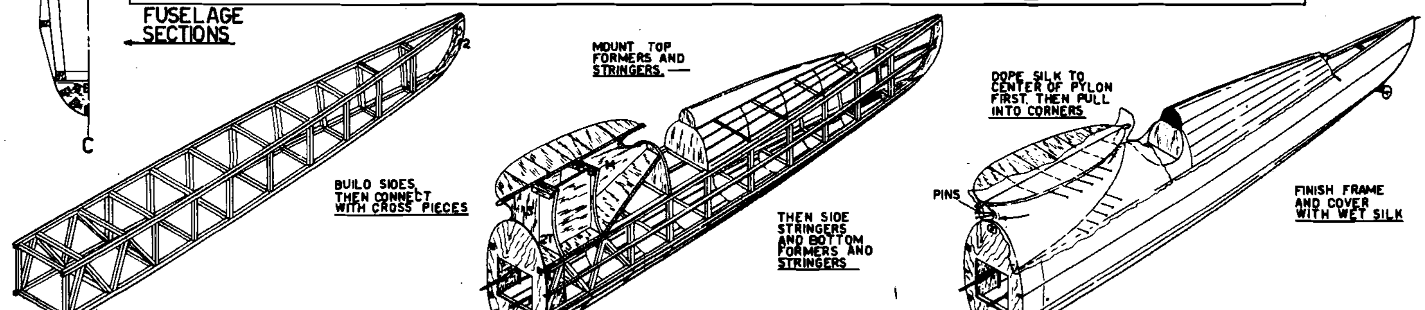
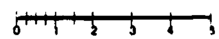


FIG. I FIG. II FIG. III

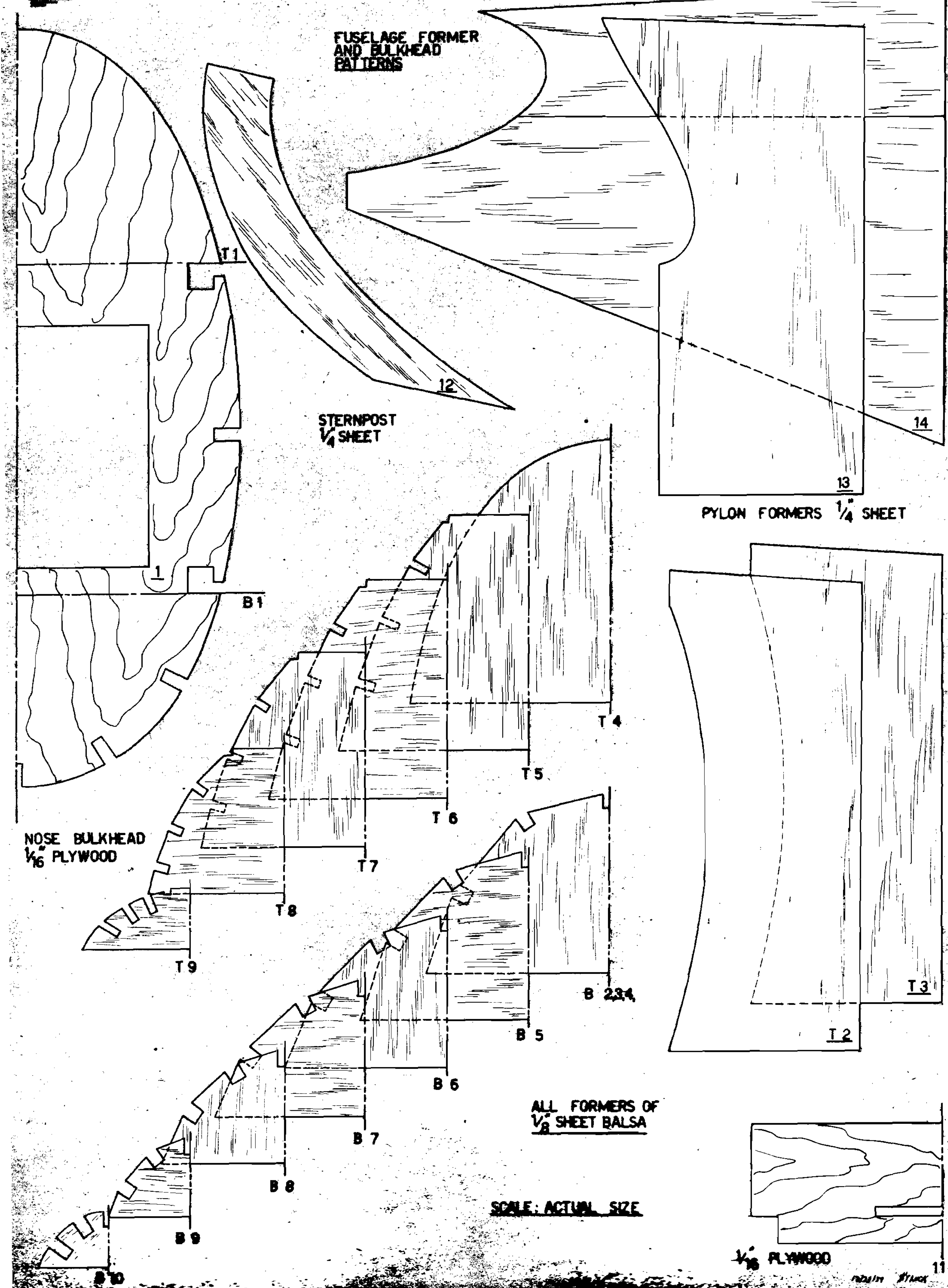


SCALE

THE NEW RULER

CONTINUED FROM PRECEDING PAGE

PLATE II



prevent the covering from sticking to the inner frame. Cement the cockpit cowl of $\frac{1}{8}''$ sheet to the top longeron. Moisten the outside of the wood slightly to avoid splitting and bend it over the formers. Glue the nose bulkhead of $\frac{1}{16}''$ plywood in place and mount the bottom formers. Insert the stringers of $\frac{1}{8}$ x $\frac{1}{4}''$, sighting frequently along their length to keep them free of "hooks" and "bellies." Cut the headrest sides from $\frac{3}{16}''$ sheet balsa. Join the sides to a $\frac{1}{4}''$ sheet top piece, first cementing the front seetion between the two small bulkheads. When dry pull the rear together and there will be no danger of the pieces springing apart. Shape the headrest to the cross section indicated on Plate I. After the headrest has been sanded smooth, cement it to the turtleback. Fit a $\frac{1}{8}''$ square fillet stringer at the bottom corner, to provide a surface to which the covering can be attached. Cement reinforcements of $\frac{1}{4}''$ sheet balsa inside the nose of the fuselage to support the motor retainers formed of bicycle spokes. Use several coats of cement to anchor them solidly. See Motor Retainer Detail, Plate I. The fuselage has now reached the stage shown in Fig. II.

Fill in the nose section of the fuselage with $\frac{3}{16}''$ sheet and carve to fit the contour of the nose bulkhead. See Fuselage Section A-A. Install the battery track guide bulkhead 11 of $\frac{1}{16}''$ plywood. See Fuselage Section B-B. Smooth the entire frame with successively finer grades of sandpaper to remove any bumps that may spoil the appearance of the finished job. Form the wing hooks of .049 piano wire and cement them solidly to the pylon formers. The fuselage is now ready for covering. Silk is recommended both for ease of application and durability. The entire bottom and both sides can be quickly covered with one piece of silk. Cut a strip about 20'' wide and $1\frac{1}{2}$ yards long. Wet the silk thoroughly and spread it over the bottom of the fuselage. The wet material will stick to the frame and make it a simple matter to work up each side, pulling out the wrinkles. When most of the wrinkles have been smoothed out, apply heavy dope over the silk along the center stringer, the edge of the nose bulkhead and the top beading, to stick it in place. Before the dope is dry pull out any small wrinkles.

Then apply two more coats of dope when the fabric dries, because the dope does not stick too well to wet wood. Cover the headrest and turtleback in the same way, sticking the silk carefully to the fillet stringer at the bottom corner of the headrest. Now to cover the pylon with silk. Cut a piece of silk of ample size, wet it and lay it in place, spreading it roughly into position. Apply dope over the frame between T-2 and T-3. Pull the silk taut vertically, using pins to hold it if necessary. Then draw in each end, pulling lengthwise, and dope and pin the silk to the outline in a similar manner. When the fabric and wood are quite dry apply several more coats of dope to prevent the silk from springing loose, and remove the pins. Try to pull the silk as evenly as possible on each side to assure a symmetrical cross section. But if one side does have less "hollow" than the other, a band of extra coats of dope brushed on lengthwise will increase the curvature. Do not permit the silk to stick to any of the pylon formers or the contour of the fillet will be spoiled. Apply three or four coats of clear dope to the fabric, polishing between each with 10 nought sandpaper to smooth the "fuzz." The completed fuselage will appear as shown in Fig. III.

MOTOR UNIT CONSTRUCTION

The motor bulkhead is a 3'' square of $\frac{1}{8}''$ plywood. Cement and brad the motor bulkhead keys of $\frac{1}{4}$ x $\frac{3}{8}''$ bass to the bulkhead.

Trace the full-size motor mount blank onto $\frac{1}{16}''$ sheet aluminum and cut out with a jig, or jeweler's saw. Clamp the blanks in a vise and file them to exact shape. Bend the blanks over the rounded corner of a hardwood block, by tapping with a mallet, or a hardwood block and a hammer. Be sure to make one right and one left. Drill all the holes with the exception of the motor bolt holes. Cut five $1\frac{1}{4}''$ long blanks from .020 x $\frac{1}{2}''$ sheet brass and bend fittings 'A' around a length of $\frac{1}{8}''$ wire. See Fitting 'A' Detail, Plate III. Form the landing gear from $\frac{1}{8}''$ diameter steel wire, measuring each bend to assure regularity.

Slide the fittings onto the landing gear. Attach the landing gear and the motor mounts to the bulkheads by $\frac{3}{32}''$ bolts. Form the coupling of .049 piano wire and clamp it to the bottom pair of bolts by a couple of extra nuts. Use a flat washer and a lock washer under each nut to prevent them from loosening due to vibration.

Lash the battery track to the coupling with plenty of thread and cement a block of balsa, hollowed out to fit the coil, on top of the joint. This unit is extremely flexible and absorbs shock and vibration well. Clamp the timer to the battery track by the remaining pair of fittings 'A.' Construct a battery box of $\frac{1}{8}''$ sheet and mount .034'' piano-wire springs at each end. See Battery Box Detail, Plate III. A pair of $3\frac{1}{2}''$ air wheels are held on the axles by washers soldered on either side.

Slip the motor unit into the fuselage and clamp it in place by tightening down a pair of bicycle spoke nipples on the projecting spokes. An upright Brown B engine was mounted in the original but any other similar-size motor may be used by drilling the mounting holes to suit. Drill one hole and set the engine in place, adjusting the thrust line until it is not offset in any way. Then drill the remaining holes and complete installation.

Remove the motor unit and install the wiring. The ignition system shown on Plate III will operate on boosters even when the timer is switched off. One booster lead is clipped to a terminal extended from the coil and the other grounded. The motor and nose bulkheads should be either doped generously or varnished to protect them from the effects of oil and gas.

Next month the wing and tail construction will be detailed. Until then don't get so impatient that you start the motor and enter the fuselage in a midget auto race!

BILL OF MATERIALS

(For fuselage and motor unit)

All strip balsa should be hard and straight grained. All sheet balsa should be light and quarter grained.

6 ¼″ sq. x 48″ longerons
7 ⅛ x ¼ x 48″ stringers
6 1/16 x ¼ x 36″ stringers
2 ⅛″ sq. x 36″ stringers
6 1/16 x ⅛ x 36″ beading
3 ⅛ x 3 x 36″ bulkheads, pylon floor
1 3/16 x 3 x 36″ pylon top, headrest
1 ¼ x 3 x 36″ pylon formers, headrest, sternpost
1 1/16 x 9 x 6″ plywood nose bulkhead and battery track guide
1 3/32 x 1 x 16″ plywood battery track
1 ⅛ x 3 x 3″ plywood motor bulkhead
1 ¼ x ⅜ x 6″ bass motor bulkhead keys
1 1/16 x 3 x 6″ sheet aluminum motor mounts
1 .020 x ½ x 8″ strip brass fittings
1 ⅛″ diam. x 30″ steel wire landing gear
1 .049″ diam. x 12″ piano wire wing hooks and coupling
1 .034″ diam. x 18″ piano wire battery springs and tail wheel fork
12 3/32″ bolts, 12 lock washers, 18 brass washers
2 bicycle spokes motor retainers
1½ yards silk
½ pint each of cement and dope
1 pair of airwheels, engine, coil, condenser, timer

What's Your Question?

Question: I would like to know what type of engine is used on the Seversky P-35 and where I may obtain a drawing of it. J. P., Riverside, Cal.

Answer: The Seversky P-35 uses a Pratt & Whitney twin-row Wasp. The drawings of the ship appear in the 1939-40 issue of Air Progress.

Question: Could you tell me where the Glenn L. Martin Co. is located? O. P. P., Ashland, Ga.

Answer: It is located in Baltimore, Md.

Question: I have heard it mentioned that Lindbergh and a number of early transatlantic fliers used an earth inductor compass to navigate by. What kind of compass is that? C. H. A., Chicago, Ill.

Answer: An earth inductor compass is a direction indicator which depends on a field of an electric generator instead of earth magnetism. The generator brushes are manually set for a given course by a controller so that as long as the airplane stays on its course no current is generated and the galvanometer located on the dashboard reads zero. Deviation from the course will cause the needle of the galvanometer to swing right or left, indicating the direction in which the ship is off its course.

Question: I am seriously thinking of designing and building a small single-place biplane. I have studied aircraft design and flying and have my own ideas. Can you help me out? H. B., Lawndale, Cal.

Answer: We really do not know how we can help you out on this. A number of ships have been designed by individuals for their own private use and turned out all right, and a number of them were utter failures. It is quite a gamble to take, unless you are an aircraft engineer.

Question: Would you please tell me if the Eleventh National Soaring Contest will be held at Elmira, N. Y., or at Frankfort, Mich.? Also the address of Jerome Gordon, part owner of the Haller Hawk, Jr., which was bought from Dana Darling? G. S., Hamburg, N. Y.

Answer: The date and location of the National Soaring Contest has not been announced as yet by the Soaring Society of America. As soon as it is we'll publish it in the gliding and soaring department. We do not know the address of Jerome Gordon. Write for his address to the Soaring Society of America, Inc., 1909 Massachusetts Ave., Washington, D. C.

Question: Could I obtain plans on how to build a low-wing two-place tandem monoplane which would be equipped with a Ford V-8 engine of either 60 or 85 h.p.? Would it be possible to get in touch with some boys who have successfully built and flown homemade planes? What are the requirements needed to obtain an A. T. C. for the manufacture of airplanes? J. G., Lewiston, Me.

Answer: Sorry, but we do not know where you can obtain plans for the ship mentioned. Write to the Oregon Pilots' Association, Portland, Ore. A number of its members have built and flown their own ships. In order to get an A. T. C. you must file in duplicate with the Civil Aëronautics Authority, Washington, D. C., detailed drawings and technical data of the ship which you have built. Write to the C. A. A. for their Bulletin #04 called "Airplane Airworthiness."

Question: I would like to know where I can secure plans for a flying Flee ship. S. K., Pasadena, Cal.

Answer: We do not know where you can get plans for this ship, but maybe someone who has a set will see this item and get in touch with you.

NATIONALS FLYING SCALE WINNER

A good flying scale job should be easy to build and fly. This Cub model has got everything.

BY ROGER HAMMER

PLANS BY PAUL PLECAN

FLYING scale models have always been popular, especially among beginners, since they look so much like their prototypes. If one should look at the list of entries at the National meet, however, he would undoubtedly think that flying scale model builders are few and far between. Such is really not the case. Many model builders who attend the Nationals each year have built and flown flying scale models, yet they seem to forget that particular type when building their ships for participation in the annual brawl.

Why? The answer is simple. A model builder thinks that he has to have something more or less exceptional if he is to place among the "big-name" builders, so he thinks of a very clean design that will take a lot of time to build. In doing so, he does the reverse of what he should do. The correct way of going about this flying scale business is to choose a simple, easy-to-build and easy-to-fly model, and to make it strong. The strength is very important if the model is to stand up under all the abuse a flying scale model is subjected to when testing and flying under adverse conditions. The Taylor Cub (the 1937 Cub, then manufactured by Taylor), while not as clean as some military designs, makes up for this by its strength, which is almost unbelievable. The square fuselage construction allows as much strength as in a cabin type fuselage of the same size, permitting the use of a powerful motor for top performance.

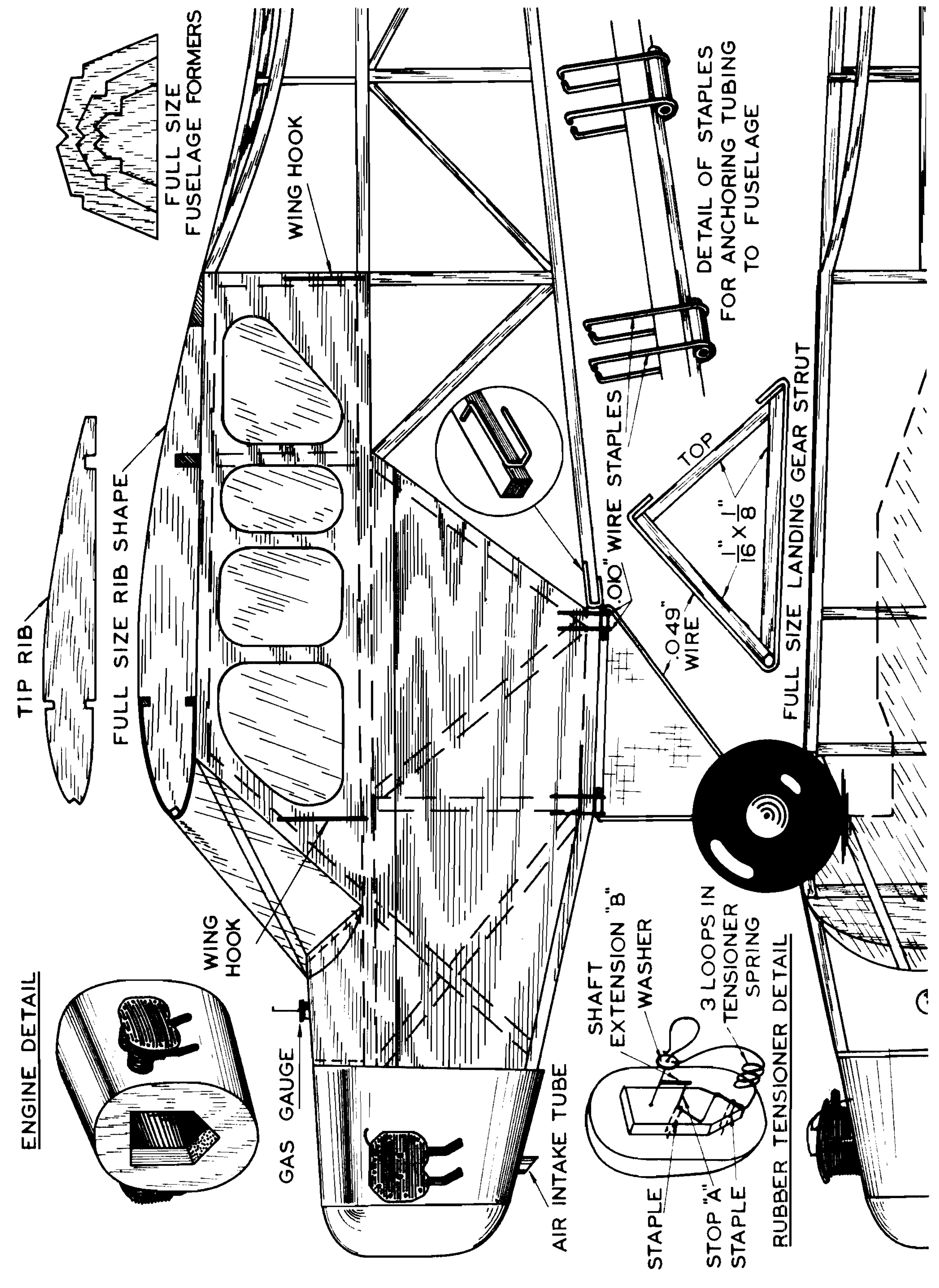
If you have intended building a flying scale model for a forthcoming contest, consider the Taylor Cub. Its fine performance in almost every flying scale meet entered, and proven stability when built as a gas model or other type, should merit your unqualified attention.

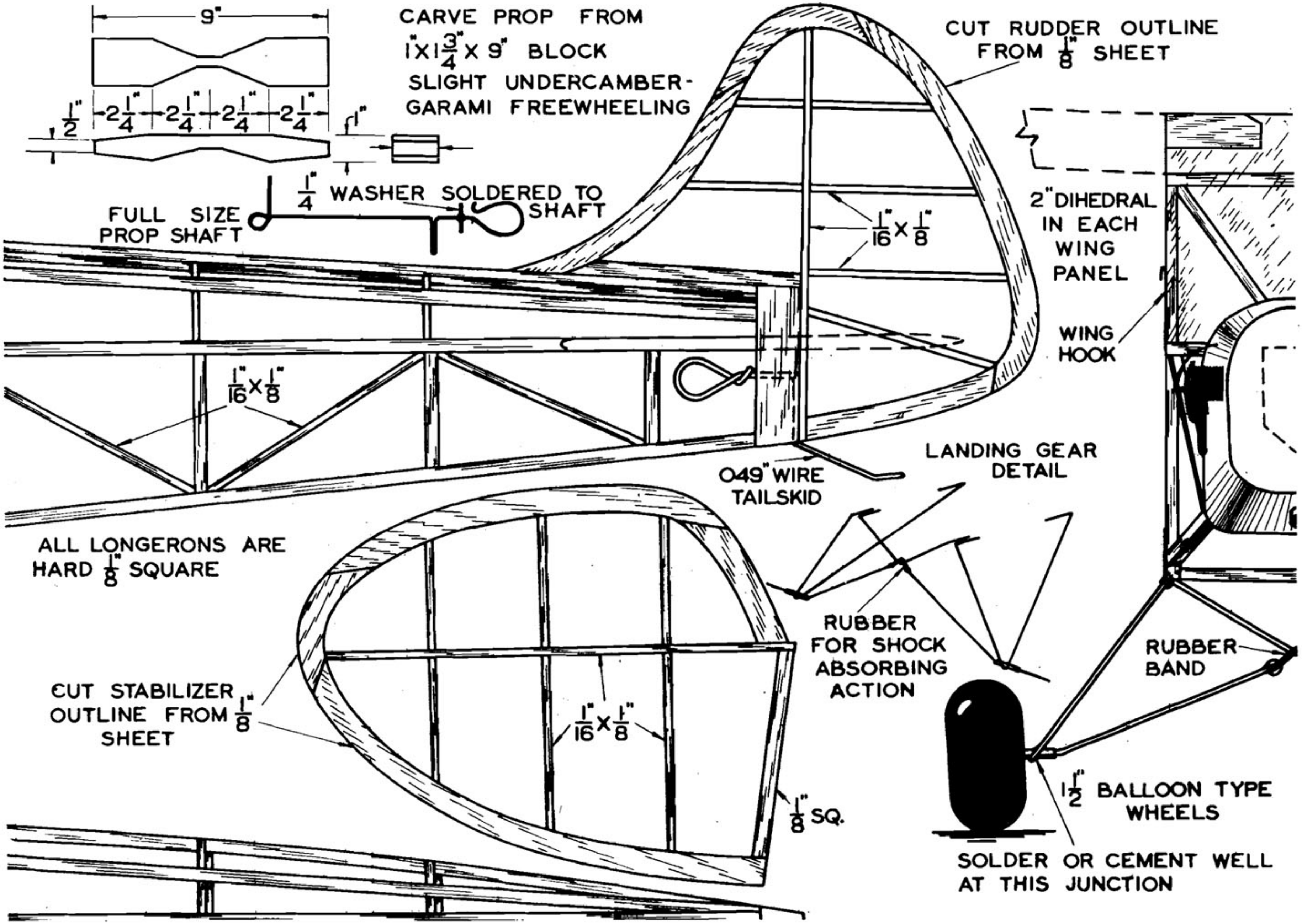
The original Cub model had to be packed in a small model box, therefore, the wing and wing struts were made so that they could be removed at will. This is not necessary if you have the room to stow away a three-foot model in your car or model box. After you have read the building instructions and looked over the details on the plans, you should try to remember to use heavy balsa in the front of the model and medium balsa in the tail surfaces, so that the model will not be as tail-heavy as the original. Since the model has to weigh at least 5⅜ ounces, it is best to put some of the weight into the fuselage and landing gear structure.

The main fuselage structure should be made first, by building both sides of the fuselage right over the fuselage side view drawing. While the sides are drying, the cross braces should be cut to double the length shown in the top view, as only the right half of the fuselage is shown. Since the bottom of the fuselage is perfectly flat behind the landing gear, the cross pieces should be inserted in place after the two sides of the fuselage have been pinned down to a drawing similar to the top view drawing. The rear cross braces should be cemented in place first, and after nearly the whole fuselage is complete, the front part should be cracked slightly ahead of the landing gear portion, and cemented.

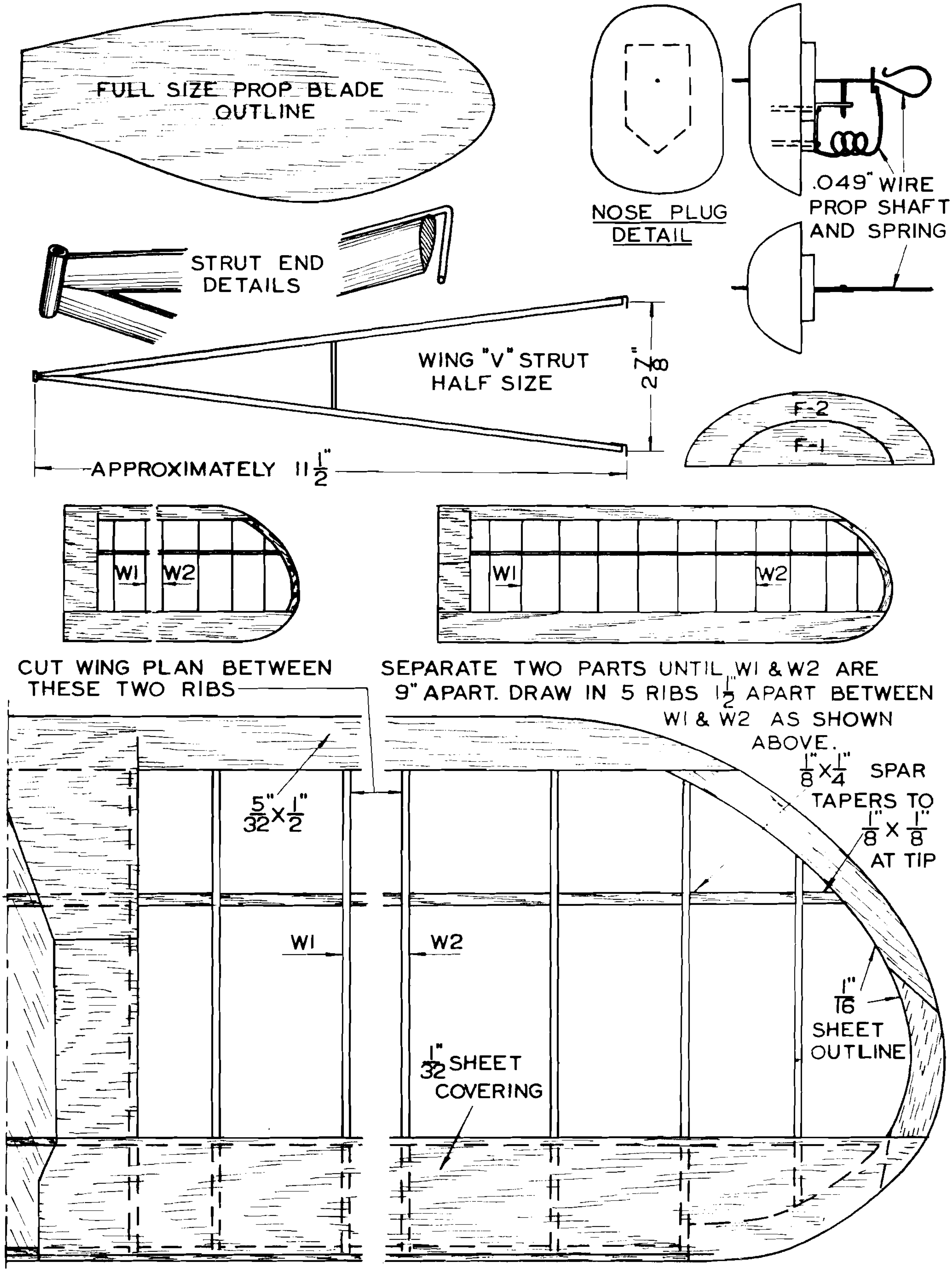
Note that the sides "toe in" quite sharply here, so reinforce this part with a few extra coats of cement. When applying formers F1 and F2 to the top of the fuselage, note that F2 is slanted forward. After the fuselage frame has dried and the stringers behind the wing portion have been added, the front should be covered with $^1/_{32}$" sheet. Do not forget to cover the fuselage bottom up to the part where the rear landing gear strut meets the fuselage. In making the landing gear strut fittings, use wire about .049" in diameter and brass or aluminum tubing that fits snugly. After the small lengths of tubing have been cemented to the fuselage, they should be reinforced by cementing small staples in place. Remember that the celluloid in the side windows should be cemented inside the cabin, after the balsa has been color-doped.

NATIONALS FLYING SCALE WINNER CONTINUED FROM PRECEDING PAGE




9"
CARVE PROP FROM
1"X1 3/4"X 9" BLOCK
SLIGHT UNDERCAMBER-
GARAMI FREEWHEELING
1/2"
2 1/4"
2 1/4"
2 1/4"
2 1/4"
1"
1/4" WASHER SOLDERED TO SHAFT
FULL SIZE
PROP SHAFT
CUT RUDDER OUTLINE
FROM 1/8" SHEET
1/16" X 1/8"
2" DIHEDRAL
IN EACH
WING
PANEL
WING
HOOK
1/16" X 1/8"
.049" WIRE
TAILSKID
LANDING GEAR
DETAIL
ALL LONGERONS ARE
HARD 1/8" SQUARE
RUBBER
FOR SHOCK
ABSORBING
ACTION
RUBBER
BAND
CUT STABILIZER
OUTLINE FROM 1/8"
SHEET
1/16" X 1/8"
1/8" SQ.
1 1/2" BALLOON TYPE
WHEELS
SOLDER OR CEMENT WELL
AT THIS JUNCTION

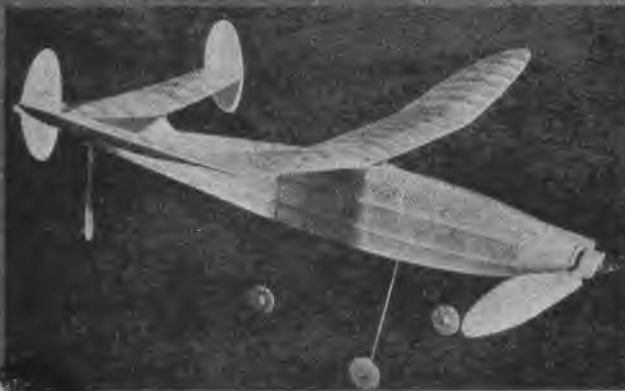
 CONTINUED FROM PRECEDING PAGE

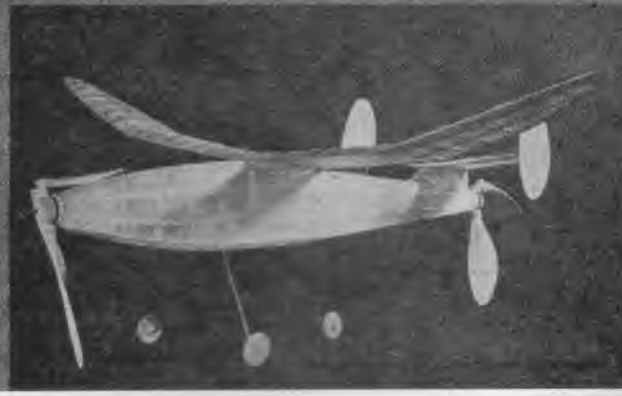


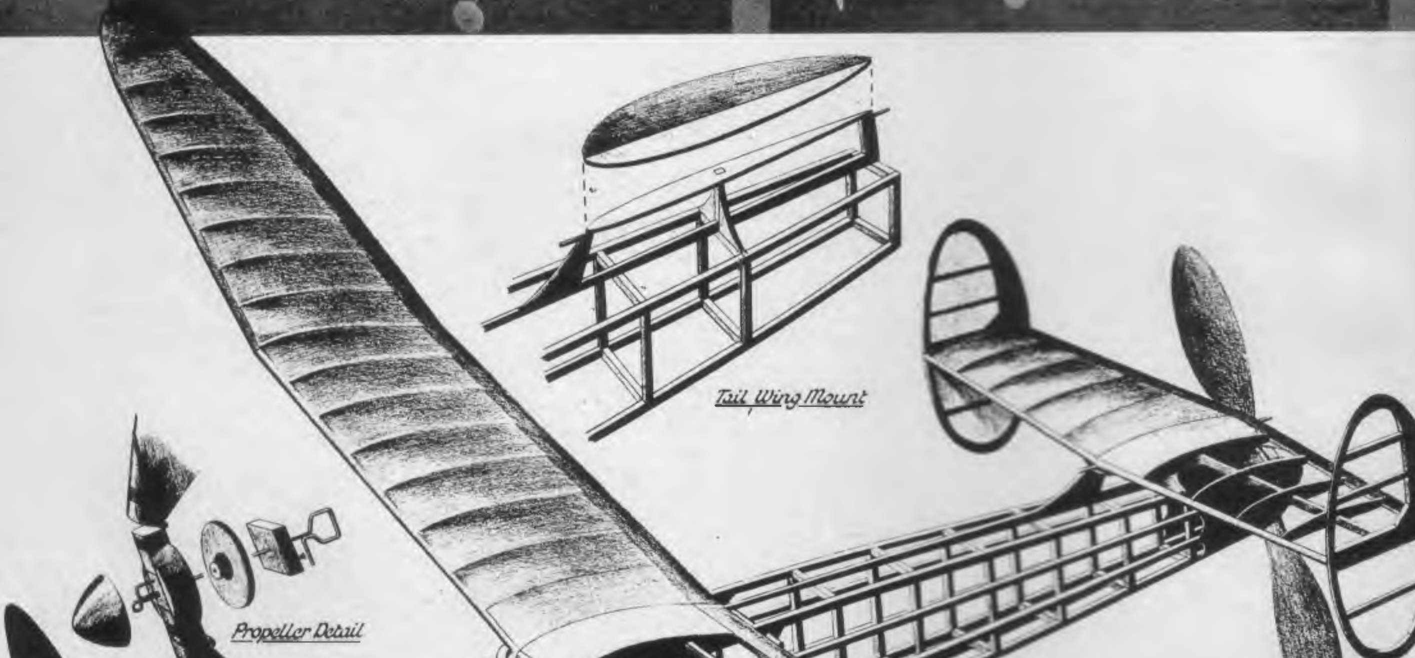
In making the landing gear strut, the following method should be used: Bend the V-shaped part first, and bend in the upper ends. Insert these upper ends into the short lengths of tubing on the fuselage, and build up a triangle of balsa to fit inside the strut. After cementing well, the strut should be covered with silk. Balloon-type wheels should be used for maximum shock-absorbing qualities, but the landing gear can take any shocks by using the rubber band spreader in the center. The band should consist of about five small loops of $1/32''$ rubber inserted in the hooked end of each axle bar and passed through the V strut that has its ends cemented to the side fuselage longerons. The axle bar should be bent at the tip to retain the wheel, but a neater appearance can be had by soldering a washer in place. An ordinary bushing is cemented or soldered in place on the other side of the wheel. The nose block should be carved out of a small hard balsa block, and the cylinder details added. The cylinders are merely $5/16''$ dowels wrapped with thread, and the cylinder head is $1/16''$ sheet balsa cut to the shape shown in the side view of the fuselage and covered with lengths of thread arranged horizontally. The engine, gas gauge, and air intake tube should be added only after the fuselage has been doped.

The details are all black, and should be cemented in place after they have been color-doped. The nose plug should be a snug fit so that it doesn't drop out of place in flight due to a slack motor. The rubber tensioner may or may not be used, according to the weight of the finished model. If the model is too light when weighed with the motor, prop and all the parts assembled, a tensioner device should be added so that a longer motor can be used to bring the model up to weight rule. No instructions will be given concerning the construction of the tail surfaces, as they are of simple flat construction, utilizing $1/8''$ sheet outlines and $1/8''$ by $1/16''$ ribs and spars. Most of the wing is given full size, and all that is necessary to complete it is to cut the plan at the proper place and separate the two parts until the space between the innermost ribs of each section is 9″. This space should be divided into six spaces of $1\frac{1}{2}''$ each, completing the layout of the entire left wing panel. Note that the end of the wing spar is tapered, allowing the tip portion to be built at a slight dihedral angle.

If it is not necessary to remove the wing when transporting the model, the wing can be cemented in place permanently and the wing struts cemented in place also. If the wing is to be made removable, the wing struts should have a tubing and wire arrangement whereby they may be slipped into place for flying and slid off when the model is ready to be packed away. The motor should not have any slack if the model comes up to weight rule when assembled, as a tight motor has much more power than a loose one. If the model is too light, the rubber tensioner device should be used. On the original, it was necessary to add 8″ of slack rubber to bring it up to weight rule. A small amount of clay was placed in the nose also, as the wing could not be moved for adjustments. A motor consisting of sixteen strands of $1/8''$ should give this model enough pep to get it upstairs in a hurry. A free-wheeling of the Garami type should be used to extend the glide to the best angle possible. The Cub should be adjusted to fly in right circles under power and in the glide. Well, your model is finished, so—happy landings!






Tail Wing Mount
Propeller Detail
Main Wing Mount

PUSH-PULL

By Bernard Schoenfeld

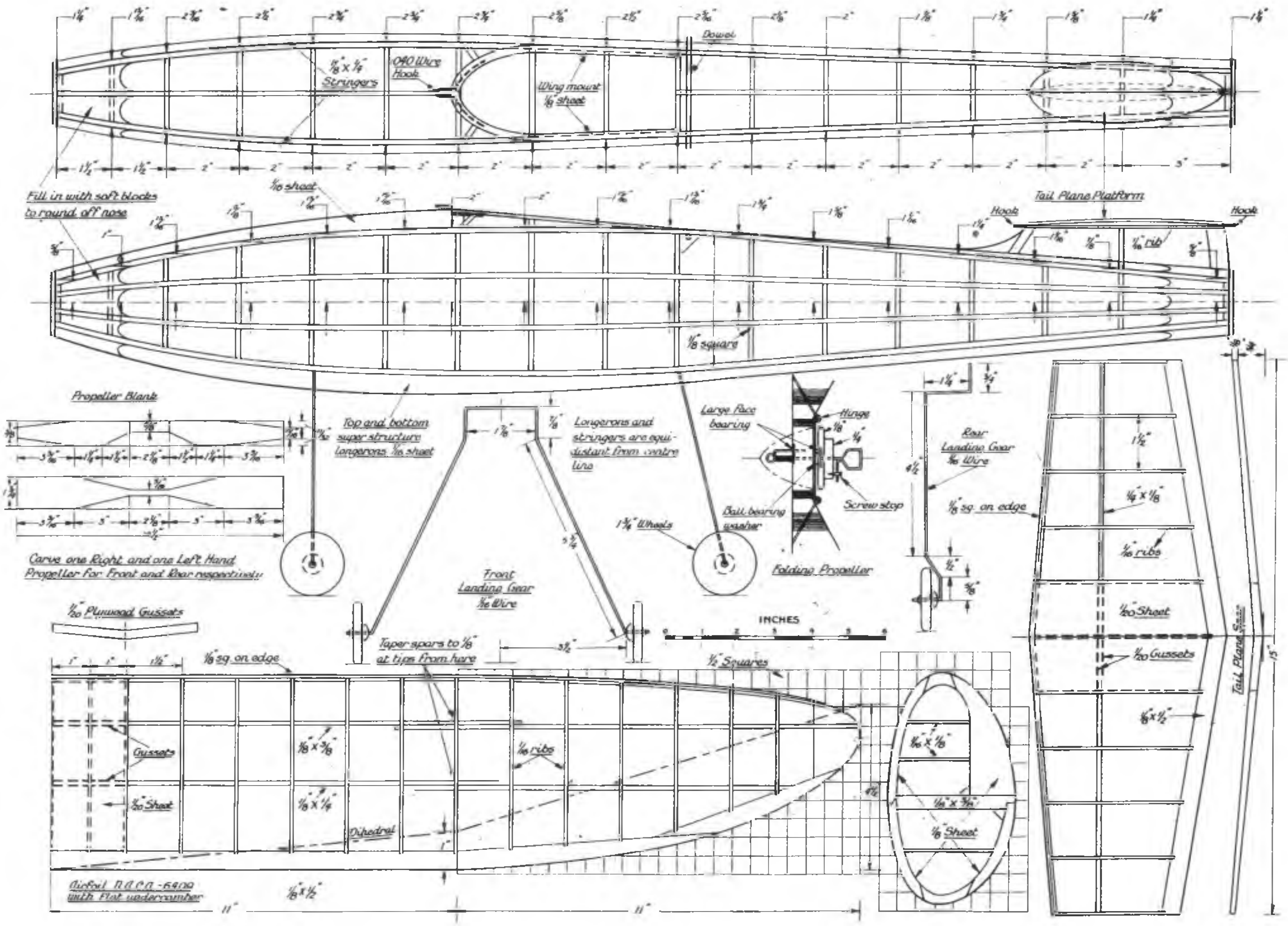
NO TORQUE, A TERRIFIC CLIMB, AND CONSISTENT PERFORMANCE ARE THE FEATURES OF THIS PUSHER-TRACTOR TYPE OF WAKEFIELD MODEL.

UNCONVENTIONAL models built solely for the purpose of making something "different looking" accomplish nothing. The design ideas behind these so-called "freaks" are what count! The "radical" system of "push-pull" actually adds a great deal to the efficiency of this ship, because it eliminates, entirely, one of the biggest headaches connected with rubber-powered models—the problem of propeller torque.

Contrary to opinions that have been expressed from time to time, the fact that the propellers are mounted in the front and rear of the fuselage in no way reduces thrust ability, but actually, as we will see later on, enables us to increase the thrust from a given power. Therefore, although the motor run may be shorter (not necessarily), the over-all results will greatly outweigh in advantages the one possible disadvantage: a shorter motor run.

Outwardly, this model is not really radical in appearance. It is rather distinctive though, featuring its "push-pull" power arrangement. This makes the ship different from what we are used to seeing around, but it in no way detracts from the beauty of its graceful outline.

When the idea of building a push-pull job was



first discussed with some of the local model builders, it was quite apparent that most of the boys expected that a model of this type would be grotesque in appearance, that, although it might fly efficiently, it couldn't possibly have any "sex appeal." The clean lines of this job were adequate inducement to cause a quick change of opinion.

One might expect that such clean, smooth lines necessitated long, tedious hours of intricate construction, but we obtained excellent results with the use of a simple, box-type fuselage, and by adding stringers to the top, bottom, and sides. The overlapping type of spar employed in the wing construction makes it almost impossible for warps to develop in the framework. It also simplifies the problem of accurate dihedral angle, because the dihedral is laid out directly on the plans.

The first day out at the field with the new ship was full of surprises. First of all, the job practically flew right off the board—doing over a minute on its first flight, with one hundred hand-winds. This was accomplished despite a slight stalling in the glide. It didn't take very long to show that it was really a high-performance job. The model is extremely stable, making it dependable in all types of weather. These characteristics, coupled with rugged construction and the ability to "take it," make the model ideal for contest work.

Another thing that speaks well for this model is the fact that it is quick in reacting to adjustments. This cuts down the "testing" period to a small number of flights. It should be remembered that in order to get the best results when making line-of-thrust adjustments, corresponding settings should be made in the thrust lines of both props. In other words, every precaution should be taken to have the two thrust lines run parallel to each other. (For example, if a sixteenth square is inserted at the top of the front nose plug, a sixteenth square should also be inserted at the bottom of the rear nose plug.) This will increase the efficiency of the power system because both props will be working together in the same direction. Whereas, if different adjustments were made in the two thrust lines, each prop would tend to cause the model to move in a different direction.

At a casual glance, one might expect that two props would complicate matters, but, with a little further analysis, we find that two props actually make things a lot simpler. First of all, we notice that we have two props of equal dimension, turning in opposite directions. Each one creates torque, but, luckily, in opposite directions, thereby balancing one another's effect. Result: no torque to worry about.

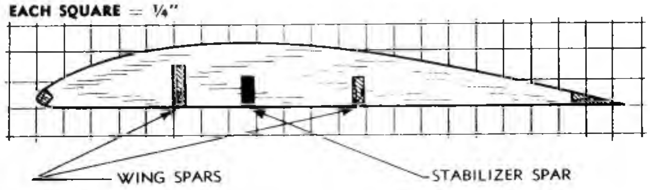
This is quite a feather in our caps, for it allows us to do something that hitherto has been dangerous because of torque; that is, we are now free to give our propellers higher pitch and also to increase the total amount of blade area. Instead of using one sixteen-inch prop for a model of this size, we use two fourteen-and-a-half-inch props, which give us almost one and three quarter times the prop area. Two high-pitched props, arranged in this manner, will increase the thrust from any given power to such an extent that it no longer is necessary to use terrifically powerful rubber motors. Therefore, we replace our "skein of dynamite" with a longer, less powerful motor. This type of motor allows us to pack in many more winds. It will also turn the props over at slightly reduced speeds. Thus we can see how it is possible to run two propellers at opposite ends of a single rubber motor, without worrying about shortening the motor run.

There are a few other important advantages in an arrangement of this type. These are things that add a great deal to the over-all efficiency of the ship. They are as follows: first, the fact that we have a comparatively small prop in the nose. This means that there is less burbling of the air in back of the prop. Consequently, we have a smoother flow of air over the wing, which, in turn, permits the wing to do its work more efficiently. This directly influences the performance of the model under power, giving the model better climbing ability. In other words, the model gets up higher, and, therefore, glides longer. We must not forget the rear prop. It, too, gives the ship a little "extra something." It directs the air over the stabilizer more smoothly and thus increases its efficiency, making it possible to reduce the stabilizer area slightly—and thereby serving to keep drag at a minimum.

We may also observe that when the props are folded in the glide, there is a cleaner flow of air over the fuselage, mainly due to the fact that the front prop is that much smaller so as not to disrupt the airflow over the fuselage as much as a larger prop would. If we were to consider the effect of each of these small increases in efficiency singly, it wouldn't amount to anything of great consequence. But the total effect of all, makes quite a difference in the performance of the ship. It is remarkable the way a simple change in power arrangement can add so much to a model.

When we add it all up, we find we have only one disadvantage: We have to carve two props. But this little extra work should be no obstacle in the path of the model builder who is really looking for performance—particularly if it will enable his model to climb with tremendous power, and still keep it free of the danger of the spiral dive to the left that so often accompanies the first power burst, due to excessive torque.

This model is a potential contest winner. The push-pull power arrangement makes it reliable and safe. It also makes for a more efficiently operating model. Advantages of this sort are the kind that give you the edge on the next fellow. These things add on extra seconds; valuable seconds that win contests.



THE AIRHOPPER

An eight-foot sailplane either towed by a gas model or launched by hand tow.

BY STANLEY ORZECK

PLANS BY PAUL PLECAN

EIGHT feet of soaring grace, the gull-winged Airhopper provides a practically new kind of model flying. Its novel features, particularly a reliable automatic release—workable for either hand or gas-model towing—and its thermal-sniffing ability are points of interest.

The ship has really been flown successfully behind a gas job and, although a plane tow is tricky for beginners, detailed instructions and notes on performance will be found under the flying directions.

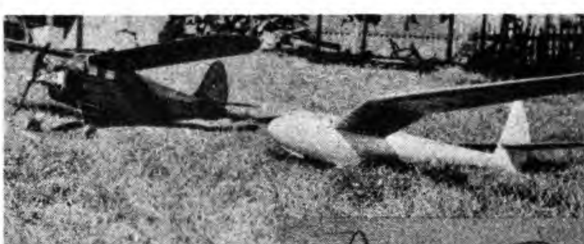
The longest flight was just under an hour in duration, covering four miles. A cloudless sky kept the model in sight, and judging from the specklike appearance in the air, the size of the ship indicated an altitude between 1,500 and 2,000 feet was reached. And this was from sixty feet of line. Imagine the consistent soaring flights possible with 500 feet of line!

A word to the wise. Don't shoot the works if those nice fluffy, cumulus clouds are around. The Airhopper will be in them in a jiffy.

CONSTRUCTION

Fuselage. Draw a centerline on a straight wooden plank and cut the bulkheads A to I from $^{1}/_{16}$" sheet. The lower parts are cut away on the dotted line shown on the full-size bulkhead layout. Pin the bulkheads to the board at the proper spacing, line them up, then cement the $\frac{1}{8}$ x $\frac{1}{4}$" main longerons in their notches. Cement the $\frac{1}{8}$ x $\frac{1}{8}$" longerons in place as indicated in the side-view drawing. Add the "keel" longeron, along the bottom centerline of the fuselage. The landing-gear braces are shown in detail and are cemented solidly into the fuselage. Any 2" wheel will do, but an airwheel is best. A sponge wheel can be home-made by inserting a length of $^{1}/_{16}$" inside-diameter tubing through a sponge ball, adding a $\frac{3}{4}$" diameter disk to each side, and compressing the unit until it flattens into a wheel. The tubing will have to be headed over or peened to hold the disks compressed. The fuselage is covered with $^{1}/_{16}$" sheet forward of Bulkhead E, and $^{1}/_{32}$" sheet to the rear of E. The upper portions of the bulkheads are now added to the half-completed fuselage, and the two $\frac{1}{8}$" square longerons installed. A $\frac{1}{4}$ x $\frac{1}{8}$" longeron is cemented along the top centerline of the fuselage. All the longerons should be flush with the outside of the bulkheads. An opening for the wing to slide through must be left in the fuselage sides. When covering the fuselage, the balsa should be cut into small rectangular panels so that it may be applied in much the same manner as used in all-metal transports. The cement dries too fast when large areas are covered.

Tail. The lower portion of the rudder is built integrally with the fuselage, and the $^{1}/_{32}$" sheet covering should fair into the fuselage and the rudder. Full-size outlines are given for nearly every part of the rudder. The diagonal braces inside the rudder are $\frac{1}{8}$" square. Cover the rudder and cut the proper curve for mounting the stabilizer. The stabilizer spars should be perfectly straight. The stabilizer leading edge tapers from $\frac{1}{4}$ x $\frac{3}{8}$" to $\frac{1}{8}$" square at each tip. After assembling, the leading edge and trailing edge of the stabilizer are covered with $^{1}/_{32}$" sheet.



The author's TD Coupe, used as a towplane, and the Airhopper. The gas model is equipped with an automatic towline release.

The front of the leading edge of the stabilizer should coincide with the leading edge of the rudder when mounted. Assemble the upper portion of the rudder and, before covering, attach the tab with small brass or copper hinges. The tab is cut from ⅛" sheet and sanded to a triangular cross section.

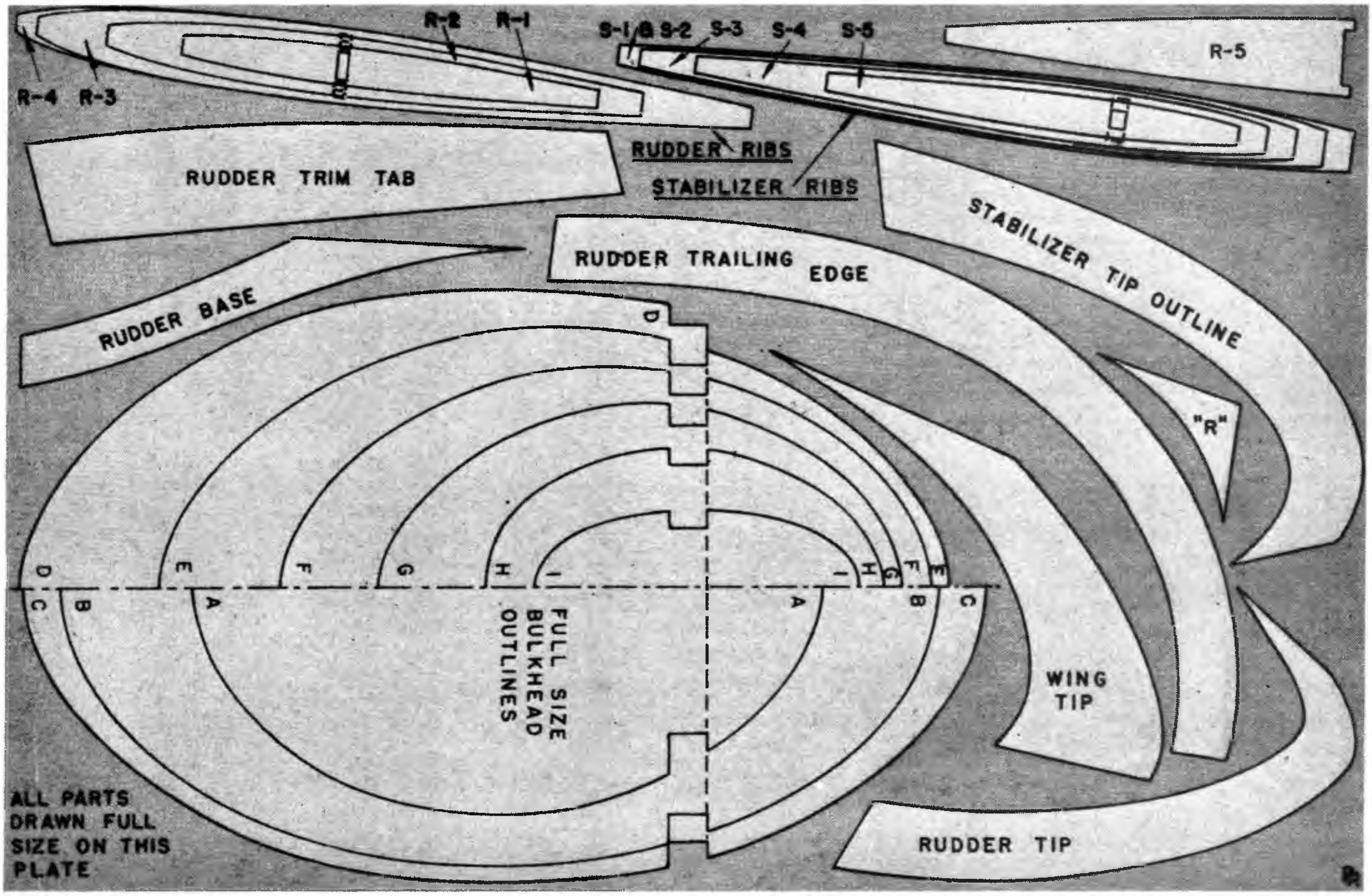
Wing. Full-size ribs are given. Cement the entire outline to a sheet of hard balsa, and cut six No. 1 ribs from 1/16" stock and six No. 1 ribs from ⅛" stock. Now trim the rib outline down to the next smaller size rib, and use it to cut two No. 2 ribs. After two ribs of each size have been cut out, the outline should be trimmed down to the next smaller size. The wing is built in three parts, the center section and two outer panels. Since the wing is of such high-aspect ratio, it will have to be built on an absolutely flat surface to avoid warping. When building the center section, slant the end ribs so that the proper dihedral may be had upon cementing all three panels together. The ⅛ x ¼" upper and lower spars are joined together by cementing a small rectangular piece of 1/16" balsa between the ribs through the span of the wing, so that the spar thus formed resembles an "I" beam. See detail on plan. Note that the 3⅝" dihedral in the center section is measured from the center to the tips, and not from the intersection of the fuselage and wing. The leading edge is covered with 1/32" sheet up to the spar line. Before covering the trailing-edge portion, cement in the ⅛ x ⅛" diagonals. The 1/32" sheet covering on the trailing edge is 1⅝" wide. In making the outer panels, it will be necessary to taper the spars from ⅛ x ¼" at the No. 1 rib to ⅛ x ⅛" at the No. 12 rib. The leading-edge covering should extend back to the spar and the trailing-edge covering should taper from a 1⅝" width at the No. 1 rib to a width of 1¼" at the tip rib. When all these panels are complete they should be pinned together to see if the end ribs of the center section have been slanted at the proper angle. The outer wing panels should be flat, with no dihedral.

The end ribs of each panel should be primed with one coat of cement, rubbed into the pores of the wood. After the cement has dried, another coat should be added, and the tip sections pinned in place. The wing is covered with bamboo paper, sprayed with water and left to dry. At least two coats of clear dope should be used on the wing to tighten up the covering. The wing can be cemented into the slot in the fuselage, but use the cement sparingly, so that the wing may be cut away if glide tests show that the incidence is too great or too small. The entire model should have two or three coats of clear dope, and if desired, a color scheme of some sort to help visibility. If a fine finish is wanted, a few extra coats of dope should be applied, with light sanding between every coat. Use a fine-grained rubbing compound for a glossy finish.

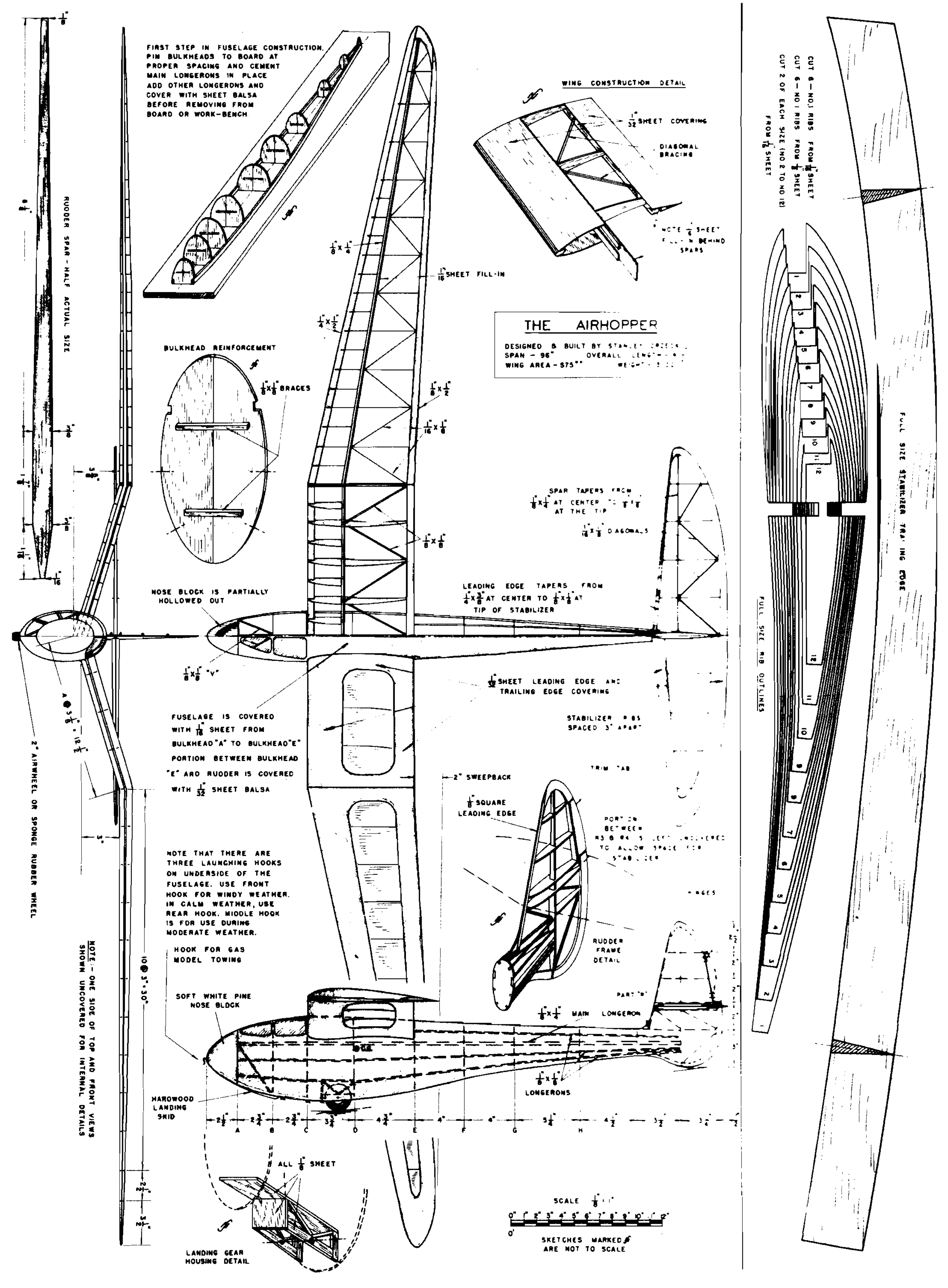
FLIGHT

The Airhopper should balance at a point ¾" behind the wing spar, and all surfaces should be set at 0 degrees incidence. If your model balances correctly, well and good, but if it doesn't, add some clay to the nose or tail to correct

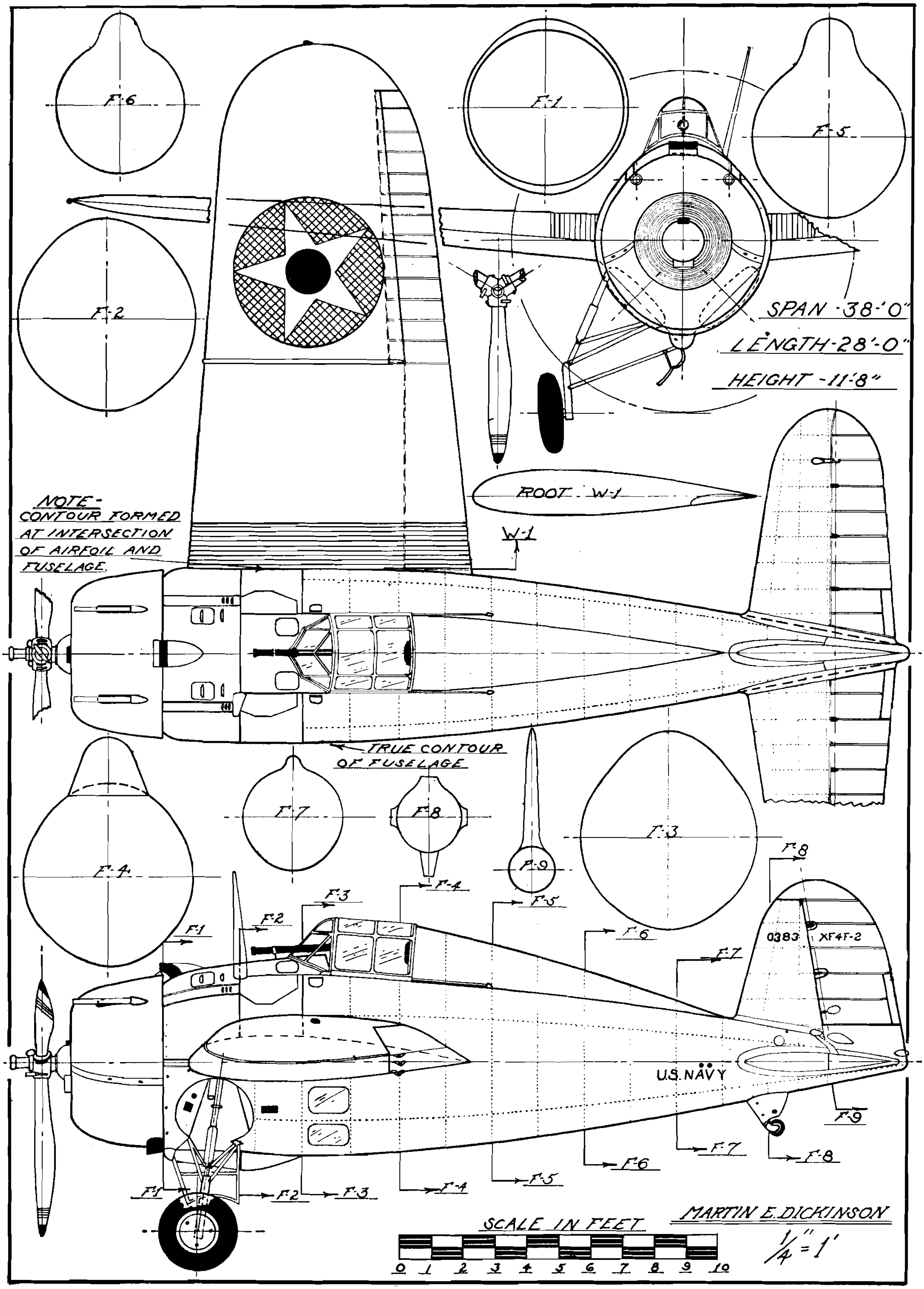
Towline launching from ground is done with cords as long as 500 ft. Release height may be as great as 375 ft



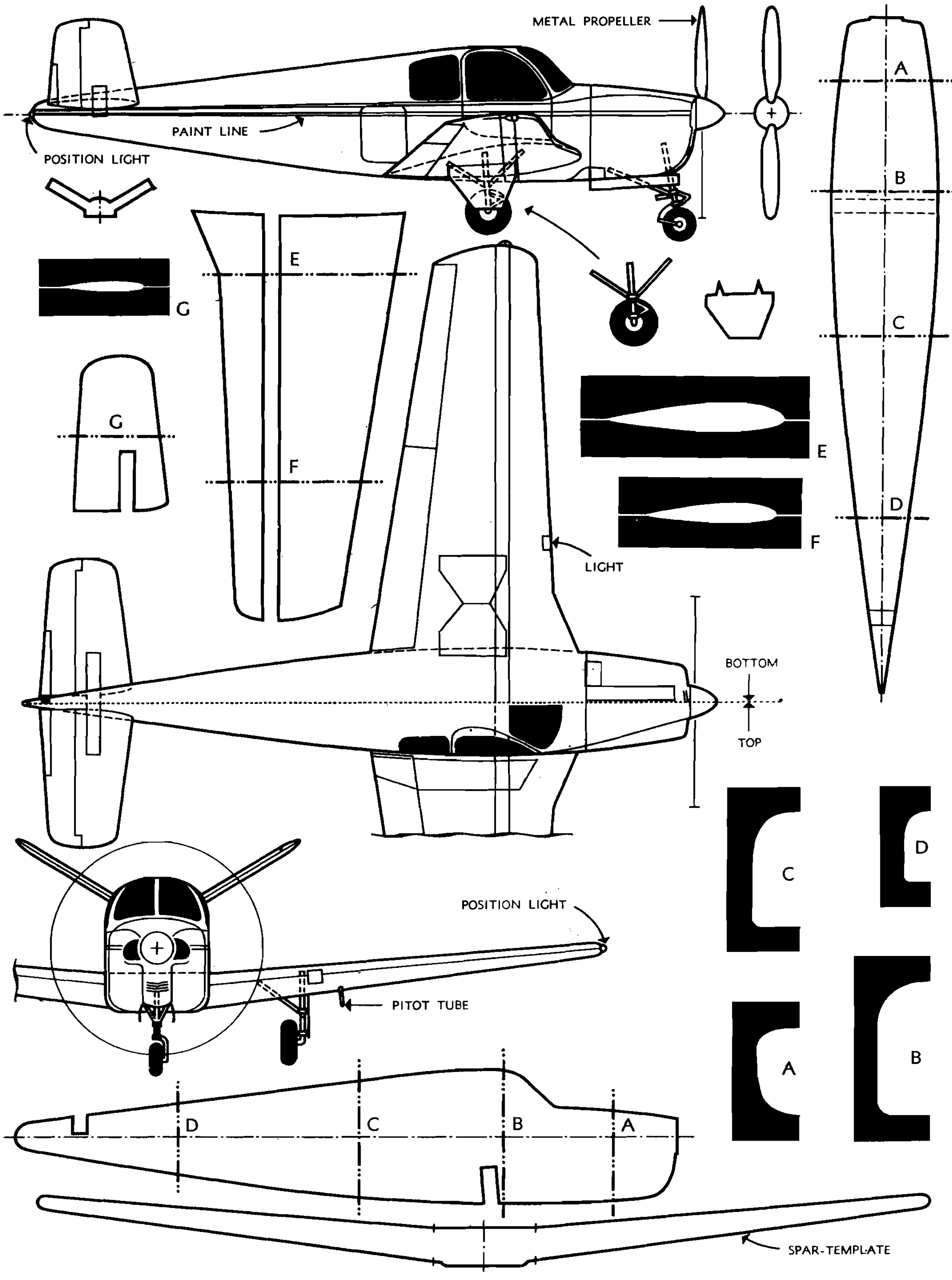
THE AIRHOPPER



THE GRUMMAN XF4F-2 MIDWING By Martin E. Dickinson



Editor's Note—The XF4F-2 was modified after test flights. Changes included more squarish wing tips and extremely large spinner.


METAL PROPELLER
PAINT LINE
POSITION LIGHT
A
B
C
D
E
F
G
LIGHT
BOTTOM
TOP
POSITION LIGHT
PITOT TUBE
SPAR-TEMPLATE

BEECHCRAFT BONANZA

THIRD IN SERIES, BEECHCRAFT'S LATEST BID IN LIGHTPLANE FIELD

by H. A. THOMAS

ONE of the most interesting personal aircraft in the new postwar field is the Beechcraft "Bonanza." The plane features so many improvements in design and structure that it is difficult to select only a few for mention here. Outstanding in appearance, though by no means a detriment, is the "butterfly" or Vee tail, which affords all the control of a conventional empennage and is a noteworthy achievement toward simplification since the two tailplanes are identical. The control surfaces move in the same direction for longitudinal control and in opposite directions for directional control.

A roomy, four-place airplane with especially clean lines, the Bonanza performs in a remarkable manner with its 165-horsepower engine. In a long list of high performance data are: Cruising Speed, 175 miles per hour at 10,000 feet; Maximum Speed, 184 miles per hour; Stalling Speed, at sea level with flaps, 46 miles per hour; Fuel Consumption, up to 18.8 miles per gallon; Range, 750 miles; and Useful Load, 1,060 pounds.

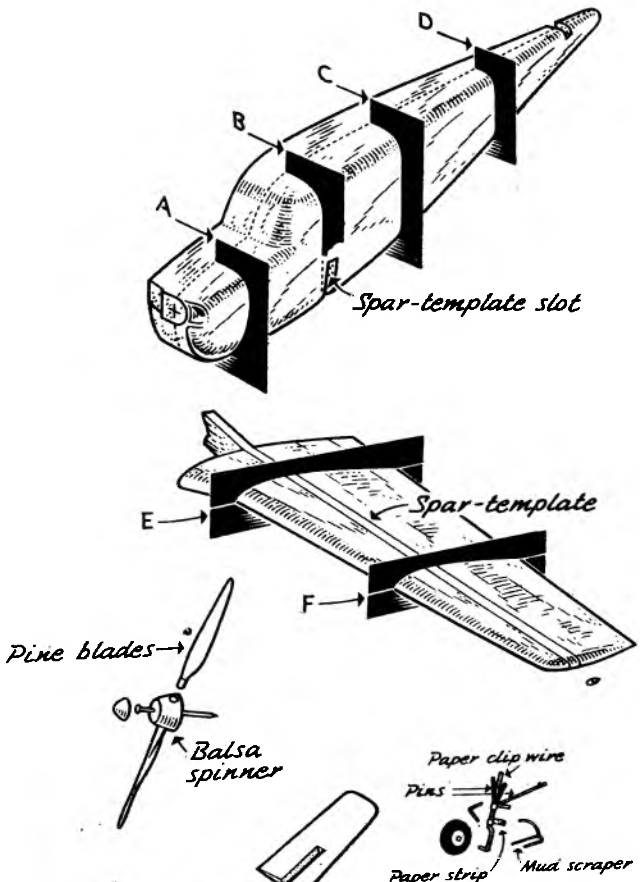
With the exception of parachute flares, which can be installed, the Bonanza is ordinarily equipped for virtually any type of flying. Radio equipment, flight and engine instruments, landing lights, electric starter, and variable-pitch propeller are included, along with an efficient engine muffler and cabin sound-proofing, ultra-violet-proof windshields and fully upholstered cabin. The rugged tricycle gear makes taxiing unusually safe and easy and is, of course, fully retractable.

The Bonanza solid scale model may be built with landing gear in retracted position and mounted on a pedestal, or the fully extended gear may be constructed. In order for the model to sit in level position on all three wheels, it may be necessary to add ballast within the nose. Construction follows that of earlier models in this series. Firm balsa of even texture is recommended for all parts. You will find a small jig-saw particularly useful in cutting parts to outline shape. Shaping to final contours is done with a sharp penknife and the templates are checked at their respective positions during sanding.

The "spar-template" is full length to provide a wing thickness pattern as well as an accurate check on dihedral. A smaller one in the tail assures correct angular settings for the tailplanes. Carve the propeller of white pine or bass. Alternate coats of wood filler with thorough sanding until the surfaces are perfectly smooth and there is no evidence of wood grain.

Sometimes wheels of correct diameter and tire size can be purchased from your model dealer. Otherwise they must be turned or carved by hand. Paper clip wire is suitable for the landing gear struts and thin aluminum is best for the landing gear doors.

Paint or spray numerous thin coats of the silver paint, and polish the final one. Mask the windows with Scotch tape strips before painting them flat black. Add talc to black dope in order purposely to kill the gloss. Colored trim stripes are added and the recessed parts of the cowl and black surfaces of the propeller blades are painted black. Decal registration numerals may finally be applied to upper right and lower left wing panels.



Zippy

Best features of the Goodyear planes and Team Racers are combined in this stunt model with the accent on appearance

By AUBREY KOCHMAN

■ We've no quarrel with "cigar box" fuselages and "barn door" wings for U-control stunt contest work, but now and then we like to fly a stunt job that resembles a full-size ship. Zippy will take an Ohlsson 23 or 29 nicely.

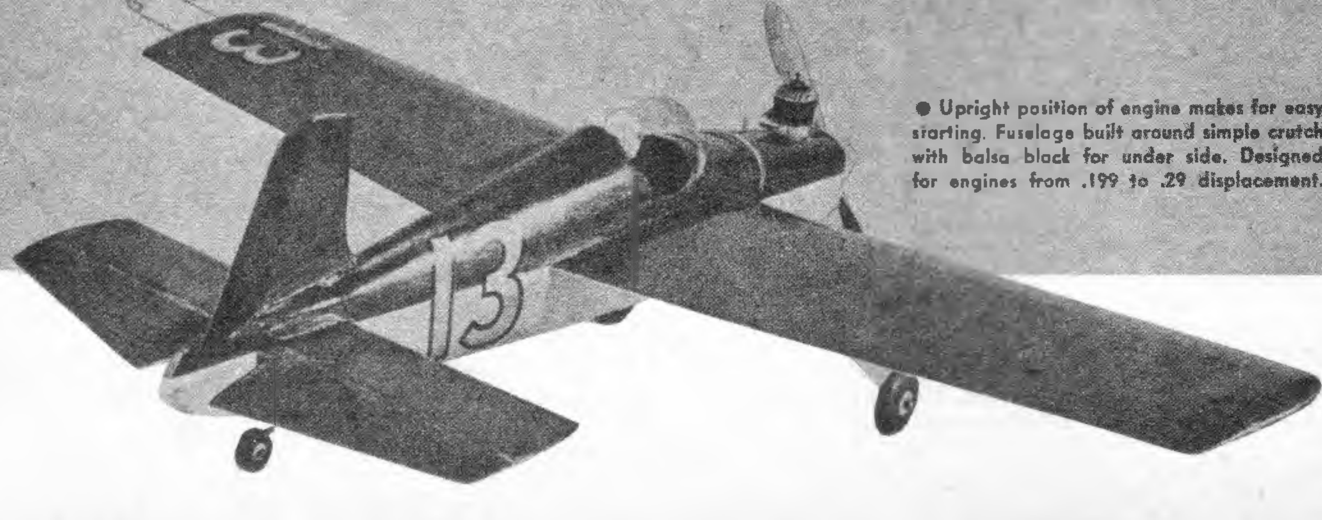
Start with the landing gear; make it in one piece if you can of 24ST dural. Bolt to 3/32 in. plywood platform with long bolts. Carve bottom fuselage block to top-view shape; cement gear in place. Add fuselage formers, then fuselage sides with cut-outs for wing and stab (watch that zero incidence). You can score the sides for bending at former #5. Cement engine mounts in position. While fuselage is drying, cut out stab and elevator; cement rudder in position.

Carve bottom fuselage block to side-view shape and round off; then attach stab with elevator. Mount bellcrank and hook up pushrod. Split 3-inch sheets of quarter-grain stock for the 1½" wide leading and trailing edges. Make rib templates #1 and #8, sandwich rib stock together and sand to shape. Wing halves are made separately; install lead-out wires before inside panel is cemented in place. Dihedral is ½" under each wing. Plywood gussets and wing supports come next, then center section sheets.

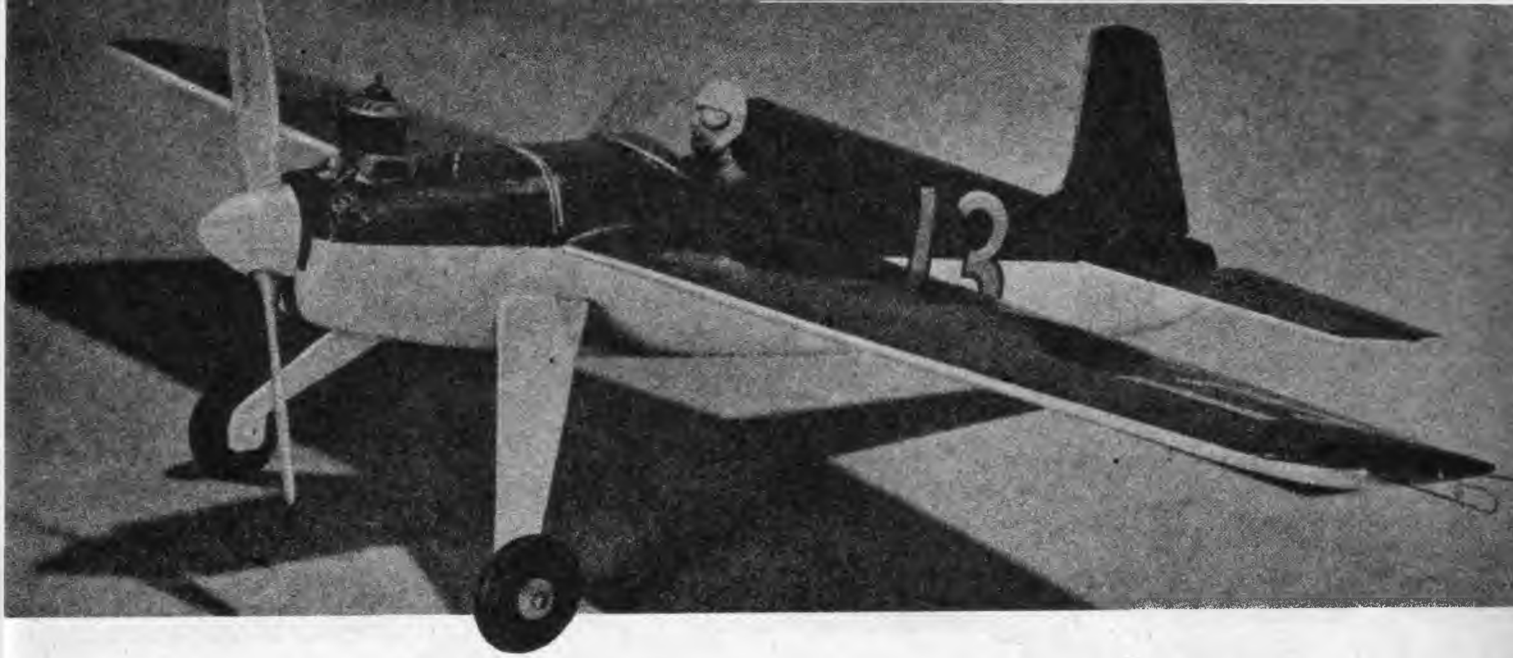
Cut turtle deck to shape. Wet top surface and give underside coating of cement. When cement dries it will curl sheet; two to three coats, each properly dried, should provide proper shape. Cut rudder slot, glue in place. Add soft balsa block at back and carve to fit. Engine cowling sections between former #1 and #3, #4 and #5 are made same way as turtle deck. Split cowling section at top and hinge each side, add 1/16 x ¼" piece under one edge as a jam.

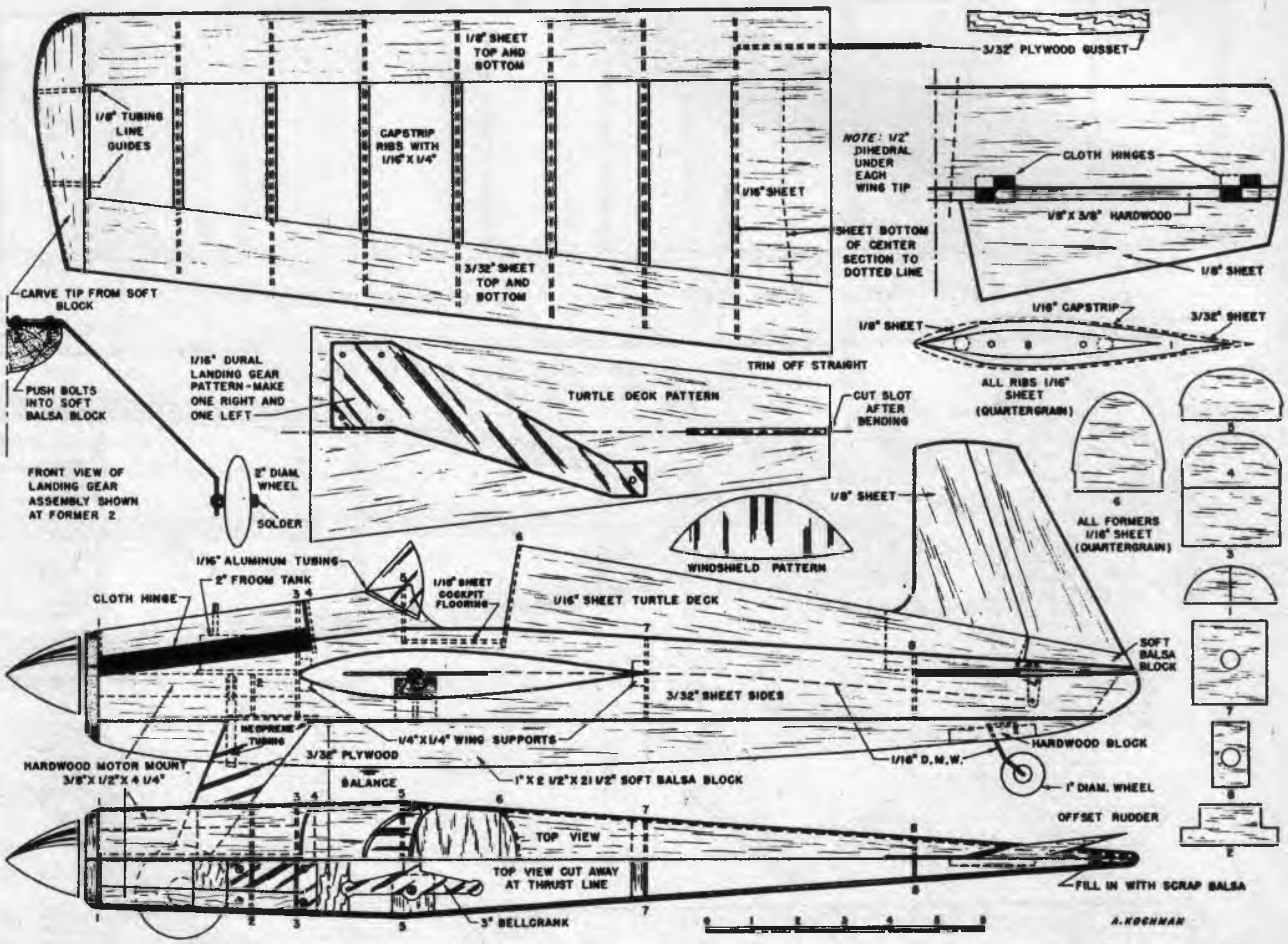
Mount the engine with four ⅝" wood screws, offsetting the thrust line slightly to the outside of the circle. It is necessary to add an extension to the needle valve and this is easy if you use an Ohlsson—just solder a length of copper or brass tubing to the protruding end.

A flat 2" Froom stunt tank mounts directly behind the engine and lines up perfectly with the needle valve if a piece of 3/32" sheet is first cemented across the motor mounts.



● Upright position of engine makes for easy starting. Fuselage built around simple crutch with balsa block for under side. Designed for engines from .199 to .29 displacement.


13


1/8" SHEET TOP AND BOTTOM
1/8" TUBING LINE GUIDES
CAPSTRIP RIBS WITH 1/16" X 1/4"
1/16" SHEET
3/32" SHEET TOP AND BOTTOM
CARVE TIP FROM SOFT BLOCK
SHEET BOTTOM OF CENTER SECTION TO DOTTED LINE
3/32" PLYWOOD GUSSET
NOTE: 1/2" DIHEDRAL UNDER EACH WING TIP
CLOTH HINGES
1/8" X 3/8" HARDWOOD
1/8" SHEET
1/16" CAPSTRIP
3/32" SHEET
1/8" SHEET
ALL RIBS 1/16" SHEET (QUARTERGRAIN)
PUSH BOLTS INTO SOFT BALSA BLOCK
1/16" DURAL LANDING GEAR PATTERN - MAKE ONE RIGHT AND ONE LEFT
TURTLE DECK PATTERN
TRIM OFF STRAIGHT
CUT SLOT AFTER BENDING
FRONT VIEW OF LANDING GEAR ASSEMBLY SHOWN AT FORMER 2
2" DIAM. WHEEL
SOLDER
1/8" SHEET
WINDSHIELD PATTERN
ALL FORMERS 1/16" SHEET (QUARTERGRAIN)
1/16" ALUMINUM TUBING
CLOTH HINGE
2" FROOM TANK
1/16" SHEET COCKPIT FLOORING
1/16" SHEET TURTLE DECK
SOFT BALSA BLOCK
3/32" SHEET SIDES
NEOPRENE TUBING
3/32" PLYWOOD
1/4" X 1/4" WING SUPPORTS
HARDWOOD BLOCK
1/16" D. M. W.
HARDWOOD MOTOR MOUNT 3/8" X 1/2" X 4 1/4"
BALANCE
1" X 2 1/2" X 21 1/2" SOFT BALSA BLOCK
1" DIAM. WHEEL
OFFSET RUDDER
TOP VIEW
TOP VIEW CUT AWAY AT THRUST LINE
FILL IN WITH SCRAP BALSA
3" BELLCRANK
0 1 2 3 4 5 6
A. KOCHMAN

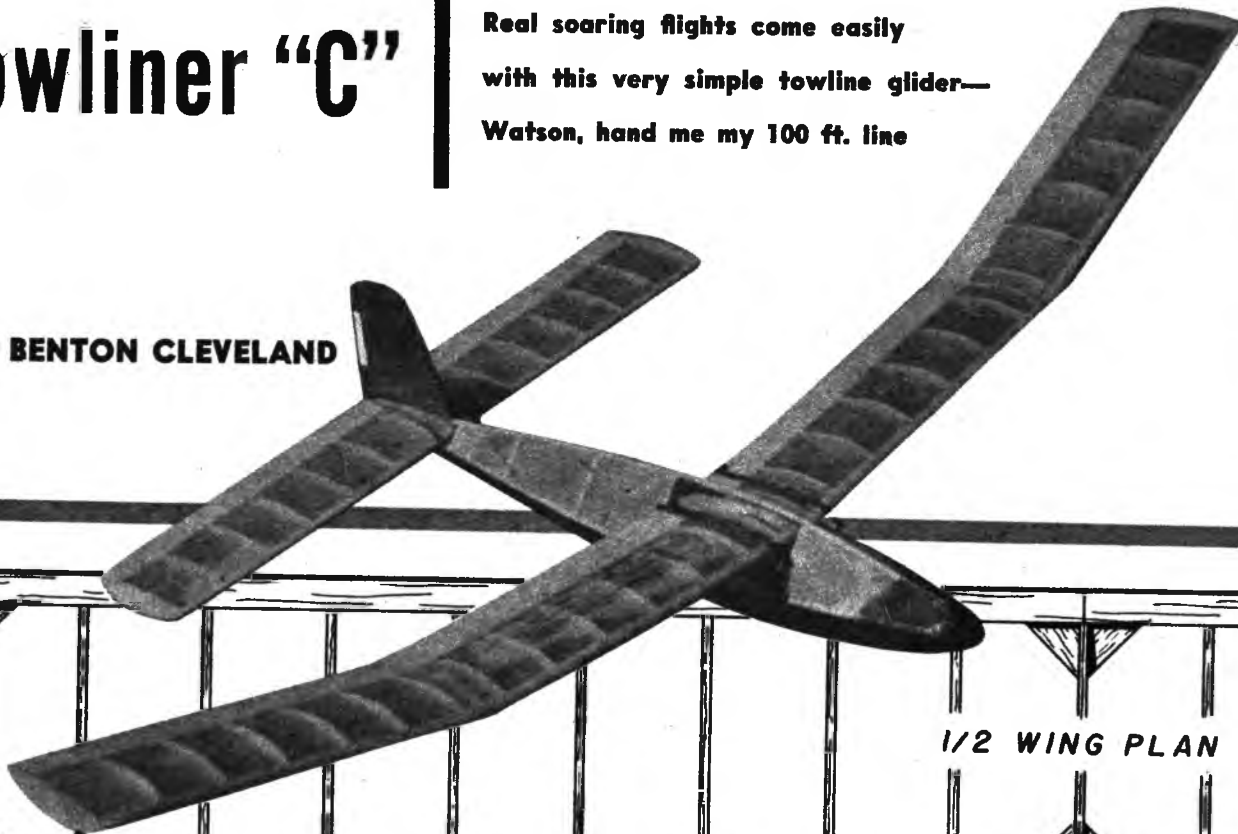

13


13

Towliner "C"

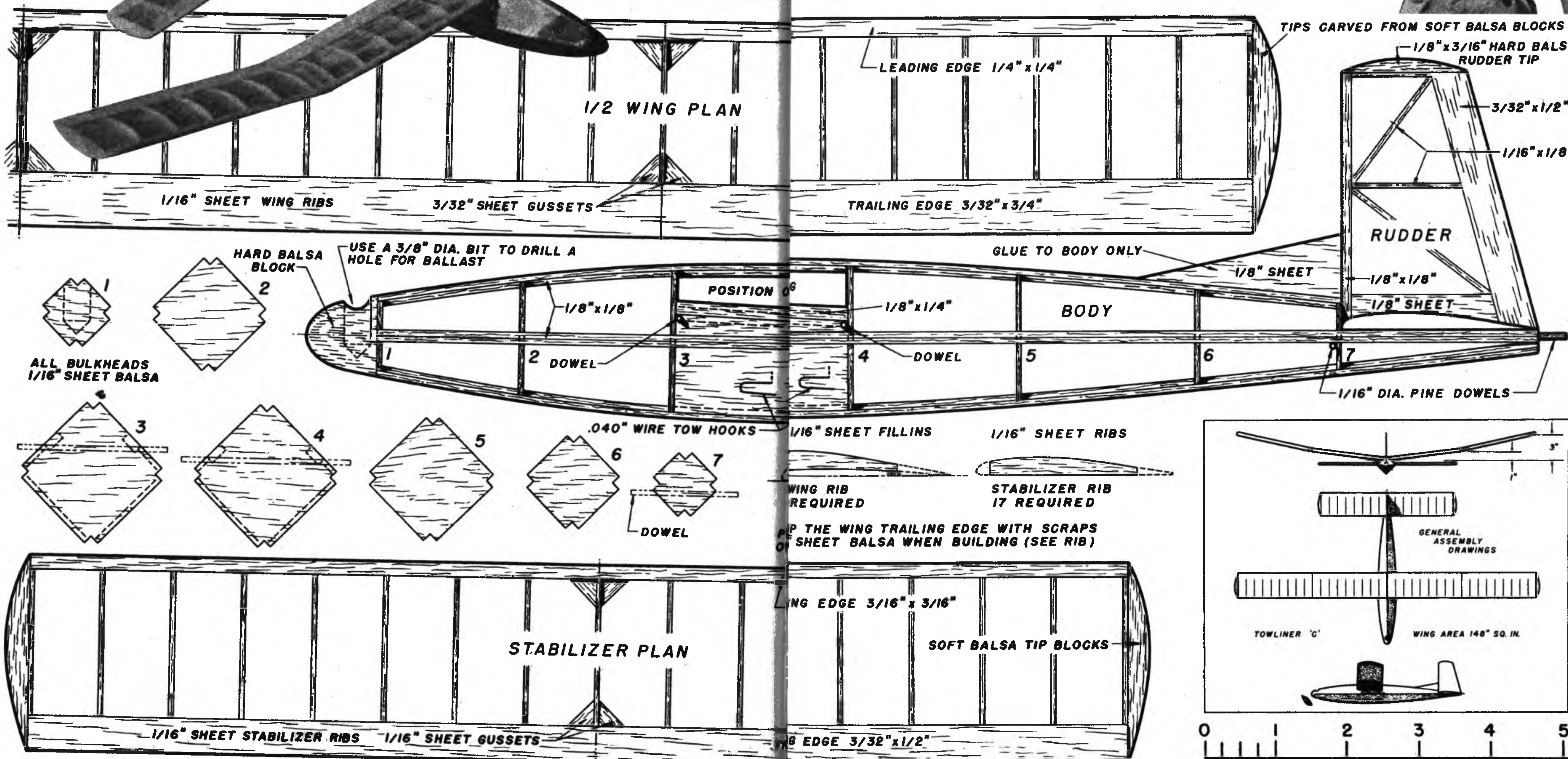
Real soaring flights come easily with this very simple towline glider— Watson, hand me my 100 ft. line

By BENTON CLEVELAND



■ For contest work and sport flying this small Class C towline glider is as ideal for the beginner as for the advanced flyer. It will equal the performance of the big Class D and E jobs without the expense of building a six-foot model.

Flown in two major contests, its performance proved its worth as a thermal-riding sailplane. It took 2nd place in a Philly Flying Circus with a 7:56 flight, and 1st in the Richmond, Va., meet with 4:32, an out-of-sight flight. The stab has 50% of the area of the wing. The sparless wing was designed to flex under tow to smooth climb.



Horizontal tail area should be about 25% of the wing area and the elevator about ⅓ of this area as previously mentioned.

Vertical location of the bellcrank in the fuselage affects the stability and control of the model and its location should be close to the line of resistance of the model. Since the actual position of the line of resistance can only be approximated, suffice it to say that a good compact grouping of all forces will result in good stability. The ideal set-up is a mid-wing model with thrust line, chord line, center of gravity, pivot point all on one horizontal line. In high-wing models the bell-crank location should be between the thrust line and the chord line. In low-wing models the same general rule holds except the bellcrank will be below the thrust line usually.

The question of power is next on the list. Control-line models always need plenty of power. If your model is fairly heavy you're going to need lots of power. Power creates the centrifugal force that keeps the model out on the end of those wires where you want it. If you try to fly in a good breeze with an underpowered model your troubles will multiply like rabbits, but with more power the same ship can bat right through with little difficulty.

The power you can get out of the engine directly depends on the propeller. Most engine manufacturers give recommended propeller sizes for control-line flying with their engine. You will find the propeller is always of smaller diameter and greater pitch than that needed for free-flight. Some experimenting with slightly different diameters and pitches will soon show you which propeller suits your engine and model combination.

Control wires should always be kept free of kinks and twists—unroll and roll them up carefully. Keep them clean and free from rust.

The control handle should be marked in some way so that you will know which end is attached to your "up" wire. The wooden type with heavy flexible steel cable is good provided that tight connection is made when the loop is formed in the ends of the cable. Large fishline connectors are good for joining handle to control wires and control wires to plane leads. Provision is made on most commercial handles for adjustment to equalize line length. This is important and should be checked carefully with lines attached to the model. Adjust handle lead until a vertical position of the handle gives a neutral elevator position. Have a little tension on the wires when doing this.

So far we've only been going to ground-school, but have patience, we're going out and fly in a little bit. Before we do, however, one more point must be emphasized. If all the troubles with gas model flying were laid end to end they would add up to one thing—soldering. So do a good soldering job on the ignition system and have some fresh batteries handy when you go out to fly. If you are using a diesel type engine or the glow plug set-up, spend some time familiarizing yourself with the proper throttle settings and choking necessary *before* flying.

Your best bet for first-time flying is a gentle breeze, so pick a day with calm air. Because the wind tends to drift the model inward in the up-wind side of the circle, control can be lost because the lines will go slack. When the model gets around to the down-wind side, the wind will tend to blow it outward, increasing the line tension which only aids in controlling. You can see that one of the cardinal points to remember when flying in any amount of wind is to guard against slack lines. Always be ready to step back. You can see the lines begin to go slack between you and the model.

CONTROL LINE DESIGN FACTORS

Wing Loading (oz. per 100 sq. in.)	
Sport	12—20
Stunt	8—12
Speed	20—60 +
Power Loading (oz. per cu. in.)	
Sport	100—80
Stunt	80—70
Speed	70—60
Aspect Ratio	
Sport	6:1
Stunt	8:1
Speed	5:1
Airfoils (Typical)	
Sport	Lifting, Clark Y, Clark Y 09%
Stunt	Symmetrical 12-15% thickness
Speed	NACA 2412, thin with sharp leading edge
Tail Moment Arm	
Sport	average about 50% of wing span
Stunt	short, under 50%
Speed	long, at least equal to span
Tail Surface and Elevator Area	
Sport	total 25% wing area; elevator, 25-40% total
Stunt	total 25% wing area; elevator, 40-50% total
Speed	total 25% wing area; elevator, 15% total

Figures given here are not absolute but represent average values that can serve as "rule of thumb" design basis.

In preparing to fly always remember to set up so that your model will make a down-wind take-off. When the plane starts rolling along the ground there isn't sufficient centrifugal force acting to maintain line tension, but the wind makes a good substitute and the flyer can help also by easing back on the lines to maintain the tension needed for good control. When flying in a fresh wind, take-off point should be moved around farther onto the downwind side of the circle to prevent the wind from nosing-up the model immediately after release.

Make a pre-flight check of your model and wires prior to flying when everything is ready to go. Check wires for proper up-and-down connection and control freedom. Separate lines and check for kinks. Check model for tab adjustments—if any. Have good batteries in plane, use boosters for starting. Start engine and adjust for steady power; most engines need to be left a little rich on the ground since they heat up when running in the air and then lean out to steady power.

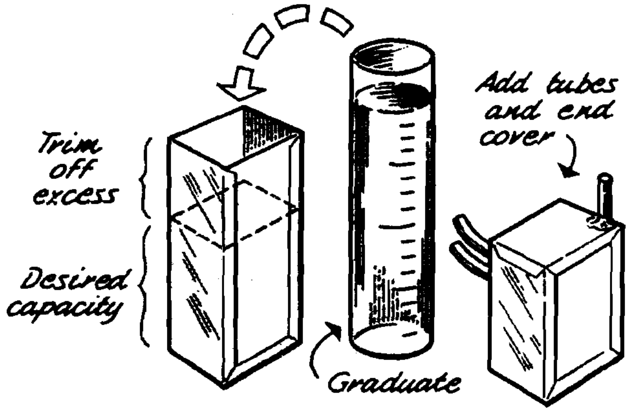
Get set with the control handle, see that wires are clear of the ground, give helper signal to release model only when you are ready. For average ground surfaces a tail-low take-off is the safest. Up elevator is used from start of the roll and the model will leave the ground in a three-point attitude and start to climb. Once airborne and as climb is increasing, care must be taken to prevent a stall. The controls should be neutralized smoothly to prevent this. Right here is the toughest spot of all for a first-time flyer. The tendency to over-control nearly always results in some pretty hectic zooms and dives until the flyer can feel his control response and judge the amount of control necessary. Once settled down, however, no difficulty should be experienced, and the flyer should concentrate on level flying, always bearing in mind the wind and line tension. Always be ready to step back to get the slack out of the lines.

In addition to drifting the model, the wind will also cause the model to balloon on the up-wind side of the circle and lose altitude on the down-wind side. Here again the flyer must anticipate the wind and compensate for it as the model flies around the circle.

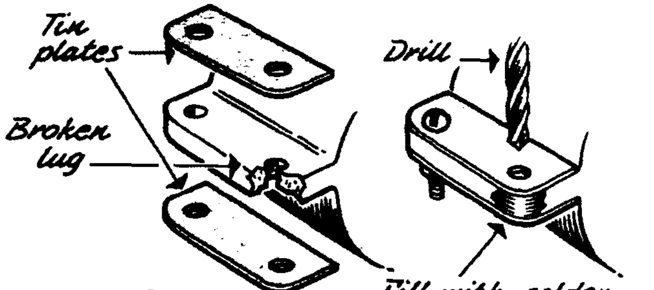
When the fuel is running low most engines pick up speed or miss, so right then prepare to land as soon as the engine quits. Do not try to climb but rather fly level and when the engine does cut, drop the nose slightly and start into a glide. If there is wind you will have to be ready to maintain line tension as the model slows down if it is on the up-wind side of circle. When close to the ground, smoothly round-out the glide with up elevator until the model touches down.

sketchbook

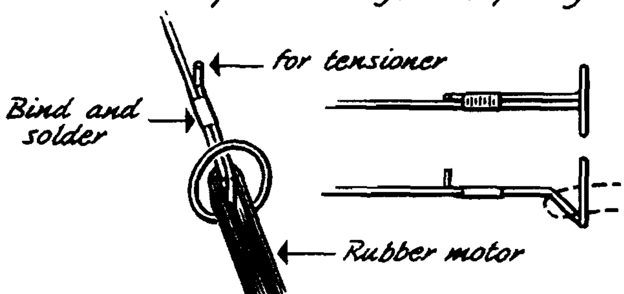
HAVE YOU DEVELOPED SOMETHING NEW IN CONSTRUCTION, CONTROL, OR FLYING THAT MIGHT INTEREST OTHER MODELERS? SEND A ROUGH SKETCH—WE'LL REDRAW IT AND PAY $2 FOR EACH ONE ACCEPTED



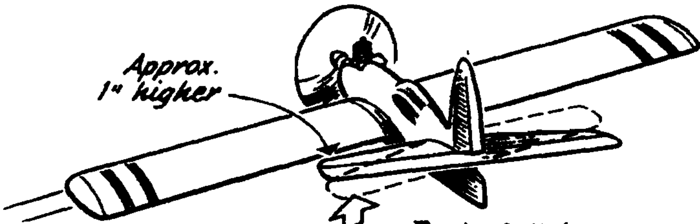
Chuck Sheridan, Seattle, Wash., pours measured fuel into partially completed tank to learn precise length–capacity.



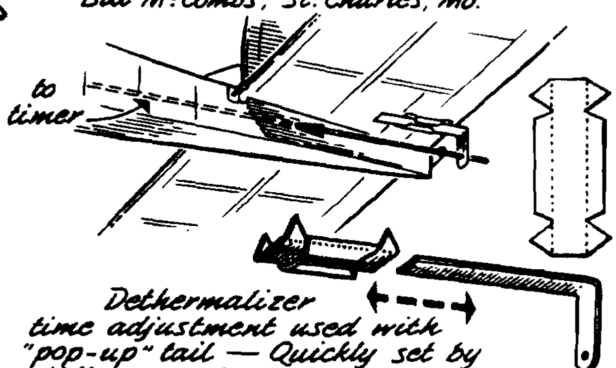
from Pete Granger, Duncan, Okla.



Device to replace "bobbin"—prevents "climbing" & strand cutting. Idea by Art Beckington, submitted by Bill McCombs, St. Charles, Mo.

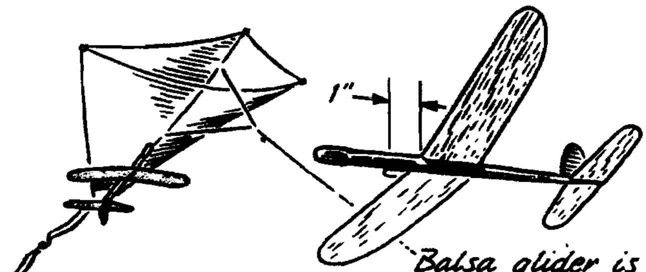


Boris C. Urban, Bayside, L.I., N.Y., tilts inside stabilizer tip of stunt job up to keep lines tight during all maneuvers.



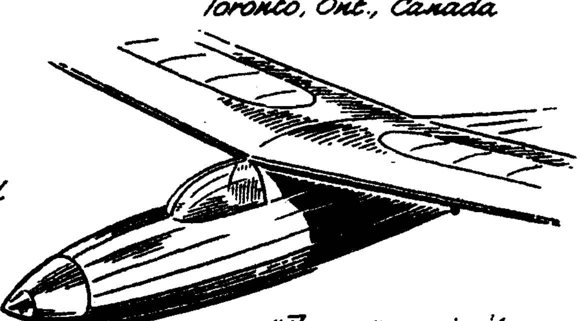
Dethermalizer time adjustment used with "pop-up" tail — Quickly set by sliding member.

B. Smythe, Toronto, Ont., Canada



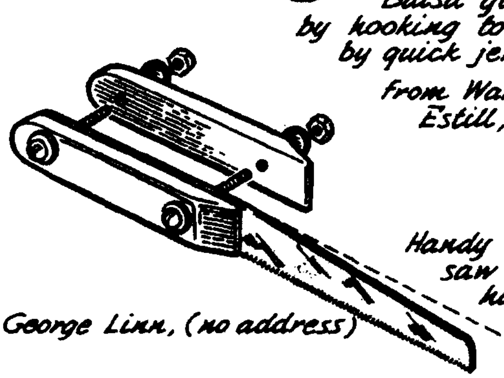
Balsa glider is towed by hooking to kite — released by quick jerk of string.

from Warren Krapse, Estill, S.C.



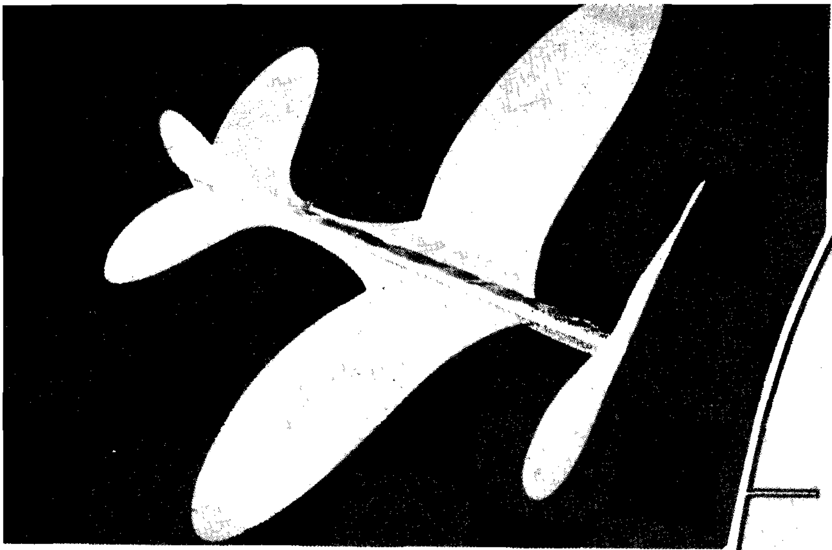
"Froom" or similar gas model spinner makes neat towline glider nose — also serves as ballast box.

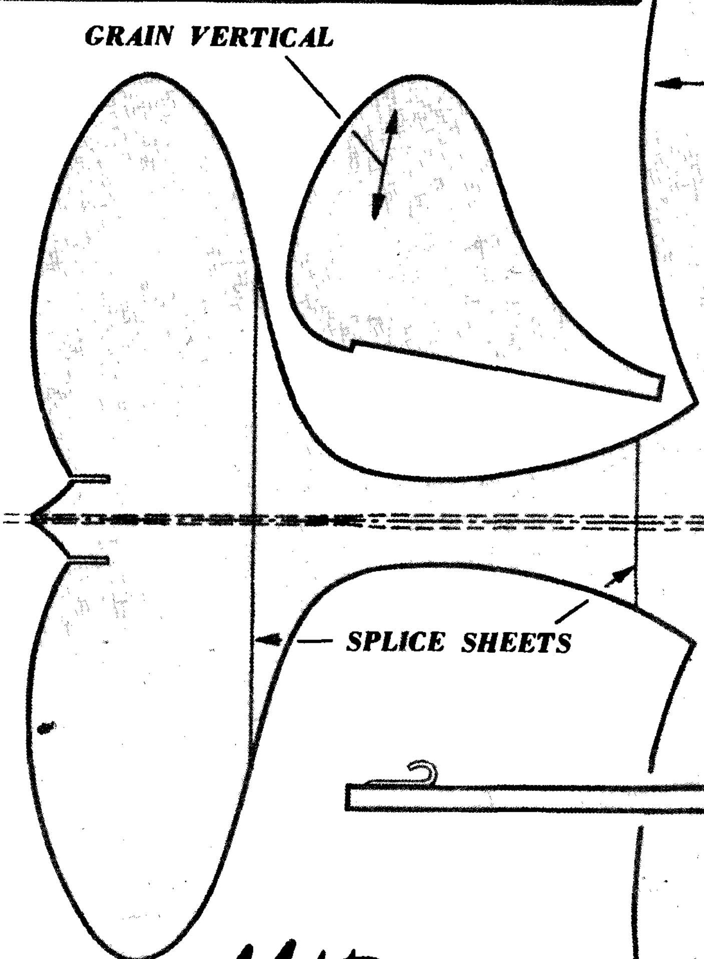
James W. Amis, Seattle, Wash.

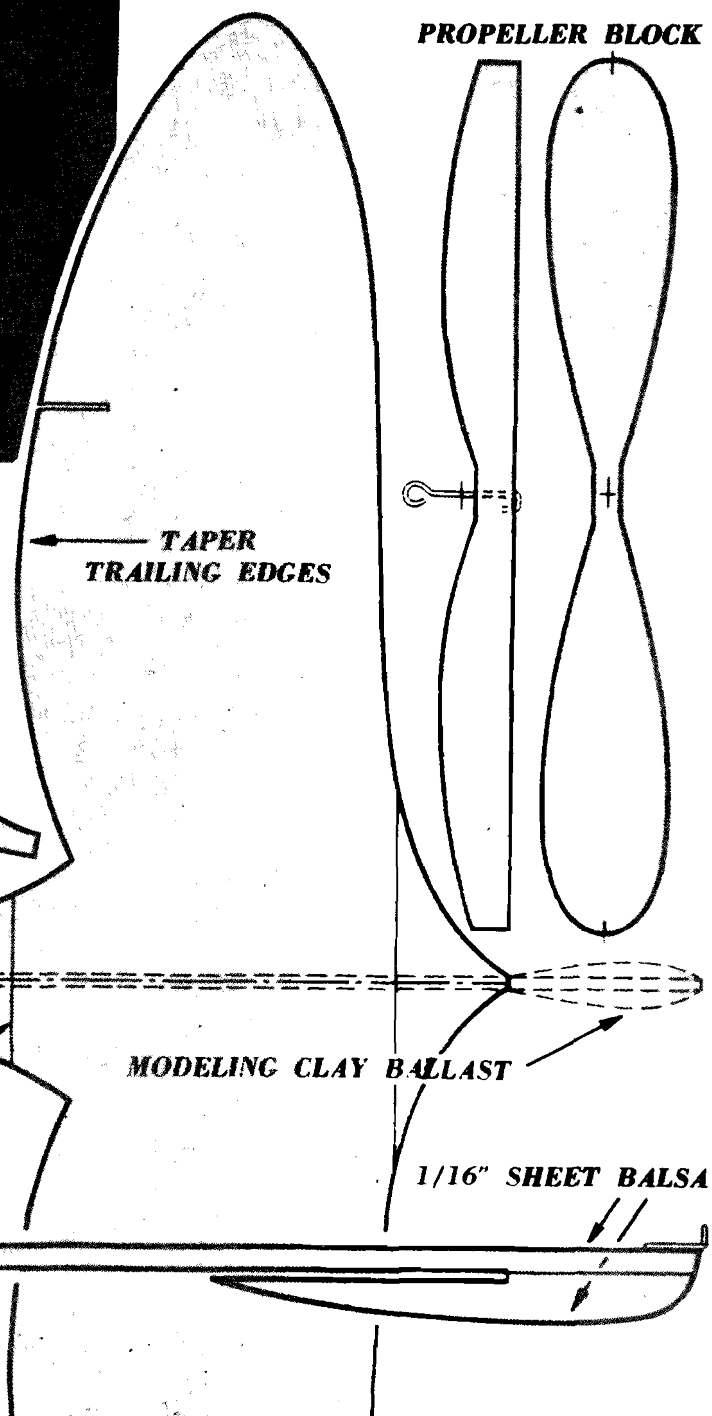


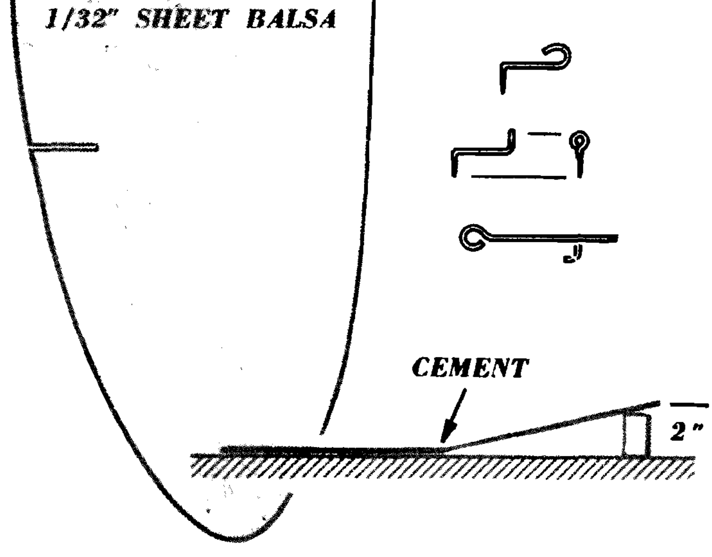
Handy modelers' saw filed from hacksaw blade —

George Linn, (no address)







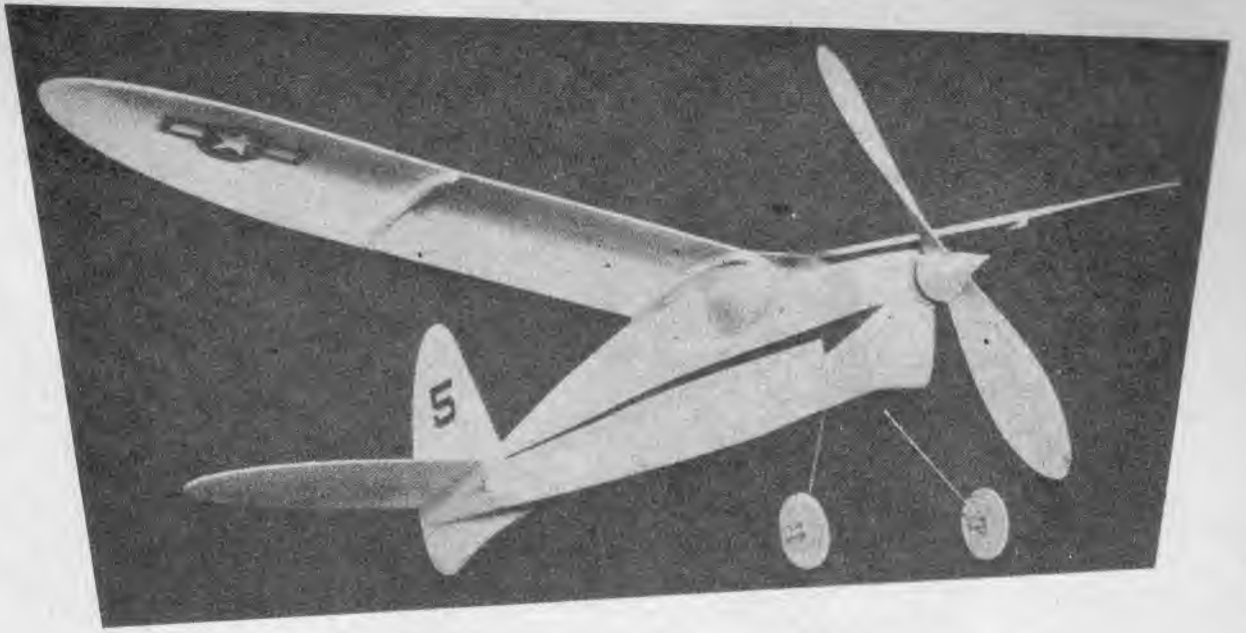


PARLOR *MIDGET*

CEMENT soft balsa sheets edge to edge and trace full-size patterns. After trimming to outline, sand smoothly and thin the tips and trailing edges, rounding entering edges. Center line is scored, one half propped up and cemented for dihedral. Later, add motor stick, lower skid and rudder.

Soft prop block is trimmed to outlines, carved and sanded. Check balance then add shaft (all wire parts bent from steel straight pins); cement thrust bearing and rear hook to body. Install prop with washer and one loop, 1/8 in. flat T-56 rubber for a starter. Smooth glide may require nose ballast, slight warp of tips and tail.

—H. A. THOMAS



Battling Boxcar

SEARCHING FOR SOMETHING SIMPLE TO FLY? THIS RUGGED ALL-BALSA MODEL IS ATTRACTIVE, HAS GOOD PERFORMANCE

BY DICK STRUHL

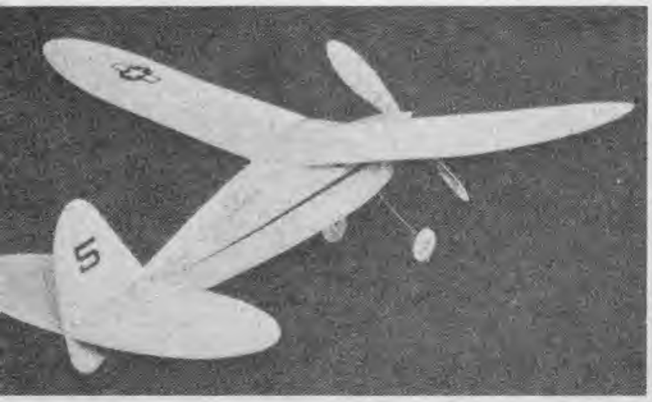
■ To the model builder the word "boxcar" is synonymous with square fuselage, ease of construction, or simplicity of design. The model presented here fits the above description perfectly. The Boxcar Battler is a design that should appeal to the beginner for its simplicity of construction and to the expert builder who wants to "knock out" a good flying model in a minimum of time.

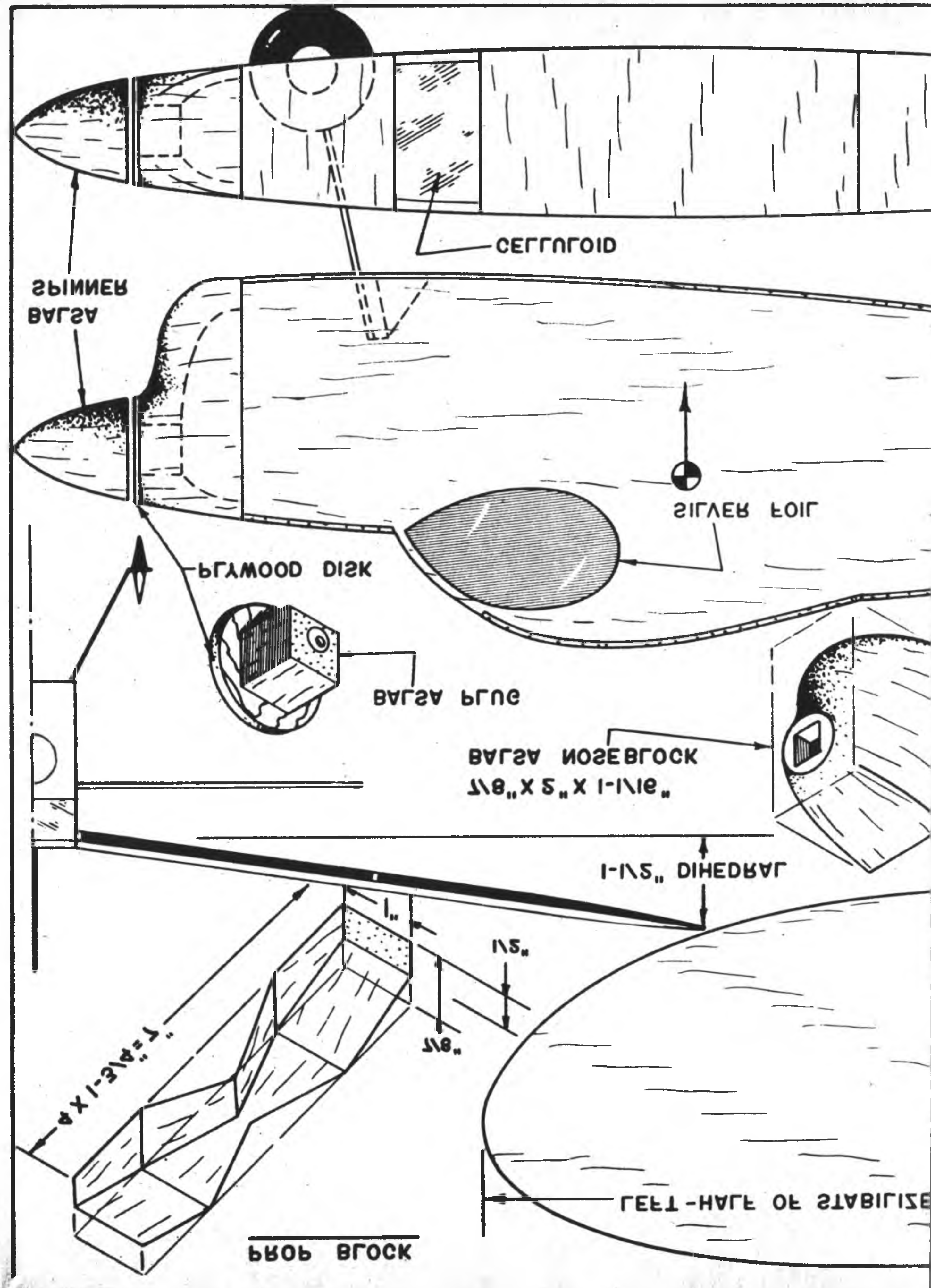
Cut two fuselage sides; if sheets are not quarter-grain stock glue a ⅛" strip vertically through the C.G. position to stiffen sides. Glue two sides together at rear. When this joint dries, glue in sections under wing, then add remaining top and bottom pieces. Mount gear through slit cut in fuselage bottom. A drop of cement on end of axles will hold wheels in place. The nose block is cemented flush with the fuselage front.

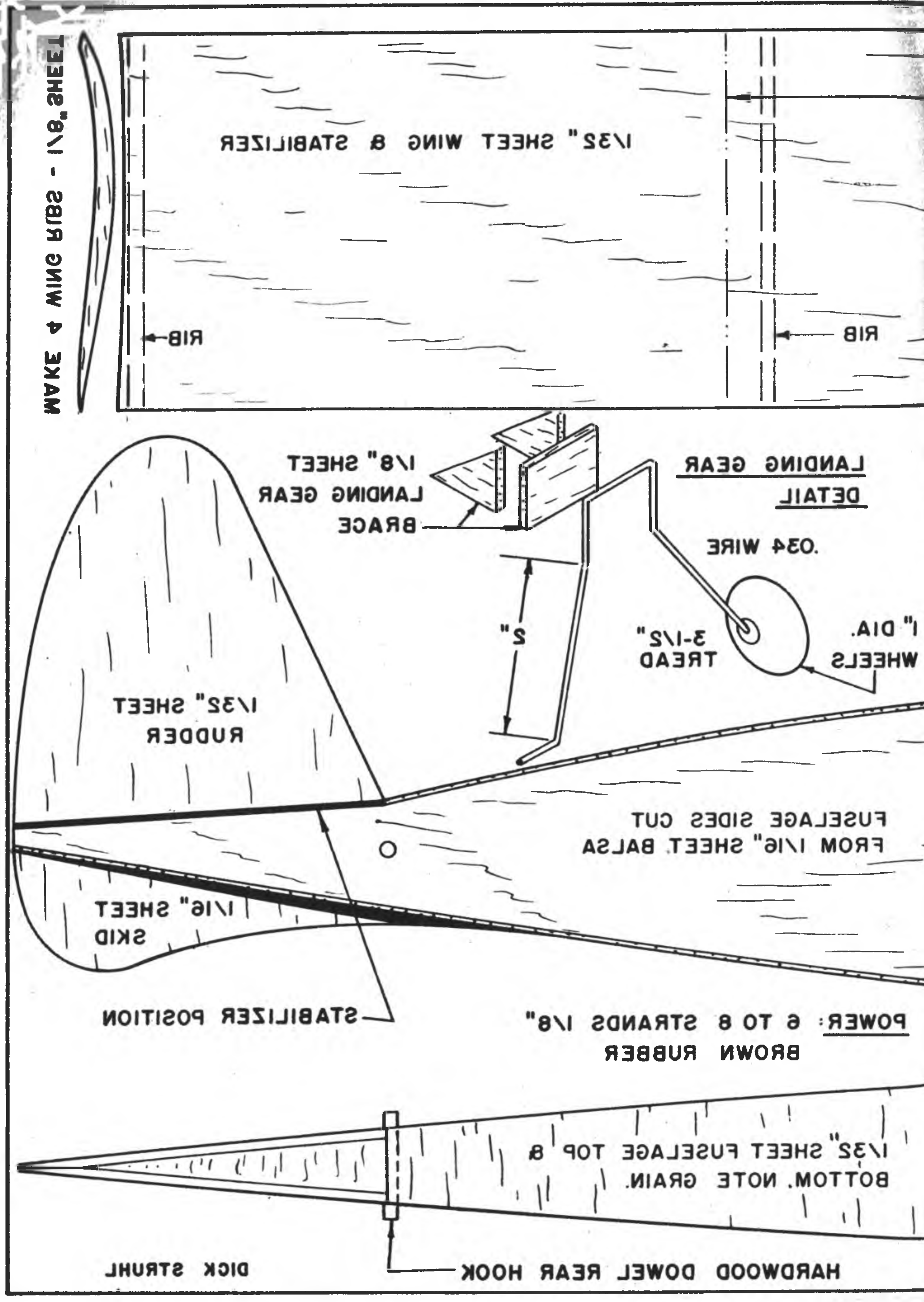
Only the left half of the stabilizer is shown. Reverse the drawing for the right side. The stabilizer is made in one piece for the most strength. The hardwood dowel which serves as a rear hook sets in holes drilled in fuselage sides.

The four wing ribs are cut from hard balsa and are cemented to the underside of the wing panels for the desired camber and strength. Use small straight pins to keep the wing curved until the cement has set. The nose plug is a thin plywood disk with a balsa cube cemented to it which fits the square hole in the front of the nose block. One ball-bearing washer is used between the prop and the nose plug.

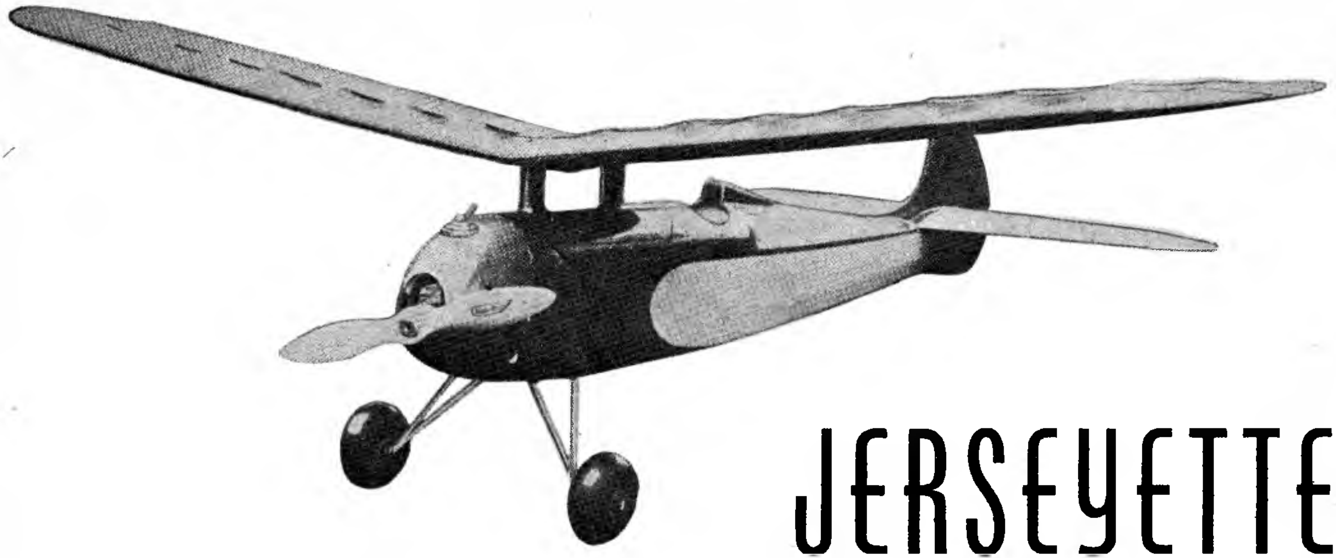
The model should be powered with six strands of ⅛" flat T-56 brown rubber. After your model is adjusted you may increase the power to eight strands for a skyrocket climb.




BALSA SPINNER
CELLULOID
SILVER FOIL
PLYWOOD DISK
BALSA PLUG
BALSA NOSEBLOCK
7/8" X 2" X 1-1/16"
1-1/2" DIHEDRAL
1"
1/2"
7/8"
4 X 1-3/4"= 7"
LEFT-HALF OF STABILIZE
PROP BLOCK



1/32" SHEET WING & STABILIZER
RIB
RIB
MAKE 4 WING RIBS - 1/8" SHEET
LANDING GEAR
DETAIL
1/8" SHEET
LANDING GEAR
BRACE
.034 WIRE
1" DIA.
WHEELS
3-1/2"
TREAD
2"
1/32" SHEET
RUDDER
FUSELAGE SIDES CUT
FROM 1/16" SHEET BALSA
1/16" SHEET
SKID
STABILIZER POSITION
POWER: 6 TO 8 STRANDS 1/8"
BROWN RUBBER
1/32" SHEET FUSELAGE TOP &
BOTTOM. NOTE GRAIN.
DICK STRUHL
HARDWOOD DOWEL REAR HOOK



JERSEYETTE

THIS VERSATILE DIESEL OR GLOW PLUG POWERED JOB MAY BE FLOWN FREE-FLIGHT OR AS U-CONTROL GOAT

DESIGNED AND FLOWN BY FRANK EHLING

ONE of the most inventive model builders in the East, Frank Ehling of Jersey City, N. J., comes up with this specially designed diesel or glow plug powered Class A or B free-flight or control-line "goat" model which has been developed for the beginning gas modeler or club novice.

To assist the less experienced flyer, *Air Trails* makes available full size plans for the Jerseyette. Information on obtaining these is to be found on page 96. With the full size drawings are included both floats and skiis. The Jerseyette has been flown off land, water and snow with equally good performance.

It would be hard to devise a more conventional type of aircraft model than the one presented here. Designer Ehling has worked to keep construction as simple as possible. He does not claim any world-shattering records for the Jerseyette. It is an easy model to build and fly, and—important—an easy model to adjust.

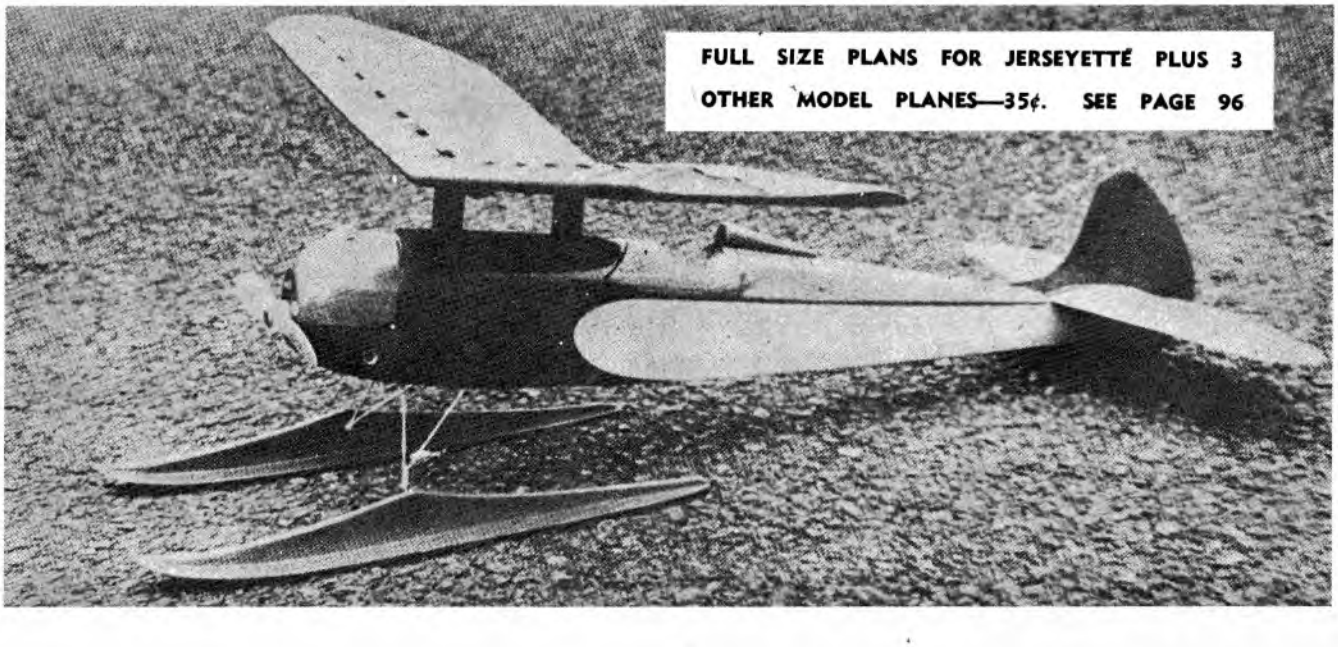
A variety of power plants may be utilized in the model. Any Class A or Class B motor can be chosen. For powering by engines under .20 cu. in. the designer recommends the model be built as light as possible without sacrificing strength. For Class B engines harder woods may be used throughout.

Fuselage is typical box-type construction with addition of rounded formers on top. Formers 2 through 5 are 1/8" sheet stock; 6 through 10 are 1/16" thick.

Pine struts are used to hold wing to fuselage. A removable section of the fuselage acts as a base for the struts—notched on top to fit wing spars and ribs.

A built-up elevator is used for free-flight work; a sheet of 3/16" thick balsa cut to shape serves as a U-

● Here Jerseyette is shown as ski plane. Slight modification is made in landing gear when plane is flown with floats from water.

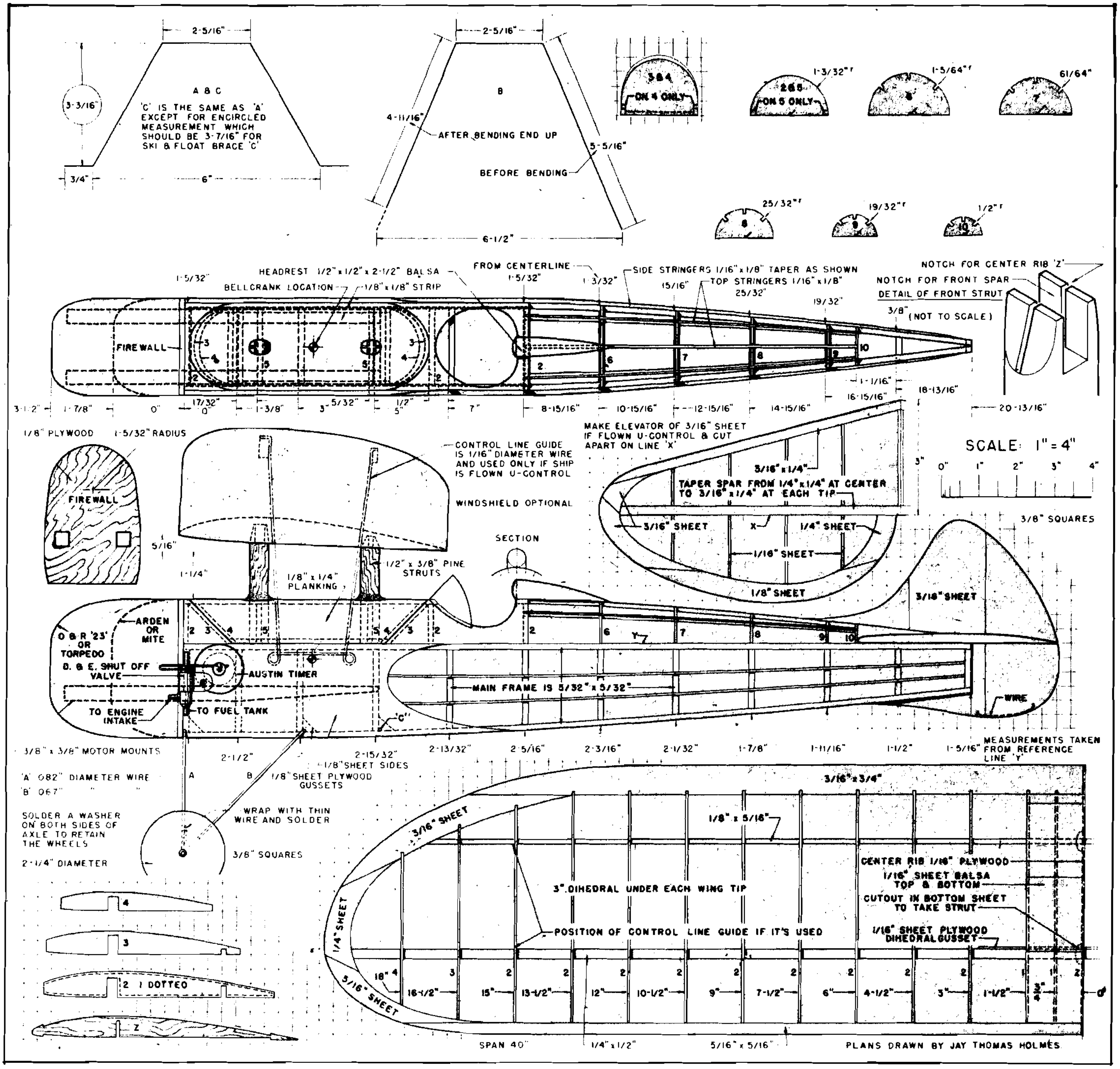


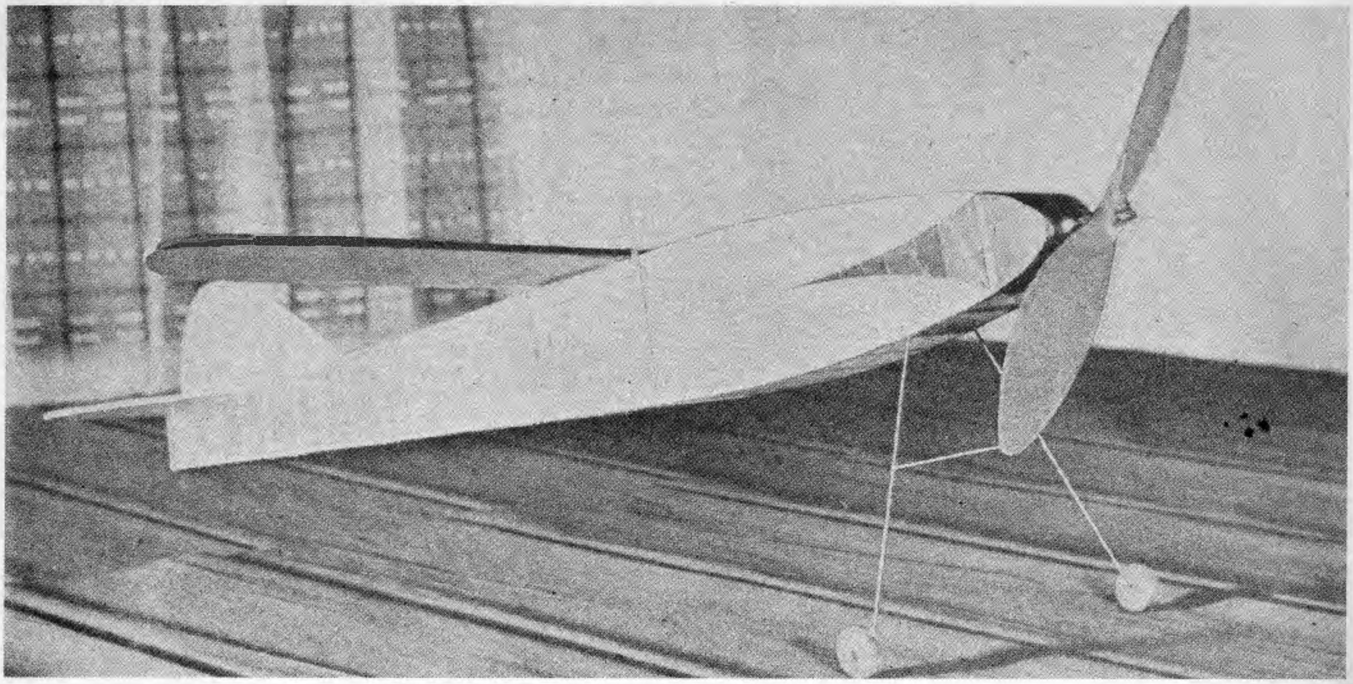
control elevator. The control mechanism is added to the ship in conventional manner with the bellcrank mounted on platform directly at the center of gravity.

Any of the standard methods may be incorporated to cut off the glow plug or diesel engine. Shown is the D-E fuel cut-off mounted with an Austin timer. The same landing gear is used for all types of flying by U-control or free-flight from land or snow. The slight change for float comes with the substitution of brace C in place of B. Wire C is placed directly below the rear wing strut. Landing gear wires should be bound to fuselage cross members and longerons with heavy thread, then given a liberal coating of cement.

Mr. Ehling's first Jerseyette was powered by an Arden .199 engine equipped with a D-E variable compression diesel head. Among the many engines which can fit this simple ship are the Ohlsson & Rice .19 or .23, the Torpedo, Arden .099 or .199, the Mite, Genie, Thor, Buzz, or Bantam—to mention a few. The smaller engines would be for sport-type free flying, the larger ones mentioned are suitable for either free-flight or control-line work.

The size of the cowling will be dictated by the type of engine selected as indicated on the plans. The cowling may be carved from a single block of soft balsa of sufficient size, or it can be built up from slabs of ½" thick sheet balsa if the modeler so desires. In either case, a cowling will add much to the appearance of your Jerseyette and will provide protection to the power plant in event of crashes.



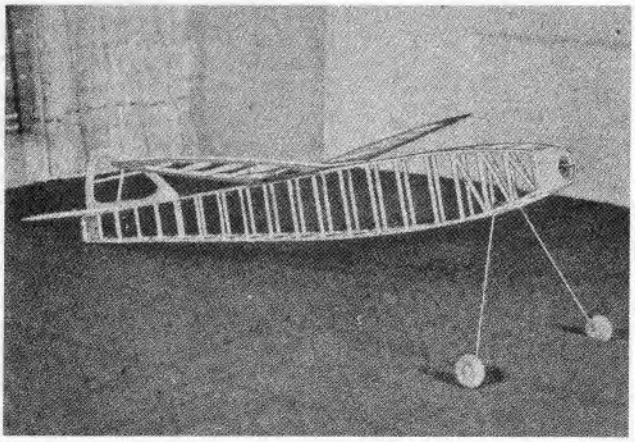


This is what a speed model looks like. Ships similar to one shown in this photograph have flown as fast as 75 m.p.h. Span is 18".

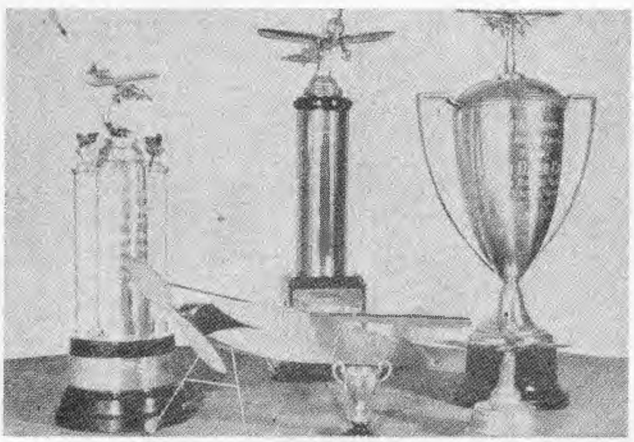
SECRETS OF SPEED

By LEONARD BECKER

Information on flying and timing racing models; plans of typical ship.



The most amazing thing about speed models is that they are unusually simple to construct. Notice simplicity in photo.



The speed event is quite popular. Here are but a few of the trophies awarded at the Junior Aviators National Air Races.

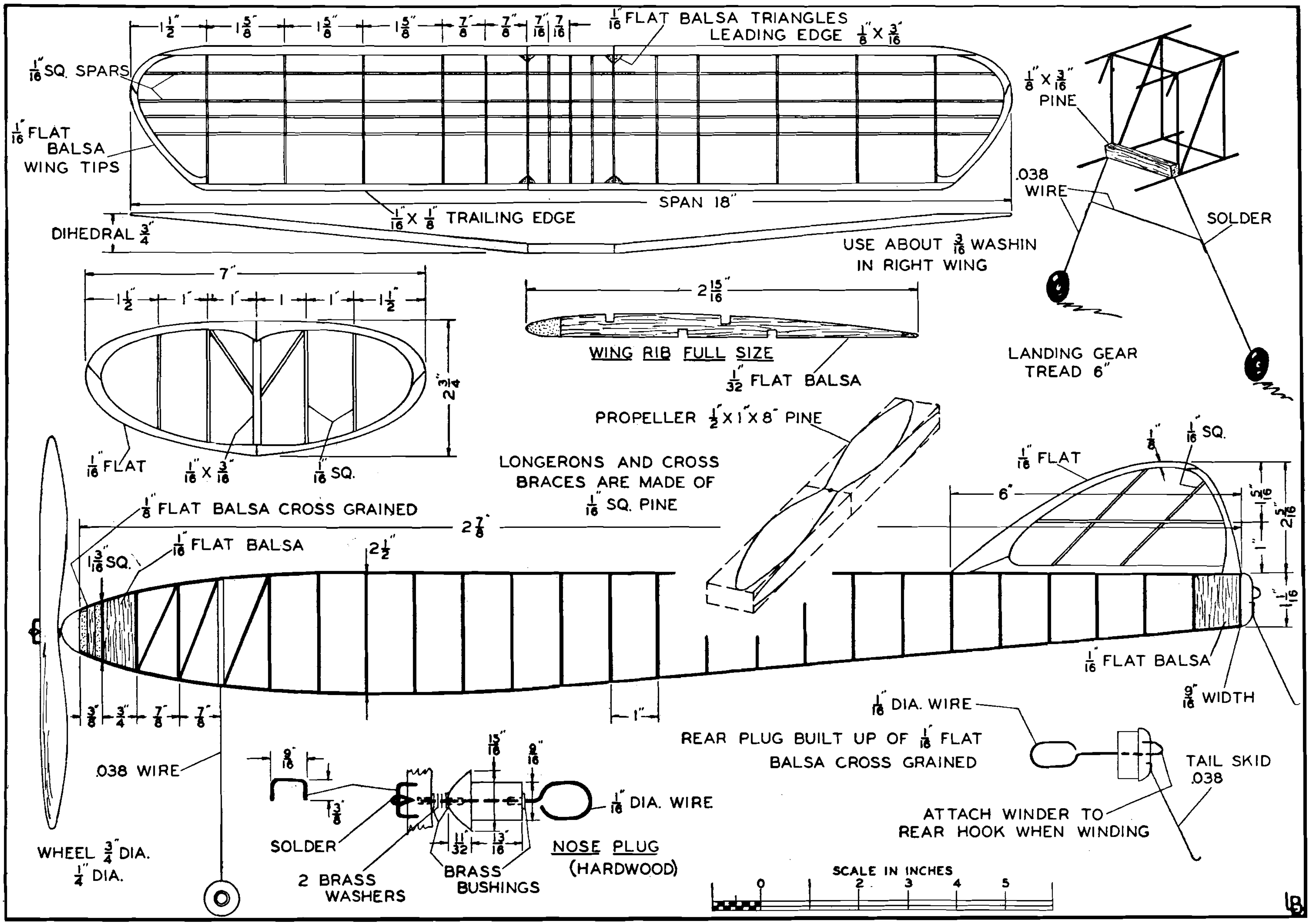
THE greatest asset of modern air transportation is speed, and it is for this reason that the field is expanding so rapidly; therefore I feel that we should do more experimenting with speed models.

Timing speed models accurately is the greatest drawback. In Cleveland we have an electromagnetic timing device. At the starting platform we have a button which causes the electromagnet to start the stop watch and another button at the finish line to stop the watch. The electromagnet is quite powerful and responds to the slighest touch of the button. Four large dry cells furnish the current for the electromagnet.

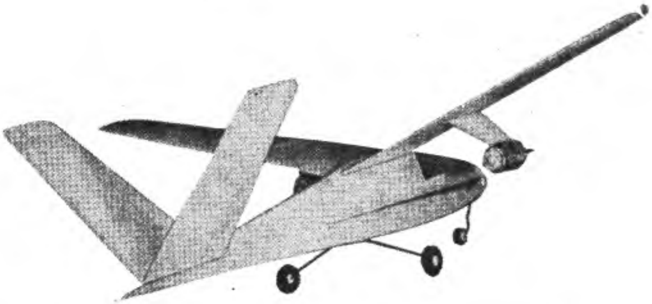
This is not the most accurate way of timing speed models, as photoelectric cells would be absolutely accurate, but it would take a whole battery of them to cover the finish line. A stop watch with finer graduations would help, when using either method.

We have been experimenting with speed models for about seven years around Cleveland, attaining speeds of seventy-five miles per hour. These tremendous speeds of between sixty and seventy miles per hour must be accurate; I have had wings rip off, due to the terrific pressure exerted on the wing when the ship climbs too steeply.

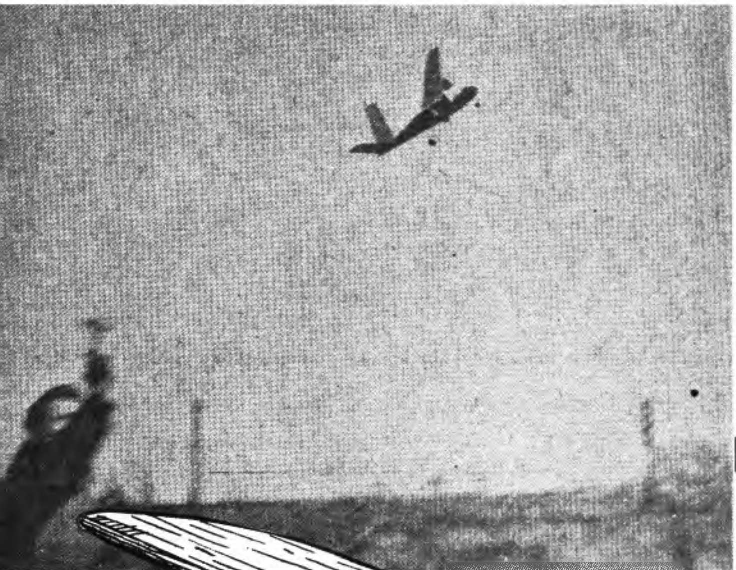
The course used at the Junior Aviator contests was eighty-eight feet long and thirty feet wide, it being an unofficial flight when the ship swerved



1/16" FLAT BALSA TRIANGLES
LEADING EDGE 1/8" X 3/16"
1/16" SQ. SPARS
1/16" FLAT BALSA WING TIPS
SPAN 18"
1/16" X 1/8" TRAILING EDGE
DIHEDRAL 3/4"
1/8" X 3/16" PINE
.038 WIRE
SOLDER
USE ABOUT 3/16 WASHIN IN RIGHT WING
LANDING GEAR TREAD 6"
WING RIB FULL SIZE
1/32" FLAT BALSA
PROPELLER 1/2" X 1" X 8" PINE
LONGERONS AND CROSS BRACES ARE MADE OF 1/16" SQ. PINE
1/16" FLAT
1/16" X 3/16"
1/16" SQ.
1/8" FLAT BALSA CROSS GRAINED
1/16" FLAT BALSA
1 3/16" SQ.
1/16" FLAT BALSA
9/16" WIDTH
1/16" DIA. WIRE
REAR PLUG BUILT UP OF 1/16" FLAT BALSA CROSS GRAINED
TAIL SKID .038
ATTACH WINDER TO REAR HOOK WHEN WINDING
.038 WIRE
WHEEL 3/4" DIA. 1/4" DIA.
SOLDER
2 BRASS WASHERS
BRASS BUSHINGS
NOSE PLUG (HARDWOOD)
SCALE IN INCHES



the EXECUTIVE—



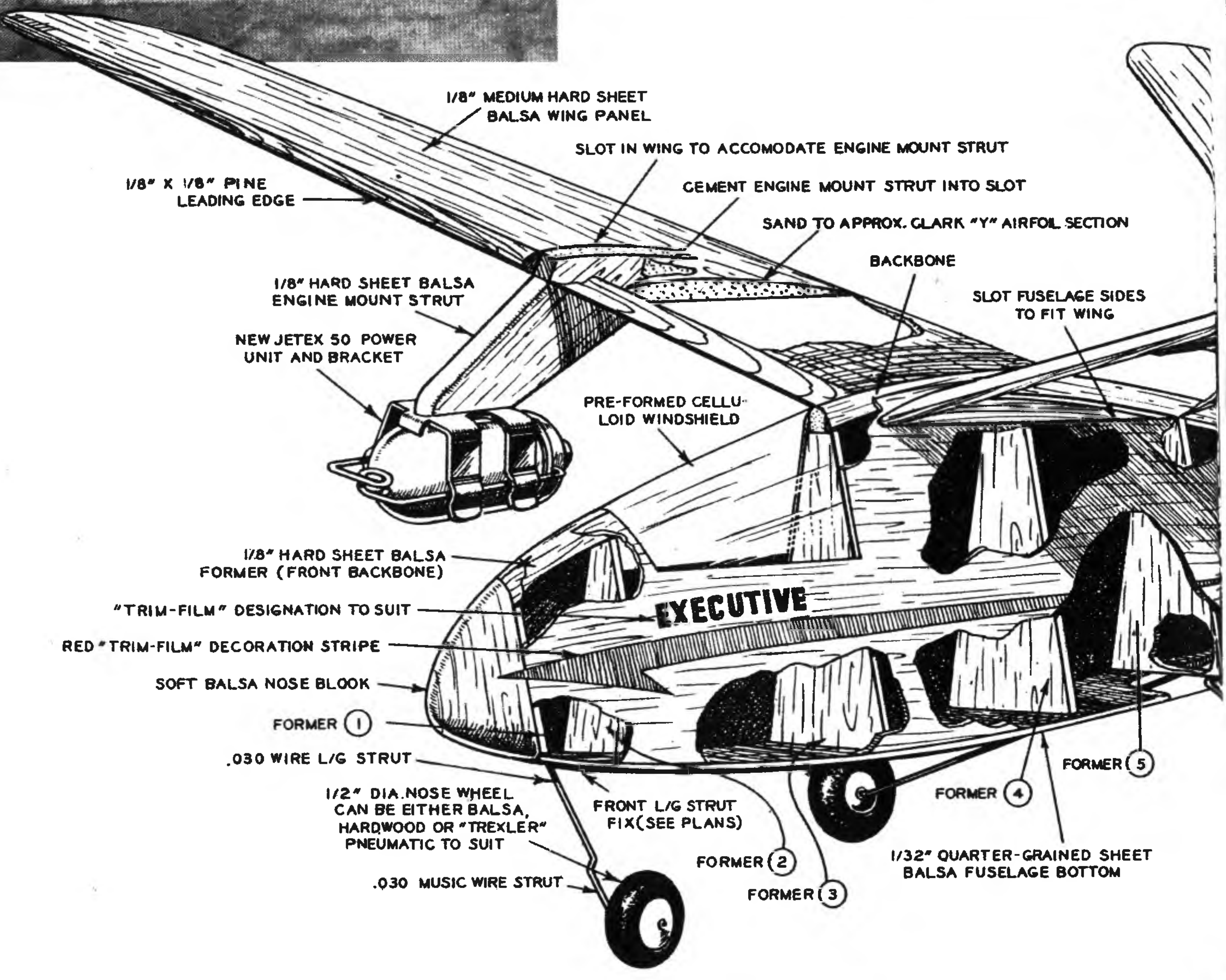
■ The *Executive* is a twin-jet-propelled free flight model developed especially for the Jetex 50 power unit.

Our basic idea was to incorporate the use of twin jets for power in order to get away from run of the mill model design, and to produce a model that had good performance yet was of rugged construction, simple, light, stable in flight and realistic looking.

The *Executive* is built up on a backbone, insuring perfect alignment and giving shape in final assembly.

Construction is conventional as indicated by the plans. The bottom of the fuselage is cut from 1/32" sheet with the grain running lengthwise. Attach this piece by gluing and using stick pins to hold in place until dry. Wheels are of balsa or hardwood, or small Trexler pneumatic wheels may be used.

Draw a windshield pattern on heavy paper, cut to shape



twin Jetex powered transport

from celluloid, and glue in place. The leading edge of the wing is stripped with ⅛″ square pine to protect the panels in case of collision.

Finish the model by assembling wings, "V" stabilizer to the fuselage. Add two coats of clear dope mixed with a little castor oil to stop any parts from warping. Decoration may be added as shown.

Your model should balance without adding weight, but in the event that it doesn't balance at the center of gravity location, balance it at the wing tips and add bits of modeling clay to the nose or tail as required.

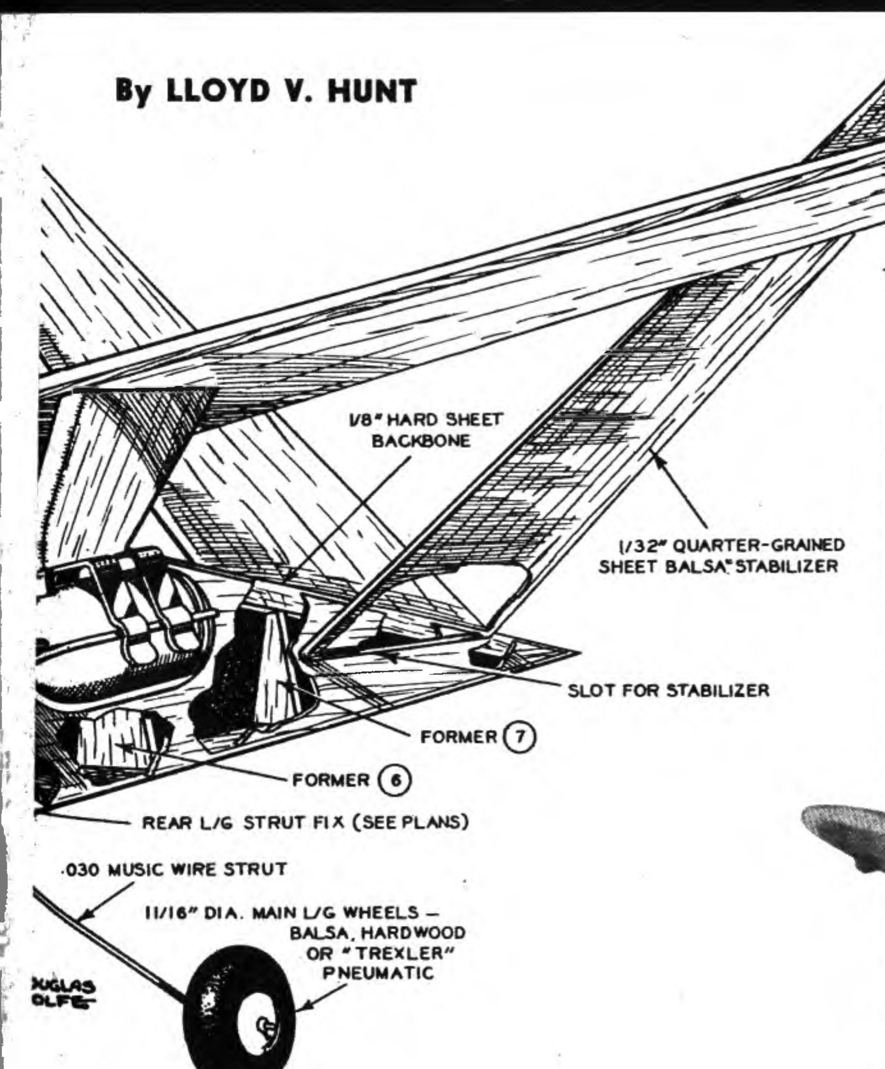
You will notice when you glide your *Executive* that it has a slow floating glide; don't let this deceive you; under power it will perform at high speeds. For the first power flights use only half a pellet in each Jetex unit. This not only saves expense, but aids in adjustment. If the model behaves well you may safely employ a full pellet for subsequent flights.

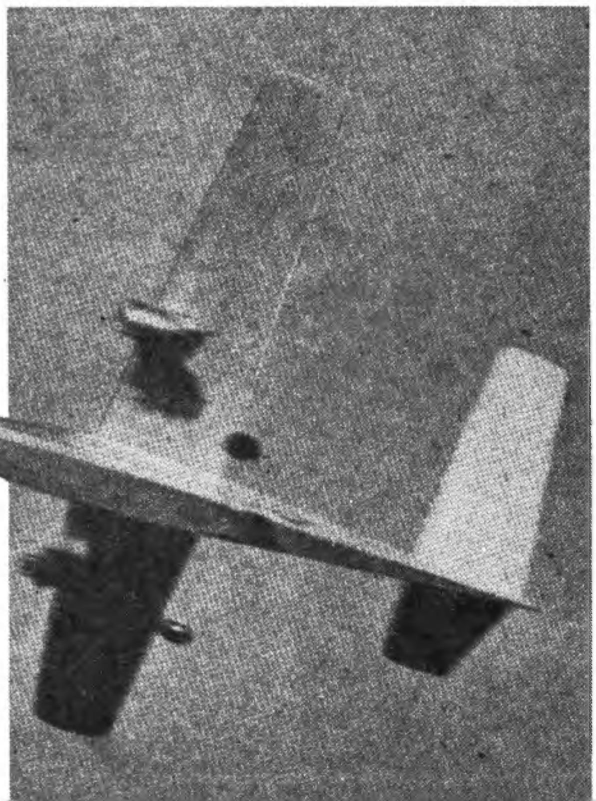
On a calm day glide test the model thoroughly, adjusting for a slight right or left turn. We emphasize "slight" adjustment because the model flies fast under power, and any slight maladjustment is greatly amplified.

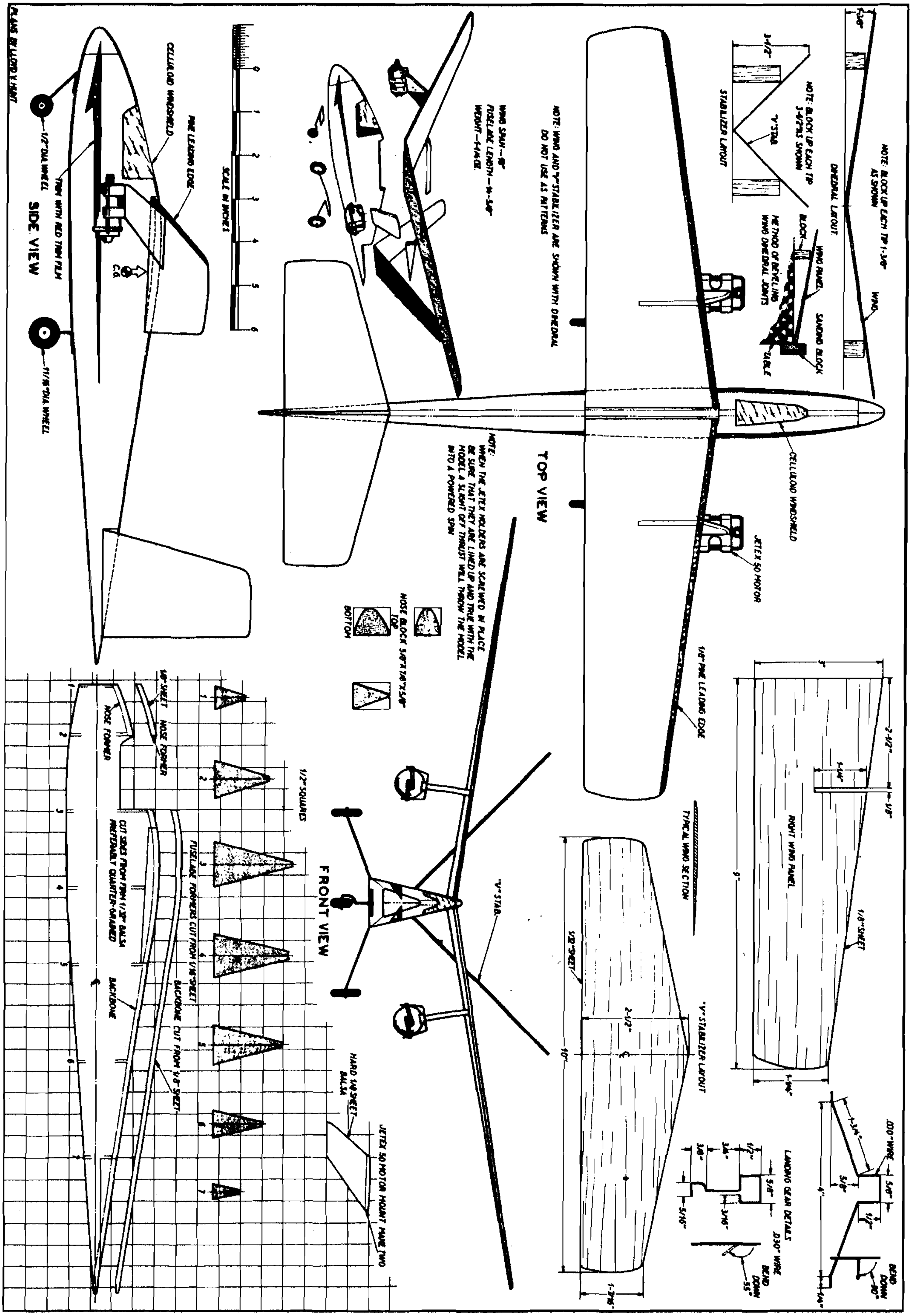
Have a friend help you when it comes to igniting your Jetex unit. The reason for this is that both units should be ignited at the same time. Wait until you can feel equalized thrust from both units. You have lots of time to get the ship into the air. Do not attempt to fly the model with only one unit in operation. This would cause it to spin in under power. Note: Downthrust should permit adequate power trimming if needed.

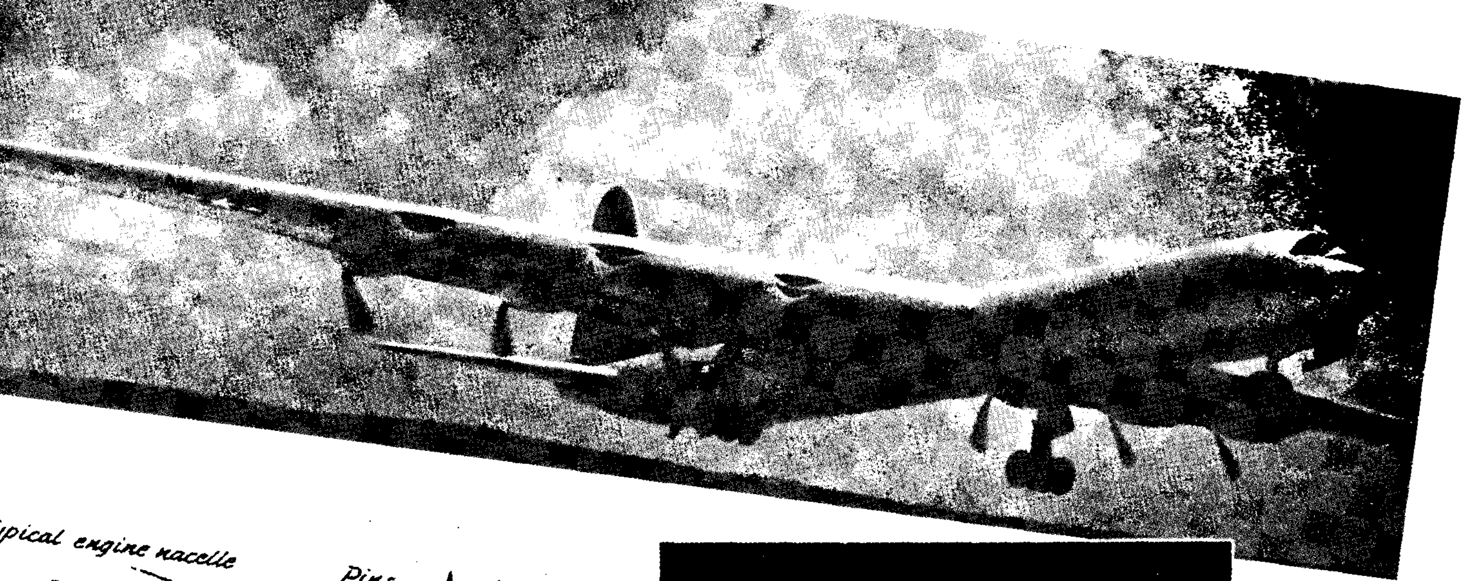
The *Executive* is capable of a minimum of 100 feet altitude under power, and a long duration in its glide.

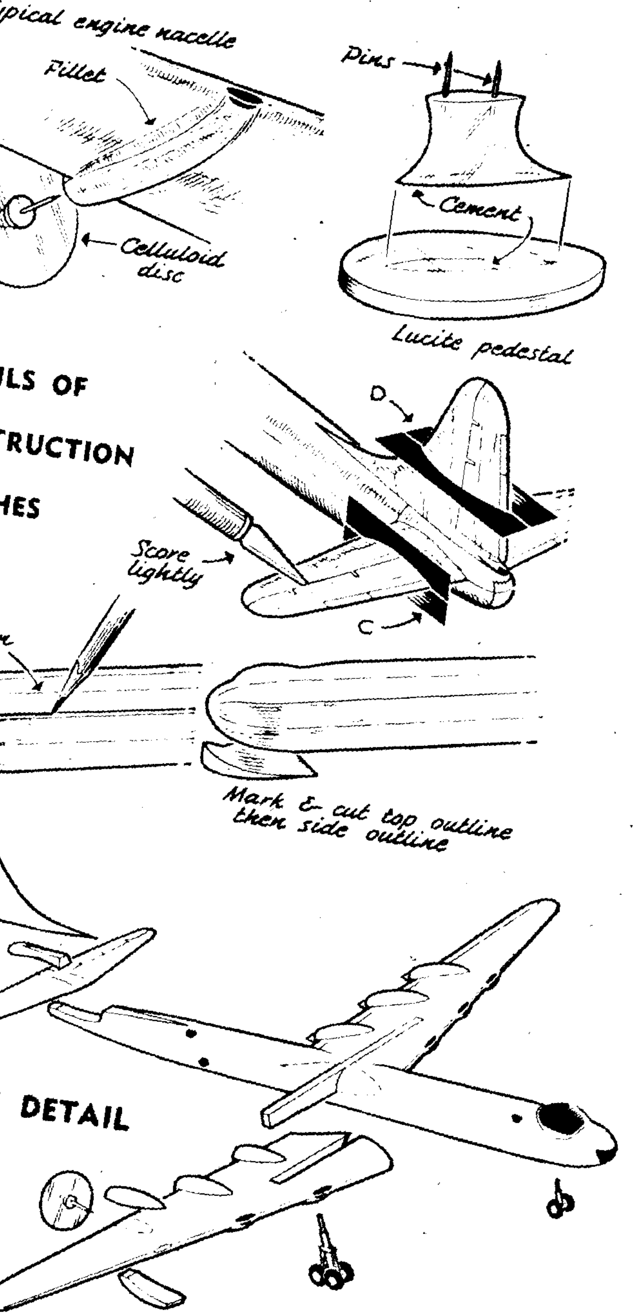
By LLOYD V. HUNT






PLANS BY LLOYD V. HART
SIDE VIEW
CELLULOID WINDSHIELD
PINE LEADING EDGE
TRIM WITH RED TRIM FILM
1/2" DIA. WHEEL
11/16" DIA. WHEEL
C.G.
SCALE IN INCHES
WING SPAN—18"
FUSELAGE LENGTH—16-5/8"
WEIGHT—1-1/4 OZ.
NOTE: WING AND "V" STABILIZER ARE SHOWN WITH DIHEDRAL DO NOT USE AS PATTERNS
TOP VIEW
NOTE: WHEN THE JETEX HOLDERS ARE SCREWED IN PLACE BE SURE THAT THEY ARE LINED UP AND TRUE WITH THE MODEL. A SLIGHT OFF THRUST WILL THROW THE MODEL INTO A POWERED SPIN
CELLULOID WINDSHIELD
JETEX 50 MOTOR
1/8" PINE LEADING EDGE
NOSE BLOCK 5/8"X7/8"X1-5/8"
TOP
BOTTOM
NOTE: BLOCK UP EACH TIP 1-3/4" AS SHOWN
DIHEDRAL LAYOUT
WING
NOTE: BLOCK UP EACH TIP 3-1/2" AS SHOWN
"V" STAB.
STABILIZER LAYOUT
METHOD OF BEVELING WING DIHEDRAL JOINTS
WING PANEL
SANDING BLOCK
BLOCK
TABLE
TYPICAL WING SECTION
RIGHT WING PANEL
1/8" SHEET
"V" STABILIZER LAYOUT
1/8" SHEET
FRONT VIEW
"V" STAB.
1/2" SQUARES
1/16" SHEET
NOSE FORMER
NOSE FORMER
FUSELAGE FORMERS CUT FROM 1/16" SHEET
CUT SIDES FROM FIRM 1/32" BALSA PREFERABLY QUARTER-GRAINED
BACKBONE
BACKBONE CUT FROM 1/8" SHEET
HARD 1/16" SHEET BALSA
JETEX 50 MOTOR MOUNT MAKE TWO
LANDING GEAR DETAILS
.030" WIRE
BEND DOWN 55°
BEND DOWN 30°

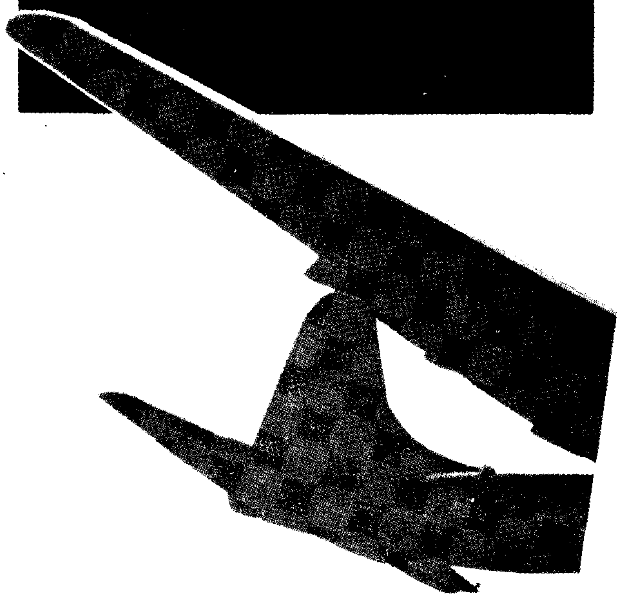


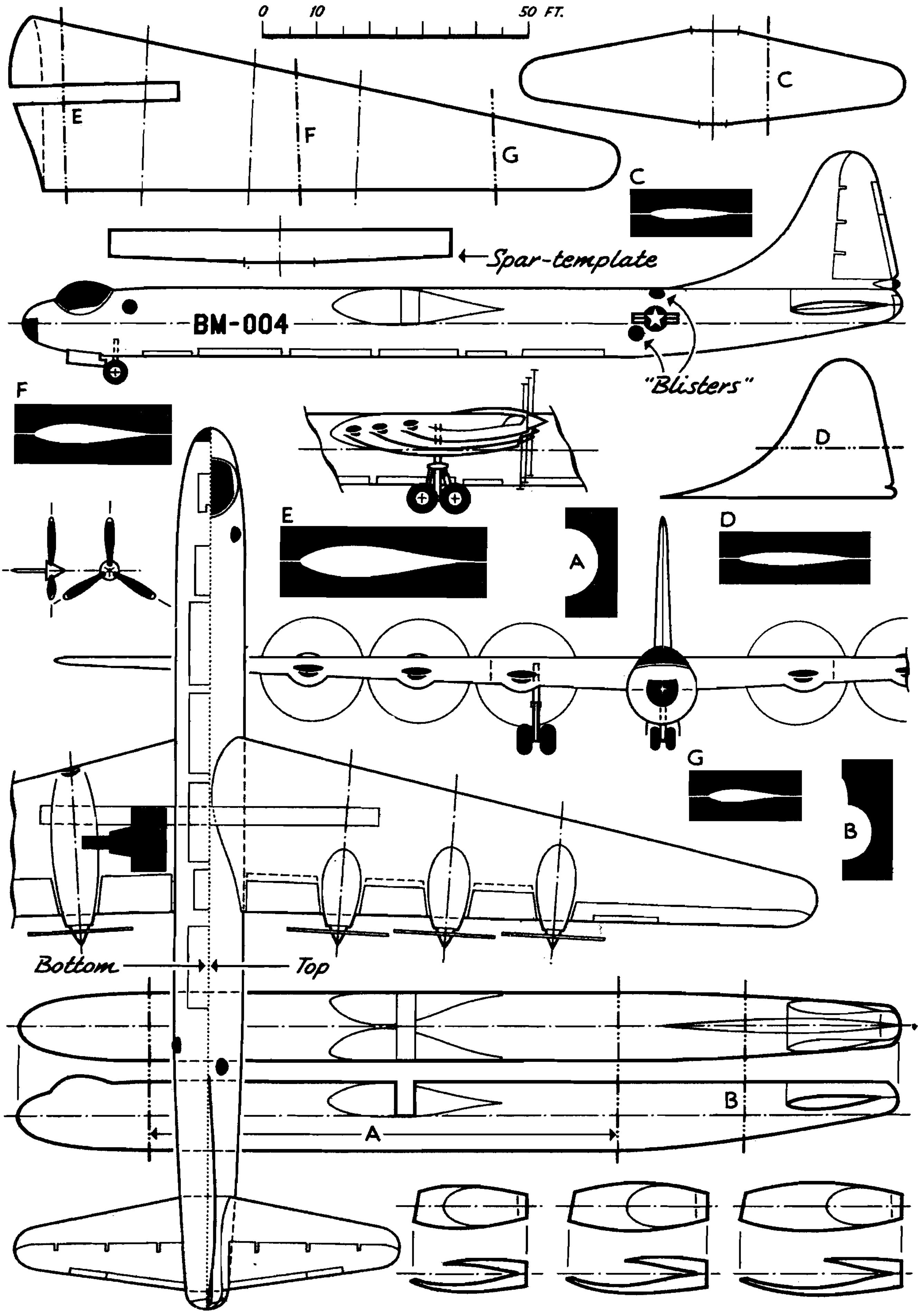


Solid Stuff:
Consolidated B-36 Bomber

BY H. A. THOMAS

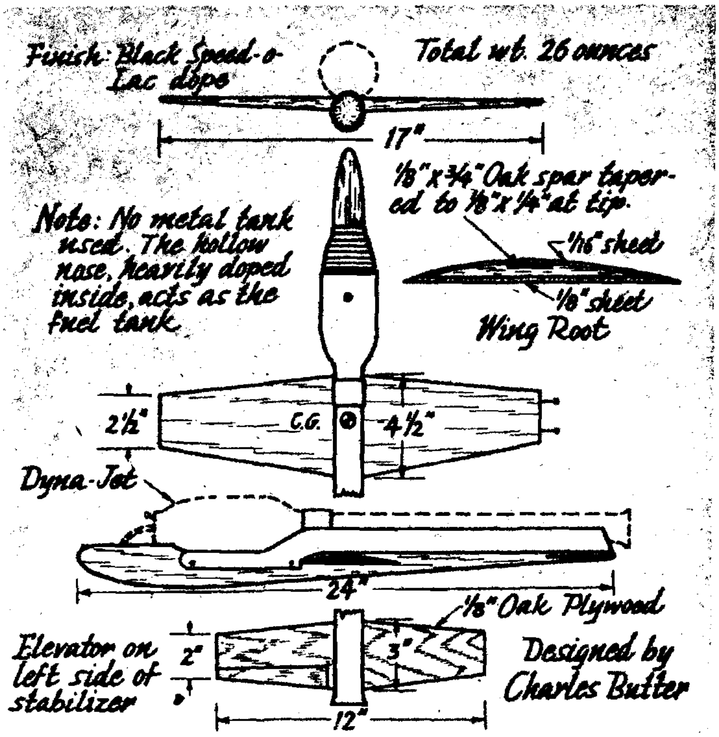
HERE'S AN INTERESTING PROJECT IN SOLID SCALE. BUILD THIS CONVAIR B-36, WORLD'S LARGEST BOMBER, A PROUD ADDITION TO YOUR COLLECTION




0
10
50 FT.
E
F
G
C
C
Spar-template
BM-004
"Blisters"
F
D
E
A
D
G
B
Bottom
Top
B
A

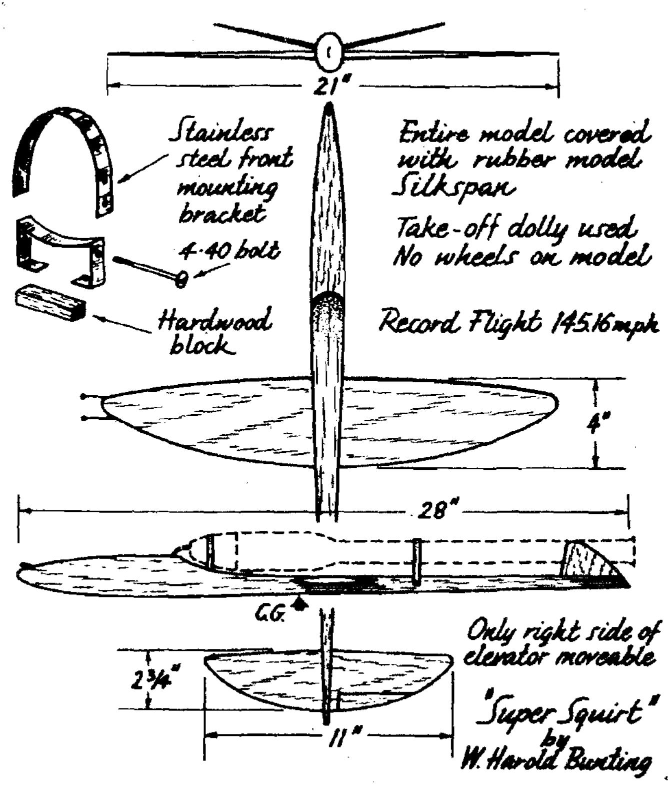
Junior Jets

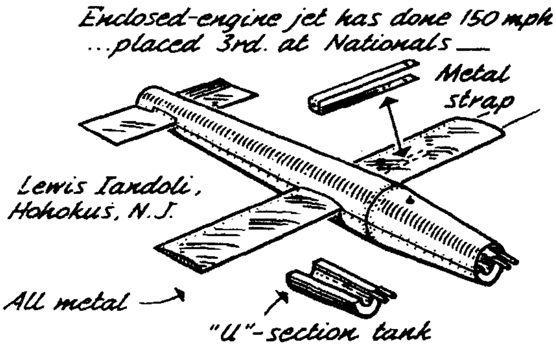
■ The "minimum" airplane has always been the quest of the jet speed designer. Since it is pretty generally believed the Dyna-Jet engine would fly itself around the circle very nicely with the addition of some small stabilizing vanes, jet model surfaces have been chopped down, down, down. Single wing, single stab jobs have been attempted, but without much success. Dollies have pretty much disappeared from the scene. All the jet speedster asks is a smooth circle from which he can skid his model off into the air. Variations in design trends are illustrated by the two record-holding models. Some not so conventional ideas on construction are below.



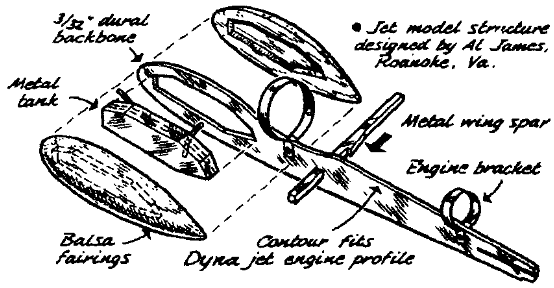
The configuration of Mr. Butter's Dyna-Jet powered record holding model represents one of two prevailing schools of thought on the design of jet speed jobs. One group favors the stumpy fuselage with fuel tank carved inside the "hull." The other favors the long, tapered nose type of model represented by Bunting's ship below. Record is currently held by Butter-type.

Harold Bunting's "Super Squirt" is a refinement of his original record-setting Dyna-Jet powered speed model which racked up its national record back when jets were just beginning to get established. This one shown here weighed 19 oz. without fuel, all surfaces set at zero. Tank capacity 2.25 oz.; engine powers model for 16 laps before tank runs dry. Maximum width 1.3 in.

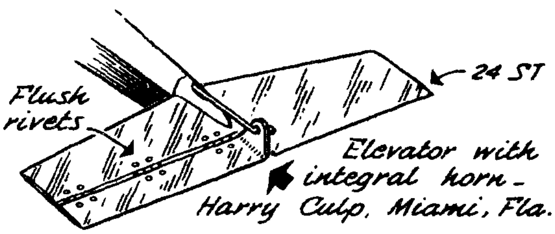




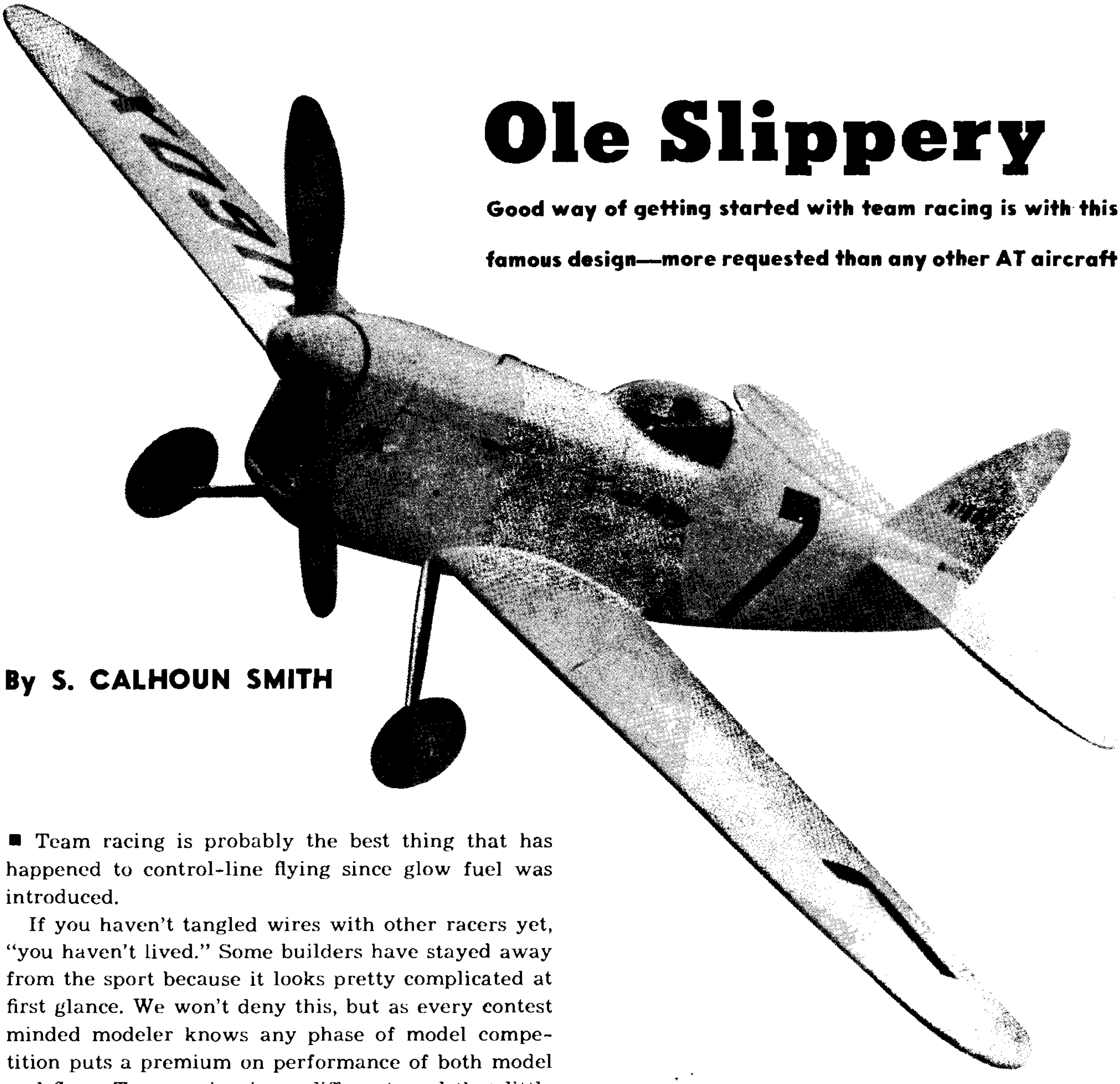
Since the introduction of the Dyna-Jet powerplant modelers have been experimenting with enclosing the engine. So far most successful applications are like this one.



This design utilizes a metal fuel tank with minimum size balsa wood fairings. Another method is to carve fuselage of hardwood and scoop out section for the fuel stowage.



A problem with jet models is developing good connections at the bellcrank and elevator horn which will be unaffected by heat and vibration. This is a neat solution, works well.



Ole Slippery

Good way of getting started with team racing is with this famous design—more requested than any other AT aircraft

By S. CALHOUN SMITH

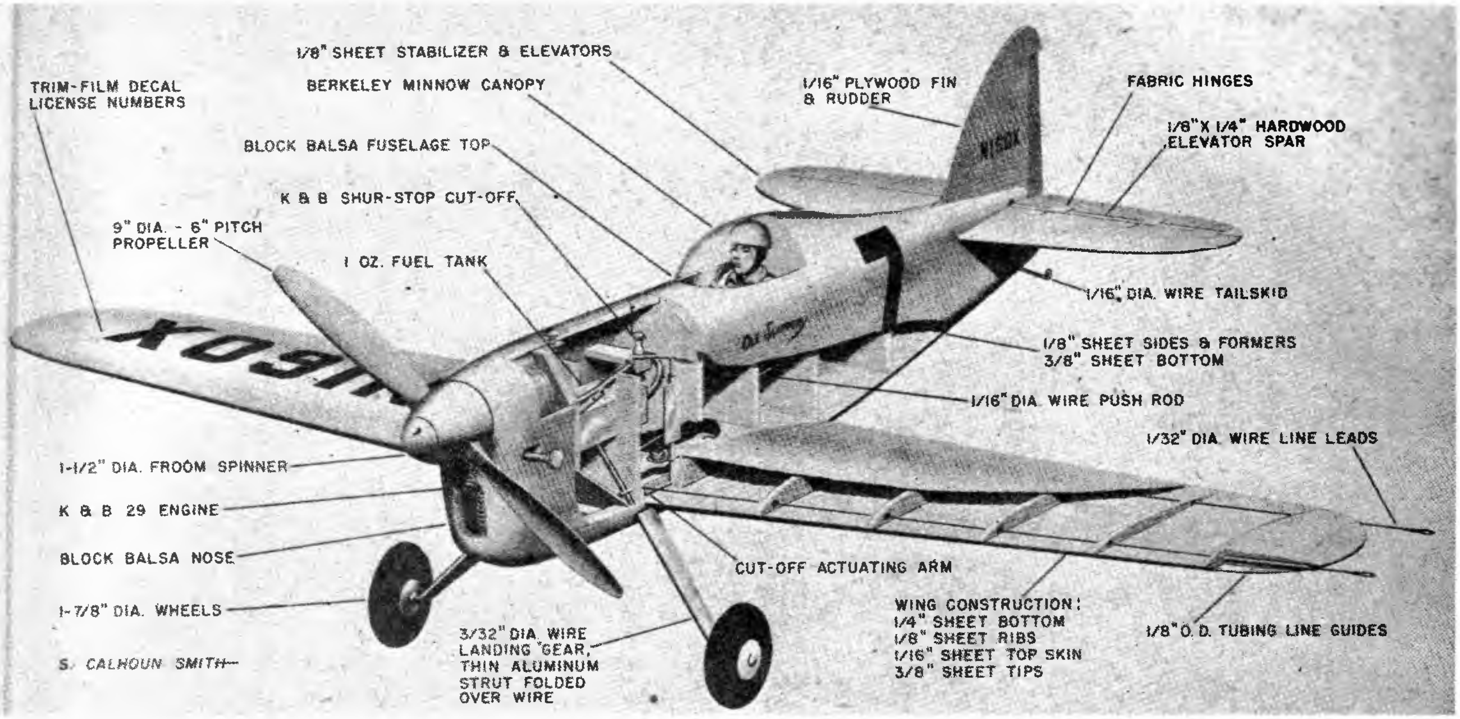
■ Team racing is probably the best thing that has happened to control-line flying since glow fuel was introduced.

If you haven't tangled wires with other racers yet, "you haven't lived." Some builders have stayed away from the sport because it looks pretty complicated at first glance. We won't deny this, but as every contest minded modeler knows any phase of model competition puts a premium on performance of both model and flyer. Team racing is no different, and that little extra effort is well repaid when the checkered flag drops on your model. Once you try it, you'll buy it. We're sure team racing has that extra something you'll like. The direct competition is a refreshing change from the old battle between model and stop watch.

The West Coast led the way in team racing and the very workable set of rules they established are now part of the A.M.A. book.

Various interested modelers have kicked around the rules a bit with rather freakish results. Using fuel tanks of greater than one-ounce capacity, for instance, destroys the whole basic idea of team race competition. It is fine for an endurance contest but team racing isn't an endurance contest from the standpoint of getting airborne with the greatest fuel load. The challenge of nursing as many laps as possible from one ounce of tiger milk really requires thought and experiment. Here's where the sport enters into the picture, because the modeler with the hottest ideas can take home the hardware.

Fuel economy without sacrificing too much speed means finding a good combination of fuel and propeller. Many modelers restrict the intake stack on the engine and by doing this can double the number of laps obtained from that one ounce of fuel. Lower pitch props are used for fast acceleration and flying in the seven-lap races. Higher pitch props giving best speed are used in the longer races where speed counts the most. Heavily methanated fuels should be used for short dashes, and the slowest burning fuel for longer races. Some modelers use gasoline and oil-based glow fuels for maximum economy.



Ole Slippery was conceived a while back when team racing was first starting. It originated in an illustration in Air Trails. The gap between picture and model has been filled in with considerable time watching and flying in team races. We don't claim *Ole Slippery* to be the final word, but rather an incorporation of pet design ideas.

Construction is conventional and has proved rugged and light. A.M.A. rules governing fuselage size are complied with. Button-head, the pilot, is close to size. Wing area is 140 sq. in., considerably greater than the 125 sq. in. minimum. The lifting airfoil (zip-zip section) is thicker than ordinarily used. The reduction in wing loading is a definite aid to acceleration and helps the model get air borne more quickly. It is doubtful that the slightly increased drag of this type of wing offsets its advantages.

Weight is 23 oz. This figure could probably be reduced by using medium grade balsa, rather than the heavier hard grade used in the original model. However, don't employ such soft wood that overall strength suffers.

The drawings show two different engine installations. The original has been flying on a well-broken-in McCoy .29. With hot fuel, a 9/6 prop, speed is 82 mph for 23 laps. With an intake restriction, slower burning fuel and higher pitch prop, speed is 70 mph for 32 laps.

Construction may be started with the fuselage. As can be seen from the drawings this will vary slightly depending on the engine used. The K&B .29 is mounted radially on a piece of 1/4" hardwood plywood. The McCoy .29 is beam-mounted on 5/16" x 1/2" hardwood bearers. Before starting construction, study the plans for differences in structure for the particular engine you wish to install.

Cut out the 1/16" plywood fuselage side doublers and the hardwood engine bearers. These should be joined with Weldwood glue. Put a couple of small wood screws through the plywood into the bearers for a tight joint. Cut out the 1/8" sheet fuselage sides and glue the plywood doublers to the front portion, again using Weldwood glue. Clamp carefully and let dry thoroughly, at least eight hours. Complete building instructions are on the full-size plan available from "AT."

No fuel cut-off system is shown on the main plan. However, the detail is shown on the cutaway drawing. A K&B Shur-Stop is mounted in the fuselage above the fuel tank. The release is actuated by an arm extending down beside the front of the bellcrank. This utilizes only the very last bit of down travel of the bellcrank. You may prefer to use a cut-off system other than this. Don't overlook the possibility of two-speed for your team racer.

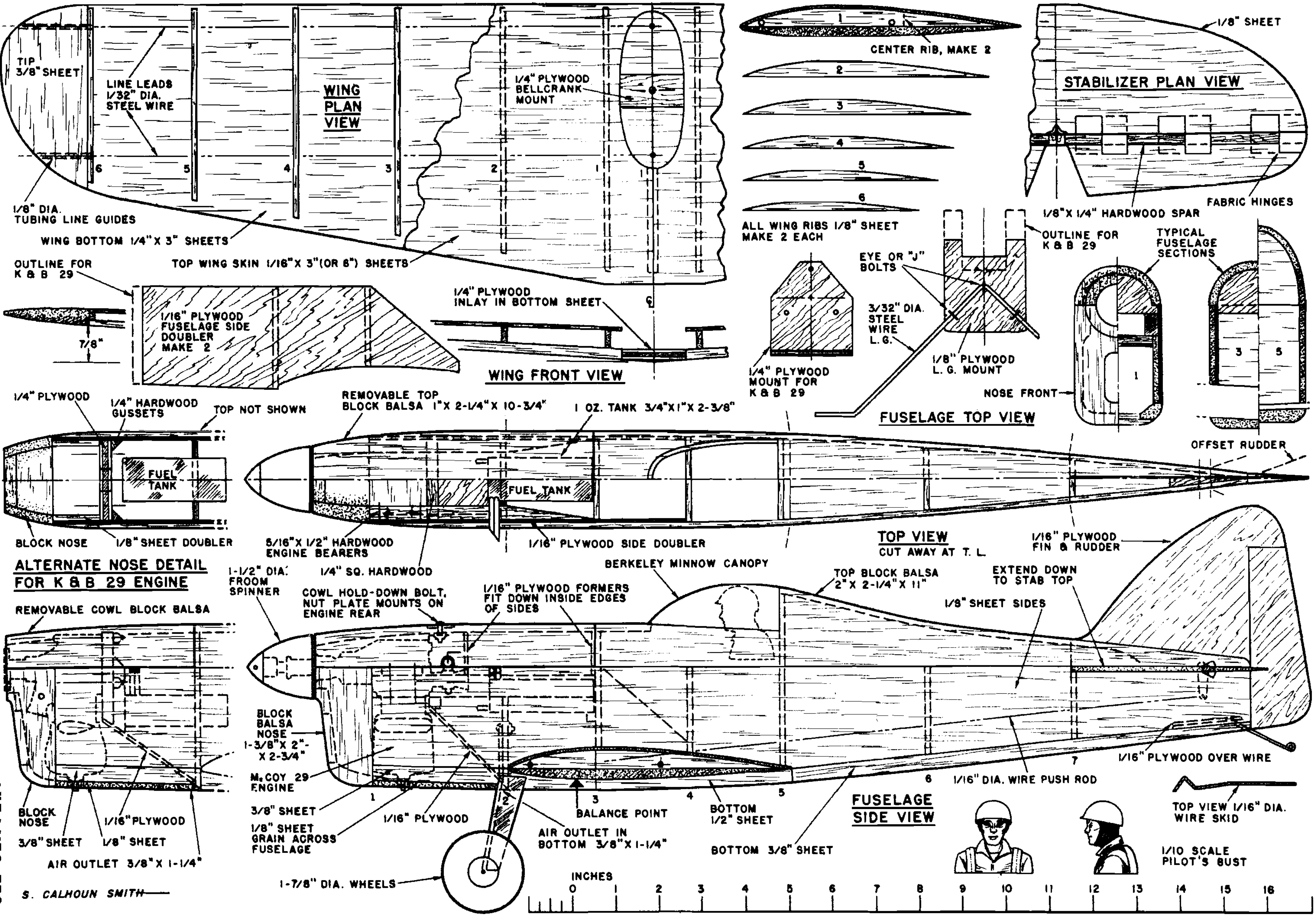
Bill of Materials—Ole Slippery

(Balsa unless specified otherwise)

Two 1/4"x3"x36", wing bottoms. One 1/16"x6"x36" (or equiv. 3" wide), wing tops. Three 1/8"x3"x36", fuselage, stab, elevator, formers, wing ribs. One 1"x2 1/4"x11", front cowl block. One 2"x2 1/4"x11", rear cowl block. One 1 3/8" x2"x2 3/4", nose cowl block. One 3/8"x3"x18", wing tips, fuselage bottom. One 1/2"x3"x7", fuselage bottom. One 5/16"x1/2"x11" (hardwood), engine bearers. One 1/8"x1/4"x 12" (hardwood), elevator spar.

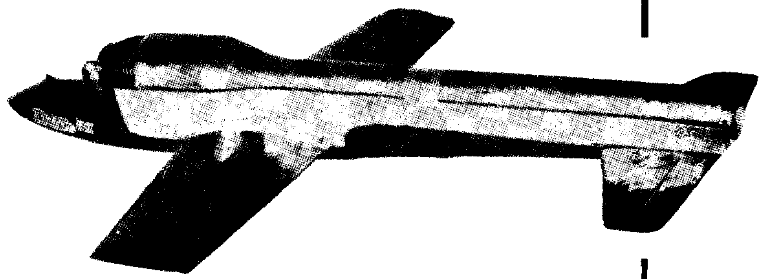
Scrap 1/8" plywood for landing gear bulkhead. 36" of 1/32" dia. wire for line leads. 18" of 1/16" dia. wire for pushrod and tail skid. 12" of 3/32" dia. wire for landing gear. One 1/2" dia. Froom Spinner. Eye or "J" bolts for landing gear fastening. 1 ounce fuel tank. 3" Veco bellcrank. 1 7/8" dia. wheels. 1/10 scale pilot's head. Berkeley Minnow canopy. Fabric for elevator hinges. Weldwood glue, cement, fuel-proof clear and colored dope. Lightweight Silkspan. Trim-Film decals.

OLE SLIPPERY



S. CALHOUN SMITH

World's *Fastest* Model



By GLENN TEMTE and BOB THOR

■ This is the jet that did 179.03 mph to set a new national record which has never been exceeded despite changes in rules or the influx of new enthusiasts to the Dyna-Jet powered circle.

Construction of B.J. VI is along conventional control model lines. If anything, the building of a jet model is a good deal simpler and faster. Use good wood and try to build as strong and yet as light a ship as possible.

Select an appropriate sized block of medium balsa for the fuselage and saw to side and top outline, being extremely careful to cut in the wing incidence at zero degrees. The model is set up for clockwise flight, but there is no reason why it won't fly equally well in a counterclockwise direction if the necessary changes in gas tank and bellcrank leads are made.

The wing is of very conventional construction. The spar is of hardwood lying flat along the top. A hickory spar cut from an old ski has worked out well for us. From medium-hard balsa cut out the bottom of the wing panels, and on them assemble the ribs and spar in their proper location. Install the control units in the wing, screwing the mounting bolt only far enough down to hold the bellcrank assembly in place. Cut the top wing covering from 1/16 " medium balsa and glue in place. When completely dry, sand carefully to final shape.

As a final step in the finishing process, paint a half-inch wing walk of silver heat-resistant paint on each wing panel where the wing is not protected by asbestos. Reassemble the metal side fittings and fasten the asbestos in place using liquid glass as the adhesive. Liquid glass is obtainable at any drug store and is used because of its heat-resisting properties. Note that the asbestos wing walk is necessary on the outer wing panel only.

The hold-down strap is constructed from a piece of tin can metal and must be made right on the engine tube. Do not use brass or aluminum for the strap, as neither will stand the severe heat. Rivet or bolt a small block of aluminum in place on the strap and tap out a hole for the tie-down bolt. A square nut will substitute for the block of aluminum.

Drill the hole through the hardwood insert and fasten the engine in place with a long bolt. Tighten snugly, but do not use so much force that the fuselage is distorted. Check this bolt before each flight. Its job is to hold the engine in the mounts and is adequate if it is kept snug. There are no side forces on the bolt as these are taken care of by the engine mounts.

Your completed model should weigh in the neighborhood of 25 to 27 ounces. We strongly recommend .016" flying wires in good condition. The control wires should leave the handle at a distance of about two inches apart. In flight, these models pull from ten to twenty pounds and while this is not excessive, it is constant, and near the end of the flight you will probably be very happy when the engine quits. The tank is sufficient for about twenty-five laps, which is definitely a good workout on a warm day.

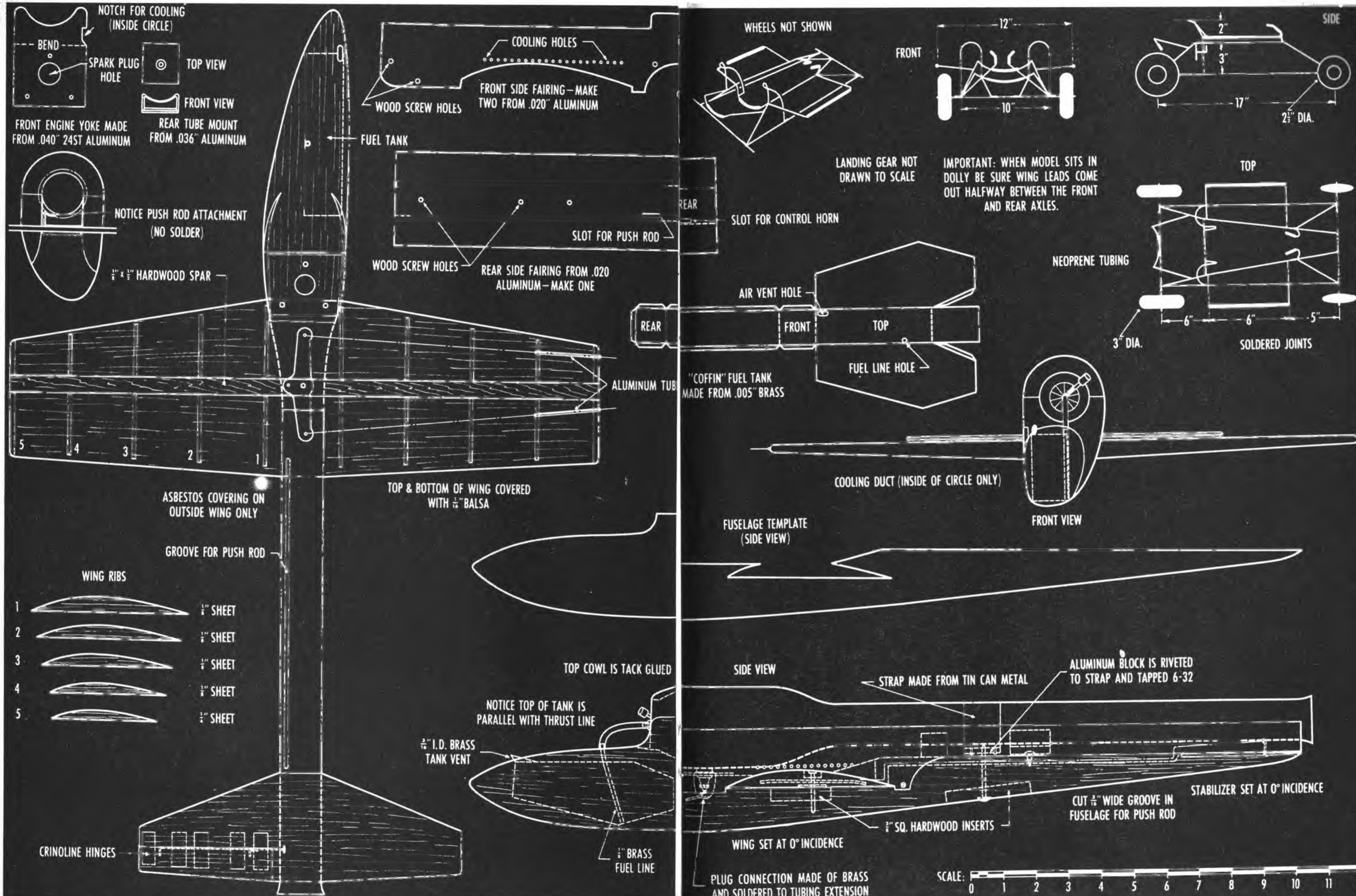
We have always favored four-wheel dollies, but any type will work if some provision is made for supporting the long nose of the model. The plane should fit snugly in a horizontal position in the dolly, and the wing bumpers of the dolly should be at least two inches above the wing leading edge. Wheels should be about three inches in diameter, preferably without tread, so that the dolly will skid instead of tipping. It may be wise to cover the wheels with Scotch Tape when flying from concrete.

Never ground-run the engine in the plane for more than four or five seconds.

Be prepared for the terrific acceleration that will take place upon release of the model. Hold full up (this is important) until the model breaks clear of the dolly and then neutralize the controls before it has a chance to climb too high. From this point on it will fly like anything else. Landings are no problem because of the exceptional glide.

World's Fastest Model

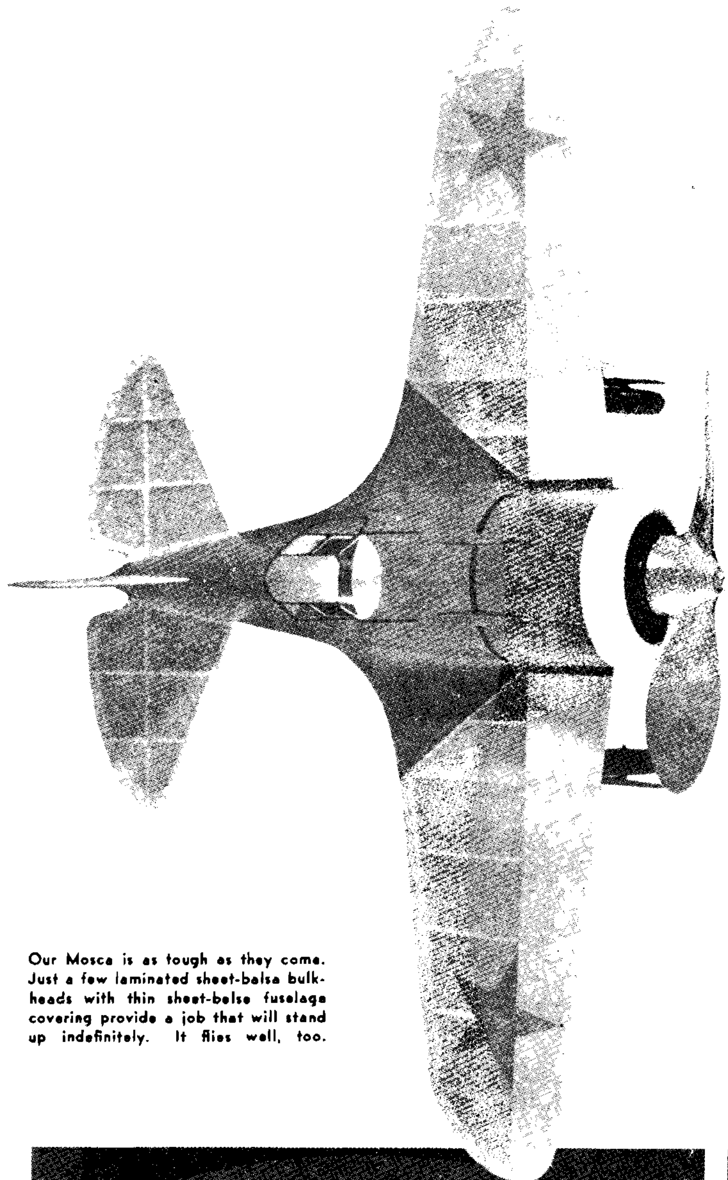
Top time ever recorded by A.M.A. was by this jet jo The World's Fastest Model is the sixth in a series of jet designs worked out by the Minneapolis tec



Mosca Flying Scale

BY H. A. THOMAS

A veteran of Spanish, Chinese, and Russian fronts, this stubby I-16 fighter makes an unusual flying-scale job.



Our Mosca is as tough as they come. Just a few laminated sheet-balsa bulkheads with thin sheet-balsa fuselage covering provide a job that will stand up indefinitely. It flies well, too.

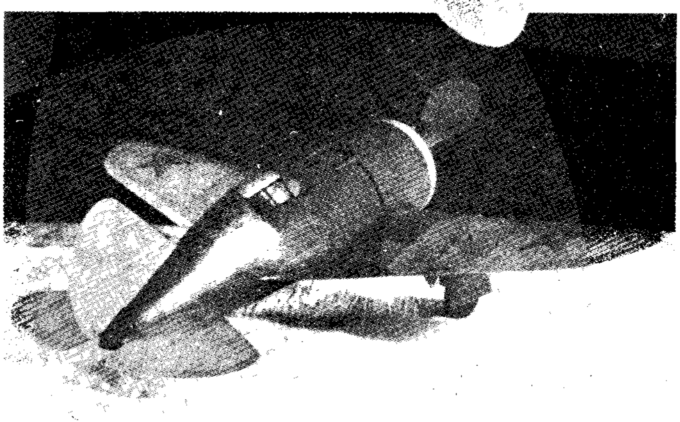
HAVING seen actual service on several war fronts, including the Spanish civil war, the doughty little Russian Mosca I-16 fighter is indeed a veteran. Reports have largely been favorable as to its performance, even though the blunt, stubby lines and the small dimensions contrast sharply with the sleek proportions of other pursuit craft. A big 700 h. p. Cyclone engine of American design and Russian manufacture is responsible for the huge cowl. Top speed is reported to be around 300 m. p. h., and the landing speed of 95 m. p. h. is not surprising for a plane of such limited wing area and span.

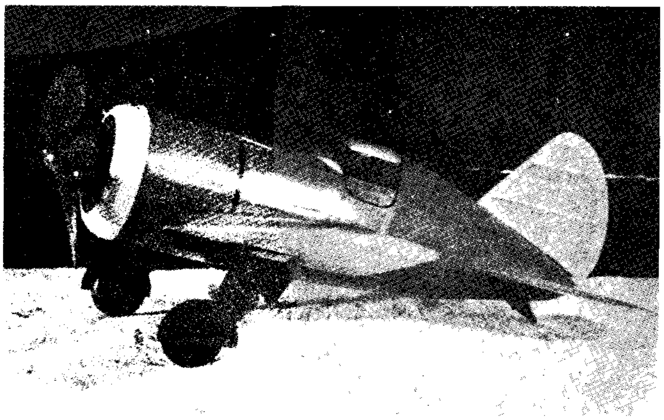
From the standpoint of flying ability as a scale model, the Mosca is not the very best selection, but for realism it is all that could be desired. The model is sturdily built, the fuselage being entirely sheet-balsa-covered. The large-size tail surfaces of the original permit the use of true scale proportions, the only deviations being increased dihedral and propeller dimensions.

The fuselage formers are cut from laminated balsa consisting of soft $^1/_{16}$" sheet cemented to soft $^1/_{32}$" sheet with the grain crossed. Spars are joined by cementing the $^1/_{32}$" sheet reinforcement in place, and the complete spar is then cemented to the rear of Former B. Formers are assembled by means of the four stringers, and the soft $^1/_{32}$" sheet covering is applied in sections. Cowl front is formed of layers of soft 1/8" sheet, the rear fuselage tip is a hollowed balsa block, and the cockpit top is also shaped of balsa. Dope fuselage and sandpaper lightly.

Assemble the ribs to the spars, attach the leading and trailing edges, fitting their inner edges to the fuselage sides. Attach the tips and the lower, triangular fairing pieces. Bend the landing-gear struts of .040 steel wire, and after adding the 1/8"-sq. braces to the wing frame, bind and cement the landing gear to the wing. Attach the hardwood wheels. Cover the upper leading edge to the spar with soft $^1/_{32}$" sheet and sand the entire wing frames lightly. Make paper patterns of the wing fairings, trimming them until they fit perfectly. Cut the soft-balsa outlines and pin and cement them in place.

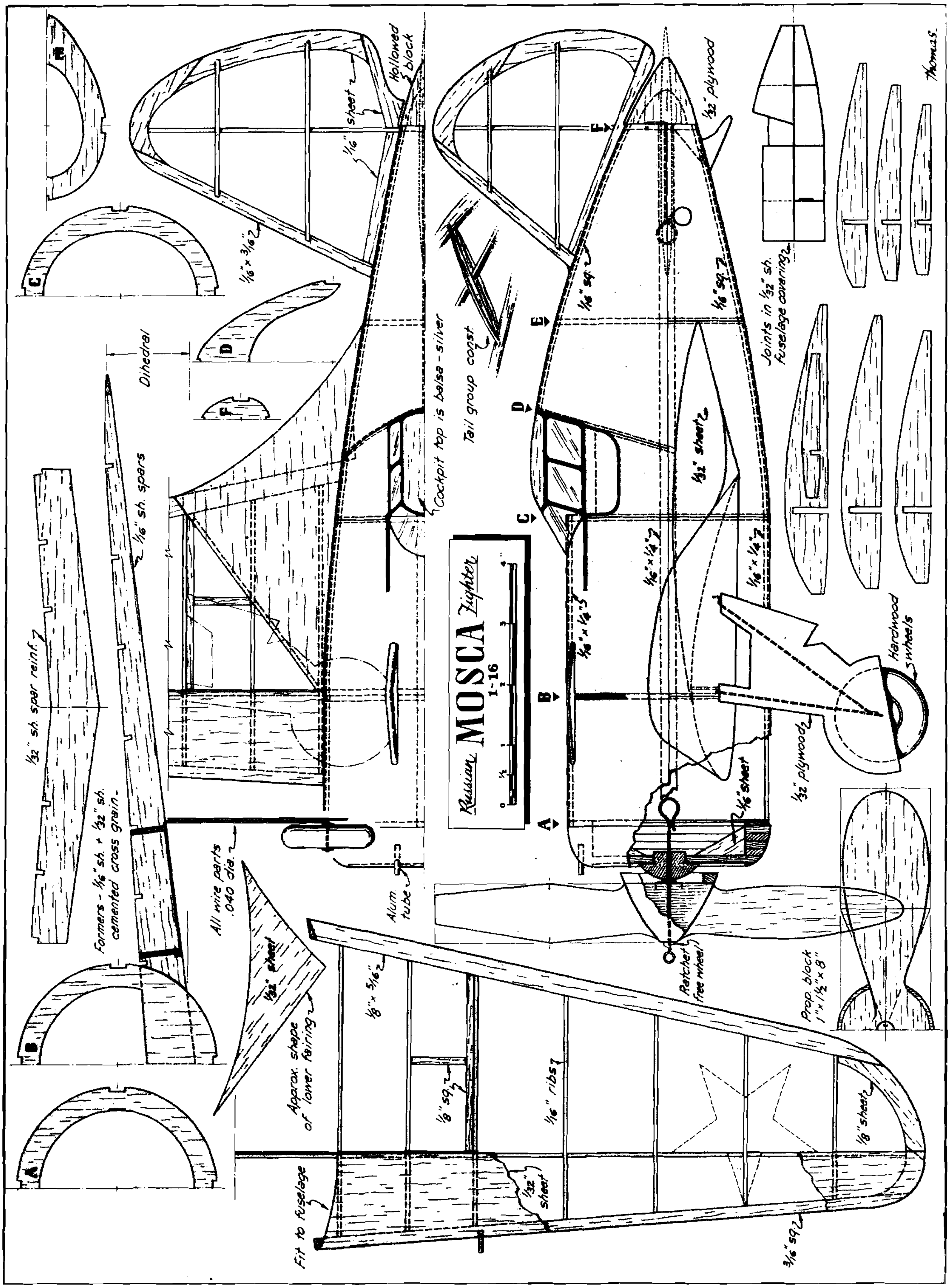
Tail surfaces are of conventional construction. They should be finished and covered with tissue before being carefully cemented to the fuselage. Wing and tail surfaces are covered with tissue, water doped, and are later given two coats of thin dope.



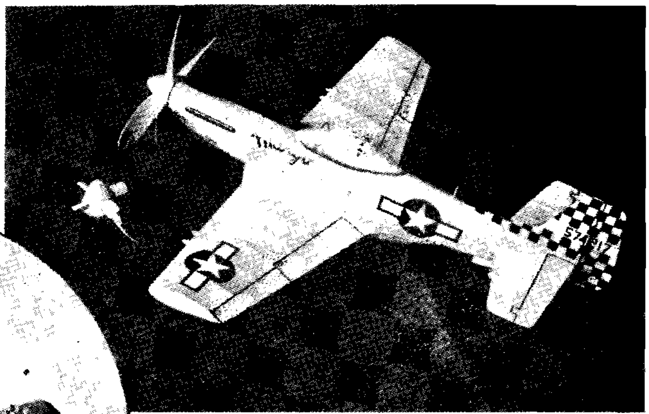


15c **FULL-SIZE PLANS** of this model may be obtained by sending fifteen cents to

AIR TRAILS FULL-SIZE PLANS, 79 Seventh Avenue, New York, N. Y.



P-51 FLYING SCALE



● Flying scale models should have two props, the endurance type, as on the ship, and the scale type, as shown.

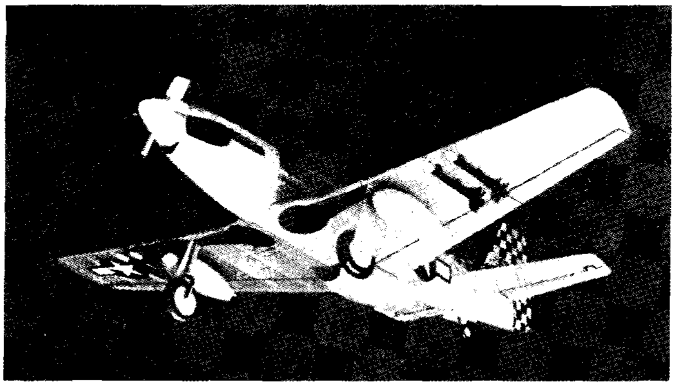
by EARL STAHL

FLYING SCALE WITH ALL THE CHEESECAKE, AND ENDURANCE TYPE FLIGHT PERFORMANCE

POSSESSORS of some of the most brilliant fighting records of the war, the P-51 Mustangs blazed a trail of destructive glory through enemy skies. Particular favorites of Allied airmen, they were feared and respected by the Germans and Japanese.

Attaining greatest acclaim as long-range fighters, squadrons of Mustangs became familiar sights over Berlin and Tokyo as well as other remote targets. Used in great numbers, first as escorts for the heavy bombers, when they were making deep penetrations into enemy territory, these aerial terrors were later used tactically in offenses against ground installations, such as supply dumps and transportation facilities. When flying protection for the bombers, range was increased by carrying fuel in external tanks beneath the wings, and the normal armament consisted of six .50-caliber machine guns. For sweeps against ground targets, rockets and bombs were mounted beneath the wings. All in all, the ships packed a deadly wallop regardless of the mission for which they were outfitted.

Before the United States entry into the war, the Mustang was conceived by North American Aviation in response to Britain's cry for a high-performance fighter. The plane that resulted proved so satisfactory that it was adopted by our Army as one of our top fighters. The original P-51 was powered by an Allison engine for fighting at low altitudes, but it was not until the Packard-built Roll-Royce engine was used that the high-altitude, long-range performance of the present-day ship was attained. Actually, the Mustangs that saw service in the closing days of the war were a far cry from the original. Aside from the changes in fighting equipment that developed through experience and the changing trends of the war, lines were altered by the new engine, the bubble canopy and the dorsal fin—only the high speed NACA laminar-flow wing and the horizontal tail appear unchanged.



● The proof of the pudding is in the eating. Super-details, such as the rockets, bombs, and droppable gas tanks, have not detracted from its flying performance.

Our model is of the latest Mustang, and while emphasis has been placed on flying ability, it is accurately reproduced in line, thus making an unusually attractive display project. Perhaps a glance at the drawings and photos may give the impression that building is difficult, but the opposite is true, for no complicated structures or methods are employed and even the catchy-looking bubble canopy is made quite easily.

Experience has demonstrated that low-wing models can be made to fly well and the P-51 Mustang is no exception. Aerodynamic proportions have been worked out carefully and so if the structural weight is not allowed to become excessive, long, stable flights can be expected.

Before starting to build, study the drawings and text to get a complete mental picture of each problem. Proceed then with care and the reward will be a neat-appearing, fine-flying miniature.

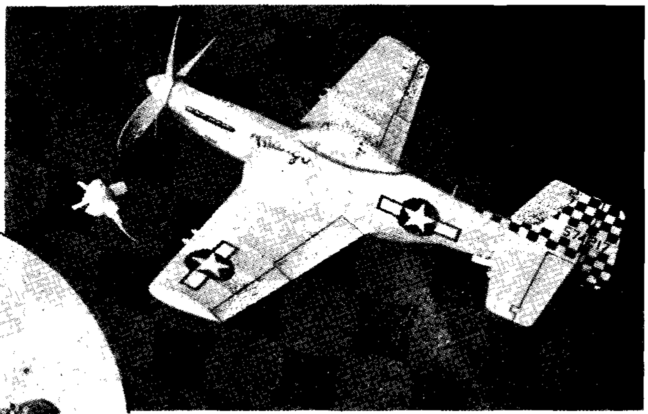
In selecting materials for your model, obtain the best possible. Balsa wood, which comprises most of the structure, should be light, firm stock. Regular colorless model airplane cement is used to join the members.

To build a full-size model, it will be necessary to enlarge the drawings to twice the printed size. This will enable construction to be done directly atop the plans, which is the best and easiest way. However, a model of the size shown may be made without altering the prints; unfortunately, though, small models do not fly as well as their bigger brothers, so we must recommend the latter.

The fuselage is usually a good item to start with, so let's get under way. The type of construction used in this ship calls for sheet balsa formers mounted on four sheet balsa keels; stringers to give the proper shape are thin balsa strips. This method of building is most practical since it is both easy and strong. First cut the four keels and numerous formers (note that two of each are required) from 1/16" thick medium grade balsa. To assemble these parts, pin the top and bottom keels right over the plan, then cement half the formers and one side keel to place. Next lift this frame from the plan and add the remaining formers and keel. Stringers are 1/16" sq. stock and are placed two at a time on opposite sides to keep from disaligning the

P-51 FLYING SCALE

by EARL STAHL



● Flying scale models should have two props, the endurance type, as on the ship, and the scale type, as shown.

FLYING SCALE WITH ALL THE CHEESECAKE, AND ENDURANCE TYPE FLIGHT PERFORMANCE

POSSESSORS of some of the most brilliant fighting records of the war, the P-51 Mustangs blazed a trail of destructive glory through enemy skies. Particular favorites of Allied airmen, they were feared and respected by the Germans and Japanese.

Attaining greatest acclaim as long-range fighters, squadrons of Mustangs became familiar sights over Berlin and Tokyo as well as other remote targets. Used in great numbers, first as escorts for the heavy bombers, when they were making deep penetrations into enemy territory, these aerial terrors were later used tactically in offenses against ground installations, such as supply dumps and transportation facilities. When flying protection for the bombers, range was increased by carrying fuel in external tanks beneath the wings, and the normal armament consisted of six .50-caliber machine guns. For sweeps against ground targets, rockets and bombs were mounted beneath the wings. All in all, the ships packed a deadly wallop regardless of the mission for which they were outfitted.

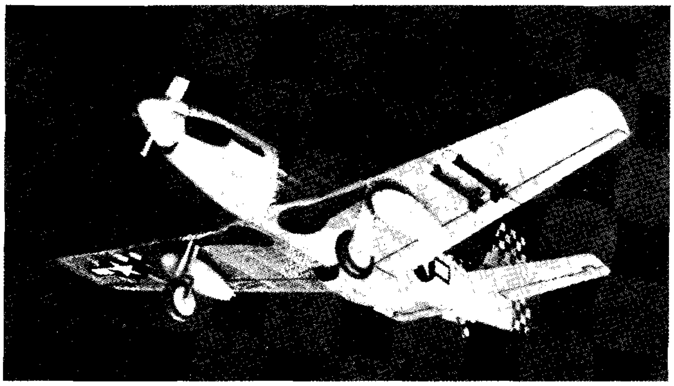
Before the United States entry into the war, the Mustang was conceived by North American Aviation in response to Britain's cry for a high-performance fighter. The plane that resulted proved so satisfactory that it was adopted by our Army as one of our top fighters. The original P-51 was powered by an Allison engine for fighting at low altitudes, but it was not until the Packard-built Roll-Royce engine was used that the high-altitude, long-range performance of the present-day ship was attained. Actually, the Mustangs that saw service in the closing days of the war were a far cry from the original. Aside from the changes in fighting equipment that developed through experience and the changing trends of the war, lines were altered by the new engine, the bubble canopy and the dorsal fin—only the high speed NACA laminar-flow wing and the horizontal tail appear unchanged.

Our model is of the latest Mustang, and while emphasis has been placed on flying ability, it is accurately reproduced in line, thus making an unusually attractive display project. Perhaps a glance at the drawings and photos may give the impression that building is difficult, but the opposite is true, for no complicated structures or methods are employed and even the catchy-looking bubble canopy is made quite easily.

Experience has demonstrated that low-wing models can be made to fly well and the P-51 Mustang is no exception. Aerodynamic proportions have been worked out carefully and so if the structural weight is not allowed to become excessive, long, stable flights can be expected.

Before starting to build, study the drawings and text to get a complete mental picture of each problem. Proceed then with care and the reward will be a neat-appearing, fine-flying miniature.

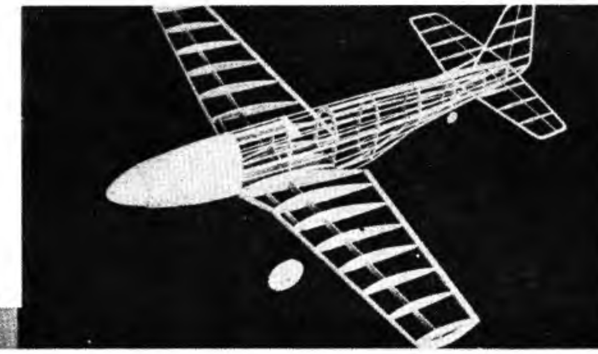
In selecting materials for your model, obtain the best possible. Balsa wood, which comprises most of the structure, should be light, firm stock. Regular colorless model airplane cement is used to join the members.

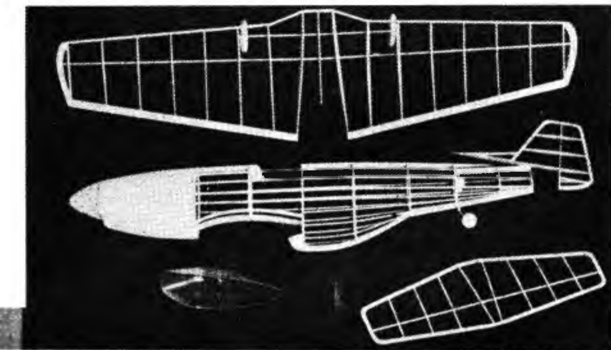


● The proof of the pudding is in the eating. Super-details, such as the rockets, bombs, and droppable gas tanks, have not detracted from its flying performance.

To build a full-size model, it will be necessary to enlarge the drawings to twice the printed size. This will enable construction to be done directly atop the plans, which is the best and easiest way. However, a model of the size shown may be made without altering the prints; unfortunately, though, small models do not fly as well as their bigger brothers, so we must recommend the latter.

The fuselage is usually a good item to start with, so let's get under way. The type of construction used in this ship calls for sheet balsa formers mounted on four sheet balsa keels; stringers to give the proper shape are thin balsa strips. This method of building is most practical since it is both easy and strong. First cut the four keels and numerous formers (note that two of each are required) from 1/16" thick medium grade balsa. To assemble these parts, pin the top and bottom keels right over the plan, then cement half the formers and one side keel to place. Next lift this frame from the plan and add the remaining formers and keel. Stringers are 1/16" sq. stock and are placed two at a time on opposite sides to keep from disaligning the





structure. Note that in some cases it will be necessary to cut the stringer notches in the formers as work proceeds; this is done in order to assure perfect alignment of these members and it does not make the task more difficult. It will be noticed that at the point where the wing fits in, curved 3/32" sheet balsa formers are used to make the fuselage sides fit to the curvature of the wings' top surface.

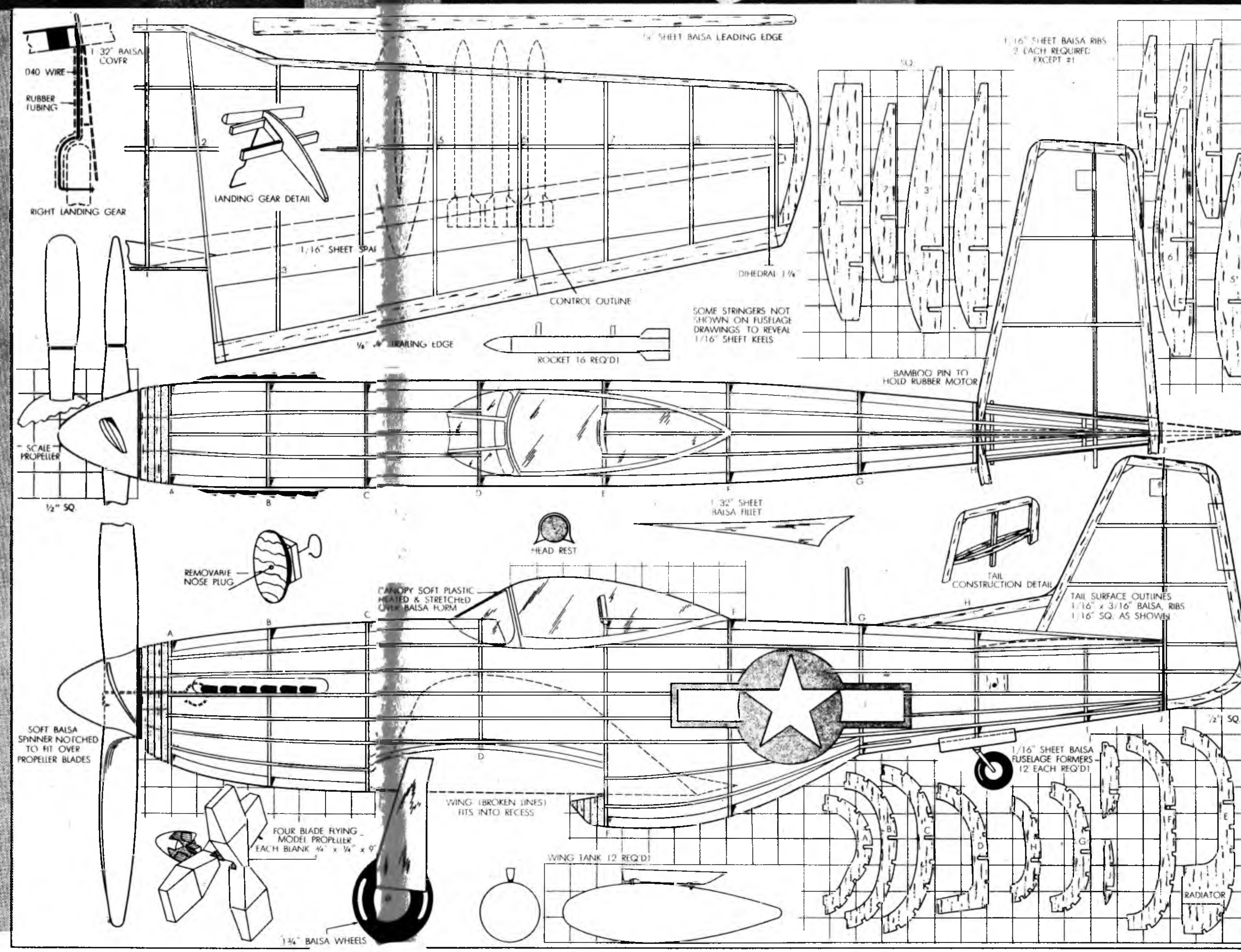
A few more items and the fuselage structure can be laid aside. For realism and strength, the nose is filled in between stringers and formers with rectangles of soft 3/32" or 1/8" balsa. This takes extra time and patience but it is worth it in the improved appearance and added strength. The nose block is made from crossed-grain 1/8" balsa laminations as is the belly radiator front. Be sure to cut out the square hole for the nose plug before cementing the block to the front former. To complete the fuselage, place the sheet balsa pieces for the cockpit and attach 1/8" thick blocks in the rear of the fuselage to cradle the bamboo pin that holds the rubber motor.

The wing and tail surface construction is so simple that little need be said. Note the sizes of the materials indicated on the plan and cut the parts from sheet balsa. For the wing, the leading edge and spar are tapered so they must be cut from sheet balsa too. Assemble the wing in two halves over full-size drawings and then join the parts by securely splicing the spars and leading edge; tips should be raised to the amount of dihedral shown. The tail surfaces are 1/16" deep structures with ribs made wider and streamlined by overlaying 1/16" sq. strips on each side of each rib and then trimming them to shape.

A very realistic and practical landing gear is employed. Bend the single struts (left and right) from .040 music wire. Then bind and sew them to the wing structure, using light, strong thread and finally cement to secure them. Wheels on the original were made from laminations of 1/8" sheet balsa but ones of correct diameter may be stocked by your neighborhood supply house. Attach washers or bearings of some sort to each side of each wheel to make them turn freely and accurately. The tail wheel on the original did not turn but served as a most realistic skid. It is a disk of balsa mounted on rounded bamboo which is in turn forced into the bottom keel and cemented fast.

Since the real plane has a four-blade propeller, we used a four-blader of flying proportions on the model. Actually, we believe a two-blade one would be just as satisfactory, so far as flights are concerned; the choice is left to the builder. Cut the blanks from very hard balsa, notch them as shown, and then cement them securely at 90 degrees to each blade. Carve a right-hand revolving prop, rounding and balancing the blades carefully. The spinner is soft balsa, shaped and then notched to fit over the blades. It is so large that a free-wheel gadget that will permit the prop to revolve freely once the rubber motor is exhausted can be hidden within it. Before the spinner is attached, install the .040 music wire shaft. The remaining part of the prop unit, the nose plug, is made from a 1/32" plywood disk backed by a cube of balsa and slipped on the shaft, but first be sure to fix the line of thrust by cementing washers or other bearings to the front and back.

Before parts may be assembled, they must be covered. The covering operation is probably the most important of all for it can largely make or ruin the whole project, depending on



whether or not a good job has been done. With this in mind, carefully sand all the frames until they are flawless. In this connection the author likes to sand the fuselage formers slightly scalloped so the stringers only will touch the paper; this makes for a much better job. Use banana oil or very light dope to stick the paper to the frames, and where compound curves exist, employ many small sections of the tissue, neatly lapped to avoid unsightly wrinkles. This takes more time, of course, but the results are worth it. A fine mist of water sprayed on the covering will tighten it but do not apply any dope until the whole model is assembled.

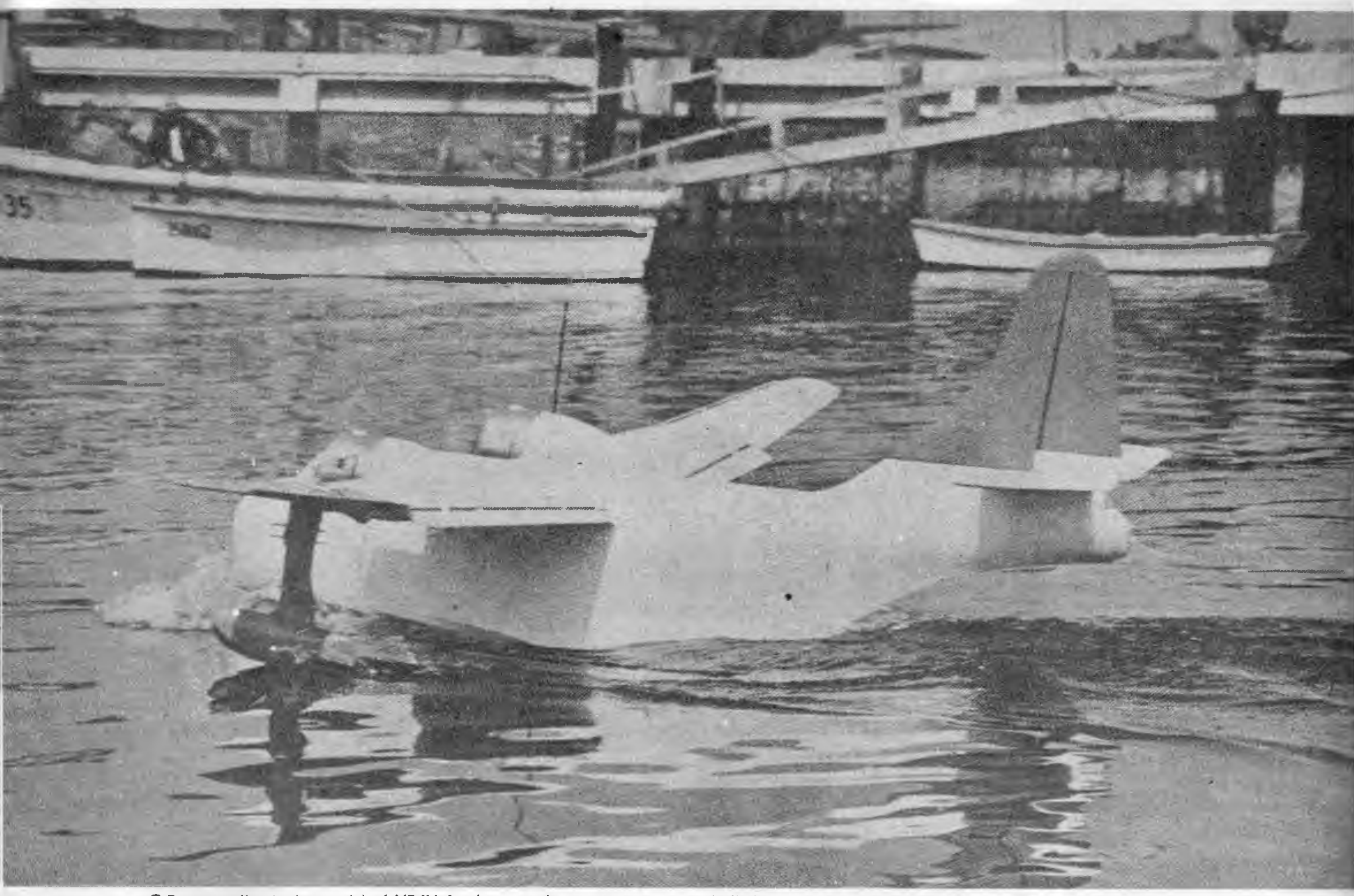
The final assembly is easy. If the parts have been made with care, wing and stabilizer will slip right into place at the proper aerodynamic angles as this was predetermined; align them carefully before cementing fast. To make the wing fillet make the sheet balsa parts shown and fit them individually to your model. Cover the fillet and bottom opening with matching tissue. Cement the vertical tail fast at a slight offset to the left (leading edge) for a right turn to help overcome torque. Now neatly fit a tissue fillet between the tail surfaces. At this time, one or two coats of clear dope may be applied to the whole model to further tighten and strengthen the tissue. On our original models we always mix a small quantity of dope of the same color as the tissue with the clear to better the appearance of the finished plane; this makes a distinct improvement and adds little or no weight.

From this point on, everything that is added to the model, provided, of course, that it is skillfully done, will improve the appearance. To make the landing gear look realistic follow this procedure: Slip ⅛" diameter rubber tubing on the struts and paint them aluminum. Color the wheels and tires and fix them to the axles with a drop of solder. Make the wheel well covers from 1/32" sheet balsa and cover them with tissue to match the wings; these are cemented to the struts but not the wing so they can spring freely to absorb landing shocks. To simulate the wheel wells, cut black tissue to the appropriate shape and dope to the covering. The tail wheel should be painted and 1/32" balsa retraction covers installed.

Probably the biggest item is the making of the bubble canopy. It is really not hard and we went about it in this manner: A balsa canopy was first carved. Then a piece of soft plastic was heated in boiling water until it became pliable. (Vinylite, Lumerith, or even celluloid 1/32" in thickness or less, can be used.) Then, using every hand that was available, we stretched it down over the form. (A person with five or six hands could do it alone!) Work very rapidly as the plastic resets quickly, but in the event that results are unsatisfactory, simply reheat and try again. Incidentally, structural details of the canopy are represented by thin strips of black tissue.

Few details remain. Control surface outlines are represented by fine strips of black tissue which are doped to the wing and tail. Exhaust ports, antenna, scale propeller, bombs, rockets, gas tanks, or what have you are made from odds and ends but go a long way to enhance the model's appearance.

"POWER EQUAL TO EXISTING .60's"
Class C
*Rocket ENGINES
Mr. Dealer
Your jobber stocks Rocket Engines or can get them direct from the factory.
$22.50
with spark plug, coil, condenser and lead wire included
TRADE MARK REG. U. S. PAT. OFFICE
Rocket ENGINE
PRODUCT OF Corporate Products Inc.
DETROIT 26, MICHIGAN



● Dynamically-similar model of XP4Y-1, above, under taxiing test, gives hull characteristics. Note man at control console in background.

RADIO-CONTROLLED FREE-FLIGHT MODELS

ENABLING FAST TESTING, RAPID ENGINEERING CHANGES, THESE MODELS DRASTICALLY CUT TIME FROM CONCEPTION TO PRODUCTION OF FULL-SIZED CRAFT

QUARTER-SCALE man-carrying models to determine flight and other characteristics of projected aircraft have been used on several occasions both here and abroad. The latest wrinkle, however, is the use of dynamically-similar radio-controlled free-flight models of 1/8th to 1/10th scale for the same purpose. These models are not only identical in configuration with the full-scale aircraft they represent but their weights and performance, as well as the dynamic forces acting on them, are to scale. In other words, a dynamically-similar model can predict with sufficient accuracy how the proposed airplane will act. Any bugs that may turn up during tests of these models can, therefore, be nipped before much time and large sums of money are spent in building the prototype. Considerable reduction in time from conception to production of full-scale aircraft is achieved by this method. In some ways, the development of a dynamically-similar free-flight model represents as complex an engineering problem as the design of a full-scale airplane.

One of the pioneers of this type of testing is the Consolidated Vultee Aircraft Corp., whose Hydrodynamic Group, under the leadership of E. G. Stout, has been, for several years, experimenting with the method, beginning with partially restrained, dynamically-similar models. Advances in radio control of aircraft led eventually to further development of this project into radio-controlled free flight. This permitted the study of hydrodynamic hull and float design under different water surface conditions and the study of acceleration and its effect on spray without recourse to the NACA towing basin which was crowded with projects during the war. The main object of this project was (1) the development of a dependable and accurate method to determine all dynamic functions of aircraft in motion, (2) to obtain tow basin and wind tunnel data, and (3) to obtain such information as could not be supplied by these methods.

The experimental model built for this purpose was a dynamically-similar model of the twin-engine Navy patrol bomber, the XP4Y-1. Sufficient wind tunnel and towing basin data on this aircraft were at hand so that accurate comparison between them and free-flight results could be made. Construction of this model is entirely of wood, the hull, wings and tail surfaces being planked with balsa. It is identical in every respect with the full-scale airplane, with the exception that, in order to compensate for the scale effect due to the small Reynolds Number of the model, full span leading edge slots were incorporated.

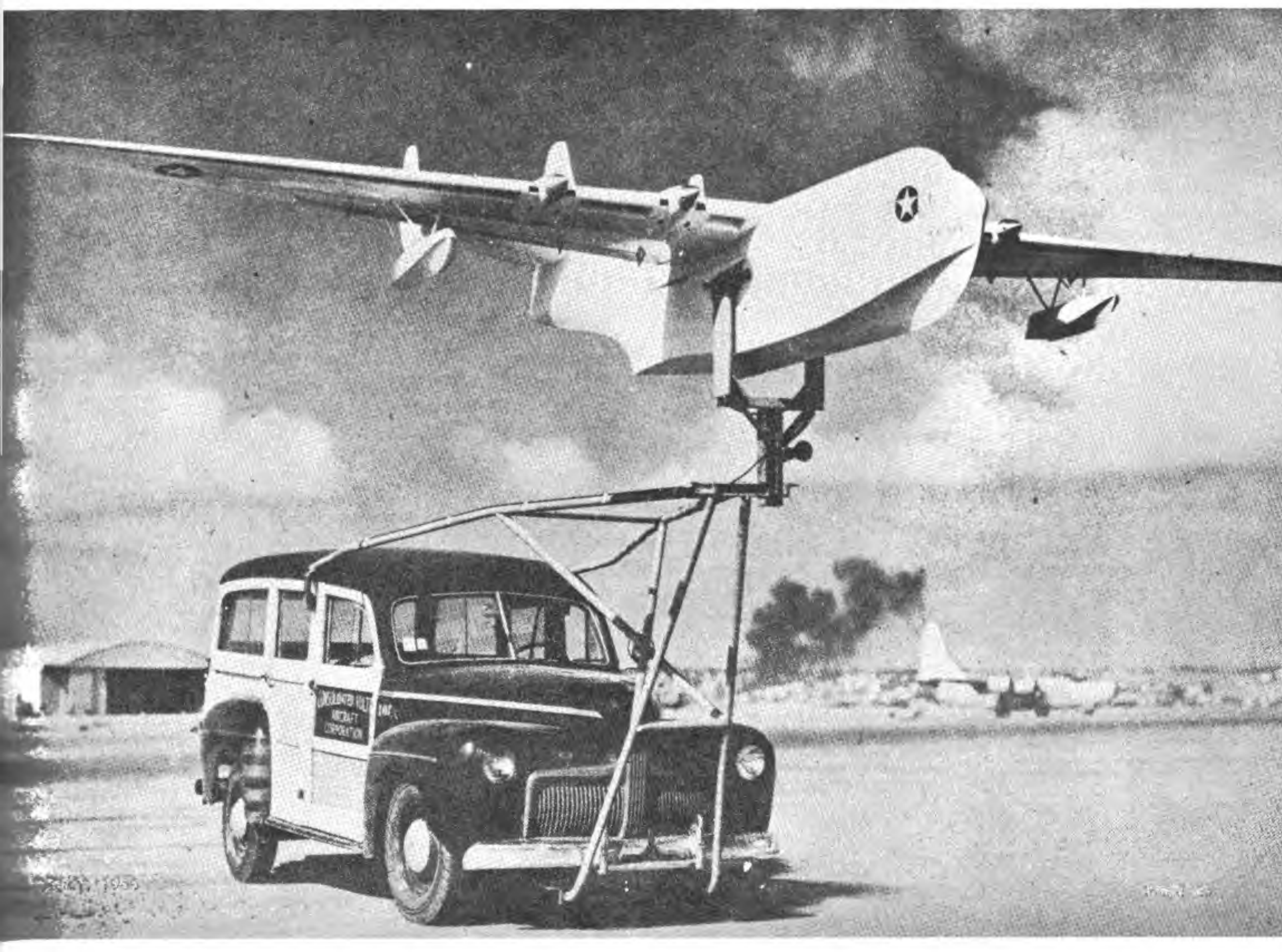
Changes in the value of the Reynolds Number (a nondimensional coefficient used as a dynamic scale of air flow which depends on density, velocity, linear chord dimension, and kinematic viscosity of the air) affect any force coefficient, such as lift coefficient, of the wing. This is known as the scale effect, and it had to be corrected by complicated mathematical formulae for wind tunnel tests. However, it has been found that with properly designed leading edge slots, full-scale lift slope of the lift curve and maximum lift coefficient could be duplicated. The other departure from geometric similarity of the full-scale airplane is the added dihedral in the outboard wing panels, giving the model a polyhedral effect. This was done to make the model inherently stable and allow for piloting errors of inexperienced operators during the early stages of radio-controlled flying.

The engines which power this and other dynamically-similar models are two-cylinder opposed, two-cycle plants designed to specifications of the Consolidated-Vultee Hydrodynamic Group by Ohlsson and Rice, well-known model airplane engine manufacturers. Rated at 1.6 b.h.p. at 4,200 r.p.m., they produce scale horsepower and r.p.m. of the 2,000-hp R-3350 engines. When equipped with 1/8th scale propellers identical to the three-bladed Curtiss-Electrics 16-ft. diameter, these engines actually produced static scale thrust at scale RPM. The interesting feature of these miniature powerplants are the large external intake manifolds which carry the mixture from the crankcase to the cylinder contrary to general model engine procedure of drawing the mixture through an internal by-pass located in the cylinder wall. Gas tanks on the XP4Y-1 model are located in the engine nacelles behind the fire wall. Another model, a four-engine flying boat, has the powerplants completely buried in the leading edge of the wing, with only propeller shaft fairings extending outward. This model is equipped with a pressurized fuel system.

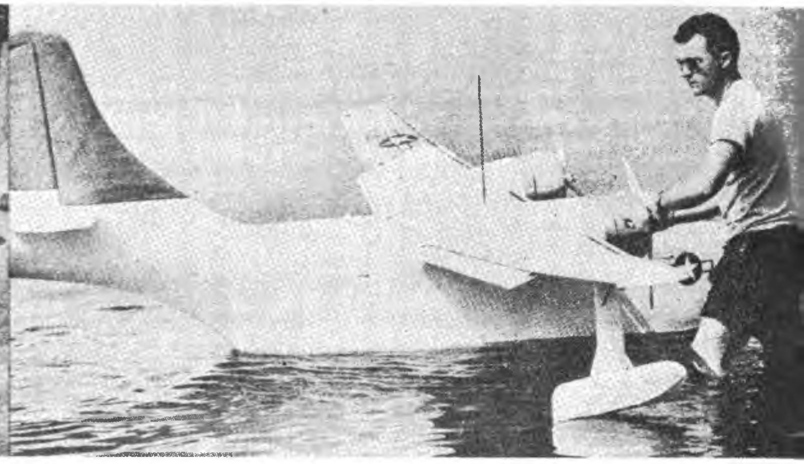
The radio system for controlling the models was developed entirely by Consolidated-Vultee. Although at the time the project started such systems were already in existence, and remotely controlled flight has been achieved on numerous occasions by model builders, no known successful system suitable for the flying of dynamically-similar models has been developed. All army experiments in this direction were, of necessity, of secret nature, and information on them was not available. Consequently, Consolidated-Vultee was forced to develop its own system, entirely independent from any other in existence. Added to this was the fact that scale gross weight of the first experimental model allowed only 15 lbs. for radio receiver and battery, which eliminated the large elaborate systems known to be in use.

Choice fell on a system using seven frequencies with amplitude modulation for positioning which permitted simultaneous and inde-

● This aerodynamic test setup of scale model and car enables determination of many flight characteristics without risking flight. Car is driven into wind.



● Before flight of radio-controlled model, engineers test it thoroughly for proper engine and controls operation.



● Dynamically similar model set for flight, while technician primes engines. Note extended flaps on wings.

pendent control of two throttles, flaps, ailerons, elevators, rudder, and ignition. The position of any one control can be determined by the amplitude (strength) of corresponding frequency. The transmitter (ground station) represents a typical cockpit and is equipped with a wheel control column, rudder pedals, and two throttle-control levels. The instrument board, besides various radio instruments, contains an elapsed-time clock, flap and ignition switches, and control surface trim adjustment knobs. An adjustable seat is provided for the operator.

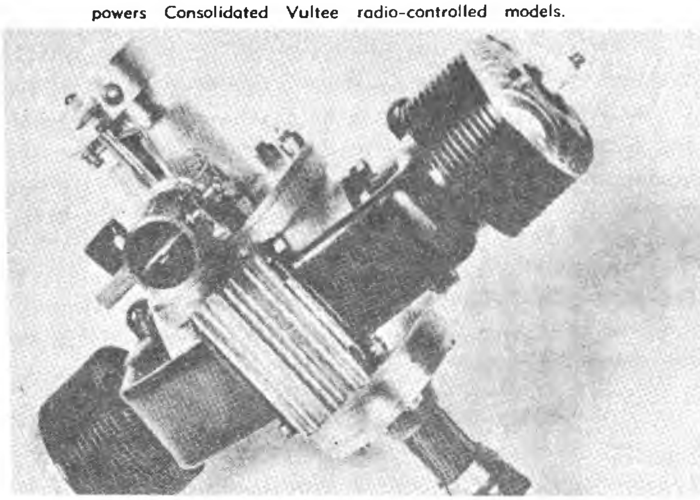
The positioning circuit in the receiver is so arranged that during the operation of the transmitter it corresponds to a mechanical linkage between the control station and the controls of the model, enabling the operator to know at all times the exact position of the model's controls. Actuation of controls is achieved by small three-pole electric motors located in the hull which are geared to a jack-screw. Homing devices are provided on all controls. These cut the throttle to idling and position all flight controls to a predetermined glide attitude as soon as the transmitter switch is cut off. By switching on the transmitter the operator can resume control of the model. In case of emergency, cutting the ignition switch releases a parachute from the dorsal compartment of the model.

A photo recorder consisting of a motion picture camera is installed in the hull. It photographs the reading of instruments which indicate the water speed, air speed and trim of the models under test. Under development at the present time is also a miniature automatic pilot, with the help of which, not only rolling and pitching characteristics of models in flight, but also hydrodynamic c.g. limits of stability, take-off, and landing characteristics, as well as all dynamic flight characteristics, will be determined.

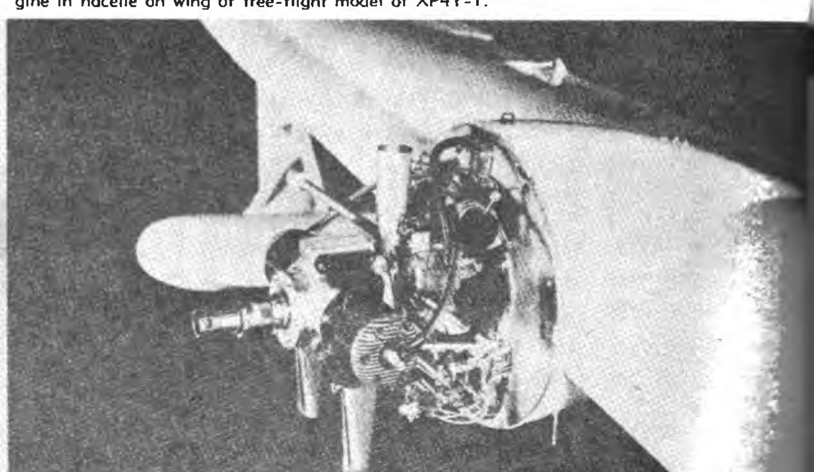
In order to facilitate keeping track of the models while in flight, the rudders and port wing tips are painted a brilliant orange. The same color scheme is applied to the corresponding controls on the ground transmitting station, namely to the left segment of the control wheel, left rudder pedal, and left throttle. This helps the operator to determine immediately the direction of flight of the model and eliminates the necessity of his orientating himself in order to execute a given maneuver.

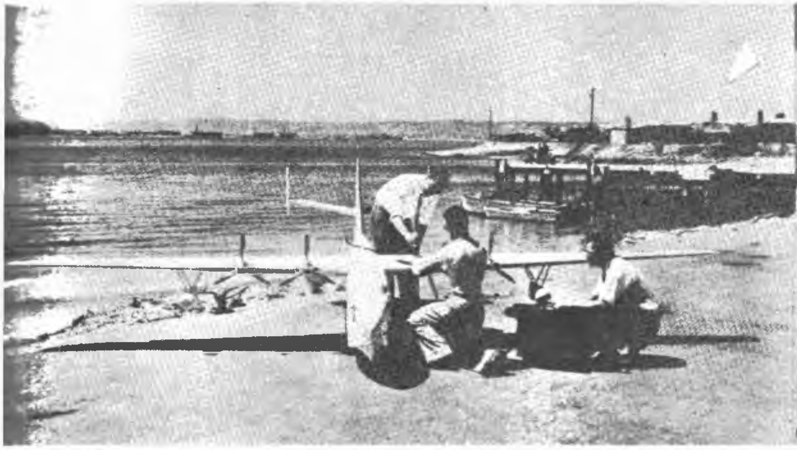
Judging from photographs, preliminary tests to determine aerodynamic qualities of models are conducted by mounting the models on a frame fixed to an automobile in such a manner that they can rotate about the pitching axis. Remote control connections between the model and the automobile permits actuation of controls. When driving the rig across the field at varying speeds, much useful data is obtained on the model's characteristics without endangering it by test flying before balance, stability, controls response, etc., have become a known factor. Hydrodynamic and trim stability of the hull are tested by radio-control taxiing the model in the water.

● This Ohlsson and Rice two-cycle, twin-cylinder engine powers Consolidated Vultee radio-controlled models.

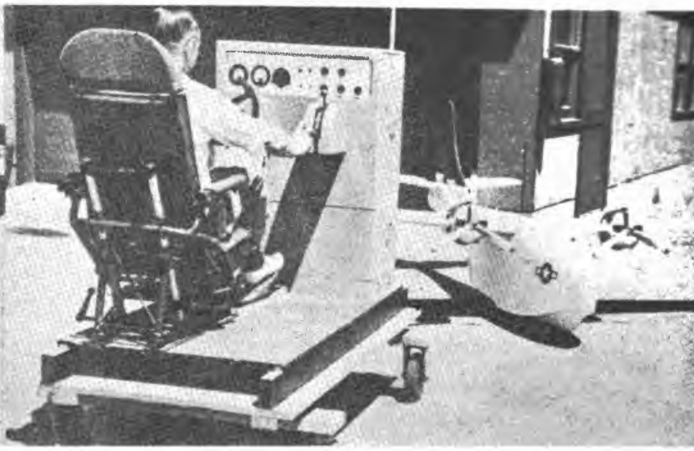


● Below. Close-up shows installation of Ohlsson-Rice engine in nacelle on wing of free-flight model of XP4Y-1.

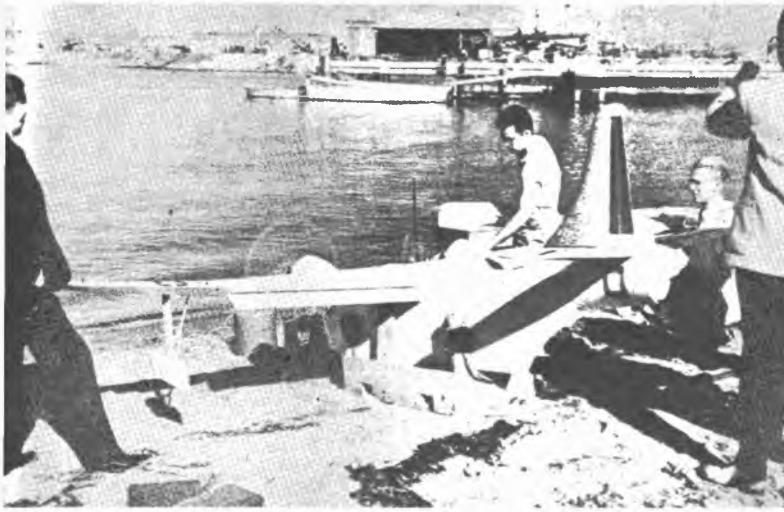




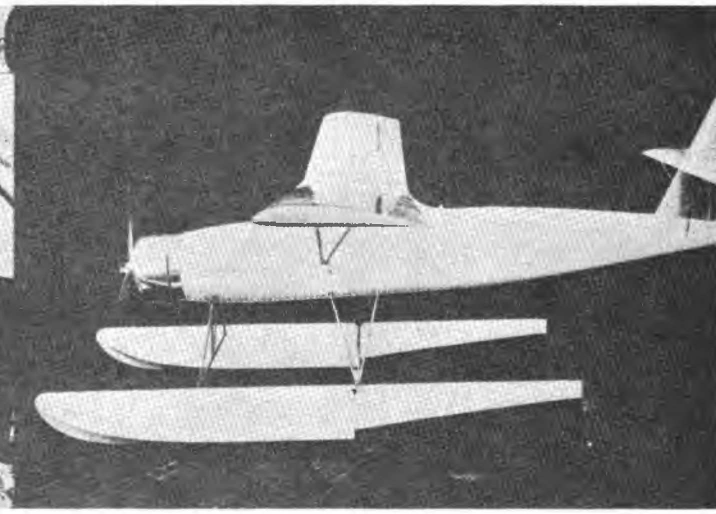
● Variation of engine mounting on this one-tenth-scale dynamically-similar model has powerplants buried in wing.



● Ground transmitter for models, on dolly, above, duplicates cockpit setup and controls of actual plane.

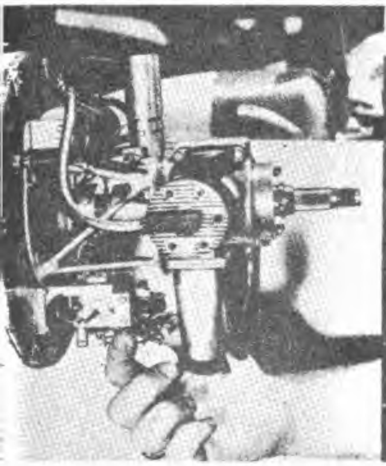


● Waterside warm-up test of free-flight model preparatory to launching for taxiing and aerodynamic tests.



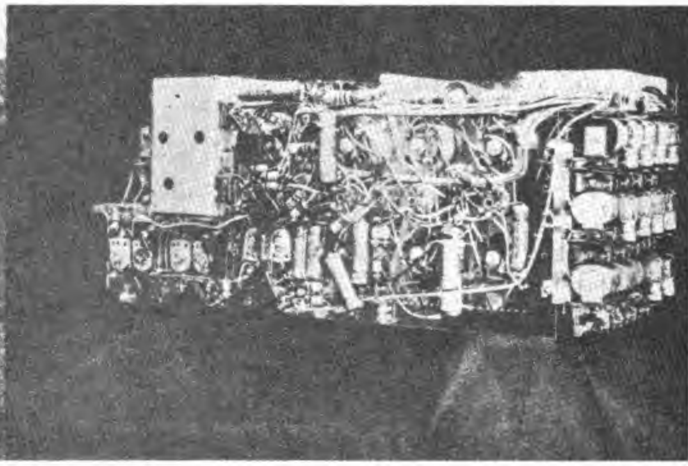
● Radio-controlled model of a seaplane shows diversity of dynamically similar projects of Consolidated Vultee.

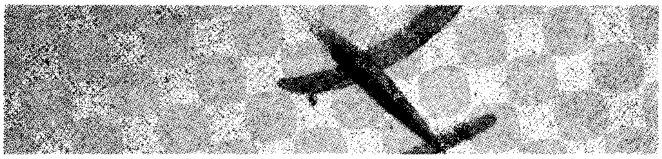
● Hand indicates radio-controlled electric motor operating engine throttle.



● Model's receiving set uses 7 frequencies which individually operate controls.

● You are looking at the filter side of the radio-control receiver. Note compactness of complicated instrument.





NATIONALS

by LEO BAILEY

"The Old Stand-by" would best describe this design adopted by contest builders around Akron.

ANOTHER winning model has come from one of our best model centers of the country, Akron, Ohio. The Senior Fuselage model of Leo Bailey, which is a consistent winner, again shows Akron on top.

Because of the inherent flying qualities of this design, and its contest-winning tendencies, this model has become an old stand-by of the designers and others. Complete records of its flying prowess would be imposing—but too long. However, a good indication of the model's abilities can be recognized in the fact that besides taking first in the Senior Event at the '38 Nationals, with the second highest duration in its class, a copy of the original won first in the Scripps-Howard contest. In the same race the original took fifth place.

This model incorporates two features in design which at the present time are not very widespread. First, it has a moderately high-angle wing setting, and second, it has a rubber tensioning device which is exactly the same as Albert Judge used on his 1936 Wakefield Winner. Setting the wing at the angle of 4½ already puts it practically at the angle it will fly, and makes excessive down-thrust unnecessary. Using the rubber tensioner allows an excessively long motor without the necessity of a long, unwieldy and ugly fuselage.

FUSELAGE

The fuselage is of the cabin type and square-cornered.

Make a full-sized layout of the fuselage sides and pin the longerons of ⅛" square hard balsa to the drawing. Cement in the ⅛" square hard balsa braces and diagonals and also the fore and aft main cross-braces of ⅛ x ⅜" and ⅛ x ¼". Coat the joints liberally with cement. Build the other side of the fuselage on the first one, keeping a sheet of wax paper between both halves so that they will not stick together. Allow the cement to dry thoroughly—three hours should suffice—in order to be sure that the fuselage sides will not change shape. (Note that the boom is built attached to the fuselage in order to keep it lined up. It is removed after the fuselage is completely built, but not covered.) Remove the sides from the drawing and build the fuselage up by inserting the cross-pieces at the wing leading and trailing edges, top and bottom. After those joints have dried, cement in the nose and tail main cross-braces. The remainder of the cross-braces may be inserted after the glue holding the nose and tail cross-braces has set.

The next job is to make the nose and tail plugs. Cut the boom off and build the tail plug on it as shown in the drawing. Use care when constructing the nose plug. Its proper construction is important. Follow the dimensions given on the drawing carefully.

SENIOR FUSELAGE WINNER

The landing gear is made of bamboo. The struts make a V, the apex of which is at the double cross-piece at the top of the fuselage. Additional strength is obtained by binding the struts to the lower fuselage longerons with thread. Put the two-inch-diameter wheels in place after the glue holding the axles and struts has dried.

The landing-gear attachment was the last operation before covering. The fuselage should be covered with a good grade of tissue. Use banana oil to attach it to the longerons and cross-pieces. (You may use a double covering for additional strength.) After the fuselage is covered, spray the paper with water. After it is thoroughly dry, paint it with model dope. Spraying the papering with water insures a tight covering with a minimum of wrinkles. Doping increases the strength of the fuselage.

WING

The wing of this model is of the regular construction and is of the polyhedral type.

Make a template of the rib section of hard balsa and cut out twenty-seven ribs from $1/16''$ soft sheet balsa. The front spar is $1/8 \times 3/8''$ medium-hard balsa, the rear spar is $1/8''$ square balsa. (Note that the spar slots in the ribs are deeper than the spars. They are made that way in order to keep a smooth surface after the wing is covered.) The leading edge is $1/8''$ square and the trailing edge is $1/8 \times 1/2''$.

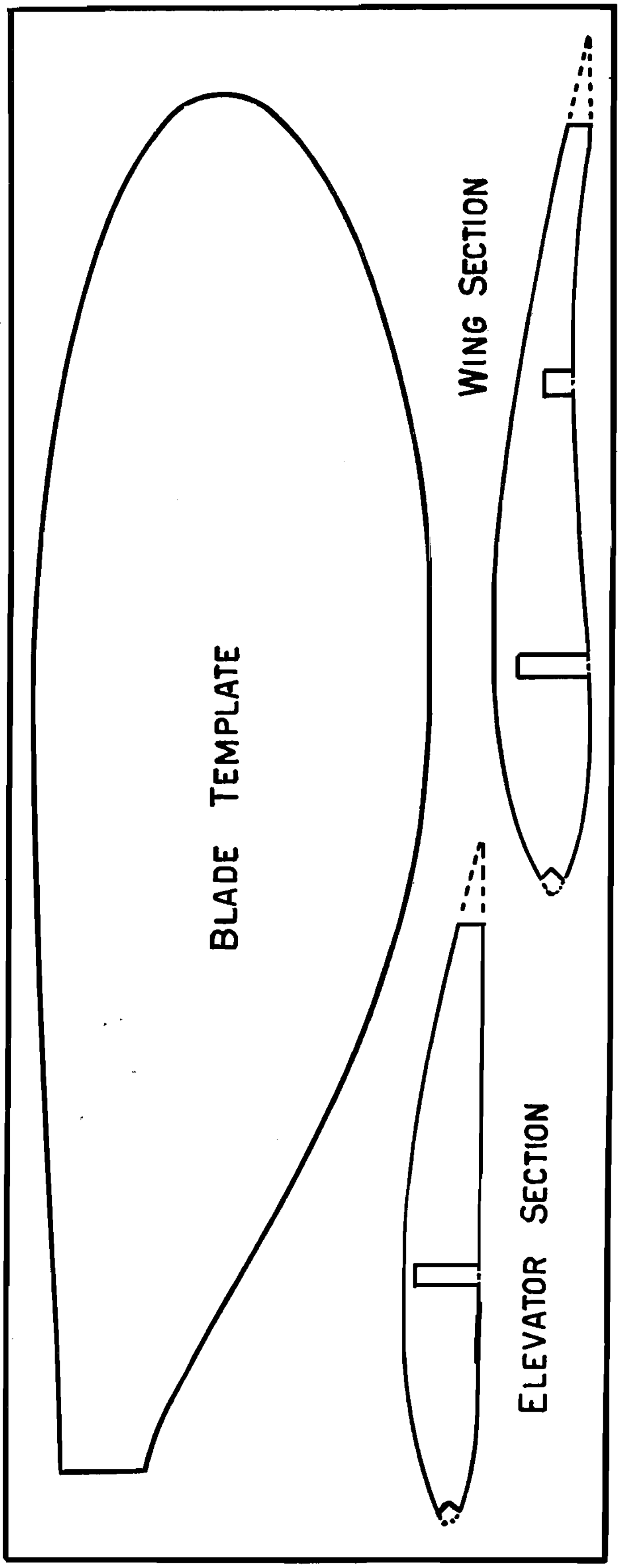
Lay the spars on the full-size drawing of the wing and cement the ribs in place. After the cement has dried, attach the leading and tapered trailing edges. The tips of the tapered $1/8''$ sheet balsa are then cemented into place. Cut the spars, and leading and trailing edges at such an angle that the proper dihedral of 5″ under each tip is obtained. Then $1/32''$ thick sheet gussets should be cemented to each side of the main spar and trailing edge in order to increase the strength of the joints.

After all the cemented parts of the wing have thoroughly dried, cover it with a good grade tissue. The top side is usually covered first, as it is the more difficult. The paper should be sprayed with water to shrink it and give it a smoother, finished look. After the paper has shrunk, dope it with a thinned-out dope. Take extreme care that the paper does not stick to the spars, as a smooth section is desirable.

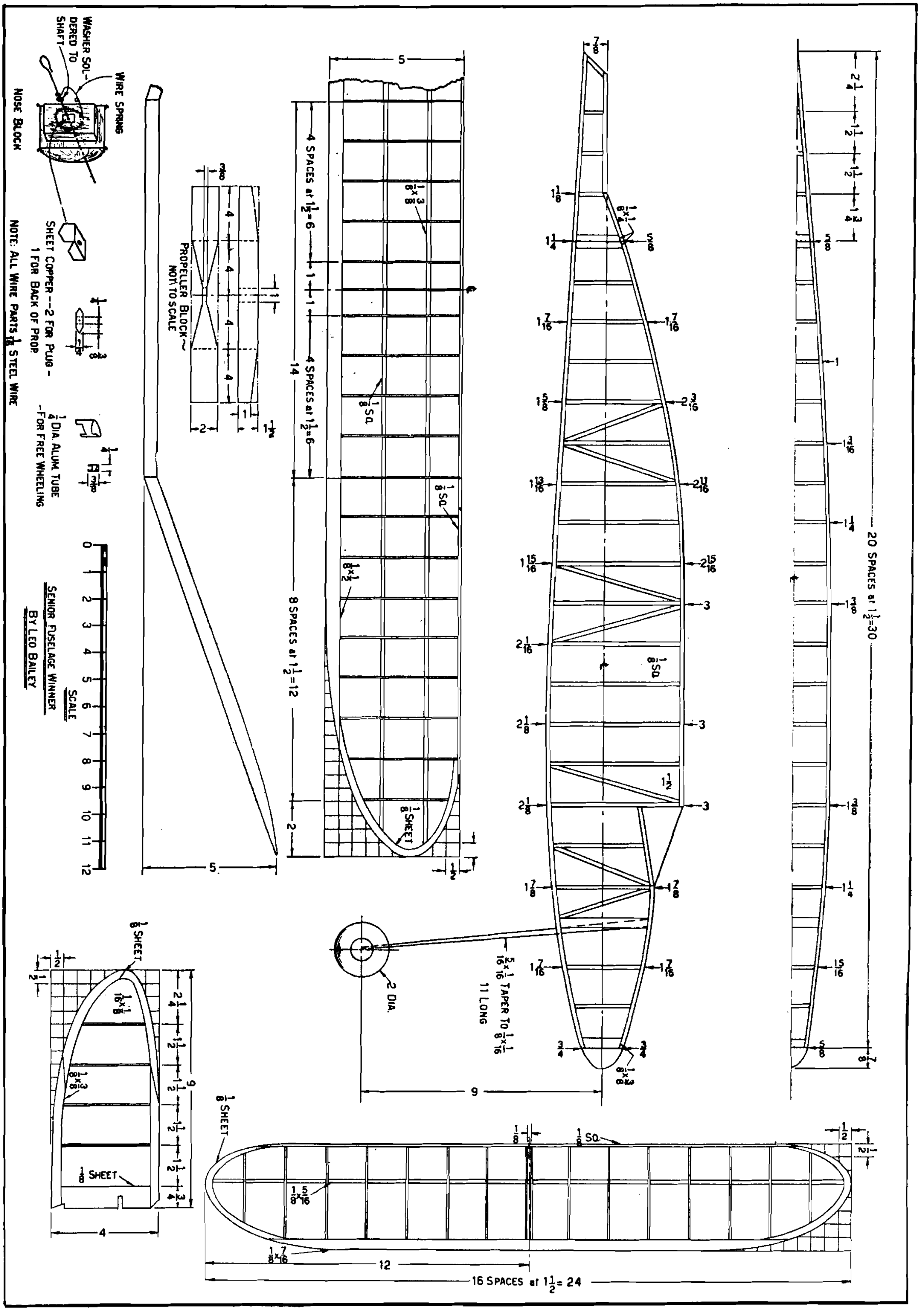
TAIL AND RUDDER

The tail and rudder are made in exactly the same manner as the wing. Note that the tail has a Clark Y type of airfoil, whereas the rudder is flat.

Cut out the sixteen tail ribs from the $1/16''$ soft balsa sheet and cement them to the $1/8 \times 5/16''$ hard balsa spar. (Note that the center ribs are spaced $1/8''$ apart to hold the rudder rib



NATIONALS SENIOR FUSELAGE WINNER



THE AMERICAN ZIPPER

by WALTER KAHN

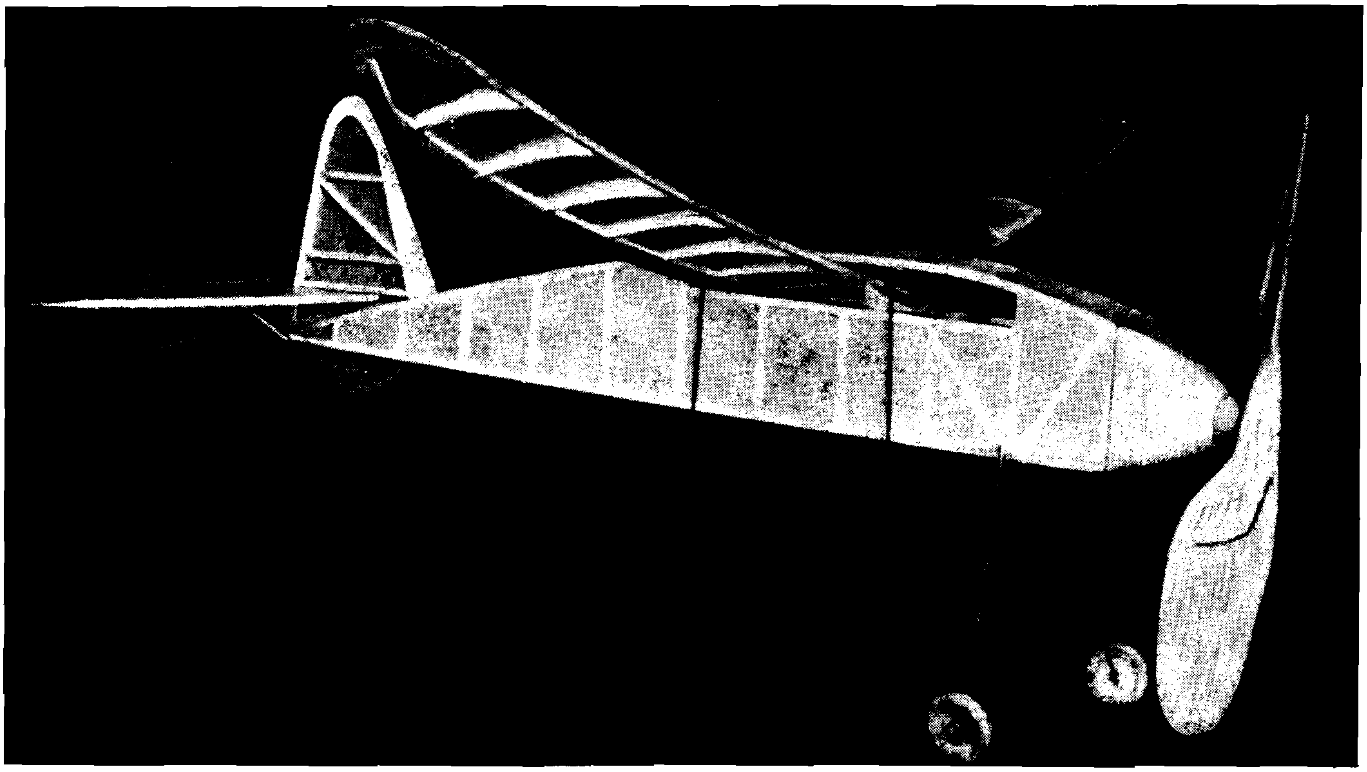
Fun for the beginner or expert—a novelty in simple flying models.

ALTHOUGH the American Zipper is comparatively small, it is unique in that it possesses the qualities of a contest ship. Its fast rate of climb and flat gliding angle are a combination always hoped for but seldom realized even from contest ships. On a calm day, without the aid of thermals, the model was clocked to the tune of one minute and thirty seconds. But let's dispense with the usual run of introduction and get right down to work.

With the exception of one half of both the wing and stabilizer, the plans shown on the following pages are full-size and complete. Since both sides of the wing and the stabilizer are constructed in one unit, it is first necessary to trace the side of the part shown to serve as a layout for the other side. As the plan is to be used as a jig, it is suggested that it be covered with translucent paper, preferably wax. This will prevent the parts from adhering to the plan.

FUSELAGE

The fuselage frame is constructed entirely of $^1/_{16}$″ square stock. The sides are first made by laying out the fuselage on the plan and maintaining the members in



A really interesting feature is the lifting fuselage shaped in profile like an airfoil. This little ship has flown over 1:30 in calm air.

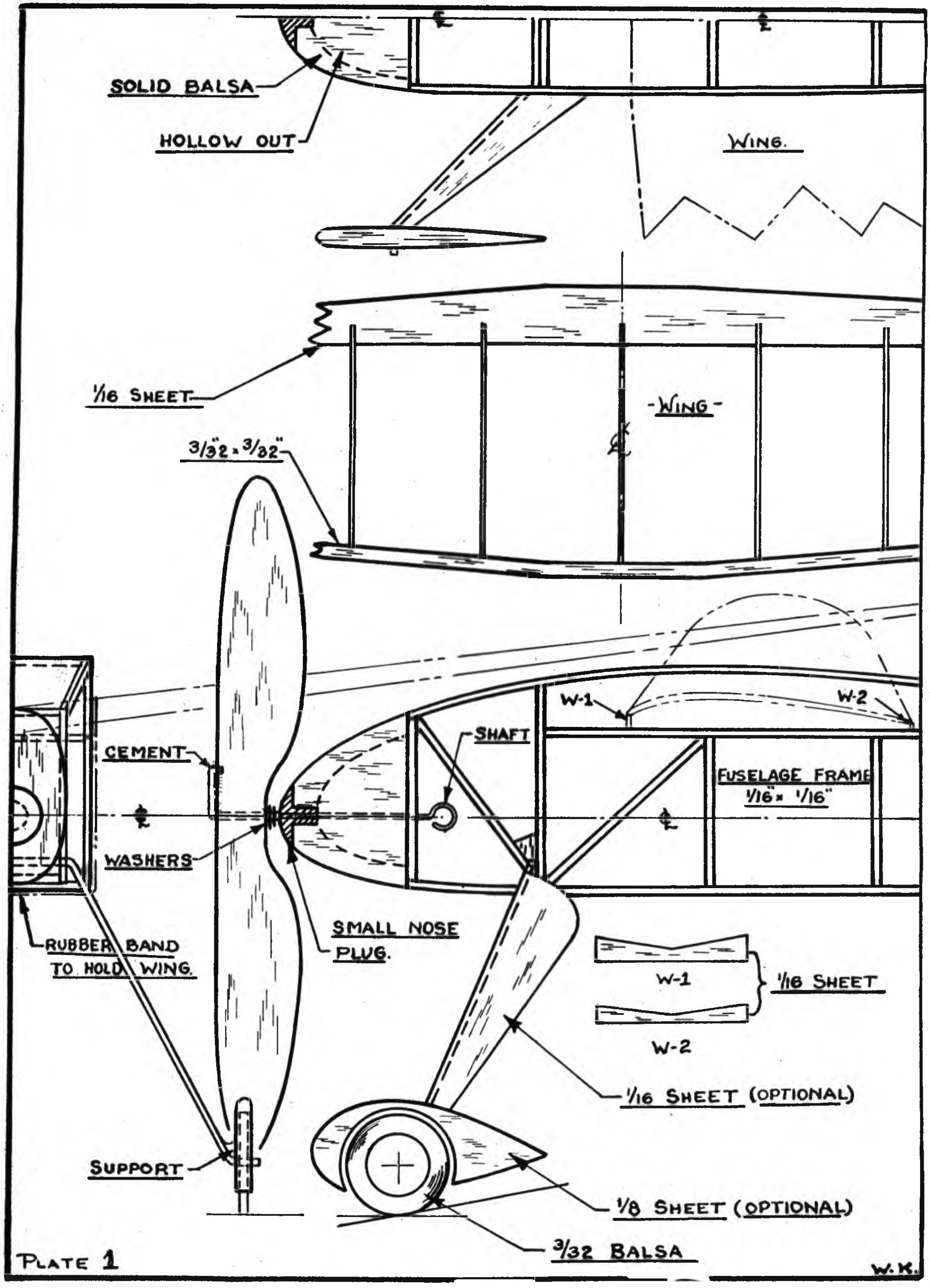
position, until the cement sets, by small pins, placed at intervals along the fuselage outline. Care should be taken not to stick the pins through the members themselves. This, as is obvious, will weaken the entire structure. The amount of cement to use at each joint should be minimum. Too much cement will not only result in a sloppy job but will add unnecessary weight and weakness in the joints.

The two side frames of the fuselage may be made together, one on top the other and then cut apart, or else they may be made separately. In both cases it is imperative that they be exact.

After the side frames have been formed they are connected by the top and bottom cross members. The sizes of these members are shown on the top half view. The nose block is next. It is carved from a very soft piece of balsa. The block is temporarily attached to the fuselage and thus carved to shape. It is then removed and the inside hollowed out. The nose of the block is cut to allow for a small nose plug as shown.

The landing gear is formed from #8 wire. It is attached to the fuselage by cement, and if desired further secured in place by thread. After the landing gear has set, the nose block is next cemented

THE AMERICAN ZIPPER



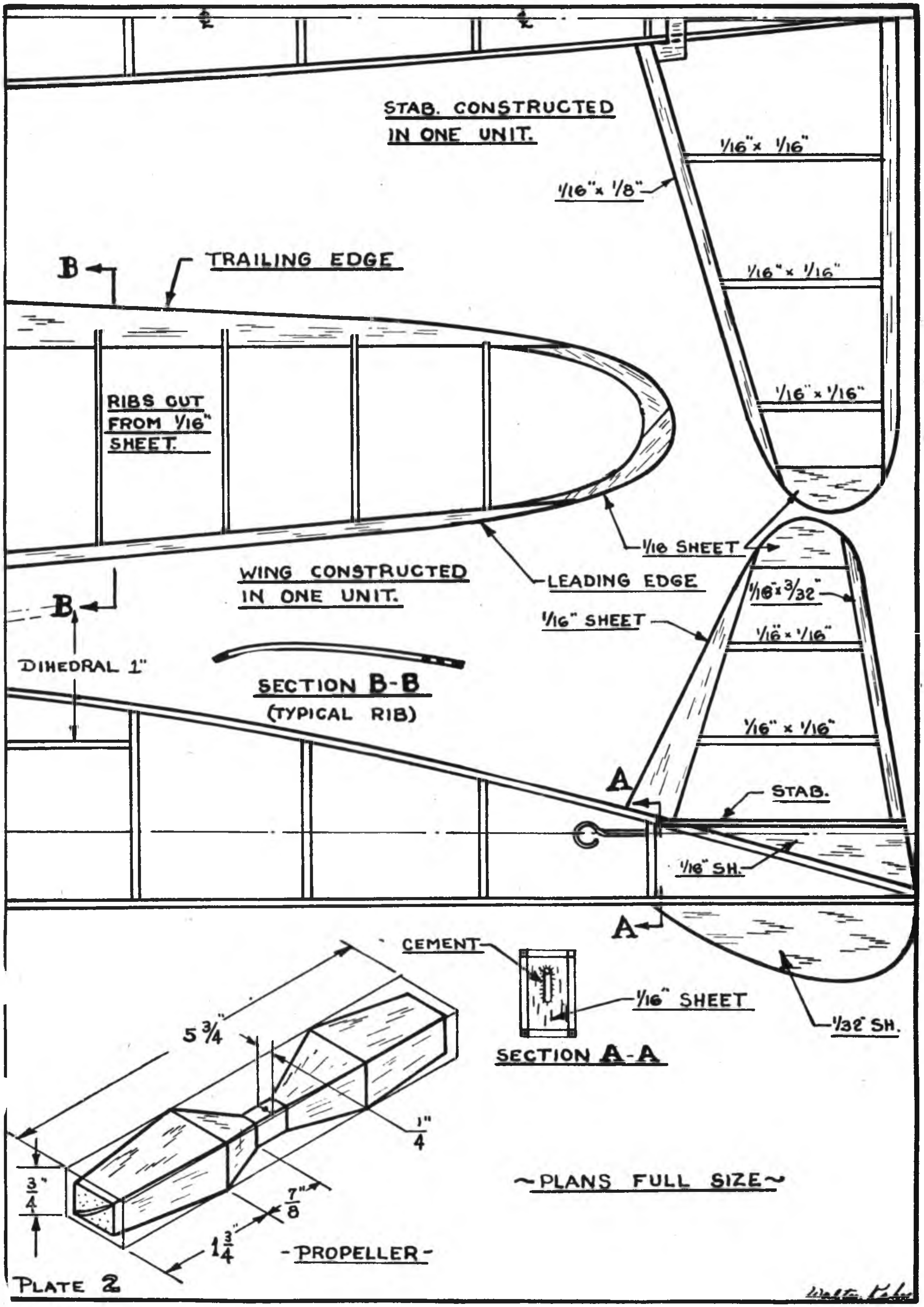

STAB. CONSTRUCTED IN ONE UNIT.
1/16" x 1/16"
1/16" x 1/8"
B
TRAILING EDGE
1/16" x 1/16"
1/16" x 1/16"
RIBS CUT FROM 1/16" SHEET.
1/16 SHEET
LEADING EDGE
WING CONSTRUCTED IN ONE UNIT.
B
1/16" x 3/32"
1/16" SHEET
1/16" x 1/16"
DIHEDRAL 1"
SECTION B-B
(TYPICAL RIB)
1/16" x 1/16"
A
STAB.
1/16" SH.
A
CEMENT
1/16" SHEET
1/32" SH.
SECTION A-A
5 3/4
1/4"
3/4"
7/8"
1 3/4
-PROPELLER-
~PLANS FULL SIZE~
Walton Kalina

PLATE 2

THE ZIPPER

permanently in place. The rear hook is attached to the fuselage as shown in Section A-A. It is held to the sheet by cement.

The wheels are cut from $^{3}/_{32}''$ sheet stock as indicated on the plan. Both the pants and the landing-gear fairing are optional.

WINGS

The wing is simple in construction. It is constructed in one unit. The ribs are cut from $^{1}/_{16}''$ sheet stock to the form illustrated in Section B-B. The trailing edge is notched to allow for the ribs as shown. The leading edge is $^{3}/_{32}''$ square stock shaped to the contour of the rib. The wing is constructed as a straight panel. It is then bent upward from the center to form a dihedral angle with a one-inch rise at the tips. W-1 and W-2 are glued in place. These members give the proper angle of incidence.

TAIL UNIT

The tail-unit construction follows along the same lines as the wing. The ribs, however, are of $^{1}/_{16}''$ square stock. Both the leading and trailing edges of each unit, horizontal and vertical, are sanded to shape after the surface has been removed from its jig.

Both the rudder and the stabilizer are attached to the fuselage in one unit. The stabilizer is maintained at zero-degree setting.

PROPELLER

The propeller is carved from a medium-hard balsa block. Its shape is outlined with a hard pencil as shown on Plate 2. The propeller is first blanked to shape. It is then carved. Actually, there is little that can be said as to the manner of carving a propeller. Experience seems to be the best teacher. In finishing the propeller it is of utmost importance that it balance. By inserting a pin at the hub the balance can easily be checked. Care should be exercised to maintain the shape of the blades alike. After the propeller has been finally completed, it is suggested that it be given a few coats of banana oil and resanded to a smooth surface.

COVERING

The complete model is covered with superfine tissue. The wing is covered on one side only, as are the stabilizer and rudder. The paper is doped to bring it taut. If water is used to shrink the paper, extreme caution should be taken not to apply too much water. Otherwise the wings and tail surfaces might be completely warped out of shape.

FLYING THE MODEL

The propeller is attached to the front shaft, which passes through the nose plug. The hook on the shaft should be made small enough to pass through the hole of the nose block. The propeller rotates against several washers, as illustrated.

The model is powered with four strands of $^{3}/_{32}''$ flat rubber. The wing is held in place by a rubber band, as indicated on Plate 1.

The wing is located approximately one half inch back of the second vertical member. The model is first glided. It should assume a very flat glide. If it tends to dive, the wing should be moved slightly ahead; if it tends to stall it should be moved to the rear. After the proper location is found the propeller should be given about fifty turns and the model launched. Readjusting may be necessary in the same manner as in gliding. Experimenting with different settings of the wing will result in the best flights.

With the model adjusted, the propeller should be wound to its full capacity and launched into the wind.

SELECTING YOUR GAS ENGINE

Are you confused by the new gas rules? Do you really know just which engine you should purchase? **by IRWIN POLK**

A TWO-STROKE-CYCLE engine is one which completes the admission of fuel vapor and air mixture, compression of mixture, combustion of mixture and the expelling of the burned mixture in two strokes of the piston or one revolution of the crankshaft. To model builders these engines are a source of constant power and a means through which their experiments in aëronautics can be carried on to a more advanced stage. While being the greatest boon to model aëronautics they are also its biggest arm ache.

The development of the miniature gas engines market has been so rapid that almost every month brings forth a new motor, thereby making a choice more difficult.

You should first decide whether you want to build large or small models. If small, then how small? In order to reach a satisfactory decision let us analyze the new National Aëronautic Association Power Model Rules which divide power models into four distinct classes:

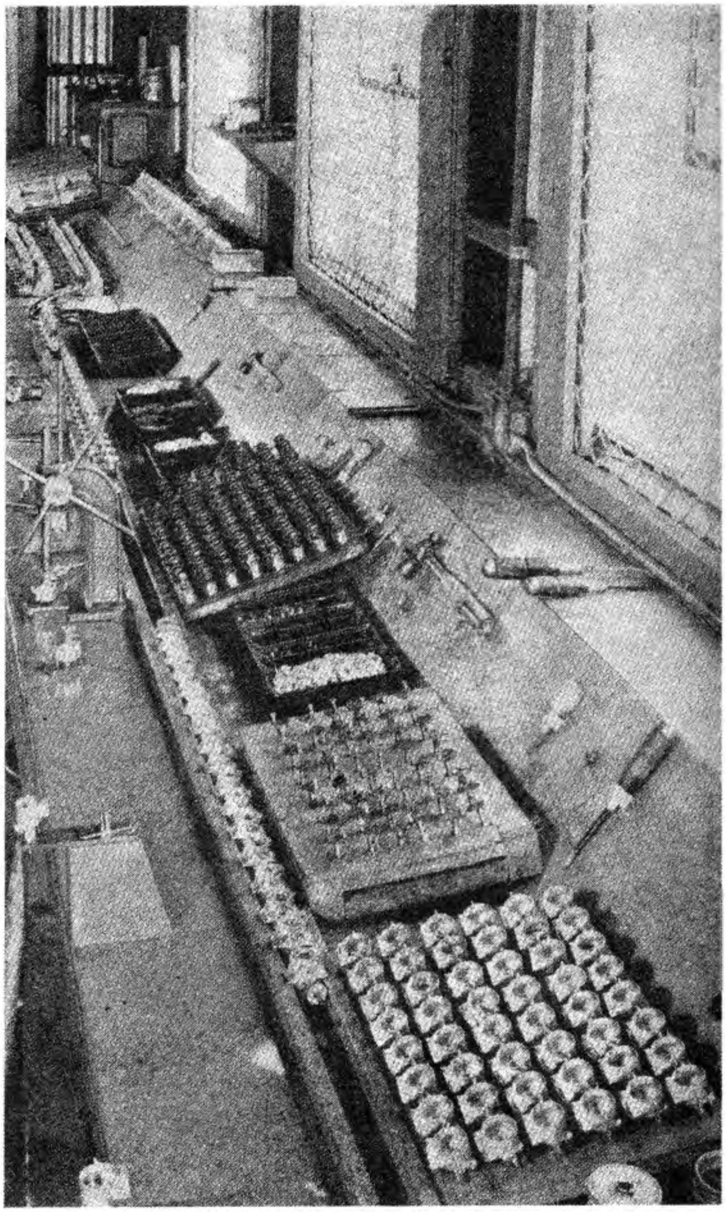
Class A. Models having a wing area up to 225 square inches. These models must use engines having up to and including .20-cubic-inch displacement.

Class B. Models having 226 to 450 square inches of wing area. These models must use engines having up to and including .30-cubic-inch displacement.

Class C. Models having 451 square inches of wing area and over. These models must be powered with engines having up to and not over 1.25-cubic-inch displacement.

Open Class Models. These are of any wing area and any engine power providing they conform to the general Power Model Rules.

Models in all classes have to conform to the following rules: In official contests the motor run must be no greater than twenty seconds from the instant the model rises off the ground. Models must weigh at least eight ounces per square foot of wing area. They must conform to the N. A. A. fuselage cross-section rule and their total weight must not exceed seven pounds. The winning time shall be the average of the three official flights.

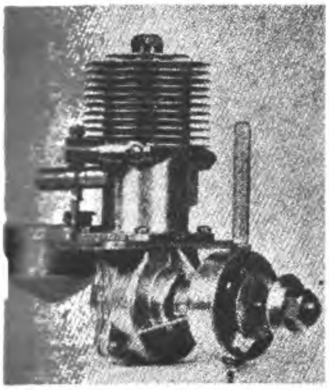


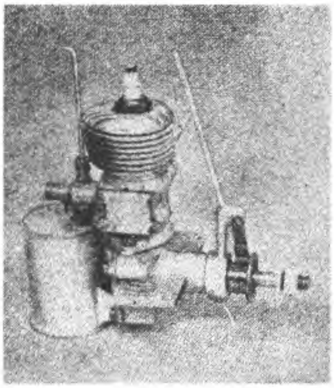
Cyclone assembly line, crankcases, foreground, to finished engines.

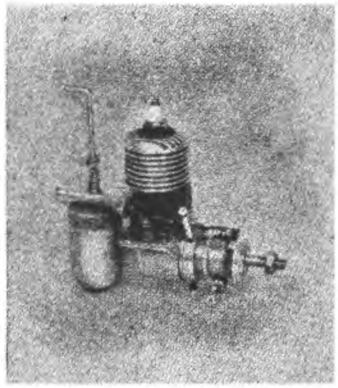
Regardless of whether it is your intention to fly in competition or not, you might as well build within a specific class. (Just in case your model turns out good anyway.)

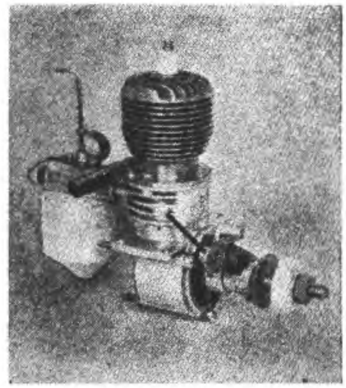
Take your Class A engines and ships. If you live in a city, if you have no car and if you are cramped for working space at home, you will want to build a Class A ship. Aside from being small, comparatively easy to build, models in this class are very economical, costing hardly more than a rubber model to build. We know builders who are able to turn out a Class A model in one week's spare time. If you contemplate working in this division you are not going to be able to save money on your power plant, since the small engines themselves are more costly to build. The saving lies in the small ship.

Bear in mind that at present there are not very many kits on the market for A engines, though some of the


Forster Brothers


Dennymite


Trojan


O. K.

B model kits may be used successfully. The day is not far off when kit manufacturers will see the practicability of a model which can be cheaply built in a short time, tucked under the arm and taken in a trolley car or subway to the nearest open space. And where a crack-up or washout will not mean weeks and months of work to repair the damage.

CLASS A ENGINES

Elf. Of the following A engines, the Elf was probably the first on the market, and is the only model aircraft engine having a double bearing crankshaft and a float carburetor. This tiny power plant also boasts a fully inclosed automobile-type timer located in the back of the crankcase. Its 1½ volt coil is, without a doubt, among the highest rated ignition units on the market. Its sand-cast aluminum cylinder is precision-fitted with a thin steel liner. It is purposely made a trifle heavier, thereby making possible practically vibrationless operation.

Bantam. The Bantam is the latest addition in the Class A family. It is considered by many as the most beautifully made model engine. It, like the Elf, uses a steel liner within an aluminum sandcasting. The Bantam has specially treated mounting flanges which in case of a severe crack-up have a tendency to bend rather than snap off.

Brat. The Brat was the first engine in this class to be put out on a production basis. It has a steel cylinder with an aluminum head. The crankcases now come through die-cast of #212 Alco aluminum. This alloy being an excellent bearing material, no other bearing is used. The connecting rod is made of Hi-Speed bronze. The latest Brats are coming through with two piston rings.

Bee. The Bee, considerably improved over the original, now has a Chapmanized steel pistol and is a lapped job. Chapmanizing provides an extremely hardened surface which insures long wear. This engine is really put out on a large production basis. The timer is of the type used on the Ace engine which is also manufactured by Syncro Devices. It has a split-type crankcase which is held together by means of four bolts making possible economic replacement of the front portion which contains the bearing. The engine may easily be inverted by loosening the lock nut at the intake manifold.

Kaydet-Chunn. The Kaydet is apparently the Chunn being manufactured by a different firm at a lower price. The by-pass and intake in this engine are cast integrally with the cylinder. It has a swipe-type timer.

Condor. The Condor is a very high-compression engine but it has not as yet made a mark for itself. The crankcase is apparently cast in a permanent mold and it has an original timer, as you will note from the photo. Its permanently fixed exhaust manifold makes for cleaner operation. This engine has a tiny screen at the intake manifold and in the gas line which prevents any dirt or grit getting into the cylinder with the gas or air.

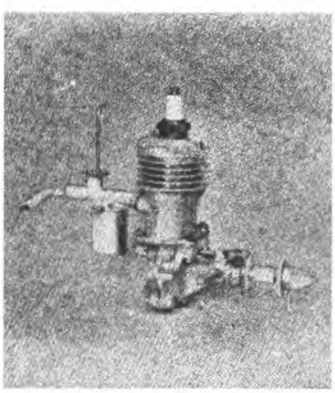
Husky. The Husky is now radically different than when originally presented, as you will note by comparing the photographs. The new one, considerably lighter, has a new inclosed timer.

Pee Wee. The Pee Wee has a cast-iron cylinder and piston. Those being shipped now have a slightly larger bore and stroke, and deliver more power. The original engine was ½ x ½".

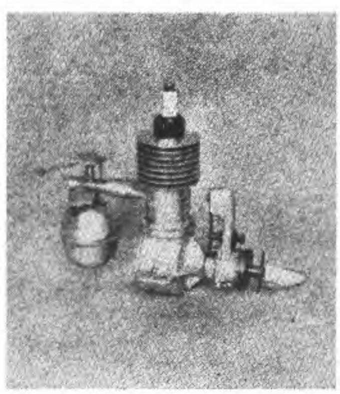
Madewell Mite-Wasp. The only difference between the Madewell Mite and the Wasp is that the by-pass and intake manifolds on the Mite are bolted

Syncro Ace

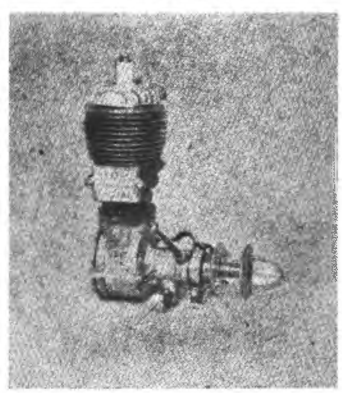
Husky Jr.



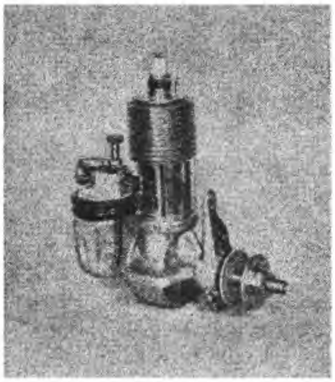
M & M



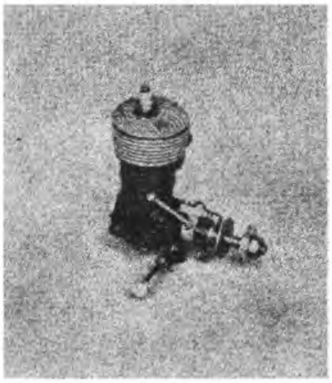
Baby Cyclone



New Husky



New Brown



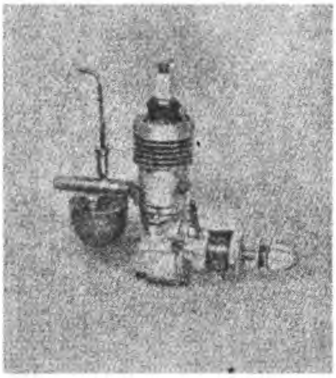
Hi-Speed

Ohlsson Gold Seal

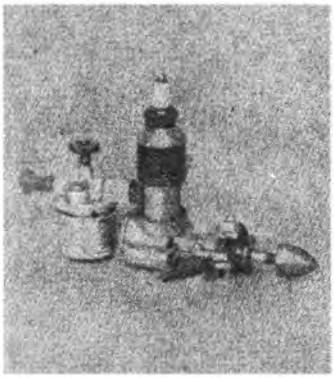
	NAME	LIST PRICE	BORE & STROKE	DISPLACEMENT	TYPE CYCLES	PORTS	WEIGHT INCL. GAS TANK	PISTON TYPE
C	BROWN "B"	21.50	7/8 × 1"	.6 cu.	2	4	7 oz.-400 Gr.	LAP
C	BROWN "D"	10.00	7/8 × 1"	.6	2	4	7 oz. 383 Gr.	2 RINGS
C	BROWN "NEW" 13/16	12.50	7/8 × 1"	.6	2	4	7 oz. 383 Gr.	LAP - 2 RINGS
A	BANTAM	16.50	19/32 × 19/32"	.165	2	3	3 oz. 100 Gr.	2 RINGS
A	BRAT	16.50	9/16 × 5/8	.155	2	4	3 oz. 253 Gr.	LAP
A	KAYDET	12.50	5/8 × 17/32	.163	2	4	4 oz. 30 Gr	LAP
A	CONDOR "MIDGET"	18.50	5/8 × 19/32	.18	2	4	3 oz. 383 Gr.	LAP
C	CYCLONE "BABY"	9.00	3/4 × 13/16	.368	2	3 ROTARY VALVE CRANKS	7 oz. 359 Gr.	LAP
C	DENNYMITE	17.85	9/10 × 9/10	.57	2	4	10 oz. 230 Gr.	LAP
A	ELF	21.50	34/64 × 19/32	.156	2	4	4 oz. 60 Gr.	3 RINGS
C	FORSTER "B"	17.75	1 1/16 × 1 1/8	.989	2	4	14 oz.	2 RINGS
C	GWIN AERO	12.00	7/8 × 13/16	.487	2	4	8 oz. 240 Gr.	2 RINGS
B	HIGH SPEED	12.75	3/4 × 5/8	.275	2	2 ROTARY VALVE CRANKS	4 oz. 328 Gr.	LAP
A	HUSKY Jr.	12.50	5/8 × 5/8	.19	2	4	5 oz. 58 Gr.	1 RING
A	HUSKY "NEW"	12.50	5/8 × 5/8	.19	2	4	3 oz. 218 Gr.	LAP
A	MADEWELL	17.50	9/16 × 19/32	.146	2	4	4 oz. 392 Gr.	LAP
B	M & M	17.50	43/64 × 11/16	.246	2	4	4 oz. 362 Gr	LAP
C	OHLSSON "GOLD SEAL"	18.50	7/8 × 15/16	.562	2	4	9 oz. 128 Gr	LAP
B	OHLSSON "23"	16.50	11/16 × 39/64	.23	2	3	5 oz.	LAP
C	O-K	21.50	9/10 × 1"	.635	2	3	10 oz. 212 Gr	3 RINGS
A	PEE WEE	14.50	9/16 × 9/16	.138	2	4	5 oz. 327 Gr.	2 RINGS
C	SYNCRO "ACE"	13.75	7/8 × 15/16	.562	2	4	11 oz. 292 Gr.	2 RINGS
A	SYNCRO "BEE"	12.50	1/2 × 5/8	.122	2	4	4 oz. 35 Gr.	LAP
A	TROJAN "Jr."	18.50	5/8 × 5/8	.19	2	3	4 oz.	LAP
A	WASP	14.95	9/16 × 19/32	.146	2	4	4 oz. 278 Gr.	LAP

Brown D

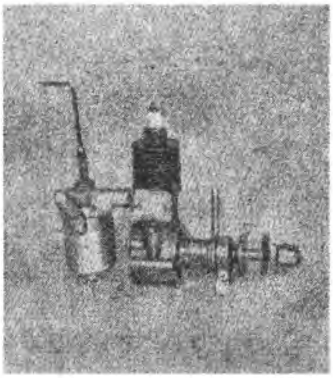
Madewell



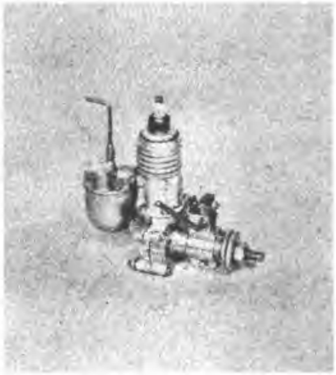
Condor



Pee Wee



Ohlsson "23"



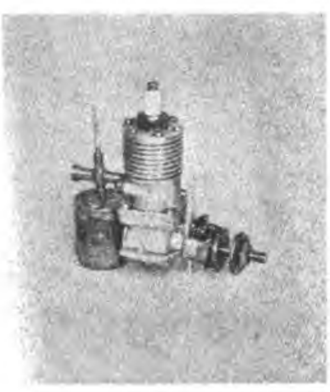
Syncro Bee

Wasp

Elf

PLUG	MOUNTING	FUEL & OIL MIX.	TEST BLOCK	RECOMMENDED PROPELLER	SPARK COIL	CON-DENSER	REVERS-IBLE	INVERT-IBLE
BROWN	BEAM	3-1 SAE 70	YES	14" DIA. 8½" P.	BROWN	.1 MFD.	YES	YES
BROWN	BEAM	3-1 SAE 70	NO	14" DIA. 8½" P.	BROWN	.1 MFD.	YES	YES
BROWN	BEAM	3-1 SAE 70	YES-NO	14" DIA. 8½" P.	BROWN	.1 MFD.	YES	YES
CHAMPION-V2	BEAM	3-1 SAE 70	YES	11" DIA.	SMITH-3V	.05 MFD.	YES	YES
SPECIAL	BEAM	3-1 SAE 70	YES	9" DIA.	SMITH-3V	.1 MFD.	YES	YES
CHAMPION-V1	BEAM	3-1,4-1 SAE 70	YES	10-12" DIA 6-7" P.	SPECIAL	.006 MFD.	NO	YES
CHAMPION-V	BEAM		YES	3 BLADE SPECIAL	SPECIAL "SEVISON"	IN COIL	YES	YES
A-C	BEAM	3-1,4-1 SAE 70	YES ENGINE MOUNT	12¾" DIA. 8" P.	SMITH-3V	.1 MFD.	NO	YES
CHAMPION-V	BEAM	3-1 SAE 70	NO	13-13½" DIA.	SPECIAL 3V	.1 MFD.	NO	YES
CHAMPION-ELF	BEAM	8-1 SAE 60	YES	12" DIA. SUPPLIED	SPECIAL ELF 1½V	.03 MFD	NO	YES
CHAMPION-V	BEAM or RADIAL	15-1 SAE 70	NO	16-18" DIA.	FORSTER 3V	.1 MFD	YES	YES
CHAMPION-V	BEAM	2-1 SAE 70	NO	12" DIA.	SPECIAL 3V	.25 MFD	YES	YES
CHAMPION-V2	BEAM	3-1 SAE 70	YES	12" DIA. 8" P.	SMITH 3V	.1 MFD	NO	YES
CHAMPION-V	BEAM	4-1 SAE 70	YES	11" DIA	SMITH 3V	.1 MFD	NO	YES
CHAMPION-V2	BEAM	3-1 SAE 70	YES	12" DIA	SMITH 1½V	.05 MFD	YES	YES
CHAMPION-V	BEAM or RADIAL	3-1 SAE 70	YES	12" DIA	SMITH 1½V	.05 MFD	YES	YES
CHAMPION-V	BEAM	3-1,5-1 SAE 70	YES	10½-12" DIA	M&M 3V	.1 MFD	YES	YES
CHAMPION-V	BEAM or RADIAL	3-1 SAE 70	NO	14" DIA	SMITH 3V	.05 MFD	NO	YES
CHAMPION-V2	BEAM or RADIAL	2-1 SAE 70	NO		SMITH 3V	.05 MFD	NO	YES
A-C	BEAM or RADIAL	3½-1, 6-1 SAE 70	YES	9-11" DIA.	SMITH 3V	.1 MFD	YES	YES
CHAMPION-V2	BEAM	3-1, 4-1 SAE 70	YES	9-10" DIA.	SMITH 3V	.1 MFD	YES	YES
CHAMPION-V	BEAM	4-1 SAE 70	NO	12-16" DIA.	SYNCRO 3V	.1 MFD	YES	YES
CHAMPION-V2	BEAM or RADIAL	4-1, 50-60 SAE	NO	9-10" DIA	SUPER LITE 3V	.05 MFD	YES	YES
CHAMPION-V2	BEAM	4-1 SAE 70	YES	9-10" DIA	SMITH 3V	.1 MFD	NO	YES
CHAMPION-V	BEAM or RADIAL	3-1 SAE 70	NO	9-10" DIA	SMITH 1½V	.1 MFD	YES	YES

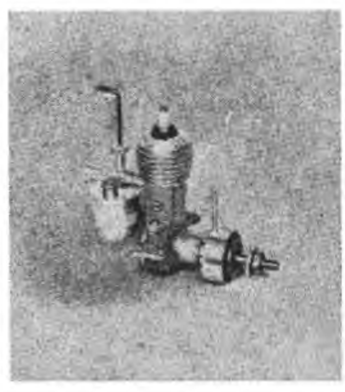
Kaydet



Gwin Aero

Brat

Bantam



SELECTING YOUR GAS ENGINE

on, while on the Wasp they are brazed on. Since nothing has been heard from the Madewell Co., of late, it is safe to assume that the Wasp is replacing it. The Wasp also comes in kit form for $12.95, and is the first kit actually on the market in the small-engine class. It is exceedingly simple to assemble and comes already lapped.

Trojan. The Trojan has a roller crankshaft bearing. By an exclusive process an absolutely leak-proof seal is obtained at the crankcase. It now comes with twin exhaust stacks cast into the cylinder and an inclosed timer.

CLASS B ENGINES

Models for Class B engines are more plentiful. There are any number of kits on the market which would perform very satisfactorily with any one of the B engines. These models, being slightly larger, sturdier, and heavier than Class A models, could be built with less skill, and since some of them could be a trifle smaller than Class C models, many builders stress them to take either a C or B engine. Or by building them at the bottom of the scale, they can be made to perform with a Class A engine, providing they are light enough. Of the small ships, Class B models are at present more popular than A models. This is due to the fact that the power plants in this class are only a trifle heavier than Class A power plants, but develop a great deal more power. The ignition system is the biggest handicap in this instance inasmuch as the weight of the coil, condenser, plug and batteries is practically the same for all engines. The B, therefore, has an advantage over the A. Should a satisfactory coil be placed on the market which will operate on 1½ volts, it will be a real boon to model builders by making possible the use of only one battery. Better still, if it would be possible to produce a Diesel engine in miniature, it would do away with the weight and difficulties caused by the inevitable ignition system.

The choice of a Class B engine is comparatively simple. There are fewer of these than in other classes.

M & M. The M & M was the first to make its appearance in this class. This engine is a lapped job having a steel cylinder and piston and an entirely original breaker-point system. The crankcase is sand-cast. The needle valve is not of the conventional micrometer type. Instead, it makes use of a baffle-type needle.

Hi-Speed. The Hi-Speed was designed by Bill Atwood, and is a rotary-valve type; that is, it receives its fuel by gravity feed. The mixture is then drawn through a hollow crankshaft which acts as a valve. This type of engine will run only in one direction, and since it is gravity fed, it is not recommended that the engine be inverted because of the tendency to flood the crankcase when the motor stops. A special inverted model is now available for $13.25. The crankcase and cylinder supports are integrally cast of Dow metal. Dow metal is an exceptionally strong super-light alloy. The plug of this engine is offset, which goes for better firing and follows a practice adopted in racing engines. Its needle valve is on a side below the shaft bearing, and extreme caution must be used in flipping the propeller to prevent snapping off the needle valve.

"23." The Ohlsson "23" has been considered by many as the finest bit of engineering in the model-engine field. This engine is ruggedly constructed, having a ¼" crankshaft with a ball-bearing thrust bearing. The bearing surface of the shaft and shaft bearing are tapered. The prop pulling through the air tends to seat the shaft. As the shaft wears, the prop may be tightened on, thereby pulling the shaft forward and providing a perfect seal as the bearings wear. The intake and by-pass manifold are cast in an integral unit with the rear section of the crankcase. The steel cylinder is then forced into the casting and spot-welded to this unit, being sealed at the joint with a gasket.

New Bantam. A new Bantam which will be known as the Bantam B will soon make its appearance on the market. The cylinder, back of the crankcase, by-pass and intake manifolds are cast as a unit. A finned head is bolted on over a steel liner. The front of the crankcase containing the crankshaft bearing is screwed into the crankcase. The timer is fully inclosed as on the small Bantam. A novel feature is the twin exhaust stacks.

CLASS C ENGINES

Our first model engines were the size used in C Class, and designs and kits for ships to be powered by such engines are plentiful. These models may be built from spruce or hard balsa sufficiently stressed for continuous flying and are of a size to permit interesting experimentation. Strong winds and clumsy handling do not affect these models so much.

Forster Bros. Forster Bros. is one of the oldest firms in the model airplane engine business and have pioneered such features on model engines as rings, aluminum alloy pistons and ball-bearing crankshafts. The motors are made of aluminum alloys throughout with the exception of the shaft, which is made of steel, and cylinder liner, which is also made of steel. The new low-head-type gas tank permits the motor to run until the tank is dry with one carburetor setting. The Forster is rated at ⅓ horsepower at 5,000 revolutions per minute. These engines have flown ships up to fifteen pounds, and they are extremely desirable for experimental and radio-controlled models. Forster Bros. manufacture their own coils, which have an excellent reputation with model builders. This engine has an automobile-type timer and runs on a leaner gas-to-oil ratio than most engines. This makes for less fouling and easier starting. Forster Bros. engines are available in three models. The B engines are air-cooled and available with either side-lug mounting or radial mounting with bronze main bearing at $17.75, or with ball-bearing for $19.50. Their C model has a one-inch bore and 1⅛" stroke, and is available either air or water cooled, and has a 14.5 CC or .883 cubic inch displacement. Rough casting kits with bronze-bearing crankshafts are available air-cooled in either B or C models for $6.50. The same engine kits with ball-bearing crankshaft cost $7.75.

Brown Motors. Brown motors, designed by William Brown, who, together with Maxwell Bassett of Philadelphia really started the gas-model bug on its way, are produced in a modern, wonderfully

AIR TRAILS ADVERTISERS—MAY, 1939

equipped plant. Practically all of the parts that go into the Brown Jr., motors are manufactured in their own factory, and even the $10 D models are test-run. All Brown engines have a remarkable weight-power ratio and have a well-established reputation for reliability. They are available in four models. The B, at $21.50, is a lapped job having a steel cylinder and piston individually fitted, micrometer needle valve and choke nut, and the Number 1 type coil. It is also cadmium-plated to prevent rusting. The C model comes mounted, ready to run on a test block, at $17, and has the same specifications as the B, except that it has an aluminum-alloy piston with two cast-iron piston rings and a baffle type of needle valve. It, like the B, comes with a Number 1 type coil. The model D, at $10, was one of the finest low-priced engines in the field. Like the C, it had an aluminum-alloy piston with two cast-iron rings and baffle-type needle valve. It, however, did not come cadmium plated, and was not mounted on a test block. A Number 2 type coil was included with this unit. The crankshaft was made of "Z" metal and has been found not to stand up as well as the chrome molybdenum crankshafts which are used on the B and C models. The M model is the same as the D, except that it has a micrometer needle valve and a choke nut and comes cadmium plated with a flywheel.

The Brown motors all use a two-piece spark plug of their own manufacture, and a two-piece gas tank with a filter. At present the Brown models are undergoing a change in design. The new engines will come through with an improved type swipe timer which is extremely simple and foolproof, and a new transparent gas tank. This timer has its points above the shaft, which goes for cleaner operation and less fouling caused by leakage of oil at the shaft. All models will have micrometer needle valves, and the shafts in the lower-priced models will be made of chrome molybdenum. The new D model will cost $12.50, the C $18.50, the M $16.50. The B remains at $21.50. The new timers and gas tanks will fit the old motors, and no doubt many Brown, Jr., owners will modernize their engines by replacing these parts.

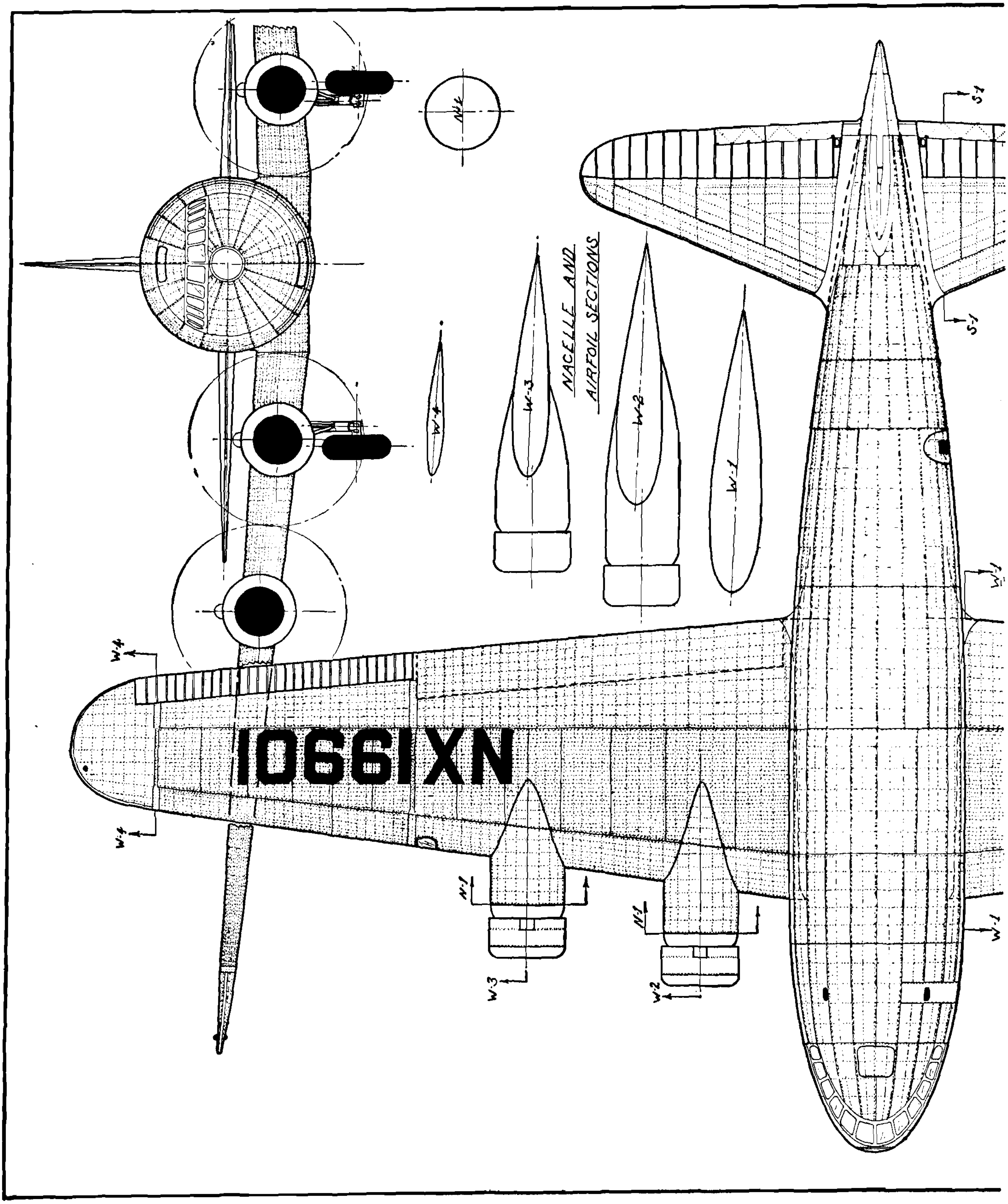
Baby Cyclone. The Baby Cyclone engine has been continuously improved since its conception. The present model F resembles the original model of three years ago in appearance only. This is a rotary-valve-type engine and comes mounted on a stand of which the gas tank is a part. The remote-control needle valve is a great improvement, which prevents a lot of needle-valve breakage and makes possible the control of the gas away from the prop. The finned duraluminum head reduces heat temperature and acts as a spark-plug gasket. The cylinder is cast iron with duraluminum sleeve shrunk on. The piston is hardened and ground steel and precision lapped. The crankshaft is drop forged, hardened and ground of high-carbon steel.

Dennymite Engine. The Dennymite engine is available in three models. In the De Lux Air Stream the cylinder is of molybdenum iron and is streamlined, presenting a greater surface to the air, which allows for better cooling. The piston is made of the same metal lapped to fit. The crankcase is made of a special aluminum alloy and has an extremely large bearing. The timer is fully guaranteed and you can get a free replacement if yours ever fails. The carburetor has a spring choke which is useful should the engine be cowled. The De Lux model has an extra long "downdraft" exhaust stack and comes mounted on dural motor mounts. The Standard Air Stream comes with a regular exhaust stack and mounts, but without the spring choke. Specifications are the same as the De Lux. The Denny Special has the old round cylinder head and comes without the streamlined outside exhaust stack and spring choke, but with dural mounts.

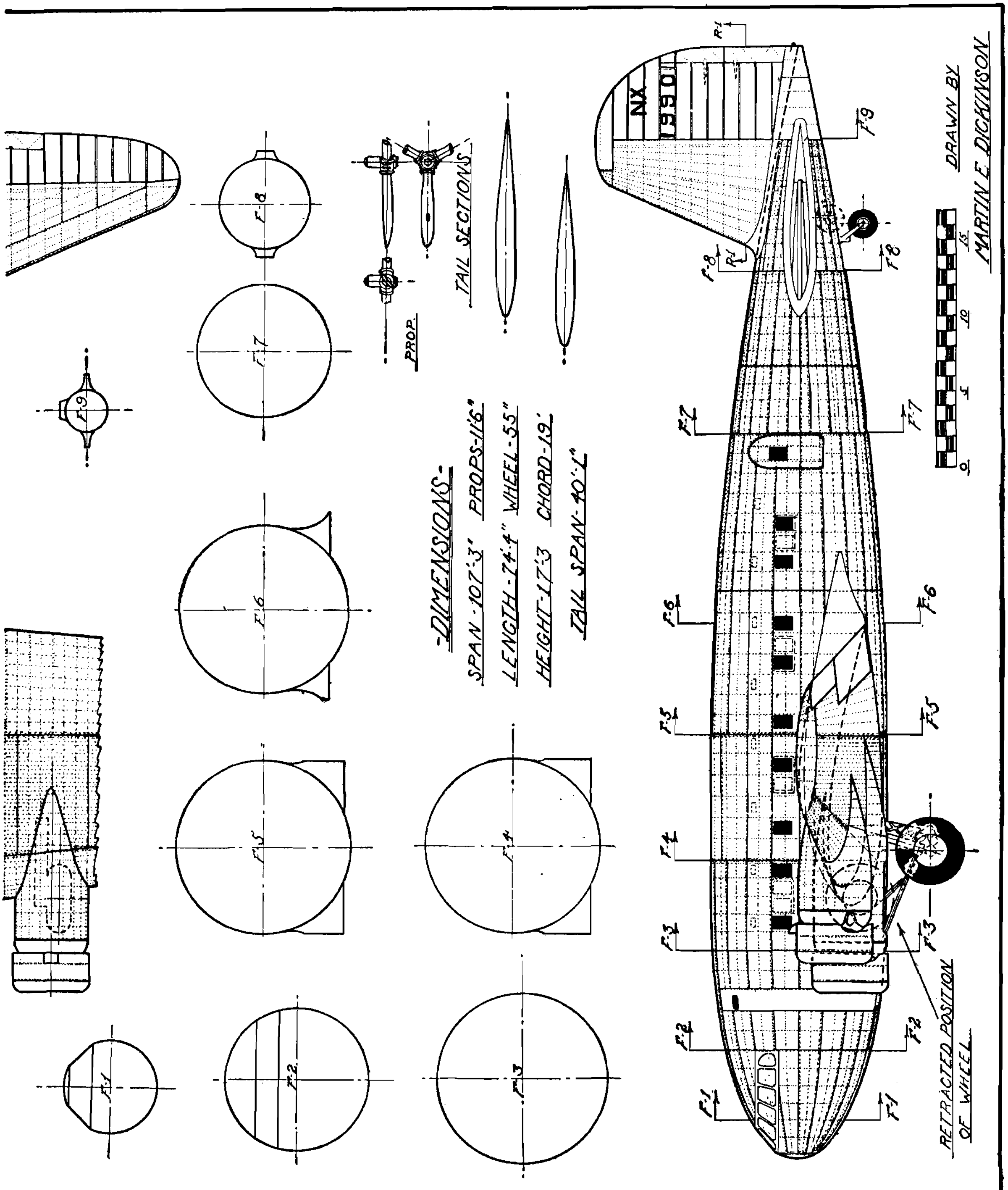
Gwin Aero. The Gwin Aero is one of a line of engines produced by the Bunch Model Airplane Company. The Gwin has a steel cylinder and comes with a permanently fixed exhaust manifold. The manifold seems to be the only apparent difference between the Gwin and the Mighty Midget line. Both kits and engines are available in assembled form, upright and inverted, and in kit form, upright or inverted. There is also the Mighty Marine engine, which is like the Mighty Midget with a better bearing, and comes with a flywheel. A new addition to the line is the Speedway engine, which is like the Gwin Aero, and comes with a special flywheel. This engine is made especially for model race cars, which are rapidly gaining favor with model builders. All Bunch engines come with aluminum high-domed pistons and two rings. These engines in kit form have brought gas engines within the reach of the average model builder. They are extremely simple to assemble and have proven very popular and satisfactory. These engine kits have all parts fully machined within very close tolerances, and require little or no skill in assembling. The only work to be done is the soldering of the gas tank, which comes complete with all metal parts formed. They now come with a timer system which is greatly improved over the original. Another new feature is the welded finned head.

Gold Seal. The newest Gold Seal has undergone a metamorphosis so complete that one would never know it from the old 1938 model.

THE BOEING STRATOLINER



the latest set of technical detail drawings made exclusively for Air Trails by MARTIN E. DICKINSON



The Nightmare

BY ROBERT L. BROWN & DALE IRWIN

Don't fret about wartime limitations on flight times. Get spin-dizzy with this control-line terror. It's patterned after the Manta fighter and has a Davis wing. Sensational!

Dale Irwin, designer, with Tiger Aero-powered Nightmare. Two wheels optional.

HERE'S a U-control racer that is causing unusual excitement among West-coast modelers. At the first appearance of the Nightmare in a local contest, the line of competing models was practically deserted. No, it wasn't a sudden Jap raid; it was because all contestants were crowding about to see Dale Irwin's spectacular new ship, a Davis-wing racer, equipped with the new "fluid" foil.

In flight, the job proved that it had a lot more on the "line" (instead of on the ball) than just looks. It was a flying demon.

Dale found a few available pictures of the Davis pursuit in a copy of Air Trails. Using these as a basis, he designed this racer. The drawing includes many improvements of design that should improve performance as well as looks.

The fuselage is quite unusual in construction. It combines some usual methods with some not so common. Cut out keels and formers; build the upper removable portion of the fuselage first. When finished it will help to jig and line up the remainder of the fuselage structure. Always cut the notches in the formers, keels, bulkheads, ribs and so forth a little too narrow rather than too wide. It is much easier to slice off a little than it is to build up the notch with splinters carefully glued and cut. (This latter process often assures a perfect covering job. Remember this the next time you begin to get sloppy in trimming ribs and formers.)

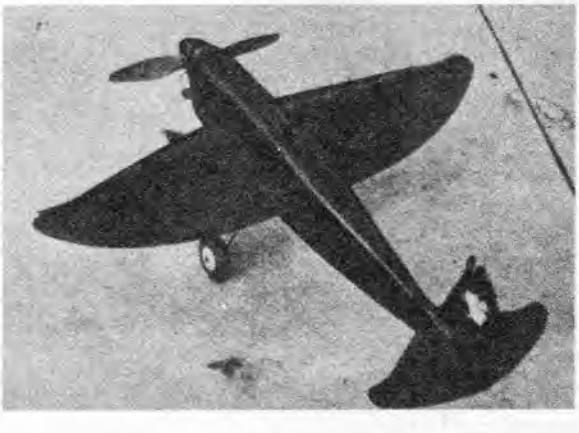
Notice that the shallow-notched keels, when pressed into the notched formers, automatically align the structure. The first step is to slide the two side keels into all the formers. Complete alignment with the top keel. Check vertical alignment of formers with a triangle.

Slide $^1/_{16}$" flat base piece Z through slots provided in Formers No. 6 and 7. To this base attach formers 4A, 5, and 5A. Carefully line up the pilot inclosure.

Glue the first plank along the bottom of each side.

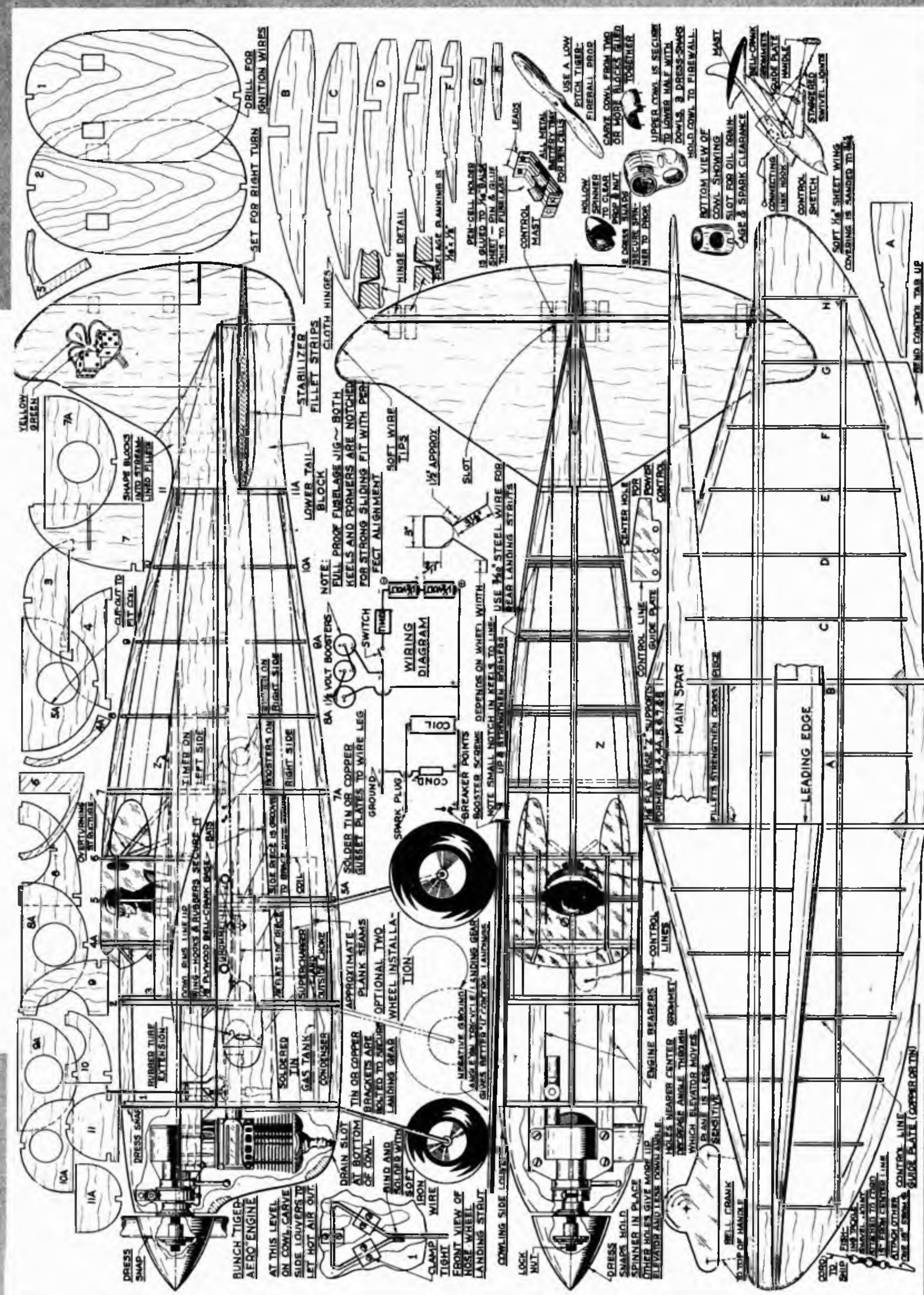
Below—Meet Robert L. Brown, draftsman. Tricycle gear irons out bumpy landings.

The peculiar planform of Manta gives added efficiency. Nightmare copies this.



15c **FULL-SIZE PLANS** of this model may be obtained by sending fifteen cents to

AIR TRAILS FULL-SIZE PLANS, 79 Seventh Avenue, New York, N. Y.



Rubber bands and small model-making pins will help to hold them till dry. Little difficulty should be encountered if the balsa planking is rather soft.

Put in $^{1}/_{16}$" square canopy framing strips. Finish covering this upper structure with $^{1}/_{16}$" x ½" planking. Cut out rear windows. Carve a pilot from balsa or soap and color realistically. Install seat back, instrument panel, throttle, overturning structure, and head pad. The cockpit interior, as well as the whole plane, is painted black on Dale's model. Paint your model to suit your own taste.

Begin lower fuselage construction by cutting out the two $^{1}/_{16}$" main side pieces. Cut them at least $^{1}/_{16}$" to ⅛" longer than shown in the side view. To be perfectly accurate, bend a strip around the contour of the side piece in the *top view*. Mark the position of Former No. 1, No. 11, and the end point. This gives you the true length to use in laying the piece out on the balsa sheet. The lower line of this piece was made straight from No. 1 to No. 11 to simplify layout.

Cut the $^{3}/_{16}$" square crosspieces which brace the top of the side piece. Pin the two side pieces on edge over the top view. Glue and pin the $^{3}/_{16}$" square crosspieces into position. Mark all lower formers as to how deep they fit between the side pieces. Before these dry thoroughly, place this partial assembly in position to insert the bottom keel. Use small model-making pins to secure till dry. Before laying this aside, check the structure for proper alignment.

Remove structure from over the top view and glue in plywood firewall and bulkhead, No. 1 and No. 2. Before inserting these last two pieces don't forget to drill one hole for the three wires, the ignition, breaker-points, and ground-wire leads; also, another hole for the gas-intake pipe. Pin bulkheads securely and apply glue generously. When dry, slide in engine bearers and add gussets. Bend wire landing struts as per drawing. Bend copper or tin holding plates and drill for small bolts. Install the ¼" flat pieces which are grooved to strengthen the landing gear and also act as a seat for the bell crank.

Put in the battery tray, coil, condenser, timer, switch, and boosters. Brackets, bolts, and glue secure these solidly. Experience has shown that a simple booster made by soldering the wires to two short bolts stuck through at right angles to the fuselage side piece is best. Clamps are used to connect the booster to these bolts. They have been found to make a better contact than any other method. Glue and pin in place the ⅛" plywood seat for the bell crank. Use a wood screw to hold the bell crank.

Carve and sand the horizontal stabilizer to shape. Install the strip leading edge in the elevator. Glue in place the control mast. Assemble the two parts, using the cloth hinges as shown. Fit this unit to the lower side of the fuselage side pieces, and glue solidly in place. Pierce the fuselage side at the position shown near the rear and insert the piano-wire control rod. Drill the side of the fuselage for the control cords and strengthen them with a plate or preferably a grommet or a regular shoelace eyelet.

Complete planking the entire fuselage with $^{1}/_{16}$ x ½" planks except between Bulkheads No. 1 and 2 around the upper section. Do not cover this till after engine is installed. Only two sheets should be used here, from the side up to the upper keel, on each side. Alternate the remaining planking, first on one side and then on the other to keep the fuselage from warping. Notch or pierce planks where the landing gear protrudes. Carefully fill in any holes around this point. Slip a washer on the landing-gear wire and glue to planking. This will help to keep the balsa from tearing during a hard

FULL-SIZE PLANS OF

THE NIGHTMARE

★ ★

SEND 15c* TO FULL-SIZE PLANS,
AIR TRAILS, 79 7th AVE., NEW YORK CITY

NAME ....

ADDRESS ....

CITY .... STATE ....

* DUE TO INCREASED COST OF MATERIAL THE PRICE OF ALL FULL-SIZE PLANS IS NOW 15 CENTS

landing. It is advisable to cut a small door between Bulkheads No. 1 and No. 2, have the upper side removable, or install the engine, gas tank, and supercharger before covering with sheet.

Bolt the engine lightly in place until the cowling is carved. This may be carved in two pieces, the upper and lower half; or in three pieces, the bottom made from two blocks glued together, and the upper half made from one block. Cut the lower-half blocks wide enough to include material from which to carve the louvers to let out the hot air. Efficient circulation is very necessary to a high-speed racer. Cut the blocks to side and top view; use a template for the circular front, and the shape of the firewall for the rear template. Leave the block flat at the point where the front cooling aperture is to be cut. This does not look streamlined while carving, but looks swell when finished, giving a perfectly contoured side view without the cupping appearance often seen.

Hollow out with a cupped chisel or carving tool. Make cut-outs for timer arm and drain, and test-fit over engine. Sand smooth, dope, install pegs to attach upper half, and glue dress snaps in place. These latter are best secured by roughing the surface slightly, covering with one coat of glue, leaving until fairly dry, and then gluing in place with a generous coat.

Bolt the engine solidly to the mounts. Solder up a rectangular gas tank (to increase capacity), including some simple L mounting brackets, and bolt to Bulkheads No. 1 and No. 2. Use an oilproof rubber intake tube bent to the right inside of the tank. Solder in place the leads to the ground and breaker points.

Carve and install the lower tail block. The upper tail block is made in three pieces, the center 3/16" flat piece which is also the fin, and the two blocks on each side which are carved to fillet the fin into the fuselage. Cut the rudder loose, hinge with sheet metal, and glue the whole joint solid again. Adjust by bending and breathing on joint. Streamline the *upper* fin before gluing into position on the fuselage. Leave the base rectangular where it fits between the two side blocks. Carve out notch in rudder to clear elevator strip. When these three pieces are glued securely and dry, carefully carve to shape, sand smooth, and clear-dope to a finish.

Solder a wire extension to the needle valve. Slip a rubber tube on the rear of the intake tube and bend in a circle so as to come out through a hole cut in the left side or, if you like, in the right side. Let this extend ¼" beyond the funnel-shaped block which catches the air, directing it into the tube. This hops up your engine. The rear of the block is streamlined as shown, and a front piece with only a small hole in its front should cover this funnel except when a record run is desired. Otherwise your engine would get too hot, and be ruined in a short time. Keep the front plug from falling out by using dress snaps, rubber bands and hook-and-eye hooks, or short dowels. Cover the canopy with celluloid, gluing black paper strips along the edges and joints.

Begin wing construction by sliding ribs into notches on main spar. Notch in the trailing edge, line up with your eye or pin to table top with the assistance of small balsa blocks (jig blocks). Glue on the leading edge, taking care that there is material for trimming. Don't undercut the leading or trailing edges. Carve, plane, and sand carefully to shape. Slip in the 1/8" square spars. Center the edges of the 1/32" sheet covering on these spars. The solid tips are shaped before the wing is covered with sheet. Secure the control-line plate to Rib E on the left wing. Cut a slot in the sheet covering to let the plate protrude. Don't forget the center-section piece (short spar) that fits against Bulkhead No. 2 on the ship.

Roughly carve the spinner to shape, not coming near the final dimensions. Drill a hole in the end, attach to a motor shaft with glue, and leave to dry thoroughly. Turn on the motor, bring to shape with a chisel, knife, and sandpaper. Remove from shaft and carve out inside to fit a Tiger Fireball propeller, nut, and lock screw. Glue on dress snaps and dope to a finish.

Hook up about a thirty-five-pound fish line to the bell crank; pull through eyelets. Secure wing in position. Pass the control lines through the guide plate on the wing, attach to the two fishing-tackle swivel joints, and finally to the hooks illustrated. Be sure to make one lead about three inches longer than the other to keep them from interfering with each other. Four of these wire hooks are needed. Two are for the long lines which go to the control handle. Length of line varies from 25 to 50 feet.

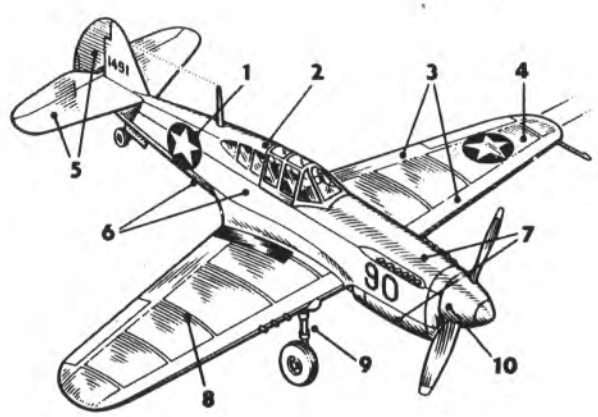
Balance the model by shifting or adding weights. There can be no test glide with this ship. It can't be thrown fast enough to attain flying speed. Start with a power flight, hang on to your hat, and before your hair turns gray you will experience the "whirl-dizzy" performance that made us decide on the name Nightmare.

BILL OF MATERIALS

- 1/32" sheet, wing covering
- 1/8" plywood, firewall and bulkhead
- 1/8" flat balsa, formers, keels, trailing edge, ribs
- 1/16" flat balsa, formers, side pieces, planking, piece Z, ribs
- 3/8 x ½" hardwood engine bearers
- Cowl blocks, supercharger block, tail blocks, spinner, pilot block
- ¼" flat tail surfaces, wing tips, main spar
- 7/16 x ¼" tapered leading edge
- Clear dope, glue, and black dope
- 1/5 h. p. engine (preferred)
- Celluloid, fishline, tin, fiber bell crank, soft wire, piano wire, swivel joints, dress snaps, bolts, cloth hinges, rubber bands, hardwood dowels, timer, booster batteries, switch, flashlight cells, wood screw, eyelets, battery tray, propeller, booster clamps, hardwood handle, and wheels.

BLUE RIBBON MODEL

BLUE RIBBON



Colorado Killer

F&B's P-40F is neat scale or team racer

■ This scale model of the famed old Curtiss Warhawk by F&B Aircraft, Denver 5, Colo., a big ship, is intended for flying scale with .19's or team racing with .29's. It was designed from the original Curtiss plans, scaled down by Bill Fox.

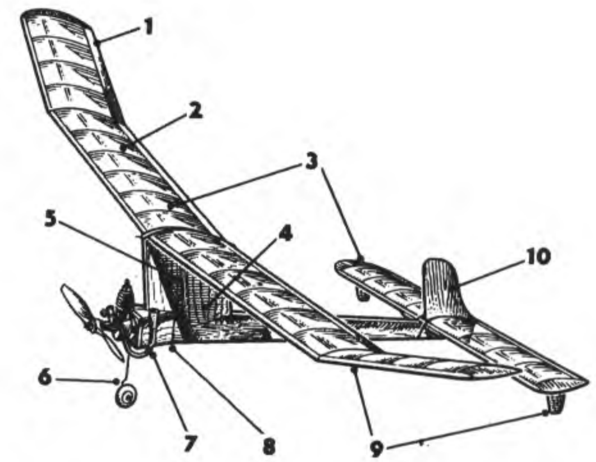
The fuselage will be no great chore to build, due to the form of construction used. Sides (6) are supplied cut to shape from 3/16" thick balsa; there are four balsa formers, all die-cut (2). Blocks of balsa (7) are rounded off and partially hollowed out for the nose. Fuselage parts are of fairly light wood. Intended for beam-mount engines, the cowl is big enough to take many of the popular .19 to .29 powerplants. Hardwood mounts (10) are supplied.

The landing gear is fastened into the wing; real care has been taken so the gear won't fold at the wrong time. Heavy ply insets are cemented between the leading edge and the half-inch-square hardwood center spar. Ready-shaped wire legs (9) are attached to the ply with cotter pins and washers, which should be soldered for additional security.

The wing is a simple assembly job, utilizing formed and notched leading and trailing edges (3). The front one should be tapered toward the tips to gain the correct wing shape. Ribs (8) are die-cut. Wing is tissue covered (4).

Tail surfaces (5) are formed from ready-cut sheets of 3/16" balsa and need only slight shaping on the edges. Cloth hinges are furnished.

The plans are full size and there are ample written instructions. Complete decal insignia (1) included.



Maryland Mite

Contest Craft's Thin Man for A/2 events

■ This little Half-A ship is the result of a successful design built and flown as a C job by Phil Jackson. Contest Craft Co., Riverdale, Md., reduced it to the baby size. Test models flown with Cub .049's averaged 1.5 min. on 15 sec. motor runs on cool spring evenings.

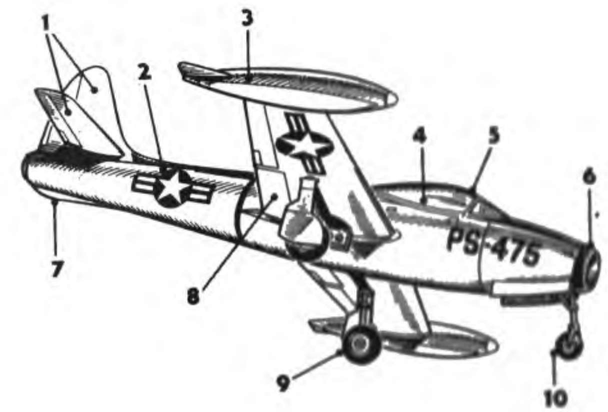
The ship will hold a 75 deg. angle throughout the climb. This design has been found excellent in windy weather; glide is fairly fast and very flat.

The fuselage (4) is a shaped piece of hard balsa 5/16" thick. It is cut to the required taper; just round the edges. The pre-shaped pylon has a hardwood stiffener (5) and is built up on the fuselage in a manner that assures maximum strength. The nose assembly is simple but very rugged. A single-wheel landing gear (6) is provided.

Wing and stabilizer are of the same construction—in fact they use the same ribs, and trailing edge (1) supplied cut to shape, and tips. Ribs (2) are in a die-cut sheet and tips are ready to use. There is no undercamber, so assembly should be a cinch. The 1/8" thick rudder (10) is cemented to the stab. Joiners and subrudders are printed sheet.

The 2-ply "firewall" (8) is pre-shaped as are the fairing supports. An eye-dropper tank (7) comes in the kit. Paper covers the wing and stab (3).

Test models have been found to weigh 4.5 oz., when fitted with the Cub, and three heavy coats of dope on the fuselage raises this to the 4.9 oz. required for contest flying. Best results have been had with 6 4 and 7/3 props.



Made, modeled on L.I.

Dyna-Model's F-84 has scale metal parts

■ One of the members of a new line of jet planes by Dyna-Model Products Co., Oyster Bay, N. Y., this kit is representative of this concern's scale work. Other ships in the series are the MIG-15, F9F Panther, F-80 Shooting Star, and F-86 Sabrejet.

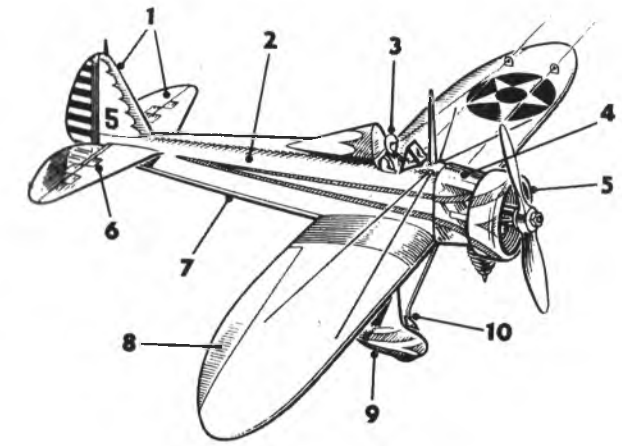
Realistic die-cast metal parts are used in the F-84. There is little or no "flash" on the 14 metal (such as 6 and 7) parts, ranging from a tiny control stick to a realistic ejection seat (4).

The landing gear legs (10) are cast; the main wheels have the wheel covers integral (9). Doors for both main and nose wheels are in the kit. Main wheels are of hardwood, and fit snugly on stubs projecting from the metal gear legs.

The fuselage is almost completely finished from hardwood and needs only a little sanding before assembly. It has a large cut-out for the cockpit. There is an instrument panel for the cockpit and a plastic canopy (5) to go over the top.

All wing (8) and tail parts (1) are in die-cut balsa sheets; the wings are of 1/4" stock and the tail of 3/16". To aid in assembly, the kit includes a heavy cardboard jig. It has sections marked out for the fuselage and wings, and will assure that correct dihedral is attained.

The plans are full size for this 1/4" scale model and give complete finishing and decorating instructions. Realism is assured in the finished job by the turned hardwood drop tanks (3), and a complete set of decals (2). The completed model has a span and length of about 9 1/4".



P-26A from Jersey

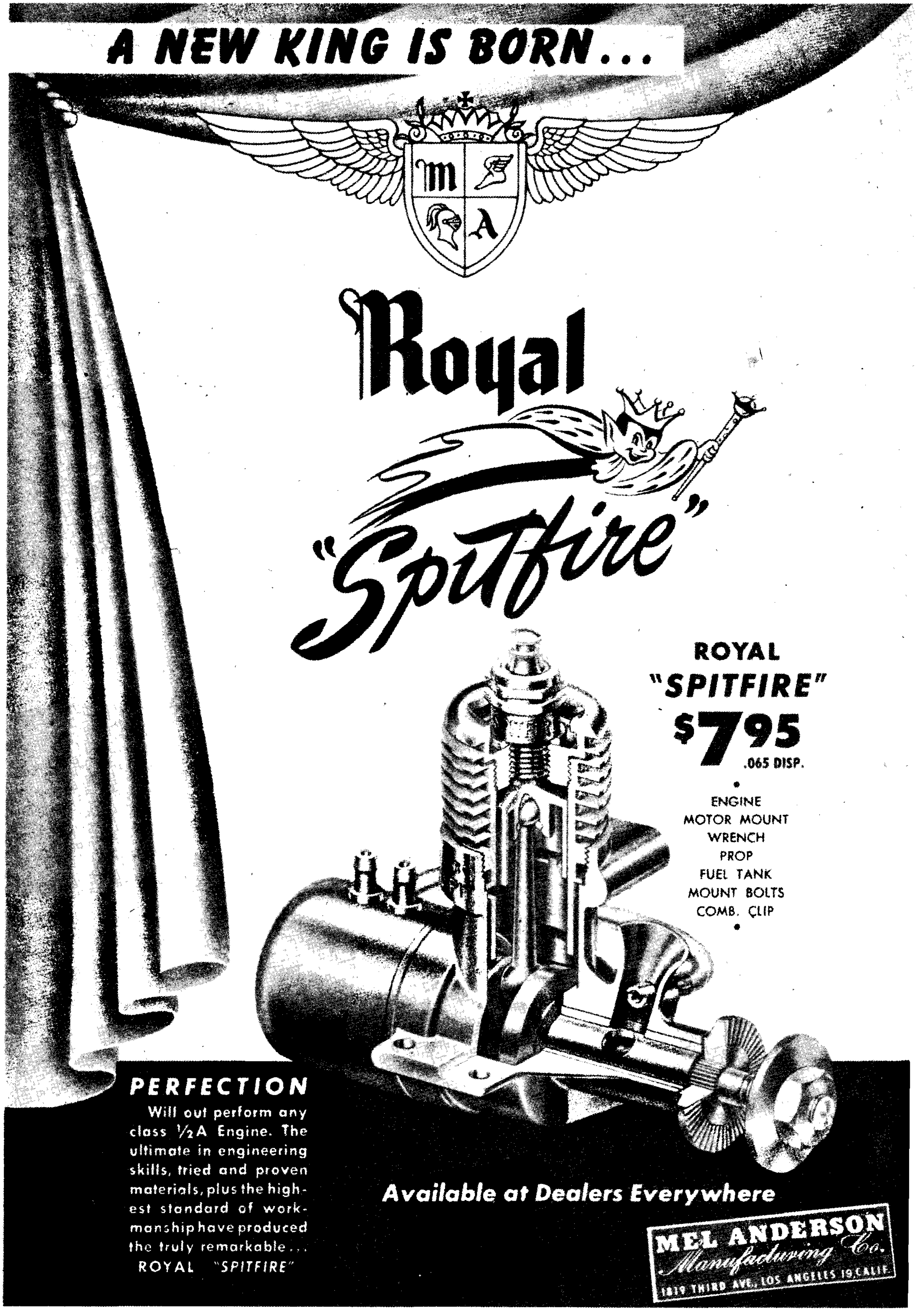
Scientific pursuit has formed ring and cowl

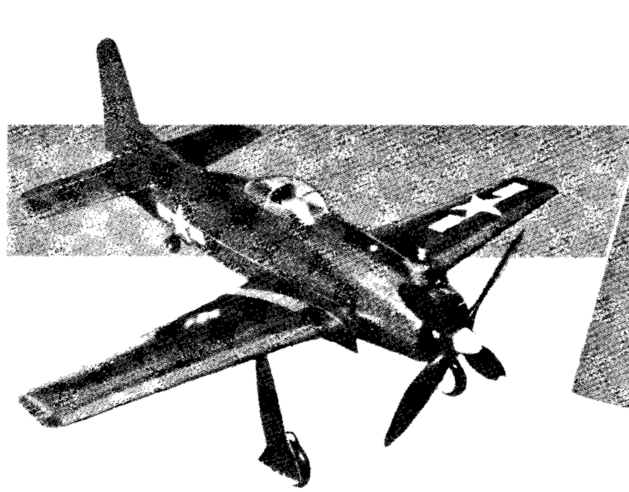
■ Latest Scientific Model Airplane Co., Newark, N. J., product is a semi-scale copy of the famed Boeing P-26A, the first all-metal pursuit ship used by the Army. Though listed only as semi-scale, the plane is remarkably life-like. The model has the faired-in landing gear, the large streamlined headrest, and most important, a finished aluminum speed cowl (5).

The kit is very complete and well pre-fabbed. Fuselage (2) comes in the form of a shaped hollowed-out block of balsa. You cut out wing openings on the underside—a cardboard template is furnished for this—after which the 3/16" thick balsa bottom plate (7) is attached. There is ample space in the forward section of the fuselage for almost any standard Half-A tank. Firewall is of sturdy 3-ply; the engine attaches to it radially with three wood screws. Dressing up the model nicely is a formed aluminum nose piece (4).

Tail surfaces (1) are die-cut sheet balsa with fabric hinges and hardwood elevator stiffener (6). The pre-shaped balsa wing (8) is cut to planform and airfoil shape. Trailing edges are cemented to it. The kit includes ballcrank and elevator horn, necessary mounting parts and pushrod. All landing gear parts (10), including three wheels are furnished. Landing gear fairing (9) is die-cut.

The old original P-26A's of the Thunderbird squadron had yellow wings, a blue fuselage with red striping. A decal sheet has the stripes, in addition to the Thunderbird insignia, plus wing and tail markings. There is a plastic pilot and plastic windshield supplied (3).


A NEW KING IS BORN...
Royal
"Spitfire"
ROYAL "SPITFIRE" $7.95
.065 DISP.
ENGINE
MOTOR MOUNT
WRENCH
PROP
FUEL TANK
MOUNT BOLTS
COMB. CLIP
PERFECTION
Will out perform any class ½A Engine. The ultimate in engineering skills, tried and proven materials, plus the highest standard of workmanship have produced the truly remarkable... ROYAL "SPITFIRE"
Available at Dealers Everywhere
MEL ANDERSON Manufacturing Co.
1819 THIRD AVE. LOS ANGELES 19, CALIF.



GRUMMAN "BEARCAT"

by W. Noonan

THE NAVY'S MOST MANEUVERABLE FIGHTER IN CONTROL-LINE SCALE FOR THE FELLOWS WHO LIKE SPEED PLUS REALISM

GATHER 'round, you scale control-line fans! You speed boys take heed, too, because here is a little replica that will delight both. The Grumman F8F-1 "Bearcat" is as neat a little fighter as has ever cleaved the old ozone. Had the war continued another few months, even weeks, impressive scores would undoubtedly have been chalked up by this agile, hard-hitting fighter.

Although not much information has been released on this aircraft, it is known that it has an engine with greater horsepower than that of its older brother, the Hellcat (plus a four-bladed Aero prop), yet has a smaller span than the famed Wildcat! Its climb rivals that of the Navy's spectacular jet fighter, the Ryan Fireball, and the Fireball has the advantage of both jet and conventional engines.

The maneuverability of the model is a sort of scaled-down version of the real aircraft, as it is both fast and easily controlled.

Fuselage: Tack enlarged plans of the Bearcat to a smooth, flat surface, placing waxed paper over them for protection from the glue. Cut keels: one top, one bottom, and four sides from 3/16" medium sheet balsa and place top and bottom in correct position over plans. Lay two pieces of 3/16" square stock along thrust line on plans also, these forming a base for hatch division. Note that top 3/16" square piece goes only as far as former 6a. Now place formers, which have been carefully cut from medium 3/32" sheet, in correct places, using a good grade of model cement in the joints. Be certain that top and bottom halves from 1 to 6 are correctly aligned with each other. After all formers (1 to 8) have been cemented in place, put 3/16" side keels in place, these running parallel with the two placed on plans along the line of thrust.

By this time, you should have a half fuselage constructed, minus planking, and three laminated nose formers.

Carefully remove this frame from plans, making sure you have allowed cement to dry thoroughly. Place corresponding former pieces in position on the right half of the keel, following the same procedure as the first half. Cement three laminated nose formers and plywood firewall in place, having previously cut notches in firewall to accommodate motor mounts—their width being determined by engine used.

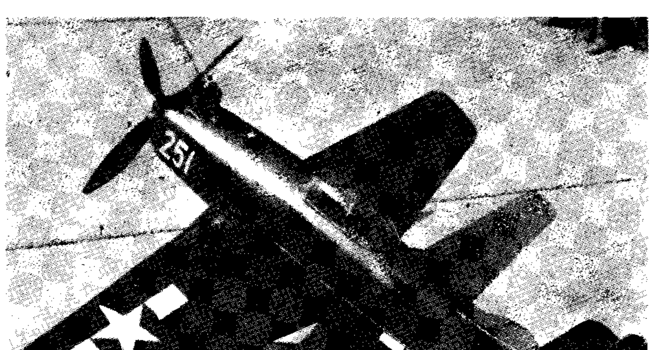
Planking is next. This is done with 3/8" by 3/32" medium stock, tapered to fit, starting aft of the cockpit. This is probably the most tedious part of the whole construction. Start by laying a piece alongside top keel and one alongside bottom keel on each side. Do not cement between these two pieces, as this is where the hatch divides. Work on the lower portion of the fuselage first; for each piece laid on one side, place a corresponding piece on the other. This way the fuselage will not become distorted from too much pull on one side. Plank the top half, then use a thumb or modeler's plane to smooth off planking. Add solid balsa tail stub and sand with progressively finer grades of sandpaper until a smooth, even contour is obtained.

Cut cockpit opening in top hatch, but leave bottom wing "seat" uncut until wing is built and can be fitted into place. Dotted portion on plans is part that will be removed to receive wing. Cut between 6 and 6a to make top hatch removable. Install ignition after wing is completed and cemented in place, locating coil, batteries, etc., in locations shown on plans. Cut hole in cowl to allow engine, needle valve, and timer arm to come through.

Cut canopy mold from hardwood. Note that from the front view, the blister bulges slightly, giving it a cross section like an inverted fish bowl. Purchase a bottle of "celluloid plasticizer"—a liquid that makes celluloid soft and pliable—at your model shop. Follow manufacturer's directions to form a neat, clear canopy. Cement in place when model has had its last coat of dope.

Wing: Construction of wing is simple and quick, yet results in a strong, neat surface. Lay out wing plan on 1/16" sheet, marking spar and rib positions. Cut out and divide at center. Prop up each tip 1" above workbench for correct dihedral, but do not cement at center.

Cut ribs B, C, E, F, G, and H from hard 1/16" sheet, ribs A and D from 3/32" sheet. Spar is cut from hard 3/32" sheet or pine.

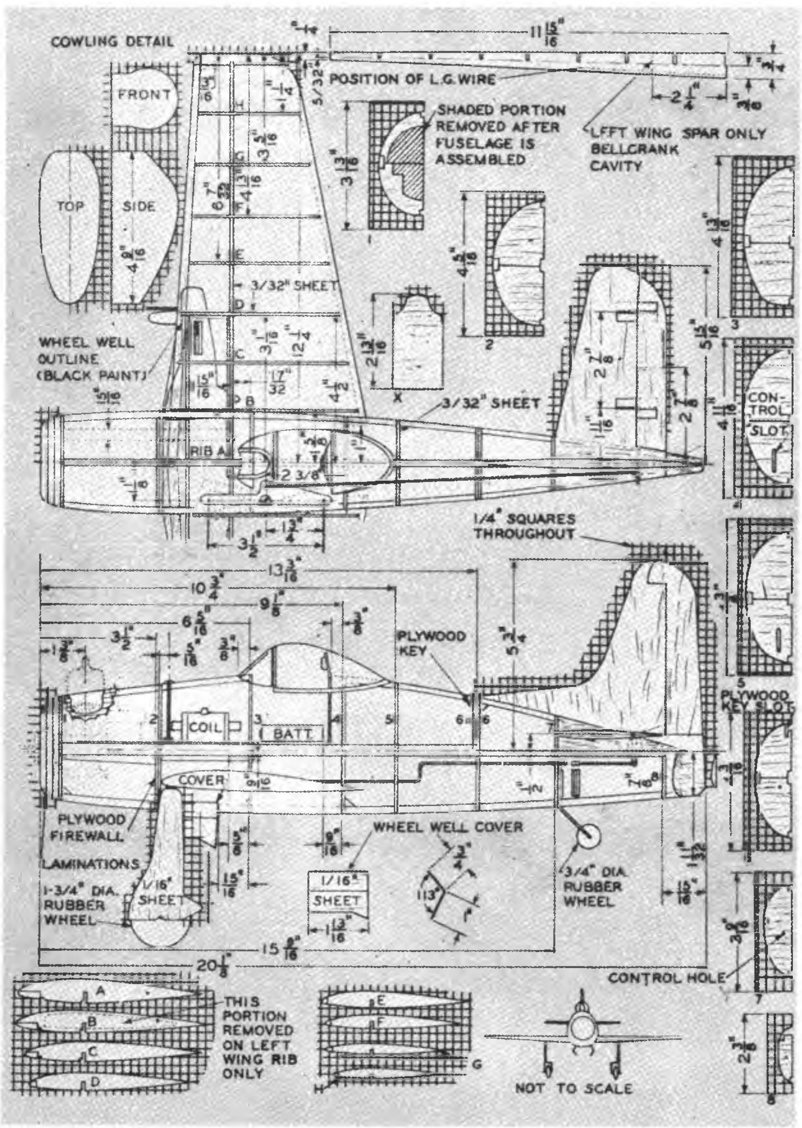


● The completed model in all its glory, ready and waiting to fly. Note how all the little details such as decals really finish a good scale job.

● Here is the big brother of the model. Developed and completed just at the end of the war, the Bearcat has the fastest climb and speed of any Navy fighter.

Now place spar in position on balsa sheet, cementing thoroughly. Note that left spar has a cut-out portion between ribs A and C, this being for bellcrank travel. Place ribs in respective notches in the spars, cementing them to the 1/16" sheet to form accurate chamber on the underside of the surface. The ribs, it is noted, do not come clear to the trailing edge, but leave about a 1/8" edge. This is beveled in order to attack top covering. Cut tip from 3/16" sheet and cement in place. Glue 1/4" square leading edge in place.

Bellcrank installation is made by driving a wood screw into a pine base, cemented between ribs A and B. Bellcrank is cut from 1/16" plywood. Pierce ribs in left panel with 1/16" diameter wire, sharpened on the end, to make holes for control lines to bellcrank, these being made of gut fish leaders or .034" wire. Cement center dihedral break together now, using ample glue. Trim leading edge, tip, and trailing edge. Set aside and cut top covering from 1/16" sheet, allowing a little excess around edges for chamber. Drill hole in correct place for 1/16" diameter elevator wire to come through on left panel, between ribs A and B. Bend landing gear from 3/32" diameter wire and solder front and rear legs together; place in correct position in wing, securing with grooved pine blocks.



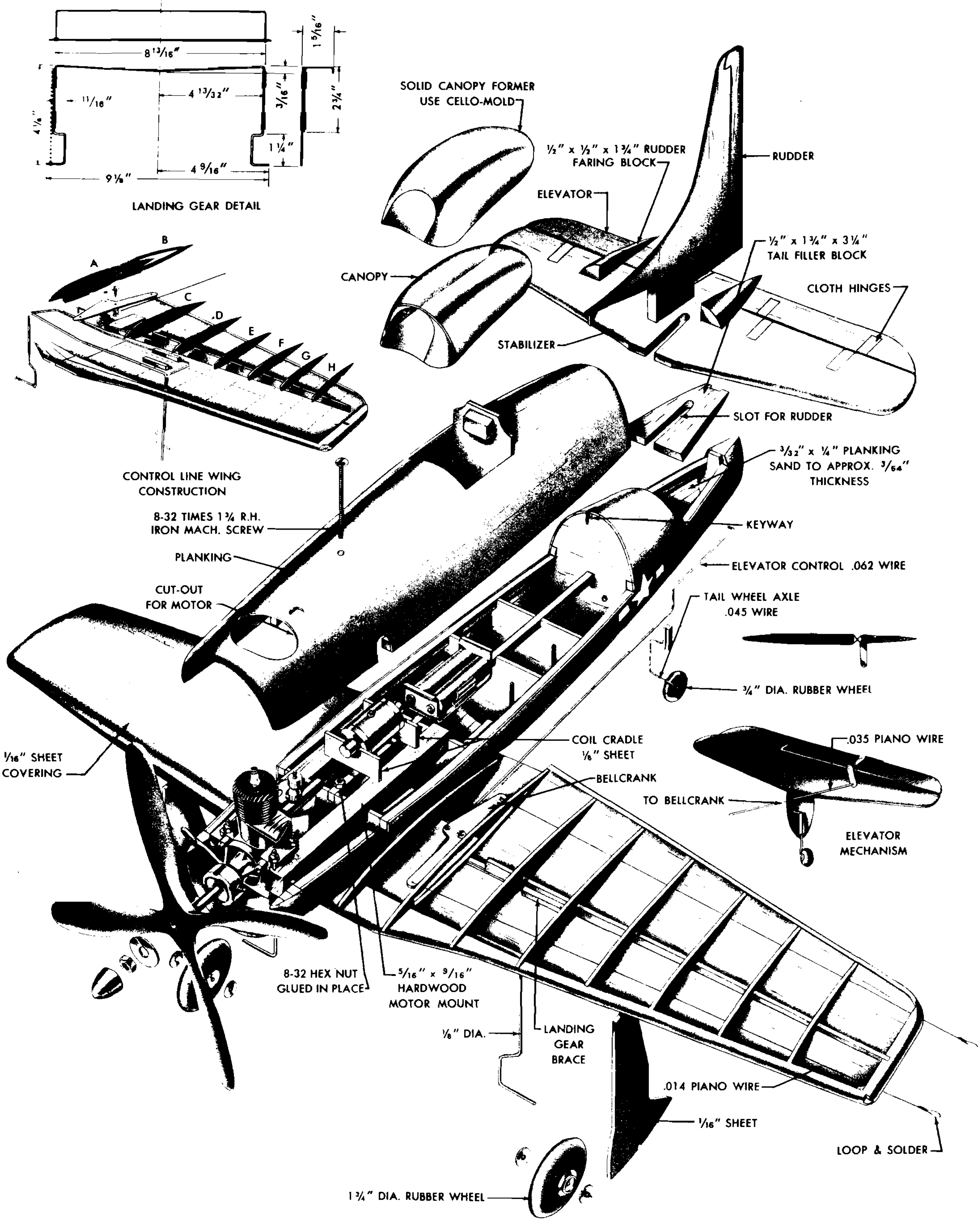
Now slip left panel covering over 1/16" control wire and set in place, using ample cement along ribs, leading edge, tip, and trailing edge. Pin leading edge and tip, taking care not to split balsa. Use clothes pins to hold trailing edge together. Repeat procedure on right panel. Trim and sand.

Now fuselage can be cut to receive wing. Use rib B as a pattern, as this is the approximate cross section of wing at the point it joins the fuselage. Take care, when cutting, as a good fit insures a strong joint. Slide control wire through bulkheads before cementing wing in place. Attach control to elevator later. Fill in under wing with block balsa, then trim to correct fuselage contour.

Tail Surfaces: Tail surfaces are cut from 3/16" medium sheet stock. Stabilizer is sanded to a streamline cross section, while it is suggested that rudder be chambered on left side only. Rudder is offset about 1/4" against circle. Gauze is used as elevator hinge (see detail).

The entire model is doped insignia blue, the Navy's standard color for aircraft. Extent of detail added to model depends on the builder; decal stars and numerals add color to the model.

When flying, be certain to launch model downwind; this will enable the model to gain flying speed and the controls to become effective. The model was originally powered with an Ohlsson 23, but later an engine of .35-cubic-inch displacement was installed, which enhanced its flying, both in speed and control.



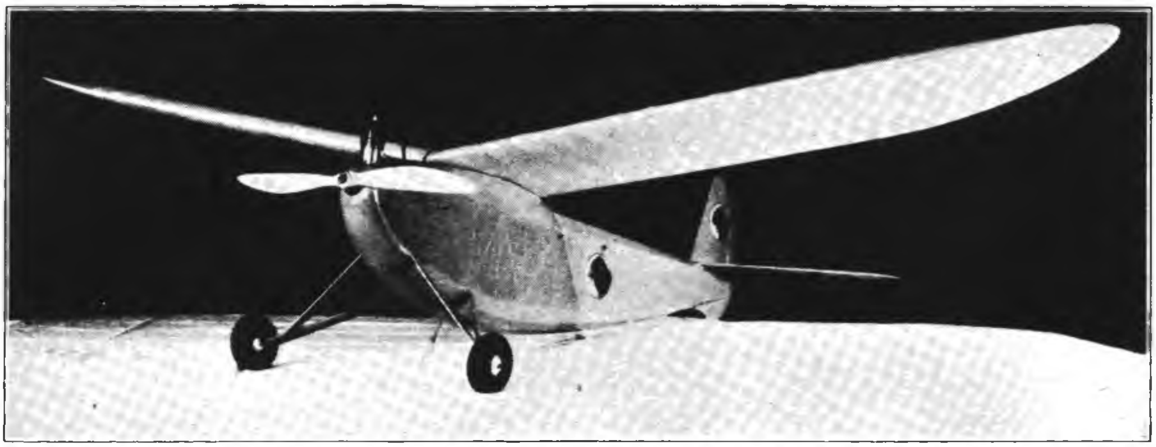
8 13/16"
1 5/16"
4 13/32"
11/16"
3/16"
2 3/4"
4 1/8"
1 1/4"
4 9/16"
9 1/8"
LANDING GEAR DETAIL
SOLID CANOPY FORMER
USE CELLO-MOLD
1/2" x 1/2" x 1 3/4" RUDDER
FARING BLOCK
RUDDER
ELEVATOR
1/2" x 1 3/4" x 3 1/4"
TAIL FILLER BLOCK
CANOPY
CLOTH HINGES
STABILIZER
A
B
C
D
E
F
G
H
SLOT FOR RUDDER
CONTROL LINE WING
CONSTRUCTION
3/32" x 1/4" PLANKING
SAND TO APPROX. 3/64"
THICKNESS
8-32 TIMES 1 3/4 R.H.
IRON MACH. SCREW
KEYWAY
PLANKING
ELEVATOR CONTROL .062 WIRE
CUT-OUT
FOR MOTOR
TAIL WHEEL AXLE
.045 WIRE
3/4" DIA. RUBBER WHEEL
COIL CRADLE
1/8" SHEET
.035 PIANO WIRE
1/16" SHEET
COVERING
BELLCRANK
TO BELLCRANK
ELEVATOR
MECHANISM
8-32 HEX NUT
GLUED IN PLACE
5/16" x 9/16"
HARDWOOD
MOTOR MOUNT
1/8" DIA.
LANDING
GEAR
BRACE
.014 PIANO WIRE
1/16" SHEET
LOOP & SOLDER
1 3/4" DIA. RUBBER WHEEL

THE "ZENITH"

WINNER OF THE 1938 NATIONALS

(BUILT RIGHT FOR PERFECT FLIGHT)

AIRCRAFT **AIRCRAFT**



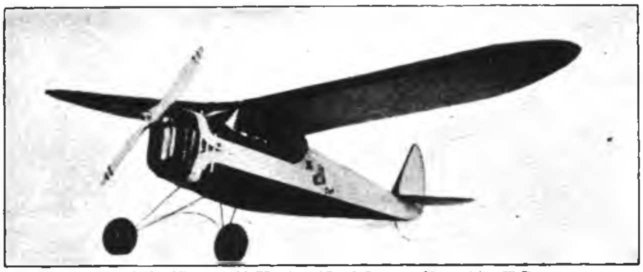
The model you will enjoy building and take pride in flying, because there is absolutely no guess work about its performance, in addition to winning first place at Detroit, it has consistently won first place in open competition all over the United States. Its ability to climb fast and glide perfectly places it above all competition.

Each kit contains:—full size detailed working plans, air wheels, extra strong wing ribs cut to perfect shape, select extra hard and firm balsa, cut smooth and straight, formed to shape spring steel landing gear struts, colored bamboo paper, cut out propeller, large can of cement and numerous other exclusive features, which space will not permit mentioning.

Wing span: 76 inches, weight: 3¼ pounds, recommended power: Brown Jr.

Price: **$5.50** plus 50c extra for mailing.

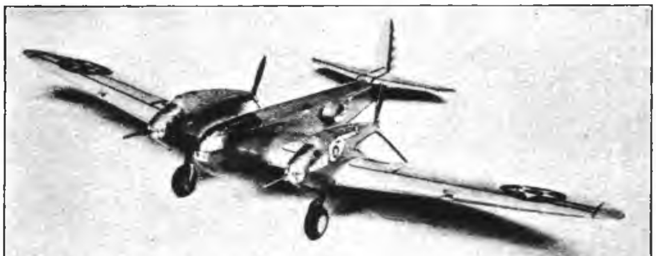
Brown Junior Motor—Model D—$10 complete



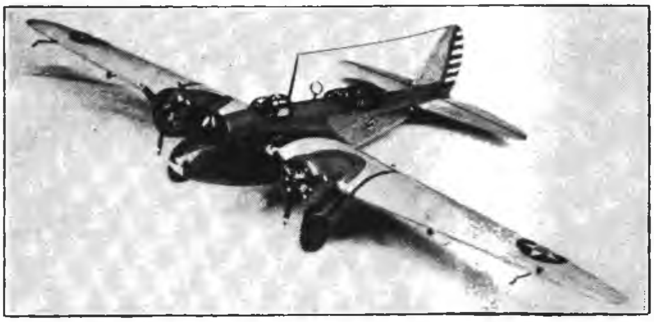
The "ZEPH" 42" span $3.75 plus 25c P.P. use ⅛ to 1/10 H.P. motor.

"REARWIN SPEEDSTER" 39" span $3.95 plus 25c P.P. use ⅛ to 1/10 motor.

Authentic One-Quarter Inch to the Foot Solid Scale Models

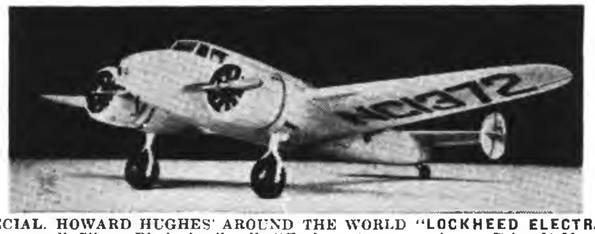


"BELL FIGHTER AIRACUDA" A perfect ¼" scale model of America's latest and most popular fighter. THE EAGLE OF THE SKY. Complete in every detail, body, wings, nacelles, and tail surfaces cut to outline shape. Color: Army yellow and blue. Wing span: 17". Price: $1.00 plus 25c for packing and postage.



MARTIN BOMBER

The U. S. Army's modern giant, ¼" scale. Wing span: 17". Color: Army blue and yellow. All difficult parts cut to shape. Price: $1.00 plus 25c for packing and mailing.



SPECIAL. HOWARD HUGHES' AROUND THE WORLD "LOCKHEED ELECTRA," 14" span, all Silver, Black detail, all difficult parts cut to shape. Price $1.00, plus 25c for packing and mailing.

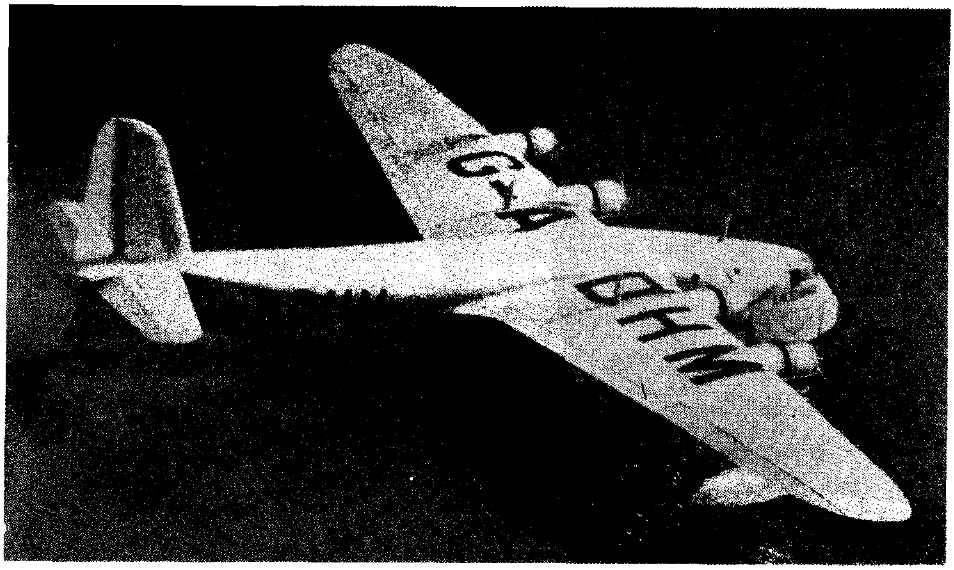
DOUGLAS TRANSPORT 22¼" span color all silver with black detail or blue and yellow as shown $1.50. Also furnished in 16" size at $1.00 plus 25c for packing and mailing.

NOTE. These are actual photographs of models built from AIRCRAFT kits.

WE ALSO MANUFACTURE A VERY EXCLUSIVE LINE OF 10c, 25c and 35c KITS

NATIONAL DISTRIBUTION dealers please write

AIRCRAFT, 4346-48 NORTH PULASKI RD., DEPT. B. 2., CHICAGO



by
William
Winter

From our cover to The Model Workshop comes an important new plane in a fine solid scale model, complete with miniature beaching gear.

Ocean Air-Liner

SHORT EMPIRE

THE Short Empire flying boat, designed for Imperial Airways' far-flung routes to the East and for the transatlantic service, is a giant as airplanes go.

The span of the four-motored monoplane is 114 ft., and the length is 88 ft. 6 in. The height from the water line when afloat is 24 ft. Construction is of metal throughout. For day service, 24 passengers are carried. As a sleeper, 16 passengers will be carried. The crew numbers five.

The four Pegasus 740 h.p. engines are expected to yield a top speed of approximately 200 m.p.h., and a cruising speed of 150-160 m.p.h. The wing flaps are of generous area and permit a reasonable landing speed.

Our 1/8" scale model is of the *Caledonia,* the second Empire boat of a series of twenty-nine to be constructed. It differs from the *Canopus,* the first to be completed, in that the *Canopus* is to be placed on the Mediterranean hop in the India service, while the *Caledonia* is said to be intended for Atlantic flights. Incidentally, the principal difference between these two boats that is evident to the eye is in the number of windows. Since the weight of the *Caledonia* is 5,000 lbs. more than that of the *Canopus* and as most of the windows have been omitted on the *Caledonia,* it is probable that interior arrangements are designed for larger fuel capacity on the ocean-hopping ship.

To start construction, trim a soft block down to the required outside hull dimensions. Draw the side profile of the body on the block and cut away the excess wood. On the top of the partially carved block, mark the top outline and again shave away the surplus wood. Round and shape the hull as required by the block cross sections given. Drill two holes for the 1/8" dowels. Sand the block to a satin finish.

Cut the tail surfaces from 1/8" sheet balsa and sand smooth, rounding the leading edges and pointing the trailing edges. Cement the finished tail units in position.

The wings are made in two halves and are cut from 1/2" balsa. Carve to the proper airfoil sections, checking with the patterns given on the plans. Slant the inner ends, which fit against the fuselage, to allow for the proper dihedral. Cut out sections in the leading edges to accommodate the engine nacelles and sand the finished panels. The nacelles are carved to the required shapes from 1" square balsa. After a trial fit, cement them in place. Provide small holes to take the pointed ends of the dowels and force each wing panel in place, using plenty of cement. The fillets are molded from wood filler.

Carve the wing tip floats to shape from 1/2" square balsa. After sanding them carefully, mount them on streamlined or rounded bamboo struts. Do not add the bracing threads until the painting has been completed.

The four propellers are cut from scraps and are mounted on pins so that they are free to turn. Note that they are all left hand, in accordance with European engine custom.

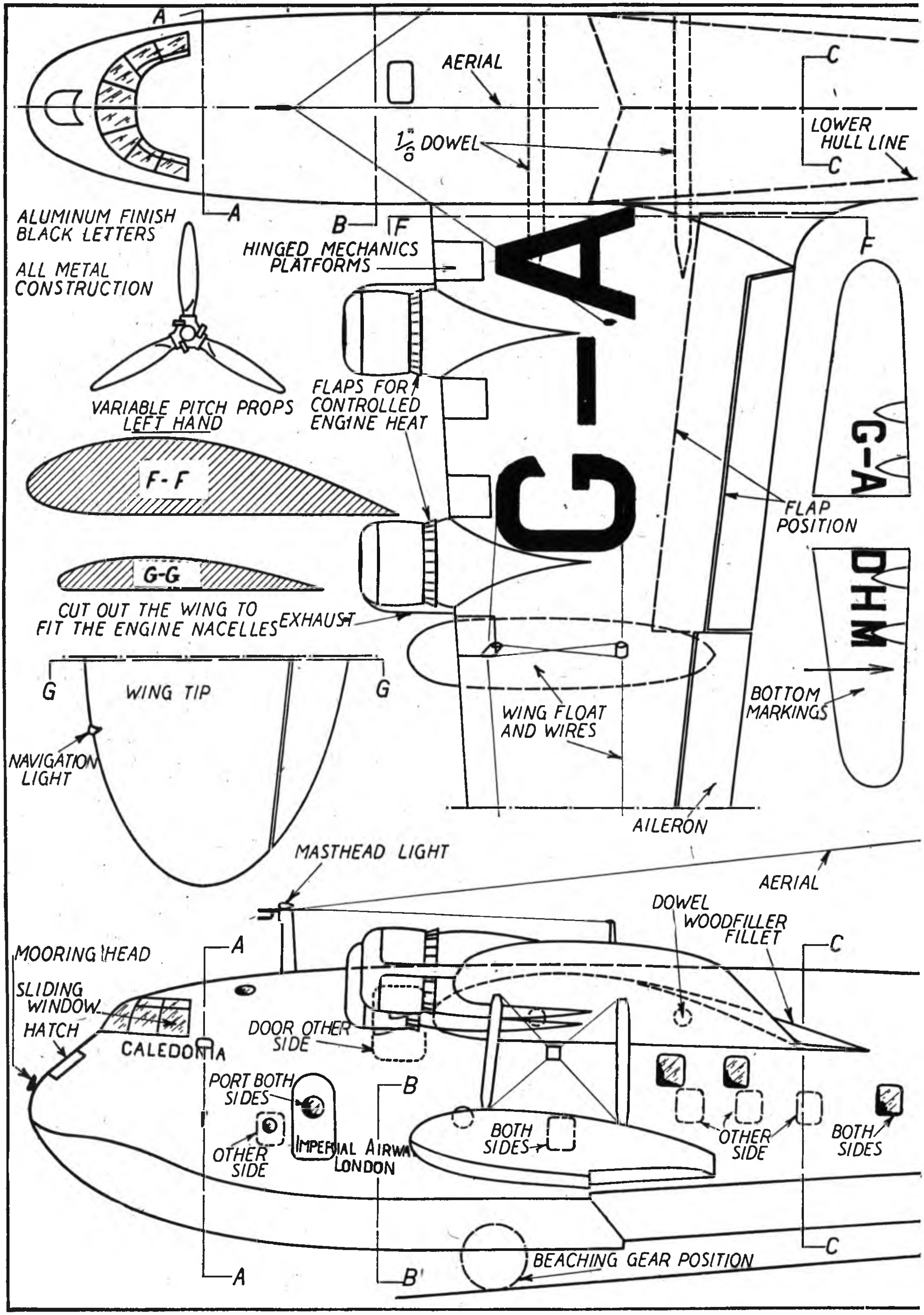
Give the model several filler coats of clear varnish, sanding lightly between each coat with very fine paper. Finish the ship in silver, making all trim and letters black. Put the thread bracing wires on the tip floats and construct the beaching gear and dolly.

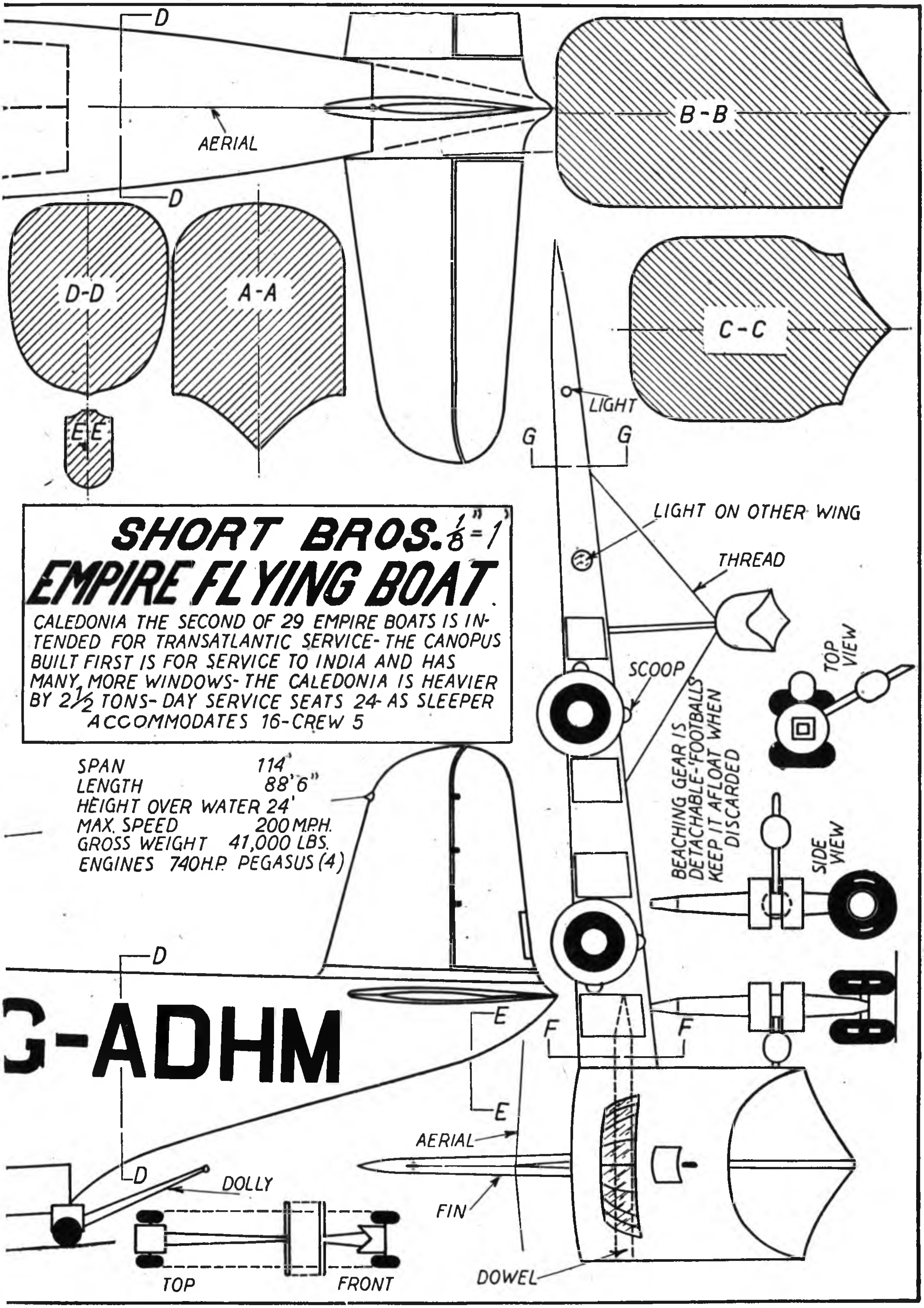
These last-named articles of equipment are used to facilitate the handling of the real Empire flying boats. A front view photograph of the beaching gear appeared in AIR TRAILS for October. The model beaching gear may be made demountable by embedding pins in it for attachment to the hull. To display the model, the beaching gear and dolly will hold far more attraction than a stand.

MATERIALS

1 11¼x2¼x1⅝"	1 18x⅛" dowel
1 ½x3x13"	1 ½" sq. x4"
1 ⅛x2x12"	½ oz. cement
1 ⅛x3x6"	clear varnish
1 1" sq. x8"	wood filler
1 1/16x⅛x6"	black #60 thread

silver and black paint


AERIAL
1/8" DOWEL
LOWER HULL LINE
ALUMINUM FINISH
BLACK LETTERS
ALL METAL
CONSTRUCTION
HINGED MECHANICS
PLATFORMS
G-AI
G-A
DHM
VARIABLE PITCH PROPS
LEFT HAND
FLAPS FOR
CONTROLLED
ENGINE HEAT
FLAP
POSITION
F-F
G-G
CUT OUT THE WING TO
FIT THE ENGINE NACELLES
EXHAUST
WING TIP
NAVIGATION
LIGHT
WING FLOAT
AND WIRES
BOTTOM
MARKINGS
AILERON
MASTHEAD LIGHT
AERIAL
DOWEL
WOODFILLER
FILLET
MOORING HEAD
SLIDING
WINDOW
HATCH
CALEDONIA
DOOR OTHER
SIDE
PORT BOTH
SIDES
OTHER
SIDE
IMPERIAL AIRWA
LONDON
BOTH
SIDES
OTHER
SIDE
BOTH
SIDES
BEACHING GEAR POSITION


SHORT BROS. 1/8" = 1'
EMPIRE FLYING BOAT.
CALEDONIA THE SECOND OF 29 EMPIRE BOATS IS INTENDED FOR TRANSATLANTIC SERVICE - THE CANOPUS BUILT FIRST IS FOR SERVICE TO INDIA AND HAS MANY MORE WINDOWS - THE CALEDONIA IS HEAVIER BY 2½ TONS - DAY SERVICE SEATS 24 - AS SLEEPER ACCOMMODATES 16 - CREW 5
SPAN 114'
LENGTH 88' 6"
HEIGHT OVER WATER 24'
MAX. SPEED 200 M.P.H.
GROSS WEIGHT 41,000 LBS.
ENGINES 740 H.P. PEGASUS (4)
D
D
AERIAL
B-B
D-D
A-A
C-C
E-E
LIGHT
G
G
LIGHT ON OTHER WING
THREAD
TOP VIEW
SCOOP
BEACHING GEAR IS DETACHABLE - 'FOOTBALLS' KEEP IT AFLOAT WHEN DISCARDED
SIDE VIEW
D
G-ADHM
E
F
F
E
AERIAL
D
DOLLY
FIN
TOP
FRONT
DOWEL

TED ENTICKNAP'S

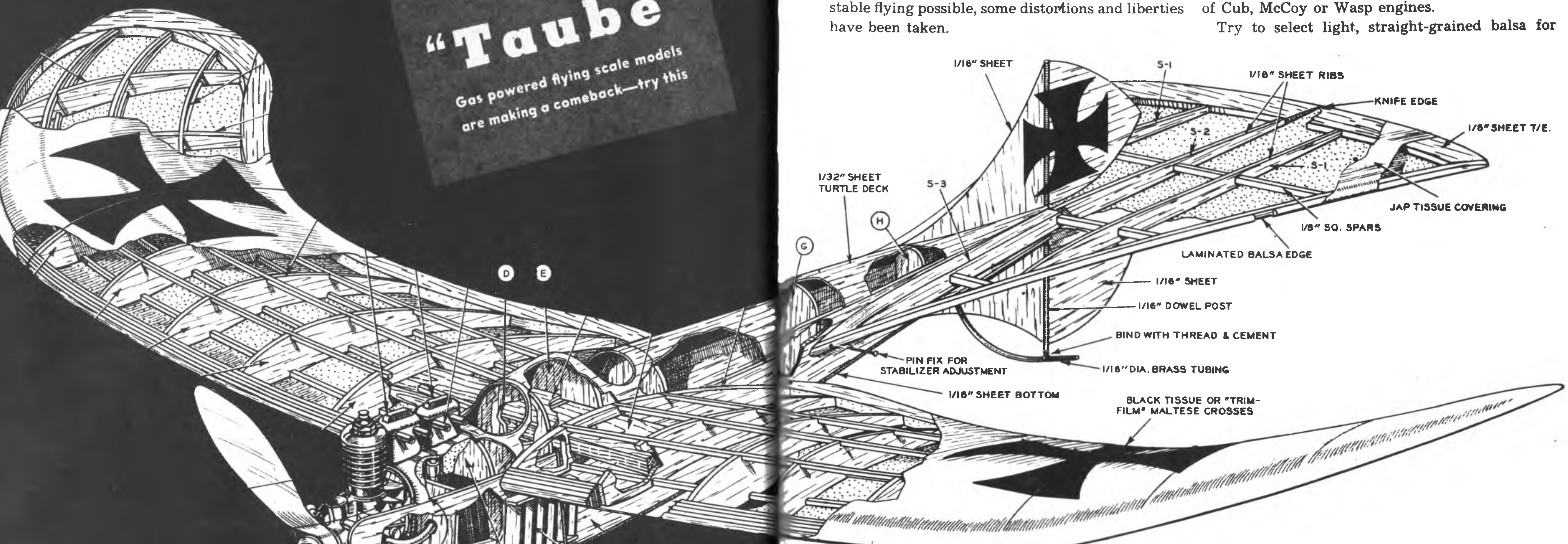
Rumpler "Taube"

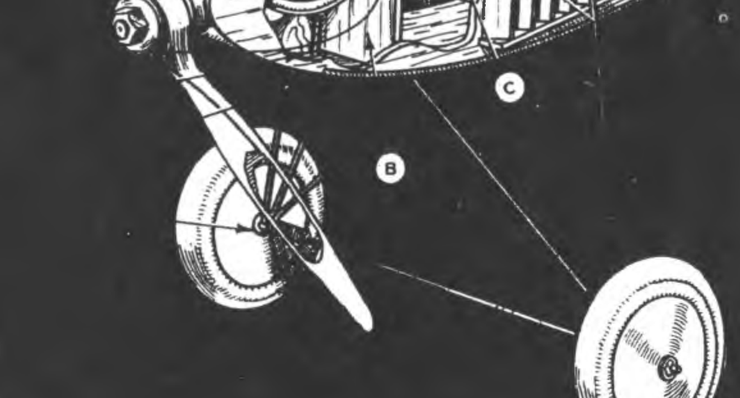
Gas powered flying scale models are making a comeback—try this

■ The bird-like *Taube* (meaning Dove) was outstanding in the early development of aviation. First built in pre-World War I days, the characteristic wing and tail shapes gave it close resemblance to its namesake. As a military craft, built by many German aircraft manufacturers early in the war, it was seen in a number of variations.

Our semi-scale model follows the *Rumpler Taube* version which was powered by a 100 hp Mercedes engine (the six cylinders being mounted in pairs) and achieved a 70 mph speed.

For realism in flight, the important scale features have been retained, but to make extended, stable flying possible, some distortions and liberties have been taken.





The complex external wing bracing wires are omitted, and the swept wing tips employ slight polyhedral rather than the sharply washed-out rigging of the prototype.

One feature, unique in any type of scale job, is that the *Taube* may be easily knocked-down for convenient carrying. British style plug-in wing panels and a removable stabilizer make this possible.

As to flyability, the model has exceeded our original hopes; its climb is comparable to most Half-A ships, the glide being very smooth and graceful. Ready to fly, the model weighs six ounces and—since it soars readily—the builder would do well to install some type of dethermalizer.

Other engines of Half-A size are adaptable, in fact the *Taube* will fly realistically on the tiny .02 Infant Torpedo. Plans show installation of the .045 Baby Spitfire engine, though very little difficulty will be had in modifying the nose for installation of Cub, McCoy or Wasp engines.

Try to select light, straight-grained balsa for fuselage sides—cutting them both from the same sheet if possible. This makes fuselage alignment easier.

Mark former locations on the sides and, beginning at the widest part of the fuselage, pin and cement the sheet formers in place.

Later add the bottom sheet and landing gear members. Build the wing "plug-in" box carefully, adding the center sheet bulkhead which assures the correct wing alignment. Engine mounting bolts are cemented firmly behind the firewall before installing it.

Dummy radiators add a bit of scale realism. However, the left one may be omitted if it interferes with timer or fuel shut-off installations. A timer cut-off can be installed in the front cockpit. Turtledeck sheeting is fitted and applied—the edge between the 1/16 inch sides and the 1/32 inch decking being sanded away.

Since some Half-A engines do not prime readily due to weak crankcase vacuum, the original model employed a gravity tank made to replace the rear dummy cylinders. Other tank installations are suitable. The simple aluminum exhaust shield or baffle is recommended to reduce the fire hazard and to keep the nose section clear of excess oil.

Thrust line can be raised if necessary in altering former "A" for installation of other engines, and the height of the dummy cylinders can be changed to match that of the engine's cylinder.

As modified from true scale, the wings are simple and efficient for model use. The curved, laminated leading edge is the only unusual aspect, and is another construction feature used widely in England. The strips are thoroughly water-soaked and, beginning with the inner one which is bent against a row of pins (working over the wing plan), the succeeding strips are pinned and liberally cemented to the proper outline. When dry the curvature is retained. Continue wing assembly with trailing edges, tip parts and ribs. Since the spar strips curve and pass the ribs at an angle, it is best to cut the notches in the outer ribs, as the spars (also water-soaked) are fitted.

Raise wing frame from the work board to add lower spars, then cut edges and spars as necessary to add polyhedral. Block to position and permit wing to dry thoroughly. The plug-in tongue should be mounted parallel to the work board when the wing is blocked to correct dihedral. Cement it firmly and later check to see that it makes a firm friction fit in the fuselage box. Round off leading edges, taper trailing edges and tips and sand.

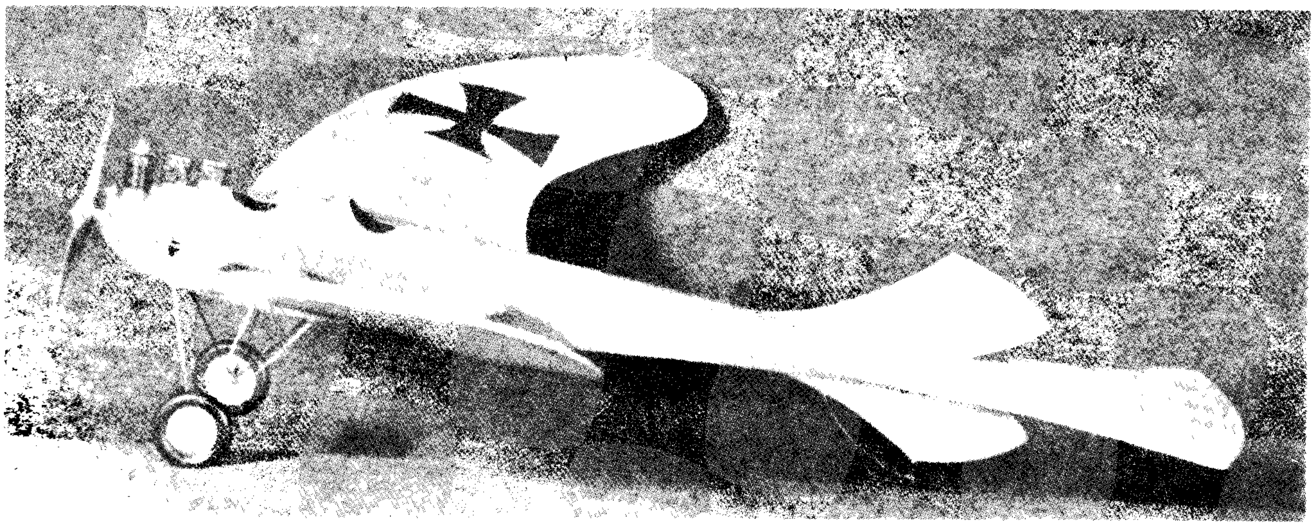
Laminated edges are used in the stabilizer, formed in same manner as the wing leading edges. Build the spars and ribs as one unit, the curved edges and trailing edge as another, then join the two after they have dried. Add the heavy inner ribs and sand the structure preparatory to covering.

Build the rudder of medium sheet, noting grain directions, and the small dowel stiffener. Tail skid is attached by binding and cementing as shown.

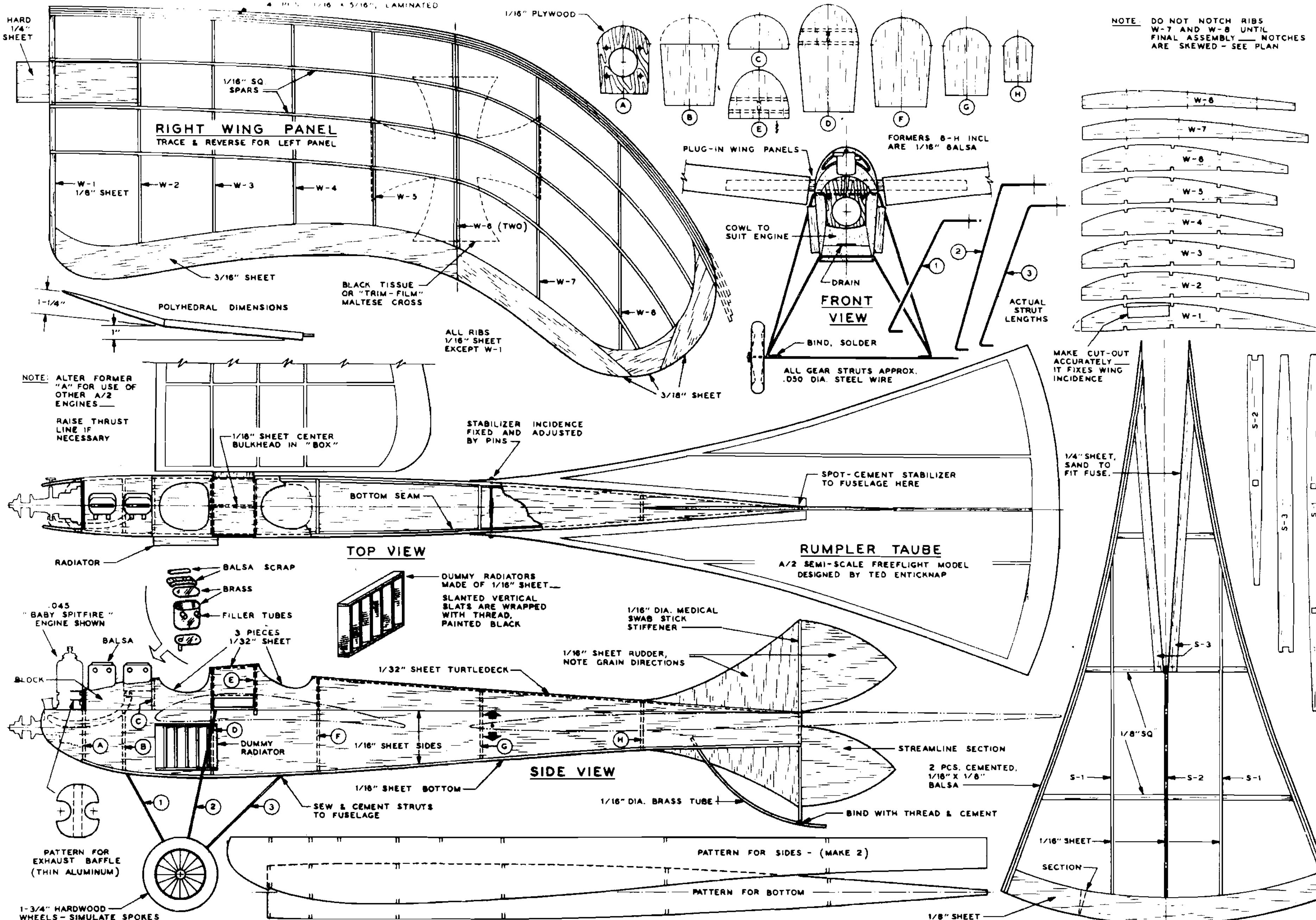
For once, dispense with the sponge donut wheels and dig up a pair of old-style hardwood wheels for realism. The gear struts are bent to shape, sewed and cemented to the fuselage, bound and soldered to axle. Simulate spokes by painting if desired.

Jap tissue is the covering material. We use and recommend Butyrate dope, which is used as ordinary clear dope but which is fuel proof and fire resistant. It is available in colors. Clear dope can be tinted or colored with dye, colors-in-oil, etc. Our *Taube* wings were left white with black Maltese crosses, the fuselage being painted a bright color. If you use Silkspan, add a plasticizer in the dope to avoid brittleness.

Balance the model near the back of the plug-in tongue. Add clay in nose or tail to achieve this C. G. location. Make hand glides to determine trim, adjusting stabilizer incidence as necessary. First power flights should be of short duration with rich setting. The *Taube* can be flown to right or left, although the original model climbed to the left in tight spirals and glided to left in large circles. Slight downthrust will likely be needed.



This model is a real flyer and has been in use for over a year. Ted has had some fine thermal flights; see unretouched photo on pg. 32.


RUMPLER TAUBE
A/2 SEMI-SCALE FREEFLIGHT MODEL
DESIGNED BY TED ENTICKNAP
RIGHT WING PANEL
TRACE & REVERSE FOR LEFT PANEL
HARD 1/4" SHEET
1/16" SQ SPARS
W-1 1/8" SHEET
W-2
W-3
W-4
W-5
W-6 (TWO)
W-7
W-8
3/16" SHEET
BLACK TISSUE OR "TRIM-FILM" MALTESE CROSS
3/16" SHEET
POLYHEDRAL DIMENSIONS
1-1/4"
1"
ALL RIBS 1/16" SHEET EXCEPT W-1
1/16" PLYWOOD
FORMERS B-H INCL ARE 1/16" BALSA
PLUG-IN WING PANELS
COWL TO SUIT ENGINE
DRAIN
FRONT VIEW
BIND, SOLDER
ALL GEAR STRUTS APPROX. .050 DIA. STEEL WIRE
ACTUAL STRUT LENGTHS
NOTE DO NOT NOTCH RIBS W-7 AND W-8 UNTIL FINAL ASSEMBLY — NOTCHES ARE SKEWED - SEE PLAN
MAKE CUT-OUT ACCURATELY — IT FIXES WING INCIDENCE
NOTE: ALTER FORMER "A" FOR USE OF OTHER A/2 ENGINES —
RAISE THRUST LINE IF NECESSARY
1/16" SHEET CENTER BULKHEAD IN "BOX"
STABILIZER INCIDENCE FIXED AND ADJUSTED BY PINS
SPOT-CEMENT STABILIZER TO FUSELAGE HERE
BOTTOM SEAM
TOP VIEW
RADIATOR
BALSA SCRAP
BRASS
FILLER TUBES
DUMMY RADIATORS MADE OF 1/16" SHEET —
SLANTED VERTICAL SLATS ARE WRAPPED WITH THREAD, PAINTED BLACK
.045 "BABY SPITFIRE" ENGINE SHOWN
BALSA
BLOCK
3 PIECES 1/32" SHEET
1/32" SHEET TURTLEDECK
1/16" DIA. MEDICAL SWAB STICK STIFFENER
1/16" SHEET RUDDER, NOTE GRAIN DIRECTIONS
DUMMY RADIATOR
1/16" SHEET SIDES
STREAMLINE SECTION
SIDE VIEW
1/16" SHEET BOTTOM
SEW & CEMENT STRUTS TO FUSELAGE
1/16" DIA. BRASS TUBE
BIND WITH THREAD & CEMENT
PATTERN FOR EXHAUST BAFFLE (THIN ALUMINUM)
1-3/4" HARDWOOD WHEELS - SIMULATE SPOKES
PATTERN FOR SIDES - (MAKE 2)
PATTERN FOR BOTTOM
1/4" SHEET, SAND TO FIT FUSE.
S-1
S-2
S-3
1/8" SQ
2 PCS. CEMENTED, 1/16" X 1/8" BALSA
1/16" SHEET
SECTION
1/8" SHEET
Thomas