Air Trails
MODEL ANNUAL
for 1943

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00 Plans and Features! GAS MODELS · RADIO CONTROL

RTIME BUILDING · WIND TUNNELS · HOW-TO-DO-IT PHOTOS

–On the Home Front

And aiding the boys out there fighting are countless model builders at home, who devote their activities to "keeping 'em flying."

Carl Goldberg, head designer for Comet Model Airplane Co., now doing defense work, teaches aeronautics during evenings.

Al Casano, of Passaic, N. J., uses his experience gained through model building to aid him in instructing women in aircraft construction work.

Frank Zaic works as a civilian draftsman for army and also is engaged in writing a simplified handbook for modelers.

Herb Weiss (left) and Hewitt Phillips (right) noted model designers and M. I. T. graduates, are now working as engineers with the Civil Service.

Dr. R. W. Hambrook, U. S. Office of Education, was one of the prime movers in promoting the school scale model program.

Paul Guillow, model manufacturer, demonstrates how his company "starts 'em flying" model airplanes constructed from non-critical materials.

Air Trails MODEL ANNUAL *for 1943*

On the cover, Bill Sutton, member of Air Training Corps of America and Isaac E. Young High School, New Rochelle, New York. Bill is an outstanding model builder and was awarded the rank of Admiral Aircraftsman for his participation in the navy identification scale model program. Color photo by Paul D'Ome.

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SPECIAL FEATURES

CONTROL-LINE FLYING

VICTORY SQUADRON

ENGINES

PLANBOOK OF FAMOUS PLANES AND MODELS

SOLID SCALE

SEAPLANES

GLIDERS

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25 CENTS
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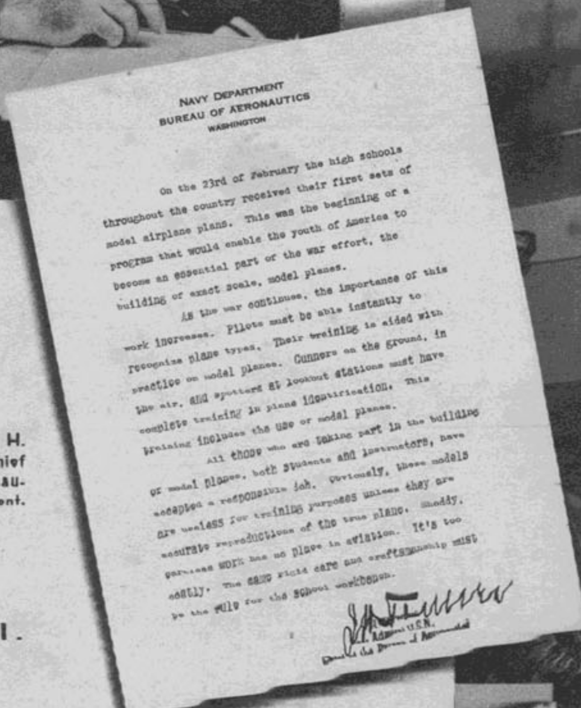
Wartime Model

Rear Admiral John H. Towers, U. S. N., Chief of Bureau of Aeronautics, Navy Department.



NAVY DEPARTMENT
BUREAU OF AERONAUTICS
WASHINGTON

On the 23rd of February the high schools throughout the country received their first sets of model airplane plans. This was the beginning of a program that would enable the youth of America to become an essential part of the war effort, the building of exact scale, model planes.

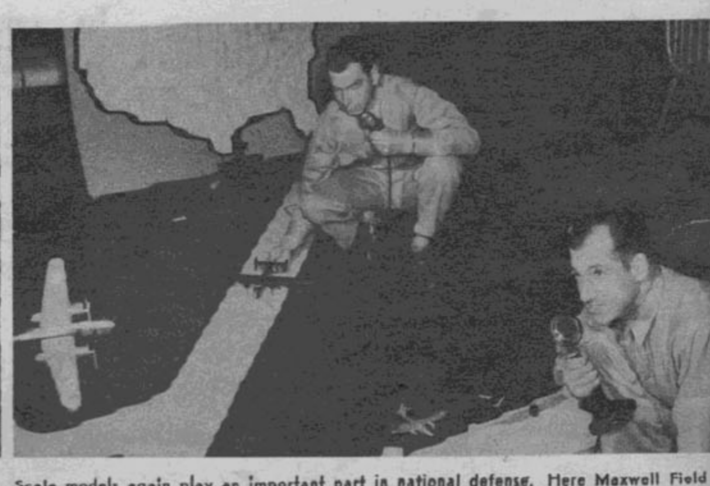
As the war continues, the importance of this work increases. Pilots must be able instantly to recognize plane types. Their training is aided with practice on model planes. Gunners on the ground, in the air, and spotters at lookout stations must have complete training in plane identification. This training includes the use of model planes.

All those who are taking part in the building of model planes, both students and instructors, have accepted a responsible job. Obviously, these models are useless for training purposes unless they are accurate reproductions of the true plane. Shoddy, careless work has no place in aviation. It's too costly. The same rigid care and craftsmanship must be the rule for the school workbench.

BY ROEL I. WOLFSON

Countless model builders have contributed their skill by building solid models of military planes, displayed wherever pilots congregate, to help familiarize them with the various types.

English girl antiaircraft students learn which are enemy planes through the use of models. Instructor points out salient points of Heinkel III H-E.



Scale models again play an important part in national defense. Here Maxwell Field army students learn control tower operation by using this miniature "airport."

Building

Despite curtailment of essential materials, model builders, schools and clubs are producing model planes vital to our national defense effort.

THERE is nowhere in the world where war isn't, and perhaps Mars thought he could do a little sneering from the modeler's bench. However, the model builder is having the last laugh, and a good, loud chuckle it is! Not only has the building of models adjusted itself to the need of materials for war production, but the model builder himself and herself has enrolled to pave the road to peace.

Last spring the navy needed scale models. Five hundred thousand accurate scale models of war planes, both those of the United Nations and those of the Axis, were required to train pilots and observers in identification of aircraft and for gunnery practice. The U. S. Office of Education proceeded to do something about it. Who, thought the office, could be better equipped for such a job than young people already interested in aviation and particularly those who were experienced in model building? The answer was found in the American schools.

A model-manufacturing company volunteered to draw up accurate plans for fifty different models, fifty accompanying template sheets and how-to-do-it charts. Dr. Robert W. Hambrook of the Office of Education, long a champion of model building as an aid in aviation training, called in a committee of experts and formulated with them a program in which pupils in grade and high schools would build the majority of models needed. Dr. Hambrook himself wrote a manual of construction. The plans and templates were put into kits, together with a copy of the manual, and presented to students of schools chosen by each State superintendent of education.

This, remember, could be no haphazard job. The types of aircraft must be instantly recognizable to the pilot of a military plane. Gunners on the ground and in the air must have no doubt about the kind of plane they are trying to shoot down. Observers in lookout stations must know exactly what aircraft are flying overhead so that raid warnings can be given in time. There was no room for careless work; the student model builders had to be accurate, had to use rigid care and craftsmanship.

They came through with a will. From schools and model clubs poured thousands of excellent models. They flowed into the hands of a waiting navy which was more than satisfied with the result. Honorary ratings were given to participants in the program who turned out a certain number of specified models. In Minneapolis and St. Paul the Academy of Model Aeronautics set up miniature production lines which

Andy Yeryzer with an electrically driven P-35. Model is used in free flight tunnel. Electromagnets activated by impulses transmitted by wire work controls.

Mr. Woodson, of England, started model building as a hobby, but soon became so proficient that he was employed by British government to make models for the RAF.

NACA modelers attribute their skill to model-plane building: construct wind-tunnel models from wood to tolerances normally required only in metal work.

Bob Crawford, facing camera, and Frank Wolak weigh in a navy Vought-Sikorsky XF4U-1 model for free-spin tunnel. This model has both rudder and elevator controls.

Wartime Model Building

were operated night and day by Twin City modelers who turned out hundreds of accurate craft. Other schools and clubs followed the Academy's example.

In late 1942, a new set of fifty plans was made. By the first of the year, school officials should have the first twenty plans of the new series. Dr. Hambrook has revised his construction manual, and modifications have been made in the specifications of several aircraft which were part of the first series. Obsolete models have been withdrawn and additional material, notably concerning Japanese ships, has been included.

An entire corps of model builders is listed in the regular personnel of Langley Field. Employed as full-time workers by the government, they construct exceedingly accurate scale models which are tested in miniature wind tunnels. The Virginia field is the testing ground for aircraft and new aeronautical developments. Necessary wind-tunnel testing cannot be done on full-sized planes because of wartime difficulties and the reproduction of aircraft in miniature is of vital importance. The modelers have civil service ratings; pressing demands have increased their number and Langley Field officials have issued a rush call for more.

For the first time, this year the high schools of the United States were officially enrolled in aeronautics. The High School Victory Corps is set up for aeronautical training, most important of which is preflight training. Here, for the first time, is official recognition that the future of American aviation lies in the hands of its youth. Model building is an integral part of the training program, for the construction of models is a great help in understanding the principles of flight.

A use for model building that results directly from the war is its value in remedying part of war's effects. As occupational therapy—having the patient make things—model building has been found exceedingly effective. Wounded members of the military forces are constructing airplanes in miniature. It's interesting to note that model making has been found so relaxing and fascinating that RAF pilots are turning to it for leisure-hour enjoyment. There's no pleasure so constructive as that of putting together a model aircraft; military hospitals and bases unhesitatingly state its value.

Many uses have been found for the little ships in different branches of military aviation. Radio-controlled models, for example, are widely used for antiaircraft-gun practice. The craft, exact duplicates of enemy planes, are sent into the air. Gunners can seek out weak spots and practice aiming by studying the flight of the little Heinkels, Messerschmitts and Zeros. Maxwell Field finds still another use for scale models. Maxwell, headquarters of the Southeast Army Air Forces Training Center, has a terrific amount of air traffic. In a special school designed to teach airport traffic control operation, models are used on a miniature airport to train control-tower operators. Throughout the country, it's model building for victory!

Wind-tunnel models require extreme accuracy and many hours of work. Engineers depend upon findings of tests for predicting full-scale results.

A classroom demonstration model equipped with astro compass, an extremely accurate instrument used by navigators for computing a course from stars.

Many of the RAF pilots find model building a very pleasant hobby as well as educational form of relaxation.

Model building plays a very important part in preflight training courses of New York Military Academy Cadets.

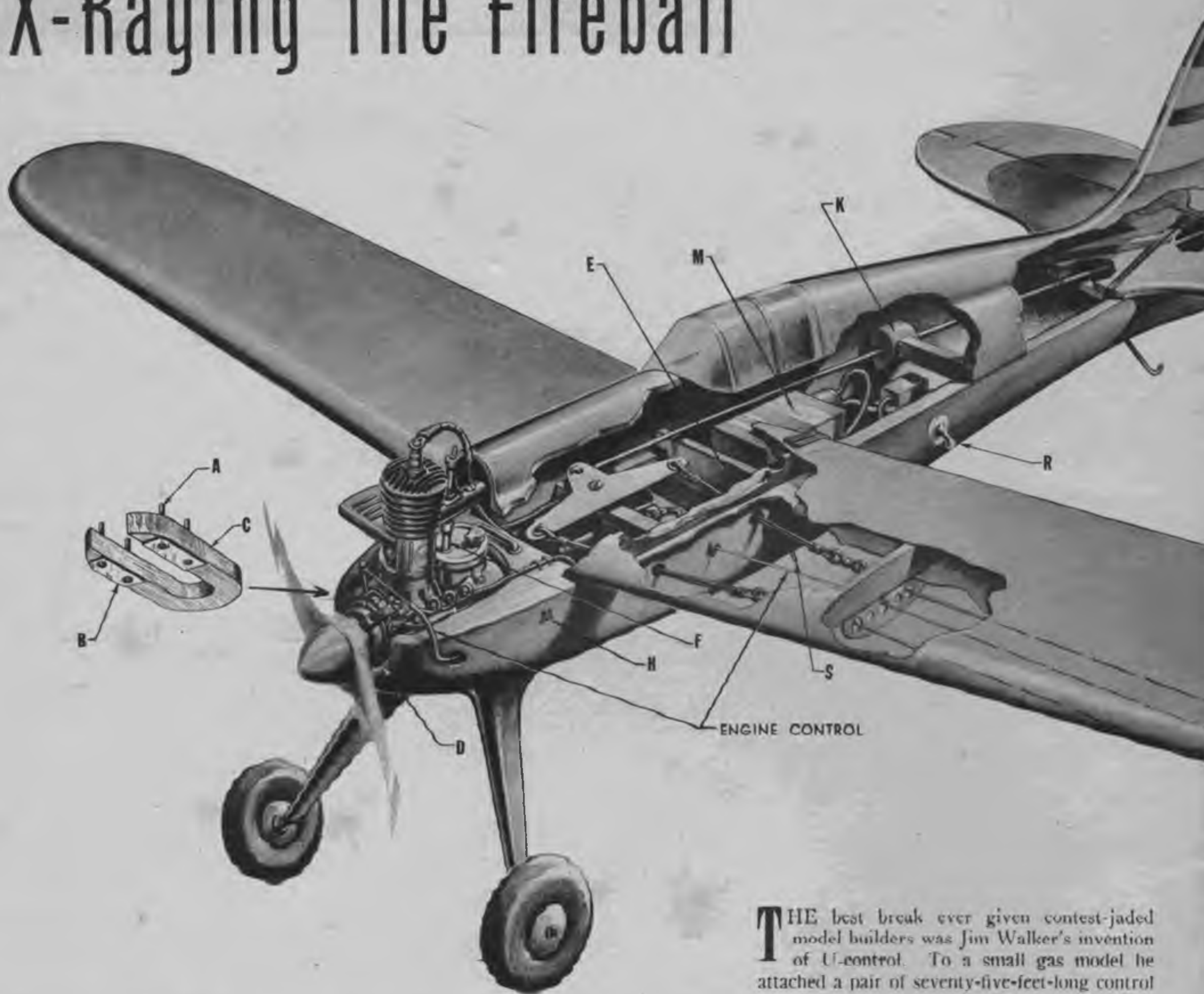
Model of Brewster for use in free-flight wind tunnel. "Pilot" controls model from cockpit in tunnel floor.

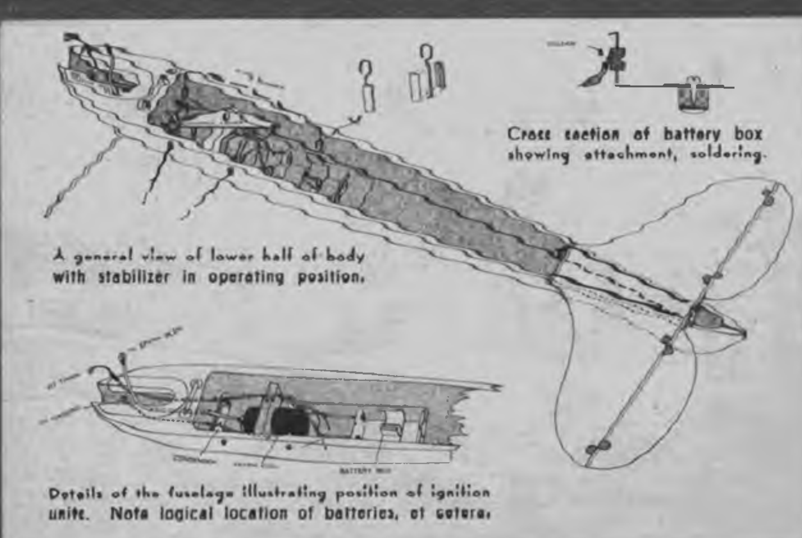
A production line for identification scale models made in Canadian technical schools for use with the CRAF.

Control Line

CONTROL LINE FLYING

X-Raying The Fireball





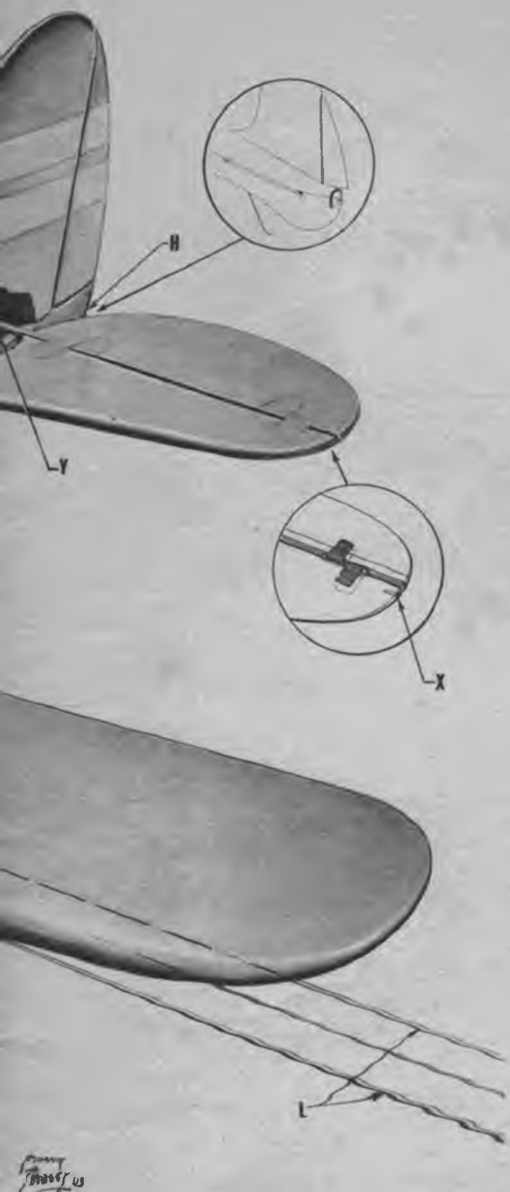
Cross section of battery box showing attachment, soldering.

A general view of lower half of body with stabilizer in operating position.

Details of the fuselage illustrating position of ignition units. Note logical location of batteries, et cetera.

THE best break ever given contest-jaded model builders was Jim Walker's invention of U-control. To a small gas model he attached a pair of seventy-five-feet-long control wires, running from the "pilot's" hand to a bellcrank inside the flippers. Tilting the ends of a U-shaped control stick moves the elevators up and down, causing the model to climb or dive. With practice, even inexpert fliers can do aerial tricks. Experimenters have looped their Fireballs. Walker flies his ship upside down by not completing a loop. Appreciative mechanics, clerks and office workers began to organize speed contests. Models screeched away at 100 m. p. h. The biggest thrill was flying detailed duplicates of famous fighters.

Control-line flying has its fine points. The flier should have the wind at his back always. The model must be dived into the wind. Tension must always be maintained on the lines or the model heads into the circle. The ship is almost certain to slide off toward the pilot if it is climbed against the wind. On these pages are shown details of the America Junior's plans for assembling and flying a Fireball.



A 4-40 or 6-32 Machine Screws.

B Brass or tin sheet. Solder bolt heads to sheets to prevent stud turning.

C Motor mount showing stud fixing detail.

D Trim fuselage back to allow point band to clear ⅛", thus allowing freedom to adjust points. Install ¼" thick balsa bulkhead carved to fit here to carry loads. Note: When cementing motor mount in place, have bare motor bolted to mount while cement dries, thus keeping studs from misalignment due to cement shrinkage.

E ⅜" thick balsa battery bulkhead.

F Neoprene fuel line. Use (Type B) carburetor, Red-top needle valve, and Fireball metal tank. Inlet motor mount and fuselage to accommodate fuel tank.

H Dress hooks—top and bottom halves of fuselage. Hold together with rubber bands.

K Fairlead (IMPORTANT) to keep drag link from buckling. Make from split dowel and ¼" sq. balsa strut.

L Control-line leads. 45-lb. fish line (DOUBLED) with swivel snaps installed at ends.

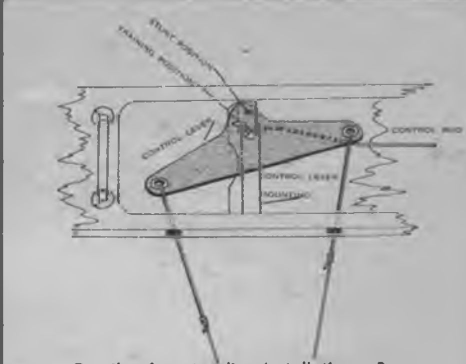
M Model airplane battery. (Minimum 4 cells must be hot.) Ignition installation must be neat and accurate.

R Toggle switch.

S Sub wire through bottom of fuselage tailed to battery side of coil for booster battery. Use alligator jaws on booster battery leads. Ground other booster lead on motor exhaust stack for starting. Always use booster battery for starting motor.

X Flipper hinge tubes aluminum ⅜" long. Cement in place and reinforce with cloth as shown. Hinge pin wire .028" or .034" music wire.

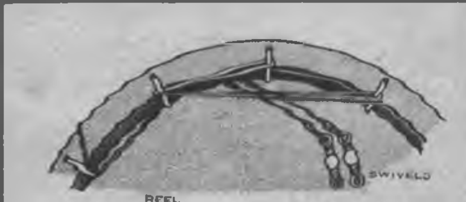
Y Elevator horn. Solder well with good fillets. Bind to elevator torque spar with silk thread and cement.



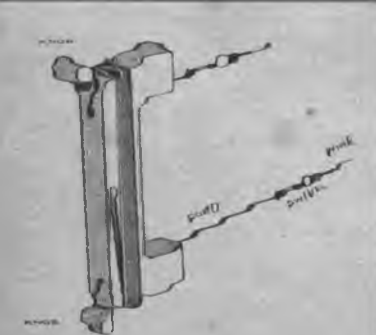
Details of control-line installation. Be sure that lines pass freely through the fuselage.

Assistant holds plane for take-off. Lines must be taut at all times for good control.

Most model builders hold the U-control in their left hand; engine control in right.

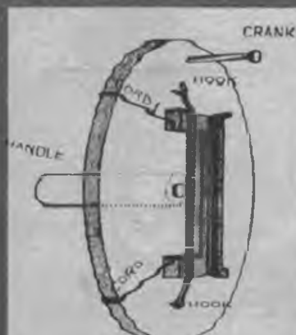


Details of the reels, showing how a rubber band is used to keep lines from tangling.

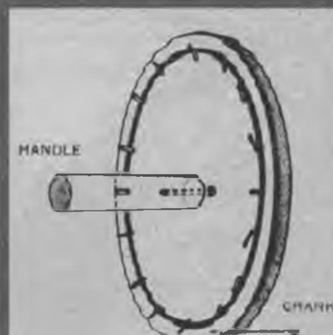


A typical U-control handle. Note notches so surplus rope may be used. Always use swivel connection.

Primary flying position control for level flight, diving and climbing.



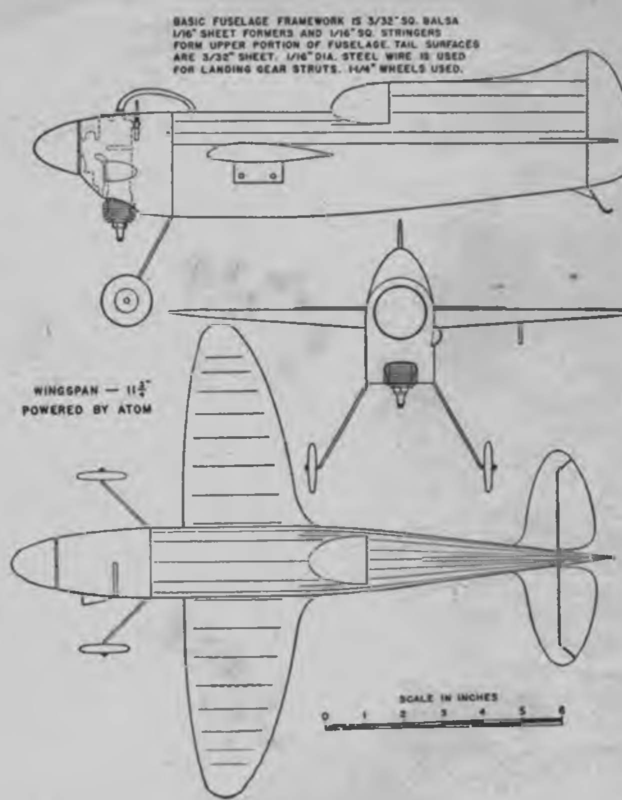
A wooden reel is recommended to keep the control wires from tangling.



Reel for the control lines shown from the handle side.

Whirligig

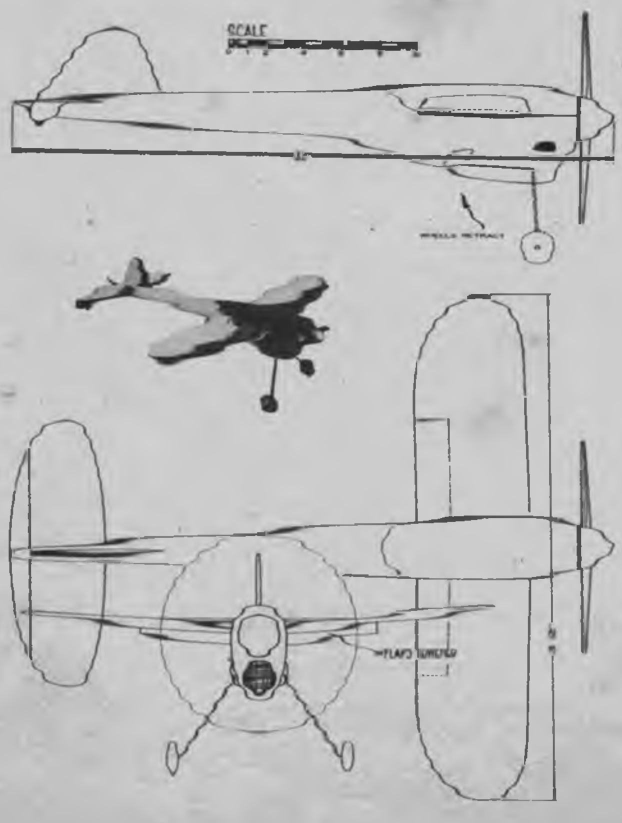
BY LLOYD V. HUNT



CONTROL-LINE flying has zoomed its way into the workshop of almost every modeler in the country. But some builders have not the powerful motors necessary for speed for big ships. So I sat down and designed a very small model for the Atom. The first one I built had a nine-inch span, but when in flight it would spin, so I changed it. I made the span ten inches long and made the stabilizer bigger. After that it flew very well for its size. In building a model of this kind it should be made of one-eighth-inch material for the body and one-sixteenth sheet for the formers. The stabilizer and rudder should be made out of one-eighth-inch material and then sanded down to size. I found that a model of this size should have no warpage at all. If it has it will not fly. The coil and batteries should be about in the middle of the center of gravity. Your rudder should be turned about five eighths to the left or right, whichever way you are flying it. The wing construction should be made very strong because of the strain. I found that a thin airfoil gave more speed. The ship should be hand-launched. The control lines can be made out of strong fish line, twenty to twenty-five feet long. I feel that in the future there will be many models of this size and different designs, and I am sure that the boys who build them will be very much pleased.

Spitfire

BY EARL CAYTON



THE Spitfire was designed and built exclusively for participation in tethered-speed events. Efficient streamlining, correct proportions and a few uncommon gadgets make it a threat in any controlled-flight contest.

Since wind-tunnel tests on models prove that pod and boom fuselage designs offer least drag, this principle was used for better streamlining. A large spinner faired into the pod reduces frontal drag. The pod is designed just large enough to cowl completely the motor and its accessories, the control-line system, the retractable landing gear, and the throttle, switch and flap mechanisms; it is then faired neatly into the boom.

Inefficient speed and incorrect proportions are common causes of failure to win events. The Spitfire's lifting and control surfaces are designed only large enough to retain stability. But the exhausts are of a size large enough to let the hot air from the motor out of the cowling efficiently.

Guide-liners have long needed a method by which to land "hot" control models safely. A tethered model has such a high wing loading that, when the motor cuts, the craft loses flying speed and practically falls to the ground. Some modelers whirl the lines of their ships; a few use timers, a difficult technique. To solve the problem, a system was devised by which the "hottest" speed racer may be easily landed. With a third line, the motor is throttled just enough to keep up flying speed. A fourth line is used to bring the flaps and landing gear down and cut the motor; the model then settles safely to the ground.

Above: the old-fashioned method of control. Right: the streamlined version that uses all nonessential materials.

Control Line Pylon

BY LARRY EISINGER

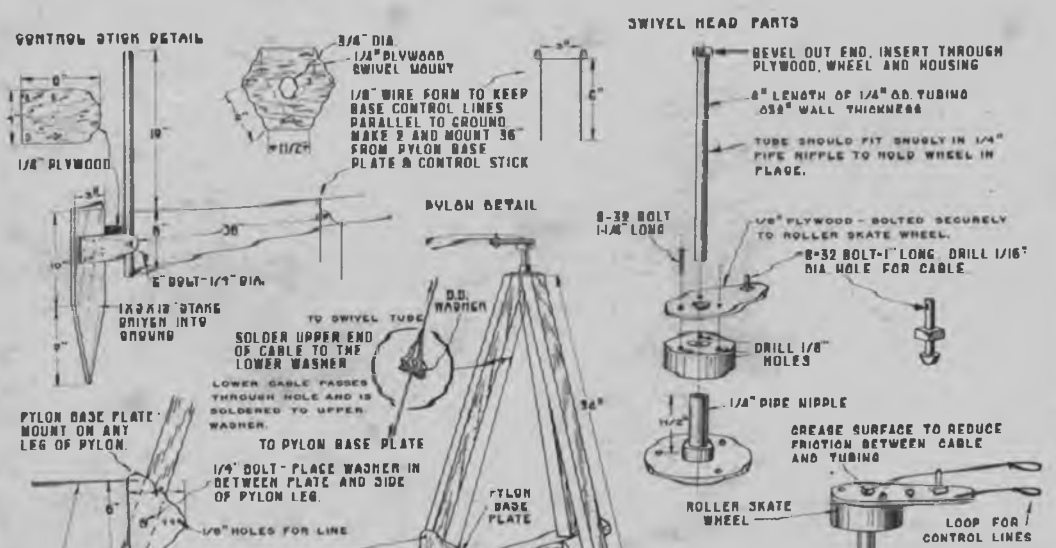
Now you can cease being a whirling dervish! Use this new control idea to eliminate needless dizzy spells.

THE pylon method makes landing even the "hottest" job simple and successful. On the outer wing tip is a toggle switch with a six-foot extension arm. When the model is low enough to contact the three-foot upright in the path of the extension arm, the switch is cut and the model lands gently.

The pylon is essentially a swivel head onto which the control lines are attached. Simple lever arrangements produce impulses relayed through lines. The pivoting control stick is mounted two feet outside the circular flight path. At the stick bottom, three inches from the pivot point, one base control line is attached; the other is fastened three inches up from the pivot point. Both lines pass along the ground to the pylon, where the ends are attached to the base plate.

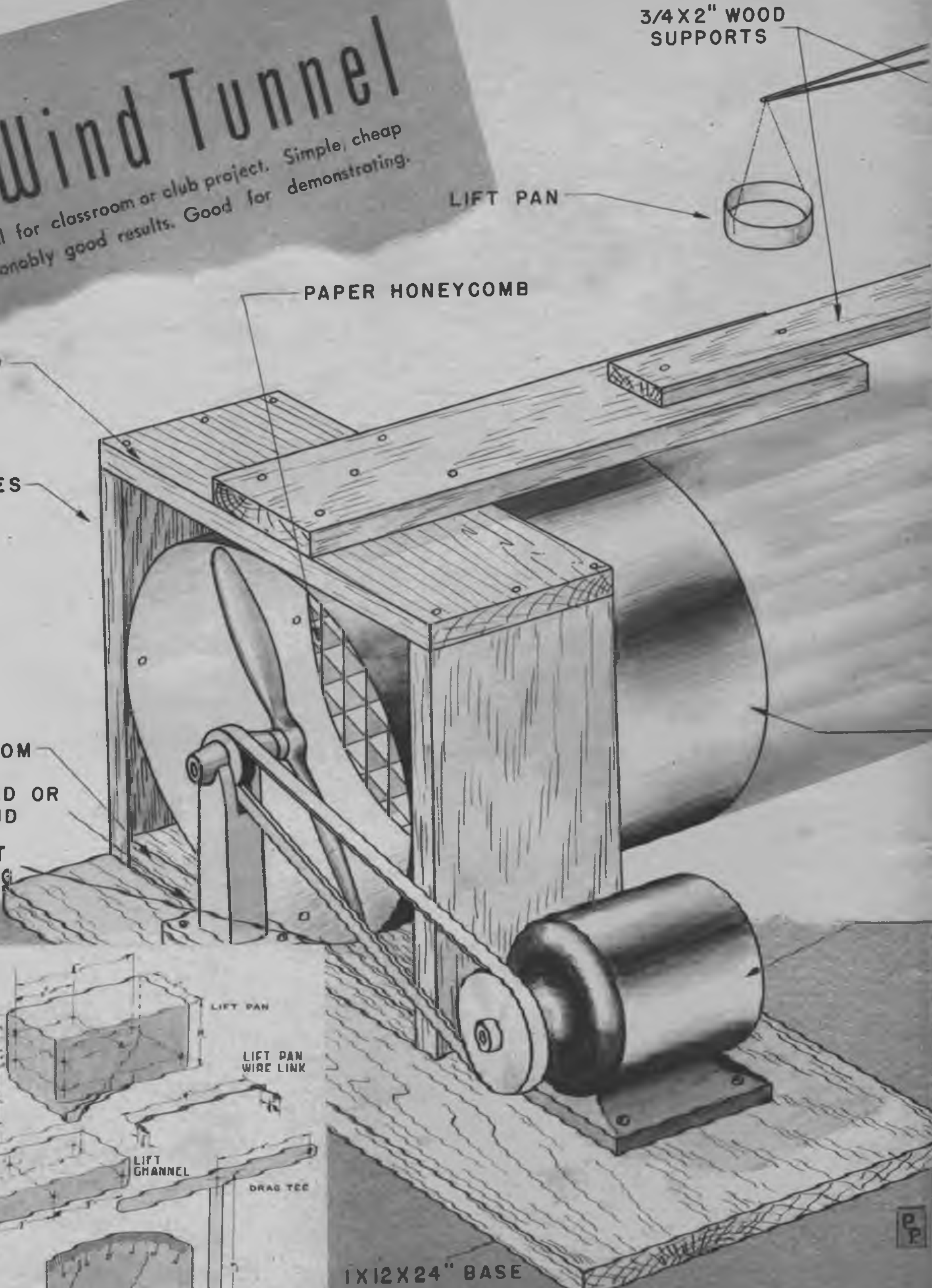
If pressure is applied to the movable lines by pushing the stick forward, the control mechanism moves the elevators. The base control lines must be so attached that up-elevator movements result from a pull back on the stick and down-elevator movements from a push forward.

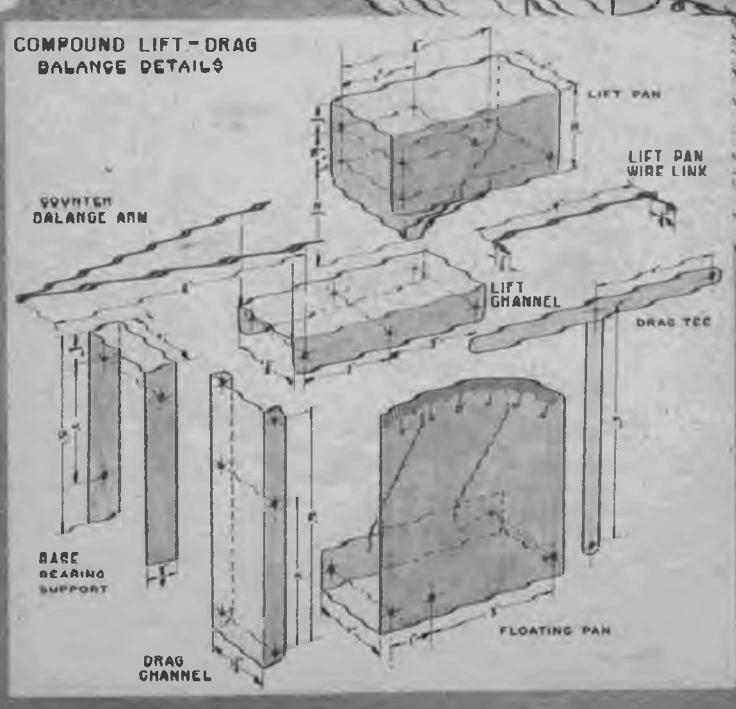
Stand the pylon in the center of the field by driving wire stakes into the ground. The control stick and seat should be so located that the model flies directly into the wind when passing in front of the operator.



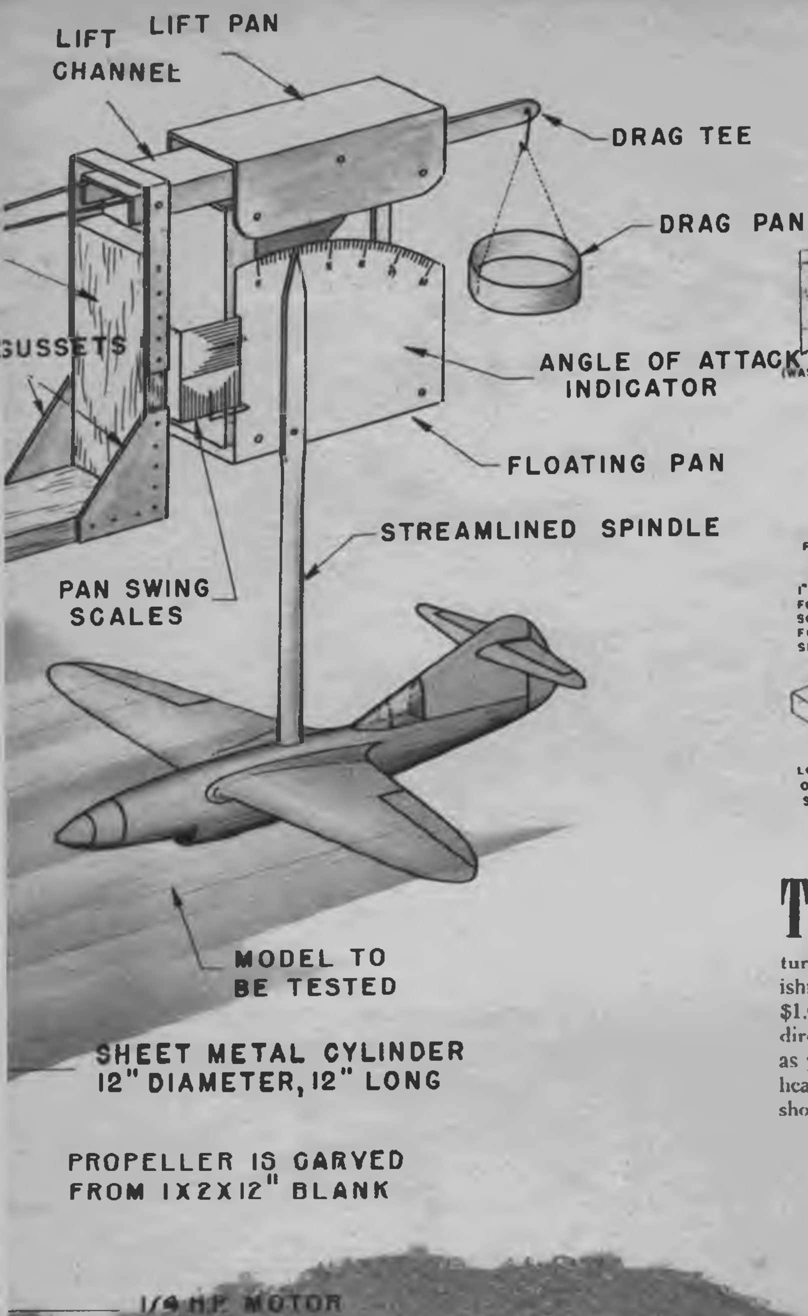
Model Wind Tunnel

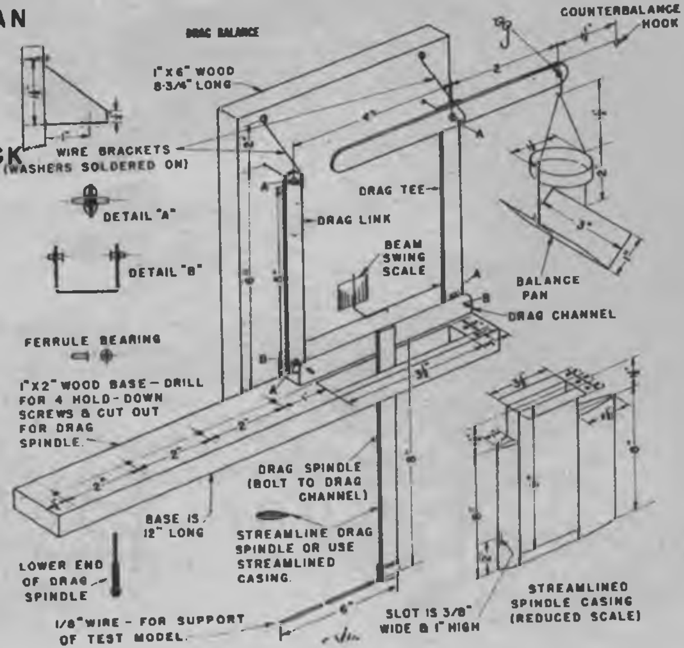
This wind tunnel is ideal for classroom or club project. Simple, cheap to build, will give reasonably good results. Good for demonstrating.



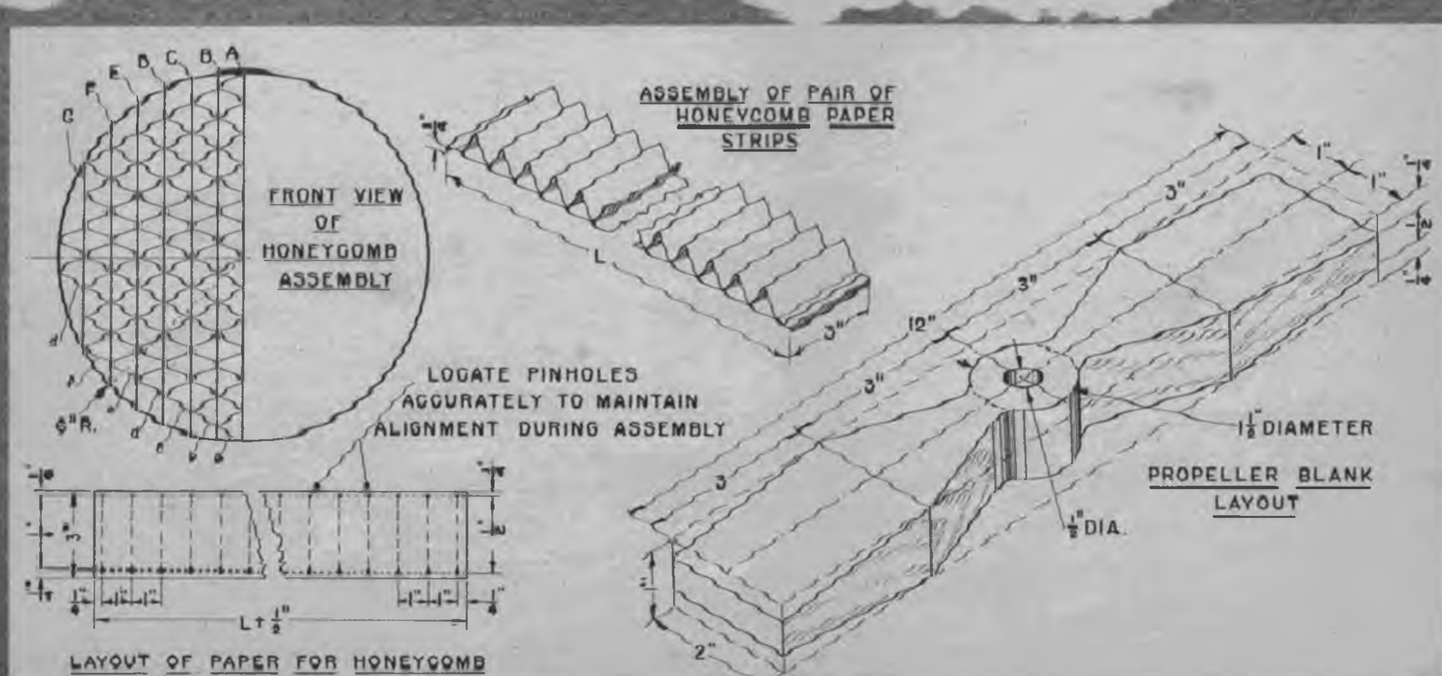


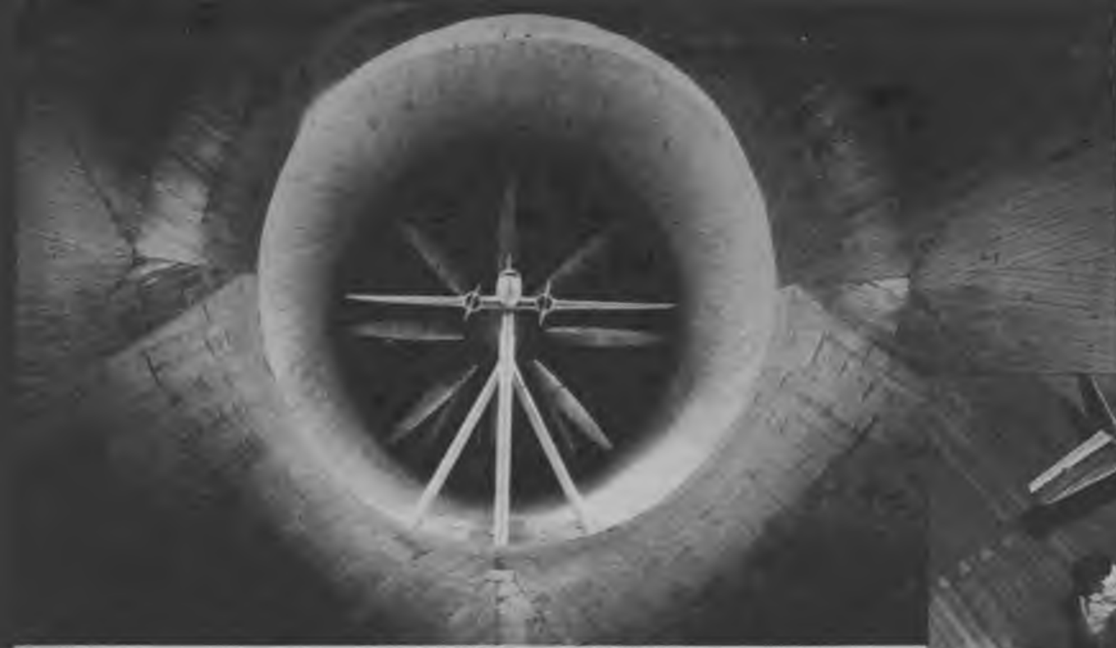
Above is the assembled wind tunnel with lift-drag balance in place. Left, various metal parts and, top of opposite page, the working principle of the balance. The paper honeycomb is essential to smooth out twisting air-flow as it comes from propeller. If you have motor, expense is small.





THIS 12" diameter wind tunnel and compound lift-drag balance is suitable for demonstrating the laws of aerodynamics. The air-jet speed is about 34 m. p. h. when a quarter-horsepower motor is turned at 5,500 r. p. m. Cost is $5: motor pulley and belt, $1.00; polishing head, $1.00; wood, 50 cents; sheet metal, $1.50; miscellaneous, $1.00. The prop is carved either right or left hand, depending on the direction of rotation of the motor. The motor pulley should be as large as possible without stalling the motor. The honeycomb is made from heavy drawing paper. Have the sheet-metal cylinder made in a tin shop.





Even the docile airliner is thoroughly tested in the interests of safety. Compare size of model with man beneath. Some tunnels have variable density, others supersonic winds.

How would you like to have this Mustang? Surfaces of models are finished to an accuracy of within a few thousandths of an inch.

Wind Tunnel Test

Five years before you see a new bomber or fighter a scale model is put through a wind tunnel to reveal flaws, make improvements.

HOW fast will it fly? How can we make it go faster? Is it stable? Will it recover from a spin quickly enough?

These and a thousand other questions are being answered every day by means of wind tunnel models at the National Advisory Committee for Aeronautics labs, Langley Field; at various universities, and by a number of major aircraft manufacturers who try to save time by running their own tests. Solid models, accurate even to the position of the center of gravity, spin free in vertical tunnels to test their recovery when a timer moves the rudder. Larger built-up scale models of real machines are flown, without any attachment whatsoever, in the supporting stream of air blasting through the tunnel. Only a tiny hair wire connects an electromagnetic gadget which moves all the working controls, in response to operator's movements of control stick located in the special cockpit in tunnel floor.

Wind tunnel models grow larger and larger. Man-carrying models of ships like the Stirling, Mariner have been flown. Actually, they are nothing but overgrown wind tunnel models. When is a model a model, and not a real plane?

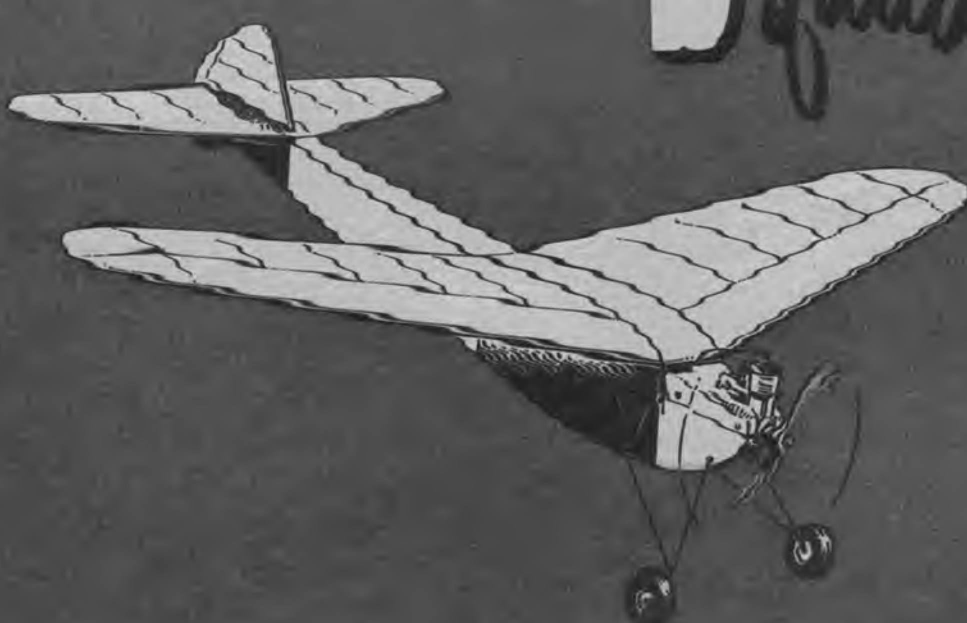
Takes a master model maker for this job. Many laminations of mahogany are used for accuracy. Tunnels heat up, require cooling.

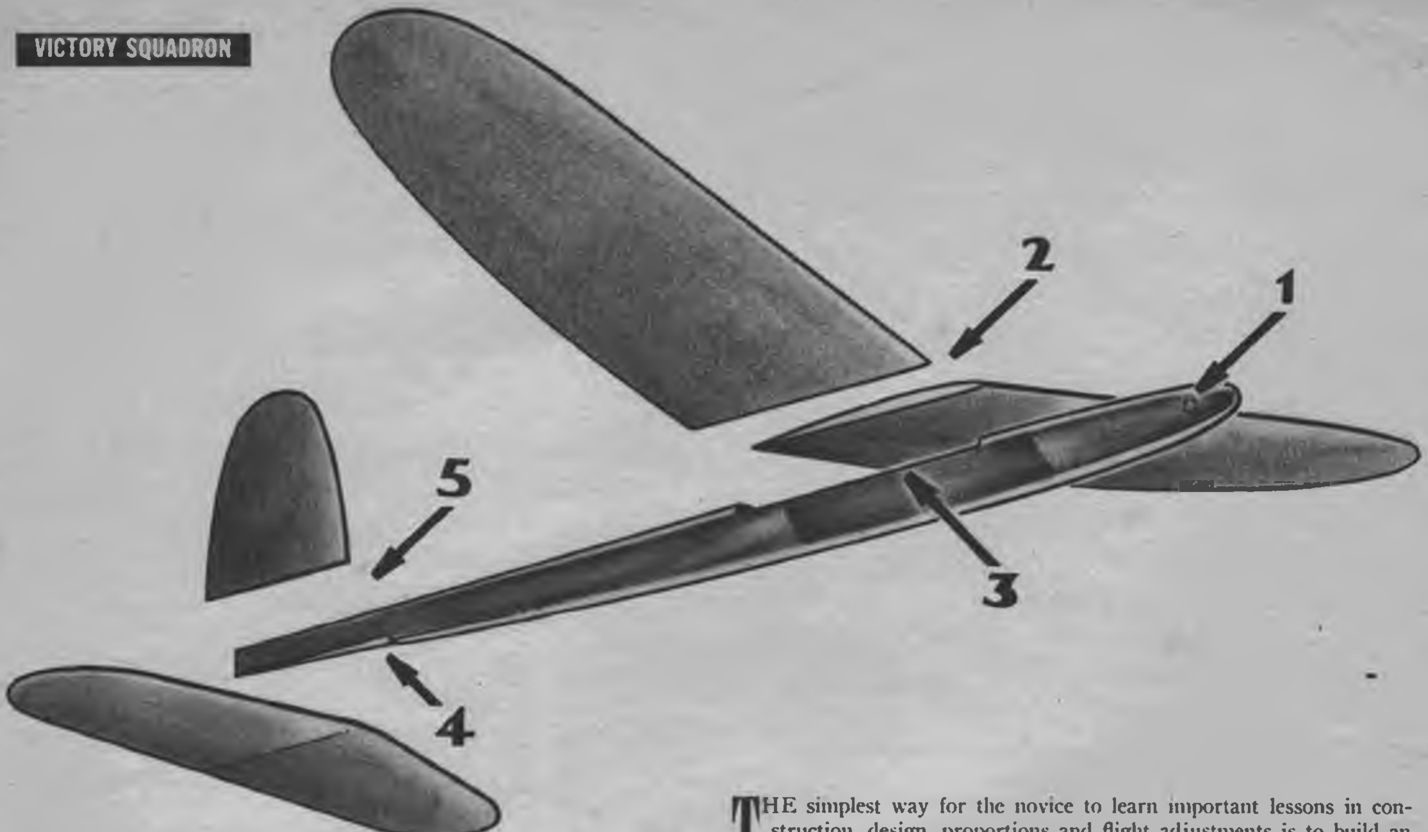
What model builders dream of. This complete shop at Boeing turned out $10,000 model of the Stratoliner, among others. Body was of spun aluminum made in sections.

Test pilot Eddie Allen investigates automatic control system of baby Stratoliner. Miniature electric motors drive propellers to simulate flying.

Four modern designs—simple hand-launched glider to a swell-performing gas model. These are tested projects, ideal for class instruction.

Victory Squadron





Kiwi

BY LARRY EISINGER

Although "Kiwi" is a nickname for beginner, you'll discover this Kiwi performs as well as any contest design.

THE simplest way for the novice to learn important lessons in construction, design, proportions and flight adjustments is to build an elementary glider. Not only an instructive project, it provides a lot of fun in flying. Such simplified design does not sacrifice performance, either, for many of these gliders have flown away from hand-launched starts.

From a straight-grained piece of hard balsa, cut the fuselage outline. Taper it at the rear as shown, rounding the nose and corners. Check the angles and sizes of wing and stabilizer notches. Sand the fuselage and dope it lightly. All other parts are cut from uniformly soft balsa. After being cut to outline, tail surfaces may be finished with a sandpaper block, using a fine grade of sandpaper. Taper them toward the tips, sanding the trailing edges somewhat thinner than the leading edges. Dope these parts and finish by sanding lightly.

Cut the two wing halves to proper outline. Now we come to the most important step in building the entire glider—shaping the wing section. Study the sections on the plans and begin by trimming the trailing edge with a sharp penknife. Long, thin slivers can be easily trimmed from such soft wood, permitting accurate shaping. Using the sandpaper block again, the wings are smoothed to final shape and the dihedral angles are beveled as shown. Dope the wings; follow with light sanding.

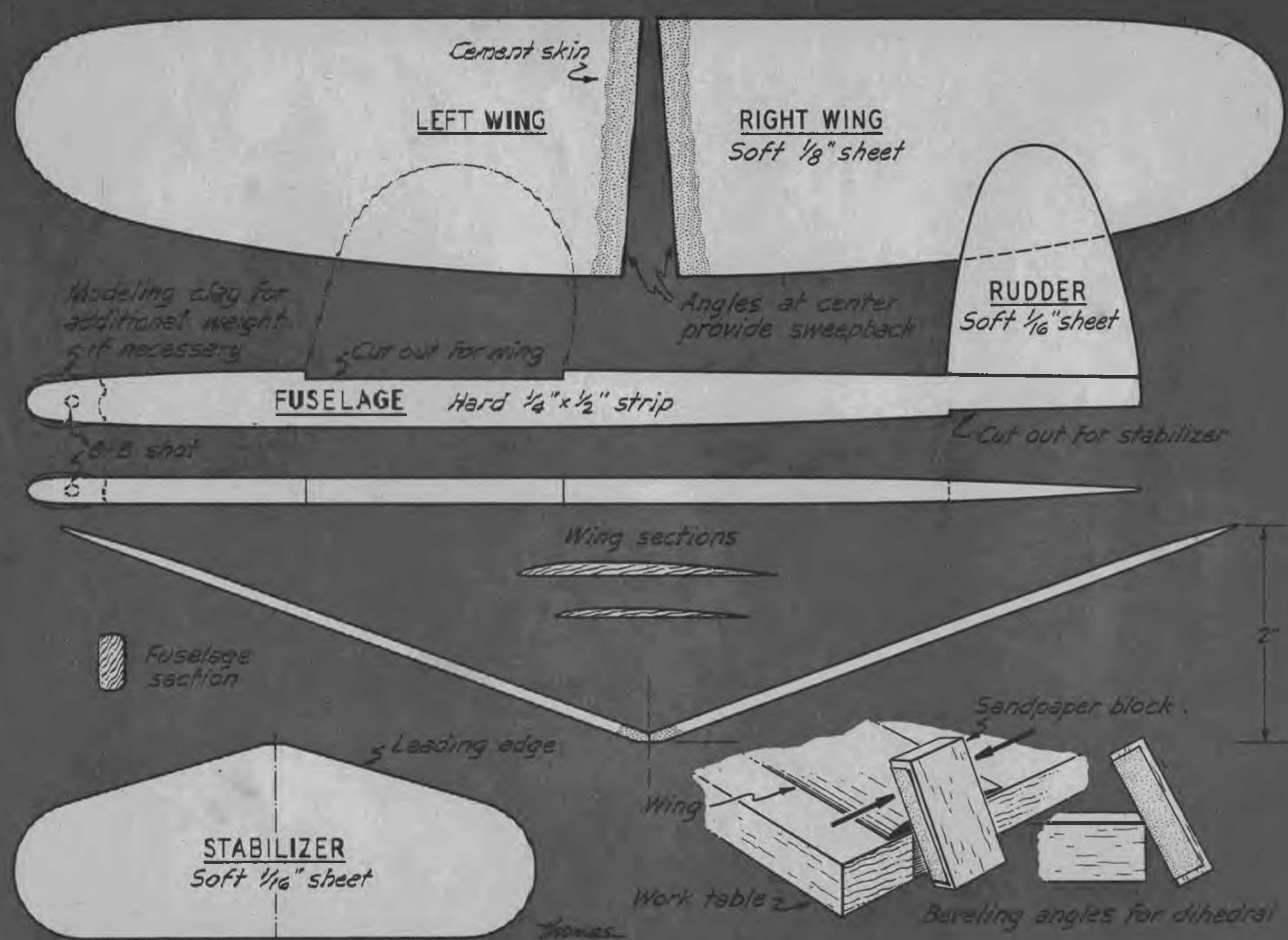
Here are the simple steps in assembling the glider:

1. Install B-B shot in the nose for weight; 2, Join wing halves at proper dihedral, using cement liberally. 3, Cement wing into fuselage notch; 4, Cement stabilizer to fuselage; and 5. Attach rudder. Check alignment of all parts.

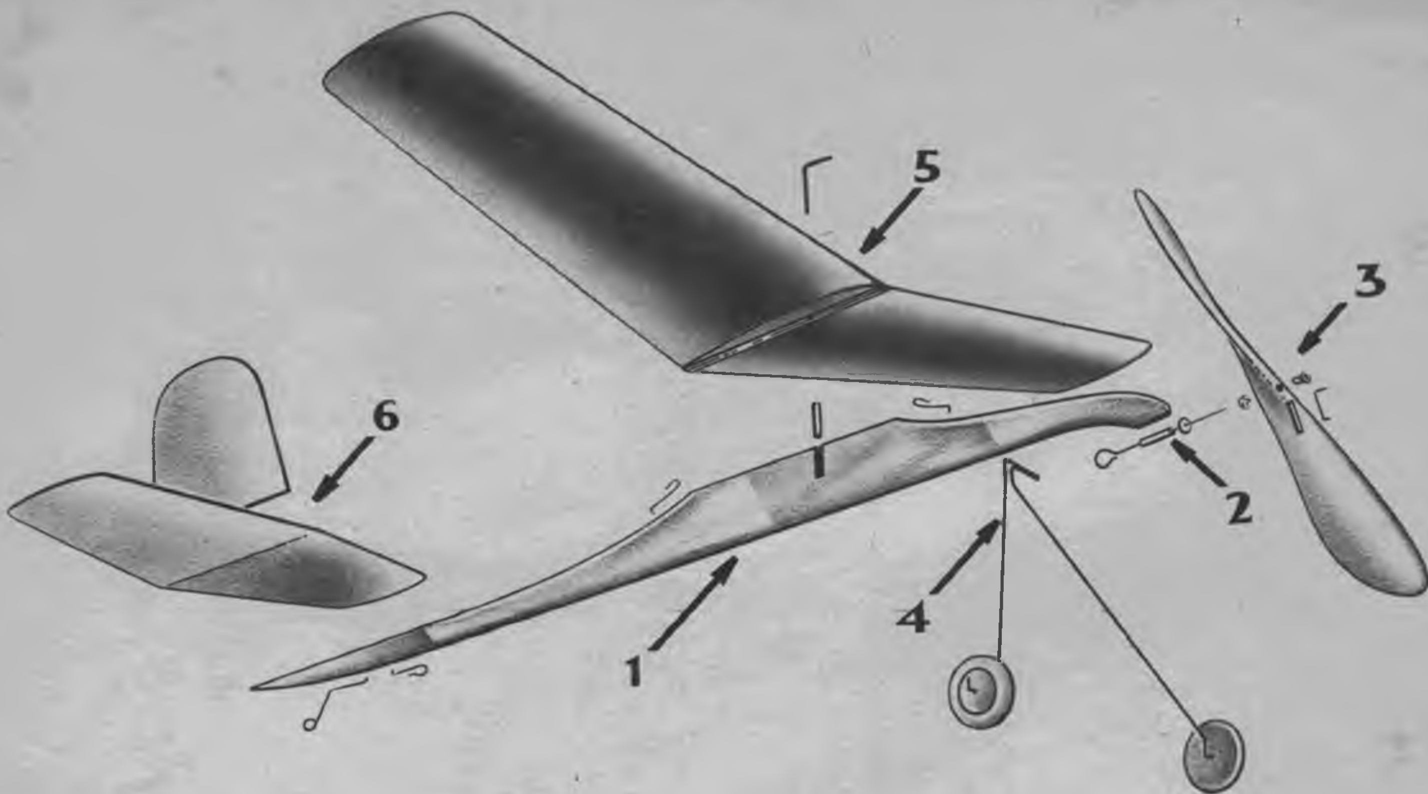
The glider should balance at a point about one-third of the wing chord from the leading edge. Add modeling clay to the nose if the model is tail heavy. Make first glides from shoulder height, tossing the glider gently with wings level and nose slightly depressed. Adjust the weight in the nose until a smooth glide is attained. Slightly warping the rudder will give gentle turns as desired.

Experts' methods vary, but one way of getting long flights is as follows: With the glider adjusted for left turns, it is launched at high speed with the right wing down. Its normal left turn adjustment causes the model to slowly recover from its starting position, resulting in a zoom with the model completely recovering at the top of the zoom. Some modelers prefer to launch the glider with the index finger held against the wing trailing edge. Others simply grasp the fuselage firmly between the thumb and index finger. The actual heave is similar to a pitcher's sidearm delivery. The point is to make the glider level out at the top of its launch, retaining all possible altitude.

When you've completely mastered the construction and flying of simple gliders you'll find the construction of more advanced models easy.



Cement skin
LEFT WING
RIGHT WING
Soft 1/8" sheet
RUDDER
Soft 1/16" sheet
Modeling clay for additional weight if necessary
Cut out for wing
Angles at center provide sweepback
FUSELAGE
Hard 1/4" x 1/2" strip
Cut out for stabilizer
B-B shot
Wing sections
Fuselage section
2"
Leading edge
Sandpaper block
Wing
STABILIZER
Soft 1/16" sheet
Work table
Beveling angles for dihedral



Cadet

BY LOUIS GARAMI

Here's the 1943 streamlined version of the all-time popular Baby r. o. g. Instructors—try this on your classes!

COVERING, more than any other phase of model building, stumps the beginner. So the smart thing to do, in order to build a simple flying model, is to make it of sheet balsa. Later, after becoming more adept through the construction of sheet models and more confident after seeing them fly, you can successfully tackle a built-up model.

The selection of proper weight balsa of even texture largely determines the performance of sheet-balsa models. Carefully pick out straight-grained wood of soft, light weight for the wing and tail group; medium weight for the propeller block, and hard for the fuselage.

Begin actual construction by tracing the fuselage outline on the 1/8" sheet balsa. Trim and sand the fuselage to shape, rounding the edges except where the wing and tail are to be attached. Trace wing formers, wing and tail group from 1/16" sheet. With a sandpaper block, taper the wing halves and tail group toward the tips by sanding them on a smooth surface. With very fine sandpaper, round off the edges.

Mark the propeller block, cut along the diagonal lines, and also taper the back of the block slightly as indicated. With a sharp knife, carve the back or under surfaces of the blades with a slight amount of under camber. Carve the front of the blades, checking them against each other for thickness and shape. Round off the tips and sandpaper the entire propeller. Apply a coat of dope and sand lightly again. Balance it on the edge of your knife and add additional dope to the lighter blade.

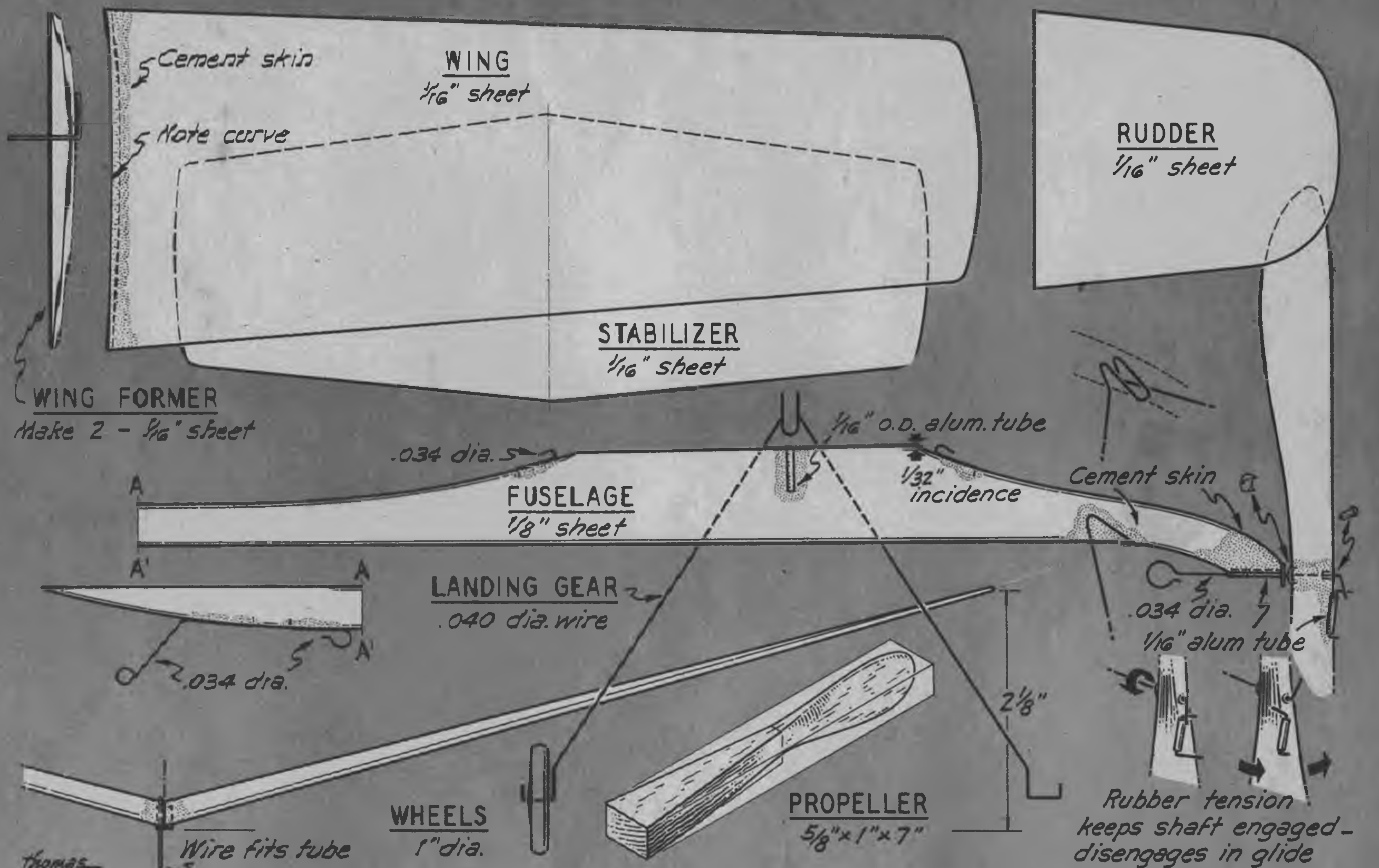
Bend the wire landing gear, attaching the wheels before bending up the axle ends. Also bend the wing-attachment wire, propeller shaft, wing hooks, tail skid, rear hook, and the small wire for the free-wheeler. Cut proper lengths of 1/16" aluminum tubing for the thrust bearing, free-wheeler, and the wing-attachment fitting. A large washer is used with the aluminum tube for the thrust bearing.

Assembly

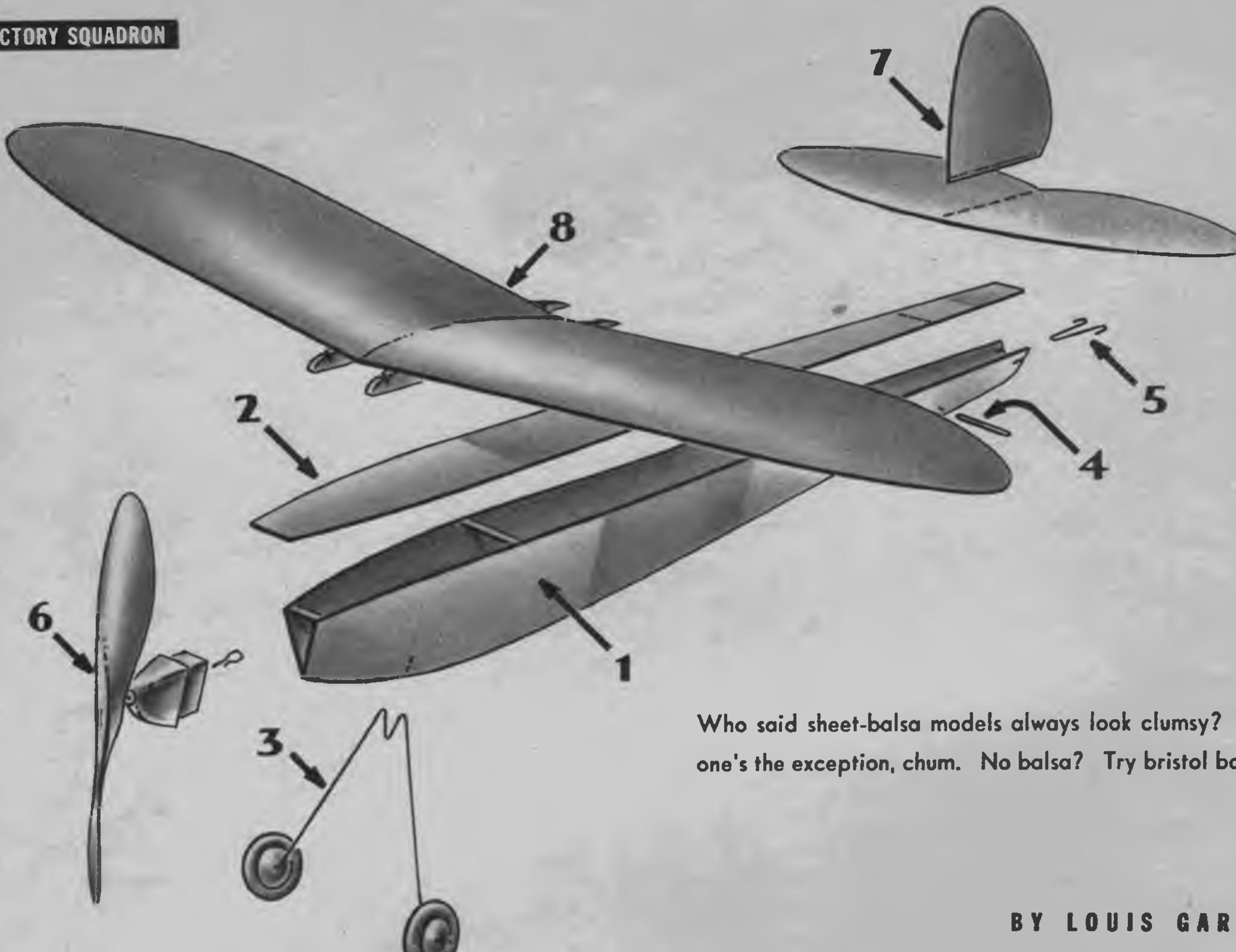
There are six steps in the assembly of this model. As shown on the sketch, they are:

1. Attach wire fittings and wing attachment tube to fuselage.
2. Assemble thrust bearing and propeller shaft.
3. Mount bearings for shaft in propeller and install free-wheeler.
4. Attach landing gear.
5. Cement wing formers in place, with aid of pins, and join wing halves. Install wire fitting.
6. Cement rudder to stabilizer and cement entire tail group to the fuselage.

Install four strands of 1/8" flat rubber with little or no slack. The rubber motor may be lubricated if desired. The model should balance even with the wing fitting. Bits of clay, stuck to nose or tail, may be used for final balancing. Check all surfaces for warps, then test-glide the model. When it is adjusted for smooth glides, wind the motor 100 turns and launch it into the wind. For maximum flights, put a little oil on the thrust bearing and wind the motor from the rear with a winder.



WING
1/16" sheet
Cement skin
Note curve
WING FORMER
Make 2 - 1/16" sheet
STABILIZER
1/16" sheet
RUDDER
1/16" sheet
1/16" O.D. alum. tube
.034 dia.
1/32" incidence
FUSELAGE
1/8" sheet
Cement skin
A
A'
A
A'
.034 dia.
LANDING GEAR
.040 dia. wire
.034 dia.
1/16" alum tube
2 1/8"
PROPELLER
5/8" x 1" x 7"
WHEELS
1" dia.
Wire fits tube
Thomas
Rubber tension keeps shaft engaged - disengages in glide



Who said sheet-balsa models always look clumsy? This one's the exception, chum. No balsa? Try bristol board.

BY LOUIS GARAMI

Commando

THE modeler usually feels that he is out of the beginner's class upon completion of his first "fuselage" model. And rightly so, for he can expect improved performance and more realism in return for his efforts. Here is the ideal first fuselage model for beginners—one that will also please advanced builders.

For even weight distribution it is important to carefully select sheet balsa of the same even, light texture. Avoid the use of hard balsa for this model. Using three-inch-width sheet, cut wing halves, tail group, and fuselage sides and top from the full-size patterns included in the plans. Lightly sand the edges, smoothing the curves. Fuselage sides and wing halves may be sanded in pairs.

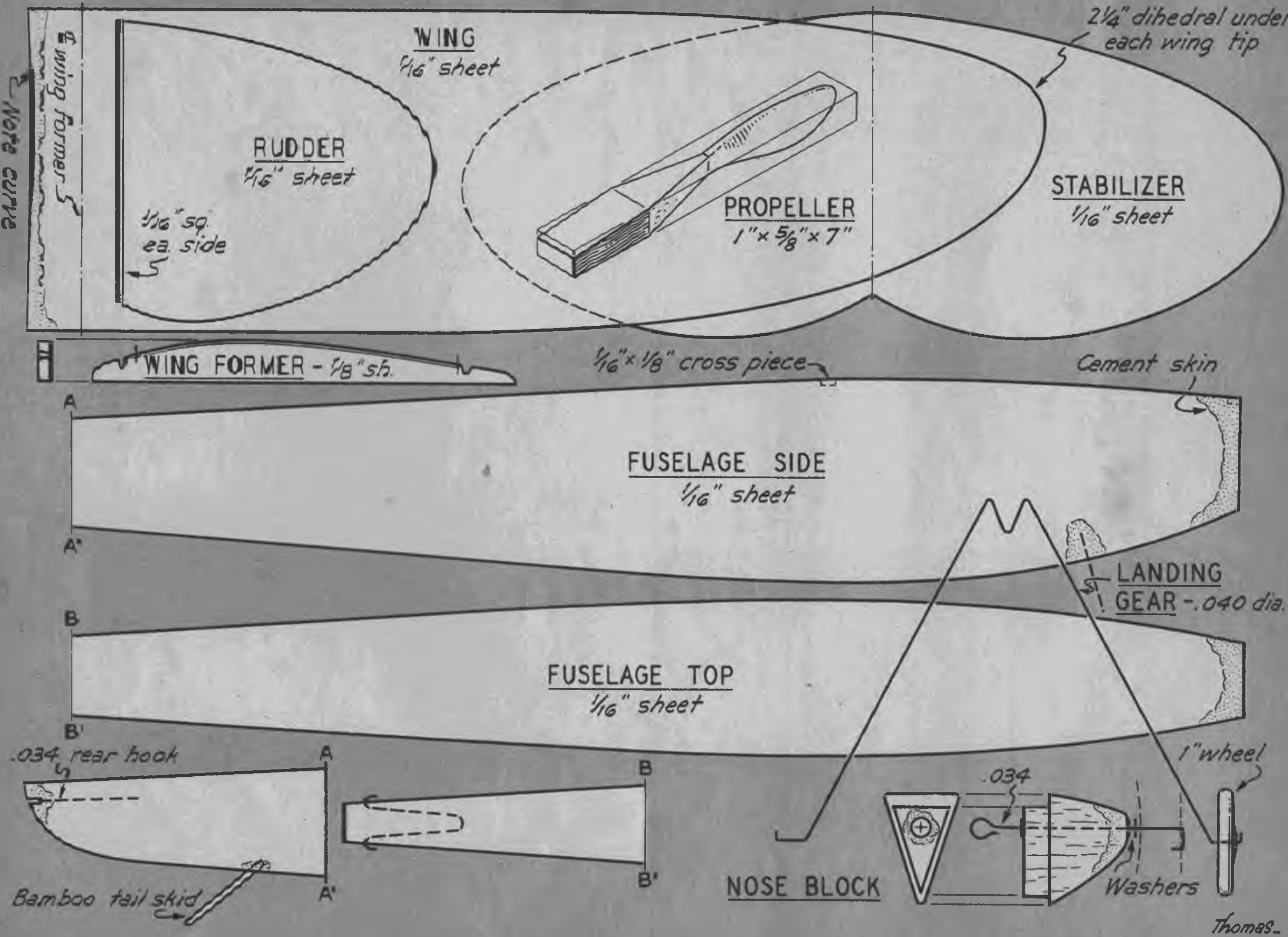
Make a sanding block of medium sandpaper and by placing the wing halves and tail group parts on a flat surface, taper the $^1/_{16}$" sheet to $^1/_{32}$" thickness toward the tips. Cement $^1/_{16}$" square strips to the rudder base for additional support when it is cemented to the stabilizer.

Carve the nose block of soft balsa to exact dimensions shown on the plans. Sandpaper it lightly and smear cement around the front for reinforcement.

Cut two wing formers from $^1/_8$" sheet. Bend landing gear, propeller shaft and rear hook. Obtain a ready-carved seven-inch propeller from your model dealer or whittle your own from the block shown on the plans. Strip a small splint of cane or bamboo for a tail skid.

Now that all parts are prepared, the model may be easily completed by referring to the assembly sketch.

Equip the model with four strands of $^1/_8$" flat rubber with little or no slack so that the nose plug and rear hook will stay snugly in place. Loop small rubber bands around the fuselage and over the wing former notches. Shift the wing along the fuselage until the model hangs level when held by the wing tips. Test-glide the model over a grassy spot, shifting the wing until the model glides smoothly. Limit first flights to few turns; final adjustments are made before winding to capacity. Let us know how she flies!



WING
1/16" sheet
RUDDER
1/16" sheet
1/16" sq. ea. side
℄ wing former
Note curve
PROPELLER
1" x 5/8" x 7"
STABILIZER
1/16" sheet
2 1/4" dihedral under each wing tip
WING FORMER - 1/8" sh.
1/16" x 1/8" cross piece
Cement skin
A
A'
FUSELAGE SIDE
1/16" sheet
LANDING GEAR - .040 dia.
B
B'
FUSELAGE TOP
1/16" sheet
.034 rear hook
Bamboo tail skid
NOSE BLOCK
.034
Washers
1" wheel
Thomas

The Tiger

Speaking of women in aviation, this gas job, built by a girl, is only "beginner's model" we know of that is a contest winner.

Myrt Thomas launches the Challenger. Design and plans are by brother H. A. Below—Don't let the paint fool you. It flies plenty.

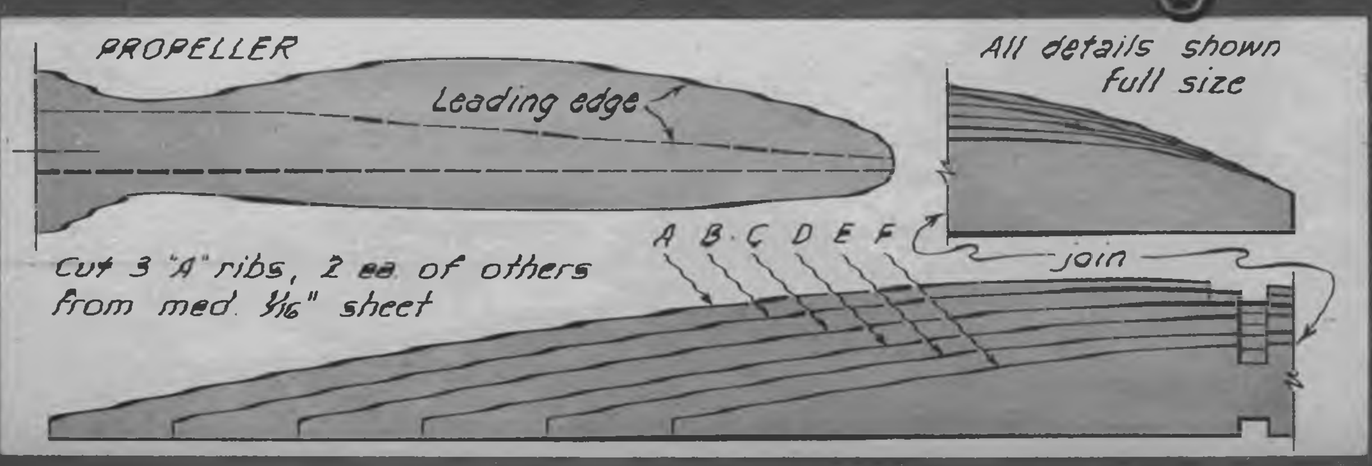
BY MARY LOUISE THOMAS

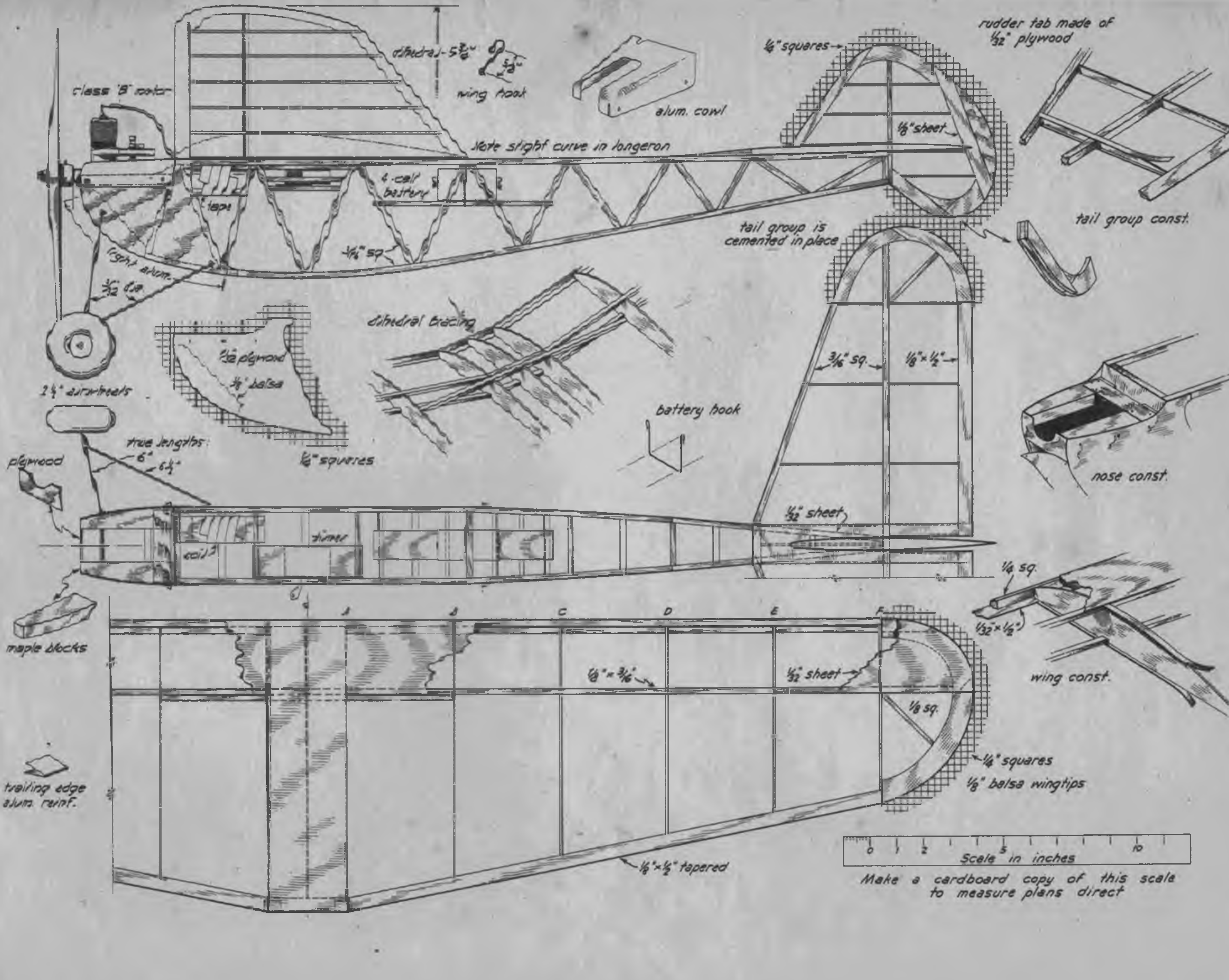
HAVING won a Class B motor, I was in the market for a plane to fit it. So I had my brother, H. A. Thomas, design me a simple, sturdy model and I built it, entered it in a contest and won first place in B Class. The ship also took first in Class B in our annual meet in Little Rock.

The model is quite conventional. Make a cardboard duplicate of the scale to facilitate enlarging the plans. The grid shown on the tail and wing tip will make them easy to enlarge. Hard balsa, pine or bass should be used for longerons, spars, wing edges, and softer balsa can be used for ribs, crosspieces, et cetera. The plywood pieces in the nose are reinforced below with pieces of ⅛" sheet balsa on the inner sides. Veneer can be substituted for the sheet aluminum. Where the landing gear passes through the plywood, small plywood pieces should also be cemented on the inside as reinforcement. All ribs are cap-stripped above and below with $^1/_{32}$ x ⅛" strips. The wing center section is covered with $^1/_{32}$" sheet balsa.

The camouflage is easy to duplicate. Ivory is the background color, with gray-orange, gray-green and blue-black splashed in at random.

Test-glide the model, moving the battery if necessary to balance.




class 'B' motor
dihedral - 5 3/4"
wing hook
5/32"
alum. cowl
1/4" squares
rudder tab made of 1/32" plywood
1/8" sheet
Note slight curve in longeron
4-cell battery
tape
1/16" sq.
tail group const.
tail group is cemented in place
1/32" dia.
2 1/4" airwheels
1/32" plywood
1/8" balsa
1/4" squares
dihedral bracing
3/16" sq.
1/8" × 1/2"
battery hook
nose const.
true lengths:
6"
6 1/2"
plywood
timer
coil
1/32" sheet
1/4 sq.
1/32" × 1/2"
maple blocks
A
B
C
D
E
F
1/8" × 3/16"
1/32" sheet
wing const.
1/8 sq.
1/4" squares
1/8" balsa wingtips
trailing edge alum. reinf.
0
1
2
5
10
Scale in inches
1/8" × 1/2" tapered
Make a cardboard copy of this scale to measure plans direct

Adjusting Your Gas Model

Ever wonder how long flights are made? It's just a case of knowing your model, plus a few simple pointers.

BY H. A. THOMAS

METHODS vary in test flying, so the following procedures are the conventional ones. Contest models with wings mounted high on a pylon differ in flight characteristics from the more realistic types. The short nose moment arm of the former makes them less susceptible to right and left thrust, and the twisting prop slipstream on the pylon turns the model to the right under power. On realistic "scale" types, right turns are dangerous.

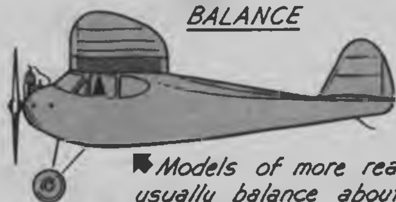
The average model balances at one third the wing chord back from the leading edge. High-wing jobs balance at half chord. Nose heaviness or stalling can be corrected by sliding the batteries fore or aft, as the case may be. Heavier or lighter wheels, or added ballast, will help. Hand-glide the model to a point on the ground about twenty-five feet ahead by tossing it straight with the nose slightly depressed. Correct abrupt turns with rudder tab. Model should land on wheels only, not three point, in which case it will stall in power flight. With the motor running at half throttle and the timer set for fifteen seconds, launch the model by running along with it and guiding one wing tip until it is airborne. If it is the realistic type with fairly long nose, it will probably turn slightly to the left. If climb is slight, more power can be applied. Best climb will be in a spiral, and a slight right adjustment of the rudder tab will result in a circling glide to the right. Stalling can be corrected by raising the trailing edge of the wing or the leading edge of the stabilizer, or by putting downthrust in the motor—if the first two methods spoil the glide. If model does not climb, slide weights back or raise leading edge of the wing. Now more power can be given. If circles are too sharp or too wide, offset thrust line by degrees up to one eighth inch. On the high-wing type with the short nose, right and left turns can be made equally as well, though model should be allowed to turn in the direction it tends to fly.

Models should generally be launched squarely into the wind, although some released for unassisted take-offs are sometimes angled slightly so that their turning tendency will have turned them into the wind by the time they are in the air.

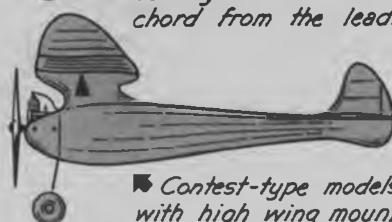
Left—How's this for a glide! Carl Cecil follows beneath his Gladiator at a contest. Below—Julius Orvitz shows how to get 'em

TEST FLIGHT PRECAUTIONS AND ADJUSTMENTS -

BALANCE



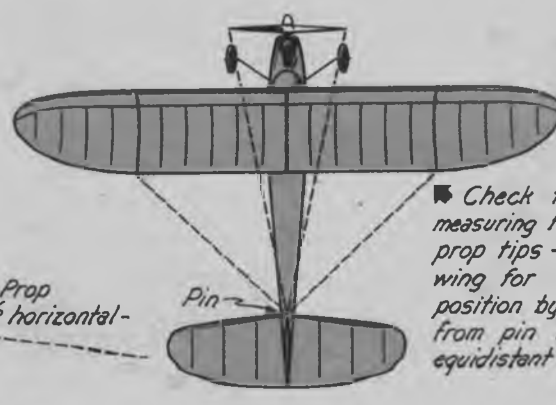
Models of more realistic type usually balance about 1/3 of chord from the leading edge -



Contest-type models with high wing mounts usually balance about the center of the chord -

ALIGNMENT

Check for possible misalignment and warps by careful front view -



Check thrust by measuring from pin to prop tips - check wing for proper position by measuring from pin to points equidistant from center -

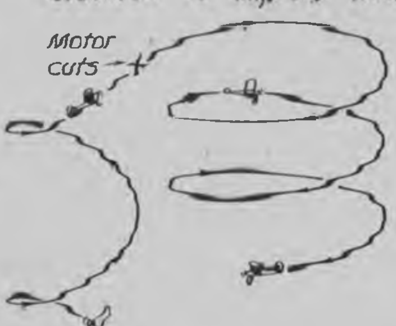
First test-glide -

TO INCREASE ELEVATION -

Shift batteries rearward if model is nose-heavy - increase positive incidence in wing or reduce positive incidence in stabilizer to improve climbing angle.

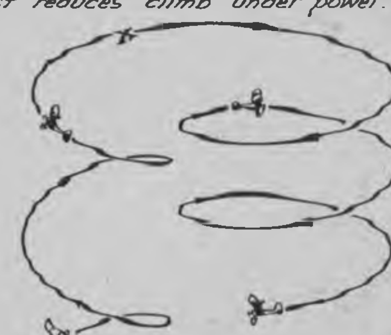
TO REDUCE ELEVATION -

Shift batteries forward if necessary - reduce positive incidence in wing or increase positive incidence in stabilizer - downthrust reduces climb under power.



Realistic-type models usually fly to left under power and glide to right. Careful adjustment will permit model to roll out of left turn into a right turn when the motor cuts off.

Contest-type models as a rule fly in right turns under power and also in the glide. Straight climb without turn is not always desirable because models usually stall when motor cuts off -



Thomas

Model Building In Pictures

Baffled by the contents of model airplane kits? If so, here's all the secrets exposed with step-by-step photos. Get yourself a kit and go along with us, from pinning the plan on the board to losing finished model in a thermal.

Thumbtack the plan to a large drawing board or similar surface. Cover with wax paper to protect plan.

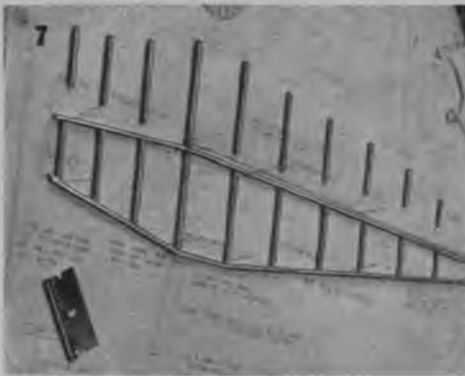
Building the fuselage. Use common pins to hold longeron in place over the side view of fuselage drawing.

Don't break strips to form acute angles in fuselage. Use a razor blade and make a clean joint as sketched.

After the two longerons are pinned in place, cut the crosspieces two at a time. Check sizes for accuracy.

Cement crosspieces in position. Use plenty of glue and be careful to see that they are properly spaced.

Pay special attention to cementing the nose crosspieces, as they must take the brunt of hard landings.



Allow your finished fuselage side to thoroughly dry before starting the other side. Don't remove the pins.

Start the second side by slipping the two longerons in place over the completed side to insure accuracy.

Complete this side in the same manner as the first. Add gussets to both sides as indicated on drawing.

Remove the sides from the work board and separate as shown above. Re-cement all joints. Allow to dry.

Now cut the crosspieces for the top and bottom of the fuselage, using the top view of plan for sizes.

Cement the two fuselage sides together at the rear and line up carefully so that they are perpendicular.

Cement crosspieces in place along top and bottom of the sides. See sketch as a guide to the finished job.

First step in wing construction is to pin the leading and trailing edges in place. Add tips as illustrated.

Cut all ribs and other printed parts in one step to save time. Use a sharp razor blade for this operation.

After tips have been added, glue in the ribs as shown. Allow to dry, then glue the main wing spar in place.

Finish off the wing framework by carefully sandpapering the roughness off the outlines. Use fine paper.

Next, build in the dihedral angle. Determine height tips should be raised from the front view on drawing.

Using a sharp blade, cut the wing frame as shown in pix 18. Bevel joints correctly to form the new angle.

Re-glue the wing frame, block up the tips and check with a ruler to see that both tips are raised equally.

The tail surfaces on most models are built in the same manner as the wings. This is the stabilizer frame.

The finished stabilizer with rudder "in the works." Note, for structural reasons, never place pins in wood.

Wire bending is tricky, so we advise you to practice first on scrap wire before attempting finished product.

Glue the finished landing gear to the bottom of fuselage. Allow to dry thoroughly, then bind with thread.

Finish propeller from semicarved form, add washers, hook, and noseblock. Balance propeller carefully.

Here are finished parts awaiting covering. Give them a final inspection now to rectify possible mistakes.

Covering the wing: from your sheet of tissue cut out four pieces to approximate size. Watch your waste.

First, cover top of wing by doping tissue to trailing edge, then attach to front. Grain runs lengthwise.

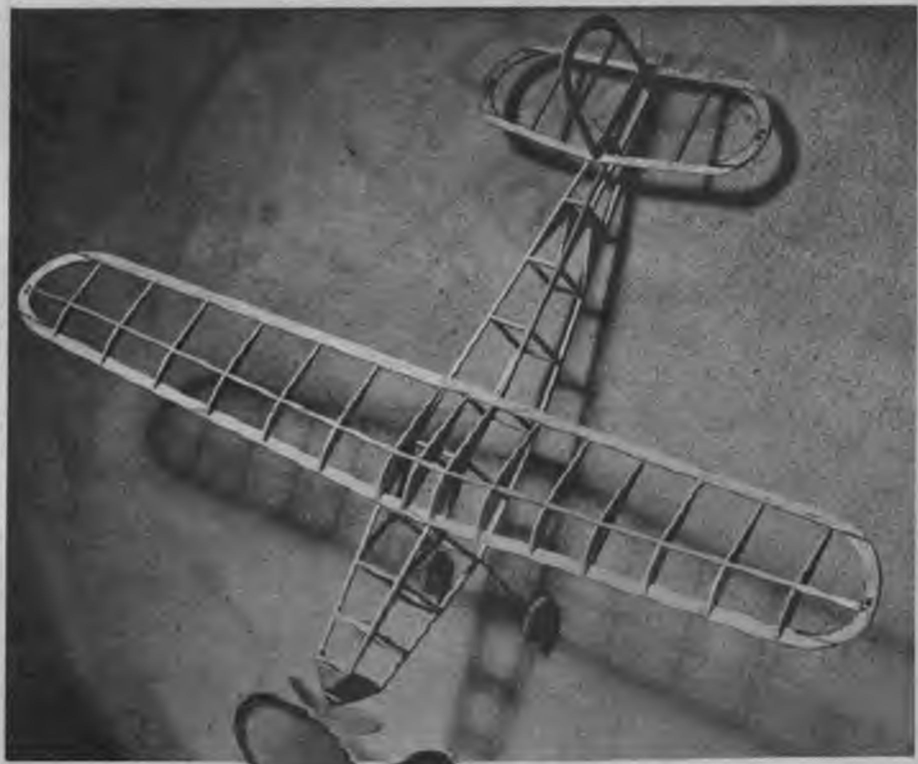
After attaching paper to the front of the wing, work out inevitable wrinkles by pulling the tissue taut.

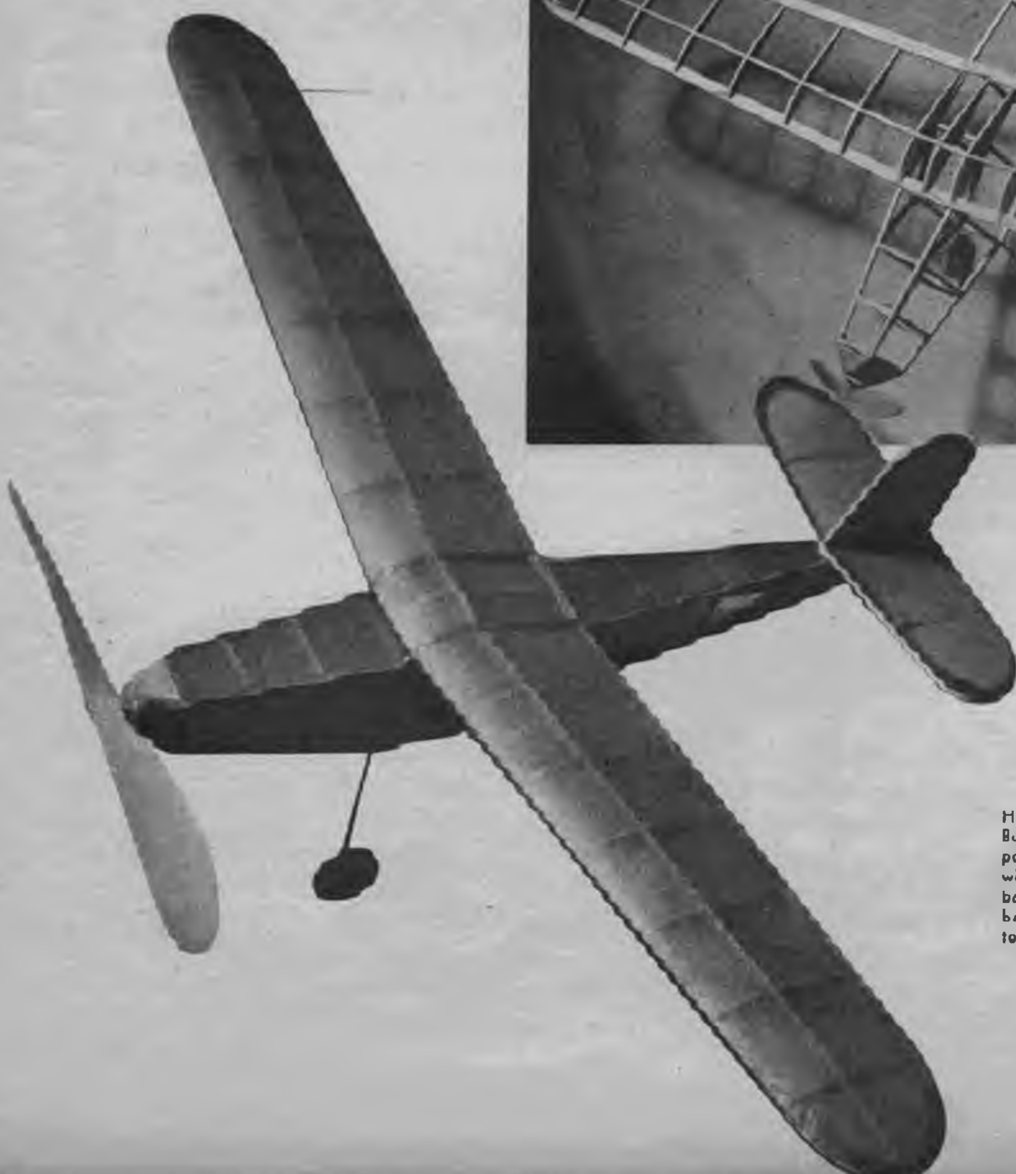
Covering bottom of wing is easier than the top. In this operation, run the paper grain along the width.

Surplus tissue may be removed with a razor blade or, as some builders prefer, by using fine sandpaper.

Tissue tightened by using water applied with cotton. Wet thoroughly, allow to dry, then dope one coat.

After you can presentably cover a wing, rest of model is simple. Above: remove paper to install motor.





Here's the finished product, ready to be test-hopped. But before gliding, check the model to determine these points: is the wing straight, without any warp; is the wing in line with the tail surfaces; does the propeller balance perfectly; does the model balance about 1/3 back from the leading edge to the wing? Now turn to page 22 to learn secrets of flying and adjusting.

Pilot the

Under view shows realistic detail of nacelles and landing gear.

Here's a 54" twin engine controlliner that's a terrific performer with either pine or balsa. One engine? We've anticipated that, too.

UNIQUE because of its slimness and high-mounted stabilizer, the Westland Whirlwind is the answer to many a model-maker's dream. Unusual performance is offered by this twin-engined model, plus an appearance that will win most any "beauty" event. A line is connected to switches in both ignition circuits to "cut" both engines if one starts sputtering.

If you are not the fortunate owner of two motors, you can still fly the Whirlwind by installing a Class C engine in one nacelle and using a dummy free-wheeling prop on the other. Of course, the coil, condenser and batteries should be placed in the dummy nacelle to balance the model. In this case the model should be flown in a clockwise circle and the engine mounted in the outside wing nacelle; that is, looking at the model directly from the front, the engine should be mounted on the right side.

Although either balsa or hardwood construction can be employed, a half-and-half combination is advised. Curved parts (formers and ribs) should be of balsa, but straight parts (stringers and spars) should be hardwood. To start fuselage construction, cut out the master keel stringers K-1, 2, 3 and 4 from ⅛" sheet. Pin them down to your workbench as shown in the fuselage-frame layout. Cut two each of all formers (A to M), mark stringer positions on them in ink, and assemble one set of the keel strips. Following the stringer marks, $^{3}/_{32}$" square stringers are cemented in place. Remove half fuselage from bench, add remaining formers and finish. Before applying *all* stringers, fill in the proper areas and assemble the bell crank support at the top of former "L."

Wing spars are cut out according to dimensions given. "Hot" landings will make hard wood imperative here. Ribs are now cemented in place. Note that the radiator extends from rib #1 to #5. The leading-edge covering is applied in sections, as the cross section changes abruptly at ribs #5-5A. The center section is covered with $^{1}/_{16}$" sheet; the tips with $^{1}/_{32}$" sheet. Also cover all the space between ribs #1 and #2 with $^{1}/_{16}$" sheet.

Rudder assembly is simple, as full-size outlines are given. Space off as indicated and cement leading and trailing edges in place. Be sure that the ribs have been hollowed out before assembling.

The stabilizer is built in the same manner, with the exception of the movable elevator. Trim the leading edge of the elevator to a "V" so that it can be hinged up and down when against the rear stabilizer spar. A silk or tissue hinge occupies the span of the entire stabilizer. Before assembling this hinge, be sure that the elevator horn is cemented in place. The tail lever, bell crank and control arm are connected next.

The nacelles are now assembled as per the sketch and plan. The "crutch" is assembled first, notched for the motor bearers, and the upper portion added. Formers and stringers are next. The portion over the engine is removable for adjustments and repair. Plank it with ⅛" sheet

Westland Whirlwind

BY PAUL PLECAN

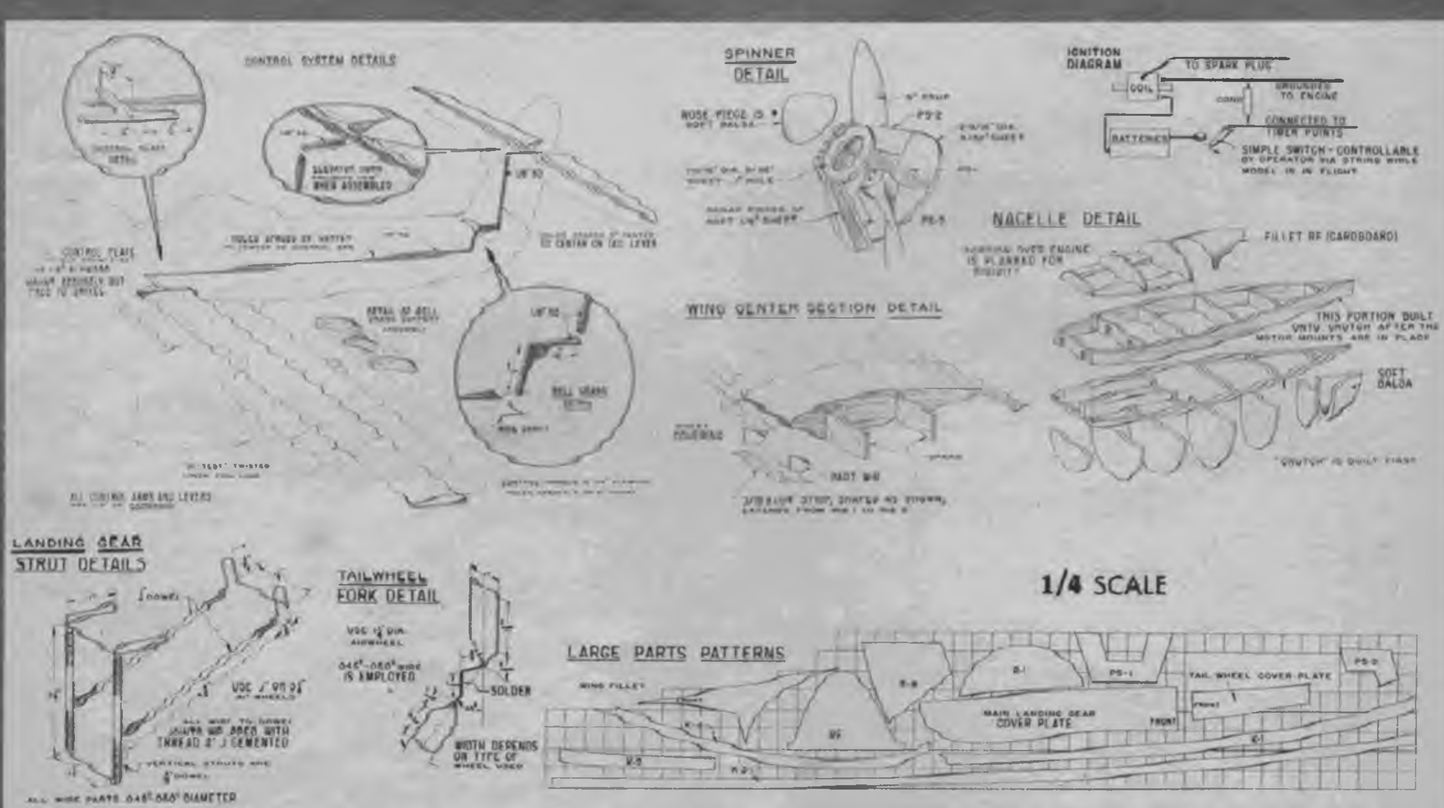
for strength, as it will be handled often. Due to slight wing dihedral a $^3/_{32}$" slat must be inserted between the nacelle and wing on the outboard side, to keep the nacelles level after assembly. Use plenty of cement at the wing-to-nacelle joint. Two-ply bristol board fillet RF, cemented to wing and R-1, simplifies fairing at that point. Assemble landing gear and cement all joints well. Do not simplify the landing gear, as the "elbows" have been incorporated to absorb landing shocks. Both longitudinal and vertical shocks are absorbed.

A pair of spinners are now assembled. Note sketch. Cement disk to rear face of prop, add parts PS-1 and PS-2, and add front disk. Planking is now applied around perimeter of spinner, topped off with a nose piece, sanded to blend with the rest of the spinner. Three or four prop-spinner assemblies will offset breakages on test flights.

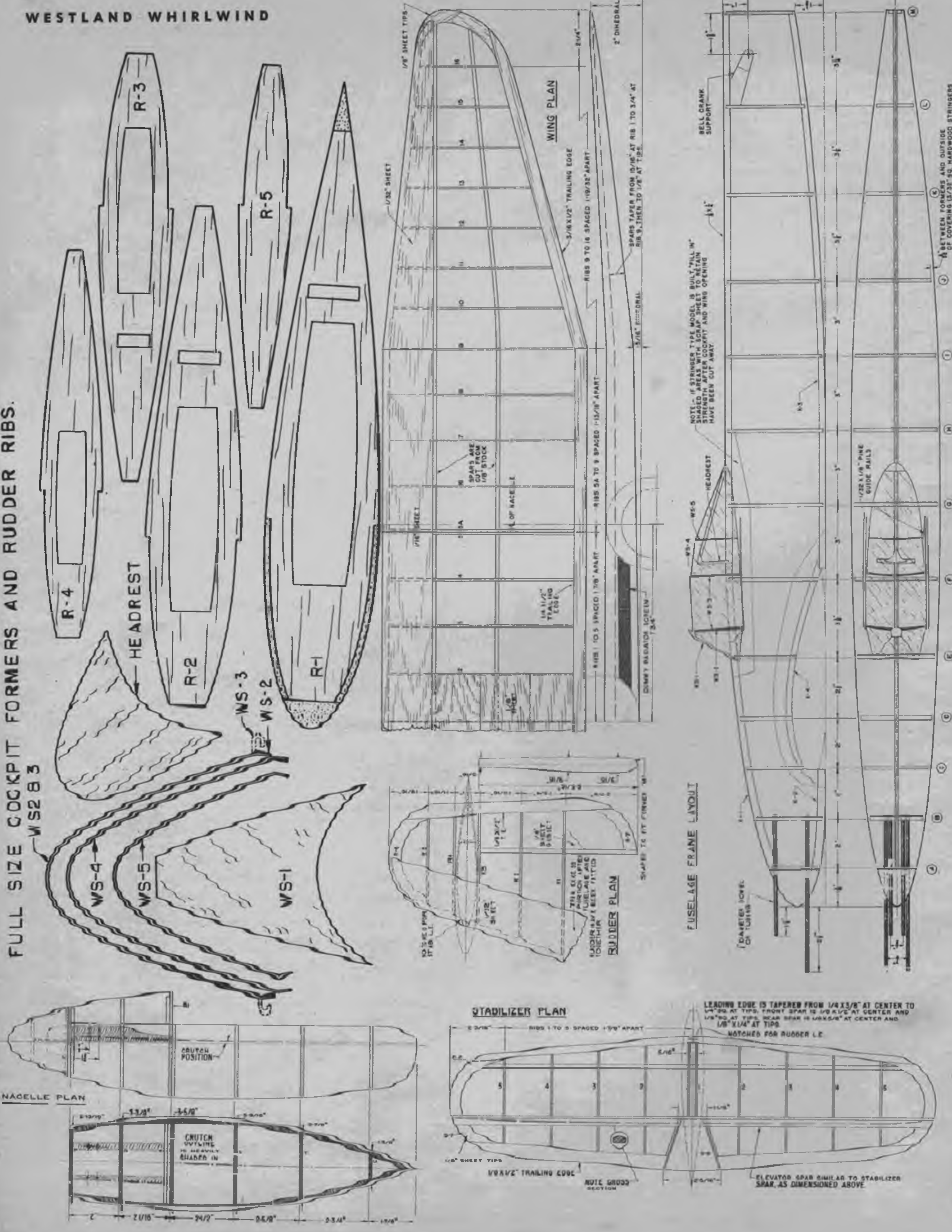
The ignition system is soldered up, following the circuit shown. With two Atom engines, the author found that the proper balance was attained by mounting coils and batteries to the front of former R.

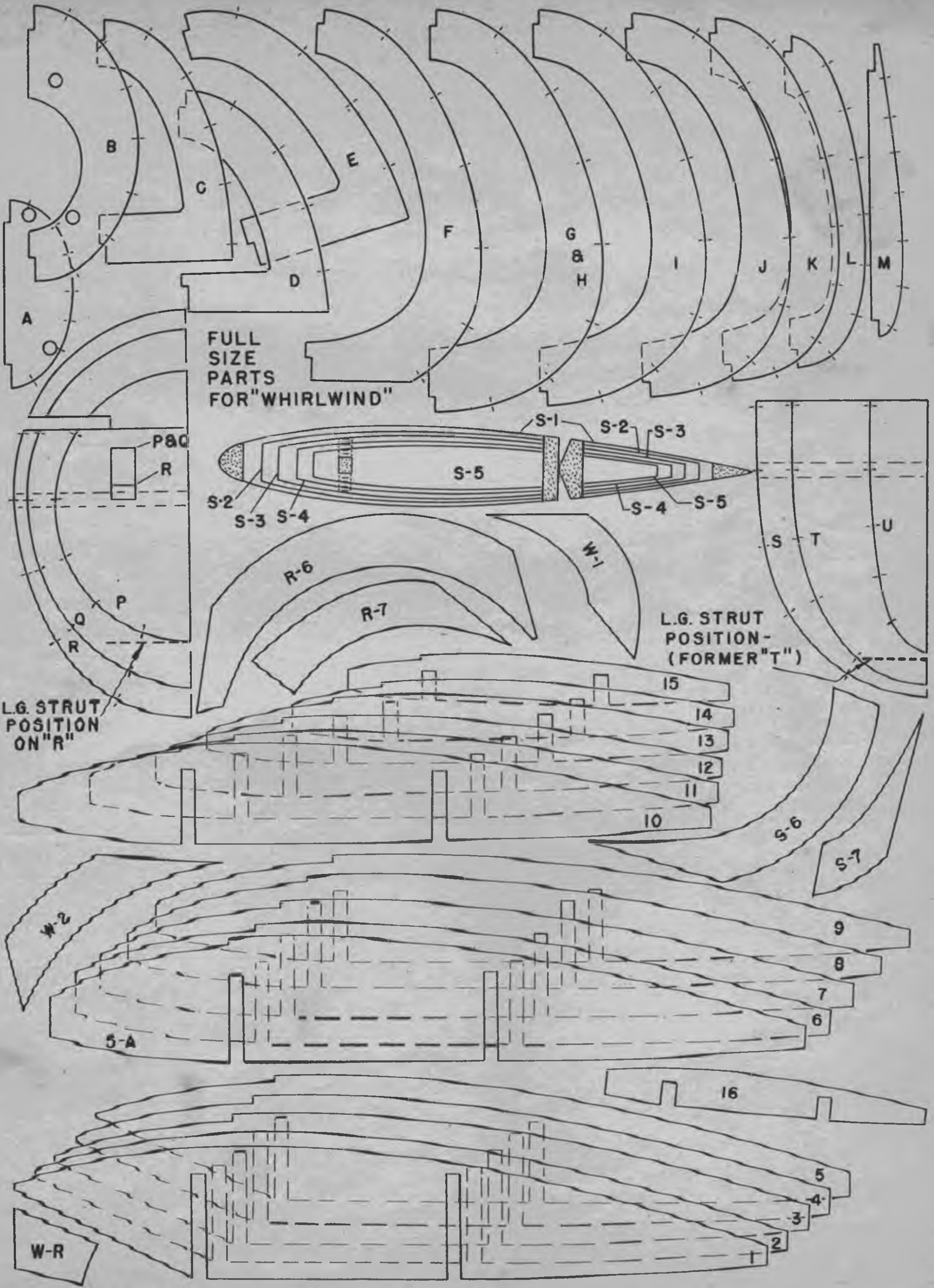
A sliding canopy is included in this model's design, and is worth while. Assemble headrest first, then cement WS-4 and WS-5 in place, line up, and cover with sheet celluloid. The sliding canopy is assembled by cementing a rectangular piece of celluloid between two WS-3 formers. A sharp bend is needed in the bottom ends of WS-3 in order to slide correctly over the $^1/_{32}$" x ⅛" guide rails. Although hard to do with steel wire, it is easily done if the part is heated over a match and allowed to cool gradually. This softens the metal and allows the small radius bend to be made: To regain the temper, heat again, but dip in water to cool it suddenly. WS-1 is best made of .050" or .063" celluloid so that it remains flat.

In order to do the coloring properly a spray gun should be used. To obtain authentic shades, refer to the cover of the October, 1941, Air Trails Pictorial. Remember to mask off the proper areas before spraying, and to thin out the dope enough to obtain a fine spray. The vertical bands on the rudder are ¾" wide and 2¾" high. The fuselage insignia is 2 $^{13}/_{16}$" diam., including the yellow ring; wing insignia 3" and 4" diam., top and bottom, respectively, 4⅛" outboard of rib #9. Spinners are white, as is the 2" wide band around the fuselage. Props and cannon are dull black. The letters P7110, ½" high, may be included on the fuselage in front of the white band.



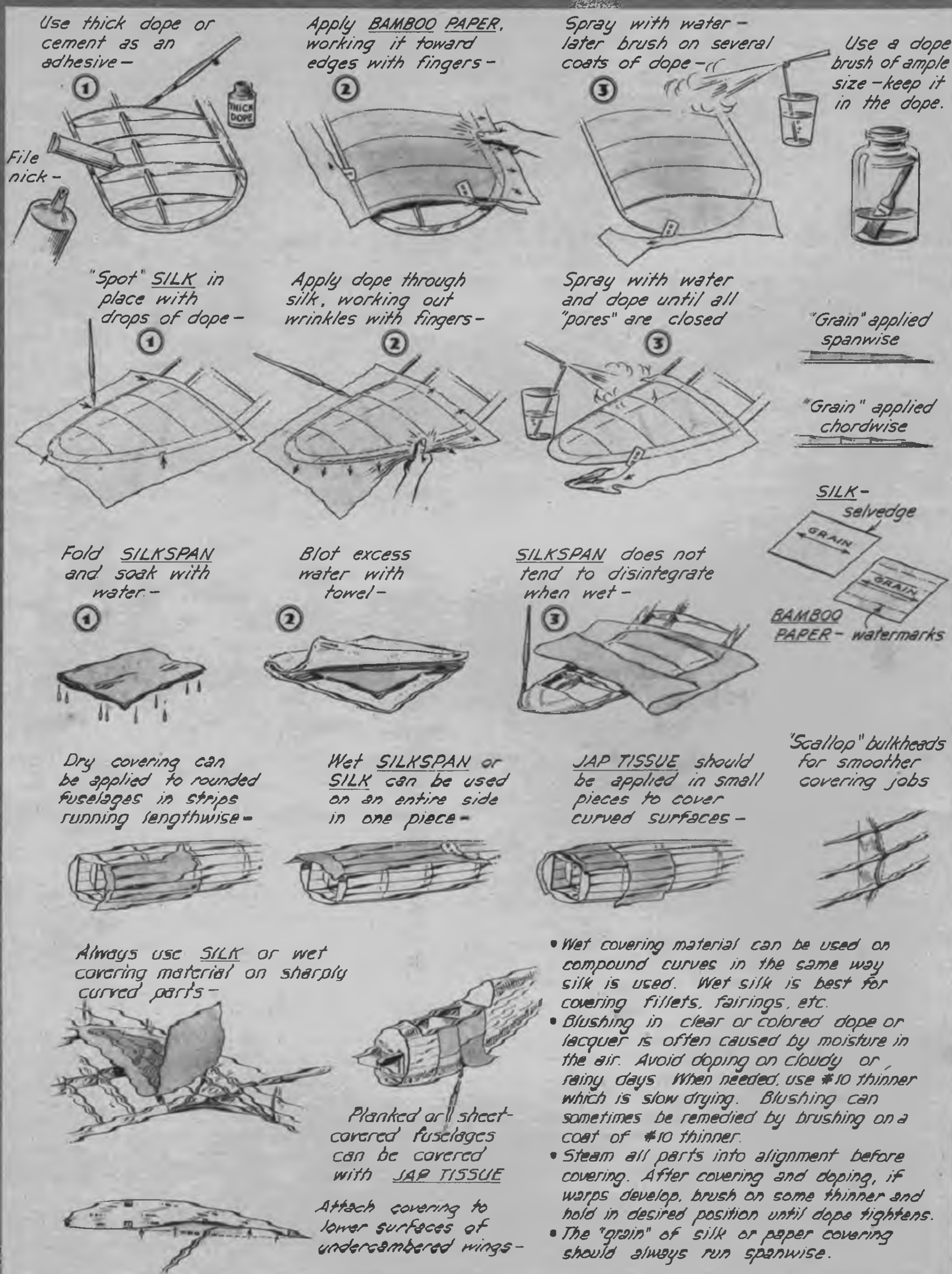
WESTLAND WHIRLWIND




FULL SIZE PARTS FOR "WHIRLWIND"
A
B
C
D
E
F
G & H
I
J
K
L
M
P&Q
R
P
Q
R
L.G. STRUT POSITION ON "R"
S-1
S-2
S-3
S-4
S-5
R-6
R-7
W-1
S
T
U
L.G. STRUT POSITION- (FORMER "T")
15
14
13
12
11
10
S-6
S-7
W-2
9
8
7
6
5-A
16
5
4
3
2
1
W-R

Tricks In Covering

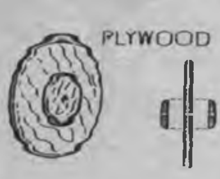
BY H. A. THOMAS



- Wet covering material can be used on compound curves in the same way silk is used. Wet silk is best for covering fillets, fairings, etc.
- Blushing in clear or colored dope or lacquer is often caused by moisture in the air. Avoid doping on cloudy or rainy days. When needed, use #10 thinner which is slow drying. Blushing can sometimes be remedied by brushing on a coat of #10 thinner.
- Steam all parts into alignment before covering. After covering and doping, if warps develop, brush on some thinner and hold in desired position until dope tightens.
- The "grain" of silk or paper covering should always run spanwise.

Engines

Tips for Gasoleers



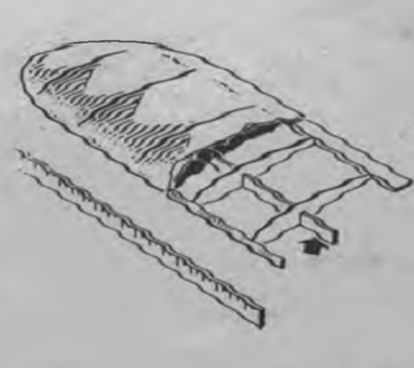
SINCE December 7, 1941, modelers have been finding most materials commonly used in the hobby quite scarce or practically non-existent. It is for this reason, more than for any other, that thousands of modelers have abandoned rubber jobs for gas in order to keep 'em flying. This article is written for these fledgling gasoleers as well as for the more experienced licensed contest modelers.

Much has been written about scale-model tips, but very little about tips, short cuts and the like on gas jobs exclusively. So get out your fountain pens and memorandum books, fellows.

First of all, we must learn to deal with Farmer Brown, Farmer Jones or Farmer Bernkornovitch instead of Airport Manager Joe, in securing a flying site. For now we must return to the early days of aviation and fly from cow pastures. In this respect, after having selected a suitable cow pasture, you should select a spokesman from your group who can handle any situation as it arises. Take one or two of your best-looking gas buggies along and approach Farmer Brown for the privilege of flying from his cow pasture. After interesting him in the planes and engines, fire the question at him. When he has consented (and he usually does), you should select a particular time to fly each week, probably Sunday afternoons. Let him know of your selection so that he will have time to get his cows into another field. It will also serve to heighten his interest, and week after week you will note that he will be waiting patiently for you to arrive at your newly acquired cowport. Not that he wants to see *you* particularly, but he'll be more than glad to see your gassie fly. Always be courteous and explain to him anything he may ask. Above all, don't forget that even one harsh answer may send you looking for another field within the week.

Now that we have the engine, the plane, and the flying site, what more do we need? Plenty, brother. For instance, you need a good field kit. And what's better for this purpose than a fishing-tackle box? You can buy one of these at your nearby hardware dealer for about a dollar and a quarter. Of course, you could buy something cheaper that would serve the purpose, but the added advantages of this type of kit are well worth the additional cost. Install a screwdriver, a pair of pliers, a soldering iron, solder dope, covering material, glue, a plug wrench, a prop wrench, an extra coil, condenser, and a couple of extra plugs. Get a couple of flat, round tin salve cans and put spare bolts, nuts, washers and lock washers in one, and pins in the other. If your hand drill has a place in the handle for the bits, put them in there along with a winding hook. This will save some space. But wait, we're not through yet. Put in your boosters, three or four extra props, fuel mixture, a clean rag, a filtering funnel (explained later), a protractor, a spare pair of motor mounts, and a pair of wheels, in case you lose one or both, and last but not least, an emergency first-aid kit. Assign certain articles to their respective places in the kit, and be sure they are kept there. All the ignition supplies should be kept in one section, wrenches in another, and so on. You will soon become so accustomed to your kit that you will experience no difficulty in making any field repairs necessary in contest flying. Paint your kit in your club colors so you can spot it at any contest. One thing to keep in mind when you go to a contest is to keep your kit locked. Many well-meaning modelers often borrow tools in your absence and forget to return them.

Another thing we must do is to preserve the life of our engines. Allowing dust to get into it is no way to accomplish this. Since most companies that formerly manufactured model aircraft engines have now taken over war work, last year's coffee grinder has become a precious thing. There are two known ways to eliminate dust: During operation, and during long periods when the plane is sitting idle between flights. The best method of



BY DON FUQUA

eliminating dust during operation is to filter the air as it enters the intake. To do this, cut a piece of tin from an old tobacco can or other available source, about half an inch long, and curve around the intake tube. Solder this so that it forms a tube which fits tightly over the air intake. To the end of this tube, solder a piece of copper screen wire from a discarded tea strainer. This wire is a very fine mesh and will stop about eighty-five percent of the dust from entering the intake. Modelers using this method will have to experiment with their own engine to find a new adjustment, since the amount of air drawn in is slightly decreased. This filter should be washed in gasoline after every fourth or fifth flight.

The other method of eliminating dust is to obtain a bowl cover from the dime store. These are made of Pliofilm and have an elastic band at the bottom. Cut a single hole in the top slightly larger than the diameter of your crankshaft, and reinforce with Scotch or other tape. Remove the prop, insert the crankshaft through the hole, and pull the cover over the engine. You need not fear damage from dust with this cover.

If you are like the majority of contest modelers, you will want your equipment as light as possible. This applies to boosters as well, so instead of using two No. 6 dry cells, use four of those large-size flashlight batteries. Wire two in series and two in parallel so that the voltage does not exceed three. Solder the leads to the plus and minus terminals, and tape well to insure insulation. You will have as much of a booster in a smaller package, and one that weighs only three ounces. It is a much more portable unit and excellent for contest flying—and costs not more than thirty-five cents.

Another trick to conserve your engine is by the elimination of sediment in your fuel mixture. This may be accomplished by filtering the fuel immediately before flying. Cut the bottom from a small squirt-type oil can and solder the remaining piece of fine-mesh copper wire from the tea strainer in its place. This, then, becomes a filtering fuel funnel, no fuelin'.

Another handy little gadget to put in your kit is one of your sister's emery boards. These are shaped like fingernail files and are surfaced with very fine sandpaper. When timer points need cleaning, a pass or two between the points with the emery board, and presto, clean as a whistle.

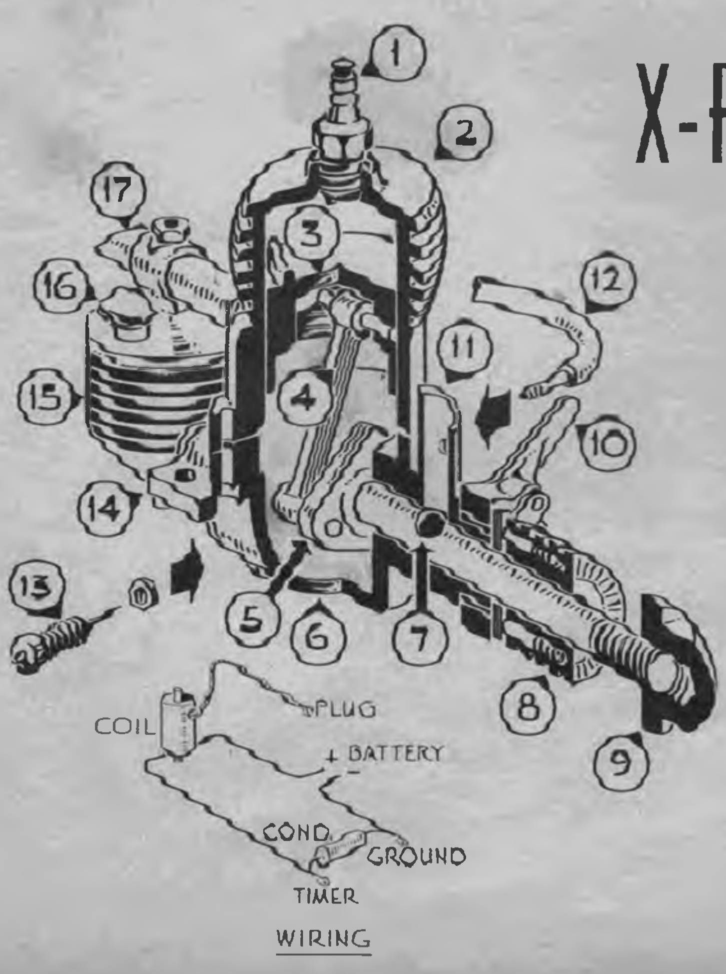
Another thing which is becoming extremely scarce is dural for motor mounts. Those of you who did not stock up are going to be out in the cold unless you find a substitute. Well, here's the substitute—twenty-eight-gauge sheet metal. Make a template the shape and size you want, and take it to your local tinsmith. In about ten minutes you'll have a pair of mounts that will stand up under the stress of nearly any motor on the market, weighing only a little more than dural, and costing about a dime a pair. For the heavier engines such as Forsters, O. K. Twin, et cetera, use twenty-two-gauge sheet steel.

Another thing which is becoming quite scarce is rubber wheels. Since we can't obtain rubber wheels, the logical thing to do would be to find a substitute, so why not plywood? They are lighter, stronger, offer less wind resistance, and are much cheaper. A pair of plywood wheels lasted yours truly for fifty-eight flights and were still in good shape at the time the ship disappeared over the horizon. Use your own judgment as to the weight and thickness of the plywood, depending on your particular model. Cement one-sixteenth-inch-thickness plywood disks to the wheel on either side before drilling. This is to prevent wabbling, and to act as a hub. Smooth the surface, round the edges and paint.

And speaking about paint, instead of drawing on the rapidly dwindling dope supply, why not use a good fast-drying, high-gloss enamel on your large Class B and Class C planes? The added weight is negligible, a more lasting finish can be obtained, it can be washed, there will be no more leaky wings, and again, it is much cheaper. I have used an enamel finish on every ship for the past three years and have had better performance than ever before.

Again, a scarcity in model supplies affecting most modelers is balsa wood. In many cases, wing spars made of yardsticks will supplant balsa. These spars are tougher, stronger, more easily handled, and are usually free.

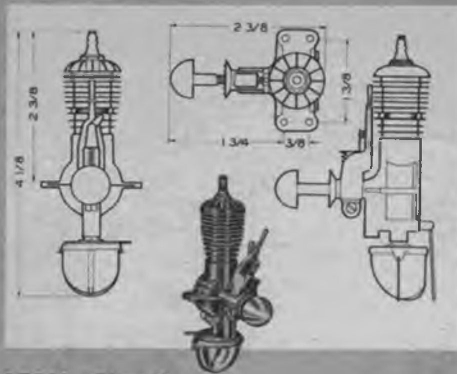
If this article sounds like a Scotchman's dream, there is a reason for it. It shows how one modeler with a limited income keeps himself in the hobby. Incidentally, lock washers from old radio sets are the best going, and again, they are free. But space isn't, so I'd better quit.



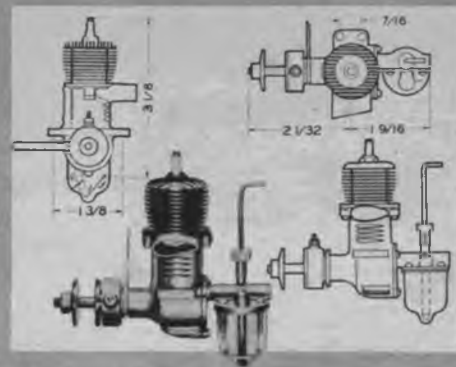
X-Raying the Rogers

1. **SPARK PLUG**
2. **MOLDED ALLOY CYLINDER**
3. **FITTED ALLOY PISTON**
4. **CONNECTING ROD**
5. **ALLOY STEEL CRANKCASE**
6. **ALLOY CRANKCASE**
7. **CRANK ROTARY VALVE**
8. **COMMUTATOR-TYPE TIMER**
9. **PROPELLER HUB**
10. **SPARK LEVER**
11. **AIR INTAKE**
12. **FUEL LINE**
13. **NEEDLE VALVE**
14. **MOUNTING LUG**
15. **FUEL TANK**
16. **FILLER CAP**
17. **DUAL AIR INTAKE**

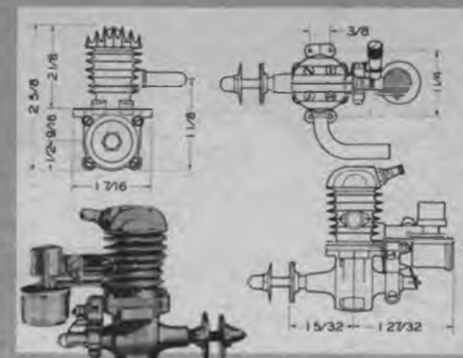
(Needle Valve Shown Unassembled)



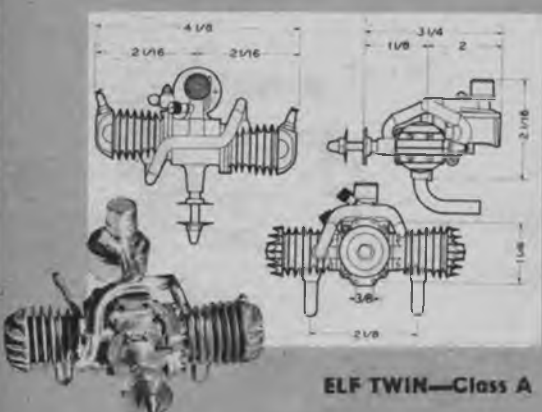
ATOM—Class A



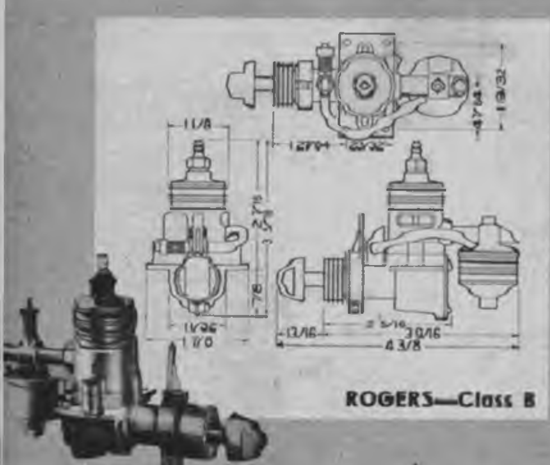
BANTAM—Class A



ELF SINGLE—Class A



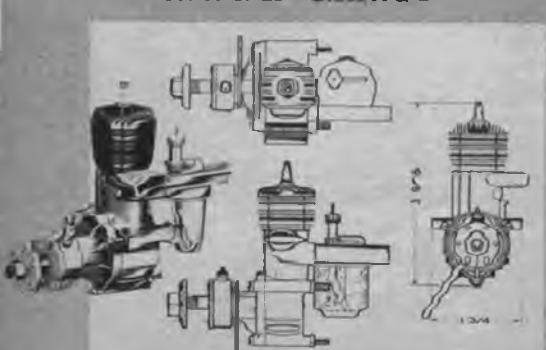
ELF TWIN—Class A



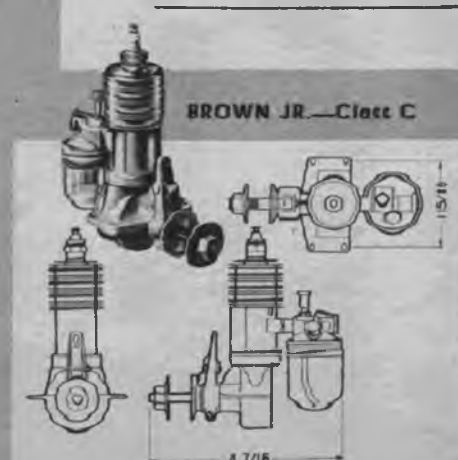
ROGERS—Class B

Engine	Displacement	Required Weight of Model
CLASS A		
ATOM	.097 cu. in.	7.76 oz.
BANTAM	.199	15.9
ELF SINGLE	.099	10.6
ELF TWIN	.198	15.8
OHLSSON 19	.19	15.2
CLASS B		
ROGERS 29	.29	23.2
OHLSSON 23	.23	18.4
FORSTER 29	.29	23.2
CLASS C		
BROWN JR.	.601	48.
COMET 35	.35	28.
DENNYMITE	.57	45.6
OHLSSON 60	.60	48.
O. K. HERKIMER 49	.49	39.2
O. K. HERKIMER TWIN	1.208	96.6
SUPER CYCLONE	.647	51.8
TIGER AERO	.45	36.

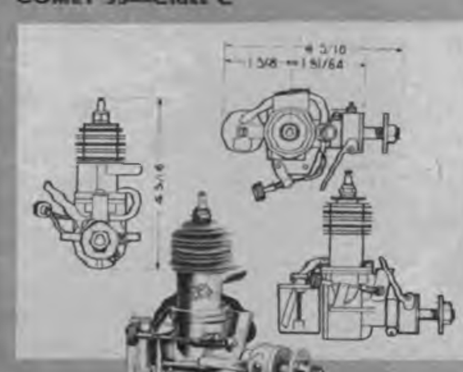
OHLSSON 19 or 23—Class A & B

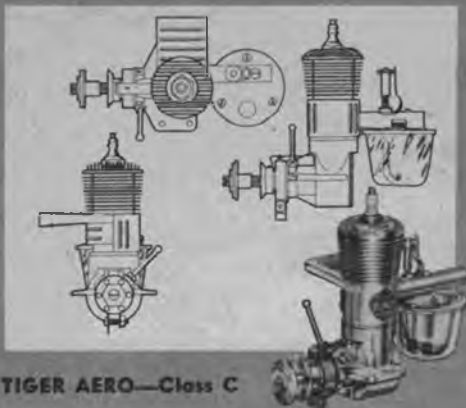


BROWN JR.—Class C

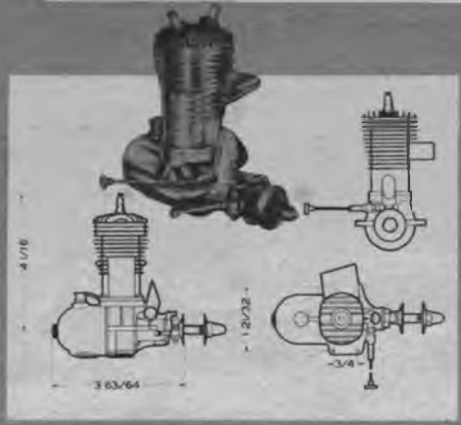


COMET 35—Class C

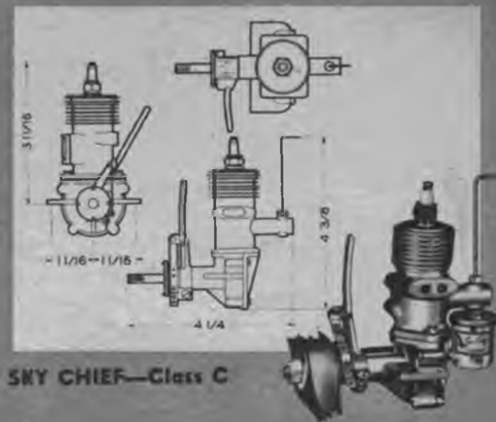




TIGER AERO—Class C



SUPER CYCLONE—Class C



SKY CHIEF—Class C

Gas Engine Trouble Shooting

Courtesy Academy of Model Aeronautics

Motor Refuses to Start

FAULTY IGNITION (weak or no spark):

1. Wiring:
   (a) High tension lead shorting out. The high tension lead to the spark plug should be isolated from all other wires.
   (b) Poor or loose connections, especially to ground, contact points, or booster batteries.
   (c) Leakage of high tension lead to other metal parts. Bad position of coil causing leakage especially on small models.
2. Spark Plug:
   (a) Spark plug fouled with oil.
   (b) Dirt, soot, or carbon between spark plug body and porcelain.
   (c) Porcelain broken or carbonized.
   (d) Points out of adjustment (.010 to .015 inch gap).
3. Batteries:
   (a) Batteries weak, check for low voltage.
4. Contact Points:
   (a) Points burned, dirty, or out of adjustment.
5. Condenser:
   (a) Broken leads or condenser failed.
6. Coil:
   (a) Shorted or broken wire in coil.

NO GAS IN CRANK CASE OR CYLINDER:

1. Needle Valve Closed:
   (a) Check needle valve position.
2. Motor Improperly Primed:
   (a) Give motor additional priming.
3. Gas Tank Empty:
   (a) Check gas supply.
4. Gas Line Clogged:
   (a) Check to see if line is stopped up.

MOTOR FLOODED:

1. Excessive Priming.
2. Needle Valve Open Too Far.
3. Excess Gas Drawn in Through Frequent Turning of Propeller Without Motor Firing.

Motor Stops

AFTER A SHORT FAST RUN:

1. Gas Mixture Too Lean:
   (a) Motor was operating on excess supply of gas in crank case.
2. Loose Connections:
   (a) Check wiring.
3. Weak Spark:
   (a) Batteries weak.
   (b) Spark plug dirty.
   (c) Condenser bad.
4. Gas Supply Low.

AFTER AN EXTENDED RUN:

1. Fuel Exhausted.
2. Loose Wire:
   (a) Loose connection or wire broken due to vibration.
3. Dirt in Gas Line.
4. Weak Spark:
   (a) Batteries weak or run down.
5. Motor Running Hot (freezes up or loses power and stops):
   (a) Improper lubrication: Wrong gas-oil mixture or oil too light.

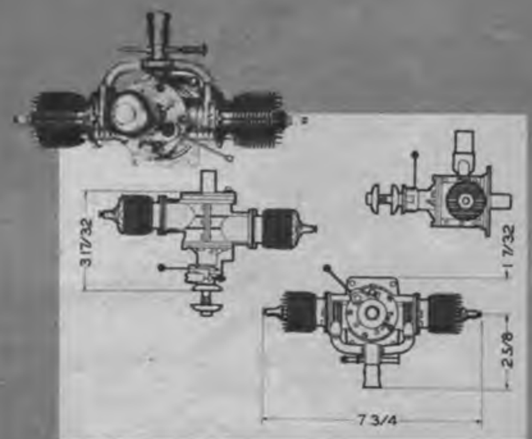
Miscellaneous Troubles

FOUR-CYCLE RUNNING:

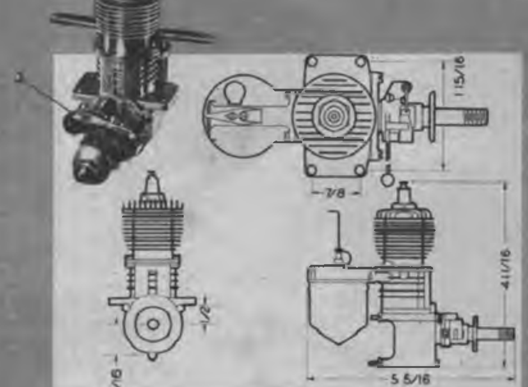
1. Gas Mixture Too Rich.
2. Weak Spark:
   (a) Check tension on contact points.
   (b) Check spark plug gap (possibly too wide).
   (c) Check contact point gap (possibly too wide).
   (d) Weak batteries.
   (e) Spark plug loose or leaking gasket.

MOTOR MISSES AT HIGH SPEEDS:

1. Weak Spark:
   (a) Spark plug fouled or shorted.
   (b) Batteries weak or contacts loose due to vibration at high speed.
   (c) Insufficient tension on contact points, or points dirty, excess point clearance.
2. Spark Advanced Too Far.
3. Improper Needle Valve Setting:
   (a) Mixture slightly too rich or slightly too lean.

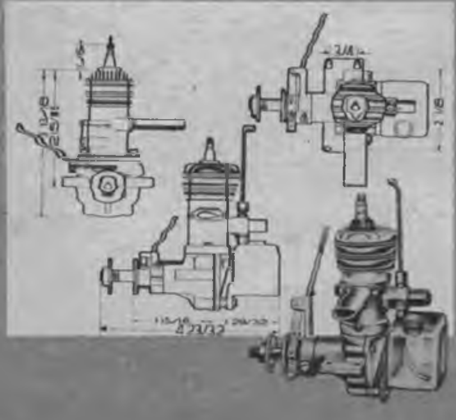


O. K. TWIN—Class C

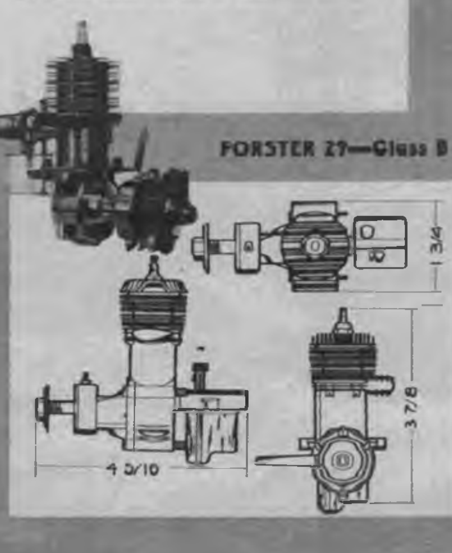


O. K. 49—Class C

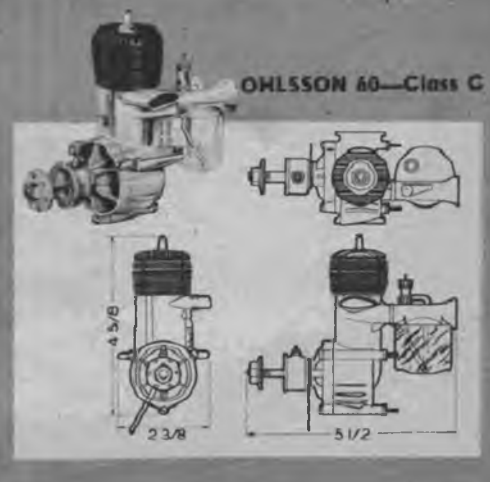
DENNYMITE—Class C



FORSTER 29—Class B



OHLSSON 60—Class C



Rigby—The Paper Man

THE New York studio of Wallace Rigby is littered with paper, paper in such interesting shapes as a superman who flies through the air with the very greatest of ease, and overhead monorail train cars. There are realistic scale models of famous ocean liners, cannons which work, trains, speedboats powered by rubber, and airplanes—all of paper. The airplanes are truly phenomenal. Most of them are only scale models, but many fly really well. The working models range from a series of tiny gliders—a small match box serves as hangar—to a thirty-inch Spitfire; there is even a scale model of the novel Northrop Flying Wing. The cheerful, lively Englishman who creates these realistic models is internationally famous. He is an enthusiastic model-plane builder from way back, with all of a model builder's experiences. He could write his autobiography and name it "The Paste Which Launched a Thousand Snips." His absorption in snappy snipping has occasioned incidents he smilingly relates.

One foggy night in France, when testing his Wakefield design for the next day's competition, he wound it to capacity, hand-launched it and listened to the whirring sound of the prop as the ship faded into the mist. When the prop stopped, Rigby had no way of knowing where the ship had gone. He groped his way across the field. Suddenly, as he says, "there was a crescendo and the model hit me in the back of the neck!"

One major disadvantage of Rigby paper flying models is that they make animal mouths water. He has had his models eaten by "critters" on many occasions—by goats on Gibraltar, dogs in England, and miscellaneous pigs. But he keeps making new ones for kits, comic strips and books; over 50,000 copies of his latest book have been sold.

Rigby's studio is a favorite gathering place for air-minded acquaintances who have a great time floating paper gliders from out his eleventh-floor window. Rigby snips them out as fast as their pilots can launch them. Some land on window ledges, where they are furtively snapped up by curious roomers. Others fly off toward the Hudson or spiral out of sight in a thermal. But Rigby's favorite anecdote is of an incident at Lake George, N. Y. He was showing some small boys how his paper models flew. Suddenly a speedboat cut across the lake. Out hopped an excited young man who said: "May I see that model? I know of a fellow in England who makes paper planes just like that—fellow name of Rigby!"

His New York studio is filled with models of all descriptions—all made from paper. Shown are scale jobs, his cut-out books, Penn locomotive, flying Spitfire.

Model-maker Rigby carefully checks finished model against his paper layout to see that when plans are printed they may be successfully cut out, assembled.

What, paper models that can fly? Rigby's been making 'em for years; here's the inside on his famous design procedure.

First step in design is to find authentic three-view drawings of the plane. Next, redesign for paper work.

It calls for quite a knowledge of geometry to transfer all the curved surfaces of the plane into accurate flat projections.

Rigby uses a very sharp model-making knife to cut out various model pieces.

With a few deft folds and creases, the fuselage appears in three dimensions from thin cardboard.

Wings fit smoothly into finished fuselage. Rigby has developed different types of wing fittings to simplify assembly.

All models are carefully decorated to correspond accurately with original planes.

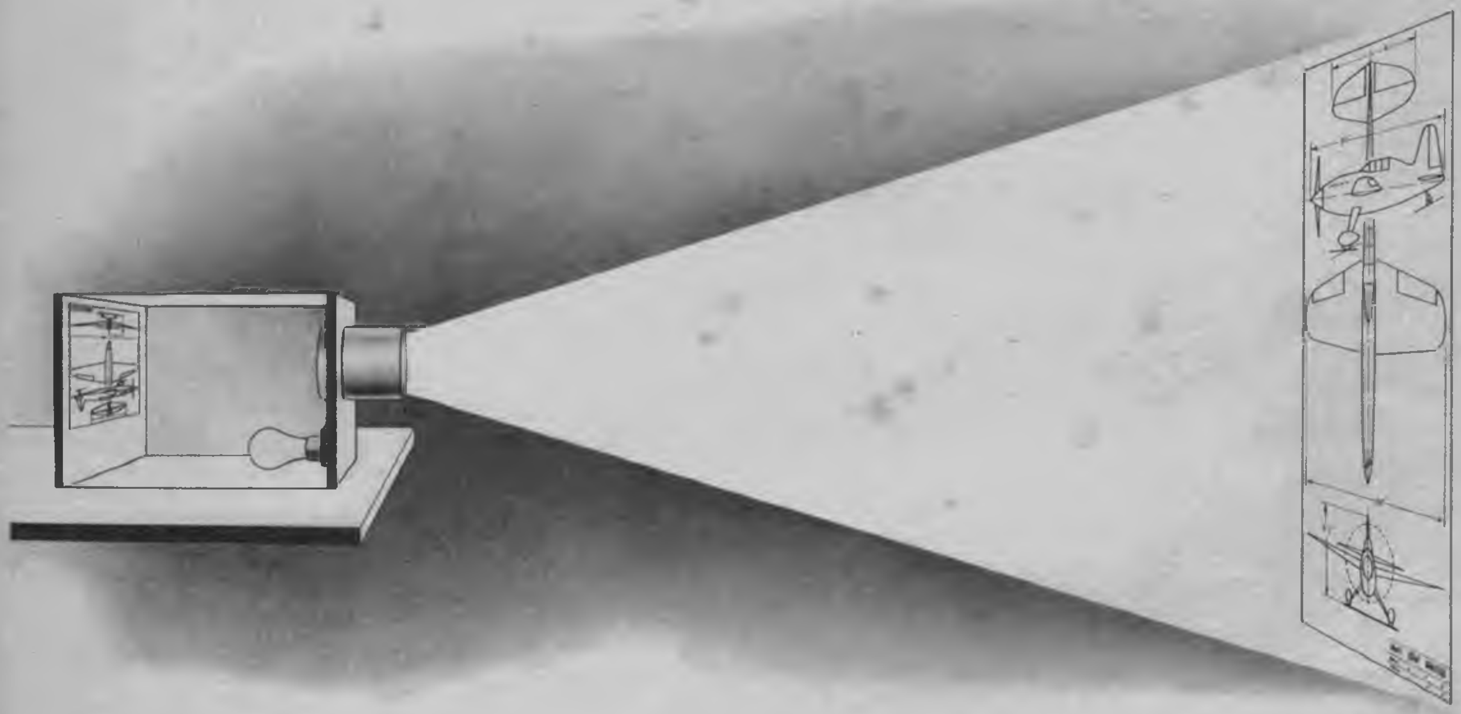
After finishing the original model, Rigby makes necessary changes and draws finished plans for the printer.

Here's the finished model being test-hopped. Don't be fooled: paper models can compete with any usual balsa model.

There's no size limit with paper models as proved by this example. Both fine fliers.

Home-Made Projector

BY MIKE POITRAS



Enlarging our three-view plans made easy! All you need is an empty five-gallon oil can, a piece of stove pipe and . . . .

CONSTRUCTION

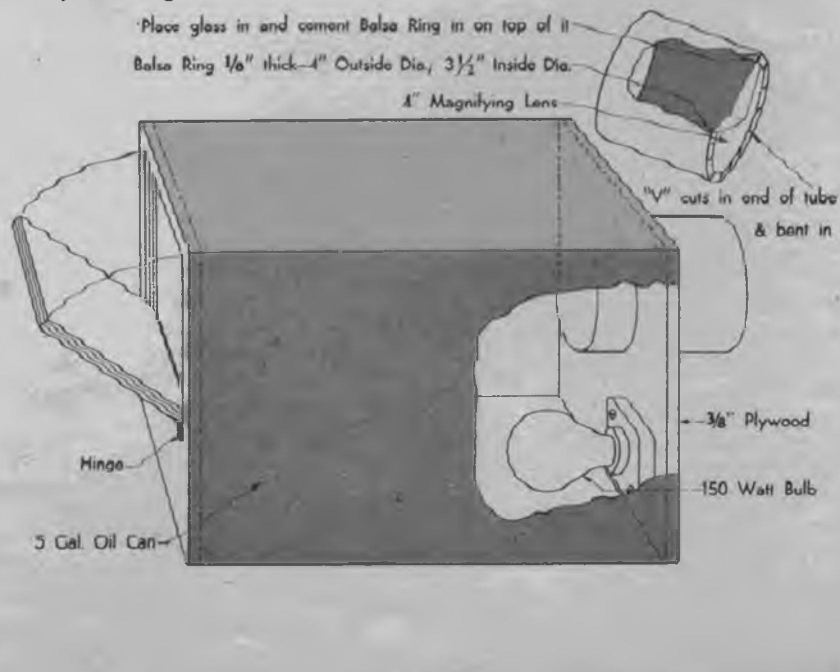
Using a husky pair of snips, cut the top and bottom out of the can. Trim two plywood panels to fit into the ends of the can. Cut a door in one and mount the lamp socket on the other. Also cut a hole for the lens tube, directly opposite the center of the hinged door. This hole should be cut carefully and should afford a sliding fit for the lens tube.

OPERATION

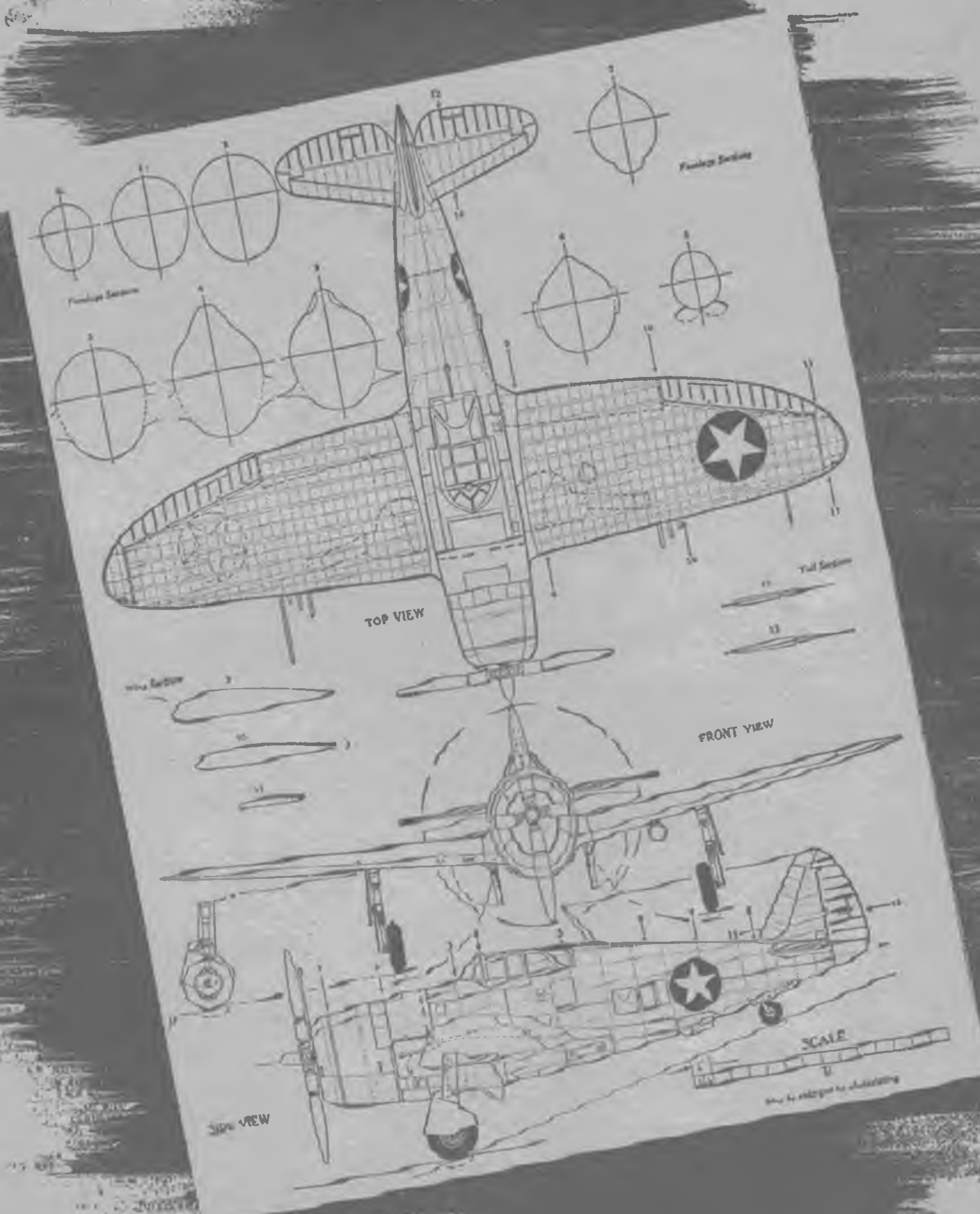
Place drawing on center of the hinged door and point box at wall. By moving the box toward or away from the wall, the desired size of projection can be had. Use the lens tube to obtain a sharp image. Distortion of the picture or plan can be remedied by cutting a disk of cardboard to fit against the lens. A hole 1½" to 2½" diameter should be cut in the center of the disk. The lens will not cover as much of the original drawing, but the projection will be much clearer. To obtain the best efficiency possible, paint the inside of the box with white enamel.

BILL OF MATERIALS

1 Five-gallon oil can
1 Porcelain lamp socket
1 100 or 150 Watt bulb
1 4" condenser lens (actually just a magnifying lens)
1 4" diam. x 4" long metal tube (stovepipe used in original)
2 pcs. ⅜ x 9½ x 9½" plywood
1 pair of hinges



Planbook of Famous Planes and Models



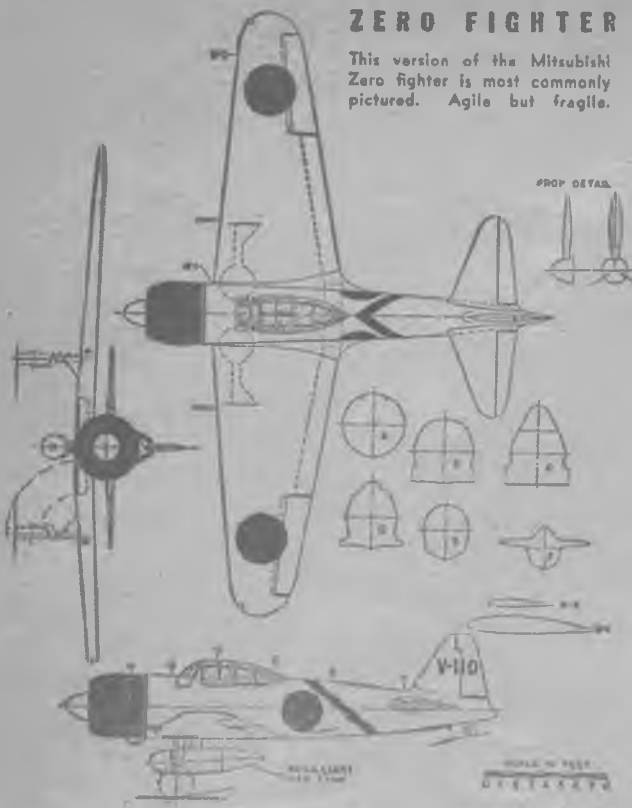
REPUBLIC P-47B

America's most outstanding fighter to date is the Thunderbolt, with a rumored top speed of over 400 miles per hour.

FAMOUS FIGHTERS

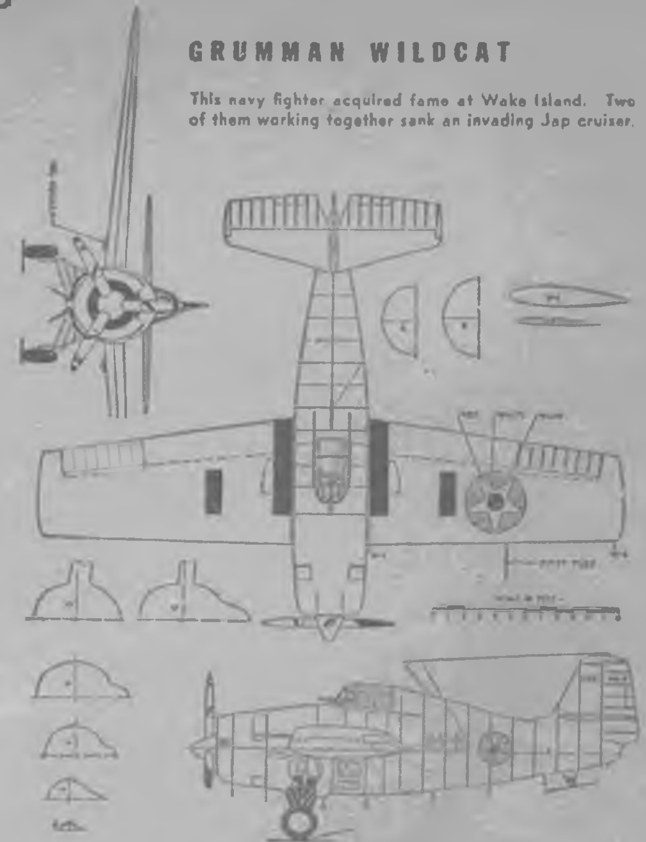
ZERO FIGHTER

This version of the Mitsubishi Zero fighter is most commonly pictured. Agile but fragile.



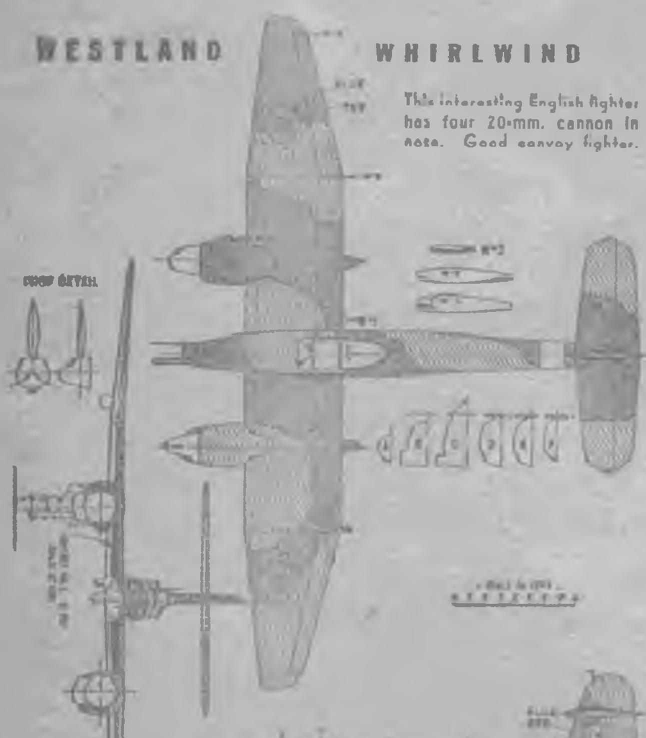
GRUMMAN WILDCAT

This navy fighter acquired fame at Wake Island. Two of them working together sank an invading Jap cruiser.



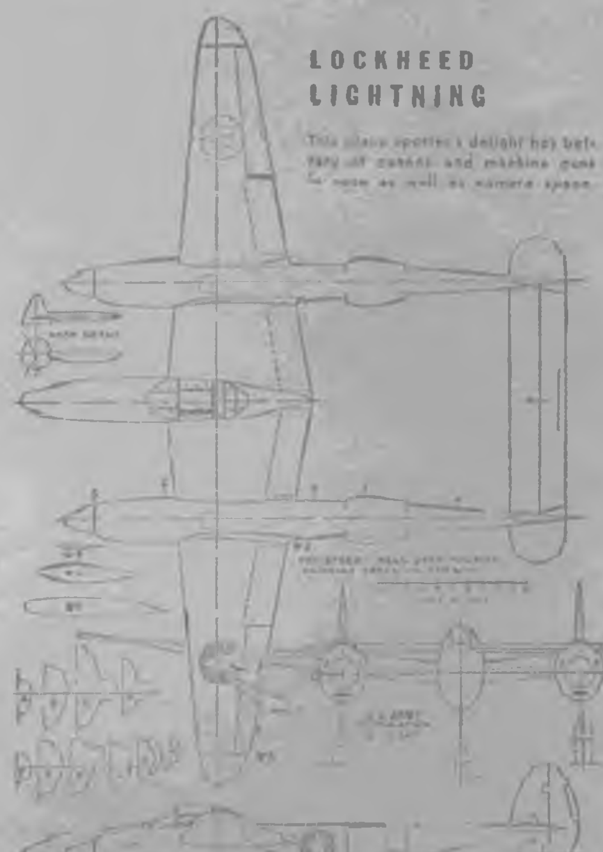
WESTLAND WHIRLWIND

This interesting English fighter has four 20-mm. cannon in nose. Good convoy fighter.



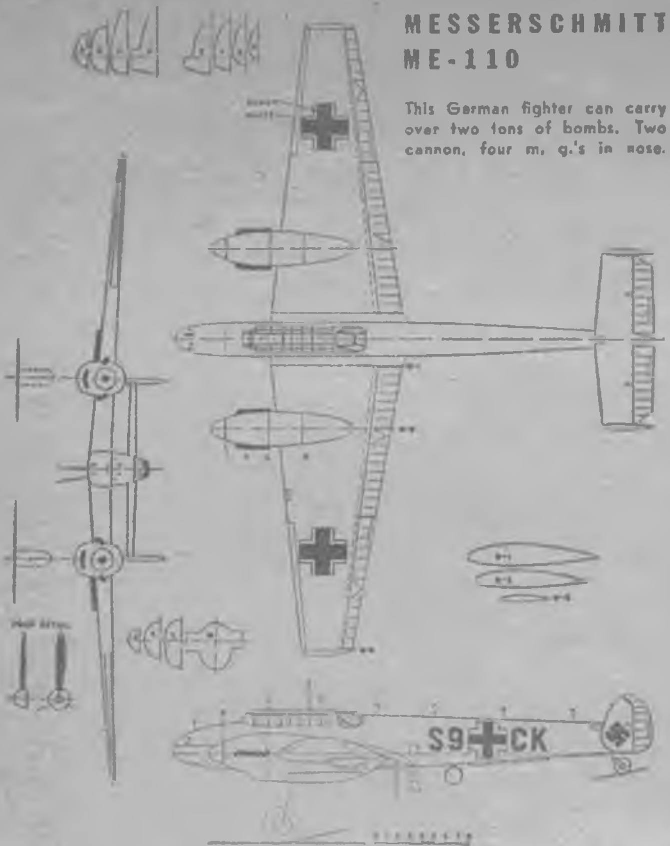
LOCKHEED LIGHTNING

This plane spotter's delight has battery of cannon and machine guns in nose as well as camera space.



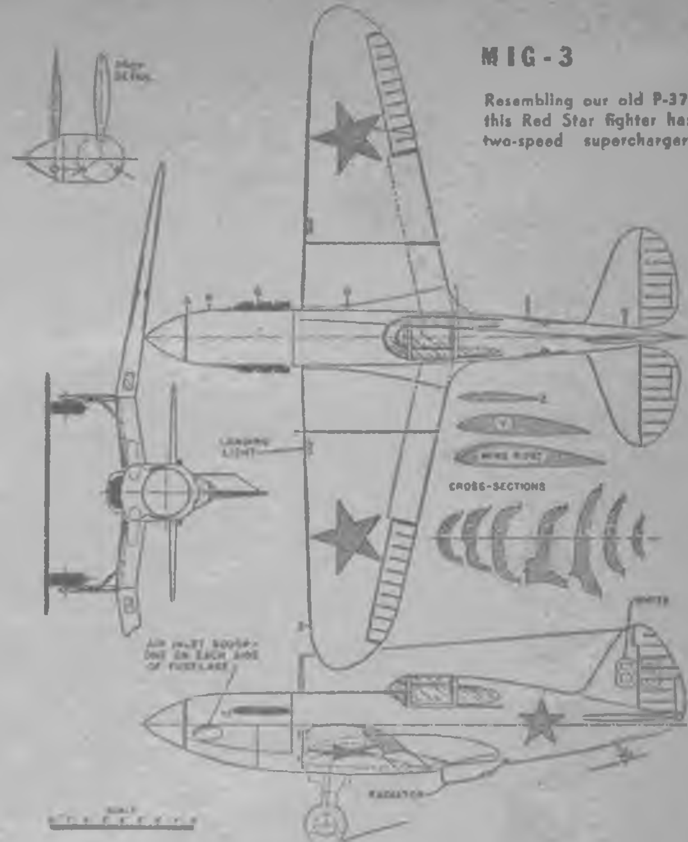
MESSERSCHMITT ME-110

This German fighter can carry over two tons of bombs. Two cannon, four m. g.'s in nose.



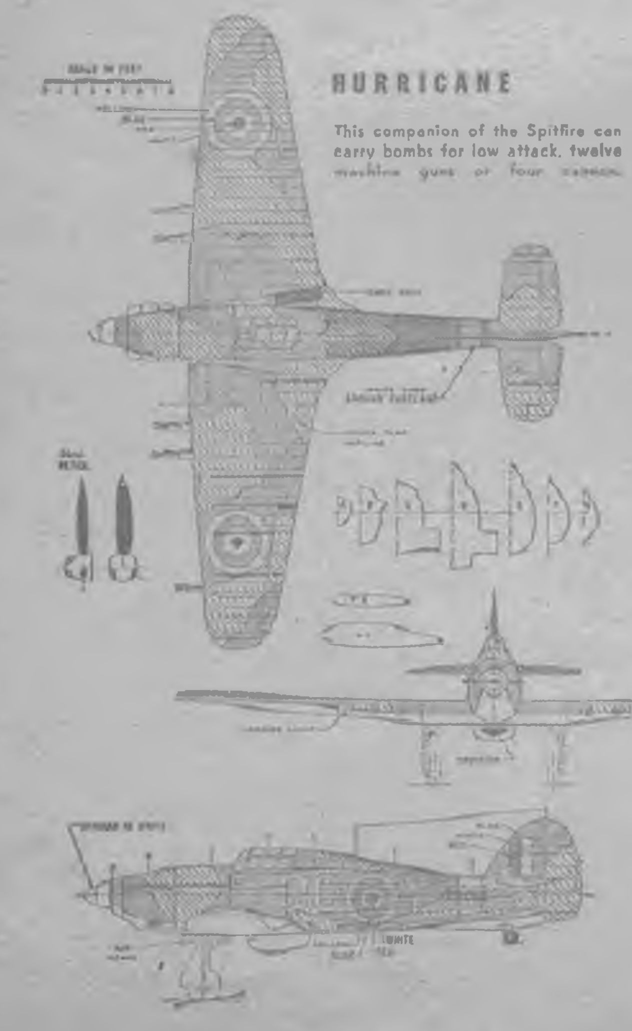
MIG-3

Resembling our old P-37, this Red Star fighter has two-speed supercharger.



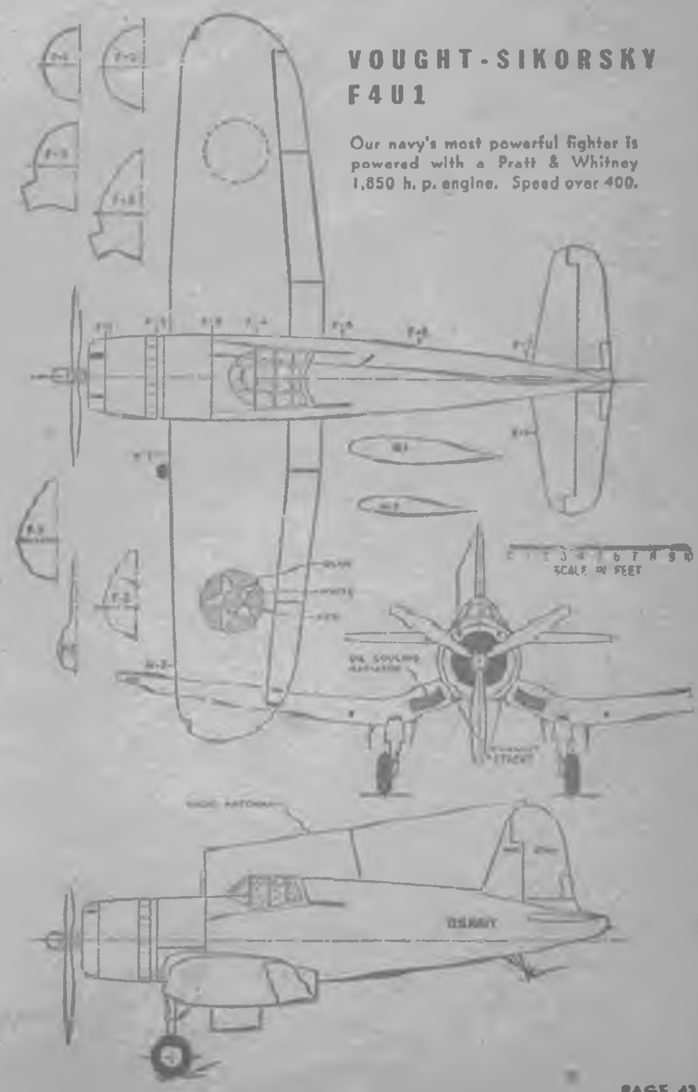
HURRICANE

This companion of the Spitfire can carry bombs for low attack, twelve machine guns or four cannon.



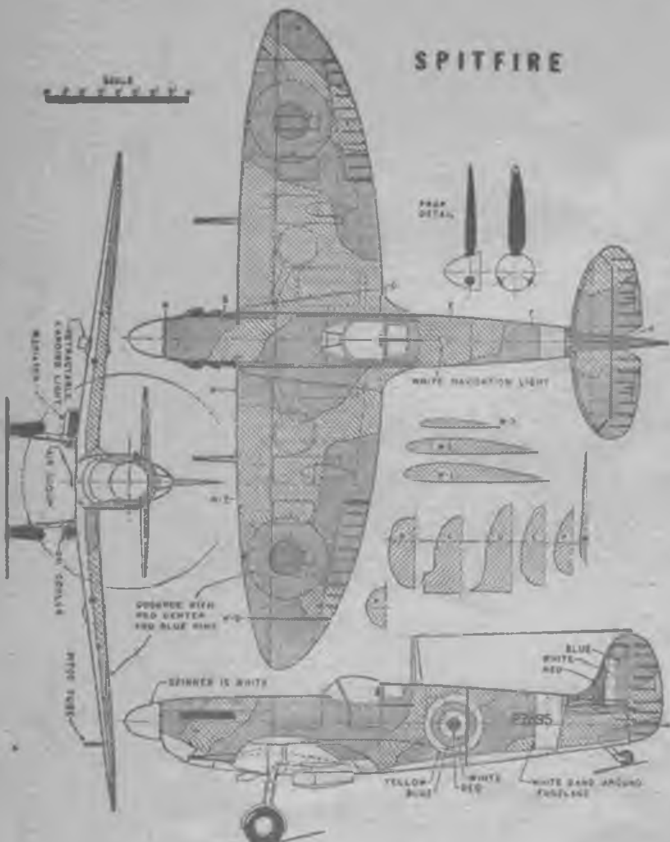
VOUGHT-SIKORSKY F4U1

Our navy's most powerful fighter is powered with a Pratt & Whitney 1,850 h. p. engine. Speed over 400.



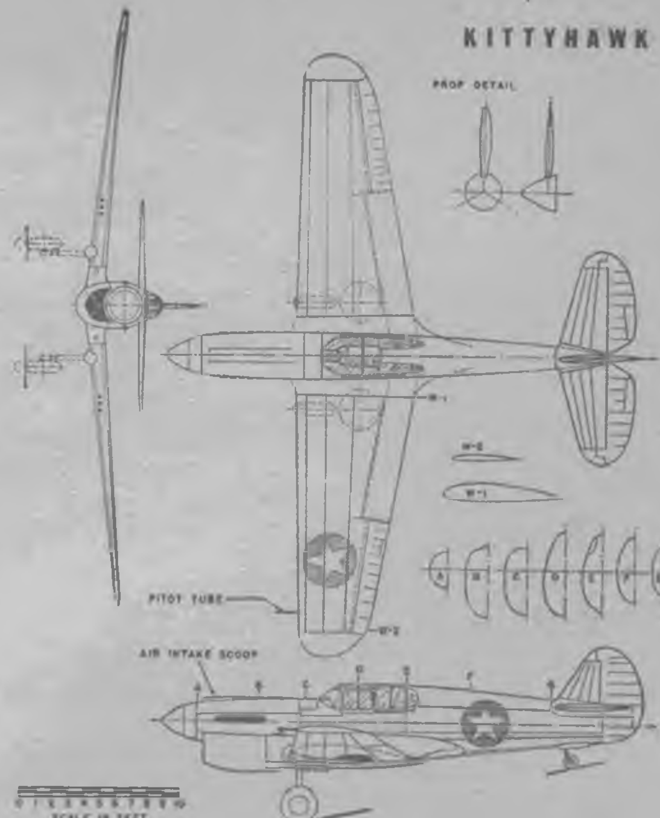
FAMOUS FIGHTERS

SPITFIRE



This famous fighter, defender of London, is now equipped with two 20-mm. cannon, four Browning machine guns, newest Merlin.

KITTYHAWK

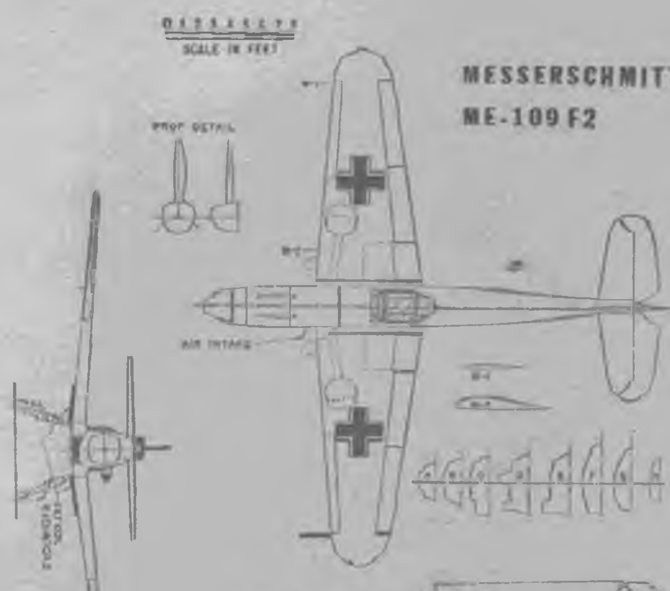


This RAF version of the P-40D has done outstanding work in Africa against best planes Axis can send against them. Allison engine.

AIRACOBRA

This plane, designed around a 37-mm. cannon laid on the lofting floor, has proven effective against tanks, armored cars, bombers.

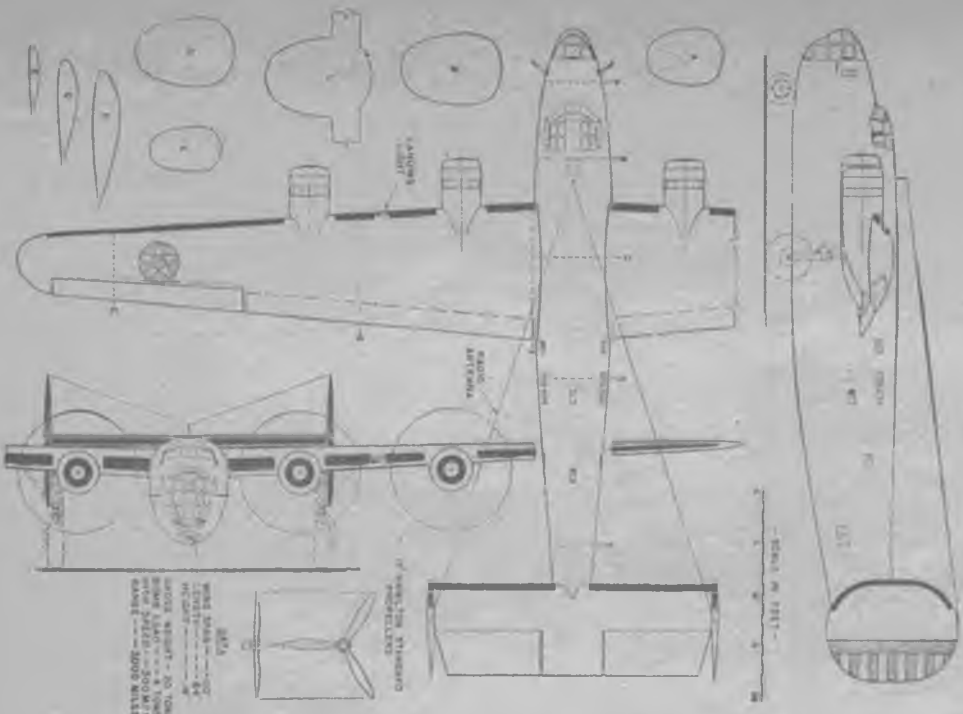
MESSERSCHMITT ME-109 F2



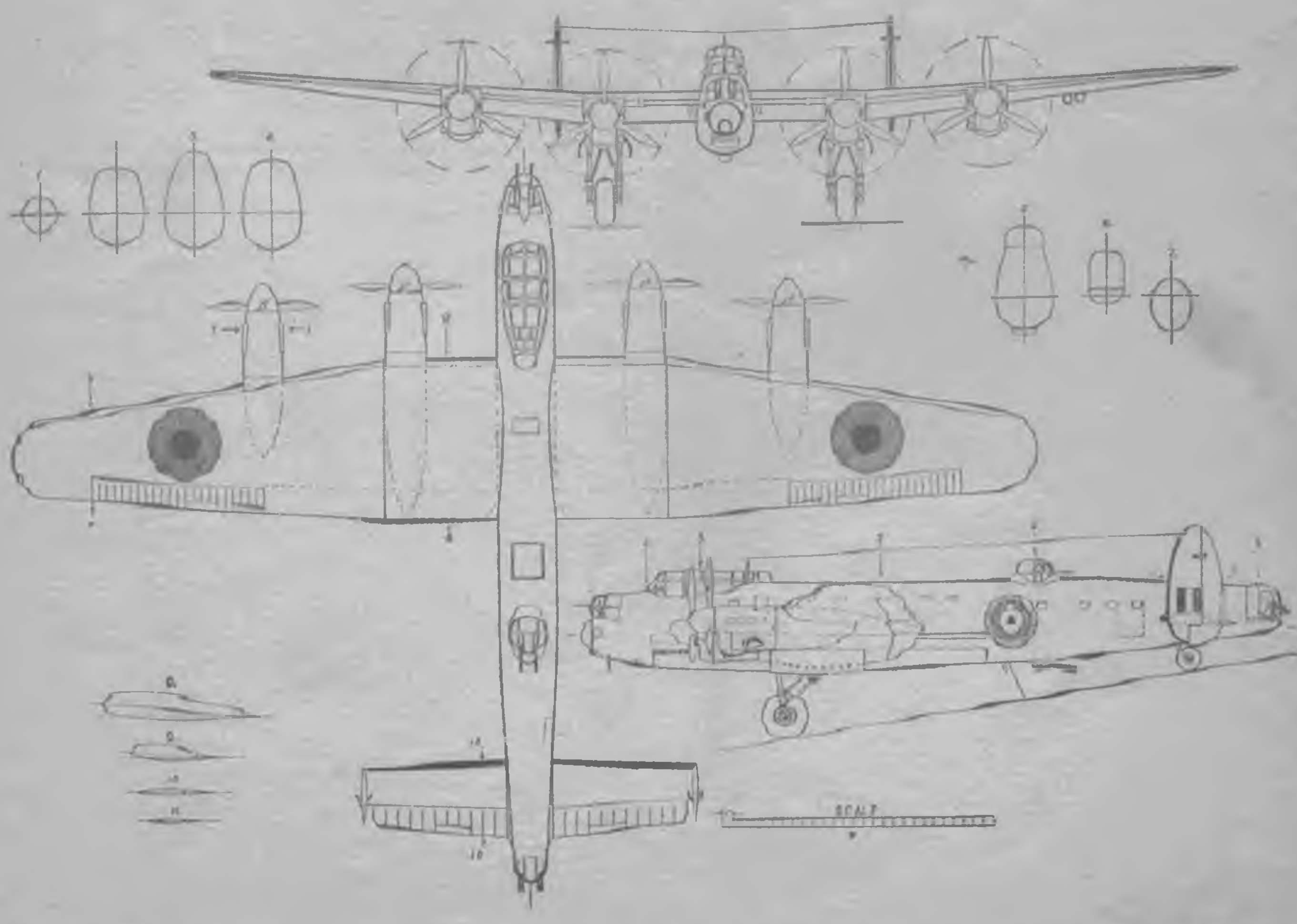
Dressed up with new rounded wing tips, cantilever tail, huge nose spinner, this latest version of Me.109 is Hitler's standard fighter.

Famous Bombers

These flying battleships are making history. Enlarge the plans for realistic shelf models.

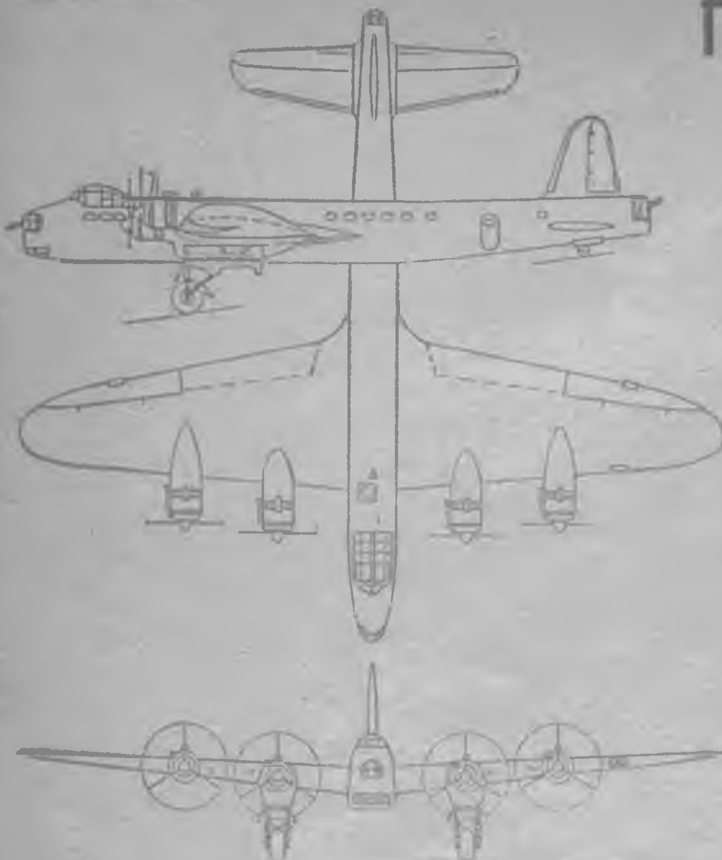


Consolidated B-24. The Davis airfoil gives the B-24, or Liberator as the British know it, extreme range and load-carrying ability at high speeds. These ships bombed the Italian fleet. As freighters they carry ten tons.

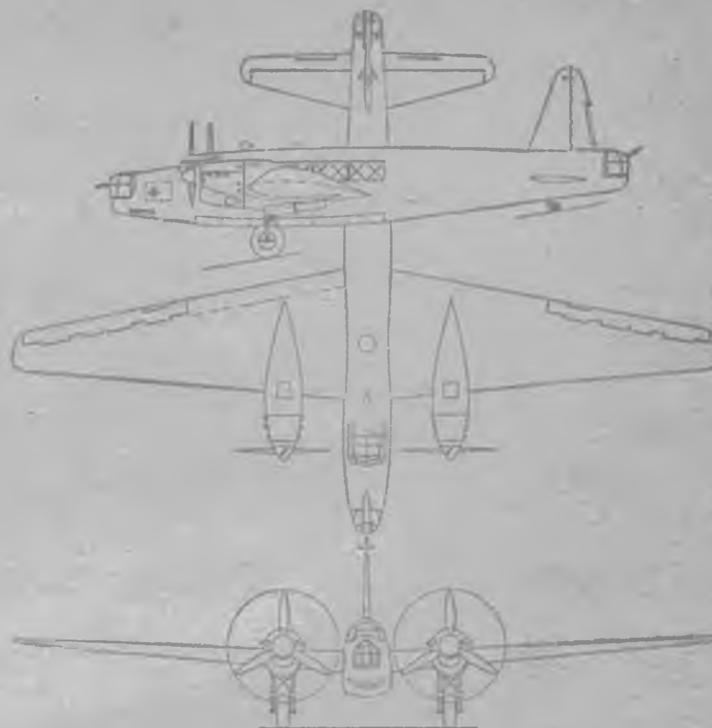


Avro Lancaster. This is bomber the British say is best in the world. It carries just under eight tons of bombs, has good range, nearly a 300 m. p. h. top. Has ten 30-caliber guns in four turrets. Its resemblance to twin-motored Manchester is due to its being same basic design. Has four Rolls-Royce Merlins.

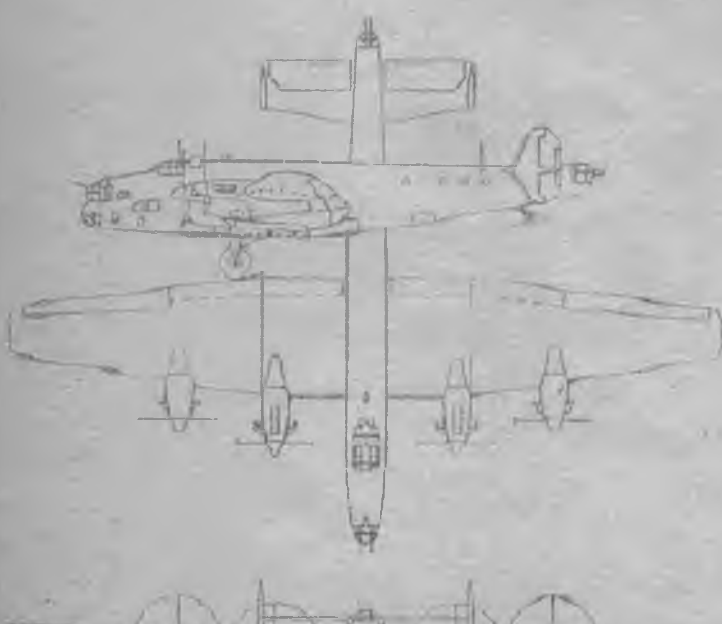
Famous Bombers



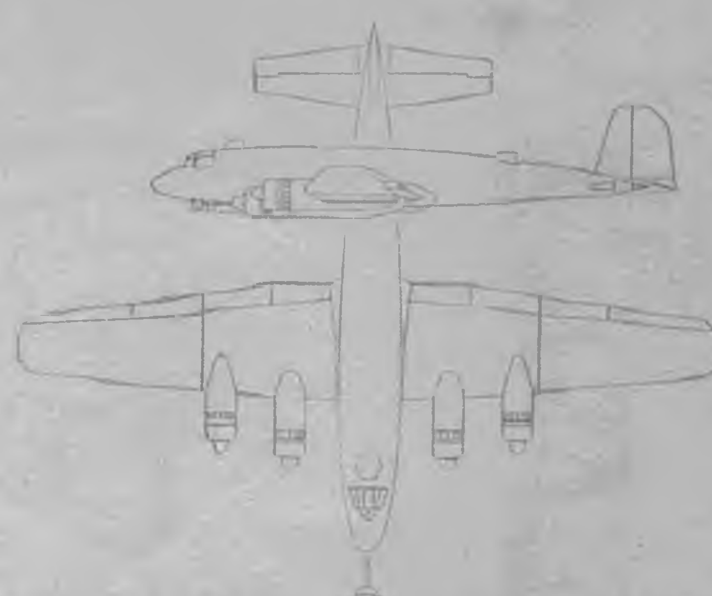
Short Stirling. Heaviest bomber in the world, this ship was started in 1936. Half-size flying scale model of it with two-man crew is still flying. Bombs carried in rows beneath belly, in wing between fuselage and inner engine nacelles



Vickers Wellington. A pre-war design for which the end is not yet in sight. Geodetic "basket-weave" construction eliminates all internal framework from body, makes wings strong enough for high aspect ratio. Has liquid-cooled Merlins.



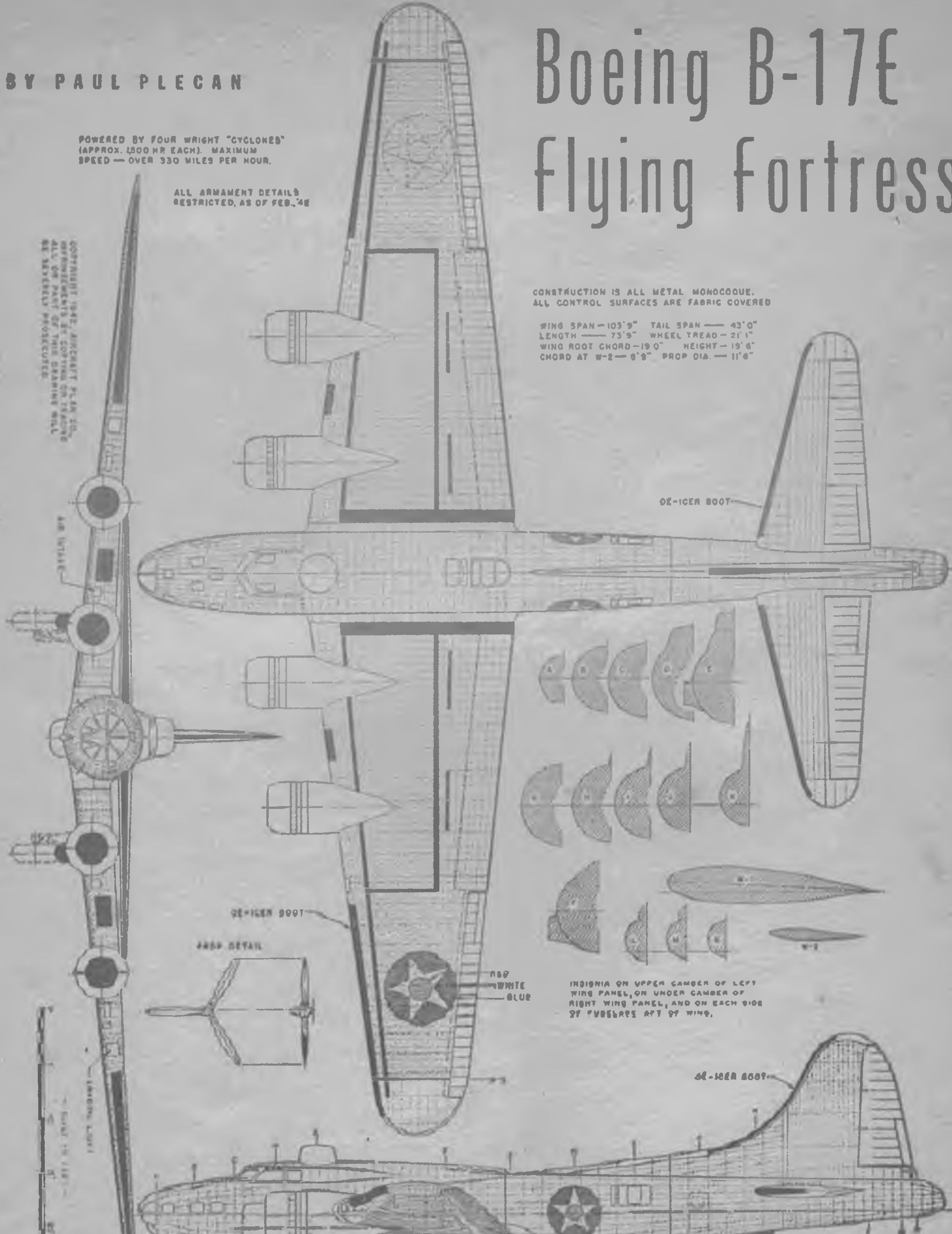
Handley-Page Halifax. A very efficient bomber for transporting large loads long distances. Beats Stirling in this respect. Like all modern heavy bombers it has ammunition magazine amidships, with bullet chutes to the four-gun rear turret.



Focke-Wulf Kurier. Developed from the Focke-Wulf Condor, which flew to New York, this job is used to bomb convoys and report them to submarine packs. "Sea Hurricanes" catapult-launched from freighters proved too much for the Kuriers.

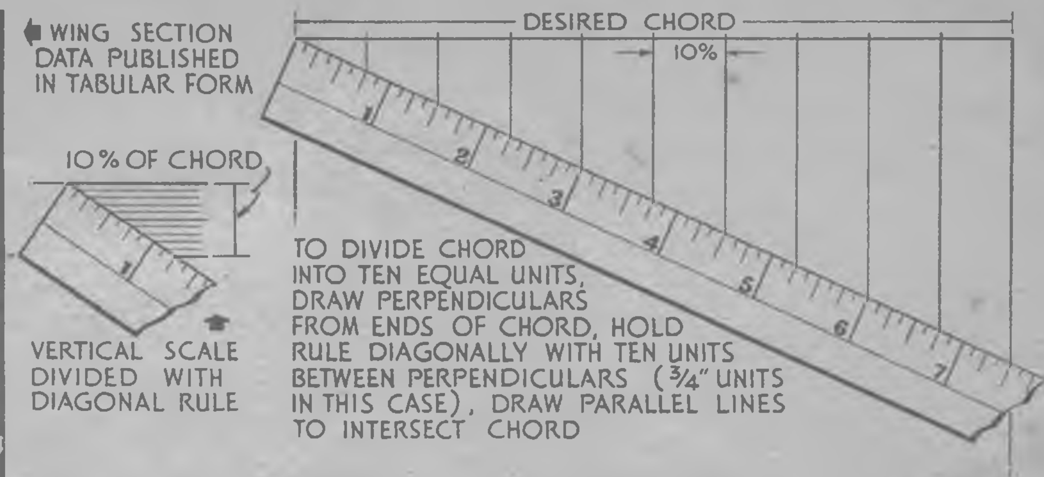
Boeing B-17E Flying Fortress

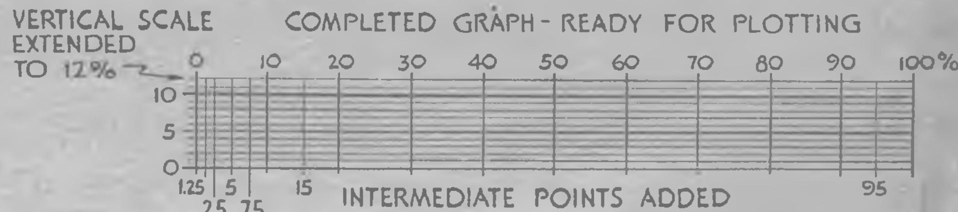
BY PAUL PLECAN

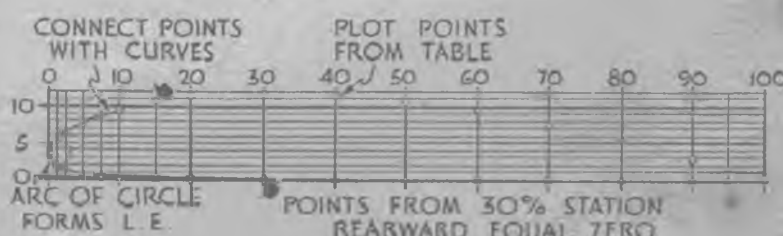


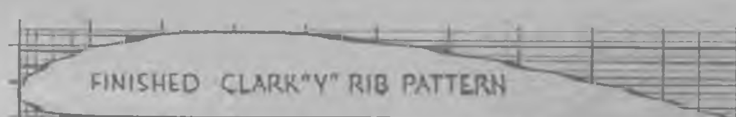
How to Plot Airfoils

CLARK "Y"		
% OF CHORD	UPPER ORDINATES	LOWER ORDINATES
0.0	3.6	3.6
1.25	5.38	1.86
2.5	6.43	1.42
5.0	7.83	0.91
7.5	8.79	0.59
10.0	9.56	0.39
15.0	10.6	0.12
20.0	11.3	0.01
30.0	11.7	0.0
40.0	11.4	0.0
50.0	10.5	0.0
60.0	9.15	0.0
70.0	7.34	0.0
80.0	5.21	0.0
90.0	2.79	0.0
95.0	1.5	0.0
100.0	0.12	0.0



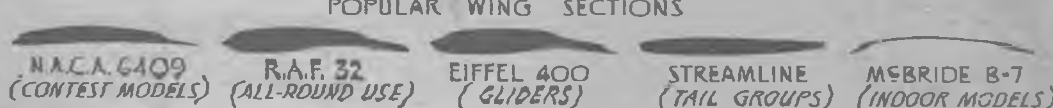






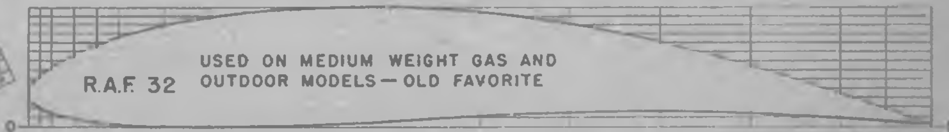
CAREFULLY PLOTTED SECTION MAY BE ENLARGED OR REDUCED BY PHOTOGRAPHY OR PHOTOSTATING

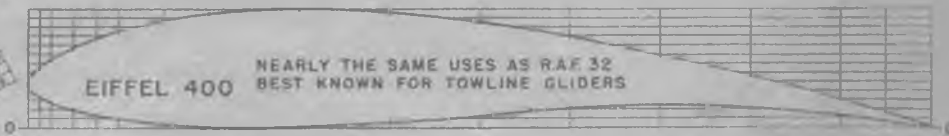
POPULAR WING SECTIONS

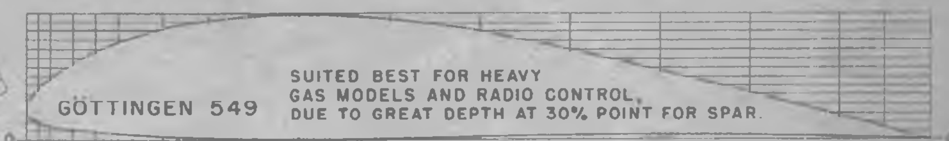


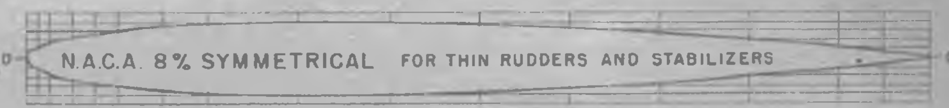
PROJECTING RIBS FOR TAPERED WING

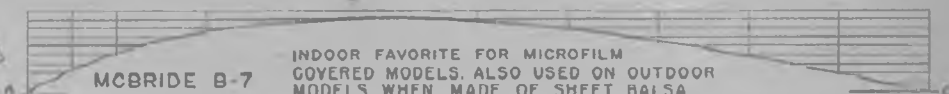
BY PAUL PLECAN

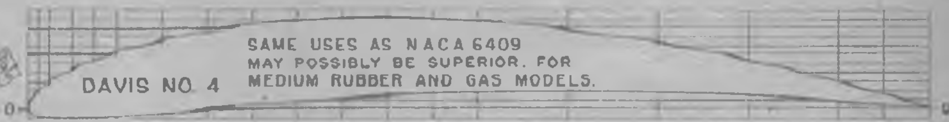


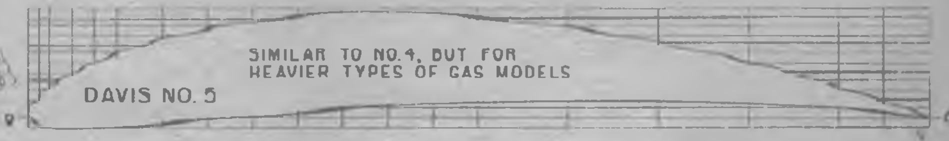












CLARK Y ORDINATES

% OF CHORD	[illegible]
UPPER CAMBER	[illegible]
LOWER CAMBER	[illegible]

NACA 6409 ORDINATES

% OF CHORD	[illegible]
UPPER CAMBER	[illegible]
LOWER CAMBER	[illegible]

R.A.F. 32 ORDINATES

% OF CHORD	[illegible]
UPPER CAMBER	[illegible]
LOWER CAMBER	[illegible]

EIFFEL 400 ORDINATES

% OF CHORD	[illegible]
UPPER CAMBER	[illegible]
LOWER CAMBER	[illegible]

U.S.A. 27 ORDINATES

% OF CHORD	[illegible]
UPPER CAMBER	[illegible]
LOWER CAMBER	[illegible]

GOTTINGEN 549 ORDINATES

% OF CHORD	[illegible]
UPPER CAMBER	[illegible]
LOWER CAMBER	[illegible]

NACA 8% SYMMETRICAL ORDINATES

% OF CHORD	[illegible]
UPPER CAMBER	[illegible]
LOWER CAMBER	[illegible]

MCBRIDE B-7 ORDINATES

% OF CHORD	[illegible]
UPPER CAMBER	[illegible]

DAVIS No. 4 ORDINATES

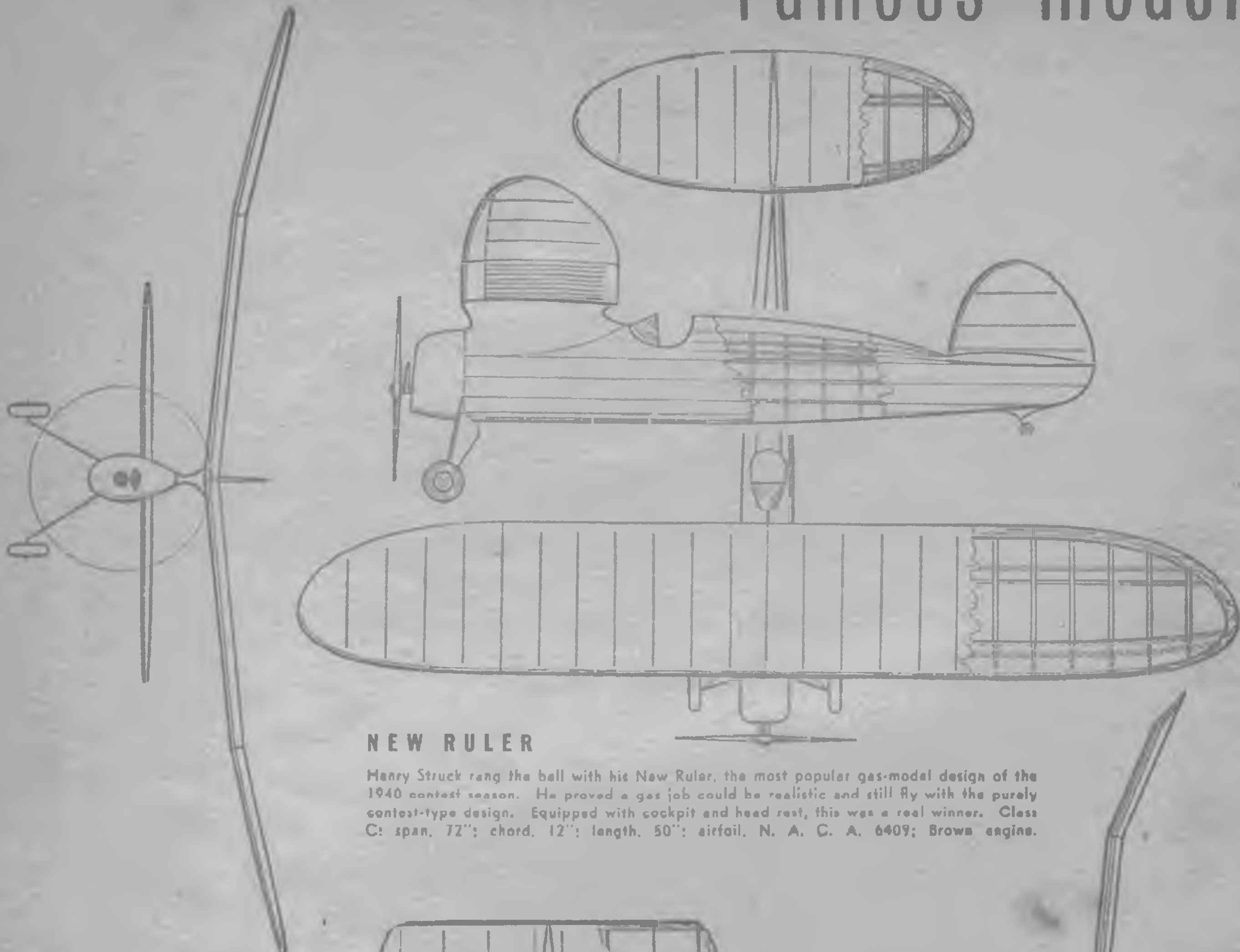
% OF CHORD	[illegible]
UPPER CAMBER	[illegible]
LOWER CAMBER	[illegible]

DAVIS No. 5 ORDINATES

% OF CHORD	[illegible]
UPPER CAMBER	[illegible]
LOWER CAMBER	[illegible]

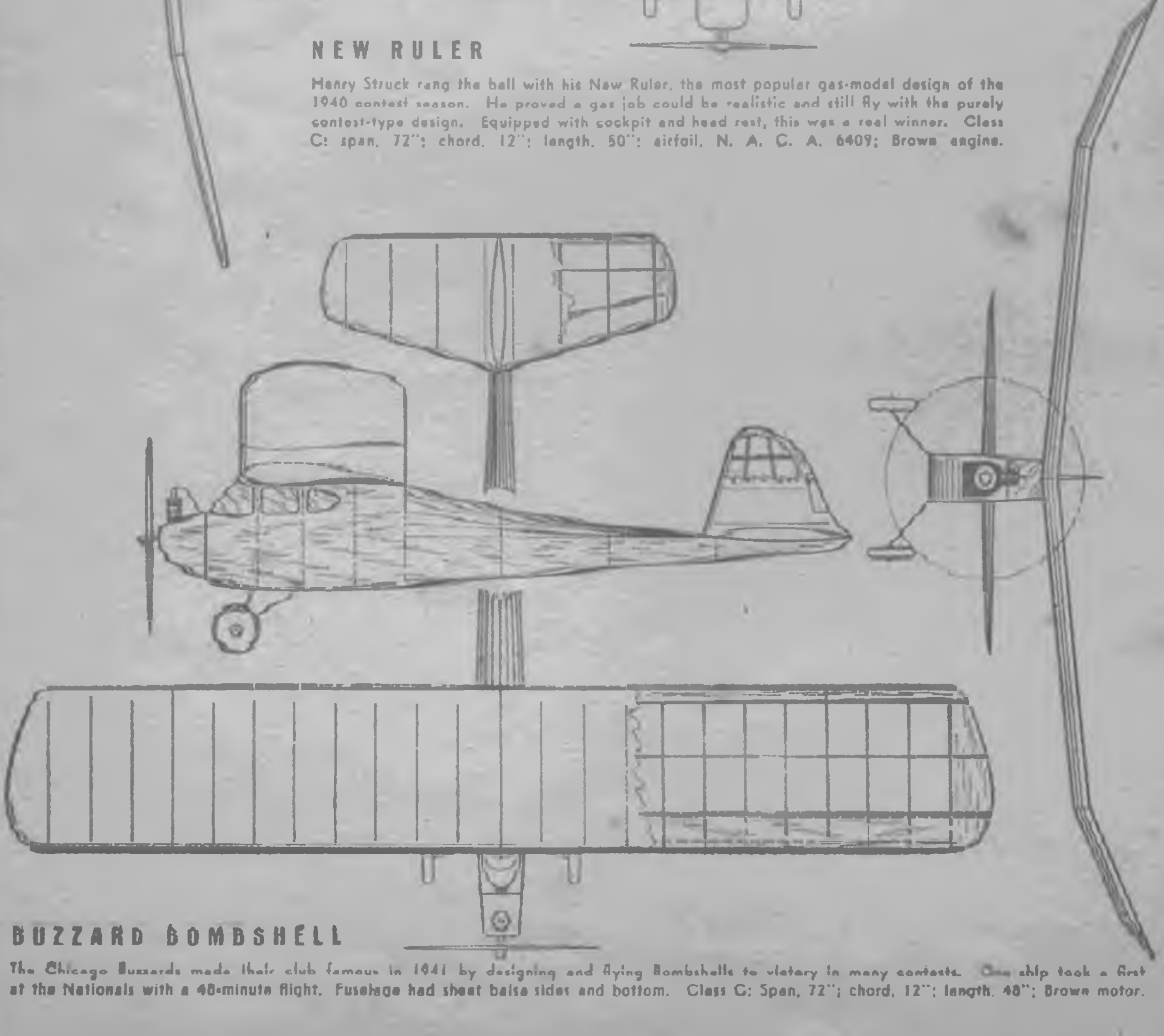
Popular Airfoils

Famous Models



NEW RULER

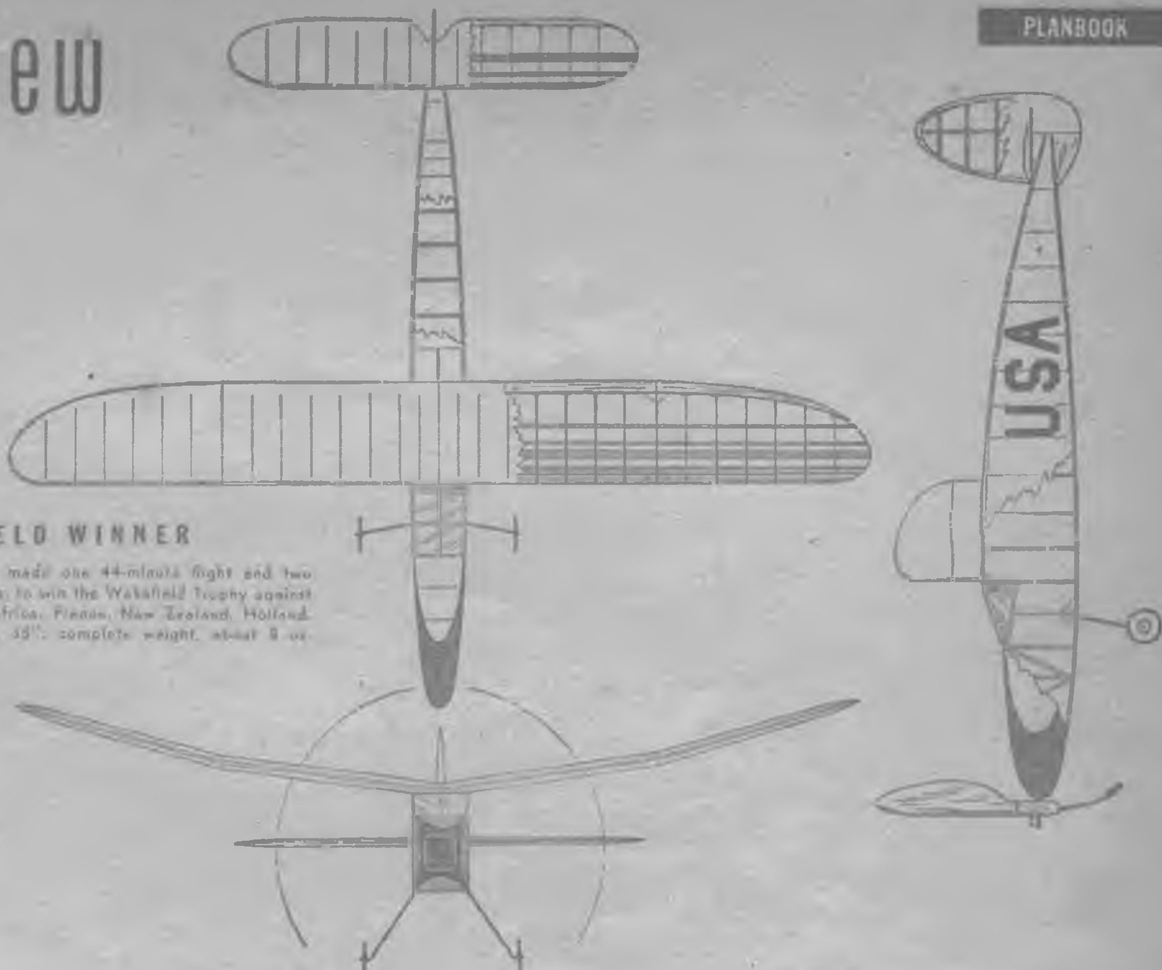
Henry Struck rang the bell with his New Ruler, the most popular gas-model design of the 1940 contest season. He proved a gas job could be realistic and still fly with the purely contest-type design. Equipped with cockpit and head rest, this was a real winner. Class C: span, 72"; chord, 12"; length, 50"; airfoil, N. A. C. A. 6409; Brown engine.



BUZZARD BOMBSHELL

The Chicago Buzzards made their club famous in 1941 by designing and flying Bombshells to victory in many contests. One ship took a first at the Nationals with a 40-minute flight. Fuselage had sheet balsa sides and bottom. Class C: Span, 72"; chord, 12"; length, 48"; Brown motor.

In 3-View



KORDA WAKEFIELD WINNER

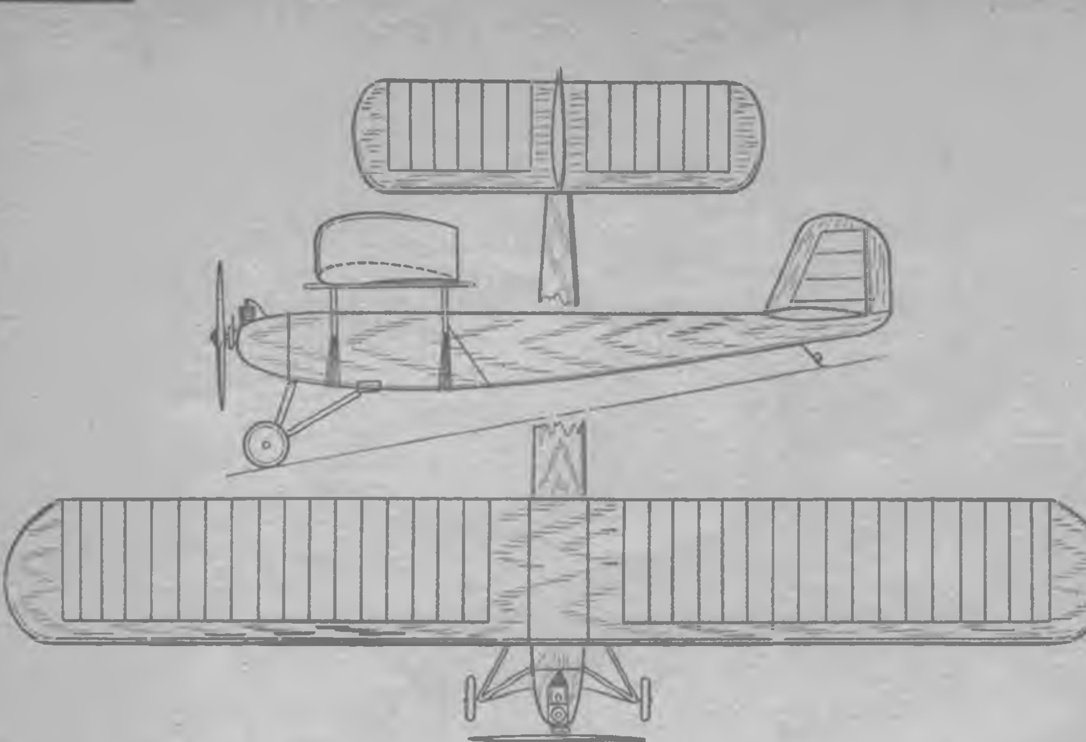
At Bendix, N. J., Dick Korda made one 44-minute flight and two others, totaling over 50 minutes, to win the Wakefield Trophy against models from England, South Africa, France, New Zealand, Holland. Span, 43"; chord, 5"; length, 35"; complete weight, about 8 oz.

SLICK STICK

His work at N. A. C. A. labs encouraged C. C. Johnson to streamline stick models. The tubular sheet-balsa body houses a rubber motor. Span, 60"; chord, 4".

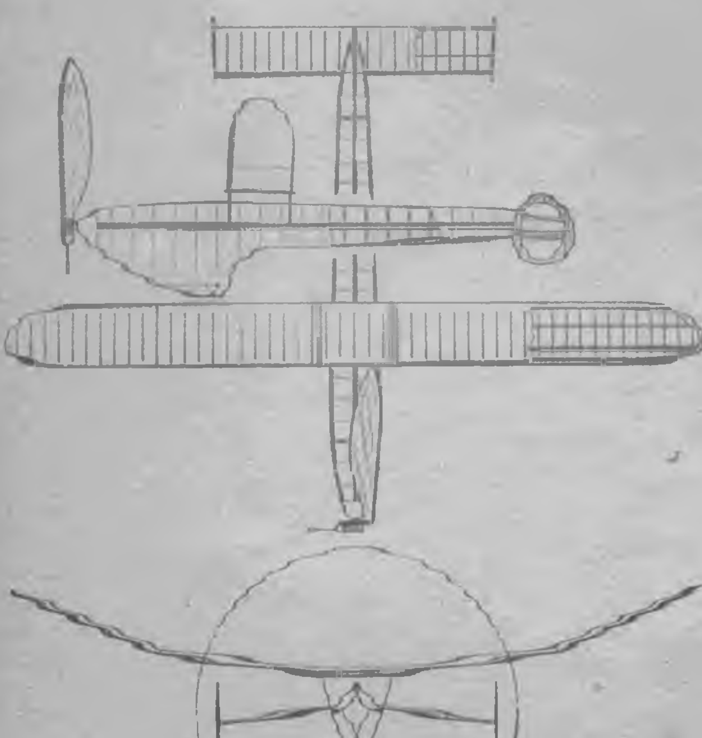
TWIN PUSHER

Prior to 1934, twin pushers were popular. Tremendous climb, long motor run, poor glide, but simple for beginners to adjust. Span, 36"; chord, 4½".



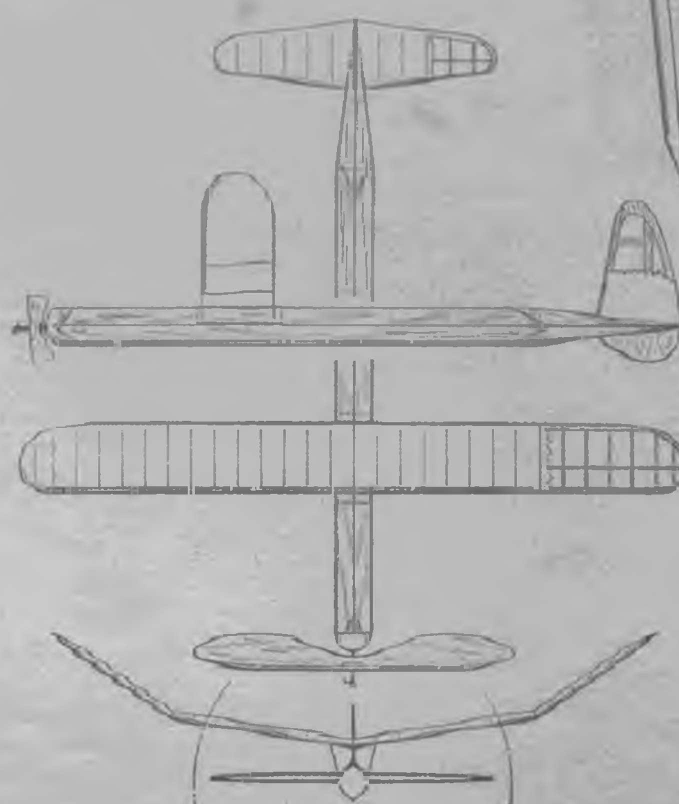
KG-2, EARLY TYPE GAS MODEL

While not the first gas model in the country, the KG proved quite popular about 1934-35. Construction resembled real aircraft in thoroughness and detail. It was big, stable, slow, though heavy. Span, 10', chord, 15"; length, 69"; weight, 6.5 lbs., Brown engine.



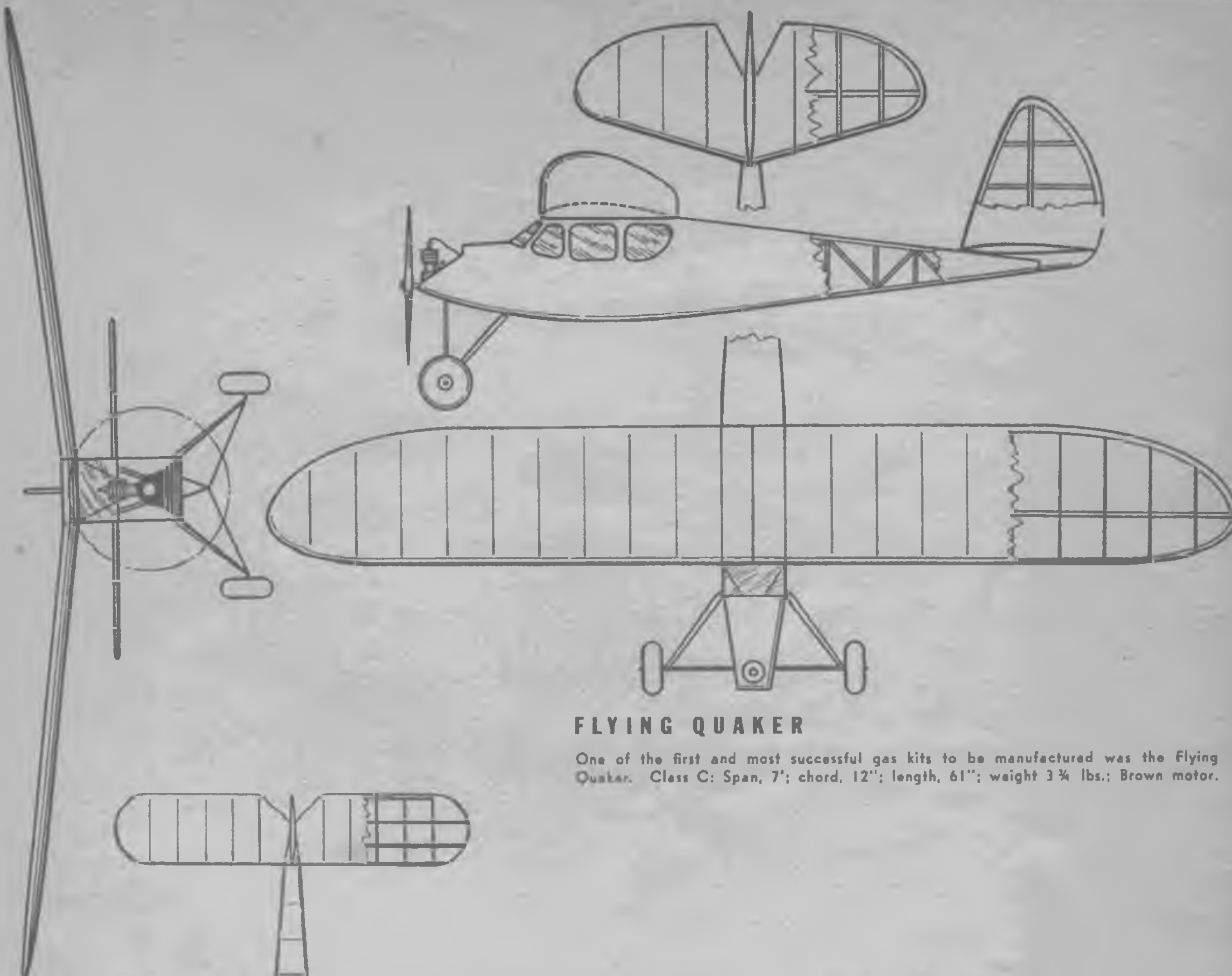
CALIFORNIA CHAMP

Ralph Baker, Tom Engleman teamed for this fine Wakefield flier. Had unique retractable landing gear. Span, 48¾"; chord, 4¼"; weight, 8.6 oz.



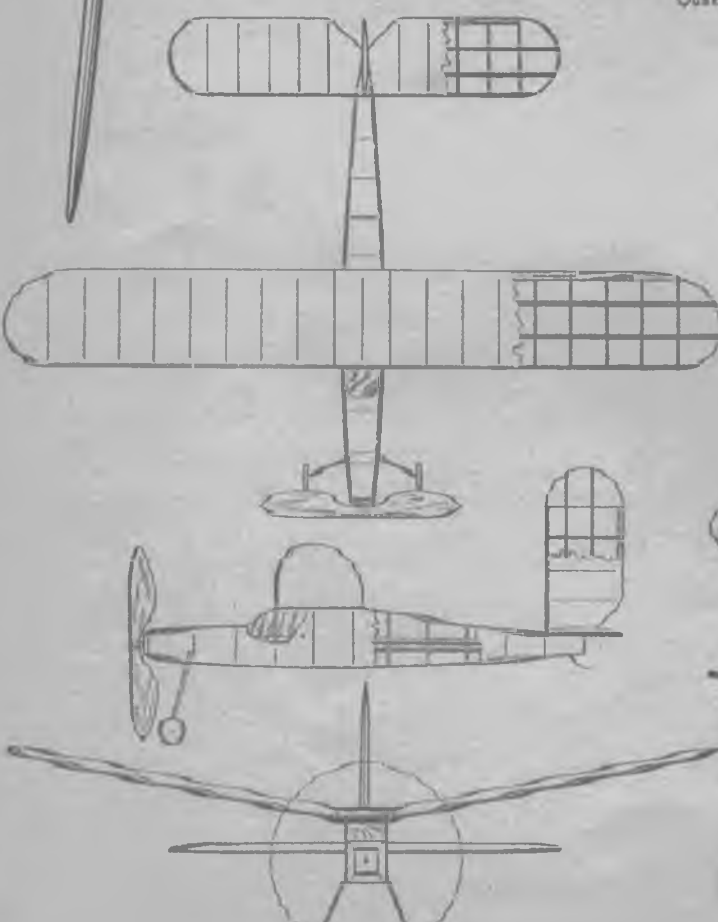
MULVIHILL TROPHY WINNER

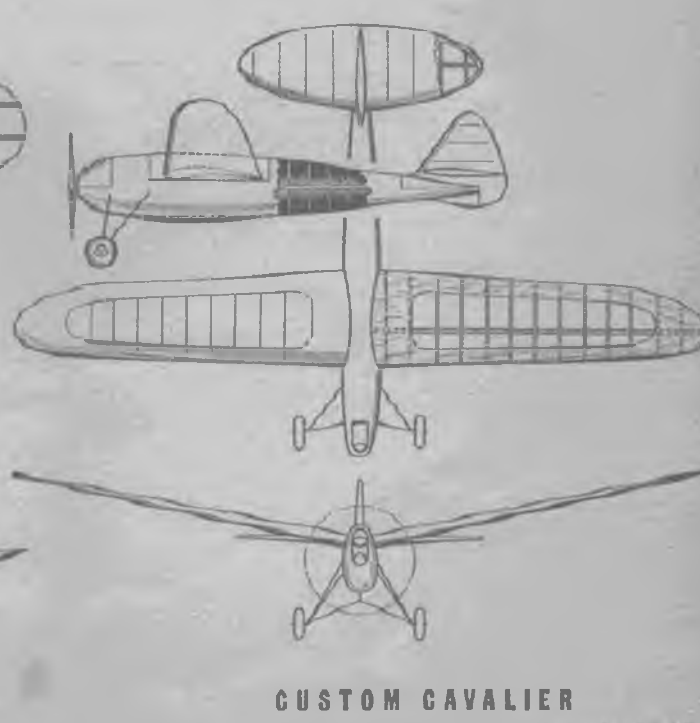
Like all Tulsa contest models, Dague's stick had high climb and flat glide. A "diamond" sheet-balsa fuselage. Span, 36"; chord, 3¾"; weight, 3.8 oz.



FLYING QUAKER

One of the first and most successful gas kits to be manufactured was the Flying Quaker. Class C: Span, 7'; chord, 12"; length, 61"; weight 3 ¾ lbs.; Brown motor.



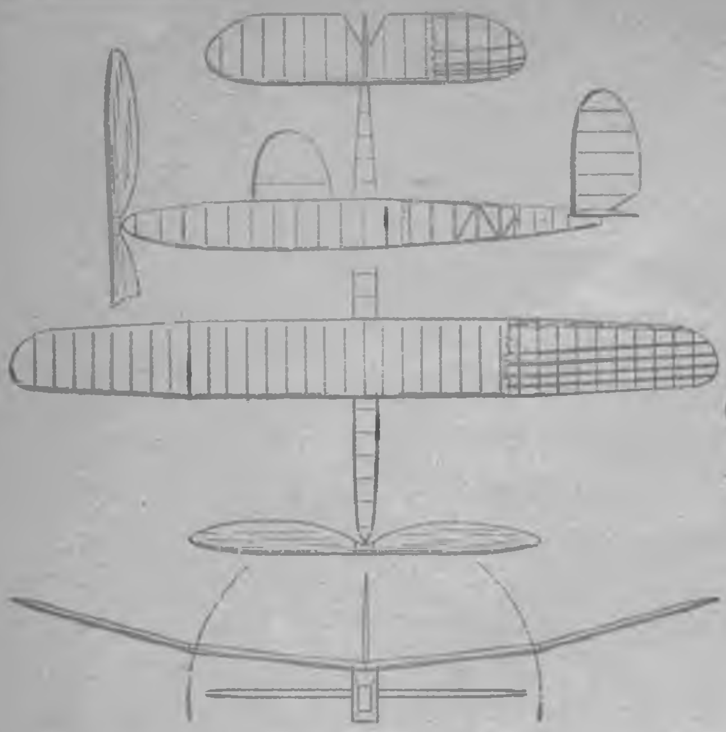


WAKEFIELD TROPHY WINNER

Gordon Light's 1935 winner probably was the simplest contest job of them all. Its motor stick, which slipped out with rubber, was unique feature. Span, 44"; chord, 5½"; length, 32"; weight, 4 oz.

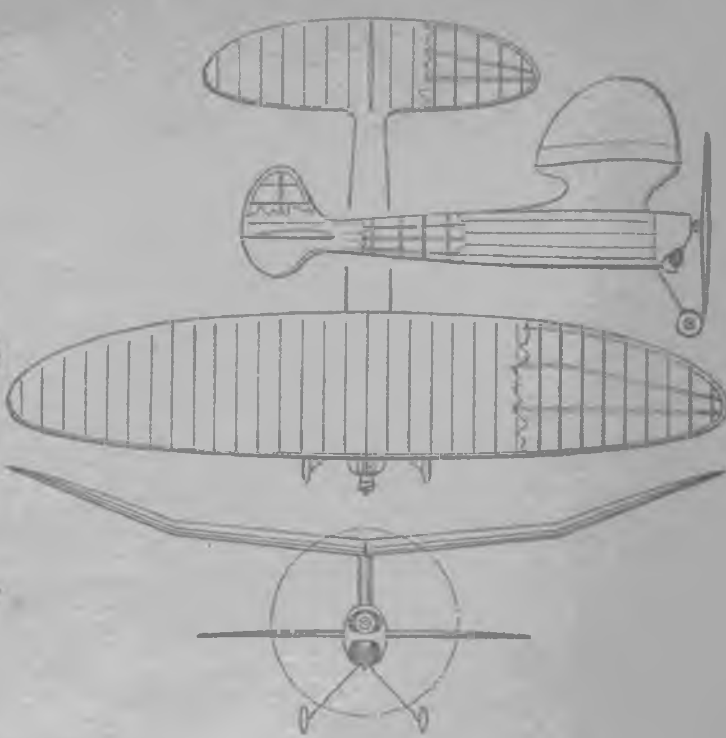
CUSTOM CAVALIER

Designed by Shereshaw, famous Cavalier is still popular after years of flying, is good for radio control. "Planked" balsa covered fuselage, rugged construction. Class C: Span, 9', length, 67".



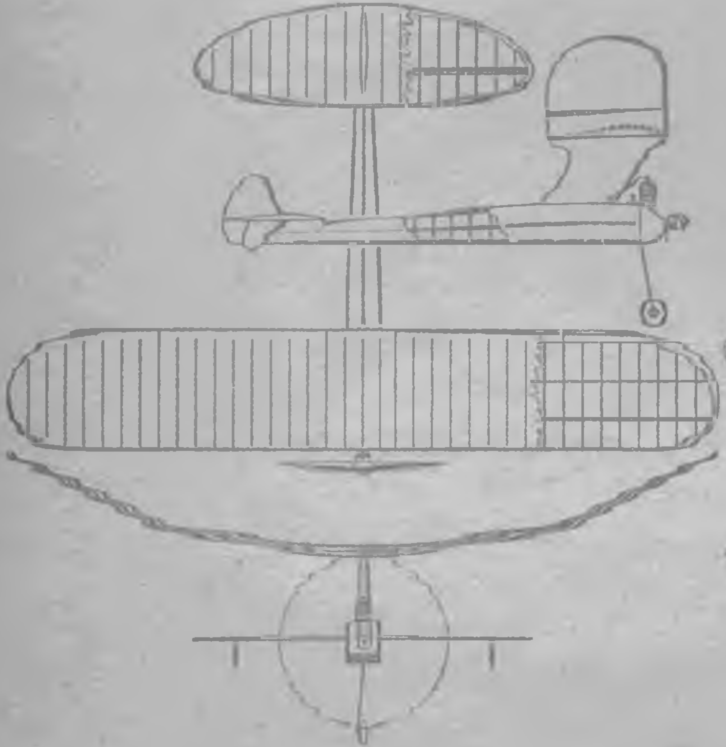
LANZO'S RECORD HOLDER

Here's a huge Class E record holder stick model. Span, 55"; wing area, 300 sq. in.; chord, 6"; airfoil, R. A. F. 32; prop, 19½"; power, 32 strands 3/16".



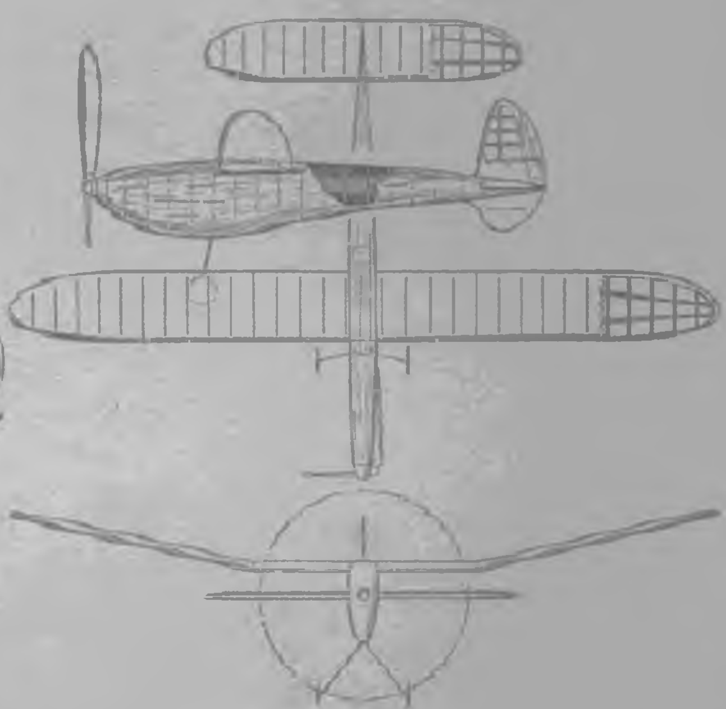
ZIPPER

Designed by Carl Goldberg for contest requirements, this model was the granddaddy of high-wing pylons. Span, 54"; wing area, 474 sq. in.; weight, 28 oz



INTERCEPTOR

This model represents new trends in gas-model design, such as retractable landing gear, high pylon wing mount, and simple fuselage design. Class A and B.



CLODHOPPER

Jim Cahill's Wakefield Trophy winner is an early example of clean model design. Span, 48"; chord, 5"; R. A. F. 32; stabilizer span, 21"; folding prop, 10"

How To Draw Plans

USING FULL SIZE PLANS –

Trace curved parts from plans to jap tissue – dope tissue to balsa stock – cut to shape –

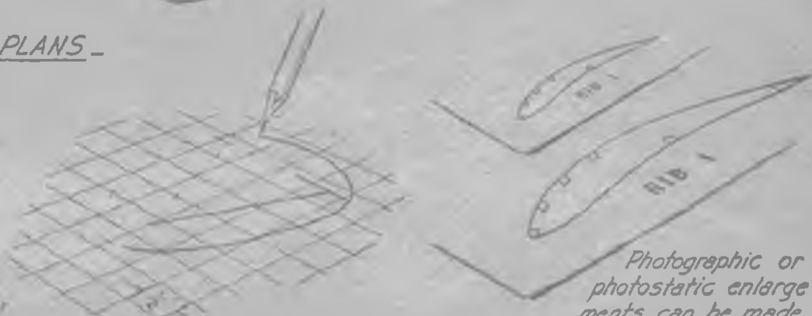
Carbon paper is handy for tracing full size plans –

Use a strip of balsa as a guide for gentle curves –

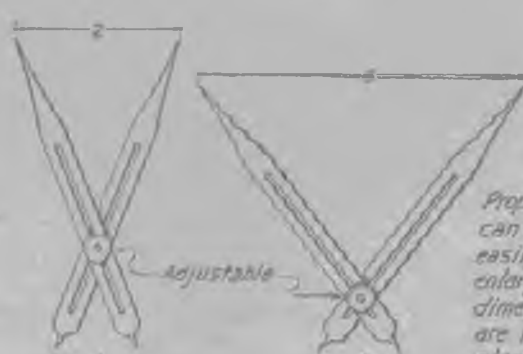
A french curve is best for abrupt curves –

USING SMALL SCALE PLANS –

When grid lines are shown. make a full size grid, plot intersection points with grid lines, connect with smooth lines –



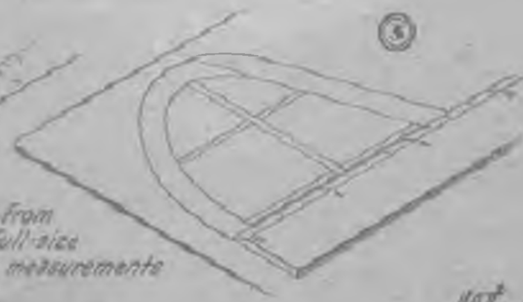
Photographic or photostatic enlargements can be made with great precision –



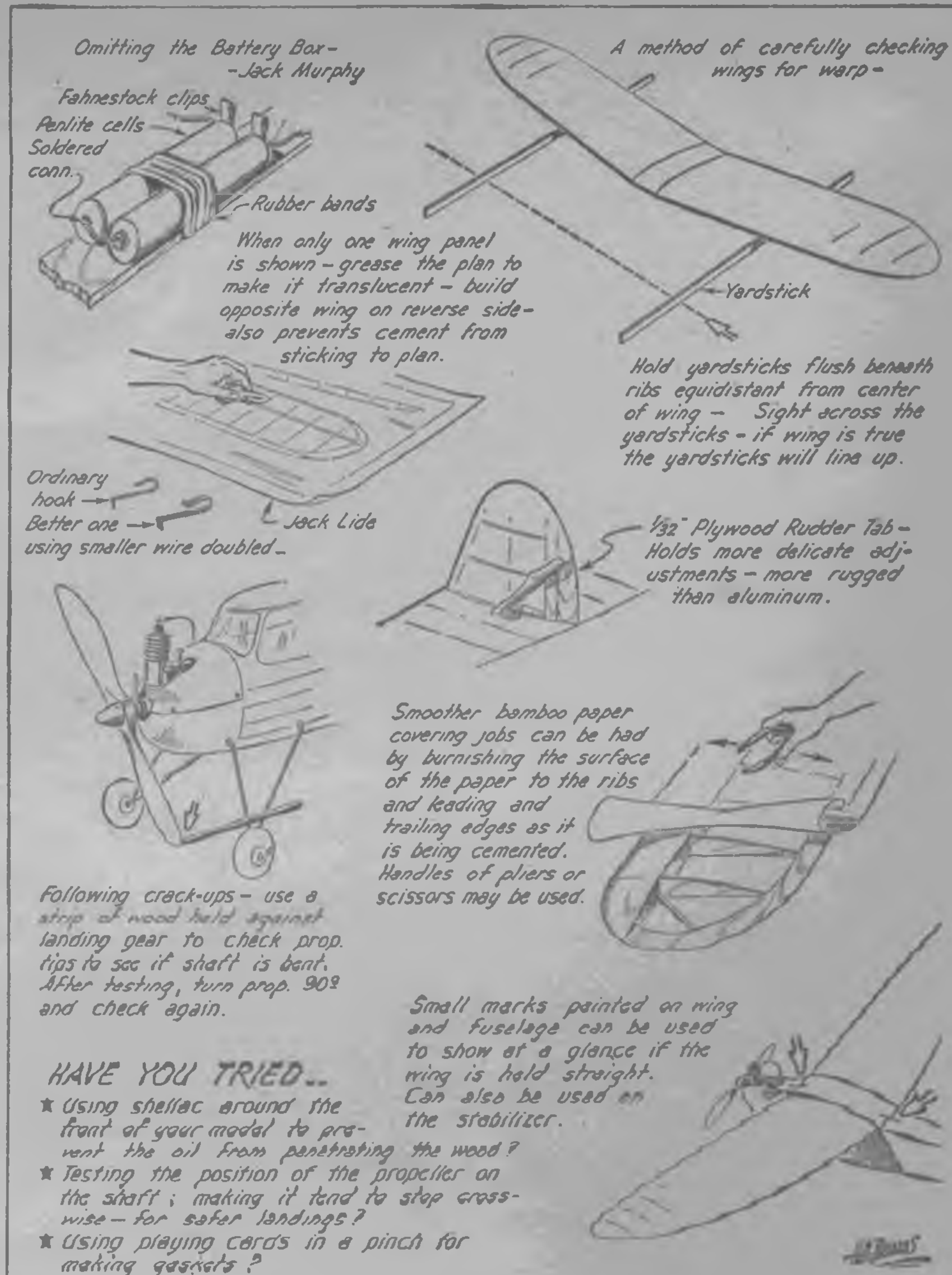
Proportional dividers can be quickly and easily adjusted to enlarge or reduce dimensions as they are taken from the plans.

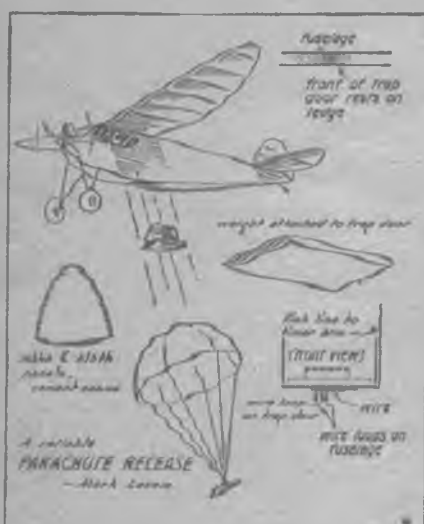
Make a cardboard copy of the scale printed on the small size plans –

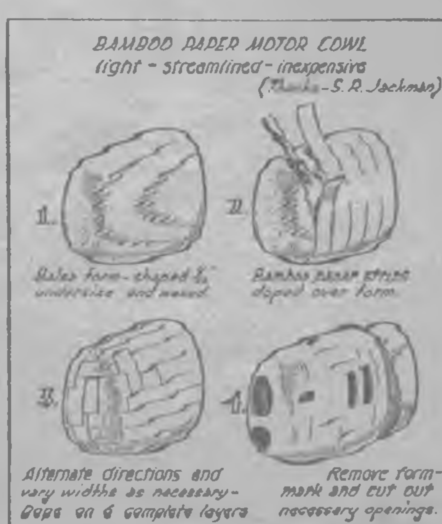
Take measurements from plans and draw full-size layout using same measurements and inch ruler



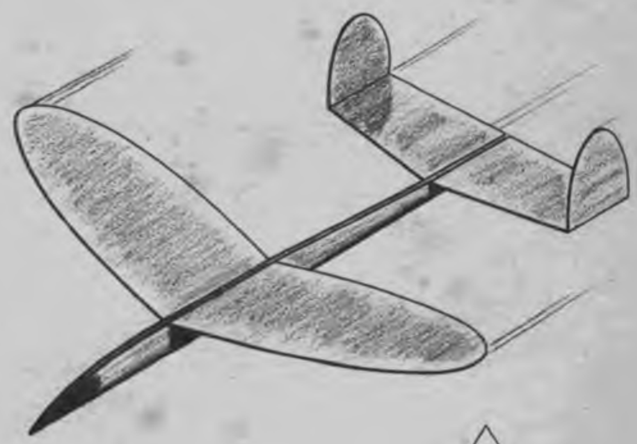
Knicks and Knacks







What— Paper Gliders!



With a few zips of the scissors you can make real soarers from a sheet of writing or typewriter paper.

DID you say paper gliders? Yes, sir, we said paper gliders. But not the type encountered in a third-grade music class. These are honest-to-goodness scientific soarers. If you don't believe it, try one yourself.

Fold a sheet of stiff paper, about the size of regular typewriting paper, and with a pair of scissors hew out a contraption similar to the one shown in the full-size plan. Bend wings down along the dotted line at a slight positive incidence. Fold down the stabilizer as shown at a slight negative angle, then bend up tips to form double rudders.

Balance the craft with glue, rubber cement, paper clip—anything that's handy. Check the alignment of the supporting surfaces, make a few test hops, then try an out-of-the-window flight. With a favorable updraft your little ship will soar away above the housetops.

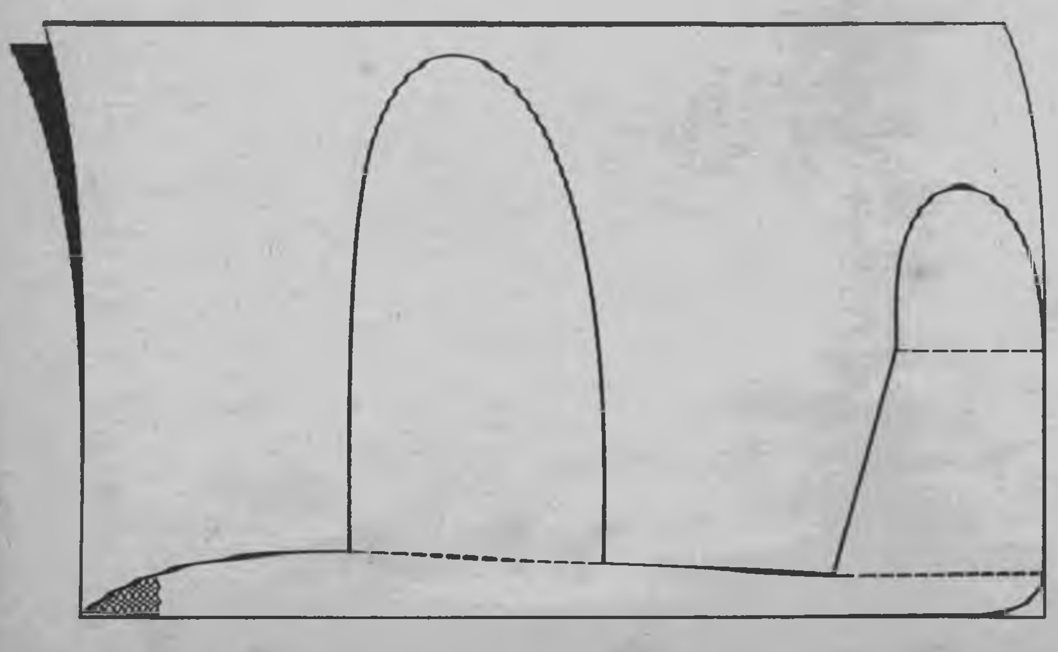
Unofficial record for this type of relaxation is attributed to Hewitt Phillips of Belmont, Massachusetts—who was, incidentally, 1938 indoor Stout Trophy winner—with a flight of more than five minutes made from the top of the Hotel Fort Shelby in Detroit.

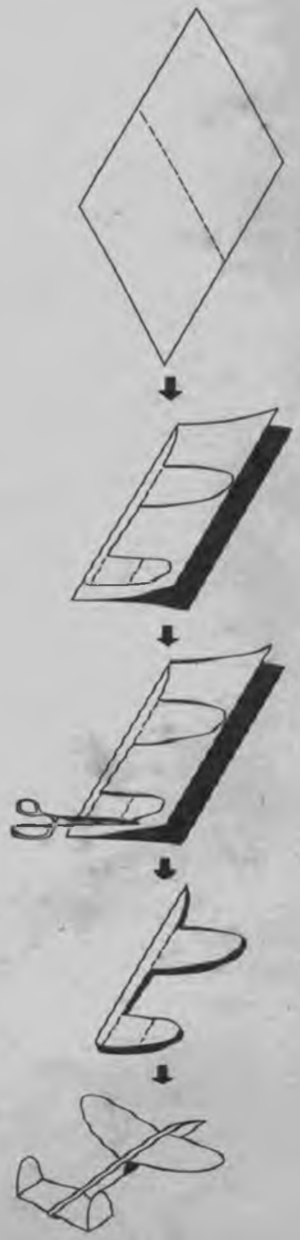
After the initial attempt, experiment with your own designs. High aspect ratio wings will require a cross brace like the one shown. Braces from the fuselage to the underside of each wing will do, too. Heavier paper can be used for larger gliders.

Paper gliders serve a practical purpose. In a few minutes' time it is possible to find out the relative efficiency of all sorts of aerodynamic set-ups. For instance, a little pruning will convert a straight taper into an ellipse. Or you can find out just how much tail is really needed.

Be sure and keep those rudders lined up! And see what a difference in flight performance results when camber is bent into the wings—or when a change is made in the wing setting—or the stabilizer angle—or— Some fun, hey?

BY AL LEWIS





HERE'S a flying scale seaplane that's one in a thousand! It's a gem of perfect proportions, flyability and swell take-off.

Start the fuselage construction by laying out the basic framework as indicated by dotted lines on the plans. Make the rear portion first. Before removing it from the plan, cover the exposed side with $^1/_{32}$" sheet to keep it from warping. Remove the framework and cover the other side. Pry them apart with and insert the cross braces by starting at both ends and working toward the middle, using rubber bands around the fuselage to hold the cross braces in place until the fuselage dries. The small nose frame is simple, but temporary diagonals should be included to keep the shape rigid until it is partially covered. Since the top of the nose section contains compound curves, planking with $^1/_{16}$ x $\frac{1}{4}$" soft-balsa strips is necessary. Cement the formers into place. While the planked portion dries, cover the hull with $^1/_{32}$" sheet aft of Station 8.

Take some $^1/_{16}$" sheet and make parts H-1 to H-12; two formers are necessary for a "step." Smaller formers are indicated by dotted lines on H-6 and H-10. Once all these parts are cemented to the proper stations, the fuselage covering can be finished; the bottom nose portion is semihard $^1/_{16}$" sheet. Trim a block cemented to the nose to conform with the fuselage lines. Cut the cabin-roof formers, cement them into place and fill the intervening space with $^3/_{32}$" or $\frac{1}{8}$" sheet. Round the cabin portion and add the celluloid windshield and side windows. Sand the fuselage to remove all rough projections and cover the top and sides with tissue.

Lay out a simple wing plan of rib spacings and a line across the span to indicate proper spar positions. Since the spar spans 38 inches, splice an extra length to the standard balsa. Build the center section first and, after covering the sheet, tip one wing panel so that the spar tip rests on the workbench. Assemble the tip and cover it with $^1/_{32}$" sheet; do the same with the other wing panel. Sand the rear edge of the leading-edge sheet to a knife edge.

Cut apart the rudder as shown in the plans and cement the lower part to the fuselage, lining it up carefully. The stabilizer is next, but insert the tail hooks before covering with $^1/_{32}$" sheet. Sand the rear edge of the sheets to a knife edge before assembling. Cover and cement the stabilizer and, after applying the sheet fillets and cementing struts, add the top part of the rudder. Now cement the bond-paper rudder-base fillets to complete the construction.

Once the required parts of the tip floats are on hand, one need only cement the top to the center pattern, followed by a chine former on each side; bend the chine former as shown. The rest is easy, for only the sides and bottom need be covered with $^1/_{32}$" sheet with vertical grain.

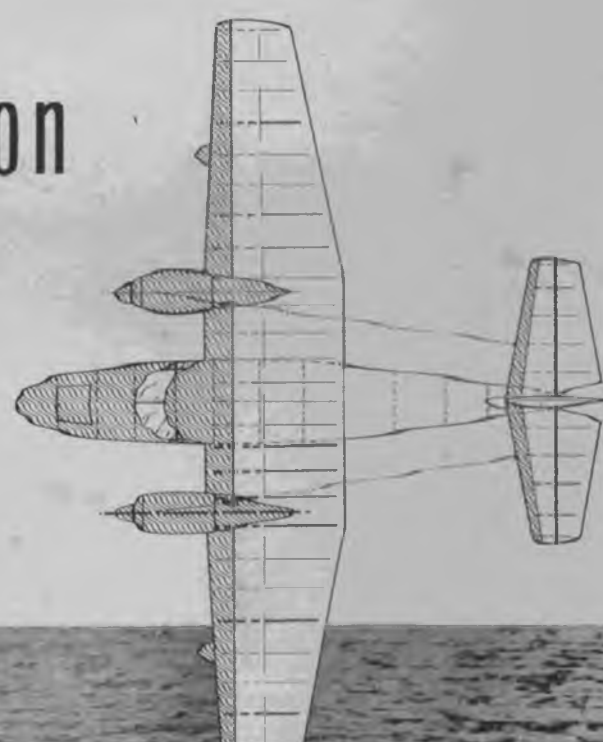
While you make the nacelles, use the cross section given to obtain an accurate set. It is best to cut out templates of N-1, N-2 and N-3. A small rectangular piece of $\frac{1}{4}$" sheet should be cemented to the rear of the nose plug to insure a tight fit into the nacelle. If you can get only medium or hard balsa, hollow out a little of the nacelles to keep the weight down. Cut a hole in the rear portion of each nacelle to allow the rubber motor to pass through. Cover the nacelles with tissue or dope them the proper color. Cement them slowly into place.

Carve the props, one left and one right hand. Spinners may be added later, but it is easier to carve them from the prop block. The entire model should be doped with clear nitrate at least twice so that it will not soak up water should it nose over when landing after a test flight.

Four coats are necessary on the lower hull and floats to prevent water from seeping in. The model should balance at Station 6, once the props and motor are installed. Before power flights, try gliding the model (over tall grass so as not to damage the hull) and add weight to the nose if she stalls, or to the tail if nose heavy. Now try test flights with a few turns in the motor. Make necessary thrust adjustments to both propellers. Although the model will r. o. w. on six-stranded $\frac{1}{8}$" flat rubber motors, eight strands will produce breathtaking take-offs.

The Grumman Widgeon

BY PAUL PLEGAN

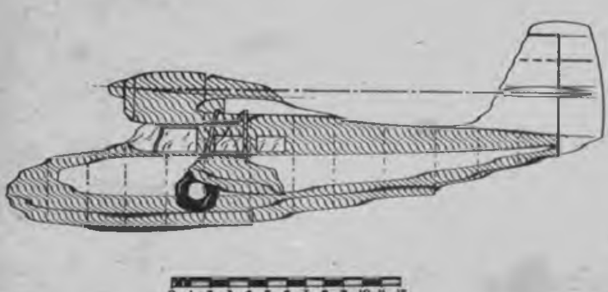


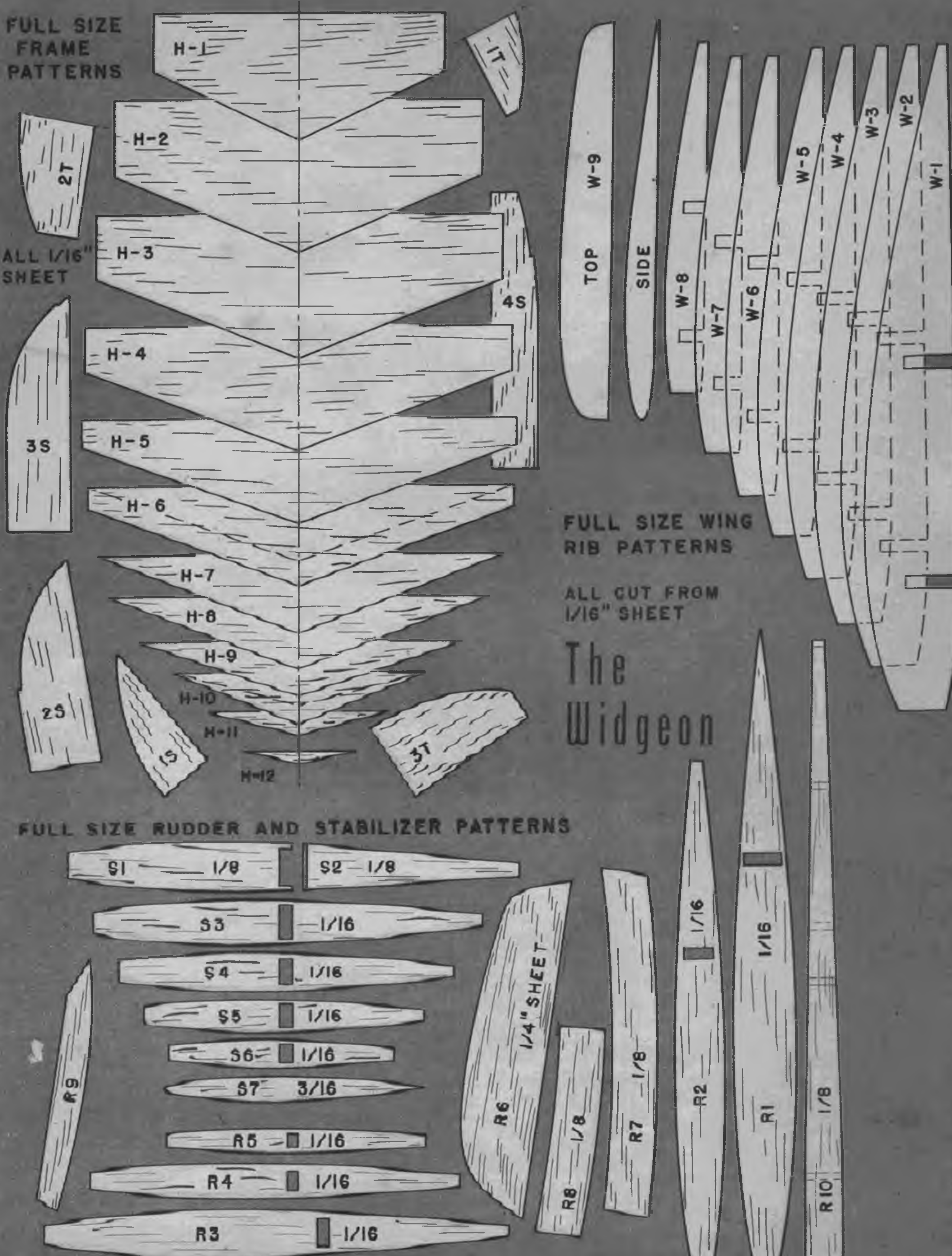
Wing-tip floats must line up parallel to the hull. Note bracing.

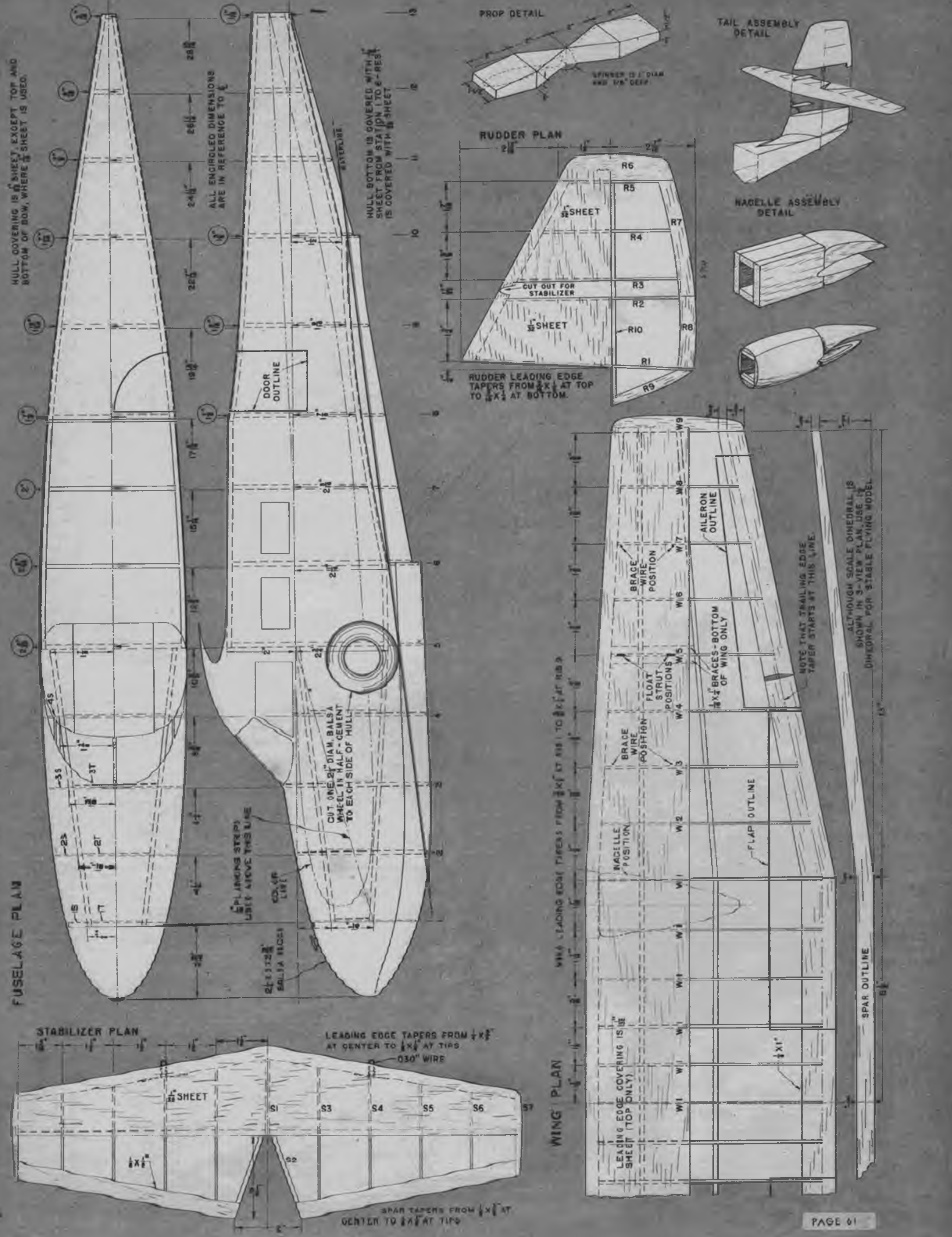
"Widgie" takes to water (and off) like a duck. Use pine, bass, or balsa, but start now for early-spring flying.

Clean, simple design is apparent from this view of the tail group.

Under view of hull shows details of engine-nacelle assembly.




FULL SIZE FRAME PATTERNS
ALL 1/16" SHEET
H-1
H-2
H-3
H-4
H-5
H-6
H-7
H-8
H-9
H-10
H-11
H-12
1T
2T
3T
1S
2S
3S
4S
FULL SIZE WING RIB PATTERNS
ALL CUT FROM 1/16" SHEET
W-1
W-2
W-3
W-4
W-5
W-6
W-7
W-8
W-9
TOP
SIDE
The Widgeon
FULL SIZE RUDDER AND STABILIZER PATTERNS
S1 1/8
S2 1/8
S3 1/16
S4 1/16
S5 1/16
S6 1/16
S7 3/16
R5 1/16
R4 1/16
R3 1/16
R9
R6 1/4" SHEET
R8 1/8
R7 1/8
R2 1/16
R1 1/16
R10 1/8


FUSELAGE PLAN
HULL COVERING IS SHEET, EXCEPT TOP AND BOTTOM OF BOW, WHERE SHEET IS USED.
ALL ENCIRCLED DIMENSIONS ARE IN REFERENCE TO ℄
HULL BOTTOM IS COVERED WITH SHEET FROM STATION 1 TO 6 - REST IS COVERED WITH SHEET
WATERLINE
DOOR OUTLINE
CUT ONE DIAM. BALSA WHEEL IN HALF - CEMENT TO EACH SIDE OF HULL
COLOR LINE
BALSA BLOCK
PROP DETAIL
SPINNER IS 1" DIAM AND 1/8" DEEP
TAIL ASSEMBLY DETAIL
RUDDER PLAN
SHEET
CUT OUT FOR STABILIZER
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
RUDDER LEADING EDGE TAPERS FROM AT TOP TO AT BOTTOM.
NACELLE ASSEMBLY DETAIL
WING PLAN
BRACE WIRE POSITION
FLOAT STRUT POSITIONS
BRACES-BOTTOM OF WING ONLY
AILERON OUTLINE
NACELLE POSITION
FLAP OUTLINE
LEADING EDGE COVERING IS SHEET (TOP ONLY)
NOTE THAT TRAILING EDGE TAPER STARTS AT THIS LINE.
ALTHOUGH SCALE DIHEDRAL IS SHOWN IN 3-VIEW PLAN, USE DIHEDRAL FOR STABLE FLYING MODEL
SPAR OUTLINE
W1
W2
W3
W4
W5
W6
W7
W8
W9
STABILIZER PLAN
LEADING EDGE TAPERS FROM AT CENTER TO AT TIPS.
.030" WIRE
SHEET
S1
S2
S3
S4
S5
S6
S7
SPAR TAPERS FROM AT CENTER TO AT TIPS

The Crossbow Launch

BY FRANK EHLING

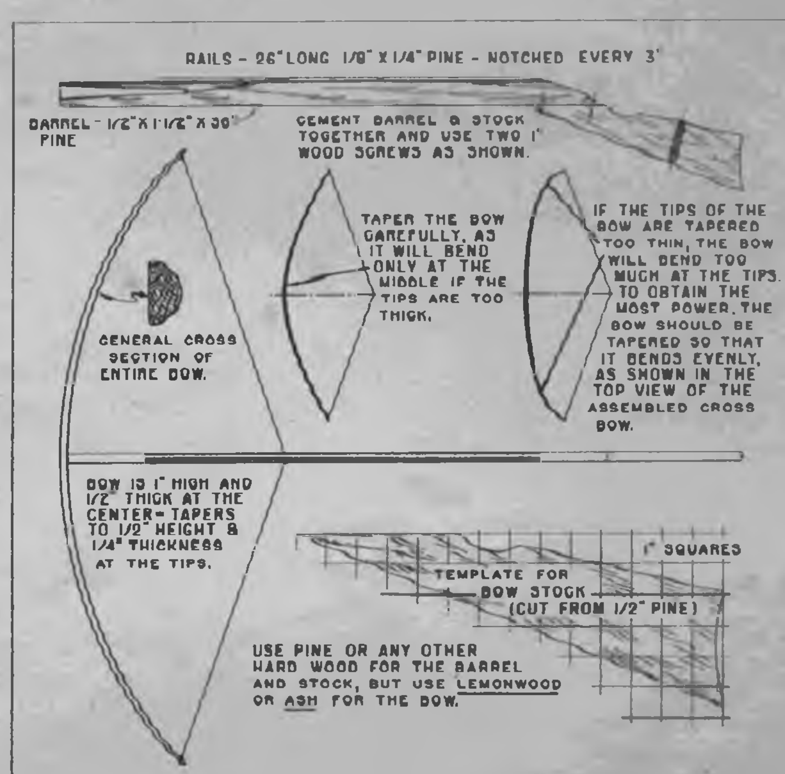
This is a spectacular way of "throwing" a soaring glider to terrific heights.

THIS is the first time to our knowledge that the crossbow has been used to launch gliders. The altitude you can attain by this method is worth the added trouble.

The gun is made from pine. Two strips are cemented on top to act as runner for glider, the body of which fits into the slot between the strips. Cut notches in strips to hold bowstring. Finish gun with black paint to protect the wood. The bow is of ash or other wood of same bending quality. Cut the bow to shape as shown on the plan, then proceed to carve the cross section. When nearly done, it can be finished off with sandpaper till as smooth as possible. Next it is given several coats of clear dope, sanding in between each coat, till the bow is as smooth as glass. Fasten bowstring in notches at end of bow and wax string. Attach bow to gun with five coats of cement. Check for alignment. The bow has a bend of about four inches.

Glider must have the stabilizer on top of the body to clear the launching groove. A notch for the bowstring is cut in the body of the glider about one third back from the nose. To launch the glider after drawing bow, lift bowstring out of notch by raising the left thumb.

You can also use the crossbow to do some balloon busting. A pin placed in the nose with one in each wing tip will give you a good chance to bust the balloon.



Below—This is how your crossbow should look. Aim it like a gun, pull string, zowie!

Solid Scale

Details such as cockpits and insignia should be added by brush.

For the ideal finish, we recommend that a spray gun be used.

It's The Finish

BY JOE BATTAGLIA

ONLY too often an imperfect finish ruins hours of effort put into the construction of a model. The best results can be obtained by the consideration of various factors. First, the weather should be clear and dry. Get the best material you can and, if it is at all possible, the use of a spraying outfit. Should spraying be impossible, get a "sable" hair brush, which streaks least. Only bronze finishes cannot be applied with a brush, and, even in spraying them, it is necessary to rub foreign matter from the surface with fine abrasive powder. Sable brushes come in a variety of sizes and costs, the wider costing more.

Other materials needed are masking tape; wet or dry emory paper; surface fillers (primer surface, shellac or wood filler); sealers (clear lacquer or aerodope) and paints. Nitrocellulose lacquers are used for fast drying, enamel or oil paints, for slow.

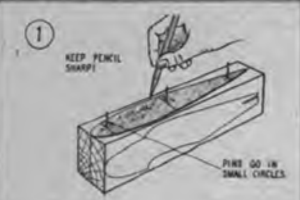
Be sure the wood is free from oil and grease stains, smooth and uniform. All the strut joints must be clean. Apply the sealer; allow it to dry and apply two more coats. Rub the last coat after drying. Apply three coats of surface filler; when they are dry, rub with the following abrasives in sequence: for lacquers—wet emory #180-C, #240-A, #400-A; enamels—wet emory #180-C, #320-A, #400-A. Use plenty of water with wet emory. After the #400 rub, apply two coats of the final colors; rub the second with #400. Apply two more coats and rub the last with #500 or #600 emory paper.

Apply the wax polish as the final operation. Use a damp wad of absorbent cotton or fine, soft cloth. Allow it to dry, rub briskly

Here are a few examples of good scale models. Note highlights produced by smooth, perfect finishes, which result from following the above procedure.

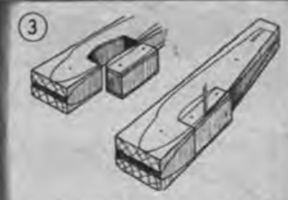
Construction Procedure

Drawings reproduced from the poster "Scale Model Aircraft Construction Procedure" printed by the U. S. Office of Education. Captions condensed from booklet.

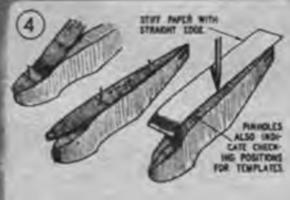


Trace the side and the top body outlines with templates.

Saw to top outlines, then replace all the pieces with pins.



A tip. When cutting out side view, leave space for wing.



Pins pushed through template holes will guide center line.

Use templates to check carving. Leave oversize for sanding.

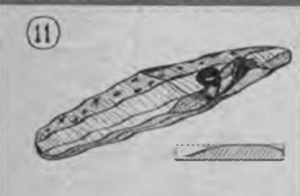
Rasp, coarse sandpaper block for bumps. Finish fine paper.

Tapered wings marked clearly.

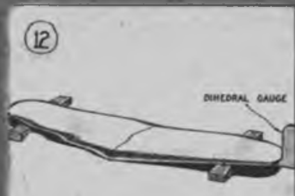
Shave away surplus wood, sand.

Mark wing outline by template, cut out with jig, coping saw.

Guide lines on top, front of wing insure proper shaping.



Shape block to guide lines. Trailing edge 1/32 in. thick.



Trim wing to airfoil shape, cut and bevel for the dihedral.

Glue panels together at proper angle. Rest on wax paper.

Push pin through template to indicate outlines of controls.

Motor nacelle positions outlined with templates, then cut out.

Nacelles carved like fuselage. Trial-fit, mark wing outline.

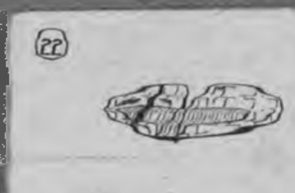
Carve nacelle as shown, leave untouched part that fits wing.

Clothespin-type nacelle cut out to fit wing. More difficult.

Clothespin nacelle sanded thus to fit over wing. Good trick.

Cut out stabilizer, fit in body slot, mark the outlines shown.

Next draw center line around thin edge of the stabilizer.

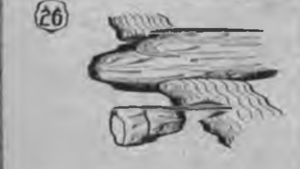


Shape tail to streamline by cutting away wood, then sand.

On low-wing model trim body to fit wing. Glue wing in place.

On midwings remove bottom section, fit wing: glue, trim.

When stabilizer is glued to fuselage, line up with wing.



On multimotored jobs, glue any nacelles in special cut-outs.

Post-card-weight paper fillet is glued on low-wing models.

Fillet top made with plastic wood. Several applications.

Now we are ready for all final details spinners, exhausts.

Now comes the flat black paint. For own home use paint gayly.

The Bell Airacobra

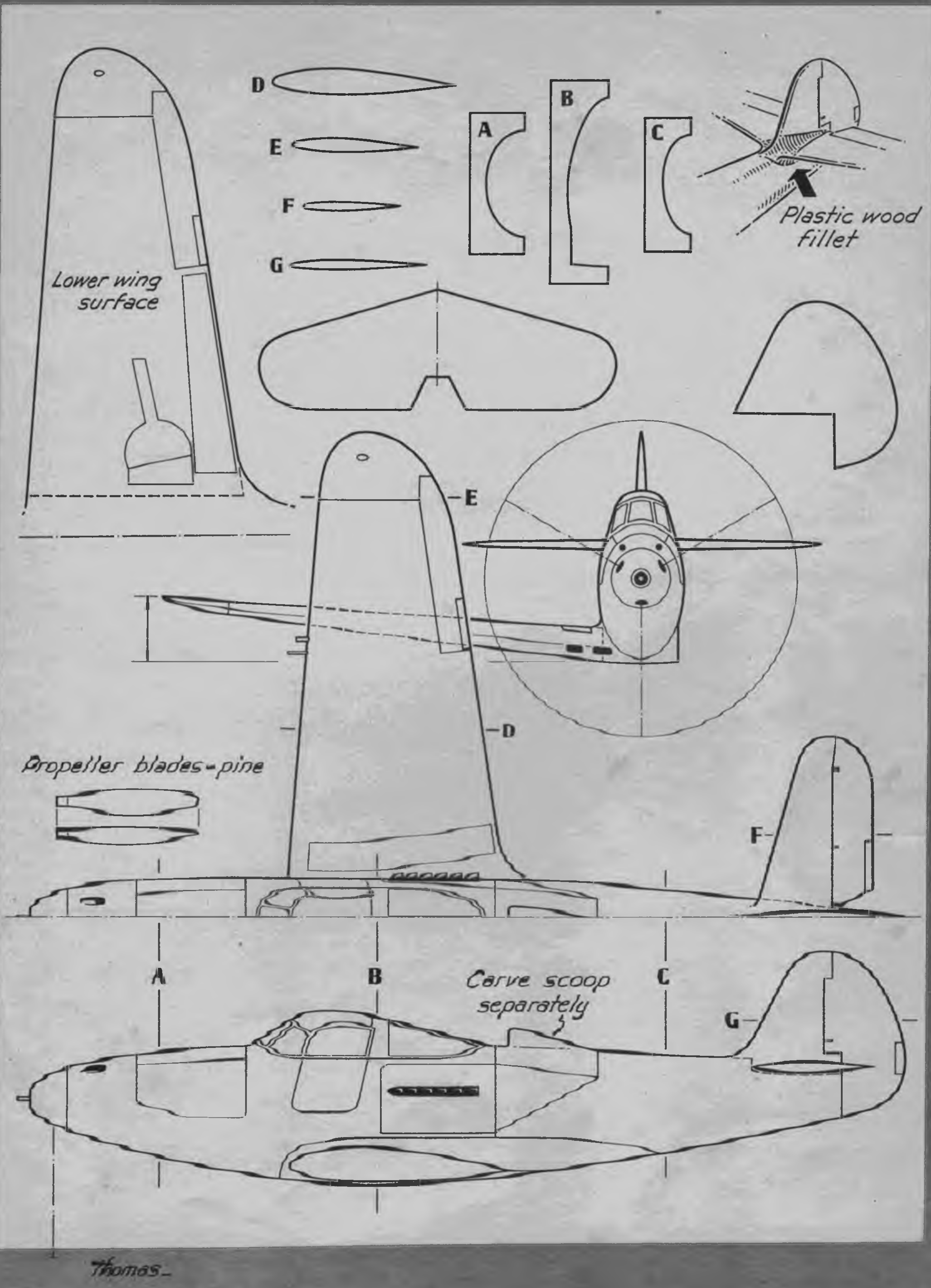
BY H. A. THOMAS

Grab the old scalpel, boys, and whittle yourself a solid scale model of America's famous fighter from scrap pine.

THE military experts claim that the Bell Airacobra is the most aerodynamically perfect airplane yet produced in this war. While actual performance figures have not been released, rumor has it that its speed is well over 350 m. p. h. which, when combined with a 37-mm. cannon and two machine guns, produces an airplane ranking high among the world's best fighters.

Your scale-model collection won't be complete without this job, so study the plans and let s get going on the construction.

From balsa or soft pine, carve fuselage to the proper side and top shapes, checking contour with cross-section patterns as you go along. Wing halves are tapered to thickness indicated on front-view drawing. Before shaping, however, carefully bevel inner wing edges for proper dihedral where they fit the fuselage. Wing tips are tapered mostly from the under side, giving an upturned appearance. Check the final wing-section shape against cross-section patterns. Tail surfaces are carved in a similar manner. Sand all parts lightly, then dope several times. Assemble model by blocking parts to proper alignment while the cement hardens. Model wing and tail fillet with plastic wood, then sand to proper shape. Shape propeller hub to fit the pine propeller blades. Now add details, such as gun barrels, exhaust pipes, et cetera. Finish in army olive drab with gray paint on the under surfaces. Trim detail with black paint, then add army insignia to complete your Airacobra.



D
E
F
G
A
B
C
Plastic wood fillet
Lower wing surface
E
D
Propeller blades-pine
F
A
B
Carve scoop separately
C
G
Thomas

Prop Carving In Pictures

What! prop carving still a mystery? Grab your knife, a block of soft wood, and whittle along step by step as our expert reveals the secrets.

Here are the tools needed for prop carving: a knife with very sharp, long blade, ruler, pencil, dope, a soft brush, and several grades of sandpaper.

First step after selecting the correct size block is to draw in the diagonal lines on top and bottom.

Draw and check direction of diagonals on end view of block so as not to end up with a useless prop.

Drill the prop-shaft hole, carve out the blank, and then rough out the two inside faces as shown above.

Now finish off the two inside faces with rough, then fine sandpaper. Check the concave with template.

Turn the blank over and roughly form convex faces of the prop. Be careful not to cut too thin. 1/8" is plenty.

Shape one of the blades as shown. For best results try to get maximum width about 2/3 out from hub.

Make a template of the blade shape and use to get the other blade identical. Finish off convex faces.

Make certain that your prop is in perfect balance by this test. Use fine sandpaper for minute adjustments.

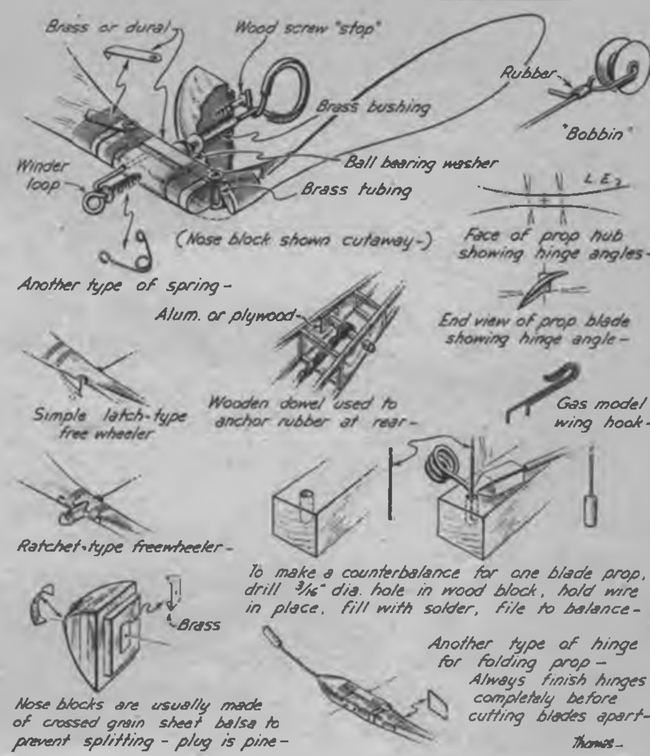
Apply several coats of dope to surfaces to reduce friction. Add shaft, washers to complete the job.

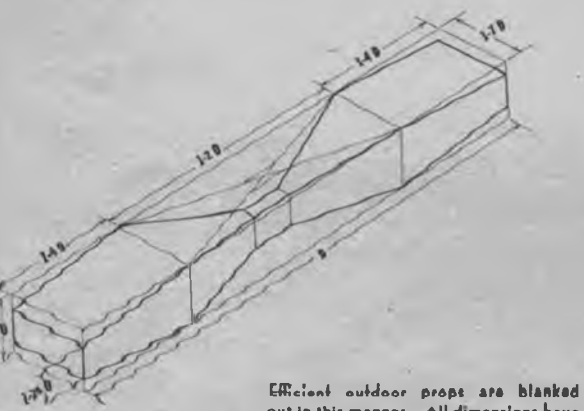
Prop Kinks

Are you the timid soul, afraid to carve your own propeller? This capsule course makes prop design and carving a snap.

MORE good models have gone wrong because of improper propellers than from any other cause. The average propeller of a rubber-powered model tends to be too high-pitched. Invariably it has insufficient blade area. Although gas-model propellers can be purchased from a dealer, rubber-model props, unfortunately, cannot. If you have had good-looking models which perform without any pep, here is information of interest. Propeller design is a matter of knowing the proper diameter, the proportions of the block and the amount of rubber required. Handy, but not essential, is a knowledge of the number of turns a given motor will take.

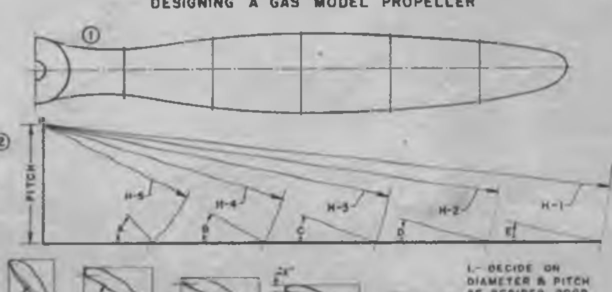
A TYPICAL FOLDING PROP AND RUBBER TENSIONER—





Efficient outdoor props are blanked out in this manner. All dimensions have been expressed in terms of diameter.

DESIGNING A GAS MODEL PROPELLER



1.- DECIDE ON DIAMETER & PITCH OF DESIRED PROP SKETCH ONE BLADE OF PROPELLER AND DIVIDE INTO EQUAL PARTS. (SIX IN THIS INSTANCE). 2.- SINCE THE PROPELLER DESCRIBES A HELIX IN PASSING THROUGH THE AIR, THE HELIX SHOULD BE DRAWN IN PLAN FORM TO GET THE BLADE ANGLE. DRAW A LONG BASE LINE AND ERECT A PERPENDICULAR AT ONE END. MEASURE OFF PITCH ON THIS VERTICAL AND LABEL UPPER END "P." TO GET TRUE LENGTHS OF HELIXES H-1, H-2, ETC., USE THE FORMULA: LENGTH = $\sqrt{DIAM^2 + PITCH^2 \times \pi^2}$

BY USING EITHER A LARGE COMPASS OR RULER, LAY OFF H-1, H-2, ETC. TRANSFER BLADE ANGLES A,B,C,D,& E TO BLANK PAPER AND ADD DESIRED BLADE CROSS SECTIONS. NOTE THAT SMALL THICKNESS "X" IS ADDED TO THE DEPTH OF THE PROP BLANK TO OBTAIN PROPER AIRFOIL. CUT PROP BLOCK TO BLADE PATTERN WITH A JIG SAW. TAPER TO DEPTHS A,B,C,D,& E AT PROPER POINTS AND START CARVING.

MAXIMUM SAFE TURNS – 1/8" X 1/30" BROWN RUBBER

			20"	22"	24"	26"	28"	30"	32"	34"	36"	38"	40"
2 STR	115	TURNS/IN	2300	2530	2760	2990	3220	3450	3680	3910	4140	4370	4600
4 "	80	" "	1600	1760	1920	2080	2240	2400	2560	2720	2880	3040	3200
6 "	64	" "	1280	1408	1536	1664	1792	1920	2048	2176	2304	2432	2560
8 "	55	" "	1100	1210	1320	1430	1540	1650	1760	1870	1980	2090	2200
10 "	50	" "	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
12 "	44	" "	880	968	1056	1144	1232	1320	1408	1496	1584	1672	1760
14 "	40	" "	800	880	960	1040	1120	1200	1280	1360	1440	1520	1600
16 "	36	" "	720	792	764	836	908	980	1052	1124	1196	1268	1340
18 "	34	" "	680	748	816	884	952	1020	1088	1156	1224	1292	1360
20 "	32	" "	640	704	768	832	896	960	1024	1088	1152	1216	1280
22 "	30	" "	600	660	720	780	840	900	960	1020	1080	1140	1200
24 "	27	" "	540	594	648	702	756	810	864	918	972	1026	1080

THE MAXIMUM SAFE TURNS GIVEN ARE FOR MOTORS THAT ARE STRETCHED WHILE WINDING FOR HAND-WOUND MOTORS, DEDUCT 20 TO 30%

MAXIMUM SAFE TURNS – 1/4" X 1/30" BROWN RUBBER

			20"	22"	24"	26"	28"	30"	32"	34"	36"	38"	40"
2 STR	80	TURNS/IN	1600	1760	1920	2080	2240	2400	2560	2720	2880	3040	3200
4 "	56	" "	1120	1232	1344	1456	1568	1680	1792	1904	2016	2128	2240
6 "	44	" "	880	968	1056	1144	1232	1320	1408	1496	1584	1672	1760
8 "	37	" "	740	814	888	962	1036	1110	1184	1258	1332	1406	1480
10 "	33	" "	660	726	792	858	924	990	1056	1122	1188	1254	1320
12 "	29	" "	580	638	696	754	812	870	928	986	1044	1102	1160
14 "	27	" "	540	594	648	702	756	810	864	918	972	1026	1080
16 "	25	" "	500	550	600	650	700	750	800	850	900	950	1000
18 "	23	" "	460	506	552	598	644	690	736	782	828	874	920
20 "	21	" "	420	462	504	546	588	630	672	714	756	798	840

TO DETERMINE MAXIMUM TURNS OF ANY MOTOR, CARRY HORIZONTAL LINE TO RIGHT FROM NUMBER OF STRANDS UNTIL IT INTERSECTS A VERTICAL LINE REPRESENTING THE MOTOR LENGTH. I.E.; 12 STRANDS OF 1/4" FLAT, 30" LONG, HAVE 870 TURNS MAXIMUM UNDER IDEAL CONDITIONS. ON VERY HOT OR COLD DAYS, TURNS WILL BE CUT DOWN APPRECIABLY.

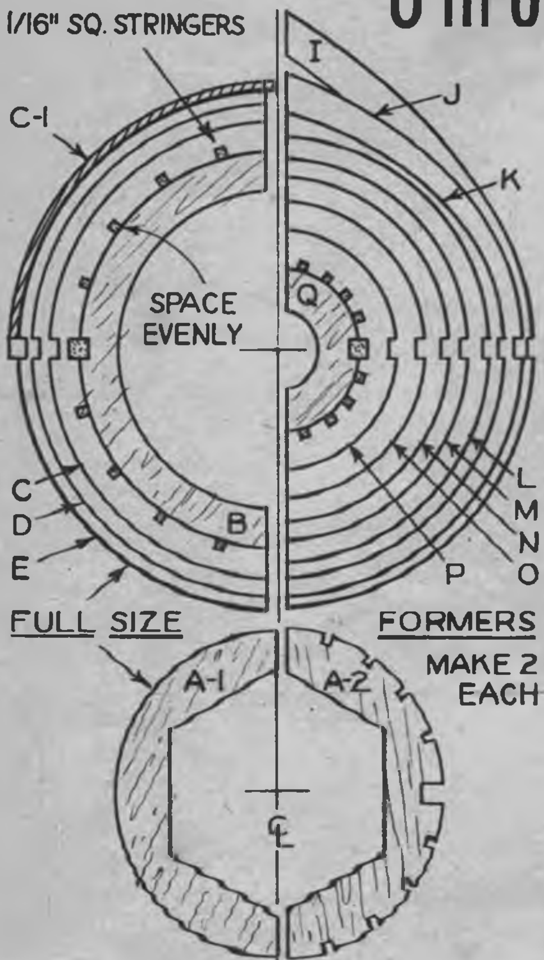
MAXIMUM SAFE TURNS – 3/16" X 1/30" BROWN RUBBER

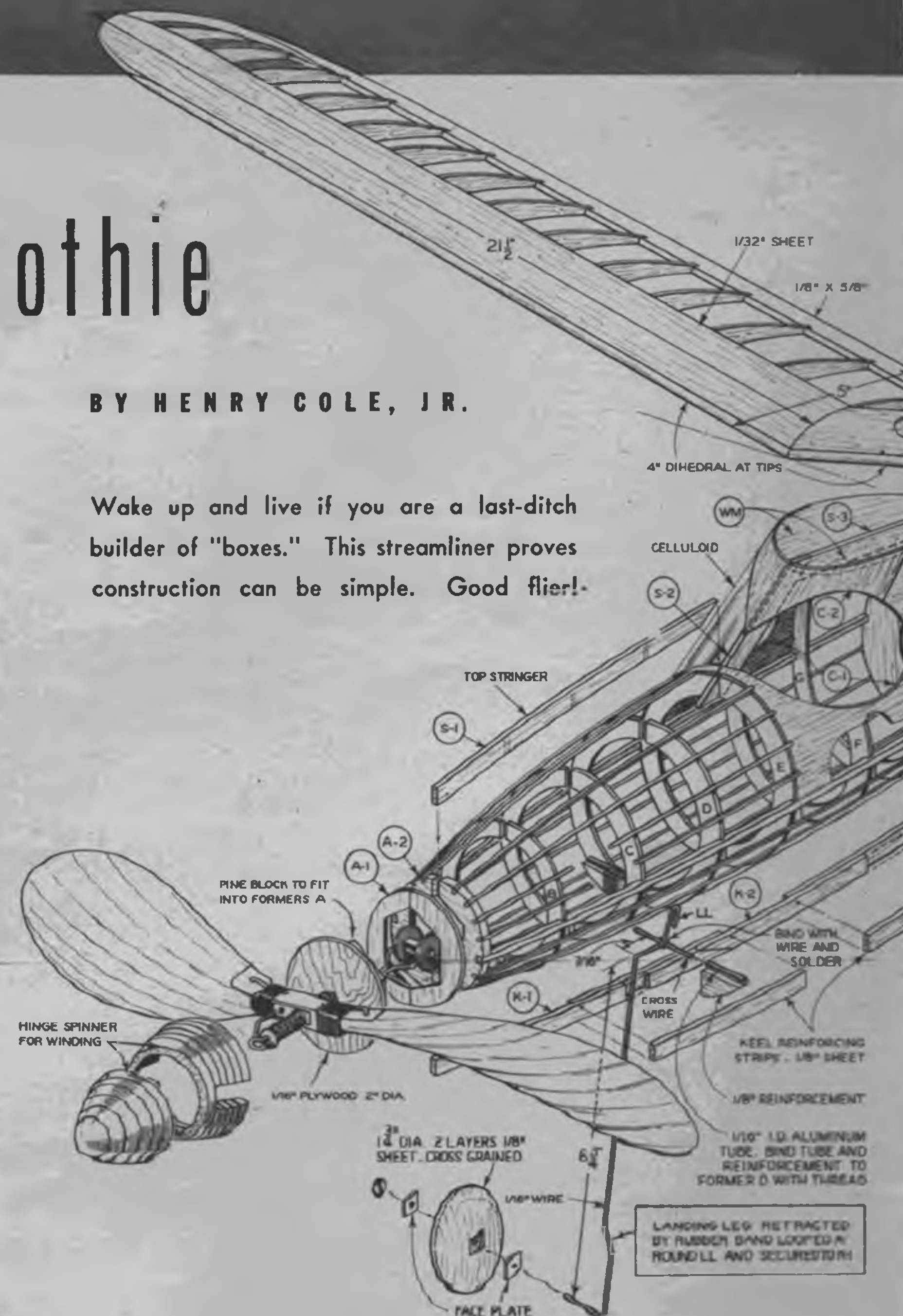
			20"	22"	24"	26"	28"	30"	32"	34"	36"	38"	40"
2 STR.	94	TURNS/IN	1880	2068	2256	2444	2632	2820	3008	3196	3384	3572	3760
4 "	60	" "	1200	1320	1440	1560	1680	1800	1920	2040	2160	2280	2400
6 "	54	" "	1080	1188	1296	1404	1512	1620	1728	1836	1944	2052	2160
8 "	46	" "	920	1012	1104	1196	1288	1380	1472	1564	1656	1748	1840
10 "	42	" "	840	924	1008	1092	1176	1260	1344	1428	1512	1596	1680
12 STR	38	TURNS/IN	760	836	912	988	1064	1140	1216	1232	1308	1484	1560
14 "	35	" "	700	770	840	910	980	1050	1120	1190	1260	1330	1400
16 "	32	" "	640	704	768	832	896	960	1024	1088	1152	1216	1280
18 "	28	" "	560	616	672	728	784	840	896	952	1008	1064	1120
20 "	25	" "	500	550	600	650	700	750	800	850	900	950	1000

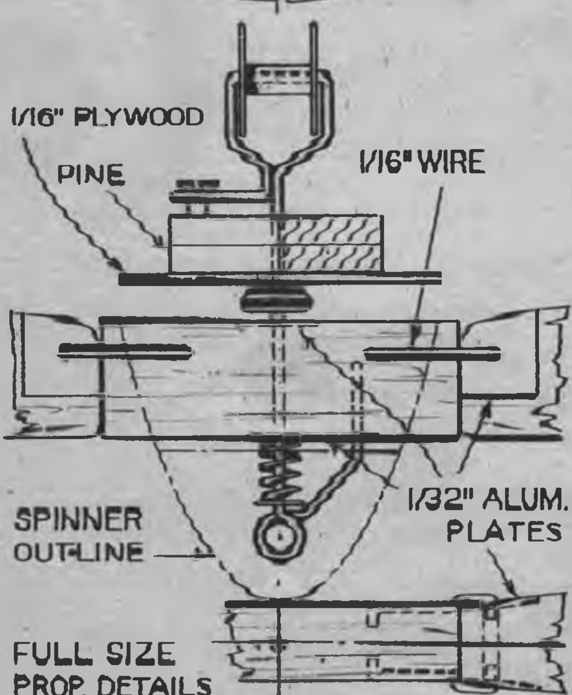
Smoothie

BY HENRY COLE, JR.

Wake up and live if you are a last-ditch builder of "boxes." This streamliner proves construction can be simple. Good flier!



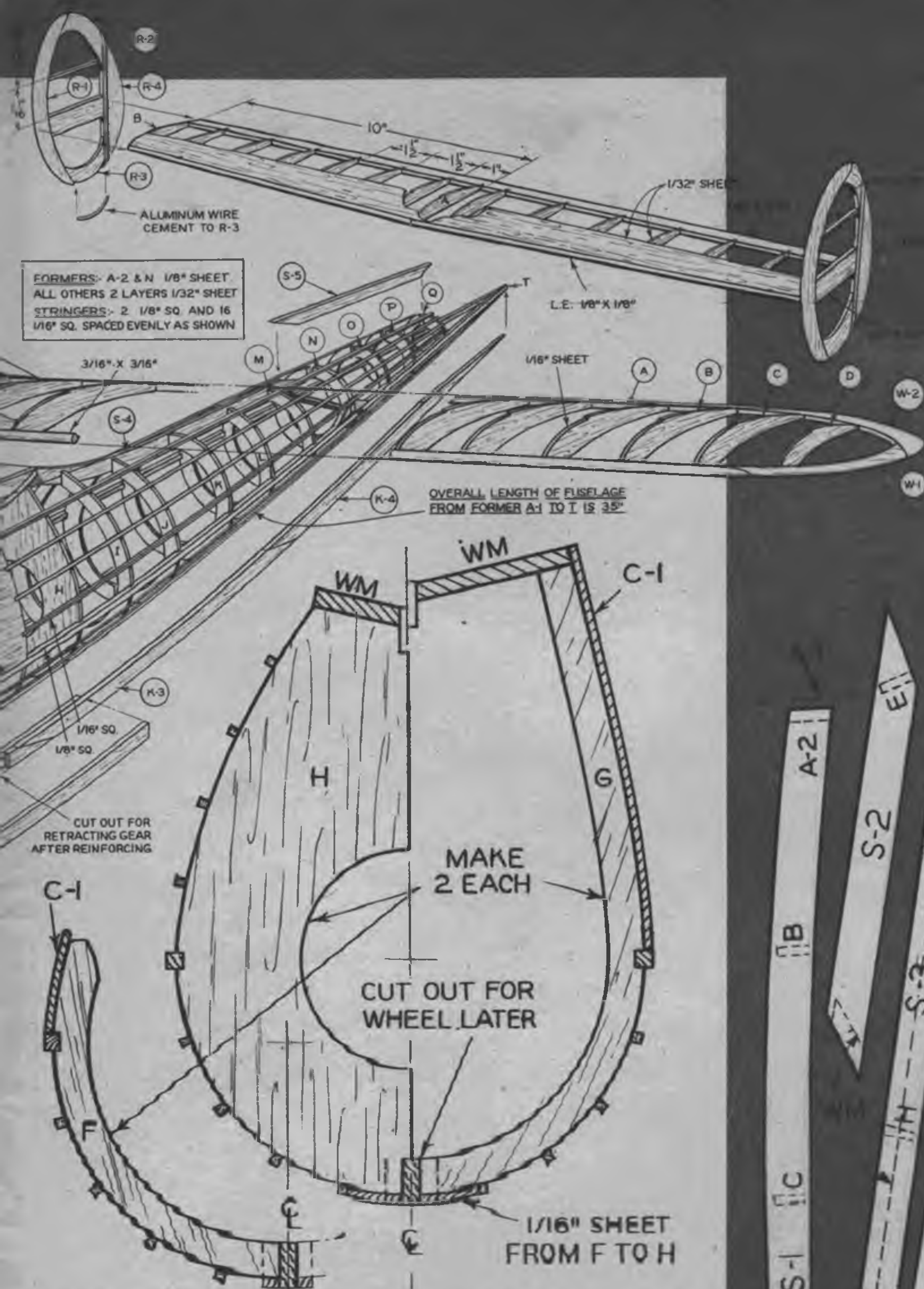




BUILT for the last National contest, the Smoothie achieves tremendous climb and extraordinary glide. Though highly streamlined, it is not complicated. Even a beginner can duplicate the neat fuselage by using keel construction and making only one half the fuselage right on the plan.

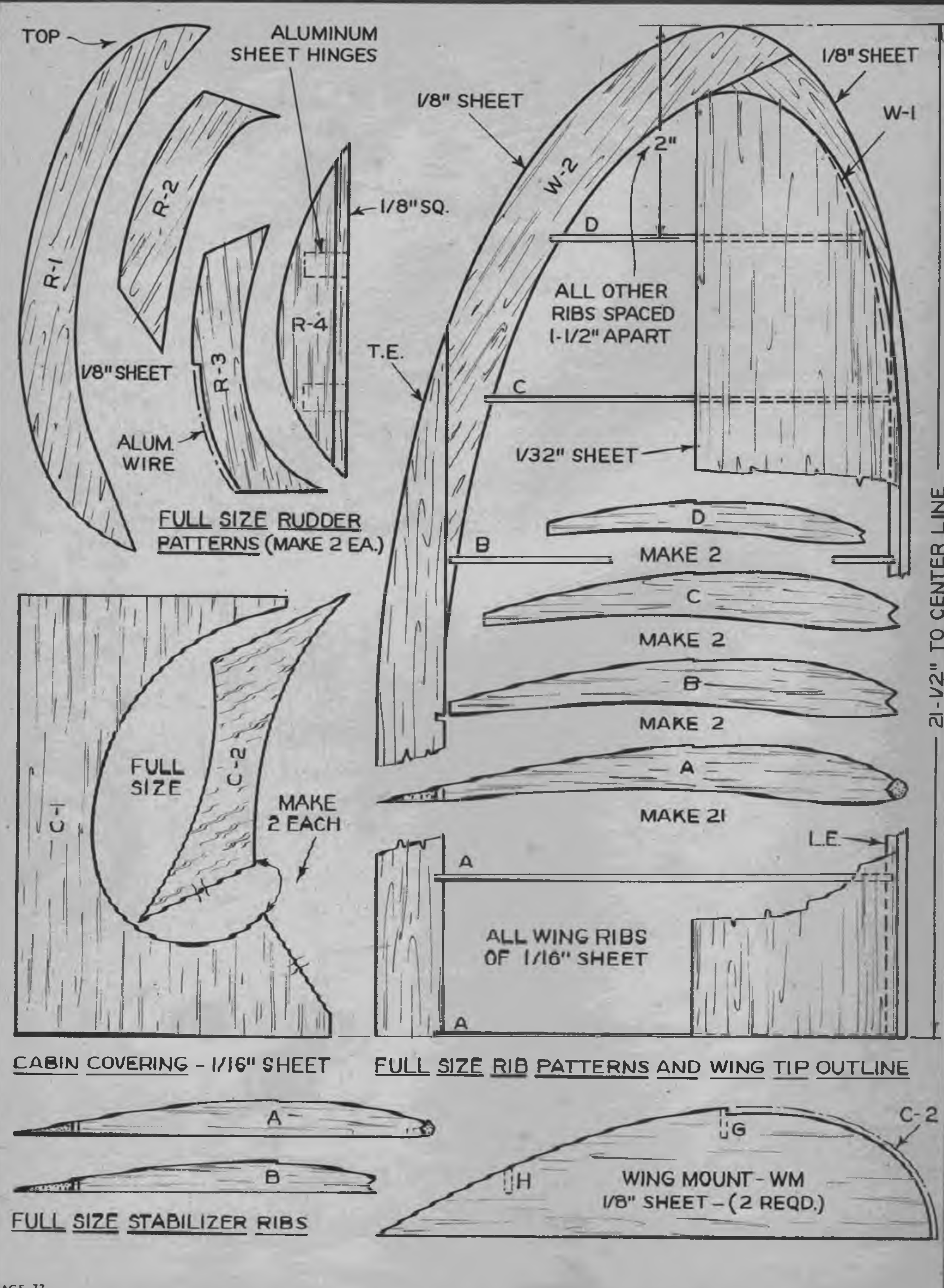
The keel piece is pinned on the plan and the half bulkheads are cemented to it. When dry, the work is lifted from the bench and the other half formers are glued in place. All formers are made of laminated $1/32''$ sheet balsa. Then, in the following order, add the $1/8''$ side stringer; the rear rubber hook anchor; the $1/16''$ stringers; sheet balsa cabin covering, and retractable landing gear.

Wing and tail construction are orthodox. Center section of wing is covered top and bottom with $1/32''$ sheet balsa. The stabilizer has a slight taper, but ribs can be estimated easily. Regular prop will do, but the blades can be hinged as shown. Silkspan covering is applied wet (six pieces on body) and pulled tight to avoid wrinkles. Use enough dope to fill pores, sand lightly, finish with gloss dope. Fair the wing mount with strips to fit rib camber. Use ten strands of $3/16''$ flat rubber 96 inches long. Wind 40 turns and double so that you have 20 strands. Rubber will take 1,200 turns on winder. No thrust adjustments are necessary; model should balance directly over the center of wheel in retracted position.



FULL SIZE HALF SECTIONS THRU FUSELAGE

FULL SIZE [illegible] & [illegible] STRINGER PATTERNS

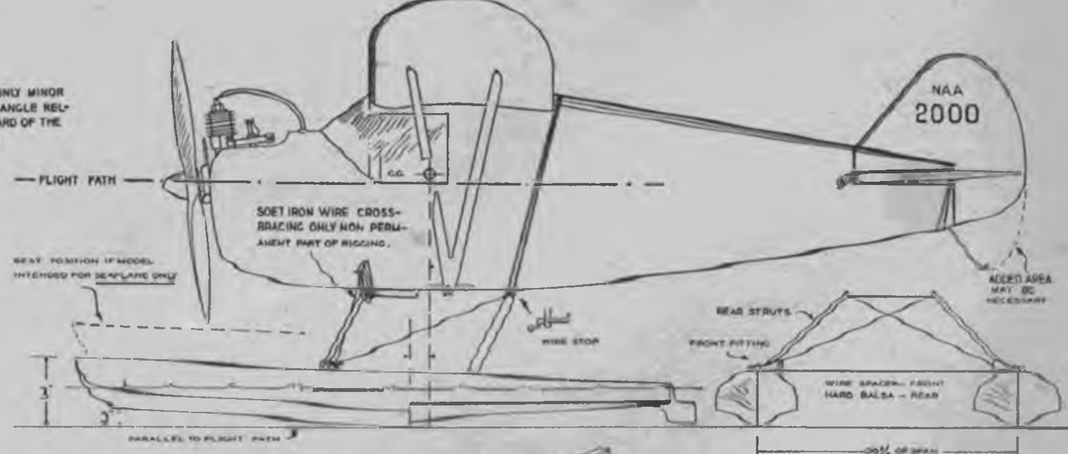

TOP
ALUMINUM SHEET HINGES
R-1
R-2
R-3
R-4
1/8" SQ.
1/8" SHEET
ALUM. WIRE
FULL SIZE RUDDER PATTERNS (MAKE 2 EA.)
1/8" SHEET
1/8" SHEET
W-1
W-2
2"
D
ALL OTHER RIBS SPACED 1-1/2" APART
T.E.
C
1/32" SHEET
D
B
MAKE 2
C
MAKE 2
B
MAKE 2
A
MAKE 21
21-1/2" TO CENTER LINE
L.E.
A
ALL WING RIBS OF 1/16" SHEET
A
C-1
FULL SIZE
C-2
MAKE 2 EACH
CABIN COVERING - 1/16" SHEET
FULL SIZE RIB PATTERNS AND WING TIP OUTLINE
A
B
FULL SIZE STABILIZER RIBS
C-2
G
H
WING MOUNT - WM
1/8" SHEET - (2 REQD.)

Seaplanes

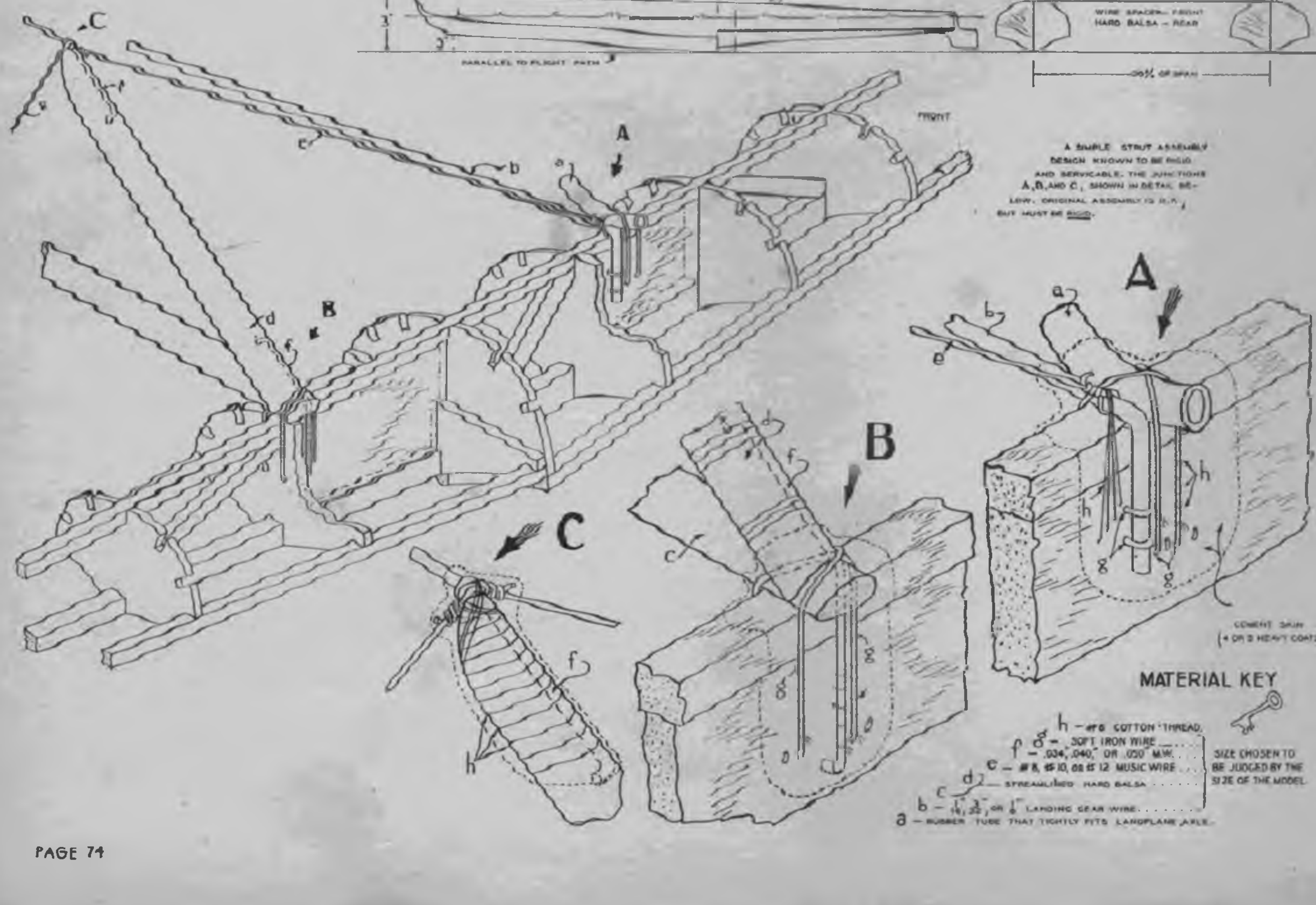
Have You

Pontoons must be just so or the ship is in for a ducking. Here's the dope. . . .

The line-up at a recent r. o. w. contest. Note the float designs.



A TYPICAL CONVERTABLE SET-UP (RELATIVE ANGLES). ONLY MINOR CHANGES HAVE BEEN MADE ON THE MODEL. THE FLOAT ANGLE RELATIVE TO THE FLIGHT PATH, THE STEP SLIGHTLY FORWARD OF THE C.G., AND TAUT RIGIDITY ARE ESSENTIALLY IMPORTANT.



A SIMPLE STRUT ASSEMBLY DESIGN KNOWN TO BE RIGID AND SERVICABLE. THE JUNCTIONS A, B, AND C, SHOWN IN DETAIL BELOW. ORIGINAL ASSEMBLY IS N.P., BUT MUST BE RIGID.

Tried Pontoons?

BY ALAN D. BOOTON

THE r. o. w. rubber-powered models require but little special treatment, while the gas models demand much more attention due to speed, weight, and protection of ignition, et cetera, so all the following data will relate to gas models. Eliminate the gas features and the data applies to rubber-powered models.

To begin with, a light model (one of 10 ounces per square inch wing loading) of accepted design and established good flying qualities will give the best performance as a hydro. Record the total weight of the model as a land plane (with wheels on); for example, the weight is 43 ounces, with length 45" overall.

Jumping to Fig. 8, it looks at first glance like a geometrical problem, but is nothing more than a 5" float bottom cross-section layout (below the chine line) with proportional width-to-depths graduated to form a handy diagram by which any ratio between a 1" and 5" float bottom section can be seen at a glance, while Fig. 4 is a table that gives the areas in square inches of the sections for quick reference.

Fig. 1 is a table by which the float width of the average gas model may be approximately determined. From these, the nearest float width relative to any existing model may be chosen, above or below the nearest width, to apply to the formula for the first try for the proper width.

The formula of Fig. 5 is only a condensation of the following process. It is desired to develop specifications for floats that will not be overly large and still support a third more weight than the actual model, simply because models have notions of their own, sometimes, so the capacity of one float will be 66 percent of the land plane weight. The best float length, C, is 70 percent of the overall fuselage length. First, the cross-section area (of one float) must be multiplied by the length C, and 10 percent of that amount added to the amount to get the cubic-inch displacement of one float to the water line. (The water line is placed at a level from which floats can rise and plane with the given capacity).

That's the trick, chum, getting them off as easy as this model. It requires design.

FIG.5 FORMULA

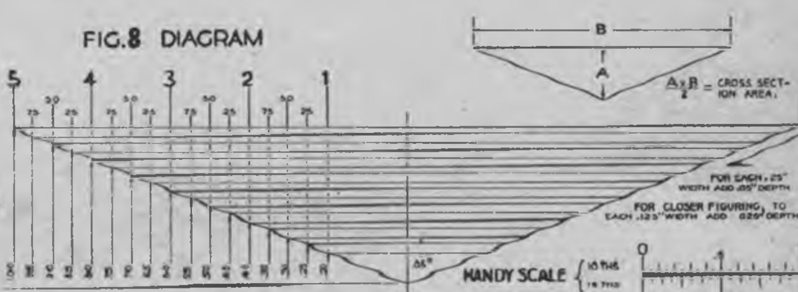
$\frac{A\times B}{2}\times C + .10\left(\frac{A\times B}{2}\times C\right)\times .558 =$ 66% OF TOTAL WT OF MODEL AS LANDPLANE, 66 BEING TOTAL TO BE SUPPORTED BY 1 FLOAT.

C FLOAT LENGTH, WHICH IS 70% OF THE OVERALL LENGTH OF THE MODEL.

.558 OZ = THE WEIGHT OF ONE CUBIC INCH OF WATER, WHICH IS MULTIPLIED BY THE CUBIC INCH DISPLACEMENT GIVING THE CAPACITY TO THE GIVEN WATER LINE OF THE FLOAT.

FIG 1 SHOWS AVERAGE MODEL LENGTHS AND WEIGHTS WITH THE CORRESPONDING FLOAT WIDTHS WORKED OUT, GIVING A BASIS ON WHICH TO START FIGURING.

FIG.8 DIAGRAM



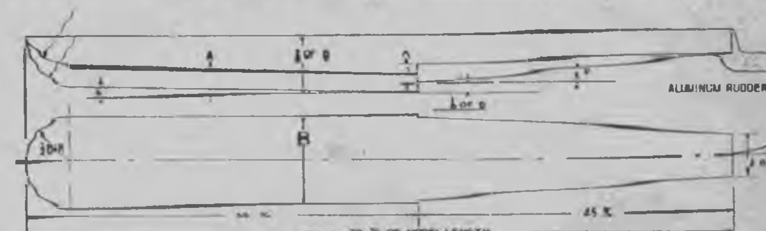


FIG.9 FLOAT DESIGN IN PROPORTIONS

FIG. 1 SAMPLE WIDTHS AS FIGURED FROM FORMULA

M.L.	OZ.	F.W.	M.L.	OZ.	F.W.	M.L.	OZ.	F.W.
20	19 (uncertain)	2.27 (uncertain)	40	[illegible]	[illegible]	60	[illegible]	[illegible]
	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]
	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]
	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	4.12 (uncertain)
25	[illegible]	[illegible]	45	[illegible]	[illegible]	65	[illegible]	[illegible]
	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]
	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	4.00 (uncertain)
	[illegible]	[illegible]		[illegible]	4.00 (uncertain)		[illegible]	4.12 (uncertain)
30	[illegible]	[illegible]	50	[illegible]	[illegible]	70	[illegible]	[illegible]
	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]
	[illegible]	[illegible]		[illegible]	[illegible]		72 (uncertain)	4.00 (uncertain)
	[illegible]	[illegible]		[illegible]	4.25 (uncertain)		[illegible]	4.12 (uncertain)
35	[illegible]	[illegible]	55	[illegible]	3.50 (uncertain)	75	[illegible]	[illegible]
	[illegible]	[illegible]		[illegible]	3.75 (uncertain)		[illegible]	[illegible]
	[illegible]	[illegible]		[illegible]	4.00 (uncertain)		[illegible]	[illegible]
	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]

FIG.2 EXAMPLE

FOR AN EXAMPLE, TAKE THE 43 OZ., 45" GAS MODEL IN FIG 1. A 45", 43 OZ MODEL REQUIRES FLOATS 3.75" WIDE AND IN FIG 4 THE CROSS-SECTION AREA FIGURES IS 1.40" SQ.

C = FLOAT LENGTH, 70% OF FUSELAGE LENGTH, OR 31.5"; THE WATERLINE CAPACITY OF ONE FLOAT SHOULD BE 66% OF TOTAL WT. OF MODEL AS A LANDPLANE, OR .66 × 43 OZ. = 28.3 OZ. THE FIGURE THAT THE FORMULA ANSWER MUST APPROXIMATE WITHIN ONE OR TWO OZ AS FOLLOWS:

31.5	FLOAT LENGTH C.
X 1.40	(A) .75" X (B) 3.75" ÷ 2.
44.1	
.10(A×B/2 × C).	
4.41	
48.51	CU. IN. DISPLACEMENT TO WATER LINE
X .558	WT. OF ONE CU. IN. H_2O.
27.07 OZ. WHICH COMPARES FAVORABLY WITH 28.3 OZ.	

FIG. 3 MATERIALS PROPORTIONATE TO FLOAT SIZE

FLOAT SIZES	20" x [illegible]	40" x 3.75" (uncertain)	60" x 4.00" (uncertain)	78" x 4.50" (uncertain)
LONG. SIZE	1/8 SQ.	3/16 SQ.	1/4 SQ.	1/4 SQ. (uncertain)
KEEL SIZE	[illegible]	[illegible]	[illegible]	[illegible]
STRINGERS	[illegible]	[illegible]	[illegible]	[illegible]
BULKHEADS	[illegible]	3/32 (uncertain)	3/32 (uncertain)	1/8
COVERING	[illegible]	[illegible]	[illegible]	[illegible]

SELECT MATERIAL MED SOFT FOR LIGHT MODEL, MED. FOR MED., HARD FOR HEAVY.

FIG. 4 CROSS SECTION AREA TABLE

B	A	C.S. AREA
1.25"	.25"	[illegible]
1.50	.30	[illegible]
1.75	.35	.306 (uncertain)
2.00	.40	.400
2.25	.45	.506 (uncertain)
2.50	.50	.625 (uncertain)
2.75	.55	.756 (uncertain)
3.00	.60	.900 (uncertain)
3.25	.65	1.06
3.50	.70	1.22
3.75	.75	1.40
4.00	.80	1.60
4.25	.85	1.80
4.50	.90	2.02
4.75	.95	2.25
5.00	1.00	2.50

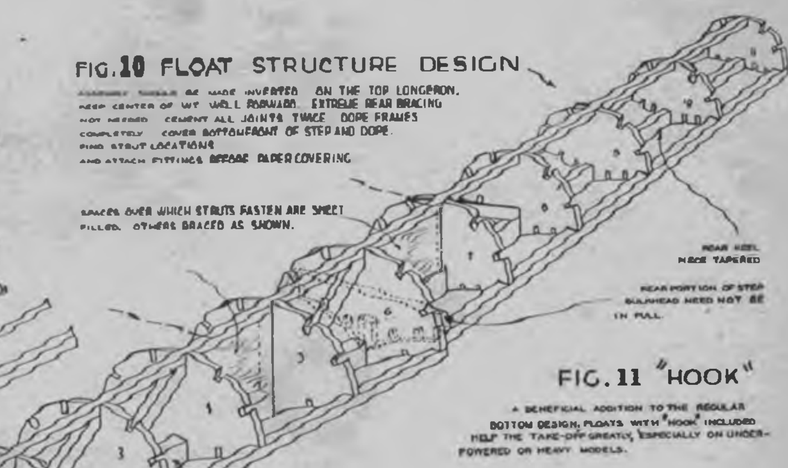
FIG.6 BULKHEAD DESIGN

EACH BULKHEAD IS SLIGHTLY DIFFERENT BUT ALL CAN BE EASILY DESIGNED FOR THE APPROPRIATE MATERIAL FIG. 3 BY BISECTING THE DIAGONALS AND CONTINUING THE THUSLY FOUND RADIAL LINES THE PROPER CENTERS ARE EASILY LOCATED.

FIG.10 FLOAT STRUCTURE DESIGN

ASSEMBLY SHOULD BE MADE INVERTED ON THE TOP LONGERON. KEEP CENTER OF WT WELL FORWARD. EXTREME REAR BRACING NOT NEEDED. CEMENT ALL JOINTS TWICE. DOPE FRAMES COMPLETELY. COVER BOTTOM FRONT OF STEP AND DOPE. FIND STRUT LOCATIONS AND ATTACH FITTINGS BEFORE PAPER COVERING.

SPACES OVER WHICH STRUTS FASTEN ARE SHEET FILLED. OTHERS BRACED AS SHOWN.

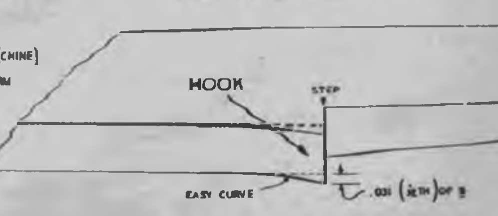


FIGS.7 FLOAT PROW

SHEET COVERING OF BOTTOM SLICED INTO STRIPS TO FACILITATE EASY BENDING.

FIG.11 "HOOK"

A BENEFICIAL ADDITION TO THE REGULAR BOTTOM DESIGN, FLOATS WITH "HOOK" INCLUDED HELP THE TAKE-OFF GREATLY, ESPECIALLY ON UNDER-POWERED OR HEAVY MODELS.



To find the capacity of one float, the sum of the cubic-inch displacement is multiplied by .558 ounces (the weight of 1 cubic inch of water), which must equal 66 percent of the weight of the land plane, or over by one or two ounces.

So in Fig. 2, the letters of the formula have been substituted for the numerical values and worked like arithmetic, as an example.

Utilize Fig. 9 to draw up the float design according to the newly found specifications established by the formula and data. With C as the float length, A as the depth of the "V" bottom, the remaining proportions are derived from the figure, paying particular attention to vital bottom angles. Figures for the model used in the example are C=31.5", A=.75", B=3.75", $\frac{5}{8}$B=2.35" ($2\frac{3}{8}$"), $\frac{1}{2}$B=1.87" ($1\frac{7}{8}$"), $\frac{1}{8}$B=.47" ($\frac{1}{2}$"), $\frac{1}{32}$B=.11" ($\frac{3}{32}$"). The approximate decimal change from fractions can be estimated by the handy 10ths, 16ths scale. After the main lines of the design have been drawn, divide the front and rear portions into equal parts, between $2\frac{1}{2}$" and 3" for the bulkhead stations. The spacing of the front section will naturally not equal that of the rear.

Fig. 6 shows the steps by which the bulkheads are developed. Since the top line (of the side view of float drawing) is straight and the chine lines angle up from the step, only the top of each front bulkhead need be developed; the bottoms are alike, but the tops and bottoms of the rear bulkheads are all different. By using the side and top views of your drawing, the main measurements can be transposed. . A glance at Fig. 3 will give some idea as to what material sizes should be chosen, so the exact slot sizes can be drawn in the bulkheads.

Fig. 10 is a typical float structure drawn to show what the finished frame should look like.

The "hook" described in Fig. 11 is one of the most beneficial additions to a good float design, especially when used on floats supporting heavy or under-powered models. Omitting the technical details, "hook" (as used in boat-racing parlance) holds the floats more level as the take-off speed increases, thereby insuring a smooth, easy departure from the water. "Porpoising," the longitudinal rocking motion encountered in floats of doubtful design, is also eliminated. The hook is added by building up the step $\frac{1}{32}$B with a gradual curve forward to the regular bottom.

Assuming that the pair of frames is ready to cover, the next step is to temporarily space (twenty percent wingspan) and attach the frames with struts and spaces (of approximately the same size that will be used finally) to the fuselage.

The lining up will be more accurate if done on a flat surface, to insure getting the float levels exact.

The step must be from two percent to five percent of C forward of the center of gravity, and the front of the floats (using straight top lines) must be raised three degrees above a line parallel to the level flight path—thrust line ignored. These two items are especially important and must be checked before flying the model. With the float raised three degrees, and the two-degree angle already in the front float bottoms, a model can glide at a maximum of five degrees and land safely. More than five degrees, the landings become doubtful.

The positions of the struts on the frames is of little importance as long as the float angle and position relative to the fuselage and flight path are correct. After finding the best strut and spacer locations, proceed to make them permanent. The pieces of rubber tube as front-axle fittings were adopted because they restrict any lateral movement and enable easy insertion of the axles, which is not possible with otherwise suitable metal fittings.

The typical strut, spacer and rigging arrangement in Figures A, B and C in the drawing will be of value if followed in design, if not in structure. Make small aluminum rudders with tongues to push through the wood and cement them to stern of each pontoon. Without these, taxiing would be confined to a circle.

Now cover the frames. Apply bamboo paper on the rounded top, cementing around the edges only. On the bottom stern cement to all external wooden surfaces. Spray with water and let dry thoroughly to tighten, and apply two coats of clear dope all over. Recover the *whole* bottoms again with jap tissue and coat with dope. This latter procedure protects against superficial leaks and makes the bottoms tougher.

Let it be assumed that the model has been tested as a land plane and adjusted to the highest degree of efficiency and consistency.

The ignition system of the motor must now be prepared for hydro flying. It would be rather expensive to replace both coil and condenser after each spill, so a coating of hot paraffin applied to the parts and part of the wire leading from them will solve the problem. In case the system is removable, several alternate layers of paraffin and waxed paper will doubly protect the parts, but if the system is built-in, uncover the model enough to do the coating satisfactorily, then recover.

Now for the trials! Attach the floats and check the rigidity by letting the weight of the model bear on one float prow and then the other.

Operating from a boat is the best policy. Check the taxi first, for it must be straight. If the model continues to turn in spite of opposite float rudder, it may be that the rudders are not large enough or are not set deeply enough to be effective. When the taxi is straightened, increase the speed of the motor slightly and check the run for straightness, increasing the time after each satisfactory run, finally increasing the speed until the model will leave the water. Shut-offs close to the water are not suitable for hydro flying, but to become familiar with the model's tendencies, these first few chances have to be taken. So the first landing may be a spill, and a drying-off period will result. The model really needs between twenty-five and fifty feet altitude to smooth out into a flat glide in consistently good flying.

Minor adjustments may be needed on the model, mainly for the center of lateral area change caused by the addition of floats, and if the model is erratic in flight, attach the extra rudder area.

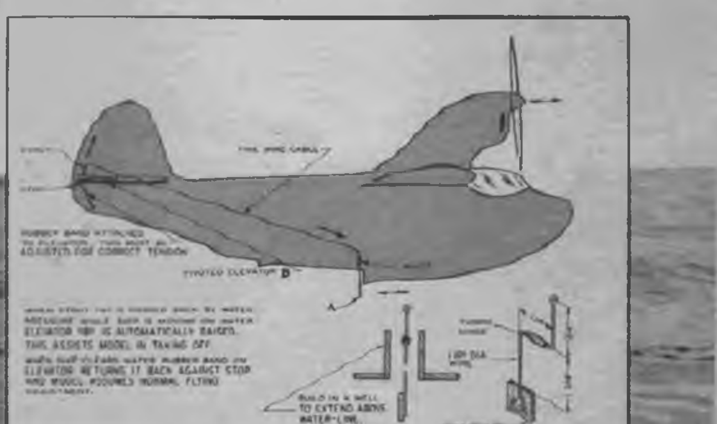
Calm air is advisable at all times, unless the model can be adjusted to head into the wind when the motor cuts.

There never was the least bit of motor trouble after the duckings received on the tests. Following an upset and drying off, the motors would exhaust oily water on the first few cranks, and after priming they would catch up and spray emulsified oil all over the place, then settle down to even running. It was thought that the porcelain of the hot spark plugs would shatter when doused with cold water, but they did not, due to the small sizes.

Two-piece V-strutted wings were used on all the gas test models to keep the alignment the same while drying off after a ducking. One-piece wings occasionally get warped while drying. The models were regular kit land planes without doped frames, but that made no evident difference. Models intended for seaplanes sooner or later should have every balsa surface doped inside and out. When built for seaplane use only, the floats can be closer to the fuselage to reduce the drag arm evident in convertible models.

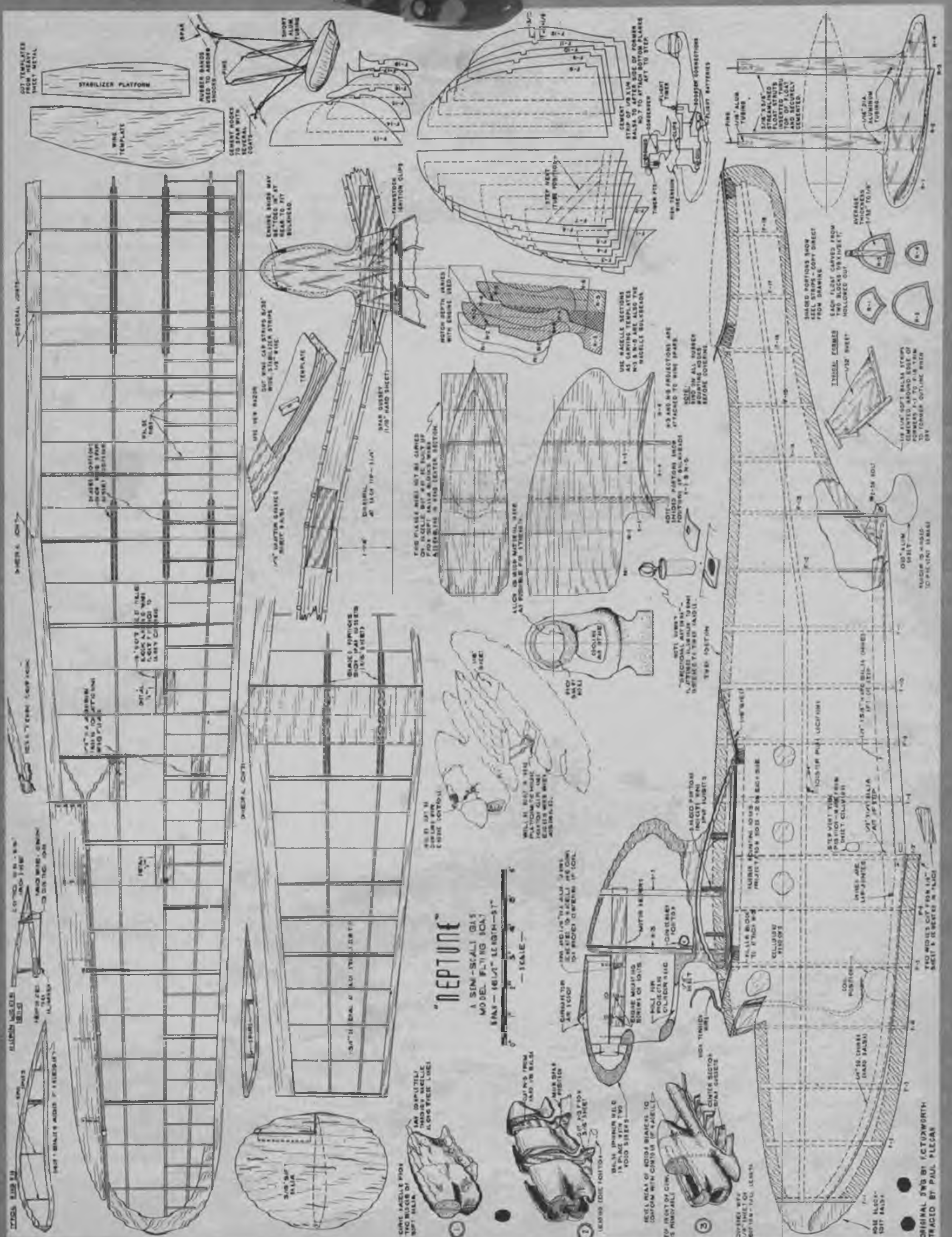
During the years that hydro flying progressed, to date, a very noticeable fact became evident. Though water can be very damaging when struck with sufficient impact, there was never a single instance of damage caused by water crashes.

Make up a set of floats and have some real sport with your model!



Neptune

BY FRED TUXWORTH



Pinch Hitter

BY PAUL PLECAN and GIL SHURMAN

Pine, bass can sub for balsa, as this job proves.

Try this job on your Class B motor and see for yourself the advantages of hardwood construction. Note neat built-up cowl.

HERE y'are, boys—a gas job, ready to fly, without a splinter of balsa in it. It is cheaper, and you can always pick up some scrap pine or spruce. Its hardwood construction makes a tough, resilient framework. So if you have a Rogers 29 or some similar motor, try building this unusual ship.

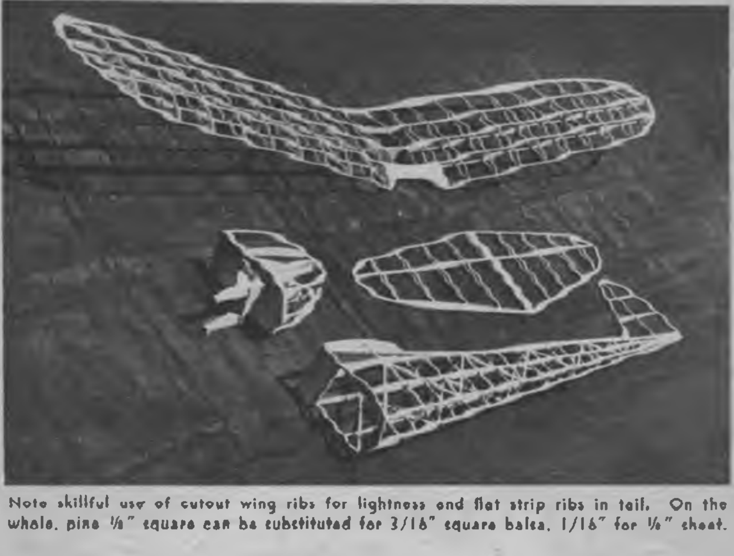
The side frames are constructed from 1/8" square pine. For glue we tried Weldwood, Casco and regular cement—all with success. Three coats of cement were required. Assemble side frames over top view, noting sketch for stringer support strips. These are bound in place and cemented. The rudder is built into the fuselage. Be sure that the wing-mount formers are absolutely flat while the cement dries. The stabilizer is made by assembling the curved outlines over the plan, then placing the bottom cap strips in place, followed by the spar, then the top cap strips. The bottom portion of the rudder is cemented to the stabilizer. Note that the camber of the stabilizer is on the bottom.

Making the wing ribs with a coping saw is a laborious job, we admit, but if you have access to a motor-driven band saw you can stack the rib stock and cut out numerous ribs in a single operation. Be sure to sand the edges of the ribs, since a rough rib will cut the lift. The two-wing panels are assembled flat, then the tips are propped up 6 1/4" each for dihedral. Spar joiners are added as shown on the plan. The cut-out section of the center section should be reinforced with Bristol board or other stiff covering.

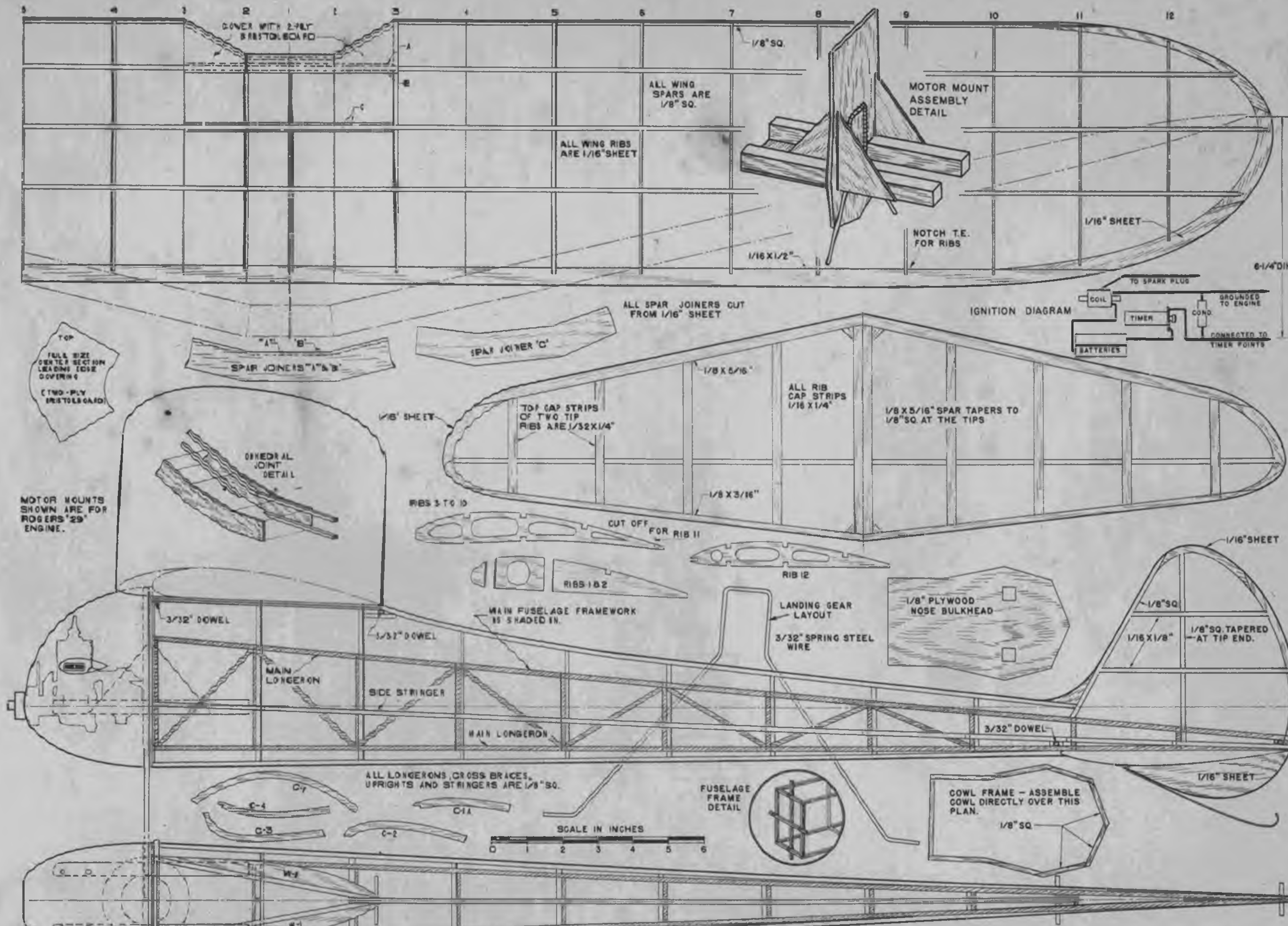
Colored Silkspan is used for covering, and should be sprayed with water before doping. When it dries it will pull tight as a drum. To prevent warping, parts should be pinned to the bench while wet and allowed to remain until dry. Three coats of clear dope are used.

The sketch of the motor mount clearly shows the 3/8" square motor bearers, the plywood firewall (to which the landing-gear wire is tied with thread and cemented) and the sheet-wood fill-in between the motor bearers which supports the battery box. The cowling is made by assembling a light framework of formers on the plan and covering it with two-ply Bristol board. Cover this with Silkspan and cut out cooling hole. A paper exhaust stack directs exhaust away from fuselage. For an Austin timer, a hole should be cut in the top of the cowl for access to the timer handle. The timer on the original model was trimmed on one side so it could be cemented flush to the bulkhead.

Incidentally, the original model gave the authors quite a shock in that it didn't quite reach weight rule, necessitating additional doping and heavier batteries. The most outstanding characteristic of the model, however, was its extreme flexibility. Subject to plenty of flying and transportation manhandling, the model is still in perfect condition. Though tissue has been shattered at times, the framework remains sound.



Note skillful use of cutout wing ribs for lightness and flat strip ribs in tail. On the whole, pine 1/8" square can be substituted for 3/16" square balsa, 1/16" for 1/8" sheet.



PLANS DRAWN BY PAUL PLECAN – INKING BY GIL SHURMAN

David Call (left), and Charles Leibfried (right), demonstrate proper method of winding for indoor models. Note the fuselage model in the foreground.

Here's how to launch the featherweights. The wings on this stick model are braced with tungsten wire for rigidity. Propeller turns at about 75 r. p. m.

Indoor Models

What it's all about—an introductory description for those who have not had opportunity to witness an indoor meet.

TO outdoor enthusiasts, indoor fliers seem to be fit inmates for asylums. A person going into an armory for the first time would see fellows walking very gingerly, and still others twisting beaters on the middle of the floor—apparently for no good reason at all. However, these people are not really crazy.

Look up in the air and you'll see the reason for all this activity. Those skeletonlike framework models you see slowly flying around in circles actually do have transparent coverings which are called microfilm.

Let's find out some of the things indoor modelists do and why. Because of the lightness, the most outstanding point in launching an indoor model is that it is never pushed. It is gently thrust forward at about the flying speed of the ship, which is slower than you normally walk.

You'll understand the gentle launching all the better when we tell you that these models, with 36" wing spans, usually weigh less than $^{2}/_{10}$ ounces ready to fly, with a 20" loop of $\frac{1}{8}$ x $^{1}/_{30}$" rubber. In fact, the lighter your model, the longer it will fly, providing you haven't sacrificed structural limitations to the extent that the model is too weak to withstand the forces exerted by a fully wound motor. To reach maximum lightness, it is necessary to employ the lightest balsa possible, usually from three to five pounds per cubic foot, and some of the experts even worry about weight to the extent of bracing their wings and motor sticks with thin tungsten wire for extra rigidity in an attempt to save a few all-important thousandths of an ounce.

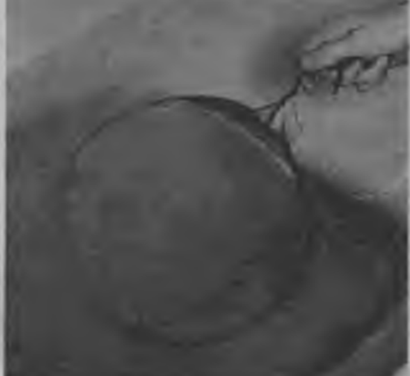
The propellers on these featherweight floaters are usually 16" in diameter and are carved from light balsa to such a paper thinness that they weigh as little as $^{15}/_{1000}$ of an ounce. Now the weight-conscious experts have developed a built-up framework microfilm prop which weighs even less than wooden types and still retains the efficiency of the now-old-style wooden types.

But what really amazes the novice is the really few times per minute at which these props turn; you can actually count 'em off. At 70 r. p. m., the average speed of most indoor models, the maximum duration for these models is about 30 minutes. But as yet, the boys have only reached 26 minutes, which should give you an incentive to try your hand at the most scientific and exacting phase of model building.

Fill bottle cap with mic solution, pour on water.

When colors appear, sheet is dry. Dip coat hanger in solution at edge of sheet.

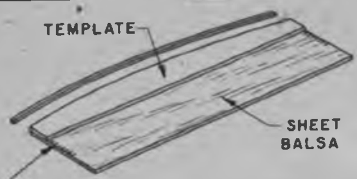
Contact edge of sheet with hoop and begin to lift sheet from water in a vertical position.



Continue this motion until sheet is off the water and on the wire hoop.

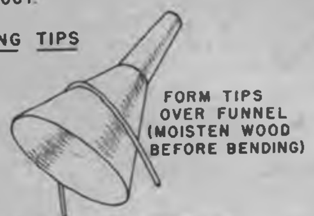
This model designed by John Stoker, courtesy of Model Aeronautics Yearbook.

CUTTING INDOOR RIBS



CONTROL DEPTH OF RIBS. TEMPLATE IS MOVED DOWN ONE NOTCH AFTER EACH RIB IS CUT.

FORMING TIPS

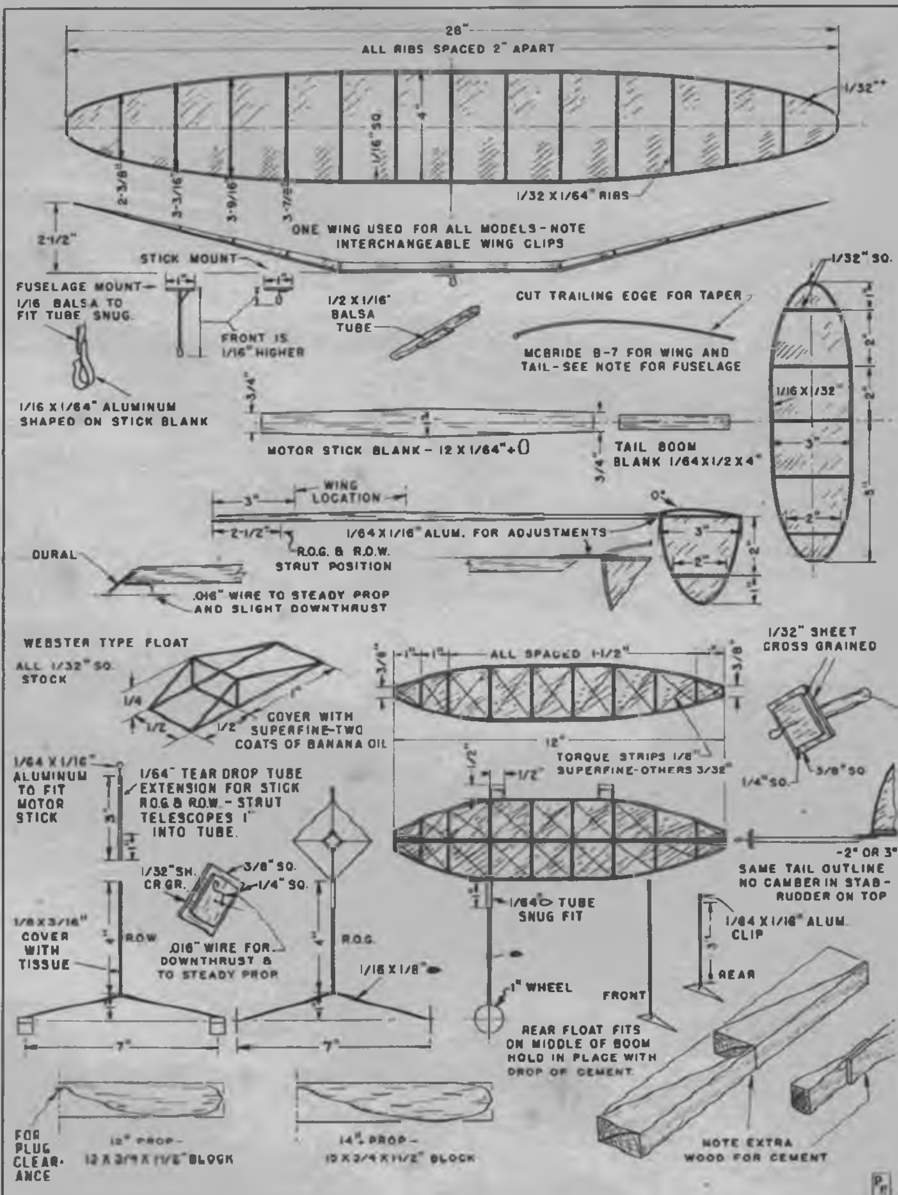


MAKING A TUBULAR FUSELAGE

TRIMMING RIBS

FIT EACH INDIVIDUAL RIB BY TRIMMING EXCESS OFF TRAILING EDGE

THRUST BEARING



WEIGHTS - FUSELAGE	STICK	NOTES	DESIGN	PROP	POWER	FLIGHT	TIME
FUSELAGE — .020 OZ	STICK — .016 OZ	PONTOON ASSEM .011	FUSELAGE R.O.G.	12"	1/16-5/64	JR REC'D	14M 15.3S.
WING — — .020	WING — .020	L.B. STICK .003 OZ.	FUSELAGE R.O.W.	12"	3/64	——	
TAIL ASSEM. — .010	TAIL — .004	26" MOTOR LOOP USED	STICK H.L.	14"	1/16-5/64	JR REC'D	18M. 12.2S.
PROP — — .011	PROP — .014	(TO FIT FLYING CON-	STICK R.O.G.	14"	5/64	JR. REC'D	17M. 19.3S.
L.B. — — .003	TOTAL — .056 OZ	DITIONS — 1/30 GAGE	STICK ROW	12"	1/16 3/64	TEST	7M. 47.8S.
TOTAL — .099 OZ.	——	BROWN RUBBER)	——	—	——	——	——

Remove any double layers of film by gently pulling it back to the edge.

Covering framework is easy. Just moisten the wood with water, lay on film, and allow to dry.

But make certain that the film has completely adhered to frame, by using fingers.

Trim with a wire heated over candle, or cigarette.

Maybe rubber IS scarce, but you can double the life of what you've got. Listen to the tricks of an old Wakefield winner!

A COMMON sound heard at any rubber-powered model contest is that of a sheared rubber motor tearing a fuselage apart. Sympathetic spectators cry, "You can fix it!" Since the new craze for Jap-slapping, however, every ounce of rubber is precious. Rubber must be intelligently used.

Every motor that breaks is a victim of misunderstanding of principles of breaking-in, lubrication and general handling. If rubber must be stored, be sure to keep it in an airtight container in a cool, dark place until you need it. Always make at least two motors for each ship and lubricate them thoroughly with lube of about the consistency of molasses. Before installing the motor carefully check over the rear hook and prop shaft for any sharp nicks which might cut the motor. If a bobbin is used, place a rubber band around the motor to prevent odd strands from twisting off and to keep the motor running true.

To break in a motor properly, always start with far less winds than the motor's capacity; gradually increase the turns until the maximum is almost reached. Never wind to maximum turns unless it is required in contest flying for an all-out effort. After it has been used, remove the

Stretch that Rubber

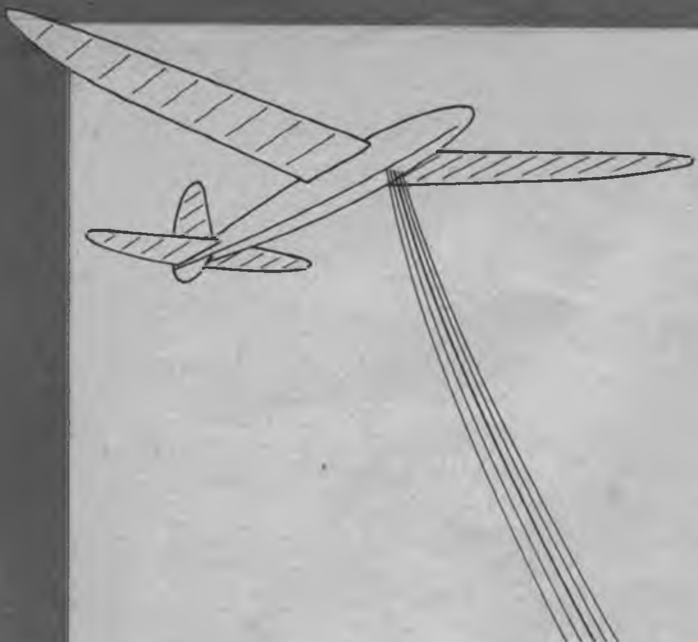
BY DICK KORDA

motor, wash it carefully and thoroughly relubricate for future use before it is stored. After all, one may excuse a fellow for taking a chance with a weak motor, but anyone who mistreats a motor deserves the worst of what will inevitably happen. If the motor is to be stored between contests, never leave it in the plane any longer than it takes to complete the necessary flights. Heat, dust and grit will invariably cause breakage. Never install a rubber motor at home and then travel with the model to a contest. It is much more sensible to install the motor just before the model is going to fly. And always carry the essential extra motor; never take chances with one which is nicked.

To repair a nicked motor, wash it first thoroughly in warm water to rid it of all lubricant and dust. Break each nick and retie the ends with two knots that should be pulled closely together. Finally, wrap pieces of thread between the two knots and around the outside of the knot. Use two separate lengths of thread.

A quality of rubber exasperating to the model builder is one with a tendency to lose power and weaken when wound to capacity too soon during the breaking-in process. The same tendency is evident during very hot weather as is generally experienced during national contests. It is at times like these that the knowledge of how to handle rubber properly and the possession of an extra motor pay off in trophies.

Gliders



Towliners Are In

DON'T LET THE RUBBER SHORTAGE HANDICAP YOUR FLYING. TOWLINE GLIDERS WILL EASILY OUTPERFORM ANY POWER JOBS.

BY CLAUDE D. McCULLOUGH

WITH rubber scarcer than Siamese twins, the long-neglected towline glider is coming into its own. Using no rubber, a minimum of steel wire, no brass or aluminum, it is the ideal ship for wartime model building. The AMA rules require a wing loading of three ounces for each 100 square inches of wing area. Since it carries no rubber motor or prop and needs no landing gear, the weight of these items may be put into structural strength. This, plus slow flying speed, makes a towliner almost indestructible. With shipments of balsa becoming less and less, son, you'd better build a couple of sailplanes!

There are only a few sailplane kits on the market, but they are good ones. If you're partial to designing your own, the procedure is much the same as designing a rubber job. Sailplanes with short moment arms are easier to adjust into the tighter spirals.

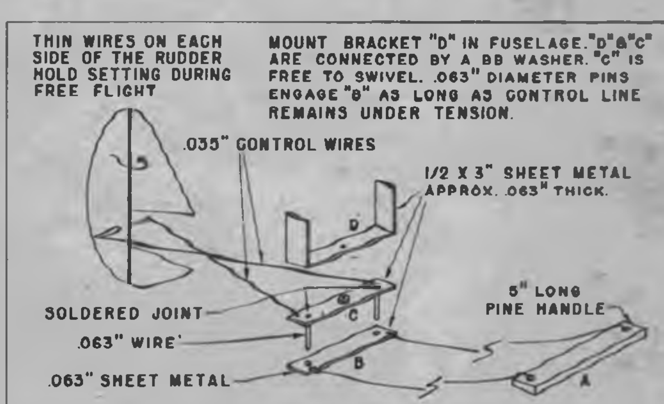
When the rubber shortage hits you, your rubber jobs can be quickly and easily converted into soarers by removing the landing gear and installing a tow hook and a nose block, to which clay is added for balance. Even gas jobs can be converted into towliners. With the ignition and motor removed, an extension for the fuselage may be built onto the firewall.

Flying adjustments should be carefully made to secure the last possible inch of altitude. The pull-out after the line is dropped should be especially watched. With a bit of practice to get used to the flying characteristics of your ship, it isn't difficult to get it to bank off the line at the very top and float away without any recovery dive. Tight spirals are desirable in the glide, since this type of flight will pick up even the smallest risers for a little hitchhike.

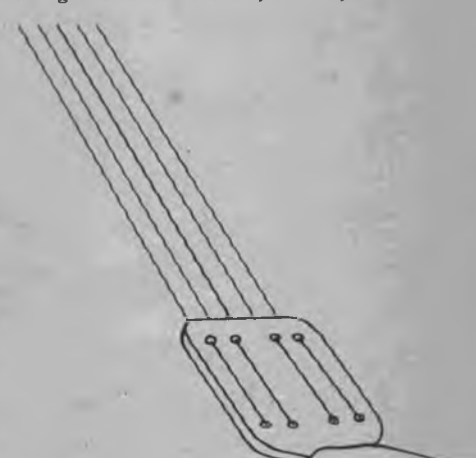
Most towliner addicts use about a No. 8 thread for a line, but good kite string does as well and is certainly less nerve-flaying when it gets into a bout with some weeds.

All ships should carry a dethermalizer of some sort to prevent loss. Our favorite is the bobbin-of-thread type dreamed up by the Cleveland boys for gas jobs. A small-sized Austin timer is arranged so that its retreating plunger pulls a pin holding in a bobbin of thread, the end of which has been tied to a wing tip. The bobbin drops, unreels, and its weight hanging beneath the wing tip throws the ship into a spin that is guaranteed to bring it out of any thermal—well, almost any. When the bobbin hits the ground, the drag is removed from the wing tip and the ship pulls out and lands.

Towliners have been long neglected in this country and official AMA records are very low. Contest directors will find towliners the only type of ships flying in a short time, and it would be advantageous for them to do some boosting now. Our gang used to laugh at pictures of Hans and Fritzy German sailing their hardwood sailplanes, but we have long since eaten large portions of humble pie. So pull up a chair, dust off the workbench and get to work—because, brother, towliners are in!



This puppet device, designed by Frank Ehling, allows rudder operation by a method similar to gas model control-line flying. In addition, the extra strings may be used to release parachutes, drop bombs, do other unusual stunts.



The Draftee

While essentially a beginner's model, this glider will still satisfy the most exacting contest builder.

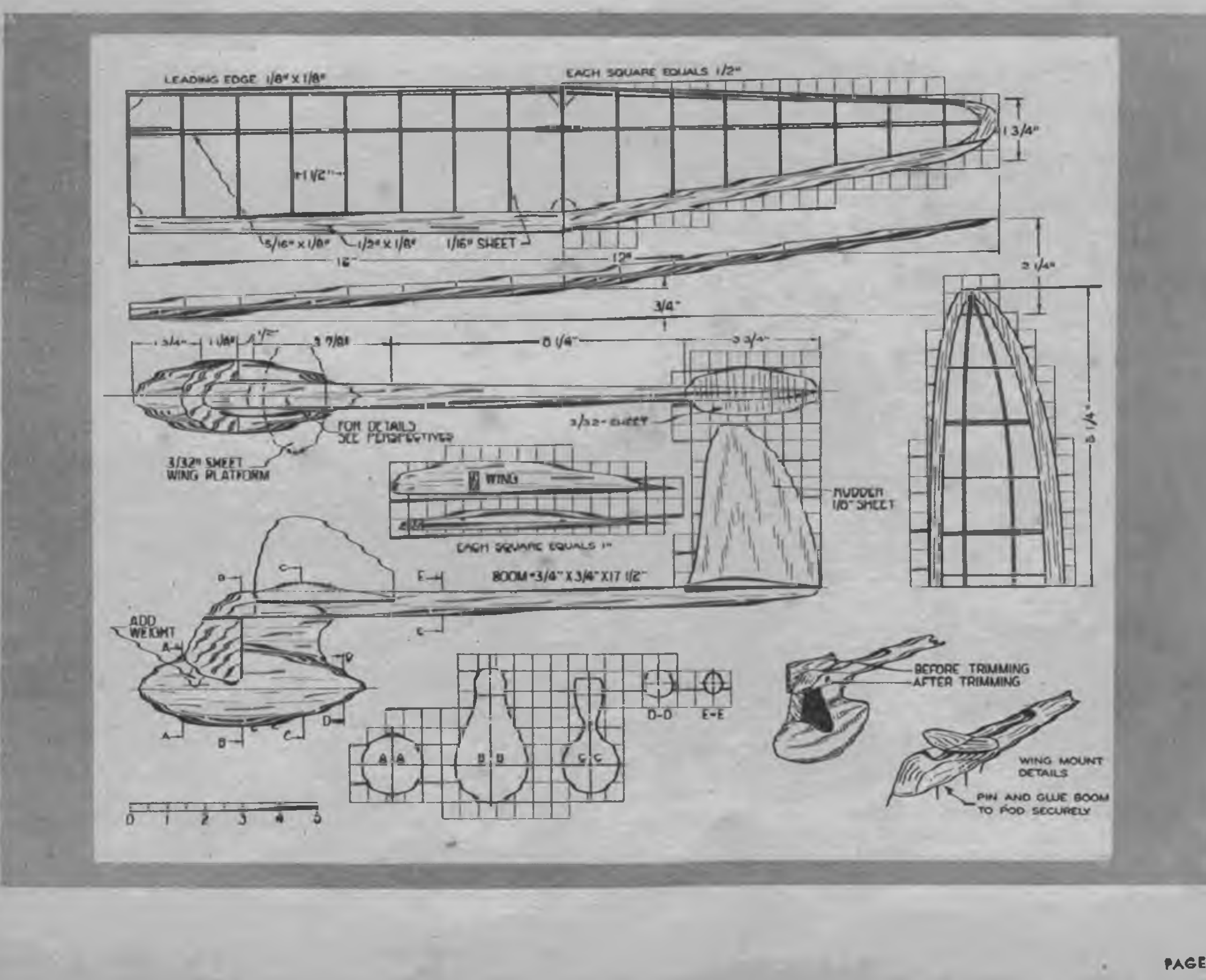
BY TONY SCHOTT

LIKE its human namesake, Draftee is a natty job with a collection of very desirable features important to consistent performance. The model has the pod type of fuselage, which means less friction and less drag, and a much lower center of gravity than is possible with any other type of fuselage. This, coupled with a short moment arm and an ample rudder, makes for safe, easy turning and enhances the spiral stability.

For the wing sections, both cambered sections and variations of the Clark Y were tried; the latter was found best suited for flat terrain, or contest, work. First, a section similar to the Clark Y with a flat undersurface is a much faster section than a cambered one; when a ship can cover a much greater amount of territory in a shorter time, the chances for the elusive thermal increase. Second, it is more stable than a cambered section; easier adjustments are possible.

The rib section used on the stabilizer is much the same as that of the wing section, except that it is very thin. Such a section is better than a streamlined section, for it keeps the tail surfaces a degree or two above the center line in flight.

No matter how you turn your ship, always be sure to launch it slightly cross wind in the opposite direction. A safe, straight tow, should result. When you feel that the ship has reached its maximum altitude on the line, pull it gently into its natural banking position. Don't pull the ship off the line; let it fly itself. Trying to disengage a model from its line with a gentle tug is a very common fault resulting in a stalled model with an inevitable loss of altitude.

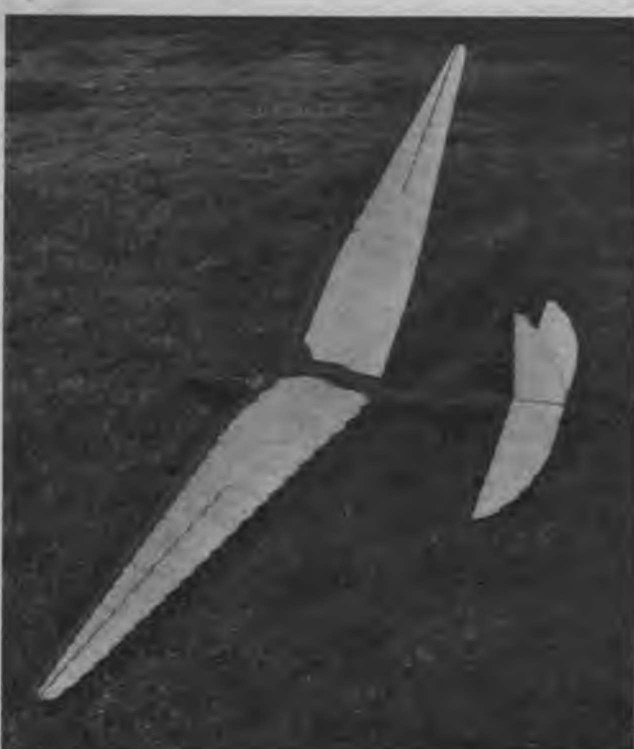


Author Dick MacNally admires his handiwork. This 80" span tow-liner resembles the Bowlus Baby Albatross in appearance and performance.

BY RICHARD MACNALLY

The Jersey Albatross

You don't need rubber to get 'em up thar! This super-soarer will outperform gas models. Meets NAA contest requirements.



High-aspect ratio gull wings combined with an efficient airfoil give remarkable soaring tendencies, while drag is minimized by pod fuselage.

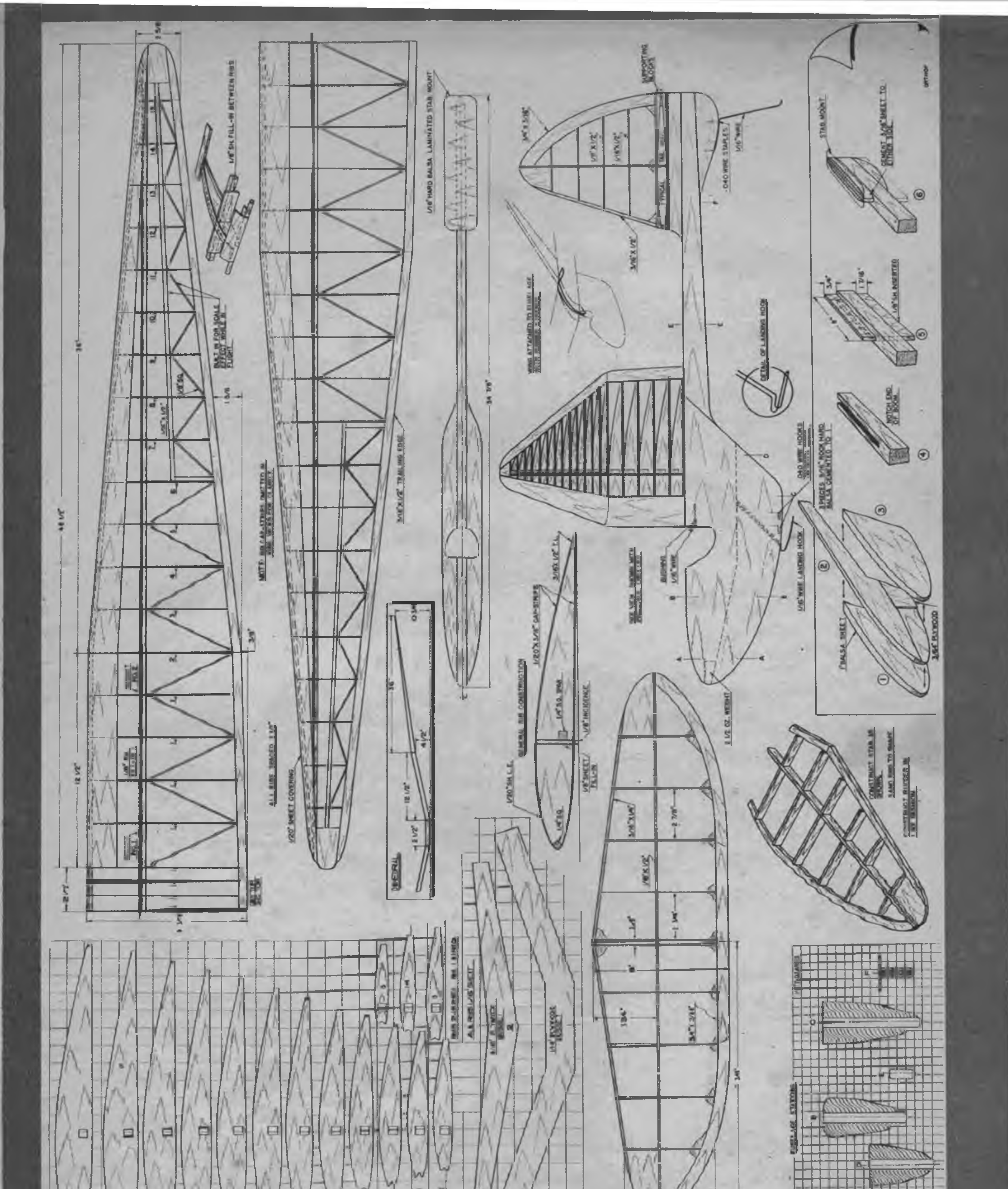
THE Jersey Albatross is the result of three previous attempts at large glider construction and flying. The fuselage is a solid pod-and-boom construction and features a detachable landing skid. The wing is a monospar, gull-wing design having sufficient dihedral and yet retaining scale appearance. Outer wing panels taper. The zigzag wing bracing and aileron construction are false and were built to further the scale appearance of the model. In flight it resembles a ship combining features of the Baby and Super Albatross soaring gliders.

Draw up a full-sized fuselage plan and, from it, trace the outer border only on a piece of one-inch medium balsa. Cut out two identical sides. Trace the three center pieces of the fuselage on $^{9}/_{16}$" stock and cut out. Cement them to one of the outer sides. Cut the two plywood sections and cement into place.

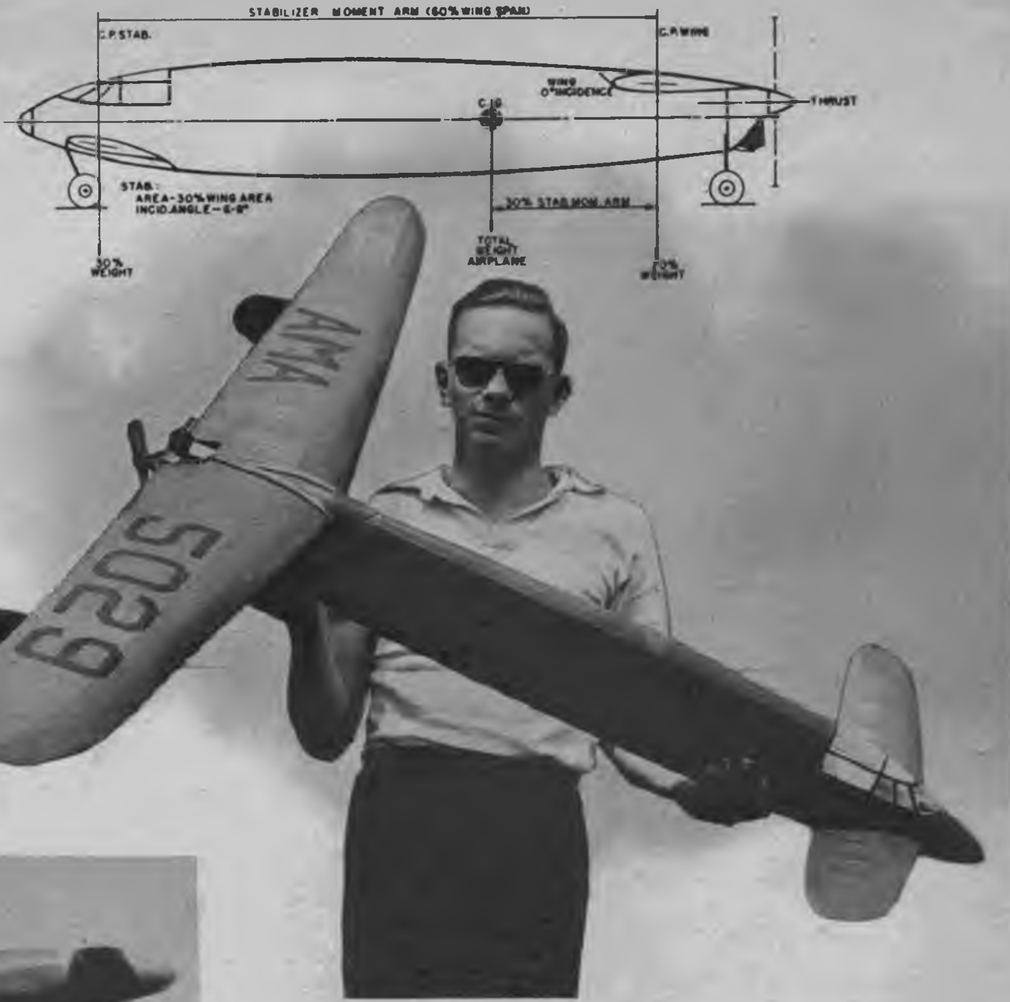
The other side is cemented to the middle pieces. Slot the end of the boom eight inches. This slot, parallel to the boom, is cut to accommodate $^{1}/_{8}$" sheet. Construct the stabilizer and rudder mount as shown. Carve and sand the pod and boom to the correct cross sections. The cockpit is hollowed and the entire pod and boom are given two coats of wood filler and three of thinned orange dope.

Draw a full-sized wing plan and cut out the required ribs. Cement them lightly in their required spacing on the $^{1}/_{4}$" square spar. After the leading and trailing edges have been cemented, cut and cement the $^{1}/_{8}$" sheet inserts between each rib and to the spar. The tapered panels are similarly made and connected to the wing. The center section is covered with $^{1}/_{20}$" sheet balsa. The leading edges of the panels are covered with two-inch widths of $^{1}/_{20}$" sheet. The ribs are capstripped top and bottom with $^{1}/_{20} \times ^{3}/_{16}$" strips. The entire wing is covered with white Silkspan.

The stabilizer and rudder are constructed by the same methods. Refer to the plans for specific instructions. Both are covered with Silkspan and doped twice. The front hook in the cockpit and tail boom are utilized to connect rubber used in binding on the wing.


1/16" HARD BALSA LAMINATED STAB MOUNT
3/16"X1/2" TRAILING EDGE
1/20" SHEET COVERING
ALL RIBS SPACED 2 1/2"
DIHEDRAL
34 3/8"
1/16" WIRE LANDING HOOK
DETAIL OF LANDING HOOK
.040 WIRE STAPLES
1/2" SQUARES
3/64" PLYWOOD
FUSELAGE STATIONS

Tail First Tips



BY ED YULKE


Author shows launching technique. Power plant is any Class B motor.


Vulnerable forward-flying surface should be held with rubber strands.

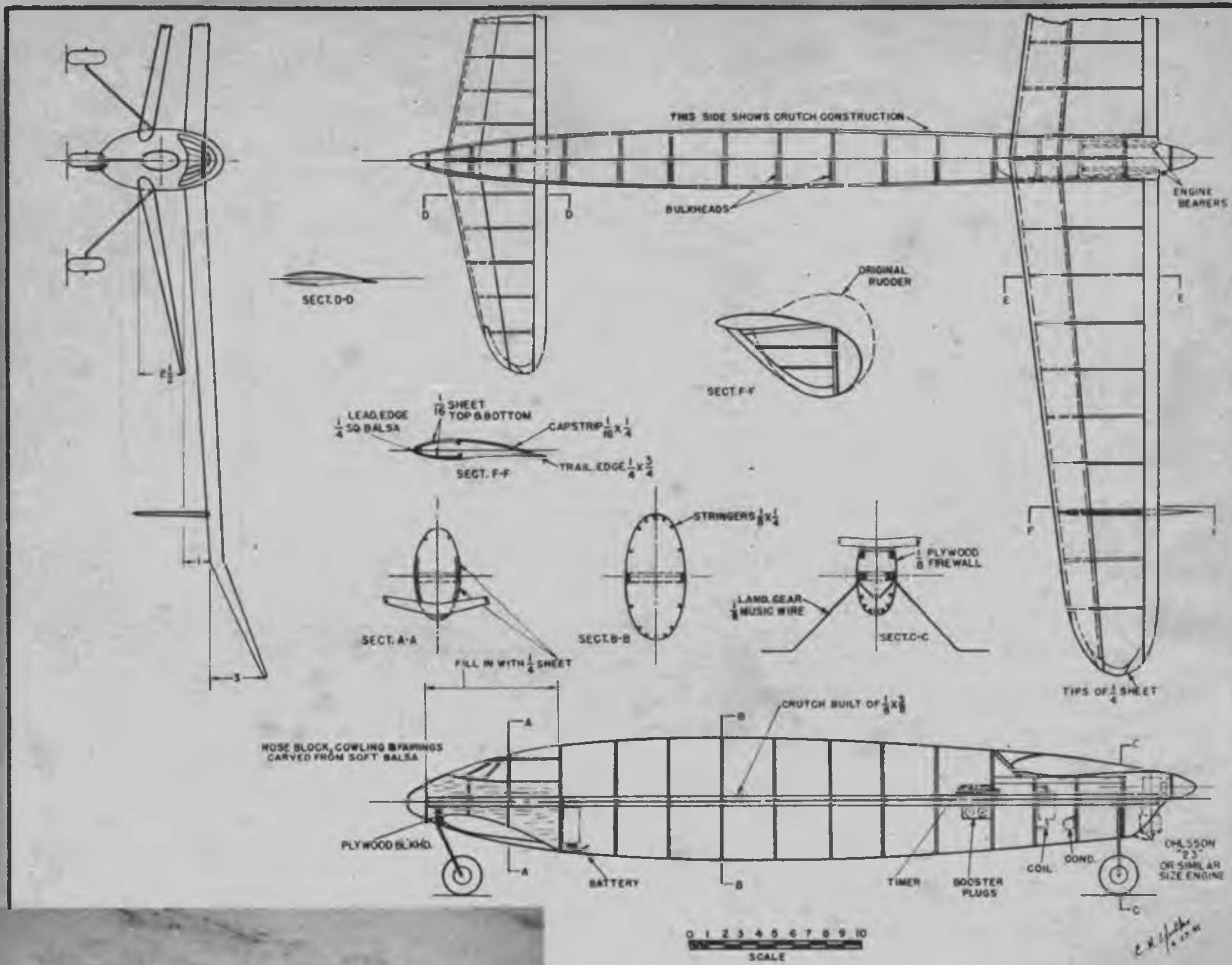
A model-building engineer at Republic gives the low-down on this novel type of airplane. It flies surprisingly well, too.

FROM the accompanying sketch it clearly can be seen that the model used for experiments by the author differs little in basic design from the old twin pusher, in which the center of gravity was about one third of the wing to stabilizer moment arm, thus requiring an incidence angle of 4 to 8 degrees in the stabilizer. The wing remained flat on the A frame. This type of model was almost universal for a number of years, but practically disappeared with the advent of gas-powered models.

From time to time, pictures have appeared in model magazines of canard-type models, but the technical data accompanying these pictures indicated that each modeler had his own idea regarding the proper location of the c. g.

The purpose of this model was to provide basic data, particularly on the difference in adjustment for the powered flight and for the glide. With the fact in mind that this type of model provides almost ideal antistall characteristics in that the stabilizer, being set at a higher angle of incidence than the wing, would stall before the wing and thus reduce the amplitude of the stall and the subsequent dive to recover flying speed, a pencil was put to work.

The result was a rough layout of a Class B canard that looked akin to a fish. The moment from wing to stabilizer was about fifty percent of the 8.1 aspect ratio of wing and had an area of 410 square inches and a span of 5 inches. The stabilizer had an area of twenty-



Longitudinal stability results from the large angle of incidence on "tail" which makes it stall before the wing, thus tending to drop nose to normal flight path.

This canard design weighs 30 ounces, seemingly heavy for a B motor. But "tail" carries nine ounces of the weight, wing 21 ounces.

five percent of the wing area. These figures were simply a starting point from which to vary stabilizer area, moment arm, and c. g. location. Thus started a period of "build and test it" that lasted five months, with the usual number of "unlucky" flights.

Glide tests required the "tail" to be set at 9½ degrees, which was thought to be excessive due to drag, so it was decided to increase this area to thirty percent of the wing. On the first power flight with engine at half power the climb was at 45 degrees, and after the timer cut at 35 seconds the ship went into a glide that had a tendency to mush and stall slightly. Since this was due to the c. g. being too far aft, it seemed feasible to move the c. g. forward, besides increasing the tail area. After many arrangements, the best set-up proved to be the c. g. at thirty percent of the moment arm and a tail area of thirty percent of the wing area. With the c. g. farther forward, the model tended to glide fast, and this could not be corrected without again increasing the positive angle of the tail, which didn't make sense.

The longitudinal stability was not consistent. Therefore the moment arm was increased from fifty percent to sixty percent of the wing span. The fuselage was cut in half and spliced together with added structure. Stability then proved O. K.

The last change in the model was the reduction of the rudder area from eighteen percent to ten percent, with all the area below the wing instead of as shown in the photos. Any rudder area above the wing would require high, narrow chord rudders, so that in a steep climbing position the wing itself would not "blanket" the rudders, with a resulting loss in effectiveness and possibly control. All throughout the tests the gross weight of the model was kept rigidly at 30 ounces. This was done so that a direct comparison could be made while the other parts were changed. While 30 ounces may seem heavy for a B motor, the tail proved to be carrying 9 ounces of the total weight, the wing carrying the other 21 ounces. Thus it can be seen that if a canard is designed for an eight-ounce wing loading, it is actually flying at less.

This is a definite advantage for contest fliers under the present rules, which do not consider the stabilizer as part of the supporting surface of the ship as long as it is not more than fifty percent of the wing. While this is an advantage in model competition, as soon as such models become popular, there is no doubt that rules will be changed to exclude this advantage. Since canards are not very popular at present, the author would like to hear from anyone building this type of model.

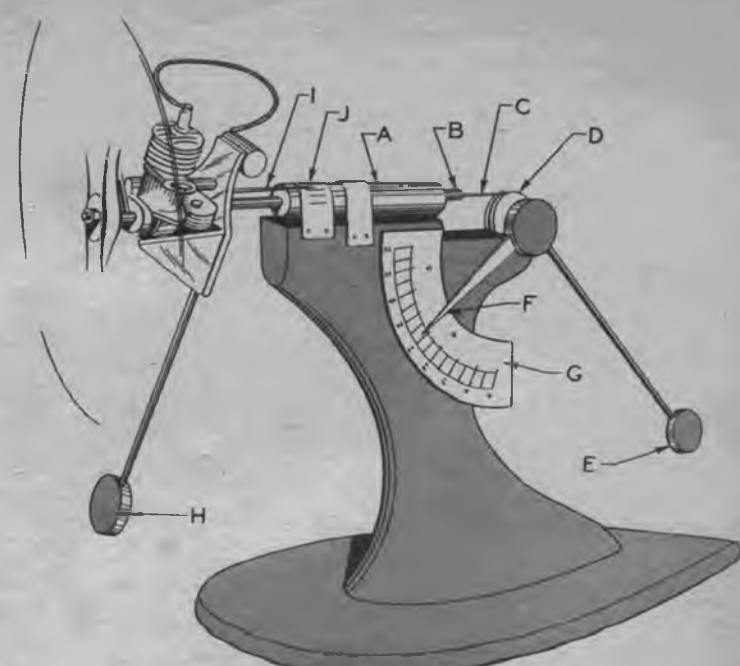
A well-designed propeller shows clean, efficient airflow almost the entire blade length. Note effective flow at tips.

A poorly designed propeller shows very little efficiency along the blade length and a great deal of turbulence near the hub.

Another example of clean propeller design showing a smooth airflow along the blade with little disturbance near the hub.

An efficiently designed propeller photoed at a wind-tunnel speed of 23 m. p. h. delivers 27 ounces of dynamic thrust.

This photograph shows a low-pitch propeller of improper design. Note lack of airflow near tips, showing inefficiency.



Testing machine barrel fitted with special ball bearings to allow friction-free movement of shaft B, both radially and reciprocating. Cable C fastens over pully D. Thrust pulls weight E. Pointer F registers thrust in ounces on dial G. This unit is also mounted on ball bearings. H, weight by which torque is registered by pointer I on dial J. This dial is graduated in foot pounds. Read thrust on dial G. To find the horsepower of any motor, the torque reading is taken in tenths of foot pounds; this figure is multiplied by r. p. m., then divided by 5,250, giving horsepower in hundreds: thrust x r. p. m./5,250 = horsepower of motor.

Propeller Smoke Tests

BY WILLIAM HALBERT

MOST model builders realize that an efficiently designed propeller is absolutely necessary to get their model up fast. In the past three years, this writer has tested hundreds of propellers of almost every make, shape and design. These tests have definitely proven that low-pitch propellers of proper design are far superior for free-flying gas models.

Model builders cannot follow the rules laid down by large plane-propeller designers, though these rules will prove of some value. As model-motor horsepower is limited, static thrust must be taken into consideration. In general: narrow blades give a higher static thrust co-efficient than wide blades, and thin blades give a higher static thrust at low-pitch settings and lower static thrust at high-pitch settings. A decided increase of static thrust is noted at blade angles of less than eight degrees at a station seventy-five percent of the radius. Very low blade angles at this point reduce terminal velocity, causing the propeller to act as a brake before reaching its maximum flying speed. This is usually why poorly designed propellers do not fly well on windy days. Therefore, factors other than static thrust must be taken into consideration.

We find there is a definite relationship between blade width, blade angle or pitch, and thickness of airfoil section along the entire length of the propeller blade. When selecting a gas-model propeller, a little care will reward you with improved performance. Do not look for very thin blades; select a propeller that has a fairly thick section to a point about one third the distance out from the hub. From this point there should be a uniform taper to the tip. The pitch should not exceed forty percent of the propeller diameter.

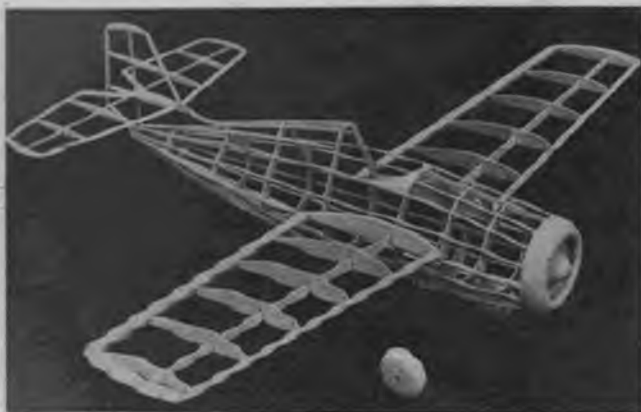
If you study the photographs you will see that a cowling will do much to improve model performance. Some recent tests on drag have more than proved this point. We will go into that in detail at a later date.

Grumman Wildcat

BY EARL STAHL

You'll enjoy building this F4F-3 used by marines at Wake Island. She's tops for performance.

Can you tell it from the big brother? The Wildcat includes large tail area, ample dihedral, which are necessary for all successful flying scale models.



Designer Stahl stresses simple frame-work construction for good flying qualities. You'll find this job no harder to build than a square-sides boxcar.

Under view and tuck-up wheels for a Jap view of the Wildcat. Note the well-proportioned prop with free-wheeling, for astounding performance.

THE Grumman Wildcat F4F-3, standard fighter of the navy and marines, is a sturdily built single-seater pursuit of midwing design possessing a high degree of maneuverability. It is used primarily as a shipboard fighter. Like most military planes, performance figures for the Wildcat have been restricted, but from British sources we learn that with a 1,200 horsepower Twin Wasp engine its top speed is around 330 m. p. h., and landing speed is 70 m. p. h. Climb is more than 3,000 feet per minute, while the cruising range is 1,150 miles.

Its midwing design and generous tail area contribute to a swell flying model that will give its prototype a run for performance. So dig into the scrap box, study the drawings, and let's get going on construction

Fuselage is made by the keel method, the rudder being built right with the fuselage. Cut the various parts of the four keels from 1/16" sheet as shown on plan. Also cut bulkheads from 1/16" sheet. Assemble in usual manner, using 1/16" square stringers. At wing intersection with fuselage, 1/16" thick riblike pieces are glued to the bulkheads and side keel—see plan. The extreme front of the nose is made from laminated 1/8" disks. Cockpit shape is formed from 1/32" sheet strips. Landing-gear bulkhead is cut from two pieces of hard 1/16" sheet.

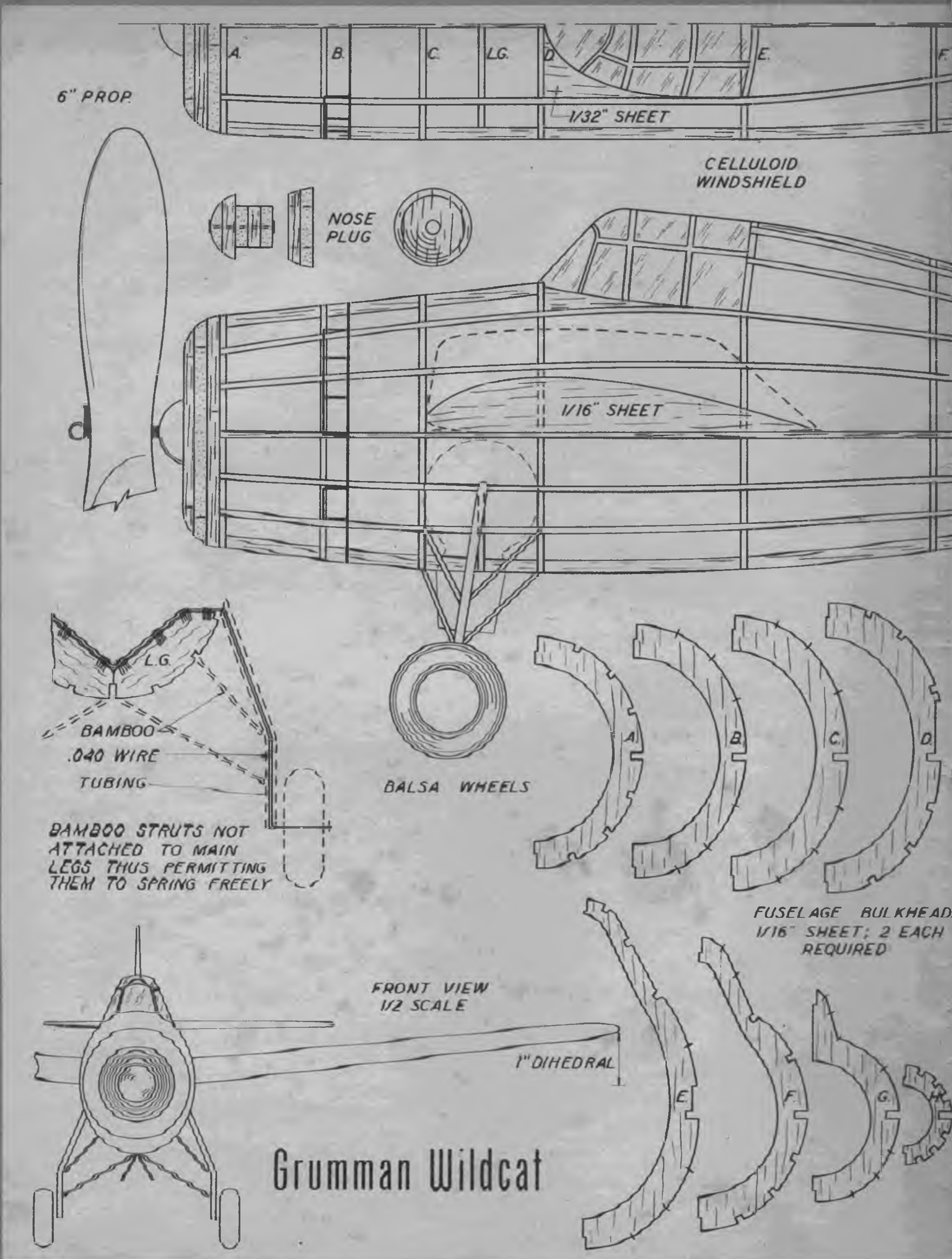
The wing construction is orthodox. Cut wing ribs from 1/32" sheet. Redraw the right wing panel. The spars are cut from 1/16" sheet. Assemble by using 1/8" sheet for the tips and outlines.

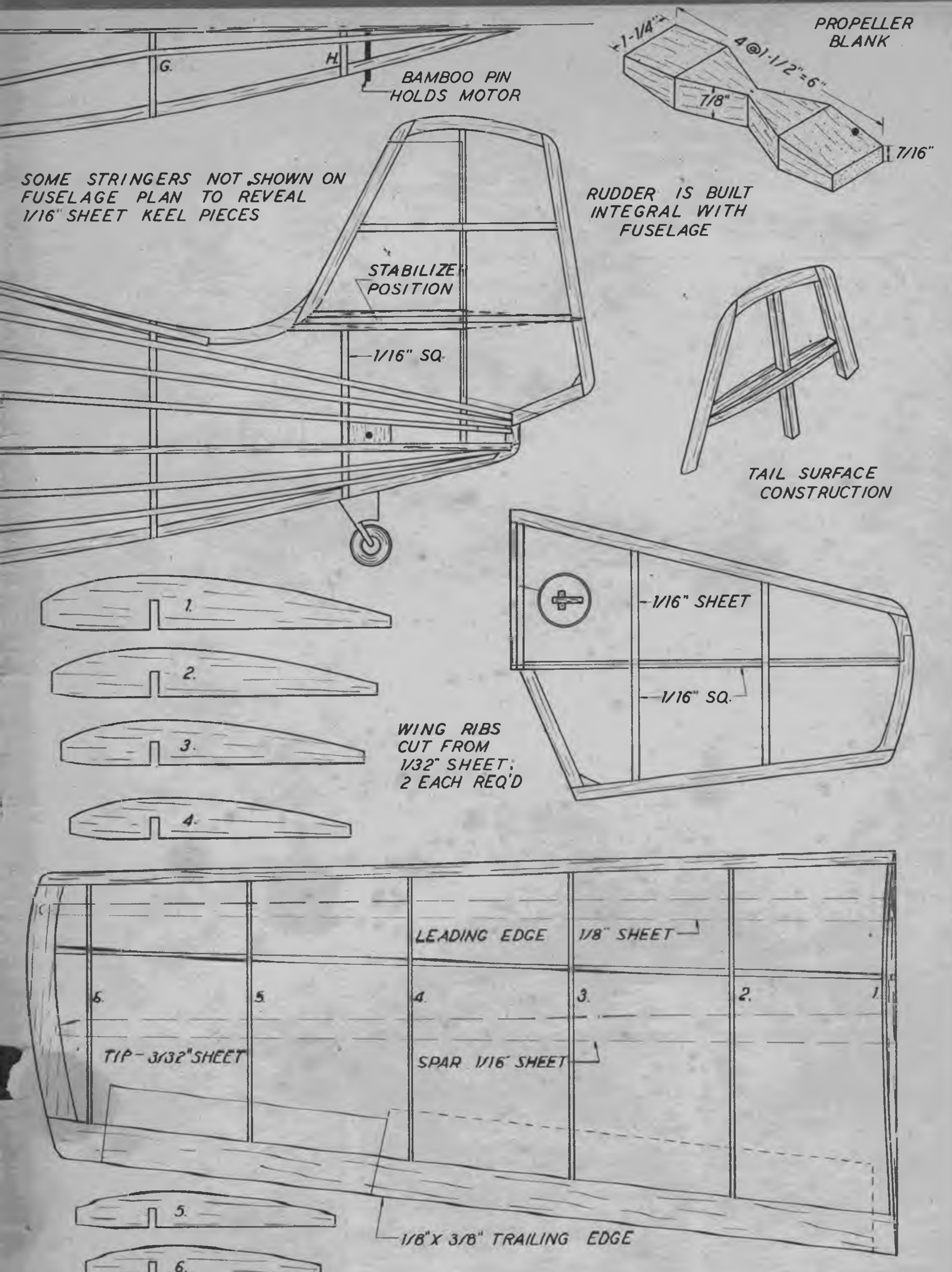
The tail assembly is self-explanatory and uses 1/16" sheet for outlines. A 6" prop is used on the Wildcat—see plan for block sizes. Make the shaft from .040 wire, and for good flying results use a free-wheeling device.

Use regular colored tissue for covering, with banana oil as an adhesive. Covering the wing and tail is simple, but when covering the fuselage use numerous small pieces to work around the curves without wrinkles. Spray the finished parts with water, and the flying surfaces should be watched to control any warping tendencies. Do not apply clear dope until the parts have been assembled.

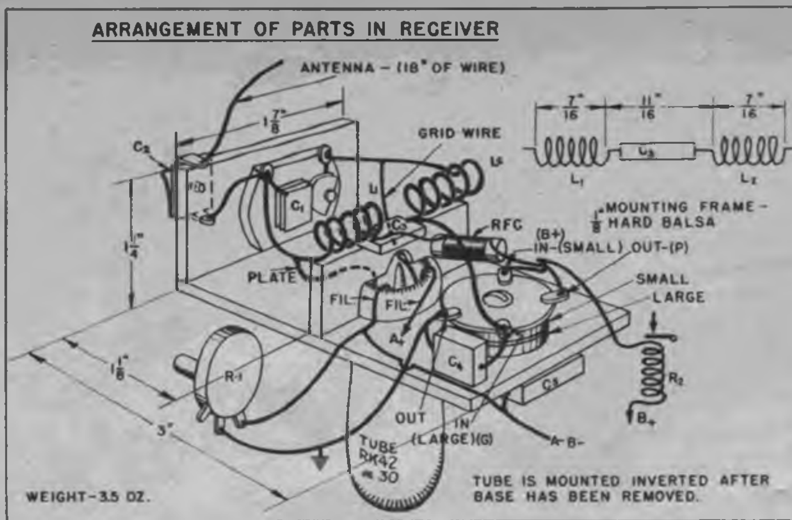
Addition of small details completes the job. Study the photos and decorate accordingly. For real detail, install a dummy motor in the cowl.

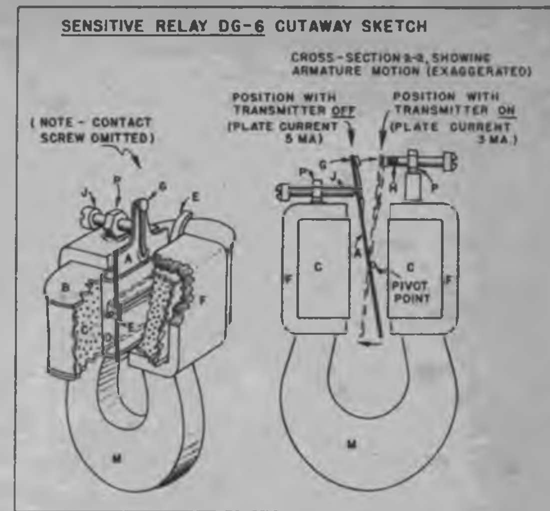
About six strands (three loops) of 1/8" flat brown rubber will be needed to power your flying Wildcat. Lubricate before placing the motor in fuselage. This model should balance near the middle of the wing chord, so add weight to the nose until your model has this adjustment. Use downthrust for flying adjustments, and side thrust to help the model circle. Once the bugs have been eliminated, use a mechanical winder for real performance.

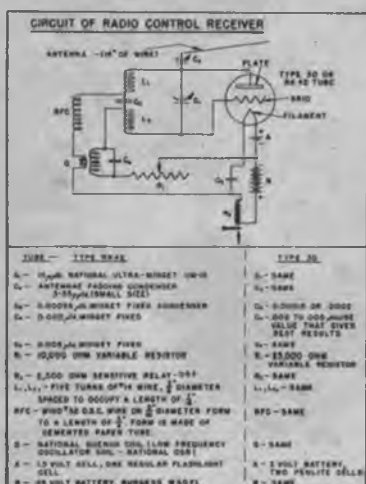

A.
B.
C.
LG.
D.
E.
F.
6" PROP.
1/32" SHEET
CELLULOID WINDSHIELD
NOSE PLUG
1/16" SHEET
L.G.
BAMBOO
.040 WIRE
TUBING
BAMBOO STRUTS NOT ATTACHED TO MAIN LEGS THUS PERMITTING THEM TO SPRING FREELY
BALSA WHEELS
A.
B.
C.
D.
FUSELAGE BULKHEADS 1/16" SHEET; 2 EACH REQUIRED
FRONT VIEW 1/2 SCALE
1" DIHEDRAL
E.
F.
G.
H.
Grumman Wildcat

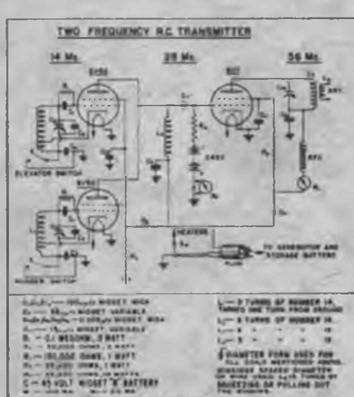


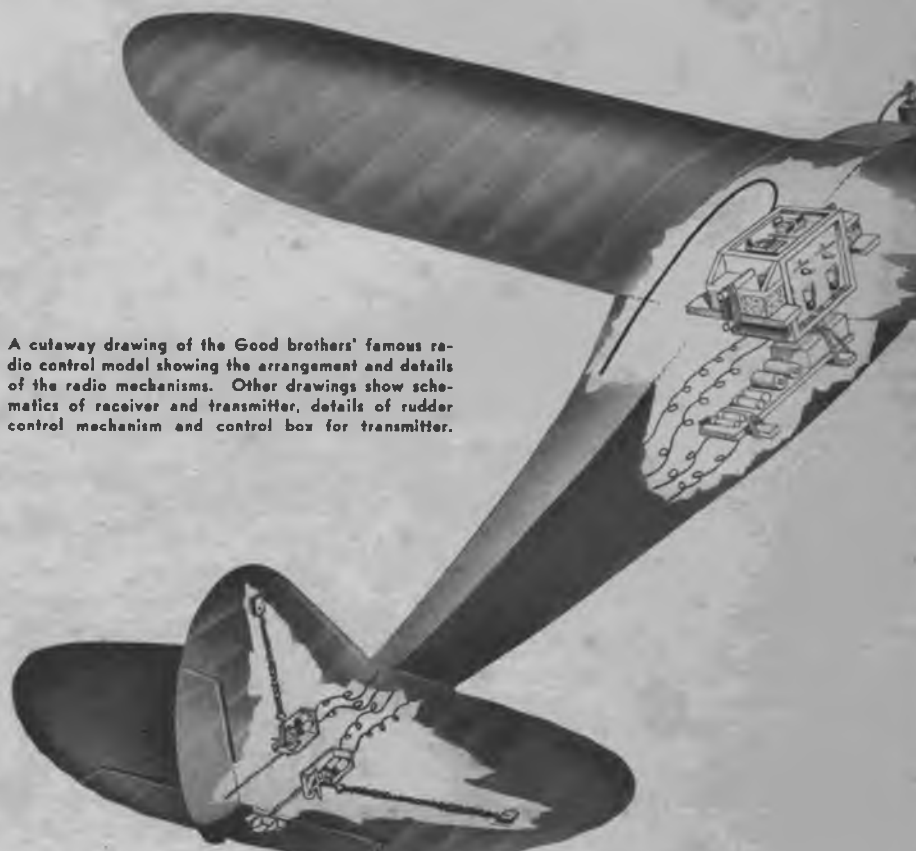
PROPELLER BLANK
1-1/4"
4@1-1/2"=6"
7/8"
7/16"
G.
H.
BAMBOO PIN HOLDS MOTOR
SOME STRINGERS NOT SHOWN ON FUSELAGE PLAN TO REVEAL 1/16" SHEET KEEL PIECES
RUDDER IS BUILT INTEGRAL WITH FUSELAGE
STABILIZER POSITION
1/16" SQ.
TAIL SURFACE CONSTRUCTION
1/16" SHEET
1/16" SQ.
1.
2.
3.
4.
WING RIBS CUT FROM 1/32" SHEET; 2 EACH REQ'D
LEADING EDGE 1/8" SHEET
6.
5.
4.
3.
2.
1.
TIP - 3/32" SHEET
SPAR 1/16" SHEET
5.
6.
1/8"X 3/8" TRAILING EDGE





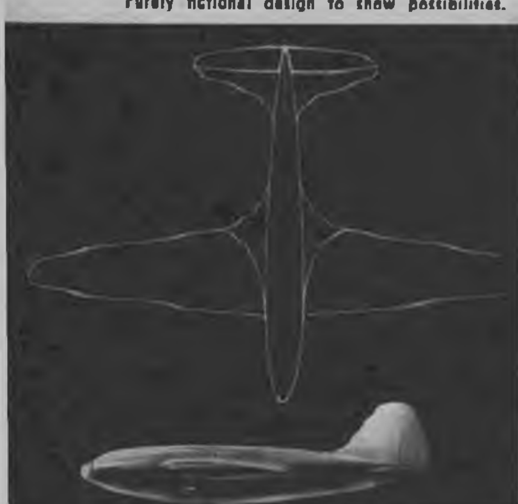






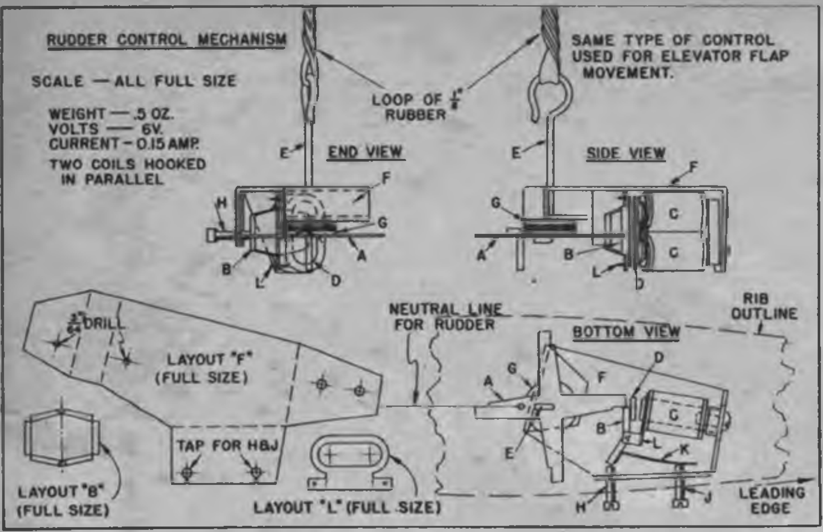
A cutaway drawing of the Good brothers' famous radio control model showing the arrangement and details of the radio mechanisms. Other drawings show schematics of receiver and transmitter, details of rudder control mechanism and control box for transmitter.

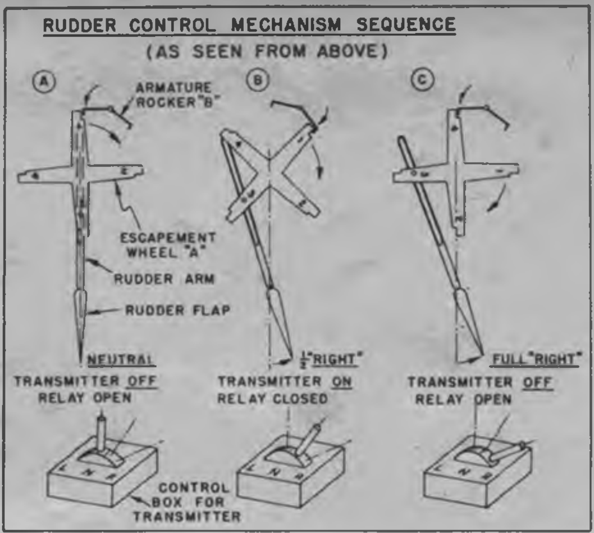
Purely fictional design to show possibilities.



A good simple beginner's design. Original flew for 32 mins.

This streamliner flew 25 miles at 1937 National meet.





Radio Control

BY BILL FRANKLIN

A discussion of radio control mechanisms with comments on design of model needed to produce a working combination.

IS there a modeler who hasn't dreamily contemplated in his mind's eye the image of a scale model doing precision aerobatics and spectacular stunts by remote control—by radio? Now advances in radio control make controlling models in the air more than a dream.

Flying a radio-controlled model, pioneers learned, was almost like learning to fly; if the pilot put the ship into a bank, he had to take it out. But a model cannot be flown like a real airplane; poor trim or insufficient inherent stability cannot be overcome merely by moving the controls.

The primary requirement is a good sound model design that will fly well without radio equipment. A model with a large wing and wing area in proportion to the fuselage is most advisable. It is essential to have proper spiral stability, which depends on correct designing of the side view of the model in respect to the center of gravity. A model with a deep-bellied fuselage and a high location of both the thrust line and the center of gravity is most likely to have good spiral stability. It is necessary because a radio model is adjusted to fly in a straight line so that it can be controlled to fly easily to the left or right.

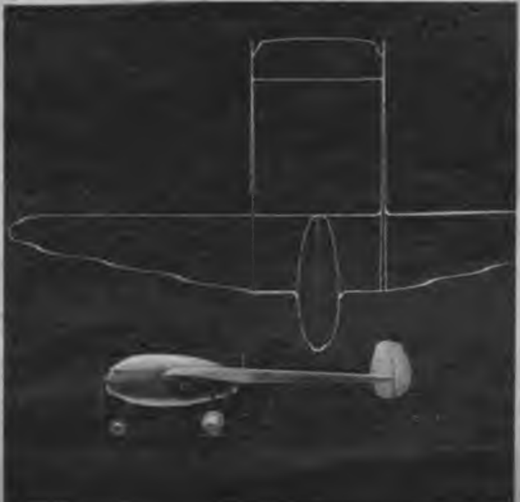
The radio apparatus should be the simplest possible; the most elementary operates only the rudder. A rudder-controlled craft climbs slightly under power; when the rudder is applied sharply, the model will bank as it turns. Experienced radio-model builders use both operable rudders and elevators or rudder and throttle control.

Radio control consists of a radio transmitter or "sending set" which sends out the radio impulses from the ground to the model and a small, light receiver in the model which picks up the impulses and converts them into motion of a "sensitive relay" or small switch. The relay closes a circuit that permits a small electric motor or rubber-strand motor to apply force that moves the proper control. The apparatus for releasing and controlling the power that works the airplane's control surfaces and throttle—if a throttle is used—is called *escapement*. One-tube receivers are usually used.

One radio modeler attained such a degree of control that he could chase seagulls with his ship. Such perfection needs work and practice. Any average hobbyists can duplicate it as mass production brings instruments within his reach.

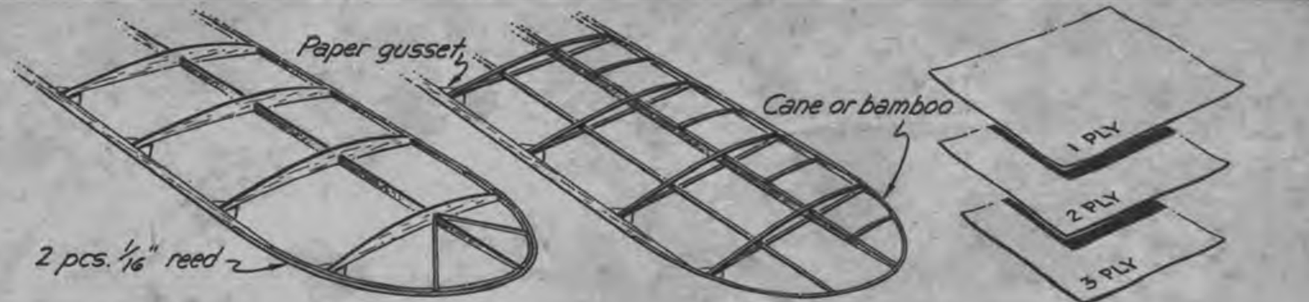
Twin engines, radio control. Best time: 1 hr. 39 mins.

Push-pull boom type. Two motors will carry large payload.



Parasol box design for experimental work.

Models Without Balsa



Ribs, spars of white pine or bass can be cut to small dimensions and still have sufficient strength.

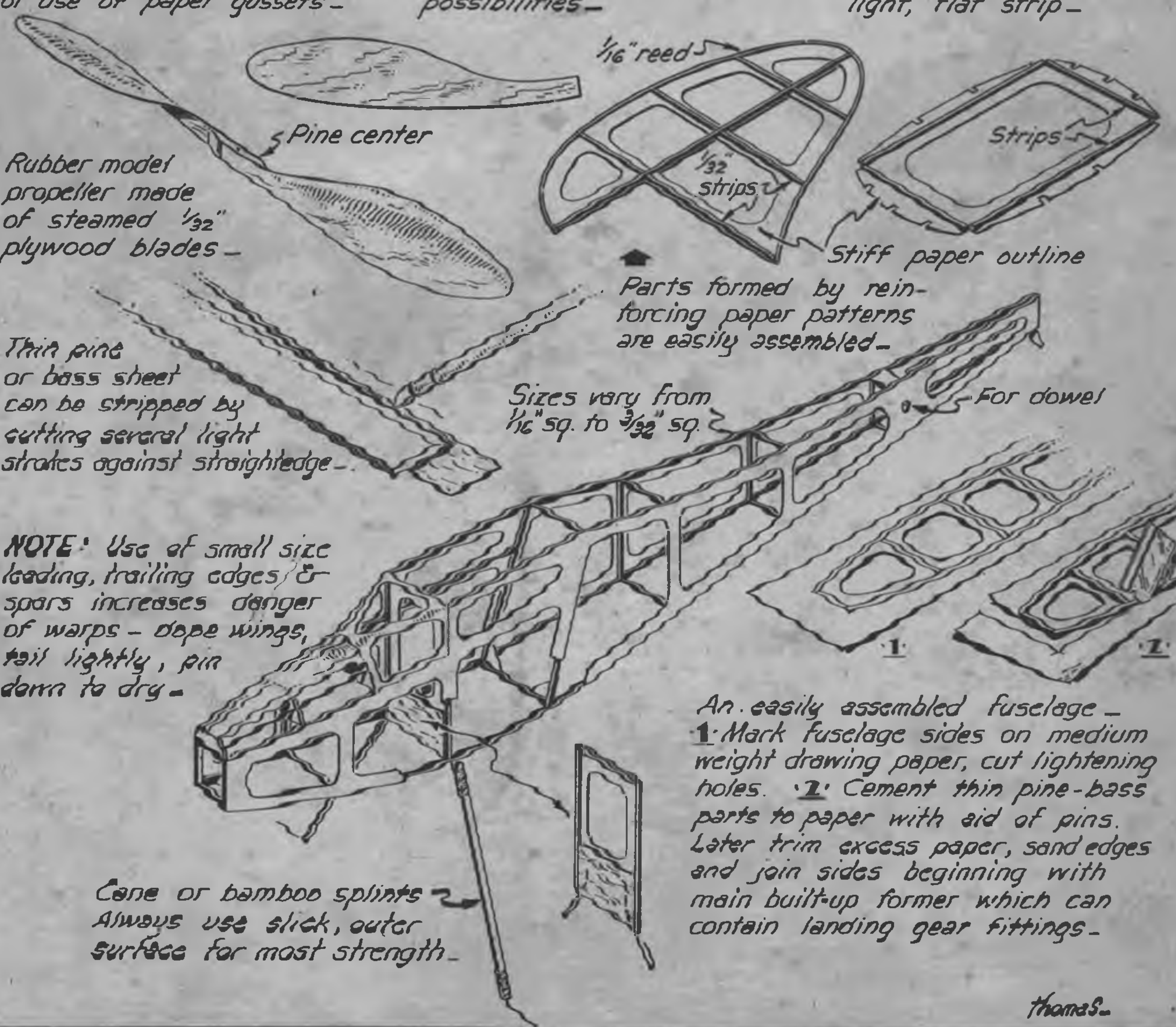
Built-up ribs can be made by bending 1/32" sq. strips over spars. Depth and location of spars determines aerofoil.

Different thicknesses of tough drawing paper for ribs, bulkheads (when reinforced), gussets, etc.

Smaller surfaces at joints require more careful cementing or use of paper gussets.

Use of soda straws for light models may offer possibilities.

Stiff paper or cardboard ribs reinforced with light, flat strip.



Rubber model propeller made of steamed 1/32" plywood blades.

Parts formed by reinforcing paper patterns are easily assembled.

Thin pine or bass sheet can be stripped by cutting several light strokes against straightedge.

NOTE: Use of small size leading, trailing edges & spars increases danger of warps – dope wings, tail lightly, pin down to dry.

*An easily assembled fuselage – **1** Mark fuselage sides on medium weight drawing paper, cut lightening holes. **2** Cement thin pine-bass parts to paper with aid of pins. Later trim excess paper, sand edges and join sides beginning with main built-up former which can contain landing gear fittings.*

Cane or bamboo splints. Always use slick, outer surface for most strength.

Thomas

–In Uniform

Representative of the thousands of model-airplane builders who went to war are these familiar faces.

Flying Officer Winston Mackley, Royal New Zealand Air Force, made thirty raids on Germany. An ardent modeler, he once competed in Moffet event.

Too tall for army air force, Lieut. Vodra Wolfe, of Cleveland Balsa Butchers, joined R. C. A. F., was shot down in Spitfire.

At Sheppard Field, in Texas, Sergeant Ed Lidgard, now instructing mechanics for Uncle Sam, still finds time to keep his hand in at model construction.

Henry Cole, designer of Smoothie in this issue, joined navy, saw action in Pacific. Now finishing aero engineer course.

A quartet of the famed Chicago Buzzards poses with record Bombshell design they perfected. We can't tell you who they are, for they wouldn't say.

We won't forget Scotty Murray, who joined R. C. A. F., became crack Spitfire pilot. Lost at Malta, awarded Victoria Cross.

FOR

VICTORY

STREET & SMITH'S AIR TRAILS MODEL ANNUAL FOR 1943