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SPECIAL FEATURES

CONTROL-LINE

DESIGN

ENGINES

RUBBER MODELS

FREE FLIGHT GAS

GLIDERS

SOLIDS By H A. Thomas

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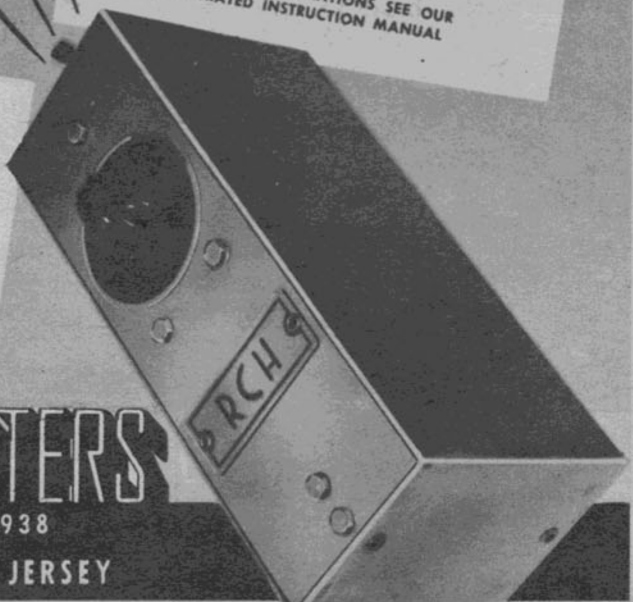

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HAPPY DAYS ARE HERE AGAIN!

WHAT could be more fitting than the words of that famous song, "Happy Days Are Here Again," to express every modeler's feelings now that it's all over.

This new era will find us more than willing to make this the greatest period in the history of models. Just imagine, this is the opportunity to fulfill all those dreams cooked up in foxholes all over the world. You know that super job that was forever running through your mind? You were going to show those other cookies that the Japs and Jerries were just one of those interludes between jobs, and, boy, wouldn't that latest one top them all. Yes, that kid brother, maybe Pop and the neighborhood kids, can get started in the right direction now that you are home to put them on the right track.

You may even uncrate some of those ersatz jobs that were thrown together from packing boxes, crates, and anything you could put your hands on out in the field and show the local guys that you haven't lost any of that old skill when it comes to building and flying.

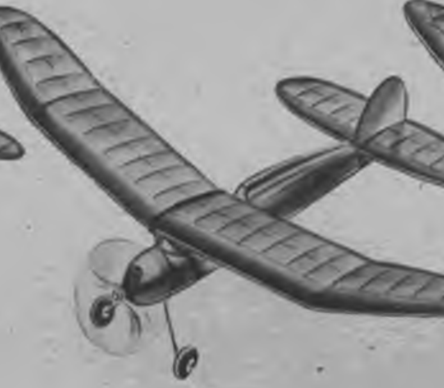
It'll be a brawl all right, that first postwar Nationals. All you guys who were too busy with your war-work to be able to build models will really have to get on the ball. The midnight oil will have to burn and the chips fly, but the model will have to be good because everything indicates the SRO sign will be out. The hands will be sore, the backs will ache from all the hand shaking and back slapping, but won't it be the biggest thing yet? We'll see you there. Good Luck!

1935-6
The early K-G (Kovel-Grant) featured complex construction, severely simplified lines. Long flights resulted from large fuel allotments of one-eighth to one-quarter ounce per pound of weight; heavy K-Gs thus took off with nearly full tanks.

1937
Michael Roll's twelve-foot-span model typified the big-plane trend. Light structure and enormous wing area permitted use of small "Baby Cyclone" engine for maximum engine duration under the still-liberal fuel allotments.

1938
Designs varied greatly by 1938. Berkeley's "Buccaneer," a popular kit, was more realistic, smaller, and faster than earlier types. The added speed revealed design errors not noticed in the slower models.

1939
Goldberg's "Zipper," a Comet kit, revolutionized gas model design with pylon mount, short nose moment, cleaner aerodynamic lines. Power loadings, wing loadings, and shorter engine runs were imposed.



1940
Typical of many designs which adopted "Zipper" features was Struck's "New Ruler," built in close conformance to rules. More care given to basic force arrangement provided stability under fast, limited engine runs.

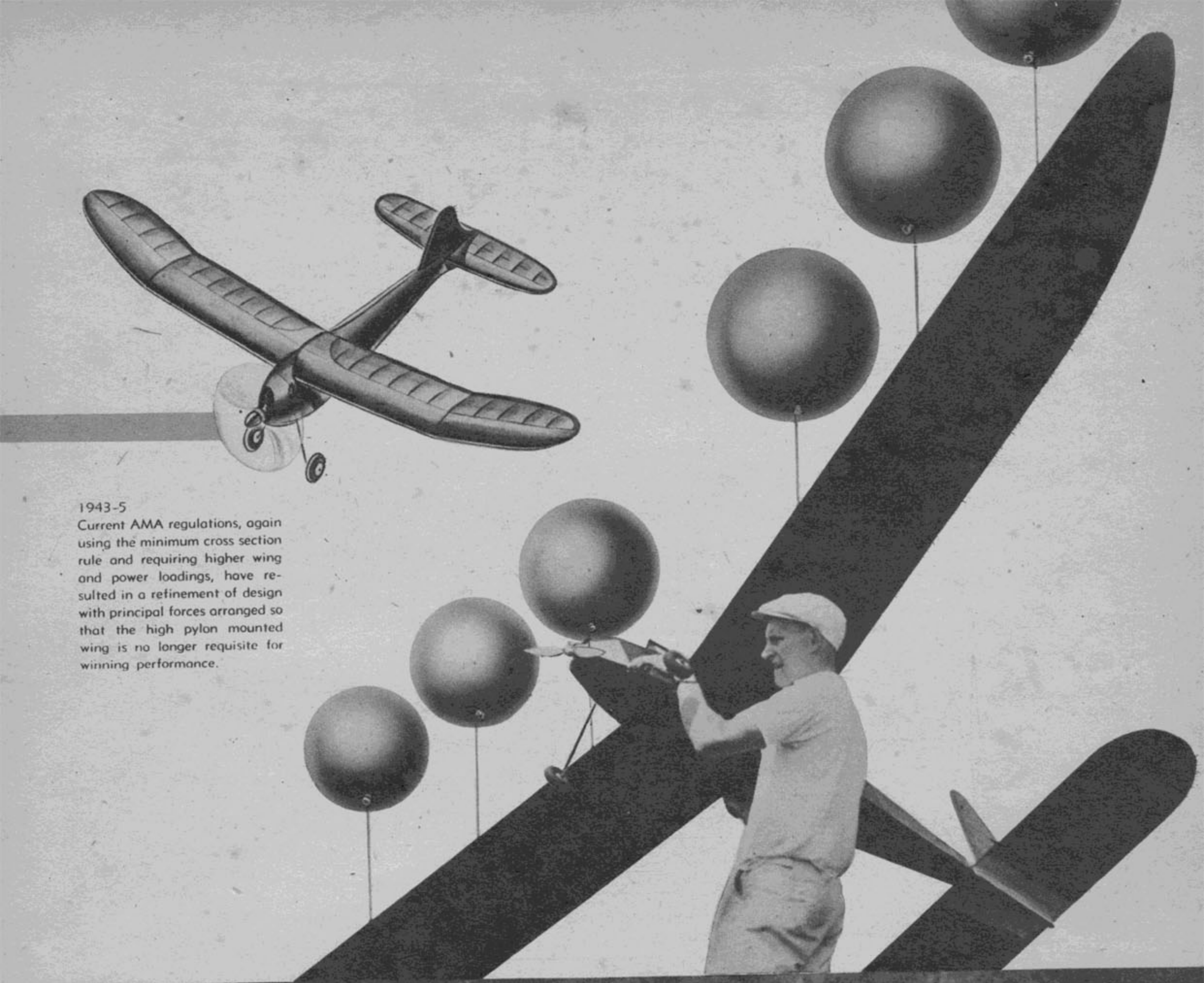
1941-2
Elimination of cross section rule brought about the "Pencil Bomber" type. Here all realism vanished; the errors in basic design, aggravated by high speeds, caused numerous crashes. Retractable one-wheel landing gear and folding propellers were widely used.

TRENDS — GAS

EVER since Maxwell Bassett turned up with the first gas model ever entered at a Nationals (Roosevelt Field, N. Y., 1933) and rode rough-shod over the rubber-powered models, the rules governing model competition have been constantly refined. Looking back at the significant changes, it is interesting to note that the trend—and this trend is still developing—has been toward more power, more heavily loaded, smaller models. Out-of-sight flights were so commonplace that almost yearly the rules decreed that, for gas, shorter and shorter motor runs be allowed, that more heavily loaded models be flown.

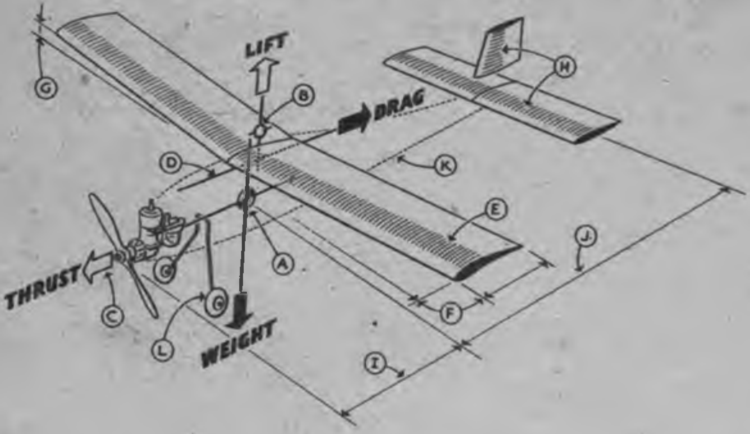
At first, the gassies were launched with a full tank of gas and they climbed until the prop stopped—which was generally thousands of feet high in the sky. Then it was decided to allow one-quarter ounce of gas for each pound of weight, which was plenty when you consider that a light model weighed four pounds, and a healthy one, seven. That was for models spanning something like eight to ten feet, which was then the vogue. Despite their gross weight, their wing loadings really were lighter than those in use today.

Another year and the gas ration was cut to ⅛ ounce. Then came the 30-second motor run, then the 20, and finally, the 15-second motor run. Wing loading restrictions had been put in force; at first 8 ounces per square foot and, finally, what we have today, seven ounces per 100 sq. inches of wing area. The *(Turn to page 100)*



1943-5
Current AMA regulations, again using the minimum cross section rule and requiring higher wing and power loadings, have resulted in a refinement of design with principal forces arranged so that the high pylon mounted wing is no longer requisite for winning performance.

Joe Raspante, of radio control fame, built "Snow White," a soundly engineered and well-made job.

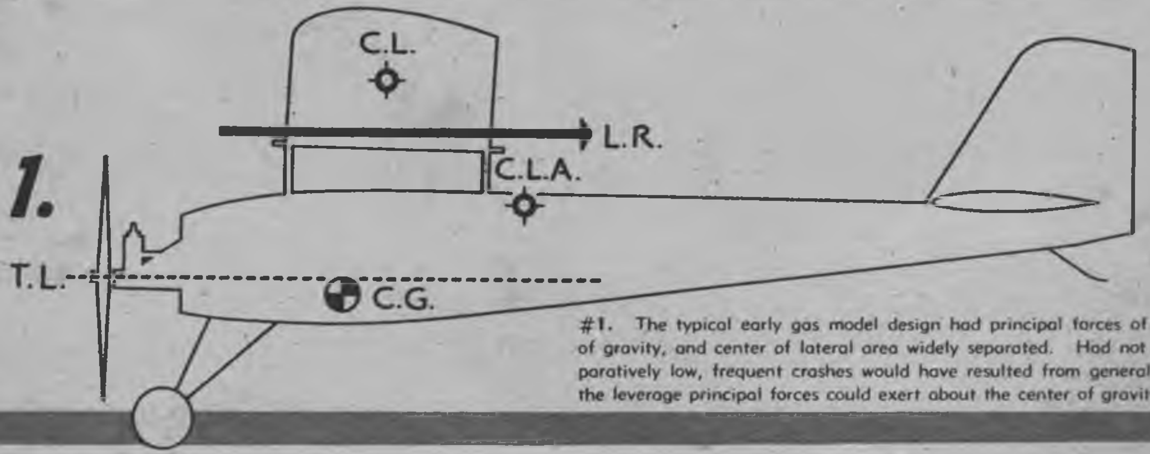


THERE are a dozen or more closely related factors which determine the force arrangement and, consequently, the performance of a gas model. Modification of one affects several other (and sometimes all other) factors.

Academy of Model Aeronautics regulations specify the minimum wing loading (7 oz. per 100 sq. in.), the minimum power loading (80 oz. per cu. in. displ.), and the minimum fuselage cross section $\left(\frac{L^2}{100}\right)$. Championship models generally utilize all wing area permitted for the engines used and weigh no more than minimum requirements.

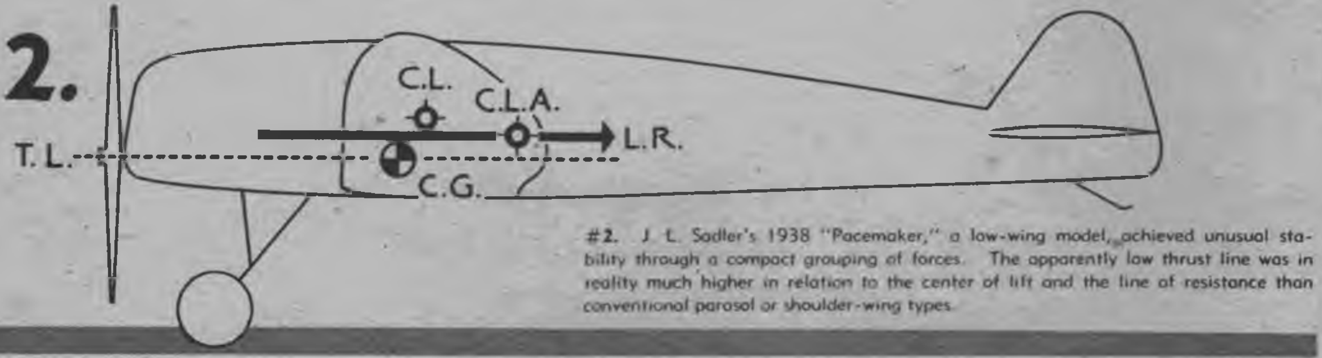
In the diagram, the Center of Gravity (A) was formerly placed low for "pendulum stability," but the modern trend is to place it on or near the thrust line. Center of Lift (B) is above and slightly behind the C.G. and is determined by the fore-and-aft location of the wing. Thrust Line (C) in late designs is being raised from its early position low in the fuselage. The Line of Resistance (D) is largely dependent *(Turn to page 100)*

1.



#1. The typical early gas model design had principal forces of lift, thrust center of gravity, and center of lateral area widely separated. Had not speeds been comparatively low, frequent crashes would have resulted from general instability due to the leverage principal forces could exert about the center of gravity.

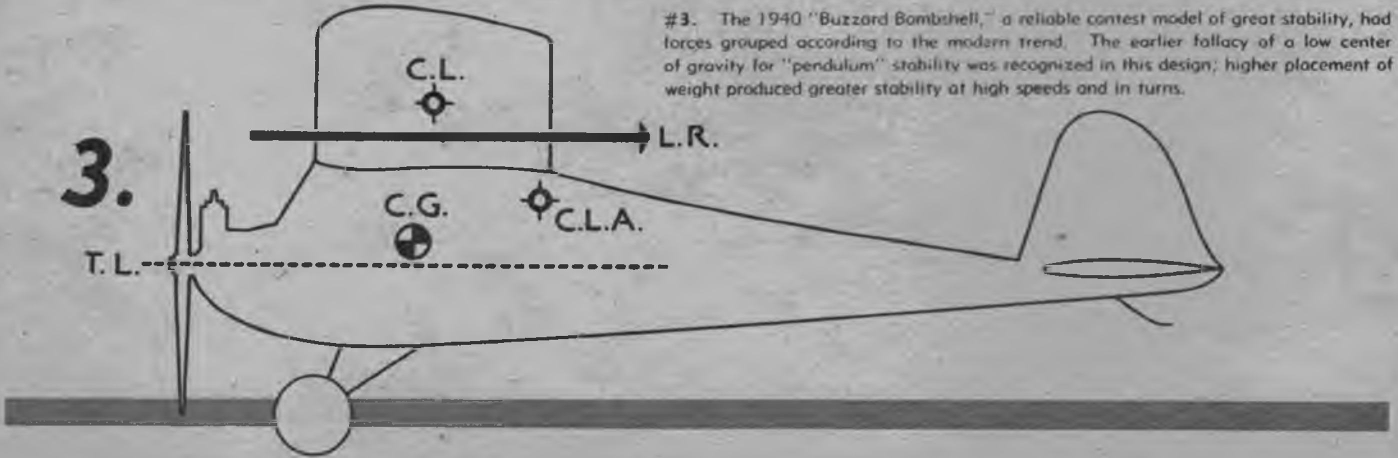
2.

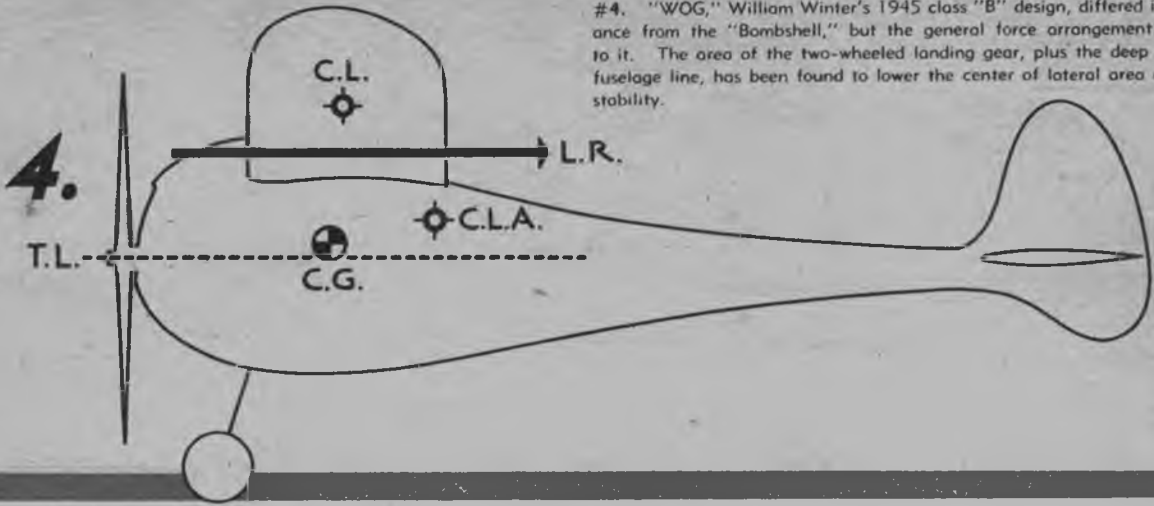


#2. J. L. Sadler's 1938 "Pacemaker," a low-wing model, achieved unusual stability through a compact grouping of forces. The apparently low thrust line was in reality much higher in relation to the center of lift and the line of resistance than conventional parasol or shoulder-wing types.

#3. The 1940 "Buzzard Bombshell," a reliable contest model of great stability, had forces grouped according to the modern trend. The earlier fallacy of a low center of gravity for "pendulum" stability was recognized in this design; higher placement of weight produced greater stability at high speeds and in turns.

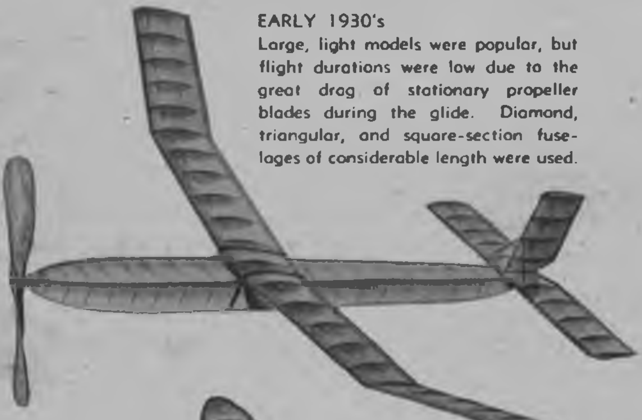
3.





#4. "WOG," William Winter's 1945 class "B" design, differed in outward appearance from the "Bombshell," but the general force arrangement was quite similar to it. The area of the two-wheeled landing gear, plus the deep curve in the lower fuselage line, has been found to lower the center of lateral area and increase spiral stability.

TRENDS — RUBBER



EARLY 1930's
Large, light models were popular, but flight durations were low due to the great drag of stationary propeller blades during the glide. Diamond, triangular, and square-section fuselages of considerable length were used.

1936-39
Smaller models with greater power had vastly improved performance due to "freewheeling" devices which reduced propeller drag. Cleaner lines and improved construction also boosted performance.

1939-41
One and two-blade folding propellers with rubber tensioning devices are features of latest rubber models. In the 100-inch wing area class, these climb at great speed and soar on the lightest currents. Streamlining is more in evidence but box-type fuselages are still popular.

THEY MADE HISTORY

● Comet's Sailplane was the most consistent winner in the field of the large gas kits. Designed by Carl Goldberg, it featured a pylon wing mount, generous wing area, and retractable landing gear.

● Roy Nelder's 1938 and 1940 Moffet trophy winner. This model featured a rectangular fuselage with a high aspect ratio wing and a tremendous climb.

● Goldberg's Clipper was another Comet winner. A realistic cabin job, it is a sure-pop contest winner.

● Jim Walker's Fireball, the pappy of U-Control. The present trend to flying scale with relay control is a real challenge to free-flight's popularity in gas.

● In rubber and Wakefield types, Jim Cahill's models always stood out. Twice a winner of the Wakefield trophy, the Clodhopper featured a shoulder wing.

NEVER let it be said that we are of the old school, whose members very paternally say, "Now, my boy, in our day . . . . ," but we do feel that any device that aids progress should always be remembered and recorded. The models shown on these pages represent the cream of the crop and have in one way or another added to the design or lore which is the fascination of model building. Some may not remember ever having seen these models in action, but all model builders can, if they will scrutinize closely, recognize the features of

● A flying scale with endurance qualities, this Rearwin Speedster by Ed Naudzius won the 1940 Nationals with the amazing average of two minutes.

● Struck's Record Hound—the 1939 NAA record holder. This gassie featured cathedral in the stabilizer, inverted motor, and a single-wheel landing gear.

THEY MADE HISTORY

● Schoenbrun's Rocketeer was among the first single-wheelers. It featured a deep bellied fuselage, high thrust, and the innards deep down in the fuselage.

● The Zombie by Shulman. Another one-wheeler with tip skids on the stab. It has the usual Shulman features: low thrust and retracting gear.

● Another all-time champion for popularity, Korda's 1939 Wakefield winner.

● Weather's Mystery Man caused as much consternation as Basset's first gassie. The jettisonable landing gear had the contest directors in a real stew.

any of today's numbers.

All these models are or were champions. Some at the present time hold National records. Most of the designs are orthodox in their creation. Some are streamlined, some are boxes, but all were flyers. Of course a résumé of the background of the designers would show that the models are not of the hit-or-miss type but definitely reflect the soundness of their creators. The skill of the builders and designers made the models the champions they were.

● The 1935 KG is one of the really famous planes. Its record of 64 minutes still stands. It features a parasol wing and wingspan of 10'; weighs 7½ lbs.

● Berkeley's Super Bucconeer is another famous kit model. It is a colossus among class "C" models. Here is Raspante's radio-controlled version.

● Here Taibi holds his "B" version of his famous Pacer. His class "C" job won the 1941 open championship and used a reverse rib camber for the stab.

Copeland's Wakefield job was the ultimate in streamlining. Note wing fillet.

Struck's Interstate Cadet set a new high in endurance at the '41 Nationals. Beautifully finished, it featured generous blade area and a free-wheeling unit.

The Buzzard Bombshell by Joe Konefes won the 1940 class "C" open championship.

The Custom Cavalier by Berkeley with its 9' wing span is one of the biggest kit jobs.

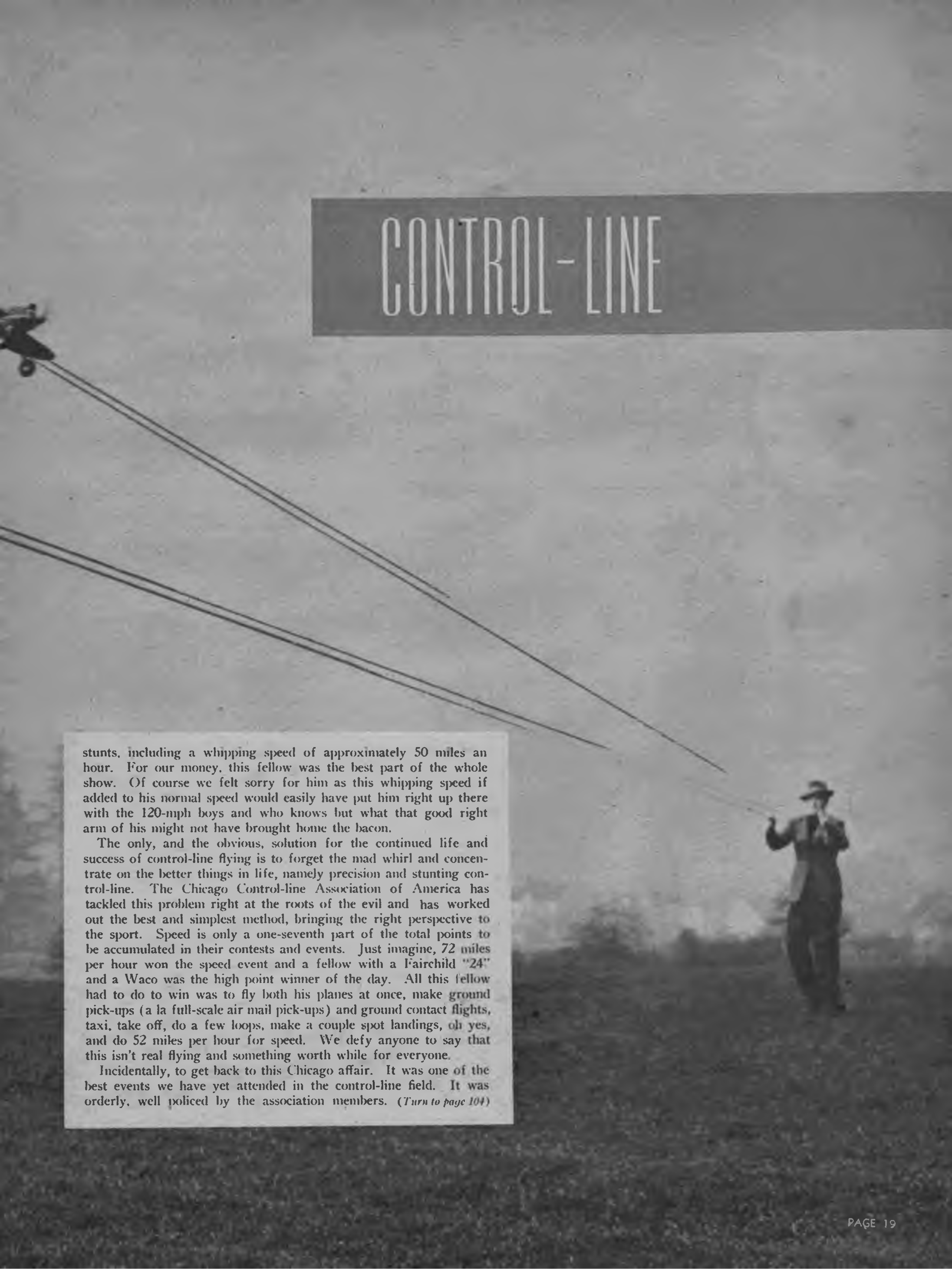
Henry Struck's New Ruler was the most popular gassie at the 1940 and 1941 Nationals.

Here's the champ, Goldberg's Zipper. Featuring a pylon wing mount it is the most popular gassie ever designed and won more contests than any other model.

WE'RE not mad and we aren't crusaders, but, isn't it time someone got down to brass tacks about this mad whirl, or craze for speed. Unfortunately, this speed phase of flying has degenerated to the point where the builder with the strongest arm and back (for whipping), plus the ability to stretch the truth (and we mean really stretch; take all these unconfirmed records as a frinstance), has the only chance of winning. Suggestions for correcting whipping have been many and varied, and isn't this an admission that the whipping evil is a factor we have to contend with? We all recognize the truth of this, but hold a contest and what happens? It starts all over again.

There's the guy who holds his arm up against his body to show he's not whipping—but watch his legs. Yea boy, the whirling dervish has nothing on him! And then there's the guy who does as fine an adagio as was ever performed on the stage—one foot three feet in front of the other and what a beautiful job of leading a plane. But, of course, who is the first fellow to state sanctimoniously that something *must* be done about whipping? You're right, it's the guy who has just finished his dance. This could go on for days, but we haven't the time.

Before we forget, though, let us tell you about the fellow at the recent flying circus. The motor of his stunting speed job cut prematurely, but did that faze him? No, he went right ahead and continued to fly his model for 35 more laps, putting on all kinds of



CONTROL-LINE

stunts, including a whipping speed of approximately 50 miles an hour. For our money, this fellow was the best part of the whole show. Of course we felt sorry for him as this whipping speed if added to his normal speed would easily have put him right up there with the 120-mph boys and who knows but what that good right arm of his might not have brought home the bacon.

The only, and the obvious, solution for the continued life and success of control-line flying is to forget the mad whirl and concentrate on the better things in life, namely precision and stunting control-line. The Chicago Control-line Association of America has tackled this problem right at the roots of the evil and has worked out the best and simplest method, bringing the right perspective to the sport. Speed is only a one-seventh part of the total points to be accumulated in their contests and events. Just imagine, 72 miles per hour won the speed event and a fellow with a Fairchild "24" and a Waco was the high point winner of the day. All this fellow had to do to win was to fly both his planes at once, make ground pick-ups (a la full-scale air mail pick-ups) and ground contact flights, taxi, take off, do a few loops, make a couple spot landings, oh yes, and do 52 miles per hour for speed. We defy anyone to say that this isn't real flying and something worth while for everyone.

Incidentally, to get back to this Chicago affair. It was one of the best events we have yet attended in the control-line field. It was orderly, well policed by the association members. (*Turn to page 104*)

FLYING SCALE

WALKER FIREBALL-U-CONTROL

EAGLE DREAMER-FLIGHT CONTROLLER

STANZEL SUPER SHARK-G-LINE ROLLERATOR

CONTROL - LINE

If you believe that all a control-line model is good for is a mad dash in a circle, you have plenty to learn about this thrilling new development in gas model flying. It is true that one kind of competition is for speed models and speeds of approximately 100 mph have been reached. But the most fun by far comes from events like aerial dog fights, balloon busting, stunts, and various types of precision flying. Where speed is concerned, builders on the Coast have developed control-line to a fine art.

It has been found that it takes more than simply shaving wing area off your airplane to make it go faster. At really high speeds the model with a little area is better than one with virtually none. One school of thought favors what might be called "egg shell specials." As the name implies such models are built almost featherweight and have extremely short lives.

For stunting, a model should be well built, and fairly large as control-liners go—that is about 40 to 45 inches in span. A powerful engine in the .60 class is required. Lastly, there must be a generous amount of wing area. It is interesting to note that scale models are best qualified for this event. A Grumman Hellcat, for example, works out well. Precision flying can be done with four- to six-foot scale models. It is possible to use engine throttle control, flaps, and even retractable landing gear arrangements, if so desired, by means of a third line. A Stinson Reliant makes an excellent precision flyer.

Of the three systems of control: U-Control, G-Line, and Flight-Controller, U-Control is most widely used. Flight-controller is coming fast, due to its simplicity, involving no moving parts other than the elevators themselves. G-Line, of course, is the method by which the model is flown from a line running from the tip of a fishing pole; there are no moveable elevators. Climbs and dives are made by lifting or depressing the tip of the pole, a good method for the individual flyer out for a little sport flying. The following is a short resumé of these types:

U-CONTROL

Jim Walker's invention, U-Control, is familiar to all control-line fans and is now on the market in several kits under license. Simplicity is one of its greatest attributes. The bellcrank is pivoted firmly within the fuselage, near the center of gravity and also in line with the longitudinal axis of the model. A pushrod connects to the hinged elevators and the two control lines lead out beneath the wing, through a guide, to the control handle.

U-Control models fly clockwise or counterclockwise. Rudders are offset and wings are sometimes warped to keep the model pulling outward at all times. Tilting the control handle backward raises the elevators, climbing the model, while the opposite movement lowers the elevators for decreasing elevation.

The many novel adaptations to U-Control include a third line for throttle control or ignition switch and a spring-loaded handle with ratchet device for untwisting lines during flight after looping.

SUPER G-LINE (WITH ROLLER CONTROL)

The familiar single line control of the early G-line models has been improved for greater control and maneuverability. The new design employs two steel control lines, a new Roller-Control and a Directional Control Stick.

The control stick, eighteen inches in length, has a vertical crossbar at the outer end, through which the two lines pass. *(Turn to page 108)*

BOBCAT

By Sgt. George Worthington

DESIGNED TO BE BOTH PRACTICAL AND REALISTIC, THIS OHLSSON 23 JOB IS ONE OF THE MOST BEAUTIFUL CONTROL-LINERS EVER MADE

THE Bobcat was designed and built around the Ohlsson 23 as a result of a discussion I had with two other model enthusiasts, Sgt. Cleon E. Long, of Oregon, and Sgt. George Weeks, of Berkeley, California. The idea was to build a U-control model with a new, practical, and more realistic design. My desire was to improve the scale model in such a way that it would be a fairly fast flyer, with a strong landing gear that would stand up under rough treatment. In order to cut down the time usually required for preparing the model between flights, my intention was to design it so that all parts would be easily accessible.

To attain these objectives, I carved the entire model from solid balsa. This made it possible to give the model the desired smooth contours, plus an extra margin of strength. Further, the model can be taken apart completely and quickly, as it has these additional advantages: 1) Removable dorsal fin, removable wings, and removable lower cowlings; 2) Upper cowling hinges open; 3) Landing gear built into wings; 4) Balsa spinner; 5) Solid balsa tail.

My plans included a Clark Y airfoil with my own modifications. I made the fuselage of one block of balsa, 3½ x 5½ x 19½ inches. However, it can be made of two separate blocks, one 3½ x 2½ x 19½ inches and the other, 3½ x 3 x 19½ inches. I designed the dorsal fin to give the model added strength and realistic appearance. The dorsal fin was attached by two bolts recessed into the former and a dress snap at the extreme end of the tail. Removing the fin gives access to the batteries and entire U-control system. All of the formers in the fuselage were made of plywood for added strength.

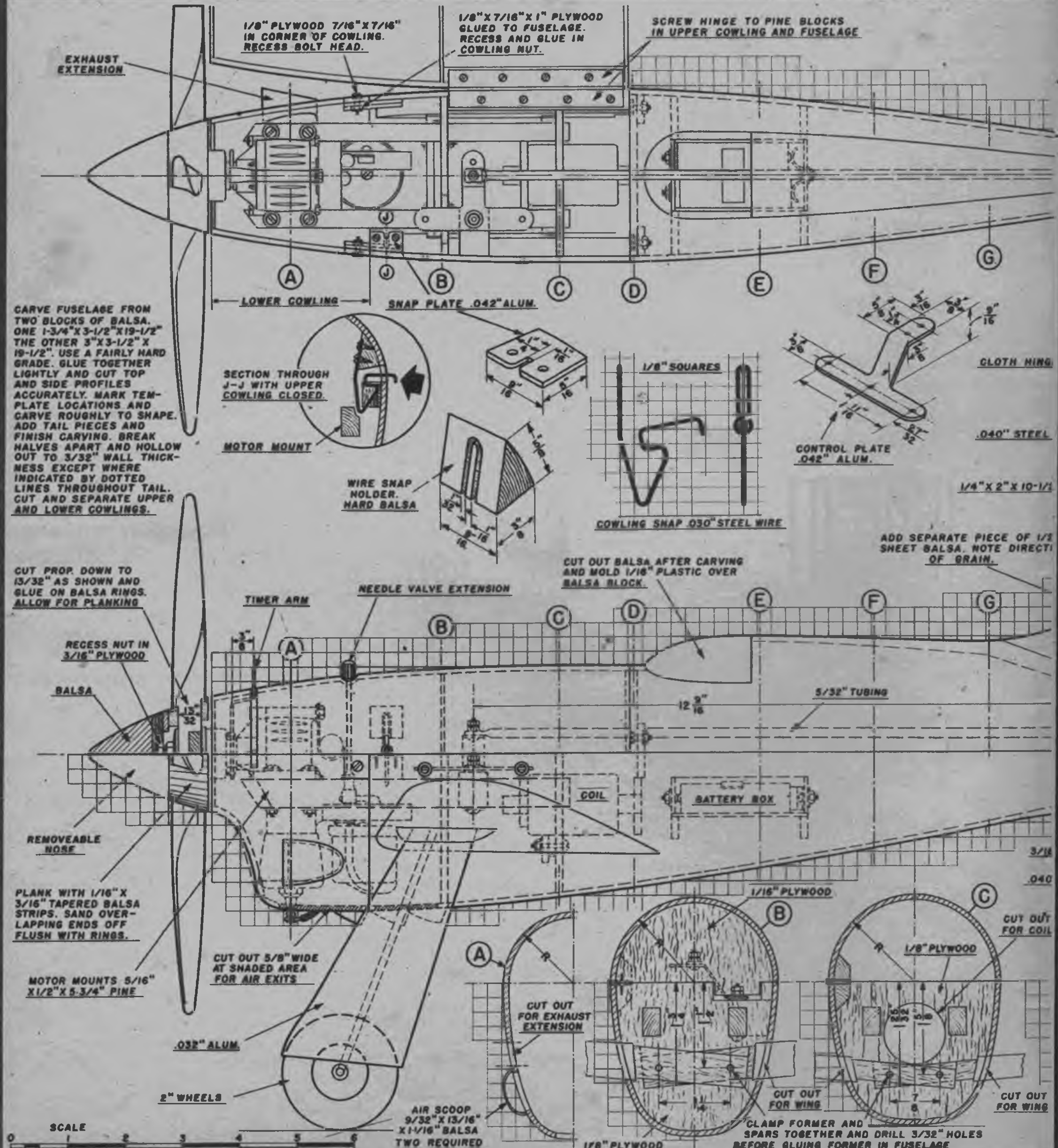
To make the fuel tank readily accessible, the upper cowling was designed with hinges, which were attached to pine blocks. The wire snap affords easy release and is strong enough to hold the cowling down in flight. After fueling, the cowling is snapped shut; then the engine is ready to start. *Note:* Cowling should not be left open while starting engine. The needle valve and timer arm were extended to the outside of the cowling. I designed a new timer arm in order to provide more clearance between the arm and the propeller.

The lower cowling was attached with two small bolts held by plywood. It is easy to remove the cowling for changing spark plugs and taking out the engine. Air scoops were added on each side in order to throw air behind the cylinder and thus get better cooling. To carry the hot air out, exit scoops were installed underneath, extending back to the first former.

I made the spinner of balsa and plywood. Its removable nose has a recessed nut held in with plywood.

(Turn to page 112)

BOBCAT

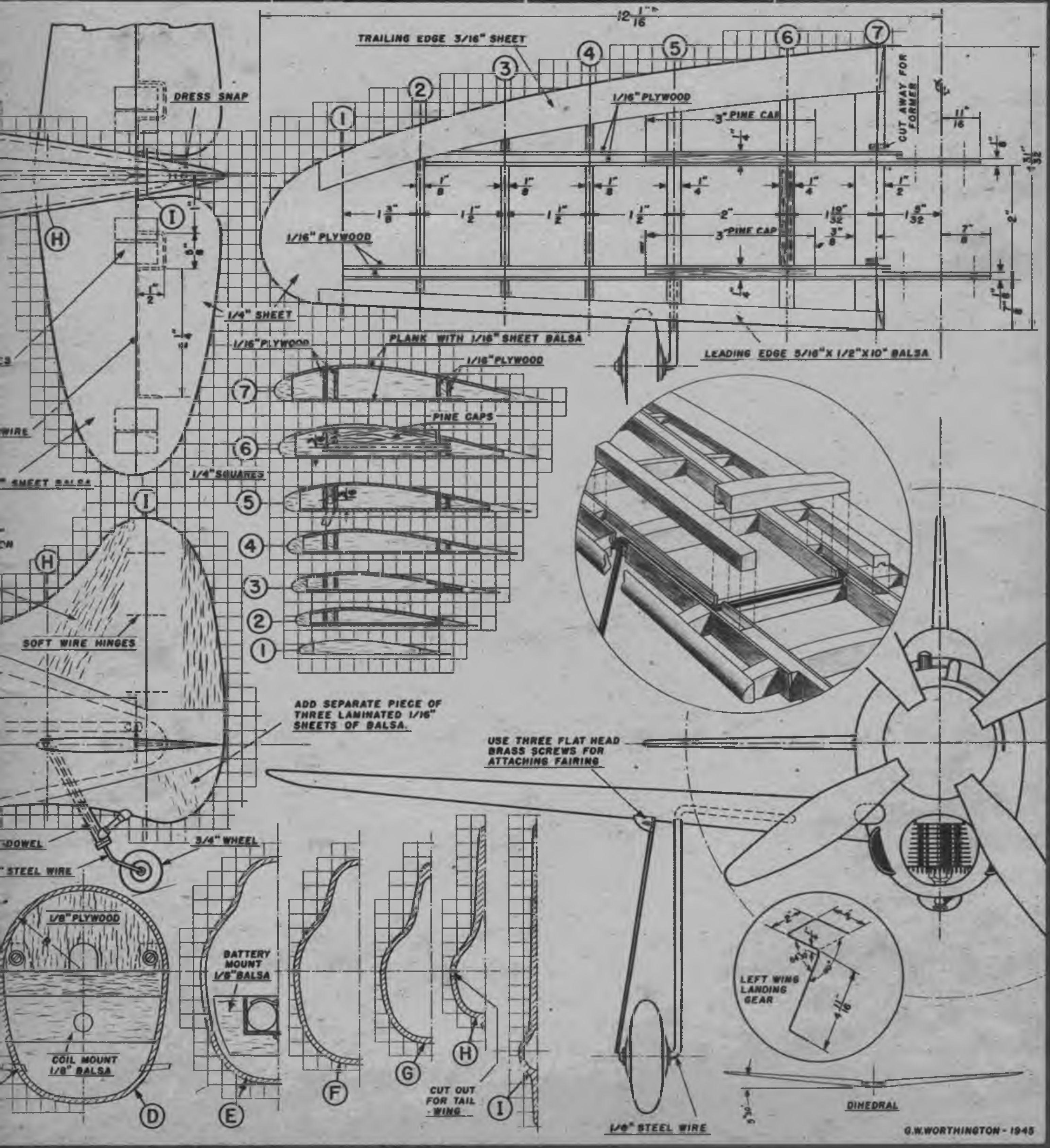


CARVE FUSELAGE FROM TWO BLOCKS OF BALSA. ONE 1-3/4"X3-1/2"X19-1/2" THE OTHER 3"X3-1/2" X 19-1/2". USE A FAIRLY HARD GRADE. GLUE TOGETHER LIGHTLY AND CUT TOP AND SIDE PROFILES ACCURATELY. MARK TEMPLATE LOCATIONS AND CARVE ROUGHLY TO SHAPE. ADD TAIL PIECES AND FINISH CARVING. BREAK HALVES APART AND HOLLOW OUT TO 3/32" WALL THICKNESS EXCEPT WHERE INDICATED BY DOTTED LINES THROUGHOUT TAIL. CUT AND SEPARATE UPPER AND LOWER COWLINGS.

CUT PROP. DOWN TO 13/32" AS SHOWN AND GLUE ON BALSA RINGS. ALLOW FOR PLANKING

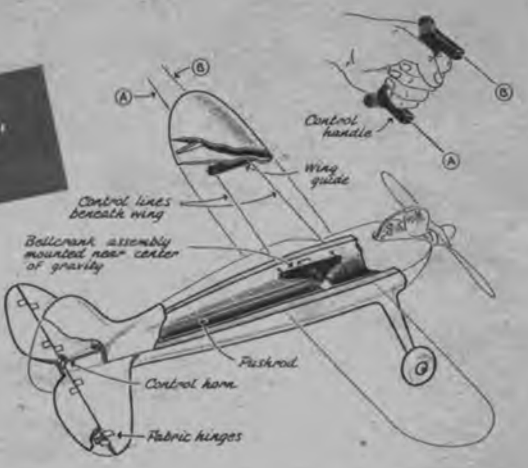
PLANK WITH 1/16" X 3/16" TAPERED BALSA STRIPS. SAND OVERLAPPING ENDS OFF FLUSH WITH RINGS.

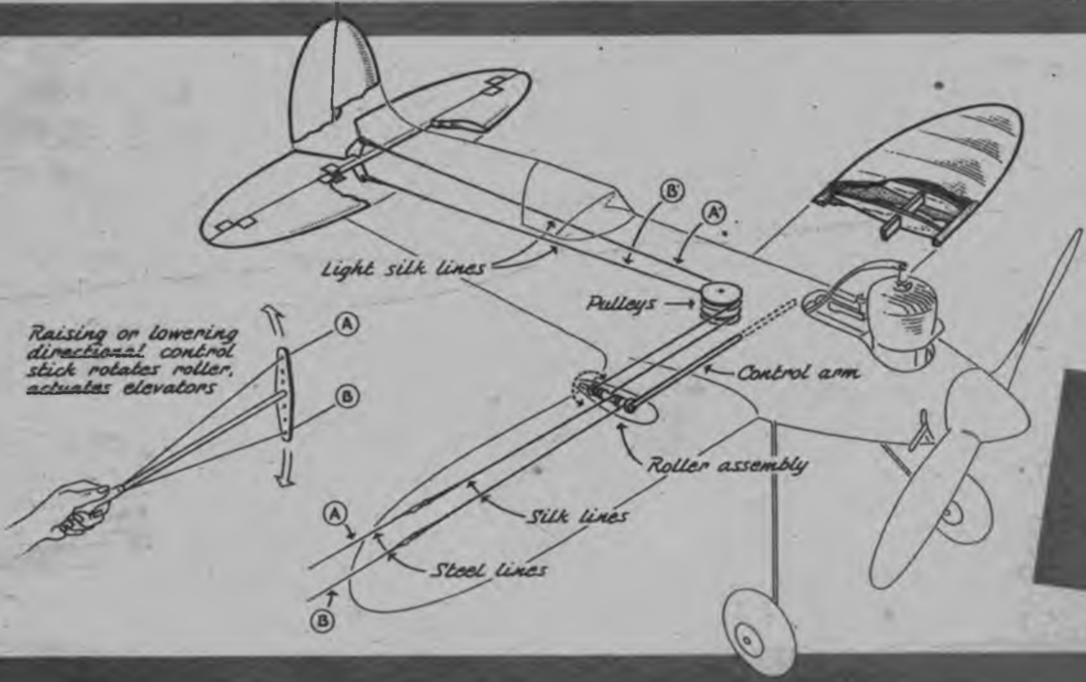
CLAMP FORMER AND SPARS TOGETHER AND DRILL 3/32" HOLES BEFORE GLUING FORMER IN FUSELAGE


12 1/16"
TRAILING EDGE 3/16" SHEET
1/16" PLYWOOD
3" PINE CAP
CUT AWAY FOR FORMER
11/16"
1 31/32"
1/8"
1/4"
1/2"
1 3/8"
1 1/2"
2"
1 19/32"
1 5/32"
7/8"
3/8"
1/16" PLYWOOD
3" PINE CAP
LEADING EDGE 5/16" X 1/2" X 10" BALSA
1/4" SHEET
1/16" PLYWOOD
PLANK WITH 1/16" SHEET BALSA
1/16" PLYWOOD
PINE CAPS
1/4" SQUARES
DRESS SNAP
WIRE
SHEET BALSA
SOFT WIRE HINGES
ADD SEPARATE PIECE OF THREE LAMINATED 1/16" SHEETS OF BALSA.
USE THREE FLAT HEAD BRASS SCREWS FOR ATTACHING FAIRING
DOWEL
3/4" WHEEL
STEEL WIRE
1/8" PLYWOOD
COIL MOUNT 1/8" BALSA
BATTERY MOUNT 1/8" BALSA
CUT OUT FOR TAIL WING
LEFT WING LANDING GEAR
1/8" STEEL WIRE
DIHEDRAL
1 2 3 4 5 6 7
D E F G H I
G.W.WORTHINGTON - 1945

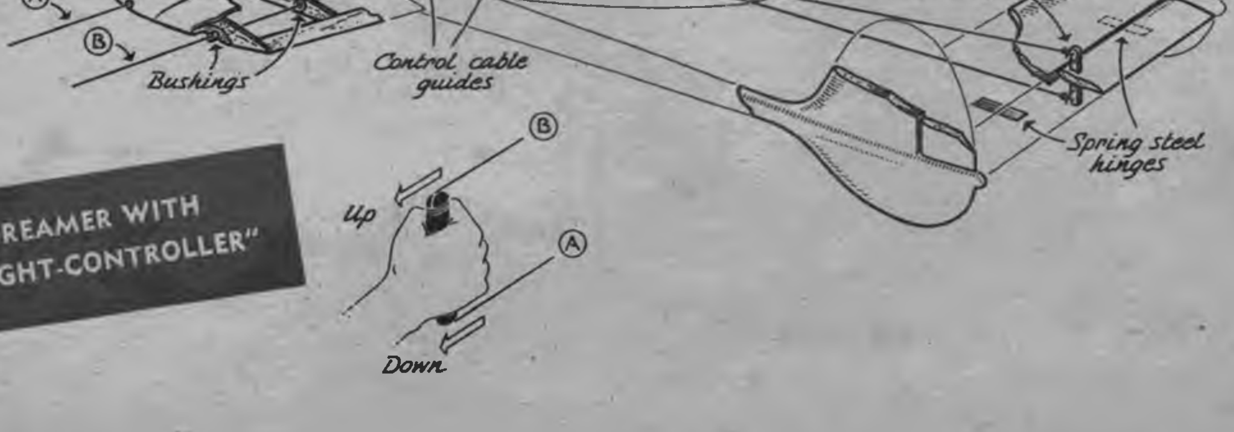
CONTROL SYSTEMS

"U-CONTROL"





SUPER "G-LINE" SHARK WITH "ROLLER-CONTROL"



DREAMER WITH "FLIGHT-CONTROLLER"

The full-scale Twister, designed by Vernon Payne in 1932, has always been of interest to builders because of its small 15-foot span and beautiful lines.

The Knight Twister

By Walter Schroder

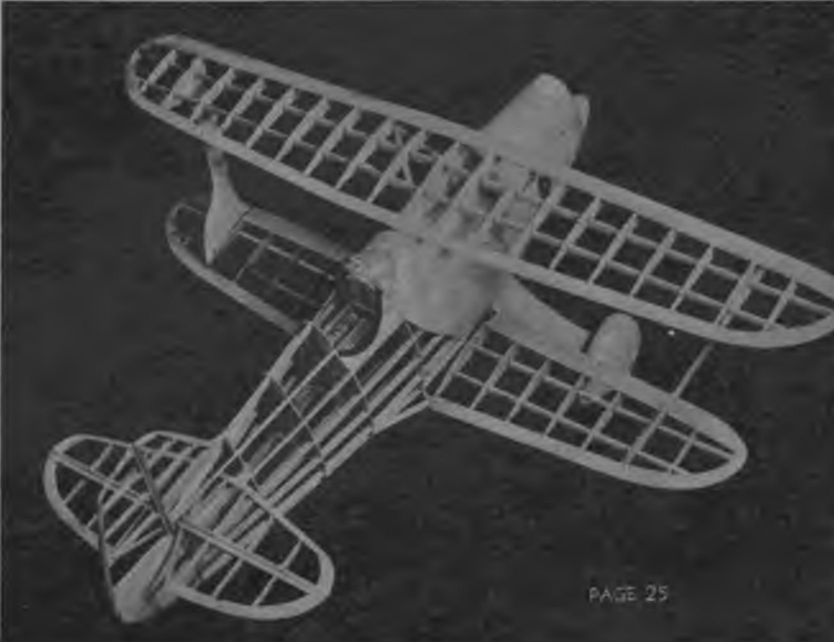
HERE'S WHAT COUNTLESS BUILDERS HAVE BEEN REQUESTING—A CONTROL-LINE KNIGHT TWISTER. DESIGNED FOR EASY BUILDING, FLYING

THIS control-line Knight Twister is a compromise between speed models and the so-aptly named "Goats." The prototype's well known lightplane history and the opportunity to combine exciting scale-model possibilities with a reasonable rate of speed, make her an ideal project for scale control-line fans. Simplicity is the keynote of the entire construction. The sturdiness and flyability of the plane will permit the use of a Forster "29" or "305," or even any other small, class "C" motor. The use of a biplane with its increased wing area permits the average control-line flyer to land this model without incorporating all sorts of complicated gadgets to blip the motor, throttle control, or spark control. Its ability to glide the model after the motor cuts offers all sorts of possibilities for stunting and regular flight maneuvers.

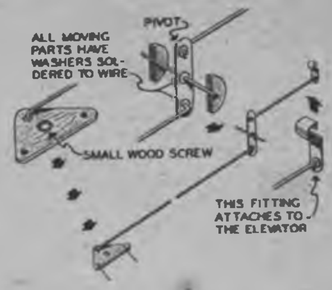
Fuselage: A conventional crutch of ¼″ x ½″ is used. Glue all upper formers in place while the crutch is drying, then install the control system. Make a platform of 3/32″ sheet and glue it on top of the crutch at the center of station #3. The control fulcrum of 3/32″ plywood is mounted on the platform, with an ordinary #9 wood screw acting as the anchor and bearing point of the fulcrum. Be sure to use a small copper burr between the head of the wood screw and the control plate, plus two copper burrs between the bottom of the control plate and the plate platform. The anchor screw for the control plate enters and fastens in the fuselage crutch cross member at station #3. Bend the control rod of light aluminum rod or .031 drill rod and place in the plate.

Glue all stringers and the front nose block in place before planking the model with ⅛″ x ¼″ soft balsa planking. Draw the planking outline on the stringers and then recess them to a depth of ⅛″ at the point where the planking ends. The landing gear fairings are made independently of the fuselage and are slotted *(Turn to page 100)*

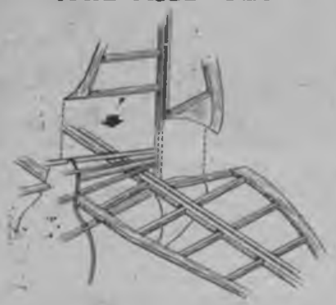
Give a look at the construction; this model was built for wear and tear. Finished, she weighs but 24½ oz. Wheels, pants, and struts are removable.



CONTROL SYSTEM



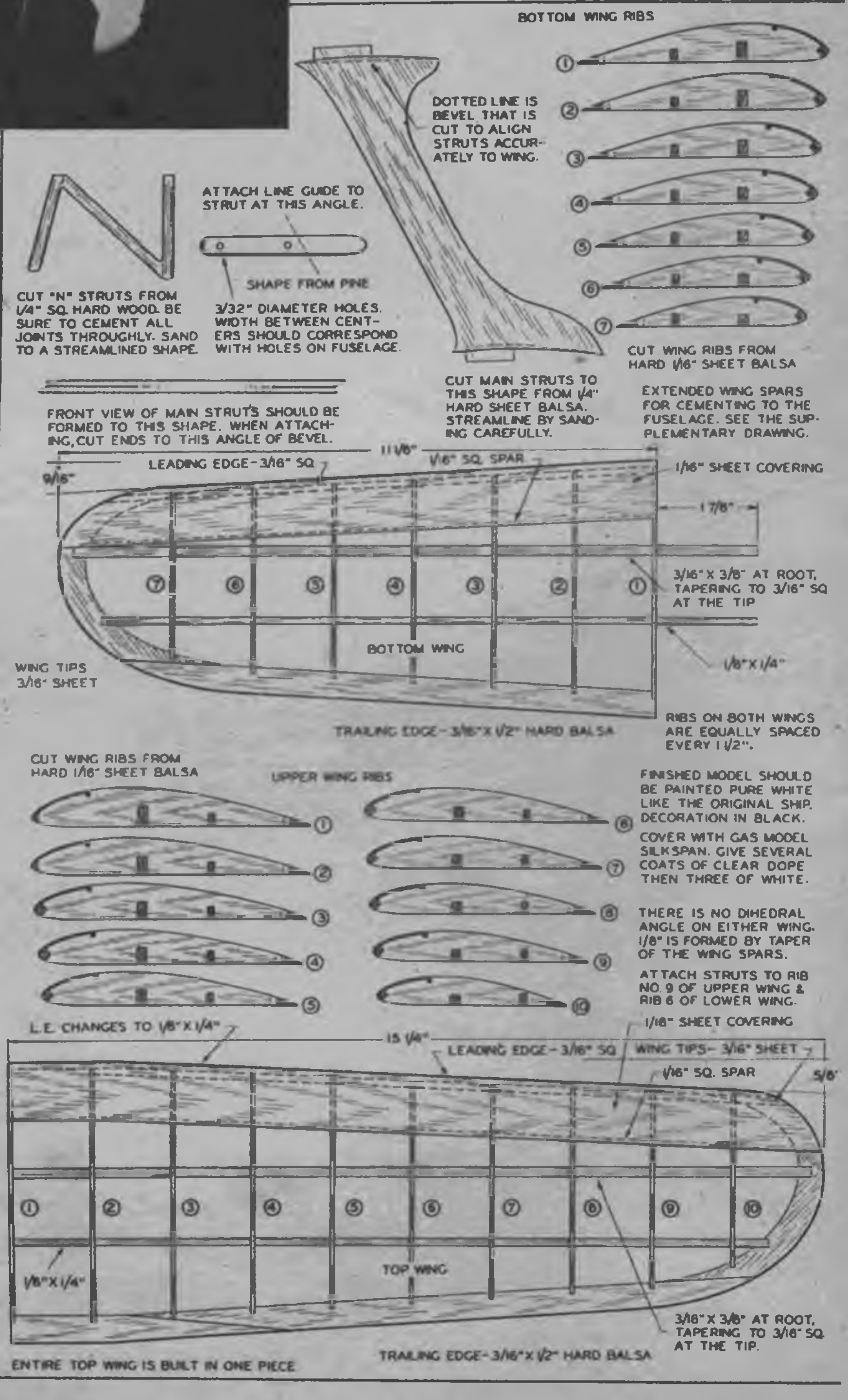
TAIL ASSEMBLY

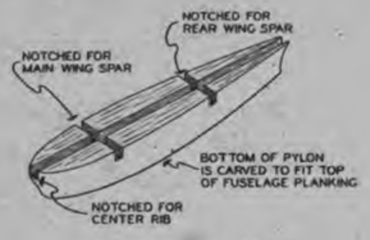


STABILIZER IS MOUNTED IN THIS MANNER: FIRST, FILL IN SPACE BETWEEN STRINGERS, THEN CUT STAB OPENING. CEMENT WELL. RUDDER BUTT-JOINTS AS INDICATED HERE.

Tail structure is not complicated. Fuselage is built on keel; then bulkheads and stringers are added.

Batteries are easily accessible. Note how stringers are faired into the planking around the nose section.

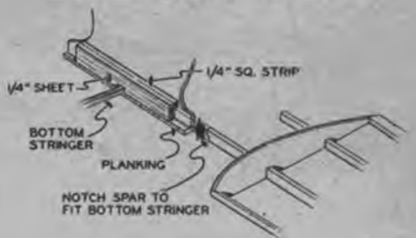


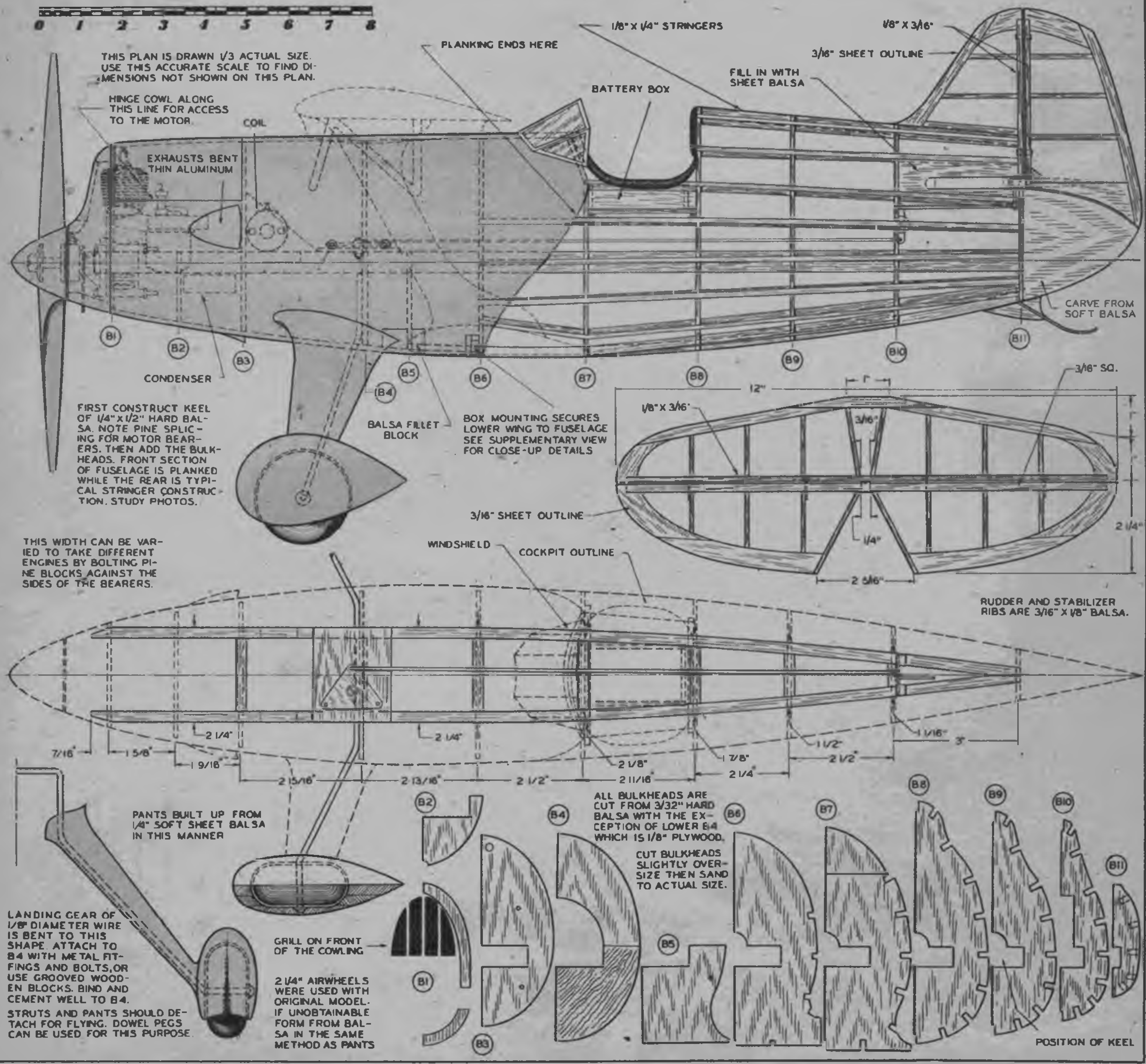


WING MOUNT

RUDDER HINGE

LOWER WING MOUNT





THIS PLAN IS DRAWN 1/3 ACTUAL SIZE. USE THIS ACCURATE SCALE TO FIND DIMENSIONS NOT SHOWN ON THIS PLAN.

FIRST CONSTRUCT KEEL OF 1/4" x 1/2" HARD BALSA. NOTE PINE SPLICING FOR MOTOR BEARERS. THEN ADD THE BULKHEADS. FRONT SECTION OF FUSELAGE IS PLANKED WHILE THE REAR IS TYPICAL STRINGER CONSTRUCTION. STUDY PHOTOS.

THIS WIDTH CAN BE VARIED TO TAKE DIFFERENT ENGINES BY BOLTING PINE BLOCKS AGAINST THE SIDES OF THE BEARERS.

ALL BULKHEADS ARE CUT FROM 3/32" HARD BALSA WITH THE EXCEPTION OF LOWER B4 WHICH IS 1/8" PLYWOOD.

CUT BULKHEADS SLIGHTLY OVERSIZE THEN SAND TO ACTUAL SIZE.

LANDING GEAR OF 1/8" DIAMETER WIRE IS BENT TO THIS SHAPE. ATTACH TO B4 WITH METAL FITTINGS AND BOLTS, OR USE GROOVED WOODEN BLOCKS. BIND AND CEMENT WELL TO B4.

STRUTS AND PANTS SHOULD DETACH FOR FLYING. DOWEL PEGS CAN BE USED FOR THIS PURPOSE.

2 1/4" AIRWHEELS WERE USED WITH ORIGINAL MODEL. IF UNOBTAINABLE FORM FROM BALSA IN THE SAME METHOD AS PANTS

● This speed job featured removable wing and cowling.

● Eight-ft. Stinson Reliant features motor control.

● Super-speed with rakish lines and cowled motor.

● This A-J Fireball with pontoons flew exceptionally well.

● World War I flying scale, this SE-5 was good, stable flyer.

● Four-engined Constellation featured retracting gear.

● P-47N with 4-bladed prop and sliding canopy.

● Both extremes in control-line: the Manta, with all the wing area, had a wonderful glide; the clipped wing job—oh well, a guy can try.

LINE-TYPES

DESIGN

ALTHOUGH there are some very good kits, there comes a time in every model builder's life when he wants to try out one of his own designs. But, unfortunately, designing one's own model sometimes proves tougher than one might think. The average balsa butcher won't admit it but he does a powerful amount of guessing. The chances are that his dream ship will have one or more vicious "bugs." There really is no need for guessing. The next time you try one of your own, use this handy information.

First, a word about wings. Stick to aspect ratios of from 6-to-1 to 10-to-1. For gas models from 7-to-1 to 8-to-1 is ideal; on rubber models try 8-to-1 and up. Aspect ratio, of course, is the ratio between span and chord. To find it divide span by chord. The wing rib or airfoil section is important. On pages 84-85, you will find drawings and data for the most popular airfoils. For average all-round flying, the Clark Y is an easy and dependable section for both gas and rubber. The Eiffel 400 and RAF 32 are good for rubber. However, for maximum performance try the NACA 6409 on your gas models. It works well because it has high lift and low drag which gives a very high ratio of lift to drag on L/D. A thin section like the 6409 requires comparatively little power from your gas engine, leaving more power for the climb.

In general, it is good to use about two inches of dihedral per foot of span, for both rubber and gas. While straight dihedral works okay, polyhedral is considered better for the higher- *(Turn to page 104)*

PROPORTIONS

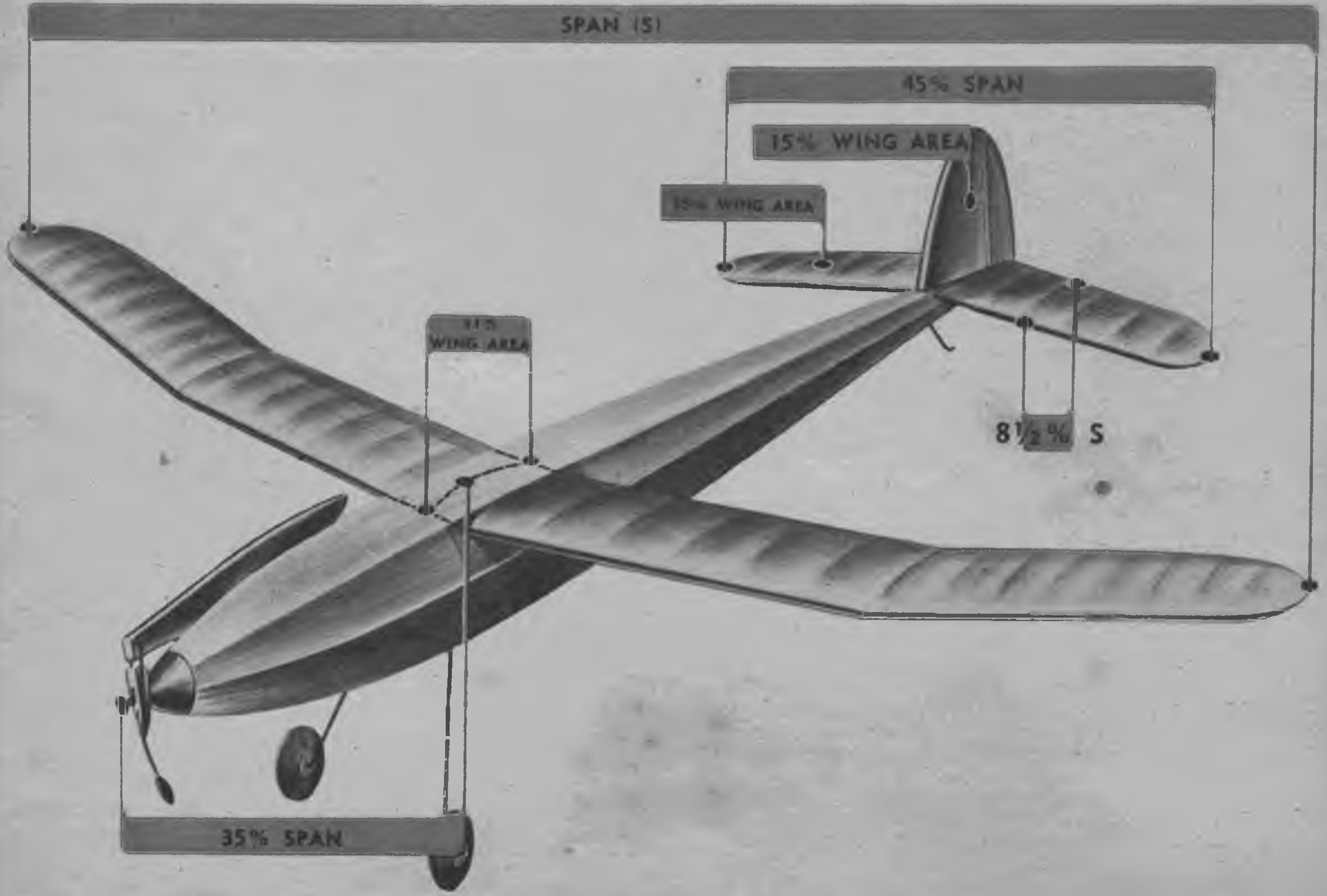
THREE outstanding models have been selected to illustrate effectively the need of sound proportions for your original design. It is easy to see that good model design proportions are fairly standard and a well designed model consists of really good clean lines developed around the proportions and force arrangements shown.

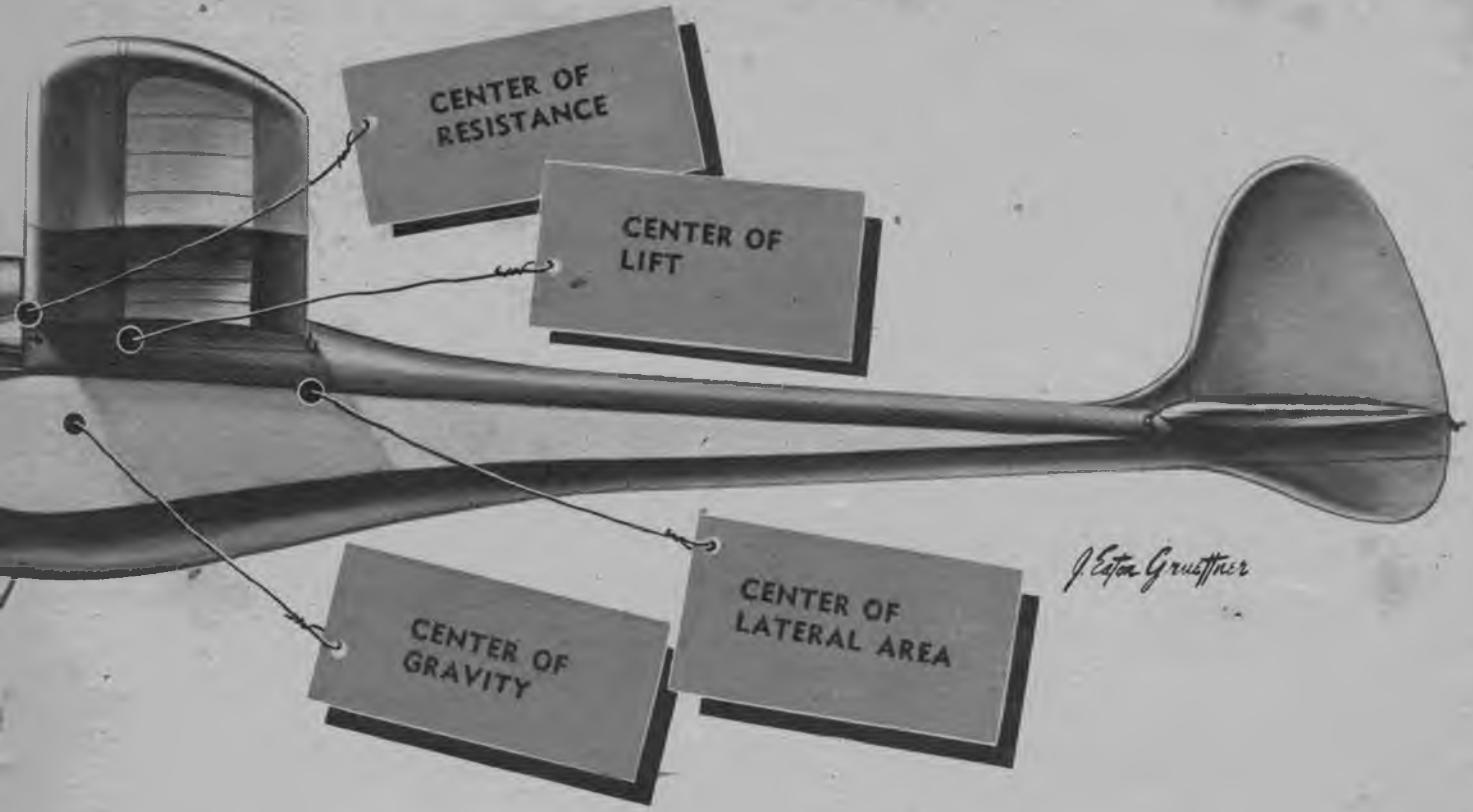
The Vagabond was selected because it shows the limitless possibilities for developing a very realistic cabin model which can compete in the rugged contest field and still hold its own with the pencil bombers, etc. Many designers may sniff and raise their heads in disdain about the box and square frame construction, but when the chips are down any good, clean, well-proportioned model will more than hold its own against the no-lateral-area models.

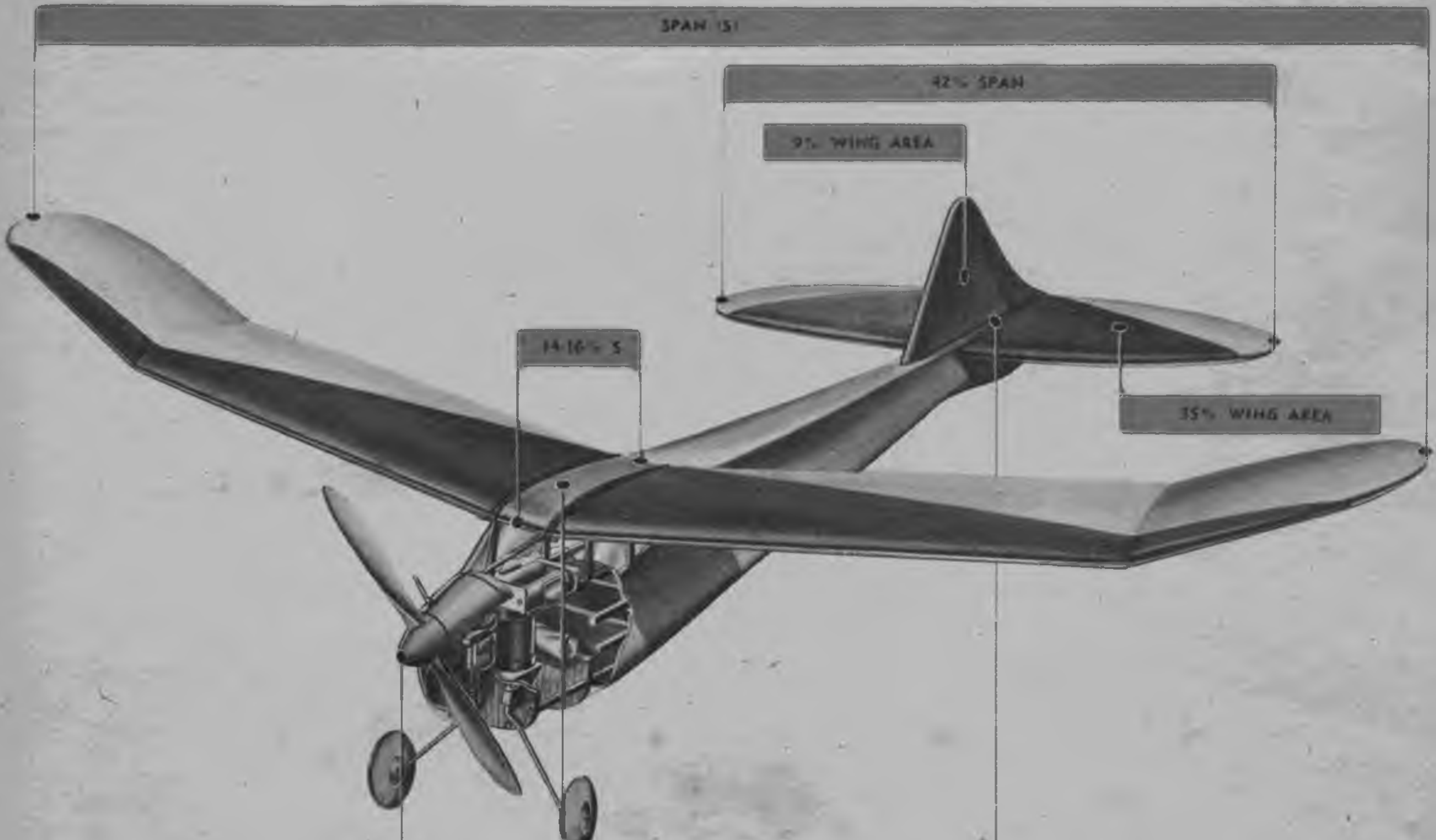
Wog was chosen not only because it represents the ultimate in good, clean, streamlined contest jobs, but also because it has one of the best force arrangements developed to date.

In rubber, Cahill is one of those that must be reckoned with in the design of good, effective jobs. That is why we selected his Super Clodhopper.

Real proof of these arguments can be had in your next original design. Just take the profile view of any of these models and draw your own super-duper around their outline. Stay within the confines of those layouts, and all we can say is "we told you so."




CENTER OF RESISTANCE
CENTER OF LIFT
CENTER OF LATERAL AREA
CENTER OF GRAVITY
J. Eaton Gruettner


SPAN (S)
42% SPAN
9% WING AREA
14-16% S
35% WING AREA
10% SPAN
42-50% OF SPAN

ARE WE IN A RUT?

By Charles H. Grant

PROF. GRANT SAYS, "YES!" SAMENESS OF MODEL DESIGNS IS THE PROOF. BUT TAKE A LOOK AT WHAT CAN HAPPEN WHEN DESIGN KNOWLEDGE AND IMAGINATION ARE BLENDED

AMERICAN youth enjoy the reputation of being the most ingenious model builders in the world, yet usually there are only two or three different basic types among hundreds of models flown at contests. Perhaps you have been surprised at the apparent lack of originality and wondered why hundreds of modelers with such variety of experience produce planes so nearly alike. Modeling is an experimenter's game and so should inspire fulfillment of original, dissimilar ideas. But only a few scientific experimenters with creative genius develop designs for contest flying or other specific purposes. The majority of model fans prefer to sidestep original development and use designs of proven value as a short cut to successful flights. The former prefer to "make the cake," the latter prefer to "eat it."

This is not due entirely to lack of ingenuity of sportsmen flyers because many have exceptional creative ability and original ideas. Perhaps the answer lies in the excellent designs available in kit form. These make it a simple matter to build and fly planes successfully, thereby satisfying desire for flight thrills without the trouble of tedious experiments. Modelers ask why they should take the time and trouble to develop a successful original design when so many of proven worth can be purchased at little cost in kit form. Then again, hundreds of modelers are comparative novices who cannot design successful ships but who can build a fairly good job when plans and material are supplied.

There are many others also who, though they can design and lay out plans for original planes, prefer to copy design features of famous contest winners. All this results in hundreds of models of similar type evident at all flying events.

Perhaps there would be a greater variety of designs in this country if more of our expert designers used models to discover new principles and ways of attaining efficient stable flight, rather than producing new variations of old designs purely for the purpose of winning duration events. But then again, perhaps the contest rules are partly to blame because they tend to restrict design, thereby discouraging originality.

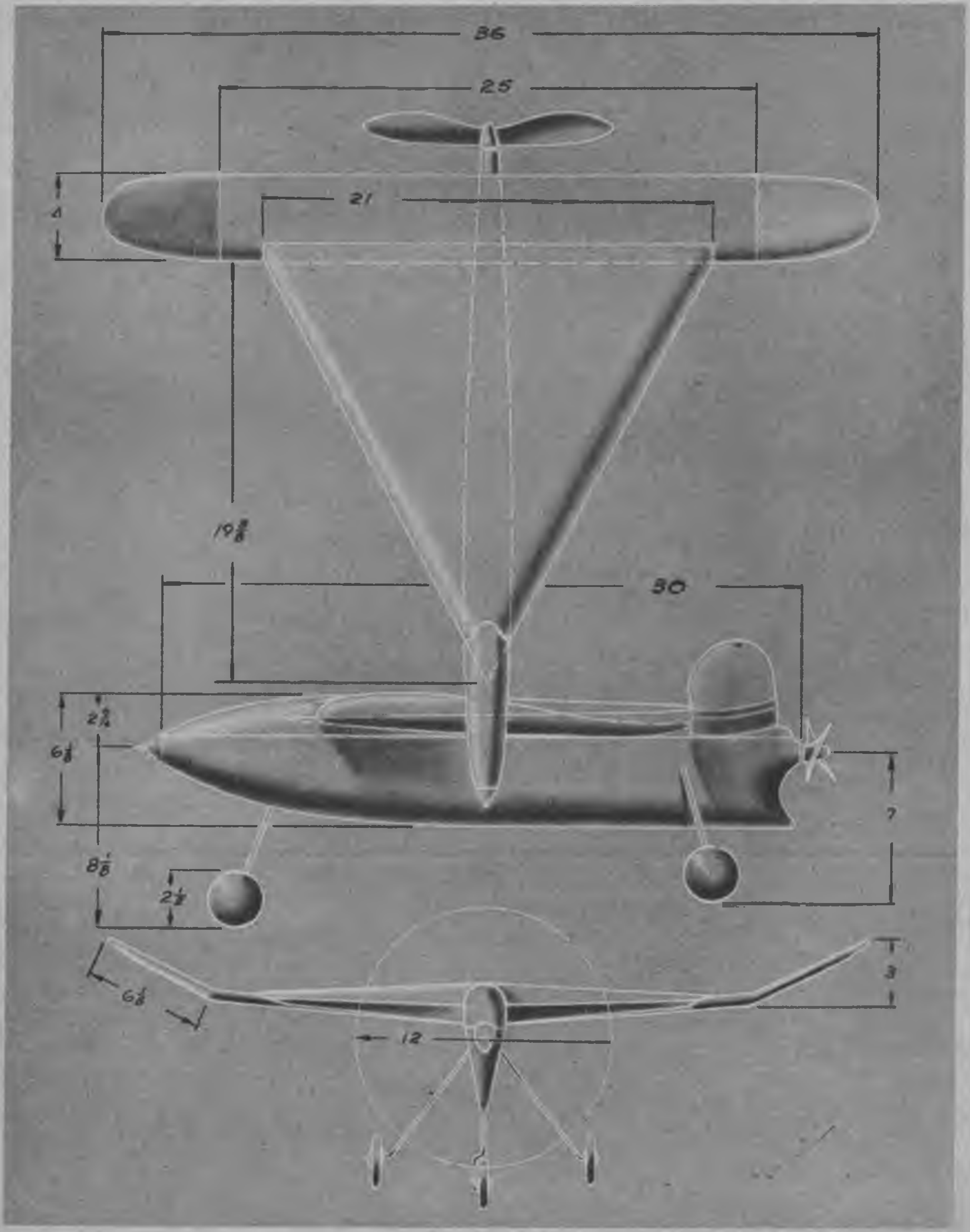
However, absence of new designs is unquestionably due to a certain lack of imagination and knowledge of what designs are possible, and their respective flight characteristics.

So, suppose we allow our thoughts to stray from the beaten path of model design. Possibly some unusual and interesting structural types have been overlooked that may give superior contest performance as well as greater variety of aeronautic knowledge. Let us consider what structural features are required for flight and how they can be arranged to form efficient new types of models.

For stable flight a conventional airplane must have certain basic units, as follows: (1) wings for lift; (2) propeller for forward motion; (3) tail surfaces for stability; (4) a frame to hold all other required units in their correct relative positions; and (5) a landing gear if the model is to take off from land or water.

For efficiency and stability these units must have certain definite

RUBBER-POWERED FLYING WING—A single-propeller plane of the future, with a triangular front wing and large-span rear wing. Space between the wings forms a wing slot that provides the needed longitudinal stability.



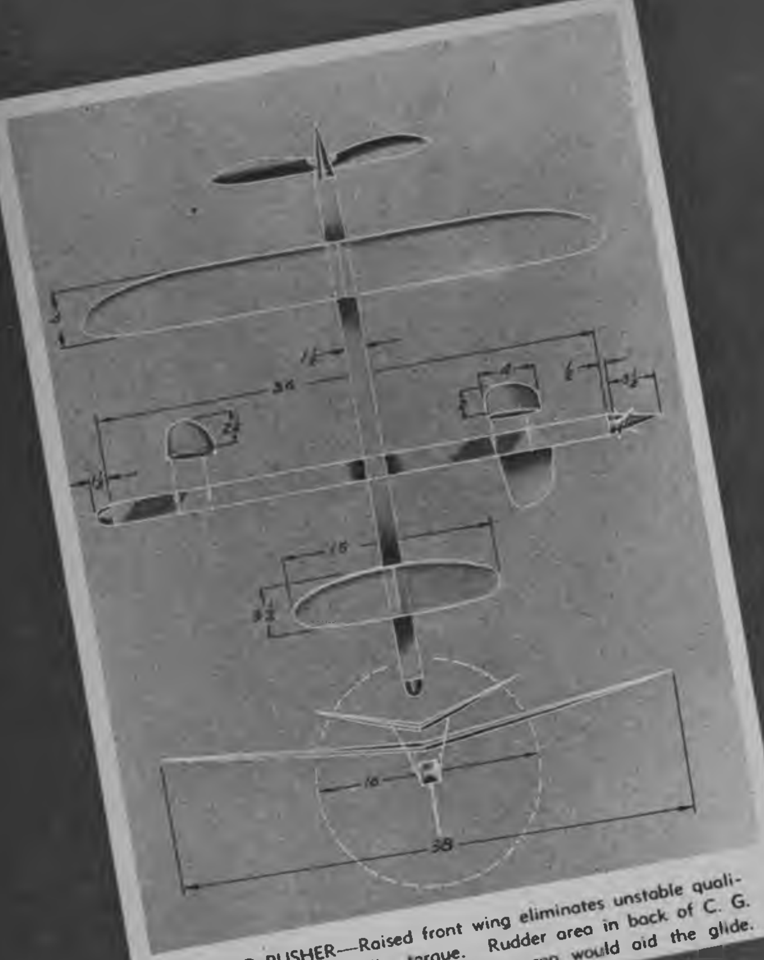
shape and be arranged in definite positions relative to one another. There is one basic arrangement of units which gives best results for average conditions. Variations in performance are achieved by modifying the basic proportions and arrangement of these units. In this way a plane can be designed for duration, speed, weight carrying, or any other desired purpose.

These modifications often result in a variety of structural types, while other types are created by structural variations that do not change the basic aerodynamic characteristics and types of performance for which they are suited.

Structural types may be divided into three general groups: (1) types determined by *position* of basic units; (2) types determined by *number* of basic units; (3) types determined by *the design* of its basic units.

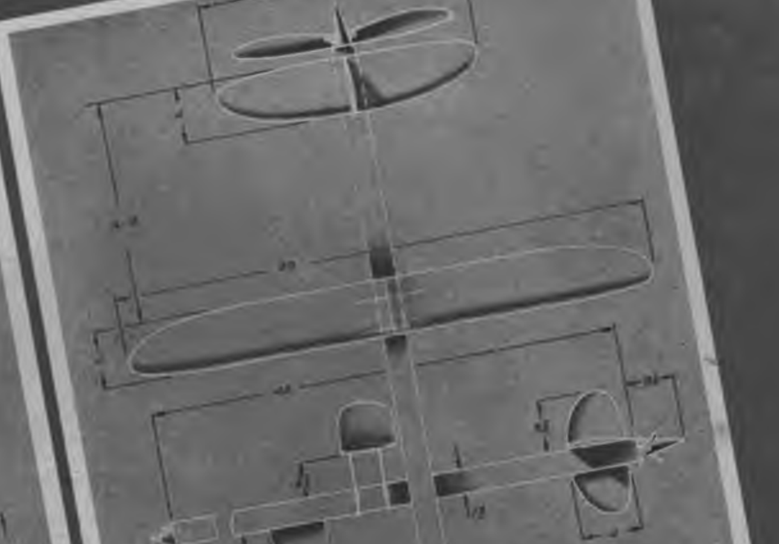
Under the first group come tractor or pusher models where position of the propeller determines their type; also "low-wing" and "parasol" planes characterized by wing position. The second classification includes biplanes, twin-propeller planes and

(Turn to page 88)

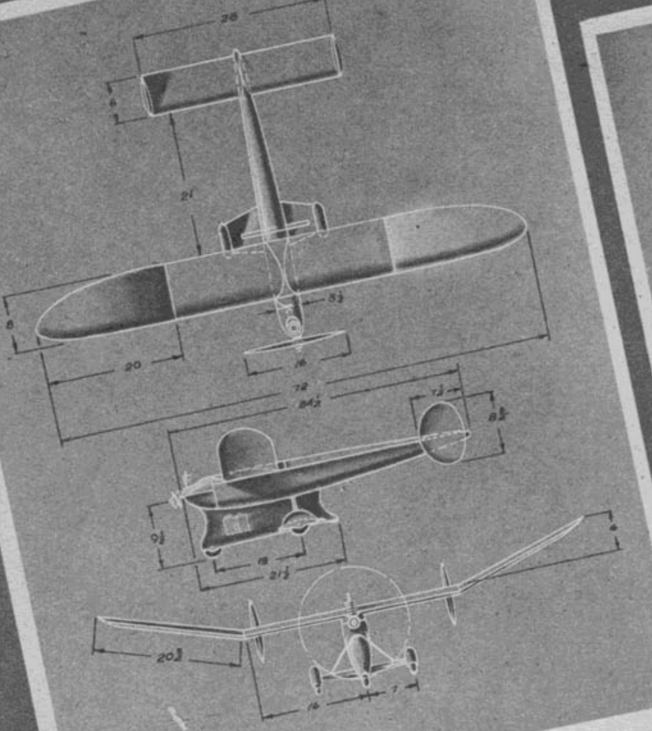


CANARD PUSHER—Raised front wing eliminates unstable qualities because of propeller torque. Rudder area in back of C. G. improves spiral stability. A folding prop would aid the glide.

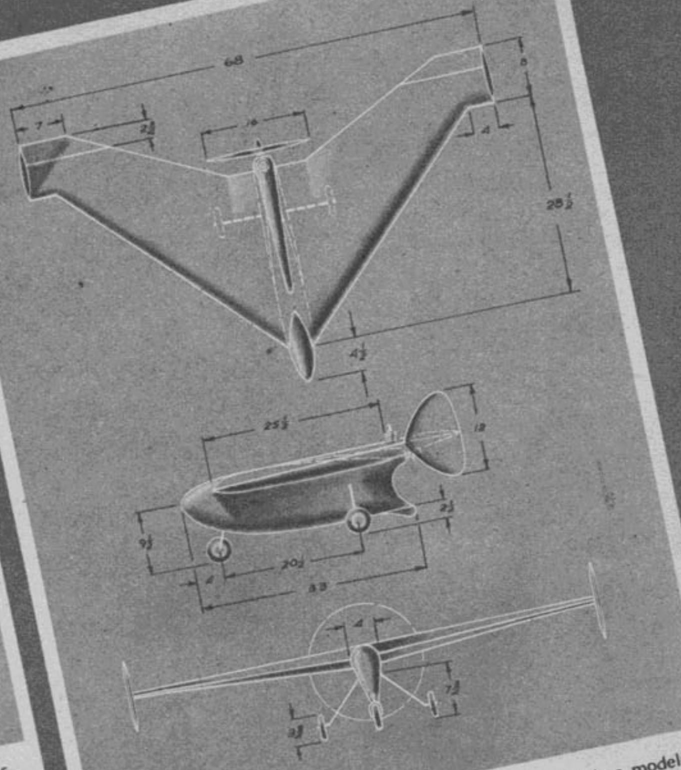
BIPLANE—To make biplanes as efficient as monoplanes: (1) use a wide gap between wings; (2) high aspect ratio wings; (3) short, small cross section fuselage; (4) eliminate inter-plane struts.



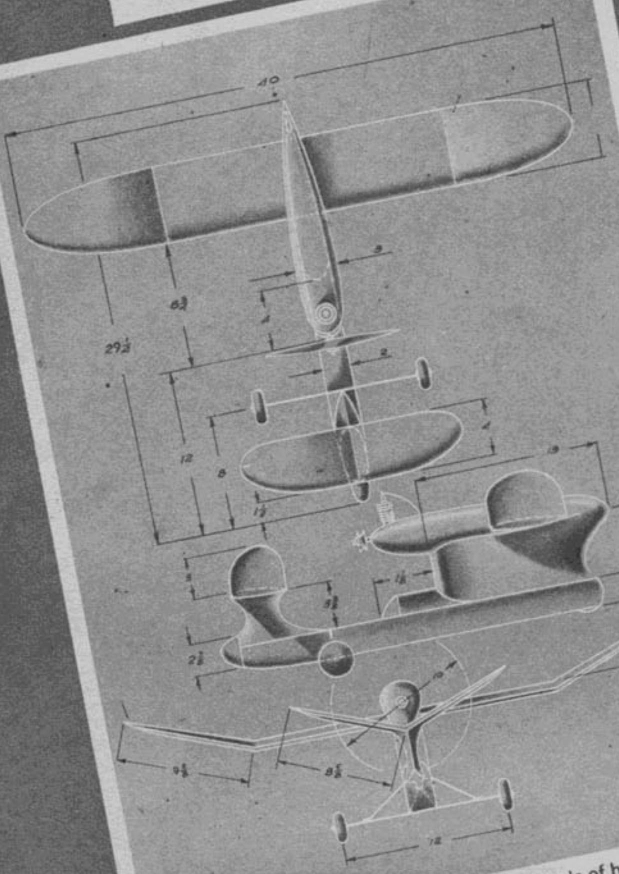
TRACTOR-TYPE PUSHER—Has the advantage of eliminating the stalling tendencies usually found in standard types when the power runs out. Prop at rear allows wing and tail to work in smooth air.



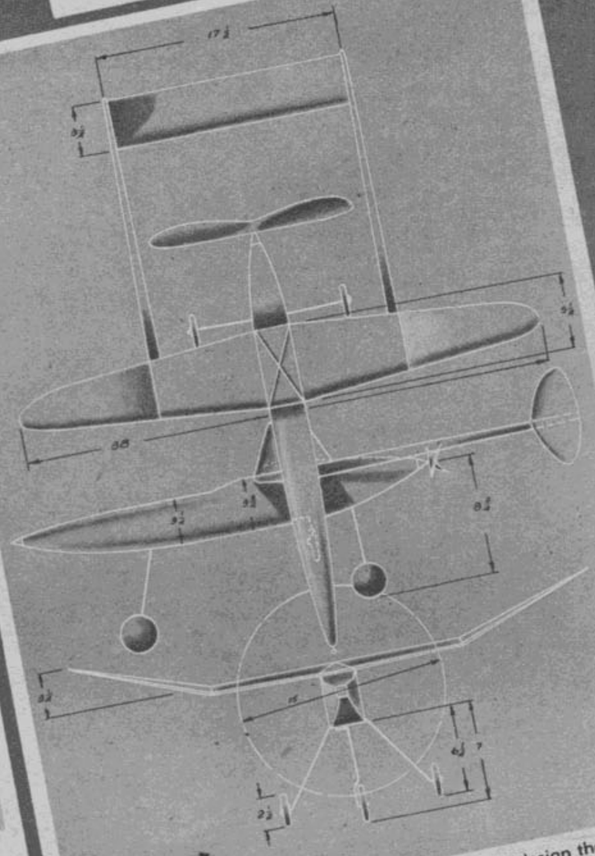
THREE-WHEEL TRACTOR GAS MODEL—Deep fuselage houses front wheel and provides space for ignition units. Brings center of lateral area below center of weight for greater spiral stability.



PUSHER TAIL-LESS GAS MODEL—Unlike other tail-less models, this design is very stable longitudinally. The secret lies in the large amount of sweepback and shape of the wing tips.



CANARD TRACTOR GAS MODEL—An example of how a "canard" gas model can be built so that the weight of motor, batteries, and coil is located at the center of gravity to obtain maximum stability.



RUBBER-POWERED FUSELAGE PUSHER—In this design the torque is reduced by placing the propeller close to the center of gravity. This arrangement increases stability as well as duration.

● An unusual class B & C job. Use only the "23" and it's B; use the Atom and "23," and it's C.

● Bob Hayes attached Handley Page wing slots to eliminate the stalling characteristics of his job.

● Note the angle of attack of the wing and stabilizer on Phil Sagano's unique class B pylon pusher.

● Here is clean design—note the elliptical wing and stabilizer dihedral, also the folding propeller.

● Maybe he didn't have enough cross section; there can't be any other reason for the design.

DESIGN

● Harry Lerman of Boston, Mass., experimented with combination tractor-pushers and finally achieved this stick model. Note single-bladed folding propellers and cradle-type wing mount.

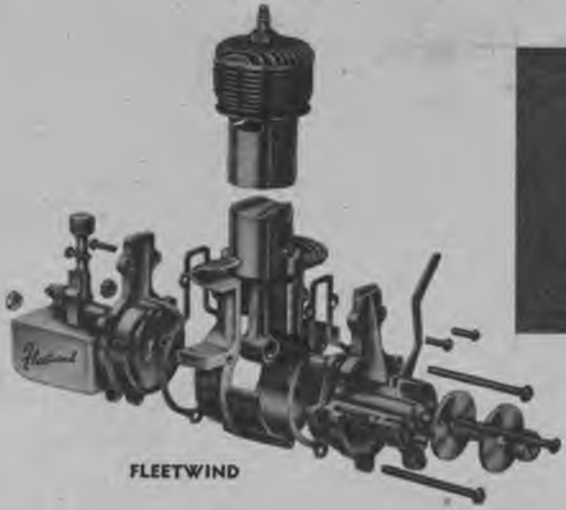
ENGINES

THE phrase "engines return" may be rather hackneyed, but it certainly is most appropriate at the moment. This is definitely the land of plenty and the gas builder's paradise these days. There are more and better motors being announced every day than at any other time in the history of the miniature two-cycle gas engines.

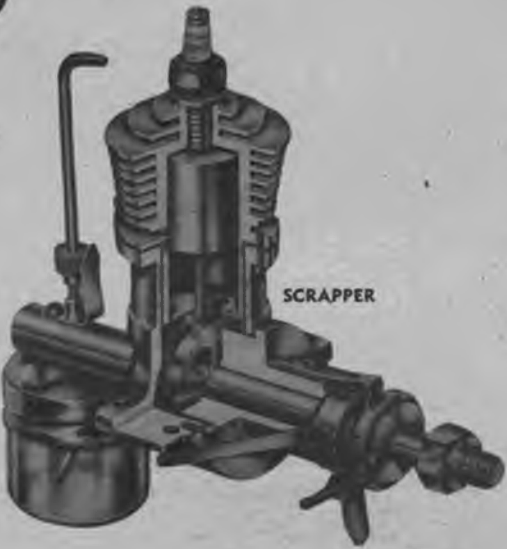
The machining and manufacturing practices in the new engines reflect all the experience acquired in the war program. The fine tolerances demanded for the mass production of war and aircraft parts are being transferred to the small engines, and many motors considered just average before the war are taking on all the qualities of the rare, prewar super-dooper. The race for power will profit model building as a whole, but, more important, it will give the model builder the first real break in many years. The power in these mighty mites can and will surpass our wildest dreams, and all those boys who sweated it out waiting only for the opportunity to get back to their models, will definitely blow the proverbial lid off model building with their new putt-putts.

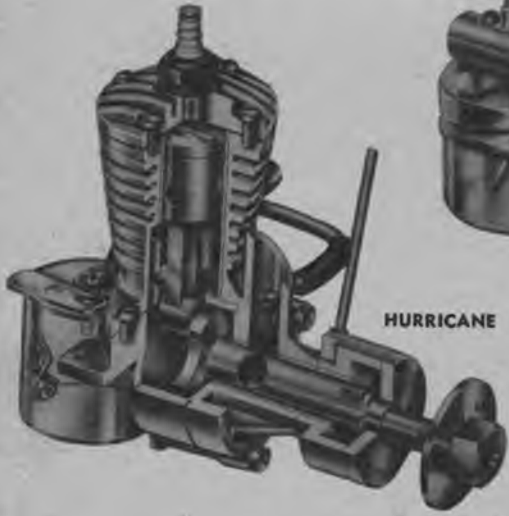
ENGINES

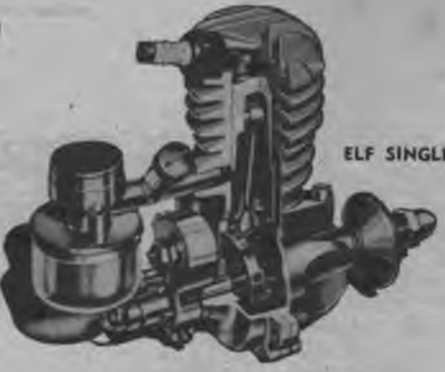

OHLSSON 60


FLEETWIND


MERLIN


SCRAPPER

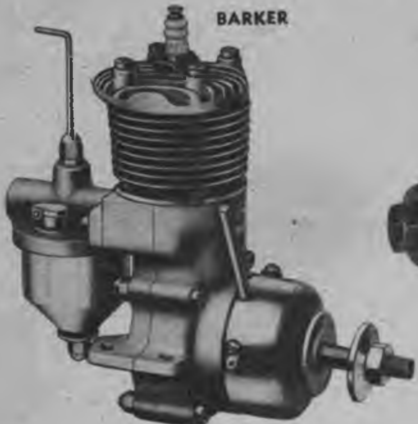

HURRICANE


ELF SINGLE


ROGERS KD-29


ROCKET


TIGER AERO


BARKER


SUPER SCRAPPER


MOLNAR

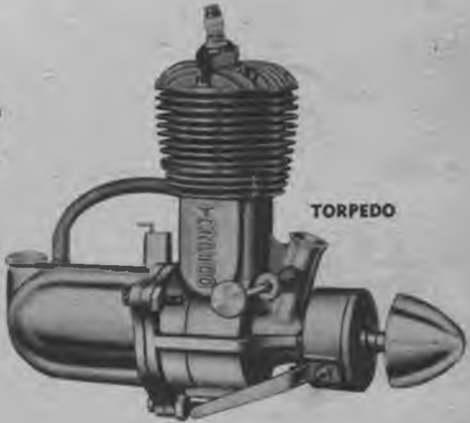

HERKIMER
SUPER SIXTY


BANTAM


FOSTER 29

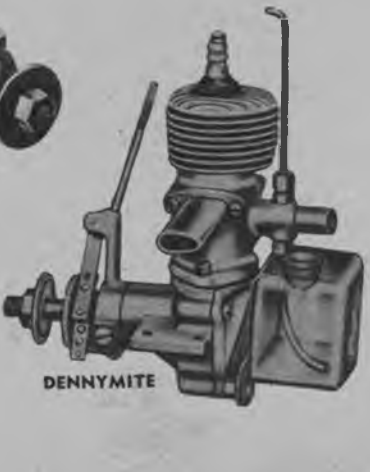

SUPER CYCLONE


ELF FOUR


TORPEDO

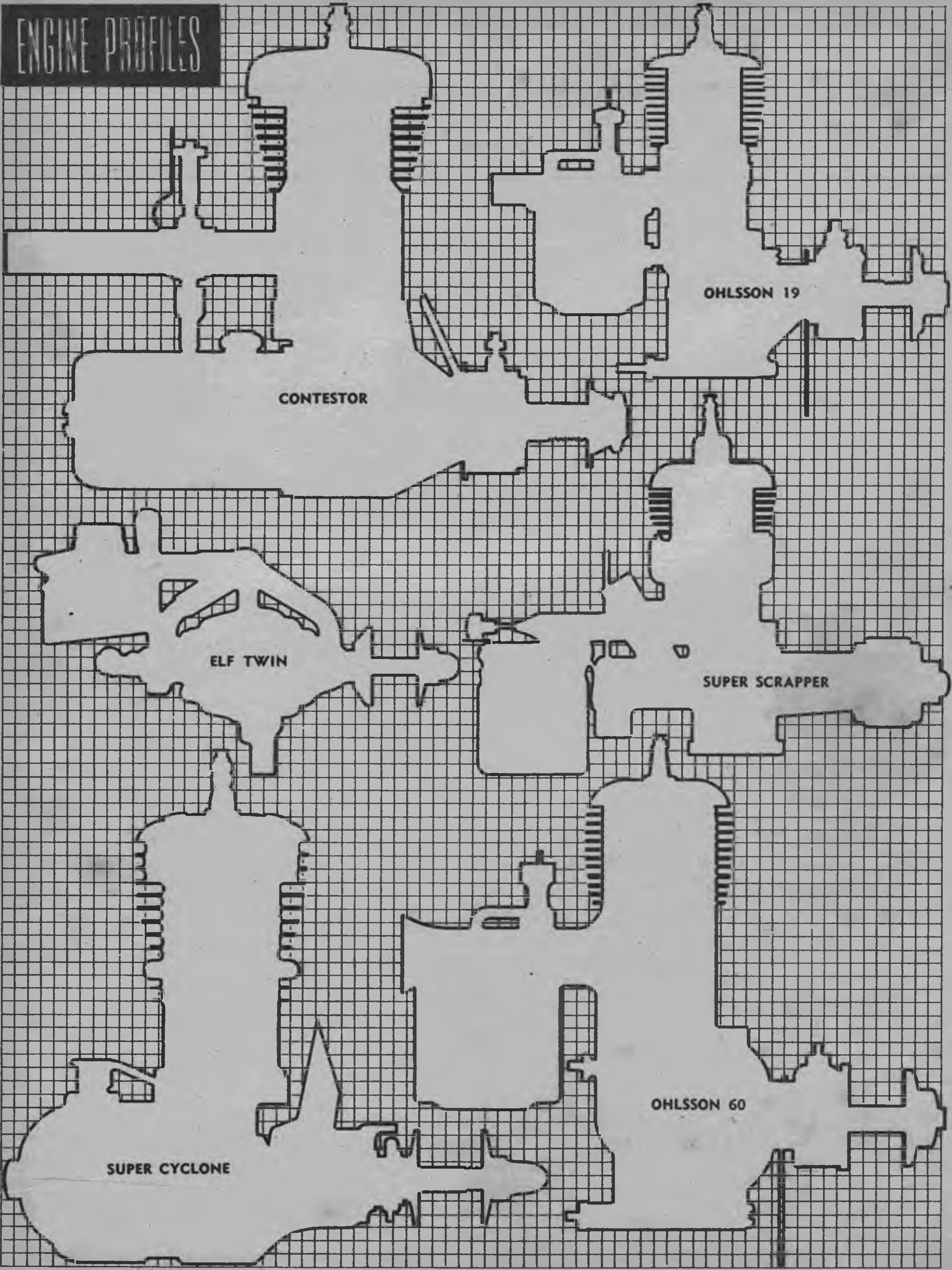

BROWN D

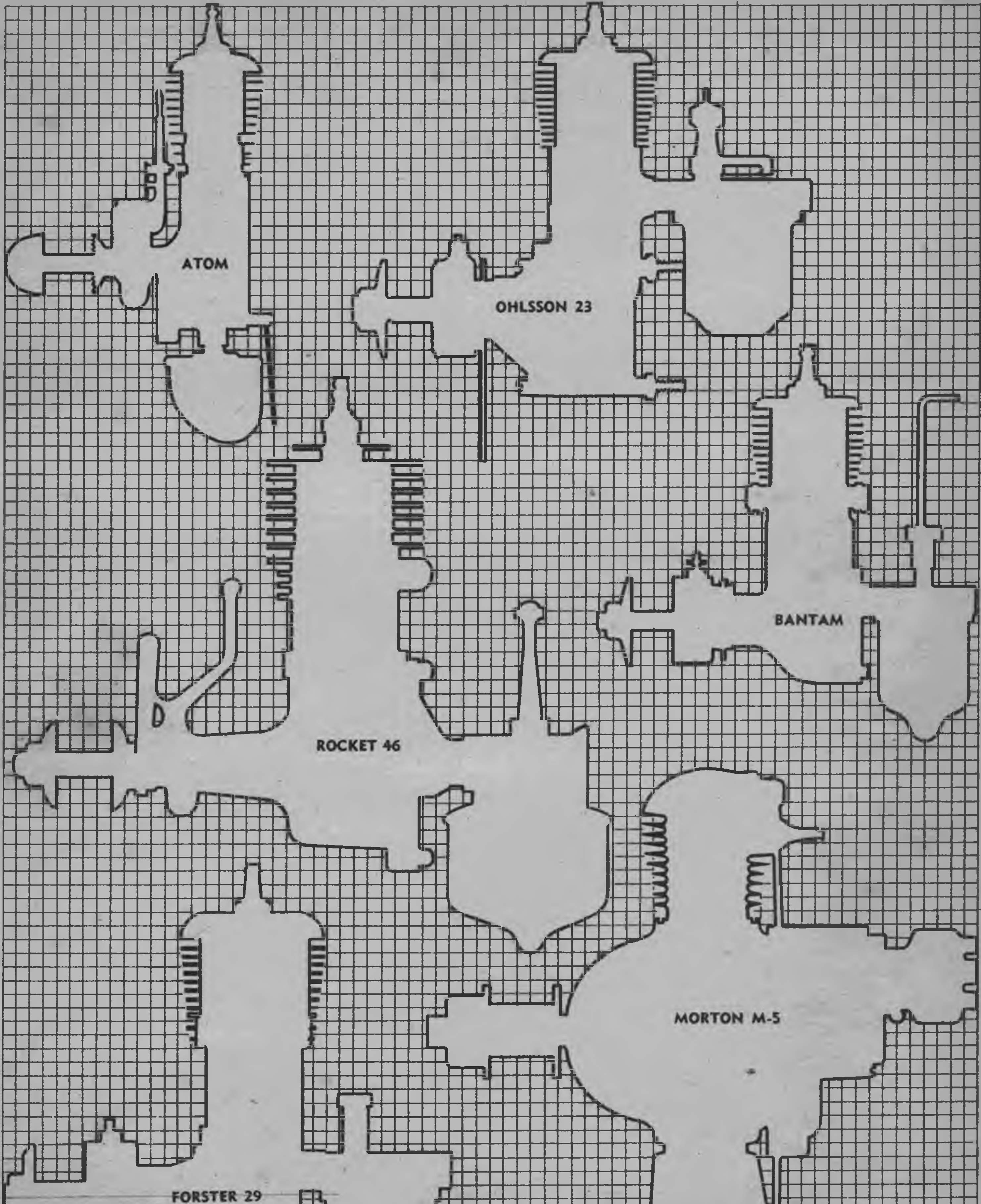

PHANTOM


DENNYMITE

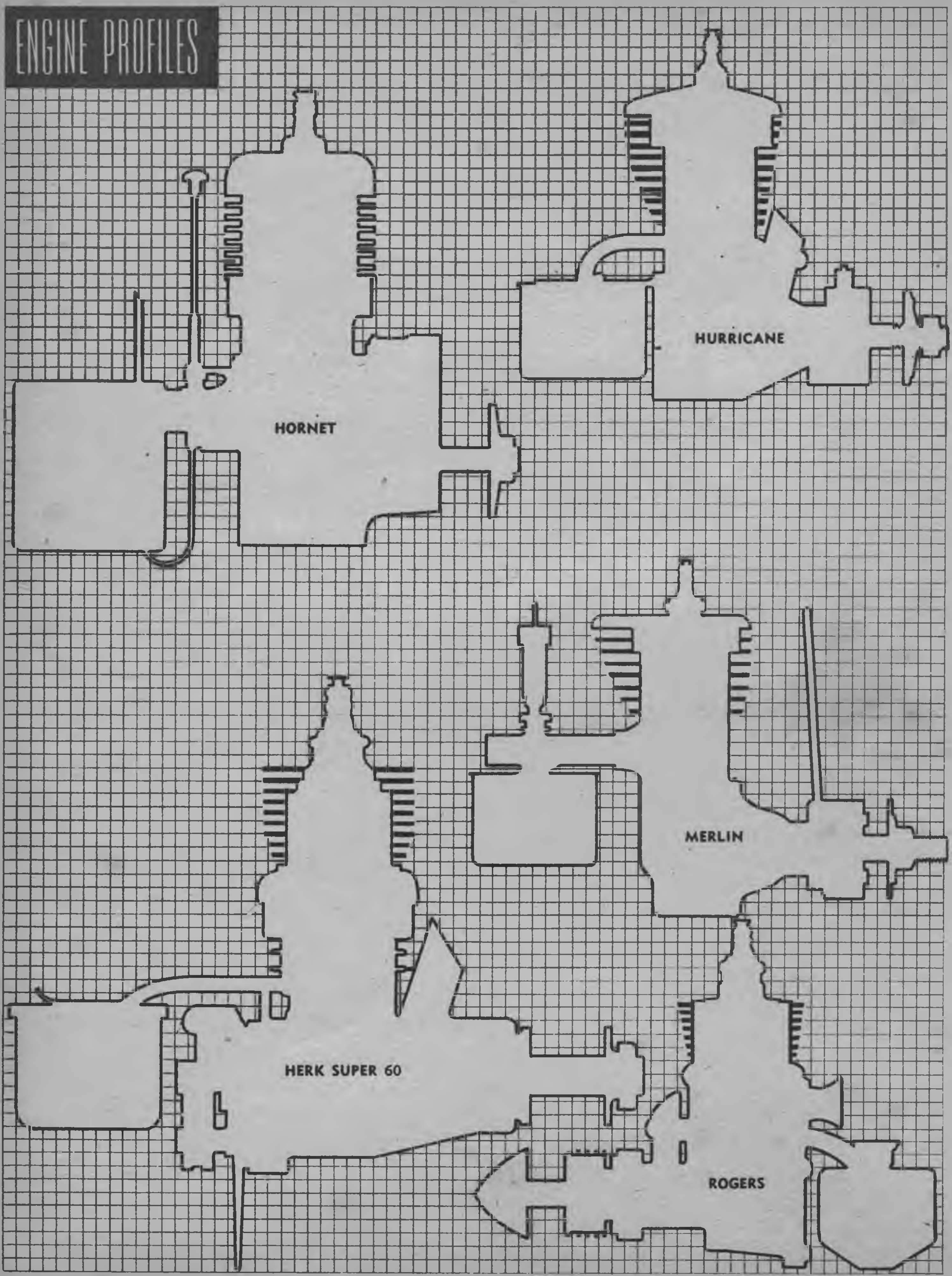

PHANTOM P-30

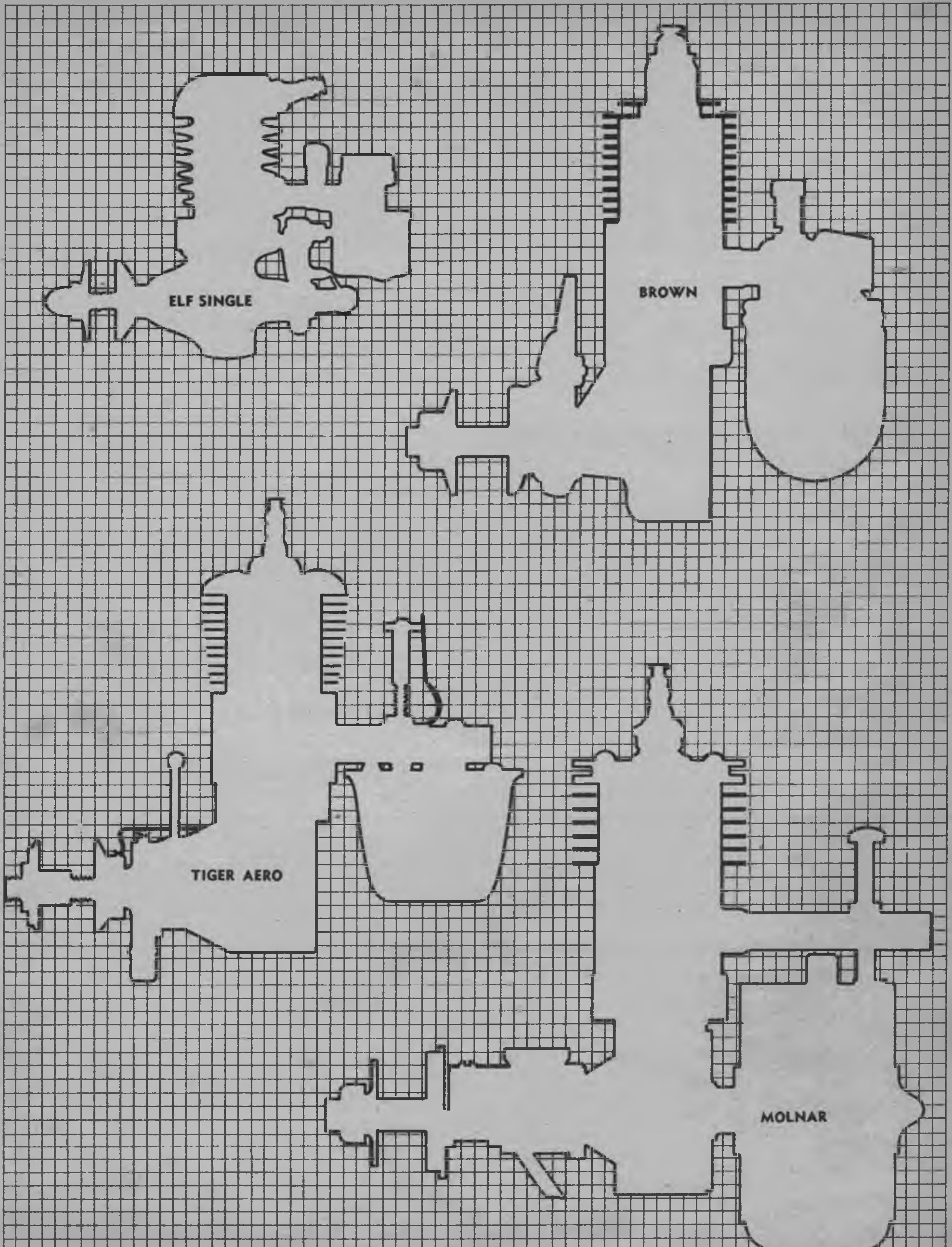
ENGINE PROFILES




ATOM
OHLSSON 23
BANTAM
ROCKET 46
MORTON M-5
FORSTER 29

ENGINE PROFILES





NEPPER

● A typical aluminum motor mount featuring right-angle bends to support the motor.

● The wooden bearers protrude through the firewall. Note gussets to strengthen mounts.

● Ample provision has been made to cool the motor in this motor and cowling installation.

● A unique motor installation in which the entire motor and ignition system is removable.

● A typical motor and track installation. The entire ignition, motor unit and landing gear are removable. Track is held in guides within fuselage.

ENGINE INSTALLATIONS

● In this mounting, the motor timer is mounted directly with the motor. Note needle valve.

● Multi-engined stuff. We can't say that it's good, but we can safely state that it's different.

● A flying scale installation. Note scale prop and gas tank in the top of the fuselage cowl.

● Another gas tank in the t of the fuselage. A very nov method of mounting the "Atom

RUBBER

PITY the orphan, for surely rubber models are the only true models to be affected by the duration. Our only hope is that it will be less than the proverbial six months. There have been many substitutes all the way from the synthetic to the cut-up inner tubes. None have sufficed, and only the will and spirit of the builders have kept this phase of modeling from dying out entirely.

Returning GI's bring stories from all over the globe, relating the progress of the builders in the various nations in which they were stationed. It is evident the fortunes and the progress of the war did little to hamper their ambitions and building and designing abilities.

From all reports, they are planning to wrest the Wakefield Trophy from the good old U. S. We can't afford to rest on our laurels and the old stand-bys such as Korda, Lanzo, and all the rest had better come out of hibernation and start bearing down to maintain our superiority in this field.

As for the flying scale boys, the time will come when you will no longer have to confine your models to the show shelves. So we should see a real spurt of building activity in flying scale, and the progress that was under way prior to the war should be renewed. The amazing times that were racked up in the last Nationals should constitute a real threat to the endurance boys.

● The author displays his model. Note the flying and scale propellers, finish and scale details.

STINSON 125

By Earl Stahl

THIS STINSON IS THE FIRST OF A SERIES OF FLYING SCALE MODELS OF POSTWAR PLANES. THIS FEATURE WILL BE BROUGHT DIRECTLY FROM THE DESIGN DEPARTMENTS OF THE MANUFACTURERS.

THE eyes of the aviation world are gradually becoming focused on the postwar personal plane. It is only natural that the thousands upon thousands of war-trained pilots and crews will want to continue to fly once they return to a more normal, peacetime existence. And the aircraft industry with its tremendous facilities for the production of fighting craft will undoubtedly project its experience in design and construction into the family plane field. With these conditions existing, private flying will boom.

In all probability, the new private planes will follow closely the prewar patterns but with many refinements for safety and comfort.

Such a plane is the new Stinson "Voyager 125" which inherits the appearance, safety, and reliability of the prewar "Voyager" as well as the ruggedness and utility of the remarkable Stinson "Flying Jeep," workhorse of the Army for observation, liaison, and ambulance work.

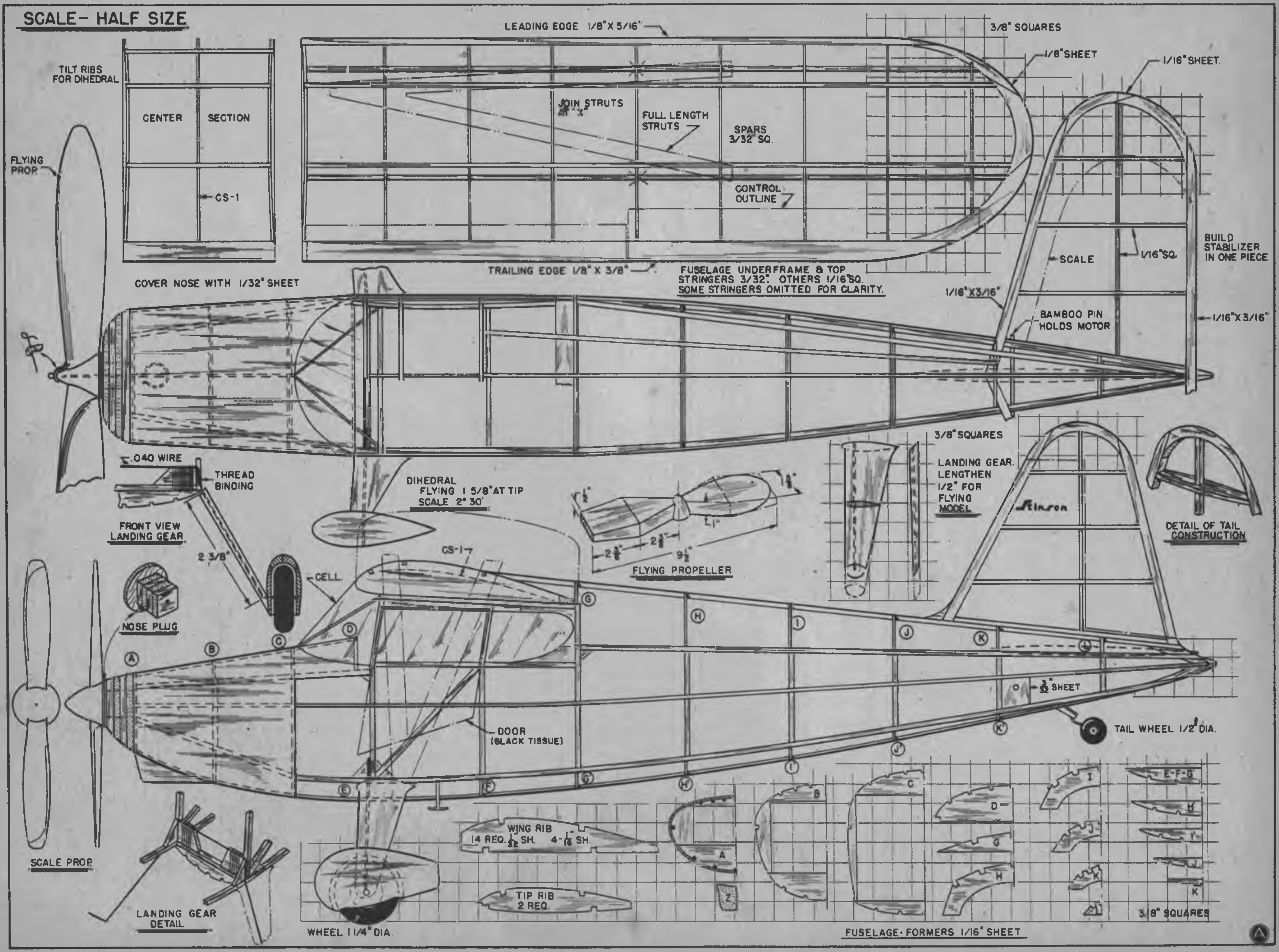
Powered by a 125-horsepower Lycoming engine, the new "Voyager" carries four persons with speed and comfort. At a cruising speed of 112 miles per hour the plane has a range of more than 450 miles, a most worthy feature for the cross-country traveler. That the ship can operate from small fields such as a pasture, golf course, or even a large backyard, free of obstructions, is reflected in the fact that the take-off run is only 550 feet and the landing roll is merely half that distance. Construction consists of a metal underframe with fabric covering. The conservative aerodynamic and structural design of the prototype make possible a fine flying craft that may be built with ease.

Large models fly best,but, unfortunately, space limitations require that the plans be reduced to half size so they should be enlarged in order that work can be done directly atop them. However, those desiring a smaller model can use the plans just as they are with complete success.

Usual model building practices are followed throughout and construction for that reason is extremely easy. Now that balsa wood is available again, it is recommended that it be used for all assemblies; regular colorless, quick-drying cement is used to join the parts. Remember that the reward for neat, careful work is a better appearing, zippier performing model.

CONSTRUCTION: Start by building the fuselage; this consists of an underframe of $\frac{3}{32}$" sq. stock about which formers and stringers are mounted to derive the scale appearance. This underframe establishes the correct angular relation of the wing to stabilizer as well as their relation to the thrust line, so reproduce it accurately. Build the two sides of the underframe, one above

(Turn to page 96)

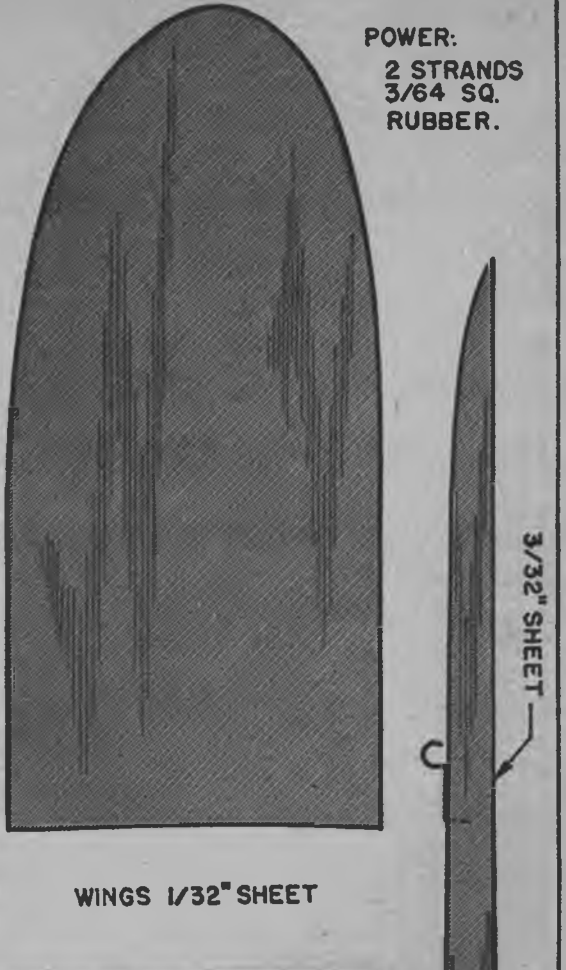

SCALE- HALF SIZE
TILT RIBS FOR DIHEDRAL
CENTER SECTION
CS-1
FLYING PROP
LEADING EDGE 1/8" X 5/16"
JOIN STRUTS AT "X"
FULL LENGTH STRUTS
SPARS 3/32" SQ.
CONTROL OUTLINE
TRAILING EDGE 1/8" X 3/8"
3/8" SQUARES
1/8" SHEET
1/16" SHEET.
SCALE
1/16" SQ.
BUILD STABILIZER IN ONE PIECE
COVER NOSE WITH 1/32" SHEET
FUSELAGE UNDERFRAME & TOP STRINGERS 3/32". OTHERS 1/16" SQ. SOME STRINGERS OMITTED FOR CLARITY.
1/16" X 3/16"
BAMBOO PIN HOLDS MOTOR
1/16" X 3/16"
.040 WIRE
THREAD BINDING
FRONT VIEW LANDING GEAR
2 3/8"
DIHEDRAL FLYING 1 5/8" AT TIP SCALE 2° 30'
1/2"
1/8"
1"
2 3/8"
2 3/8"
9 1/2"
FLYING PROPELLER
3/8" SQUARES
LANDING GEAR. LENGTHEN 1/2" FOR FLYING MODEL
Stinson
DETAIL OF TAIL CONSTRUCTION
CS-1
CELL
NOSE PLUG
A
B
C
D
G
H
I
J
K
L
3/32" SHEET
TAIL WHEEL 1/2" DIA.
DOOR (BLACK TISSUE)
E
F
G
H
I
J
K
SCALE PROP
LANDING GEAR DETAIL
WING RIB 14 REQ. 1/32" SH. 4-1/16" SH.
TIP RIB 2 REQ.
WHEEL 1 1/4" DIA.
A
Z
B
C
D
G
H
I
J
K
E-F-G
H
I
J
K
3/8" SQUARES
FUSELAGE-FORMERS 1/16" SHEET
A

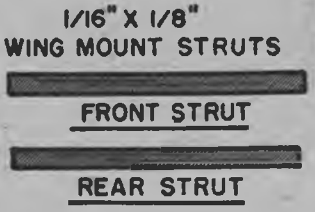
ANOPHELES

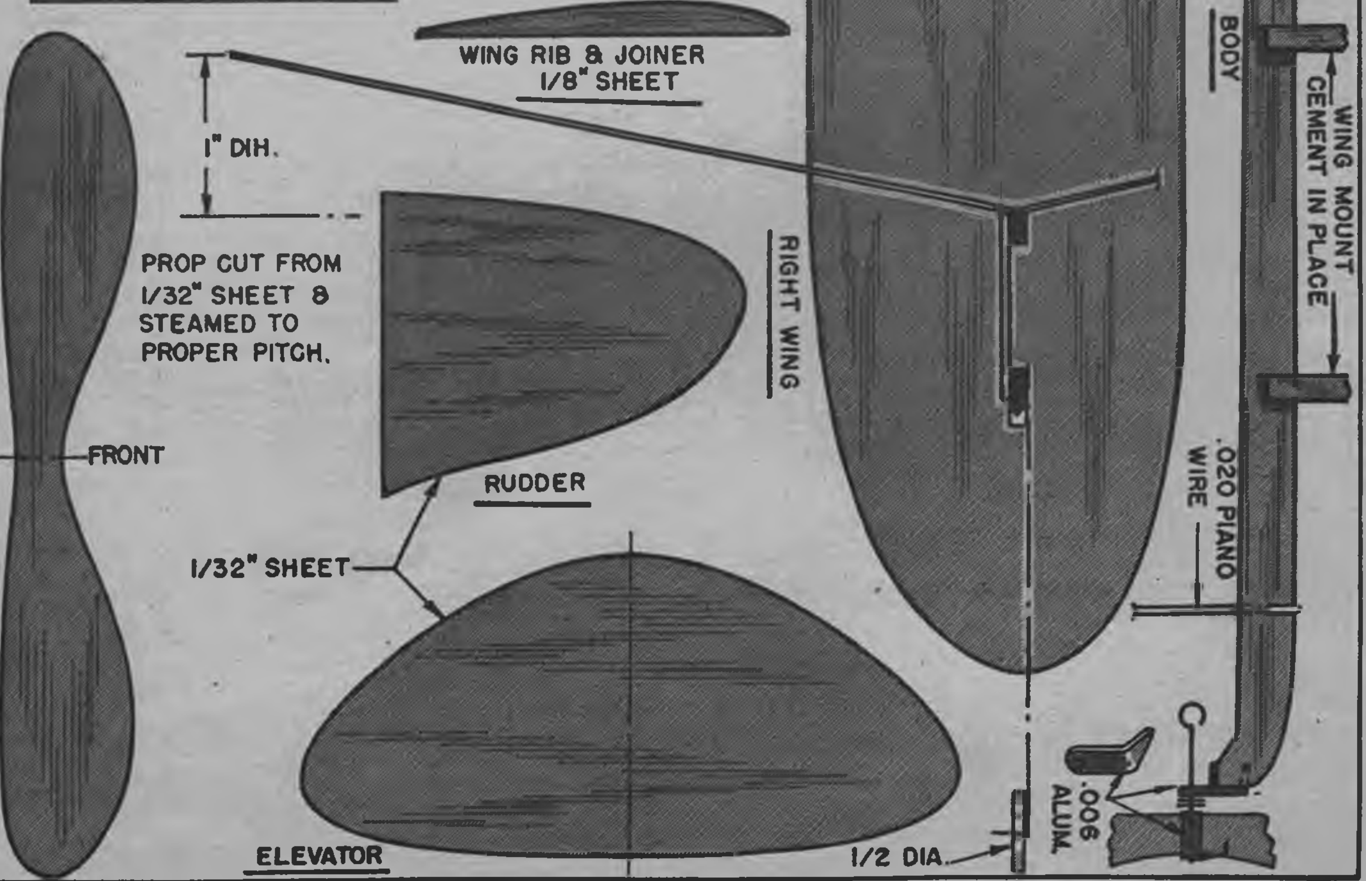
By Louis Garami

AN HOUR, THAT'S ALL, TO MAKE THIS FEATHERWEIGHT PARLOR PURSUIT

ANOPHELES—Mosquito to you—was designed for tight circles in confined areas. A little model, it had big design problems. Turns had to be consistent despite steadily diminishing power output of a rubber motor. Precision flight was achieved by this combination. We wanted the model to turn with torque; to make the circles tight we used left rudder. Ordinarily, left rudder plus torque effects make a model spiral dive. So, we made the left wing longer than the right and twisted the left wing tip to have about 3/32" washin or increased incidence. On 75 to 100 turns, the Mosquito makes three to four precise turns of the room. You can make it land on a handkerchief with a little practice.







TIGER PUSS

By Paul Plecan

SOME fellows like 'em slick and lean, others like em square and sturdy—it's hard to please everyone. But Tiger Puss is a design that should answer the demand for a sturdy, reliable, and good-looking contest model. A proven "box" design has been cleaned up, and, with the addition of a "Tigershark" cowling, has resulted in a snappy-looking model. Built under trying conditions, Tiger Puss has pulled through in fine fashion and has shown its strength and stability in countless flights. Since the construction is conventional, we'll mention only those items which require special care.

In assembling the two sides of the fuselage on the workbench, be sure that all the diagonals (stations B to G) are in place before removing the framework from the bench. This will help in preventing distortion. Once the fuselage is assembled, the nose section should be "filled in" with ⅛″ sheet (see pieces marked P and Q in construction sketch). By filling in the inside portion of the nose, the corners can be sanded later to blend with the lines of the prop spinner. The landing gear should be cemented in place before covering of the fuselage is attempted. Do not cover the rear end of the cowling, as it is the outlet for the air that enters the cowl opening in piece "R". A small opening between stations I and J may be left uncovered on the bottom to allow access to the rubber motor. Wing mount former "U" should be added now, the windshield being the last piece of work on the fuselage.

Since it will probably be necessary to use some down and right thrust in adjusting the model, it will help to sand the nosepiece at an angle to provide a small amount of "built-in" down and right thrust.

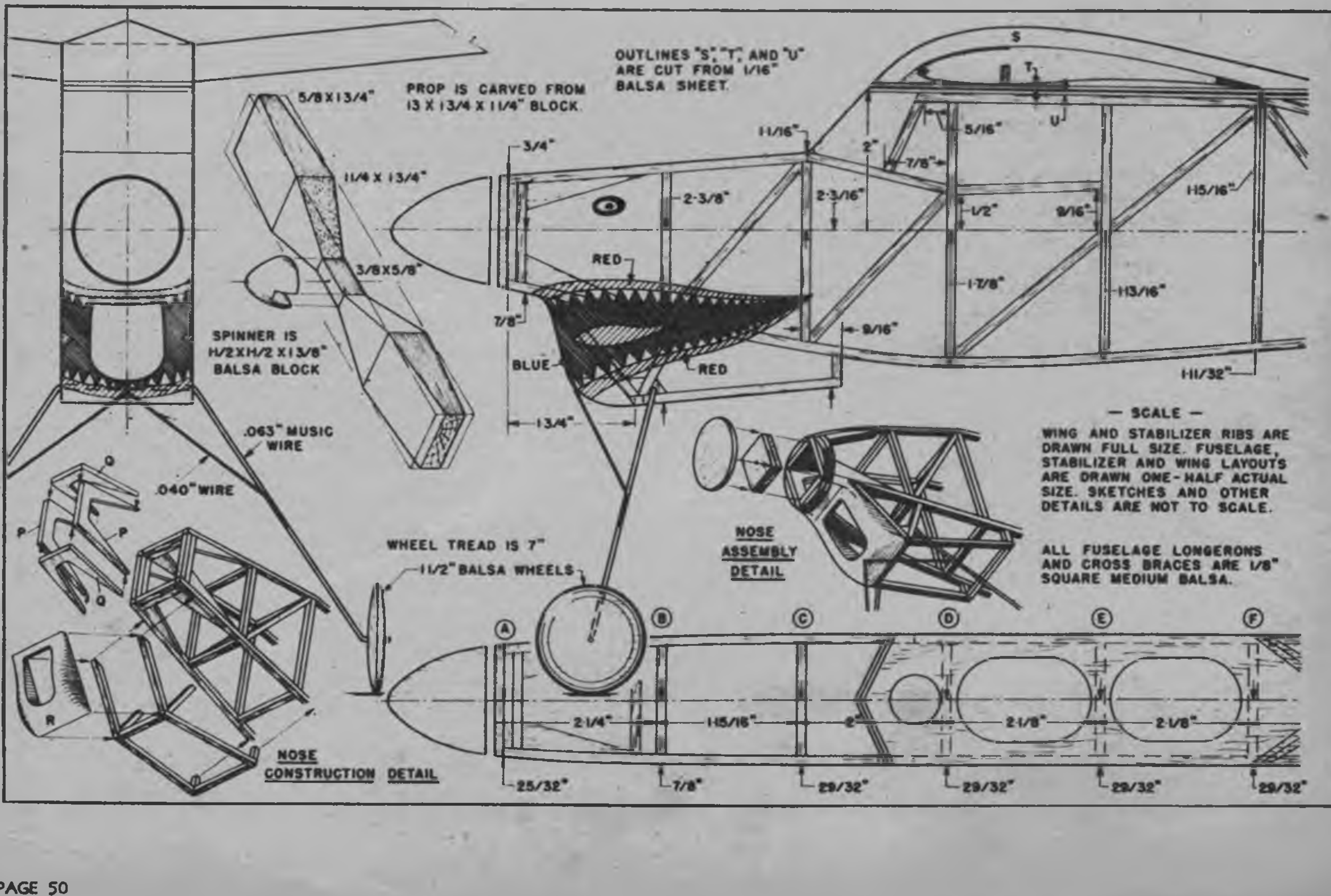
Wing and stabilizer construction is orthodox—the only unusual item here being the fairing "S" on the center section which blends into the lines of the fuselage. A platform, "T," is cemented to the under side of the wing, to match the shape of the top of the fuselage where the wing is attached. In covering and doping the wing, warp a slight amount of "washin" into the right wing panel—about ⅛″ will do. Rudder construction and material dimensions for it are included in the plans. Small hooks, bent from .020″ wire, should be cemented to the fuselage slightly forward of station "D," others at "F," to provide an anchorage for the rubber bands that will hold the wing in place.

To obtain the proper performance, employ a 13″ prop of the dimensions shown on the plans. Use only 1/16″ or less undercamber in the prop, and keep the blade section thin out near the tips. Silk or tissue can be used as a covering to reinforce the prop blades. Eighteen strands of ⅛″ flat rubber will provide ample power for sport flying, but up to 24 strands can be used if you have had experience in adjusting high-powered contest models. The best results can be had by using 3 inches of slack in the motor (that is, if you can get enough rubber) and a ball-bearing thrust washer, in conjunction with a folding prop. If you aren't too eager, a plain, freewheeling attachment will do in place of the more complicated folding prop.

Testing should be done in a grassy area, and should start with gliding tests from a low altitude to determine the model's trim. Once the glide has been smoothed out, use rudder offset to make the model circle to the right. Now powered flight should be attempted, in easy stages. As flight testing progresses, adjustments should be made with the noseplug only; for the flying surfaces should be let alone, once the performance in the glide is satisfactory.

The model should climb in fairly tight circles, and, through the proper use of washin and washout on the wing, should be made to circle without banking excessively. Too sharp a bank will sometimes throw the model into a spiral dive, which is the last thing you'd ever want to have your model do. Always strive to improve the glide—you want your model to *stay* up there! Properly built and adjusted, Tiger Puss will give you endless hours of flying enjoyment.

TIGER PUSS



PROP IS CARVED FROM 13 X 1 3/4 X 1 1/4" BLOCK.

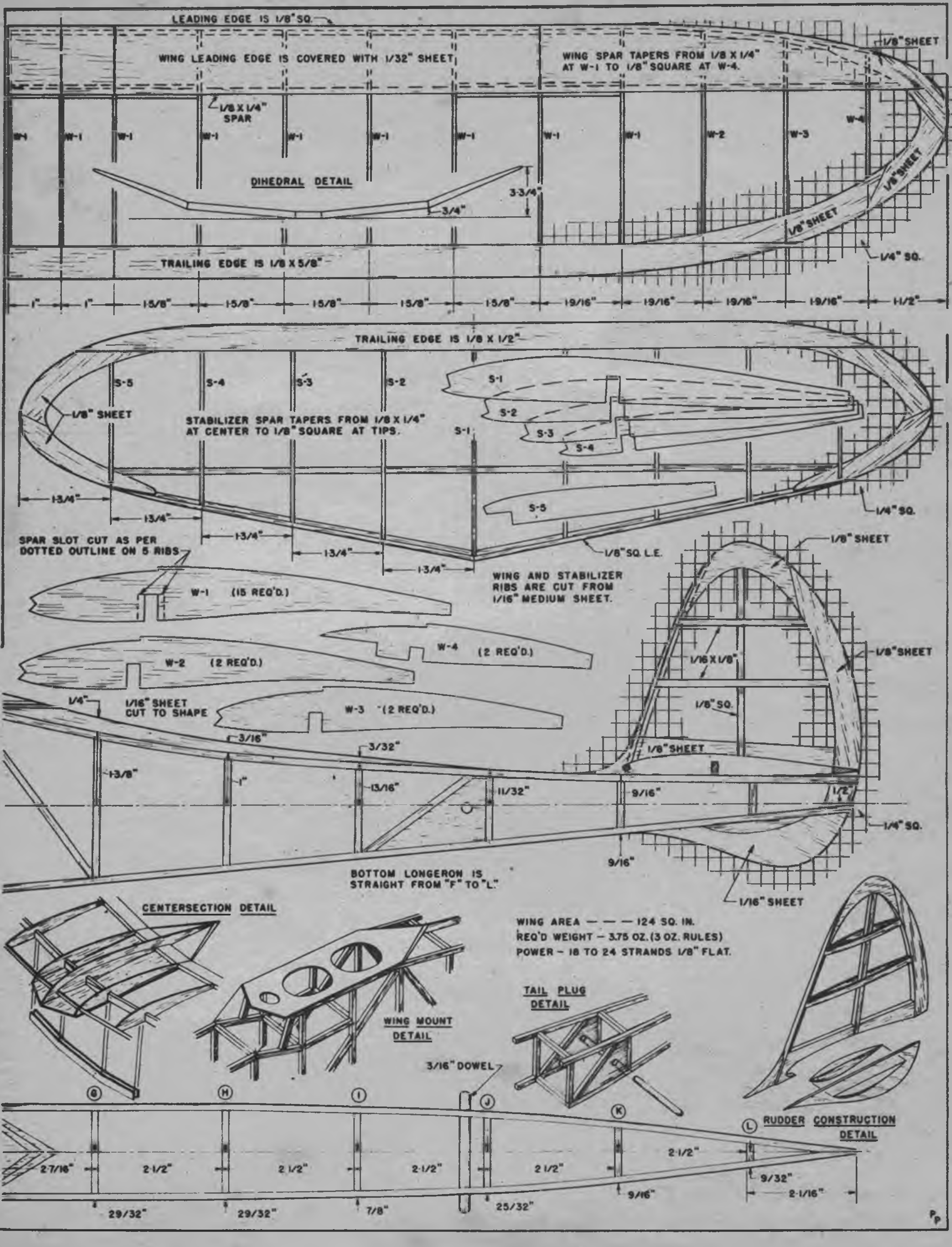
OUTLINES "S", "T", AND "U" ARE CUT FROM 1/16" BALSA SHEET.

SPINNER IS 1 1/2 X 1 1/2 X 1 3/8" BALSA BLOCK

— SCALE —

WING AND STABILIZER RIBS ARE DRAWN FULL SIZE. FUSELAGE, STABILIZER AND WING LAYOUTS ARE DRAWN ONE-HALF ACTUAL SIZE. SKETCHES AND OTHER DETAILS ARE NOT TO SCALE.

ALL FUSELAGE LONGERONS AND CROSS BRACES ARE 1/8" SQUARE MEDIUM BALSA.



WING AREA — — — 124 SQ. IN.
REQ'D WEIGHT – 3.75 OZ. (3 OZ. RULES)
POWER – 18 TO 24 STRANDS 1/8" FLAT.

GARAMI'S GIRO

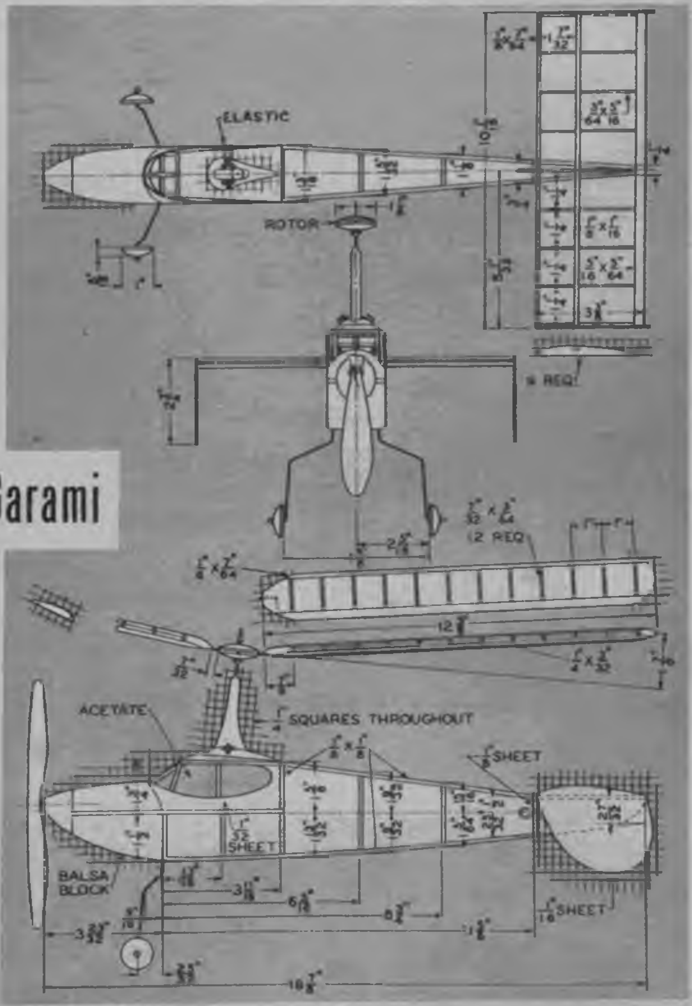
THIS model is the result of a dare. Too many fellows had told me that it was impossible to make a true Giro. Goldberg had made a Giro, but he used a wing. When the wing was removed it wouldn't fly, but even without the rotors it flew just as well. So now Goldberg and the others will have to eat their words.

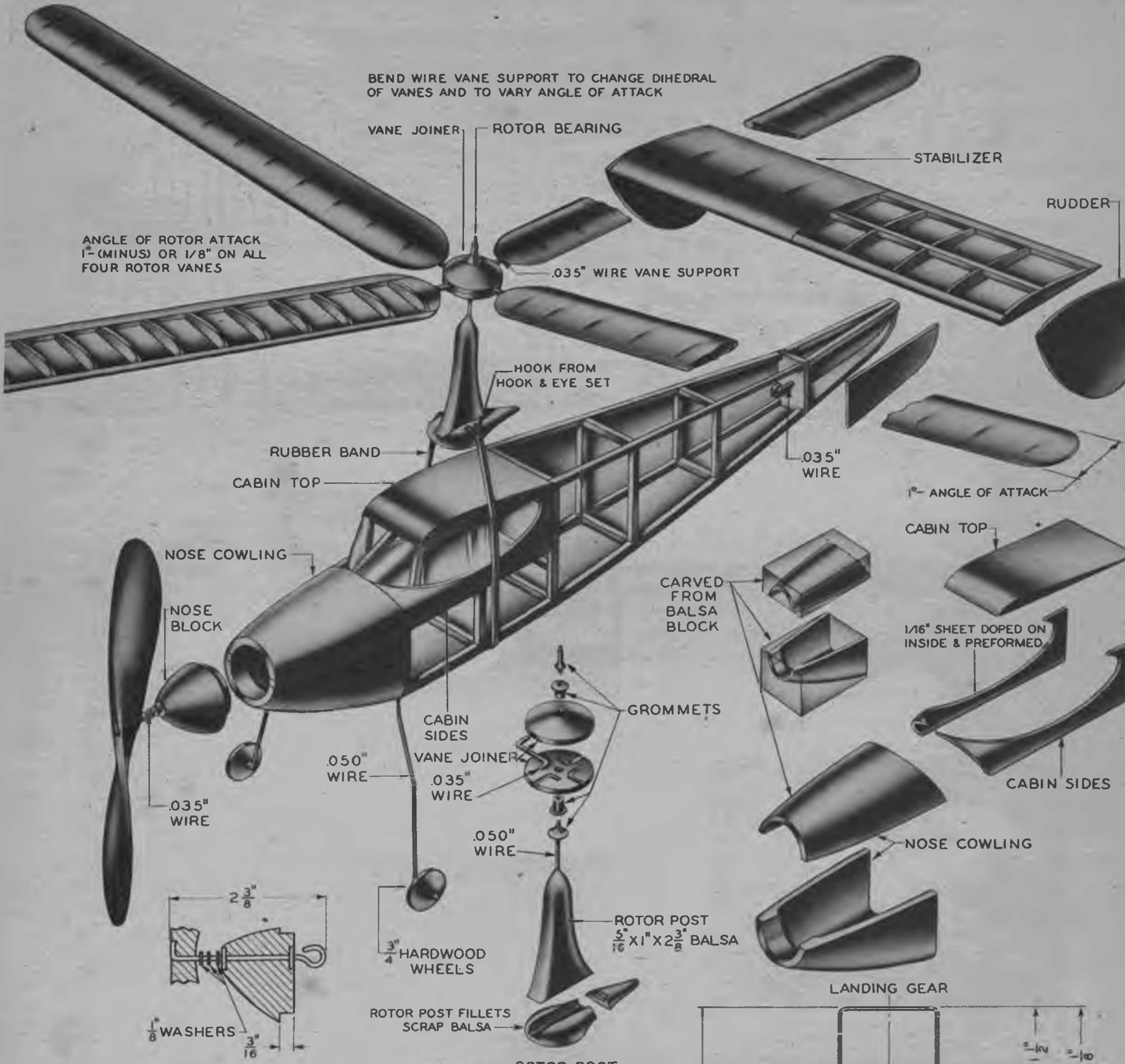
The original of this model was developed back in 1936, when Henry Struck made a stick model following my theory. The stick job flew quite successfully so I followed up with a cabin job which flew even better. It was quite small and in the indoor class "B," with a 20" rotor span. Many successful flights and lots of fun were had in the Jefferson Armory in Brooklyn.

This version is a refinement on the original models, and was developed for indoor and outdoor work. Much experimentation and developing was necessary to make this model fly successfully. It took one full day, in which over 100 test flights were made (*I know, because I chased 50% of the flights*—Model Editor), before the present force arrangements were developed. Starting with zero thrust it was finally changed to 10° down thrust. This was necessary to overcome the power stall at the beginning of the flight. Torque was quite a problem, but the down thrust gave the model more

(Turn to page 108)

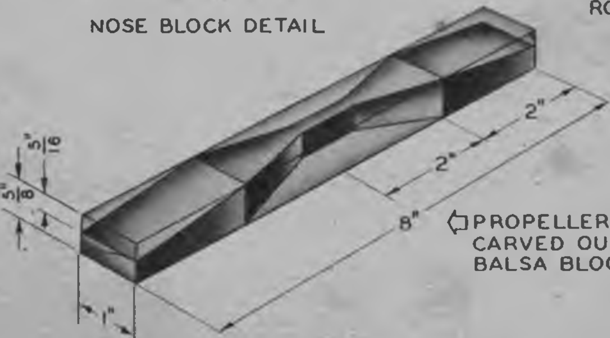
By
Louis Garami





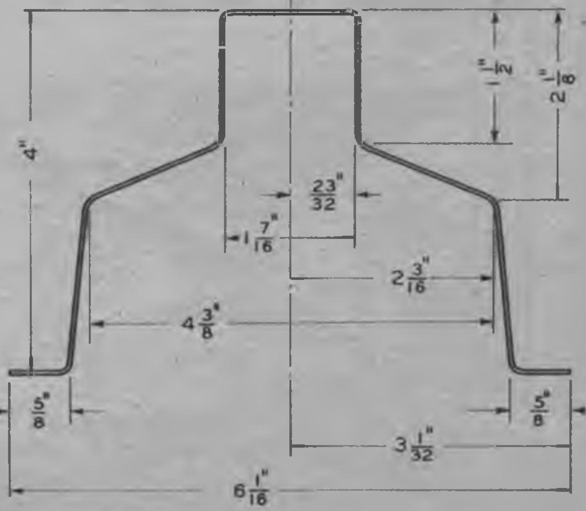
NOSE BLOCK DETAIL

ROTOR POST



PROPELLER CARVED OUT OF BALSA BLOCK

LANDING GEAR



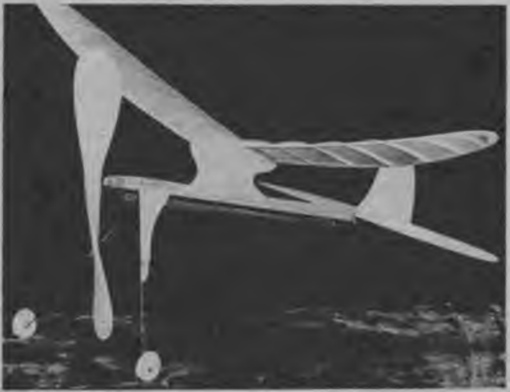
RUBBER TYPES

● Shades of 1930. Here is a fine sample of the famous old twin pushers. Though quite fast, they were very stable.

● A DC-8 in miniature, this pusher is fast, stable.

● A Wakefield type with a free-wheeling prop. Made of ersatz material, it flew well and met weight rules.

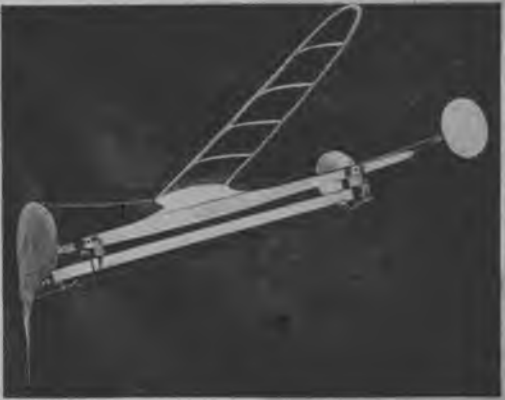
● Imagine rubber without Garami! This little duck of his featured a sheet balsa fuselage and a retracting gear.



● A simple little ROG that performed very well indoors and outdoors. Note landing gear fairing and spar-less wing.

● This little stick job features dihedral in the stab and twin rudders.

● Earl Stahl's Boulton Paul scale model had endurance, performance.



● The rubber motor and motor stick dropped off at end of power run.

● Another Wakefield type, this job featured shoulder wing, stab anhedral, and folding single-blade prop.

FREE FLIGHT GAS MODELS

THE end of the war means that at last we can go full speed ahead on all those plans we made. Great credit is due the kit manufacturers for the rapid change from duration to prewar quality of materials. Many manufacturers are contemplating entirely new lines in free flight; many are getting the good old stand-bys back into production, and the way balsa is getting back into the wood bins is a caution.

We can look for the greatest spurt in the history of free-flight design and building. The best of our designers were absorbed into the war program and original design was stymied by the lack of materials, by lack of guidance for the younger generation in the theory of free flight and design, and by lack of transportation to and from the flying field.

But, finally, the era of the portable fox-hole is about to end, and we will again be able to visit the local contests in comparative safety. No longer will the younger generation be able to toss those high-powered buzz bombs into the air with their usual lack of discretion. Now there'll be one of the old-timers around to set them straight.

We have turned that well known corner in the annals of free flight gas models, and the green light is on.

Wog

By William Winter

A CLASS B GASSIE DESIGNED TO PROVE THAT PYLONS ARE NOT NEEDED FOR CONTEST PERFORMANCE. HIGH ASPECT RATIO IS PART OF SECRET

● Author Winter with Wog 1. Dihedral was changed to polyhedral on final design for greater stability.

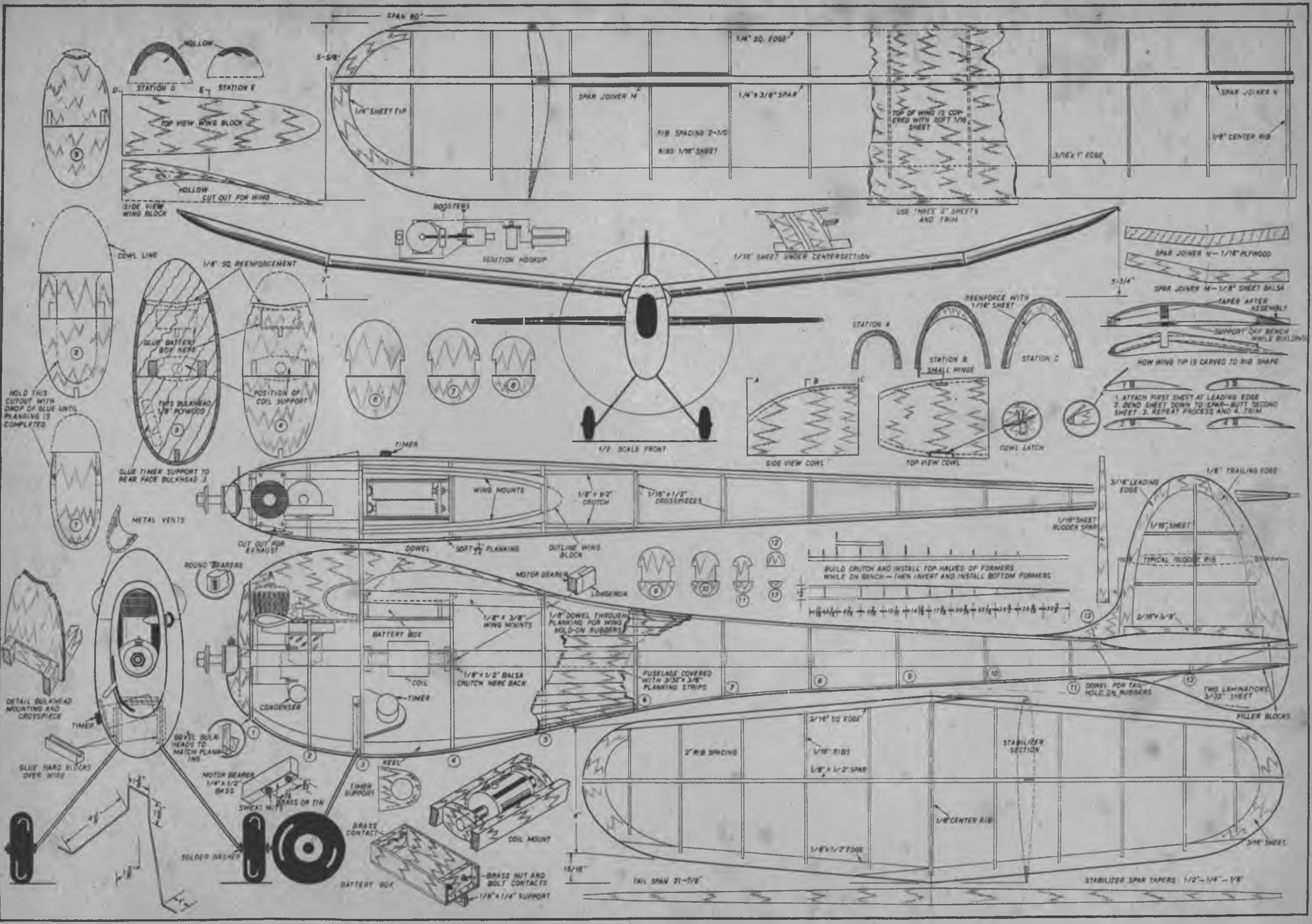
"WOG" (short for Polywog) was designed and built to prove a number of things and to disprove some others. Wog has proved most of the things it was designed to prove. It flies well, has good climb and glide and none of the vicious turn characteristics that lead to spiral power dives, is easily adjusted, and, as the boys on the field say, it is built like a brick outhouse.

It all began with a lunchtime discussion between three of the editors, Walt Schroder, an ex-editor now running his own kit design service, Ed Yulke, and the designer, as to whether, under present Academy of Model Aeronautics rules, power loadings—that is ounces of weight per cubic inch of engine displacement—weren't too low. At a contest the day before, numerous gassies had been observed in wild spiral power dives ending in wood-rending crashes. Too much power, the contestants had said almost to a man. Our discussion turned to ways and means of controlling excessive power. The problems involved proved so interesting that the resulting doodles ultimately led to these plans.

The designer had a soft spot for high aspect ratio wings. Would high aspect ratio control power? And could a high aspect ratio wing—we were talking ratios of ten or more to one—be constructed strong enough to defy a twisting at high speed, despite the fact that the popular NACA 6409 airfoil as used on Wog would be only 5/8 of an inch thick for a 60-inch wing span?

Problem number two proved to be adjustments. Adjustments can be elaborate and are many and varied. Walt Schroder suggested off-setting the thrust line of the motor to the left and, at the same time, giving the ship right rudder. On the plans of the Javelin (Air Trails Pictorial, August, 1944) right thrust purposely had been shown to prevent non-expert flyers from spiraling in their ships to the left under power, as left thrust could do (left

(Turn to page 92)

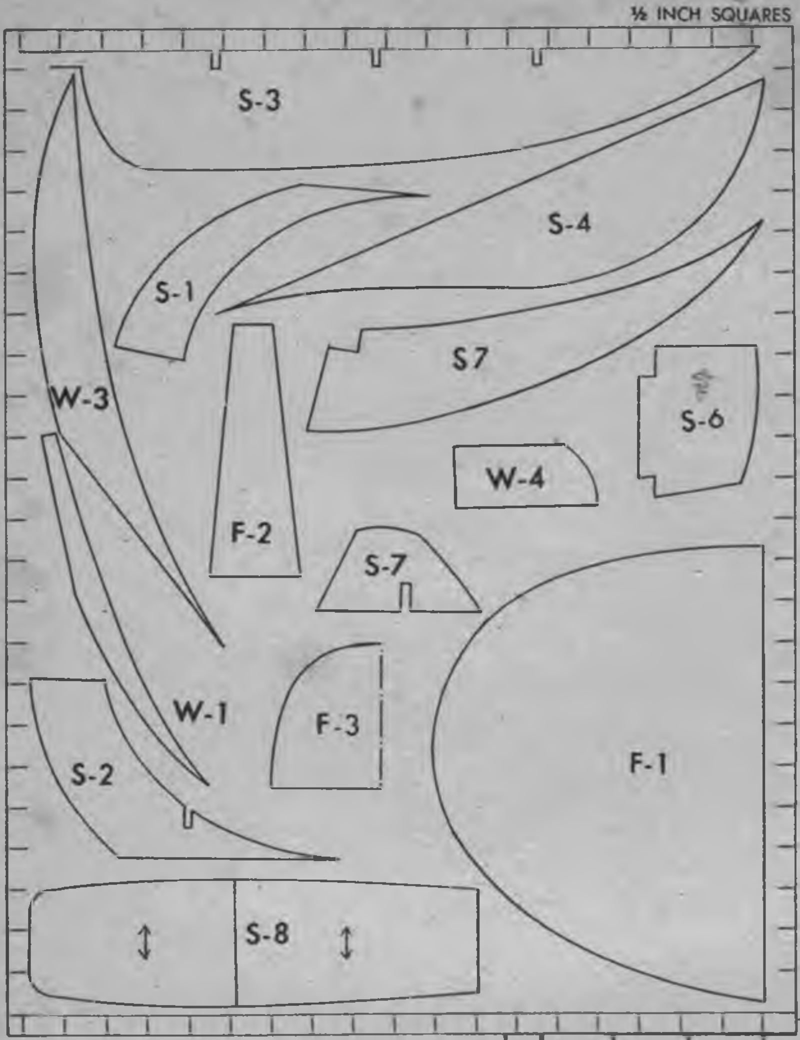

SPAN 60"
5-5/8"
HOLLOW
STATION D
STATION E
D
E
TOP VIEW WING BLOCK
HOLLOW
CUT OUT FOR WING
SIDE VIEW WING BLOCK
1/4" SHEET TIP
SPAR JOINER M
1/4" SQ. EDGE
1/4" x 3/8" SPAR
RIB SPACING 2-1/2
RIBS 1/16" SHEET
TOP OF WING IS COVERED WITH SOFT 1/16 SHEET
USE THREE 2" SHEETS AND TRIM
3/16" x 1" EDGE
SPAR JOINER N
1/8" CENTER RIB
BOOSTERS
IGNITION HOOKUP
1/16" SHEET UNDER CENTERSECTION
2"
5-3/4"
SPAR JOINER N — 1/16" PLYWOOD
SPAR JOINER M — 1/8" SHEET BALSA
TAPER AFTER ASSEMBLY
SUPPORT OFF BENCH WHILE BUILDING
HOW WING TIP IS CARVED TO RIB SHAPE
1
2
3
4
1. ATTACH FIRST SHEET AT LEADING EDGE 2. BEND SHEET DOWN TO SPAR—BUTT SECOND SHEET 3. REPEAT PROCESS AND 4. TRIM
COWL LINE
1/8" SQ. REENFORCEMENT
GLUE BATTERY BOX HERE
THIS BULKHEAD 1/8" PLYWOOD
POSITION OF COIL SUPPORT
HOLD THIS CUTOUT WITH DROP OF GLUE UNTIL PLANKING IS COMPLETED
GLUE TIMER SUPPORT TO NEAR FACE BULKHEAD 3.
1
2
3
4
5
6
7
8
9
10
11
12
13
1/2 SCALE FRONT
STATION A
STATION B
SMALL HINGE
STATION C
REENFORCE WITH 1/16" SHEET
A
B
C
SIDE VIEW COWL
TOP VIEW COWL
COWL LATCH
TIMER
WING MOUNTS
1/8" x 1/2" CRUTCH
1/16" x 1/2" CROSSPIECES
CUT OUT FOR EXHAUST
DOWEL
SOFT 3/32 PLANKING
OUTLINE WING BLOCK
1/16" SHEET RUDDER SPAR
3/16" LEADING EDGE
1/8" TRAILING EDGE
1/16" SHEET
TYPICAL RUDDER RIB
3/16" x 3/8"
METAL VENTS
ROUND BEARERS
MOTOR BEARER
LONGERON
BUILD CRUTCH AND INSTALL TOP HALVES OF FORMERS WHILE ON BENCH — THEN INVERT AND INSTALL BOTTOM FORMERS
1/8" x 3/8" WING MOUNTS
1/8" DOWEL THROUGH PLANKING FOR WING HOLD-ON RUBBERS
BATTERY BOX
COIL
1/8" x 1/2" BALSA CRUTCH HERE BACK
TIMER
CONDENSER
FUSELAGE COVERED WITH 3/32" x 3/8" PLANKING STRIPS
DOWEL FOR TAIL HOLD ON RUBBERS
TWO LAMINATIONS 3/32" SHEET
FILLER BLOCKS
DETAIL BULKHEAD MOUNTING AND CROSSPIECE
TIMER
GLUE HARD BLOCKS OVER WIRE
BEVEL BULKHEADS TO MATCH PLANKING
MOTOR BEARER 1/4" x 1/2" BASS
SWEAT NUTS
BRASS OR TIN
KEEL
TIMER SUPPORT
SOLDER WASHER
BRASS CONTACT
BATTERY BOX
COIL MOUNT
BRASS NUT AND BOLT CONTACTS
1/16" x 1/4" SUPPORT
3/16" SQ EDGE
2" RIB SPACING
1/16" RIBS
1/8" x 1/2" SPAR
STABILIZER SECTION
1/8" CENTER RIB
1/8" x 1/2" EDGE
3/16" SHEET
4"
15/16"
TAIL SPAN 21-7/8"
STABILIZER SPAR TAPERS 1/2"—1/4"—1/8"
4 1/2"
1 1/2"

THE WANDERER

By Sidney Michaels

HERE IS THE ONE MODEL THAT CAN PLEASE ALL BUILDERS. SIMPLICITY, RUGGEDNESS, AND REALISM PUT THIS JOB IN A CLASS ALL BY ITSELF

● The simple beauty is very apparent in this view of the model. Note the effective and streamlined motor cowling fairing into fuselage.



(This model published with the permission and courtesy of the Eagle Model Aircraft Co., Brooklyn, New York.—Editor)

SIMPLICITY, ruggedness, and conventional styling was the paramount aim in the design of the Wanderer. Too much emphasis has been given to ultra-streamlining and the mystery of high-performance design and no thought whatever to Mr. Average Guy who just likes to fly for the fun of it. We all like to attend the contests and see the excitement, but most of all we want to fly and perhaps go home with some hardware. However, we also want to take home our models in one piece.

Here, in the Wanderer, there is the ability to fly without all the mysterious adjustments so necessary to the weird arrangements and design of the average contest job. Given an even chance, this little baby will more than hold its own with the so-called experts.

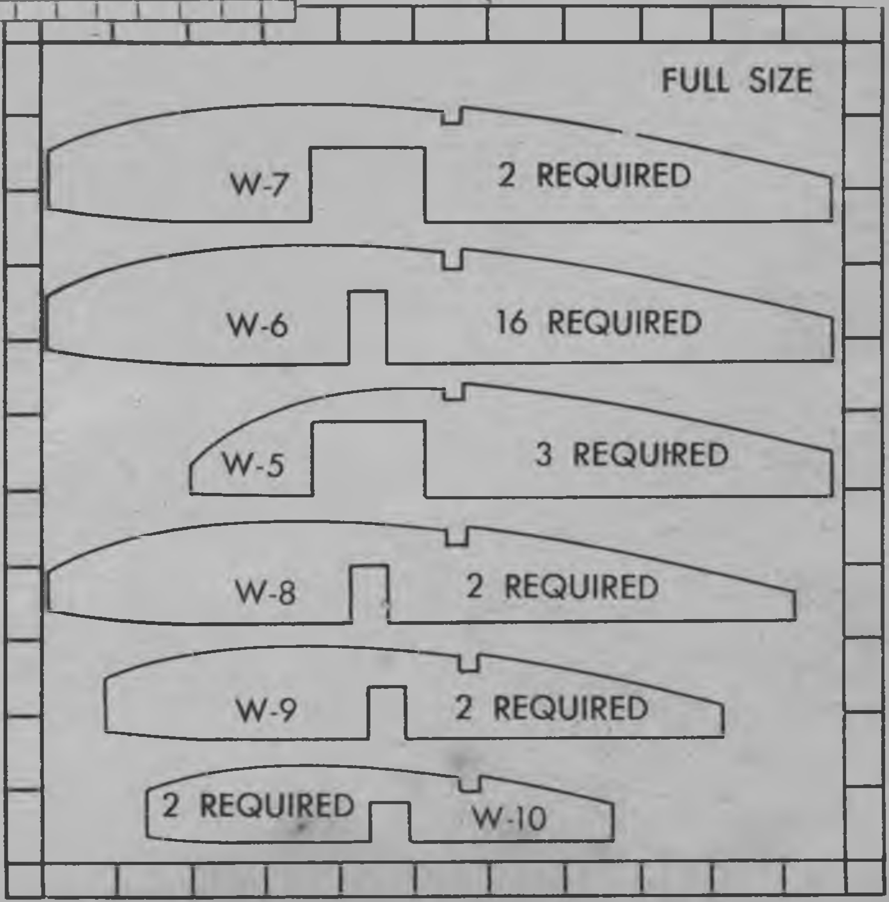
Designed primarily for the Forster 29, this class B job will take any class B or small C motor up to .35 displacement. With a wing span of 55½", 347 square inches of wing area, and a Clark Y rib section, the Wanderer has an exceptionally slow glide with very little sinking speed. The high aspect ratio (9 to 1) wing adds to the over-all stability of the model and it's one of those rare jobs that will fly right off the work bench.

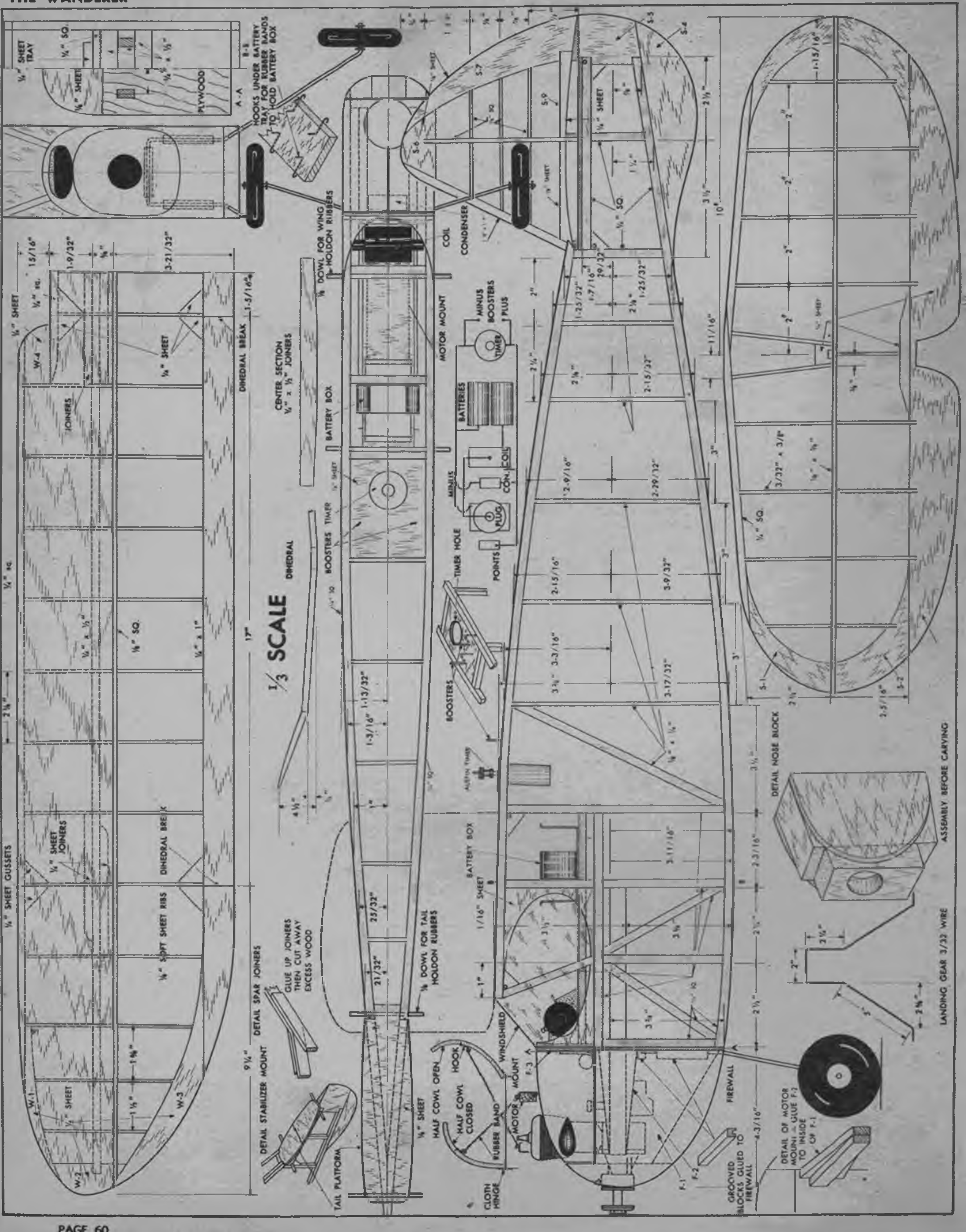
Construction: The plans are complete with all dimensions and as there are no complex curves it should be easy to scale the plans to full size. The simple rectangular fuselage of ¼" sq. longerons and ¼" sq. and ¼ x ⅛" crosspieces and uprights is easy to assemble. I would suggest setting down one side of the fuselage and then placing the other side directly over the other. This will guarantee perfect side members. When dry, use a thin double-edged razor blade to separate the two sides. The nose cowling may present some trouble, but with the assembly drawing on the plans, plus a little time and care, you should have a very neat job. Do not try to put the motor in place until the cowling has been completed.

After rough-forming and sanding the cowling to shape, cut a circular hole in the top of the cowl in the center and at the distance from the front of the fuselage as shown on the top view. Cut this hole so that the cowling fits snugly about the cylinder head of the motor. Now slit the top of the cowling down the center of the cowl. Also cut this cowl free from the noseblock and on both sides. The cut on the sides should be even with the top of the ¼" square cabin longeron. These points are shown on the side drawing. Use cambric or cloth to make the hinges and make .035 wire hooks as shown in the cowling detail drawing. Use fine rubber bands to actuate and hold the cowling in a set position. After covering the inside of the cowling with two or three good coats of dope you can insert the motor. The wing, rudder, and stabilizer are of a conventional type and do not require any explanation.

Flying: Make a rough check-up before attempting to test-fly or test-glide the model. Make certain that there are no warps, that there is no misalignment between the surfaces, and that the model ha —

(Turn to page 104)




1/3 SCALE
1/16" SHEET TRAY
1/4" SQ.
1/16" SHEET
PLYWOOD
A-A
B-B
HOOKS UNDER BATTERY TRAY FOR RUBBER BANDS TO HOLD BATTERY BOX
15/16"
1-9/32"
3-21/32"
1-5/16"
1/8" SHEET
1/8" SQ.
W-4
1/4" SHEET
JOINERS
DIHEDRAL BREAK
1/4" SQ.
1/8" SQ.
1/8" x 1/2"
1/2" x 1"
17"
2 1/8"
1/16" SHEET JOINERS
1/16" SOFT SHEET RIBS
1/16" SHEET GUSSETS
1 5/8"
1 1/2"
W-1
W-2
W-3
9 1/2"
DETAIL SPAR JOINERS
GLUE UP JOINERS THEN CUT AWAY EXCESS WOOD
DETAIL STABILIZER MOUNT
TAIL PLATFORM
1/8" DOWL FOR WING HOLDON RUBBERS
CENTER SECTION 1/8" x 1/2" JOINERS
DIHEDRAL
BATTERY BOX
BOOSTERS
TIMER
4 1/2"
1-3/16"
1-13/32"
25/32"
21/32"
1"
1/8" DOWL FOR TAIL HOLDON RUBBERS
1/4" SHEET
HALF COWL OPEN
HALF COWL CLOSED
HOOK
RUBBER BAND
CLOTH HINGE
COIL
CONDENSER
MOTOR MOUNT
MINUS
BOOSTERS
PLUS
TIMER
BATTERIES
CON.
COIL
PLUG
POINTS
TIMER HOLE
AUSTIN TIMER
1/16" SHEET
WINDSHIELD
MOTOR MOUNT
MOTOR
F-3
A
F-1
F-2
FIREWALL
GROOVED BLOCKS GLUED TO FIREWALL
DETAIL OF MOTOR MOUNT — GLUE F-2 TO INSIDE OF F-1
S-1
S-2
S-3
S-4
S-5
S-6
S-7
S-9
1/4" SHEET
1/8" SQ.
1 1/2"
29/32"
1-7/16"
1-25/32"
2"
2 1/2"
2 1/8"
2-15/32"
2-9/16"
2-29/32"
2-15/16"
3-9/32"
3-3/16"
3-17/32"
3 1/4"
3-11/16"
3 1/2"
1/8" x 1/4"
3"
10"
11/16"
2 1/2"
3 1/2"
2-3/16"
4-3/16"
1-13/16"
3/32" x 3/8"
1/8" x 1/4"
1/8" SQ.
2-5/16"
DETAIL NOSE BLOCK
ASSEMBLY BEFORE CARVING
LANDING GEAR 3/32 WIRE
2 1/2"
2"
5"
2 5/8"

BANSHEE

By Lt. Leon Shulman

GUARANTEED FLIGHT PERFORMANCE, PLUS RADICALLY NEW CONSTRUCTION BY A DESIGN EXPERT

● The clean lines and well developed design with reduced drag is very apparent in these two views of the model.

(While the Banshee is a comparatively old model in years (the design was developed in 1941), it still is far ahead of all the models to date. The climb, we can safely state, is the fastest we have ever seen. The altitude gained in this climb guaranteed an out-of-sight flight every time the model was flown.—Model Editor.)

THE Banshee, with its weird, high-pitched wail, has astonished many a builder with its extremely fast climb and surprisingly flat glide. The Banshee has entered only two meets (you know, the war and all that) but it won both with the longest, most consistent flights of the meet. The best performance was turned in with three flights of six minutes each, all official.

The present Banshee design was achieved after several experiments with a rudderless design that would be spinproof. This design featured a stabilizer that was one-half the wing area and was of the inverted polyhedral type. After several modifications, this type of stabilizer was laid aside and the present, conventional type used. The Banshee has proven to be more stable and more consistent in flight in its present form than the present-day designs. This can be attributed to its force arrangement and clean design.

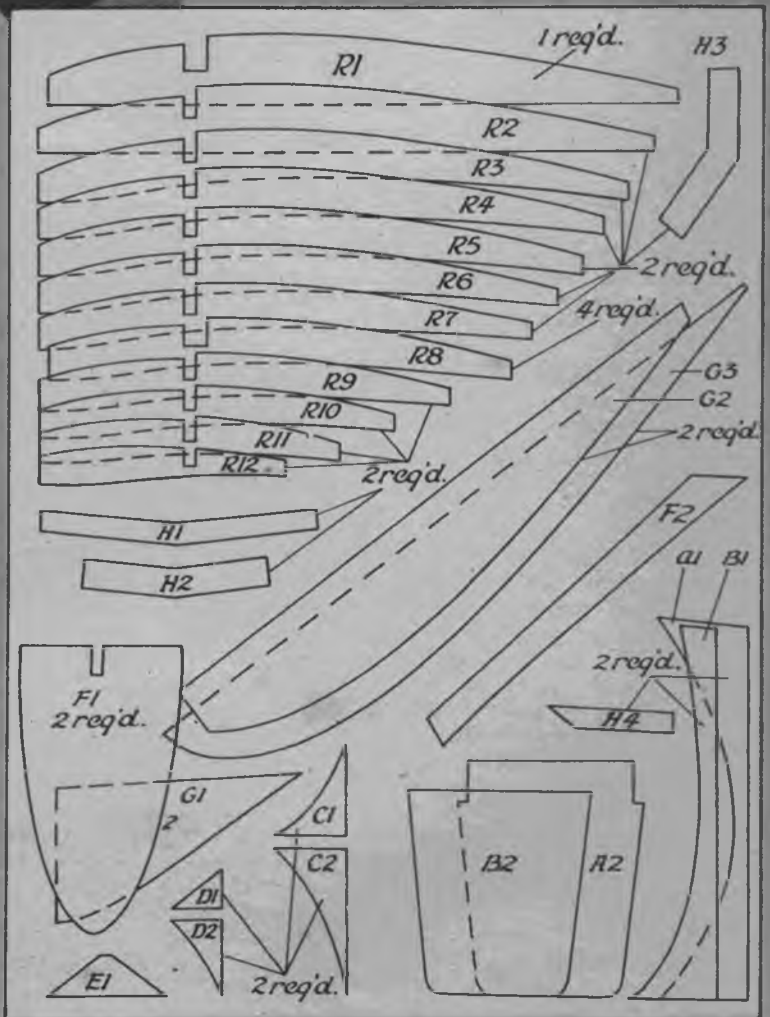
Theory: The theory upon which the Banshee is based has been proven practical by past designs. Past experience has shown that a low wing loading

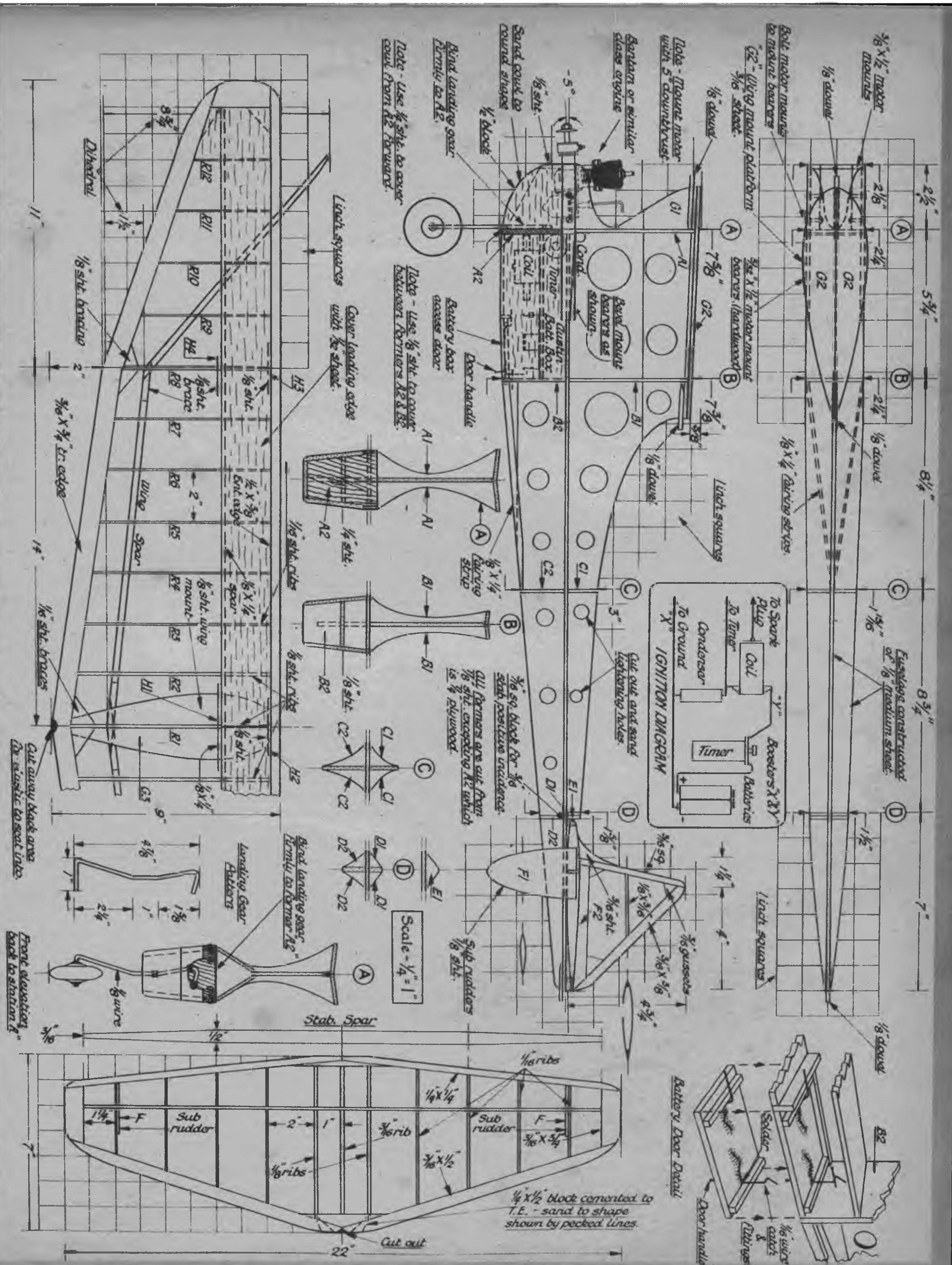
(Turn to page 88)

BANSHEE

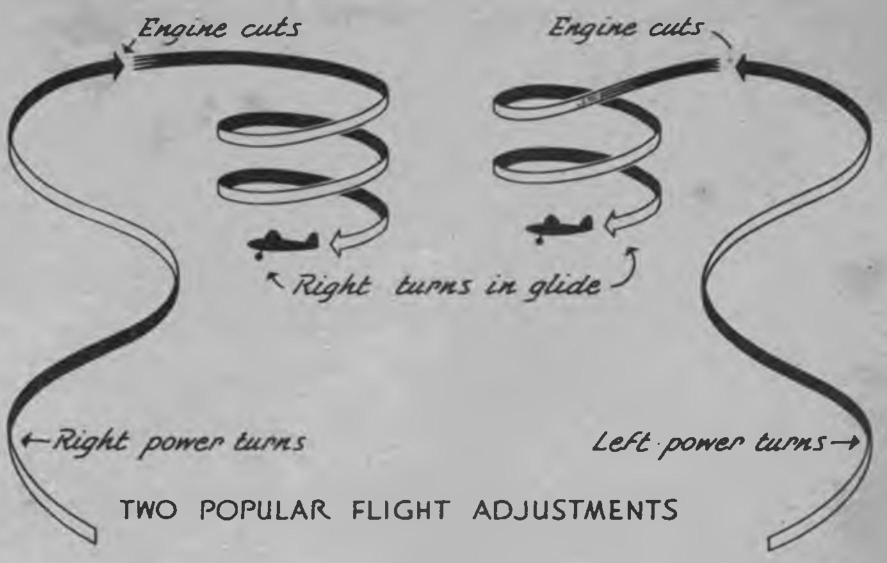

Tail Construction

Fuselage Construction

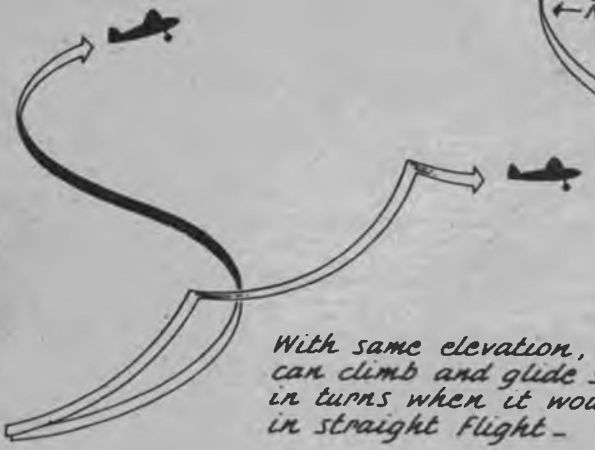



1/8"x1/2" motor mounts
Bolt motor mount to motor bearers
"G2" - Wing mount platform 3/16" sheet
1/8" dowel
Note - Mount motor with 5° downthrust
Bantam or similar class engine
-5°
1/8" sht.
Sand cowl to round shape
1/2" block
Bind landing gear firmly to A2
Note - Use 1/4" sht. to cover cowl from A2 forward.
Note - Use 1/8" sht. to cover between formers A2 & B2.
Battery box access door
Door handle
Coil
Timer
Cond.
Austin Batt. Box
Balsa mount bearers as shown.
3/8"x1/2" motor mount bearers (hardwood)
7 5/8"
7 3/4"
3/8"
3"
1 3/8"
1 1/4"
4"
4 3/4"
A
B
C
D
A1
A2
B1
B2
C1
C2
D1
D2
E1
F1
F2
G1
G2
G3
1 inch squares
1/8"x1/4" fairing strip
1/4" sht.
1/8" sht.
1/16" sq. block for 3/16 stab positive incidence.
All formers are cut from 1/8" sht. excepting "A2" which is 1/8" plywood.
Cut out and sand lightening holes.
IGNITION DIAGRAM
To Spark Plug
To Timer
Coil
Condenser
To Ground
"X"
"Y"
Boosters "X" & "Y"
Timer
Batteries
+
-
1/8"x1/4" fairing strips
Fuselage constructed of 1/8" medium sheet.
2 1/2"
2 1/8"
2 1/4"
5 3/4"
8 1/4"
1 1/16"
8 3/4"
1 1/2"
7"
3/16" sq.
1/16"x3/16"
3/16" sht.
1/16" gussets
3/16"x1/8"
Sub rudders 1/8" sht.
Dihedral
8 3/4"
1 1/2"
11"
2"
14"
9"
R12
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
H1
H2
H3
H4
1/8" sht. bracing
3/16"x3/4" tr. edge
1/16" sht. braces
Cut away black area for plastic to seat into.
Cover leading edge with 1/16" sheet.
1/8" sht. brace
1/4"x3/8" Ldg. edge
1/16" sht. ribs
1/8"x1/4" spar
1/8" sht. wing mount
Wing Spar
1/8" sht. ribs
1/8"x1/4"
Scale - 1/4" = 1"
Landing Gear Pattern
4 1/8"
2 1/4"
1"
1 1/8"
Bind landing gear firmly to former "A2"
1/8" wire
Front elevation back to station "A"
Stab. Spar
1/2"
3/16"
1/16" ribs
1/4"x1/4"
3/16" rib
1/8" ribs
3/16"x1/2"
3/16"x3/4"
Sub rudder
F
1 1/4"
22"
1/4"x1/2" block cemented to T.E. - sand to shape shown by pecked lines.
Cut out
Battery Door Detail
Solder
1/16" wire catch & fittings
Door handle

HERE IS THE FIRST MATERIAL ON THIS SUBJECT THAT HAS BEEN PREPARED FOR BOTH EXPERT AND NOVICE BUILDER..



TWO POPULAR FLIGHT ADJUSTMENTS



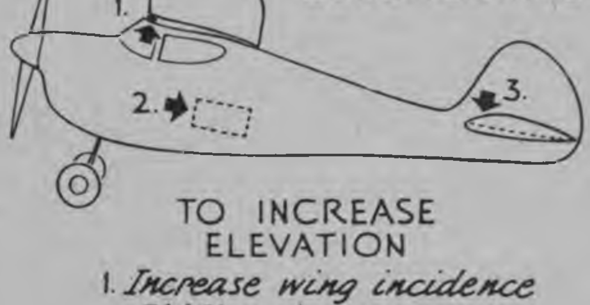
With same elevation, model can climb and glide smoothly in turns when it would stall in straight flight.

ADJUSTMENTS

TIME was when adjusting a model to fly properly was merely a matter of trimming it so that it neither stalled nor dived. Nowadays, you don't really start adjusting a model until it has been trimmed. It's the easy-to-learn, additional tricks that spell the difference between a model that just flies and one that flies like a bat out of the nether regions. Considering that these tricks are easily available to all of us, it is hard to understand why most of us ignore them so completely and then wonder why the other guy's airplanes make monkeys out of ours. An expert is merely a chap who is hep to adjusting his models.

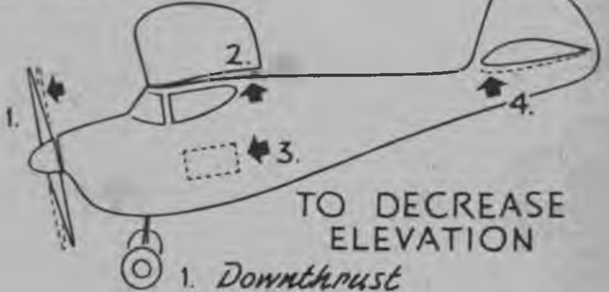
The model must balance before we can do anything. For gas models, the practice is to balance them at one-third the wing chord back from the leading edge. Two people can support the model by the wing tips to check the balance point. If the nose drops you should move your battery box back until the model trims. A detachable battery tray—the motor, bearers, ignition system, are mounted as one removable unit—facilitates trimming. If the tail drops, shift the weighty objects forward. It is not advisable to make your own first gas model design with a permanent installation of batteries, etc., for, unless you are lucky, your ship may be badly out of balance. Kits, of course, have been well tested, so as far as adjusting is concerned it doesn't matter too much what type of

LONGITUDINAL ADJUSTMENTS



TO INCREASE ELEVATION

1. *Increase wing incidence*
2. *Shift weight to rear*
3. *Decrease stabilizer incidence*



TO DECREASE ELEVATION

1. *Downthrust*
2. *Decrease wing incidence*
3. *Shift weight forward*
4. *Increase stabilizer incidence*

engine and ignition installation they have. If, despite your best efforts, the model remains slightly out of balance it is possible that it can be flown successfully anyway. But if it remains badly out of balance, it needs some reworking before it can be flown. Of course, if the design has a wing that can be shifted a bit both forward or back, the day is saved. For nose heaviness, move the wing forward until it balances properly; for tail heaviness, move the wing back.

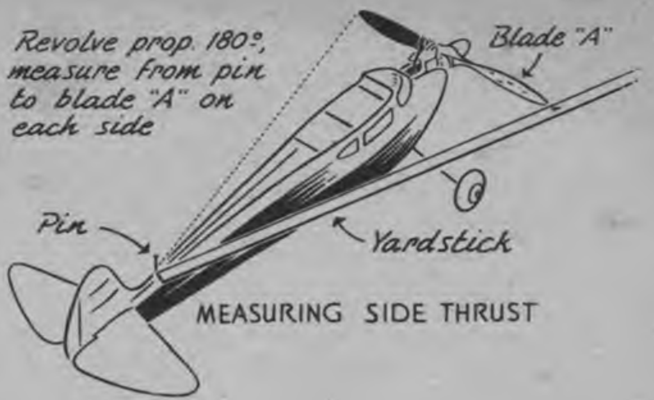
The model should first be hand-glided. Do this over tall grass, if possible. Crouch down and shove the model forward with plenty of speed at a point about 35 feet ahead of you. It should glide fast with the nose a trifle low. A slow glide with the nose carried a little high looks better, but the model will stall under power when so adjusted. If the glide seems tail-heavy, put a sliver of wood about 1/32 inch thick under the leading edge of the stabilizer. If the condition persists, add additional slivers of wood; these may be replaced later with one piece of the proper thickness glued in place. If the glide is obviously nose heavy, place slivers of wood under the leading edge of the wing.

Now, if the model had been badly out of balance in the beginning, you would have had to use excessive corrections in the angle of attack of the tail or the wing, leading to poor performance. When the model seems to glide properly, try it under power. Give it about 10 seconds' motor run at the minimum throttle setting that will fly the airplane. On most airplanes this means that the motor will be throttled down all the way. Hand-launch the model with a smooth, and not too violent, shove. Watch the way it flies. Is it tail heavy or nose heavy under power? How does it glide? This is the time to make more accurate adjustments to wing and tail to get perfect trim. With such a reduced power setting the model should either fly level or climb gently. Be sure you don't confuse the tendency of the model to "dip" when the power cuts with a stall.

The next step is to make the model turn. Torque usually makes the left wing drop down so that, under power, the airplane will tend to circle left. The more power you use the tighter that left circle. Under full power, most gas models will turn so tightly that they actually spiral faster and faster into the ground. So it is advisable to use right rudder, which tends to make the model turn right. Properly done, the right rudder adjustment prevents the model from circling too tightly to the left when the engine is running and, when the engine cuts, the right rudder will cause the model to leave its left-hand power turn and pass into a right-hand gliding turn. It is common practice to use rudder to oppose the power turn. The idea is to make repeated flights, gradually increasing both power and the rudder adjustment.

More advanced builders, who like definite consistent characteristics, alter the thrust line of the motor. For example, if the power turn is dangerously tight, the thrust line is offset to the right so that the motor tends to pull slightly to the right. This can be done by drilling oversize holes in the bearers and then twisting the engine with the hold-down nuts loose, tightening them when the engine is in the new position. On subsequent models, you may want to drill the holes about 1/16" out of line for this very reason.

Sometimes offset thrust is used in opposition to the rudder. In other words, the thrust is set to make a circle in one direction and the rudder in the other. One example is left thrust with right rudder. In this case, a large amount of right rudder prevents the power circle—despite the offset thrust to the left—from tightening too much. When the power cuts, this excessive rudder setting puts the model into a very tight right-hand glide. A tight-circling glide tends to keep the model in a thermal. However, such adjustments are apt to be tricky unless you have flown at least a few gas models. Another exception to the usual technique is to offset the thrust to the right and to turn the rudder in the same direction. This requires "washing" or a slight upward warp of the leading edge of the right wing tip which keeps the model from spiral diving into the ground. Boiled down, the simplest adjustment is to use right rudder; the more complicated ones—really necessary on very powerful short span models—incorporate offset thrust, usually toward the right, plus moderate right rudder, or left thrust and right rudder.

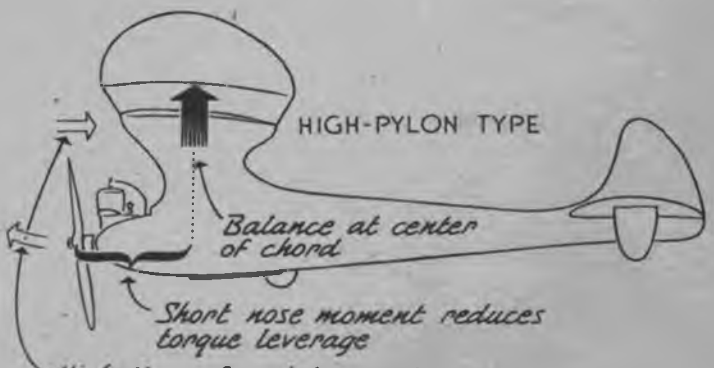


MEASURING SIDE THRUST

Hold wing at eye-level, sight from trailing edge to detect warps

CHECKING WING ALIGNMENT

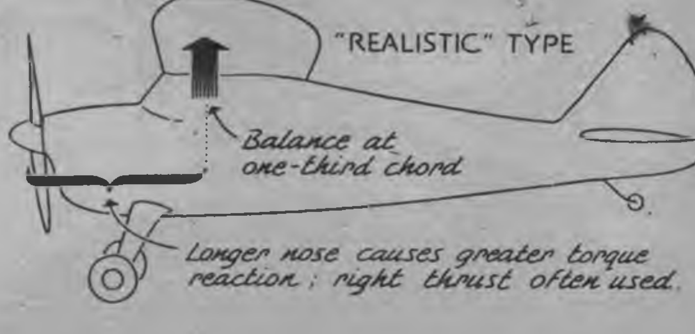
By H. A. Thomas



Balance at center of chord

Short nose moment reduces torque leverage

High line of resistance, low thrust, causes nosing-up tendency; offset by downthrust and by lifting stabilizer.



Balance at one-third chord

Longer nose causes greater torque reaction; right thrust often used.

FREE FLIGHT

● The baby of the Guff family. This famous series designed by the Good brothers featured classes A, B, and C free-flight models and a National champ in radio control.

● Could Be was the name of this realistic cabin job that could be flown free-flight or control-line.

● Another cabin job. Note the built-in head-wind with the engine rearing its ugly head in the breeze.

● A realistic cabin job that featured a demountable wing, removable wing struts, and fully cowled motor.

● A super-streamlined Sailplane. Note the revisions of the original design, the streamlined landing gear, the engine cowling with the air scoop on top and the side vent.

● This pod-and-boom job is the ultimate in streamlining. Even the wheel on the retracting gear is faired.

● This little Atom-powered cabin job featured a very fast climb and soaring glide with a low sinking speed.

GLIDERS

RATIONS and the duration may be over, but we venture to predict that towline and hand-launch gliders are here to stay. We don't profess any occult or soothsaying ability; but well deserved popularity guarantees their continuance.

Where can you find any hobby or sport as economical? You don't need any motor, and so you don't have to buy the expensive gadgets and equipment necessary for gas, or spend hours carving the typical rubber endurance prop with all its gadgets (you know the folders, one-bladers, tensioners, etc.) We venture to state that a buck ($1.00) will cover adequately the expense of the usual towliner, and the hand-launch cost is infinitesimal.

It was because of this very economy that this phase of flying came into its own during the war. At first, the boys didn't worry too much about losing their gliders, but the present trend toward the use of dethermalizers shows the hold these models have for their builders.

The design trend is toward bigger and better towliners (by better we mean the clean design and streamlining). (The free-flight gas and rubber boys might help themselves if they were to show the same design progress within their own field.) Incidentally, even the kit manufacturers have recognized this move to bigger and better towliners. Jasco's Thermic 50 went to the Thermic 72 and now there are plans for the Thermic 100. (The numerals all represent inches of wing span.) Some time ago, Cleveland's 84" Condor was the colossus of towliners, now they are featuring the 120" Albatross. Who knows, maybe they'll be putting in cockpits for junior one of these days. As yet, they don't have any event at the Nationals for this group, but from the present feeling (and they can count on assistance from us), it is safe to assume that the powers that be in the AMA will have to recognize and include the gliders as a major event.

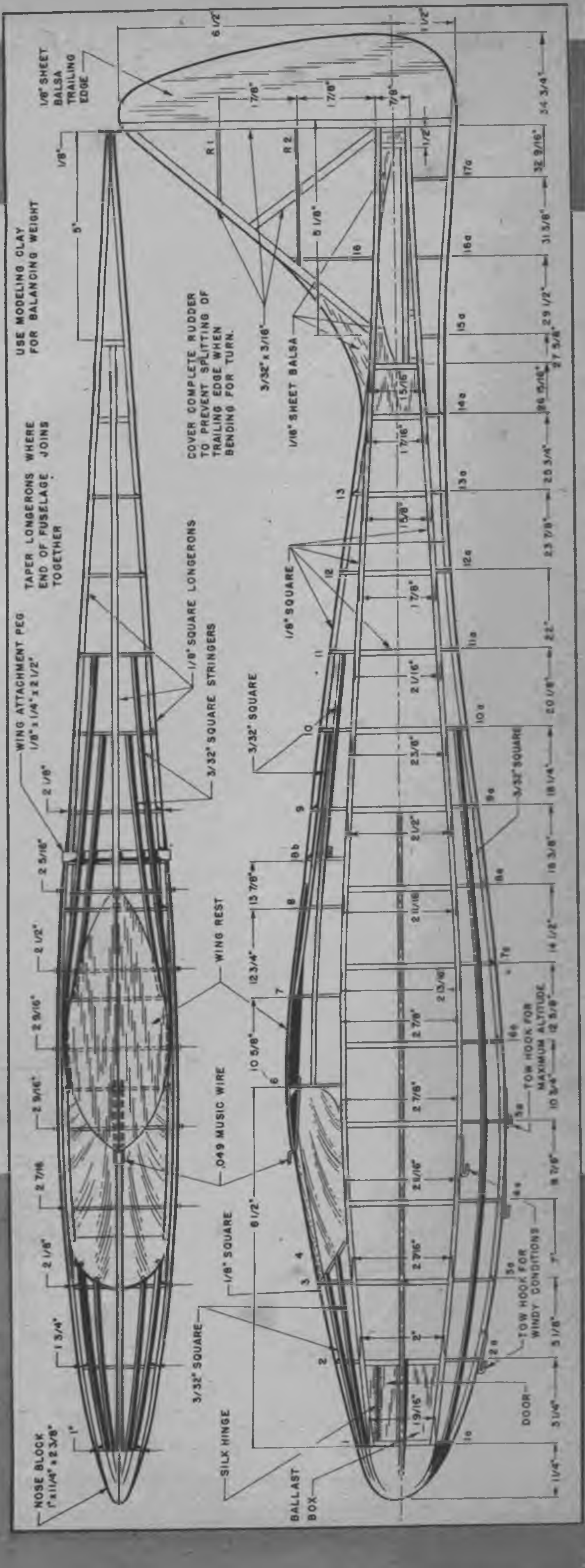
THERMIC 70

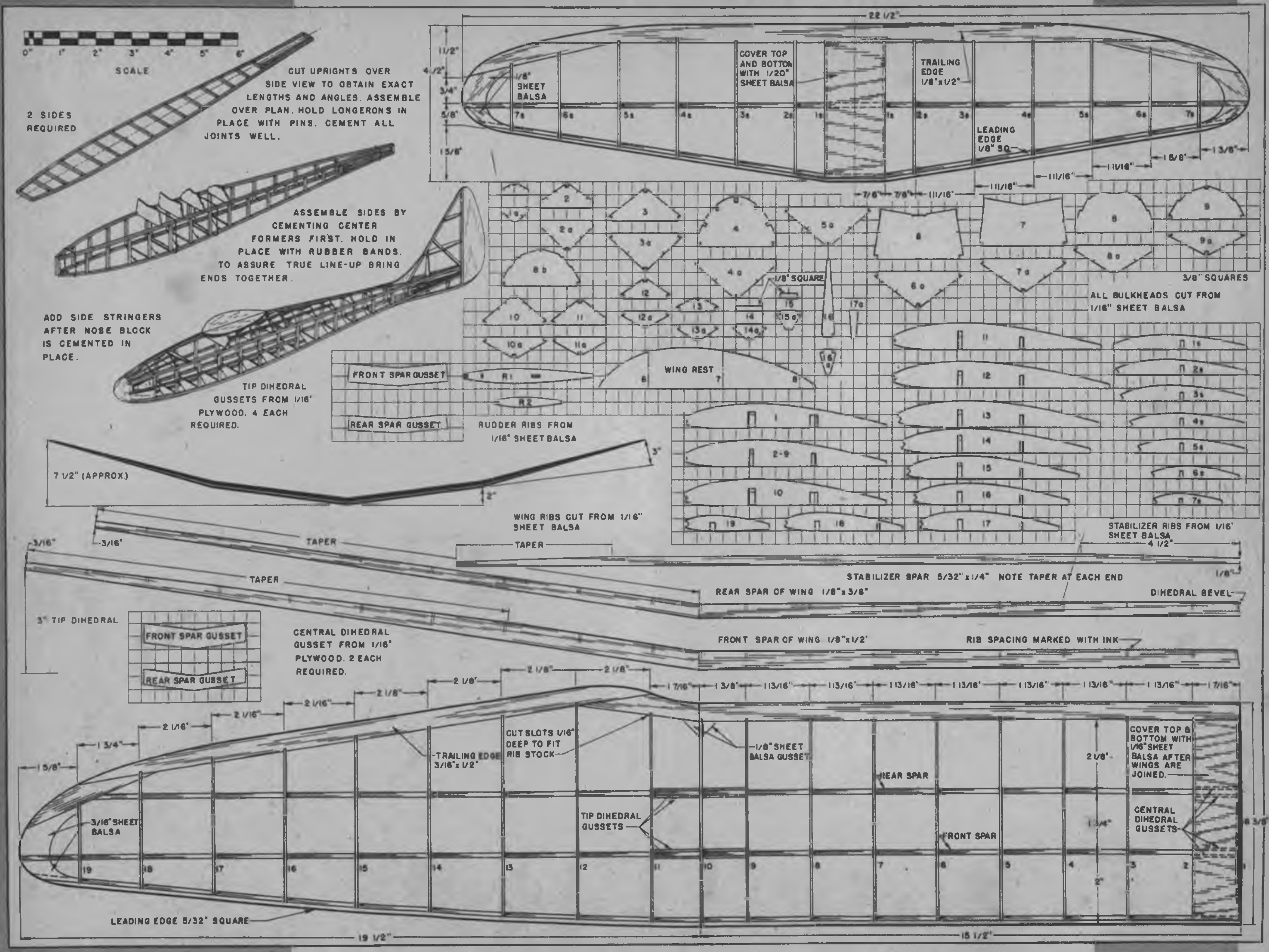
THE Thermic 70 is almost a direct scaled-up version of the wartime Thermic 50. The essential differences are the shorter fuselage and the smaller stabilizer area. Good design practices required these changes on the larger version.

The present series of famous Thermics were designed in early 1943 to take the place of the pod-and-boom design. This design change was necessary to bring simplicity of construction in the towline field. The fuselage is the standard square framework type, using stringers to give the final shape. The fuselage outline conforms to the good secondary type of full-size glider. The built-in rudder was incorporated to eliminate the prevalent evil in the rubber field: "the shifting rudder affixed to the removable stabilizer." Another feature incorporated is the removable wing with the platform mounting. Any impact, no matter how slight, will cause the wing to fly off.

The wing follows the familiar Thermic pattern, except that polyhedral is used. The wing outline was influenced by two outstanding prewar German gliders, the "Minimoa" and the "Wolf." It has not been determined whether this shape has any beneficial effects in the small model type. As a matter of fact, the Thermic owes its performance to strong construction which keeps the basic aerodynamical layout under all circumstances. It is a good design rule to use airfoil sections that permit strong construction rather than the super-dupers which may warp all out of shape, as soon as they meet the sun or heat.

By using fairly large fuselage frontal area the *(Turn to page104)*




0" 1" 2" 3" 4" 5" 6"
SCALE
2 SIDES REQUIRED
CUT UPRIGHTS OVER SIDE VIEW TO OBTAIN EXACT LENGTHS AND ANGLES. ASSEMBLE OVER PLAN. HOLD LONGERONS IN PLACE WITH PINS. CEMENT ALL JOINTS WELL.
ASSEMBLE SIDES BY CEMENTING CENTER FORMERS FIRST. HOLD IN PLACE WITH RUBBER BANDS. TO ASSURE TRUE LINE-UP BRING ENDS TOGETHER.
ADD SIDE STRINGERS AFTER NOSE BLOCK IS CEMENTED IN PLACE.
TIP DIHEDRAL GUSSETS FROM 1/16" PLYWOOD. 4 EACH REQUIRED.
22 1/2"
1 1/2"
4 1/2"
3/4"
5/8"
1 5/8"
1/8" SHEET BALSA
COVER TOP AND BOTTOM WITH 1/20" SHEET BALSA
TRAILING EDGE 1/8"x1/2"
LEADING EDGE 1/8" SQ.
7s 6s 5s 4s 3s 2s 1s 1s 2s 3s 4s 5s 6s 7s
1 3/8"
1 5/8"
1 11/16"
1 11/16"
1 11/16"
7/8"
7/8"
1 11/16"
1 2 2a 3 3a 4 4a 5a 6 6a 7 7a 8 8a 8b 9 9a 10 10a 11 11a 12 12a 13 13a 14 14a 15 15a 16 16a 17a
1/8" SQUARE
3/8" SQUARES
ALL BULKHEADS CUT FROM 1/16" SHEET BALSA
FRONT SPAR GUSSET
REAR SPAR GUSSET
R1 R2
RUDDER RIBS FROM 1/16" SHEET BALSA
WING REST
6 7 8
1 2-9 10 11 12 13 14 15 16 17 18 19
1s 2s 3s 4s 5s 6s 7s
WING RIBS CUT FROM 1/16" SHEET BALSA
STABILIZER RIBS FROM 1/16" SHEET BALSA
4 1/2"
7 1/2" (APPROX.)
3"
2"
3/16"
3/16"
TAPER
TAPER
TAPER
1/8"
STABILIZER SPAR 5/32"x1/4" NOTE TAPER AT EACH END
REAR SPAR OF WING 1/8"x3/8"
DIHEDRAL BEVEL
3" TIP DIHEDRAL
FRONT SPAR GUSSET
REAR SPAR GUSSET
CENTRAL DIHEDRAL GUSSET FROM 1/16" PLYWOOD. 2 EACH REQUIRED.
FRONT SPAR OF WING 1/8"x1/2"
RIB SPACING MARKED WITH INK
1 5/8"
1 3/4"
2 1/16"
2 1/16"
2 1/16"
2 1/8"
2 1/8"
2 1/8"
2 1/8"
1 7/16"
1 3/8"
1 13/16"
1 13/16"
1 13/16"
1 13/16"
1 13/16"
1 13/16"
1 13/16"
1 7/16"
TRAILING EDGE 3/16"x1/2"
CUT SLOTS 1/16" DEEP TO FIT RIB STOCK
1/8" SHEET BALSA GUSSET
REAR SPAR
FRONT SPAR
TIP DIHEDRAL GUSSETS
3/16" SHEET BALSA
COVER TOP & BOTTOM WITH 1/16" SHEET BALSA AFTER WINGS ARE JOINED.
CENTRAL DIHEDRAL GUSSETS
2 1/8"
1 3/4"
2"
6 3/8"
19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
LEADING EDGE 5/32" SQUARE
19 1/2"
15 1/2"

GLIDERS

● Gordon Lambrecht's 14-foot soarer is the largest towliner we have seen. Gliders this size require too much flying space.

● A larger gap between the wings would make this hand-launch glider much more effective and stable.

● A very effective hand-launch canard. Models of this type do a lot to popularize flying without power

● A quickie. Originally designed for hardwoods, it should be very effective in balsa construction.

● Towline flying wing. The fuselage and stabilizer drop off when the model reaches its maximum altitude on the tow.

● Another all-balsa quickie. Designed for contest work, it can also be used in the corner park.

● A simple project, this towliner is extremely sturdy and has had many flights of long duration.

● This hand-winch tow was used by these two members of the Jugoslav team at the King Peter finals in London, England.

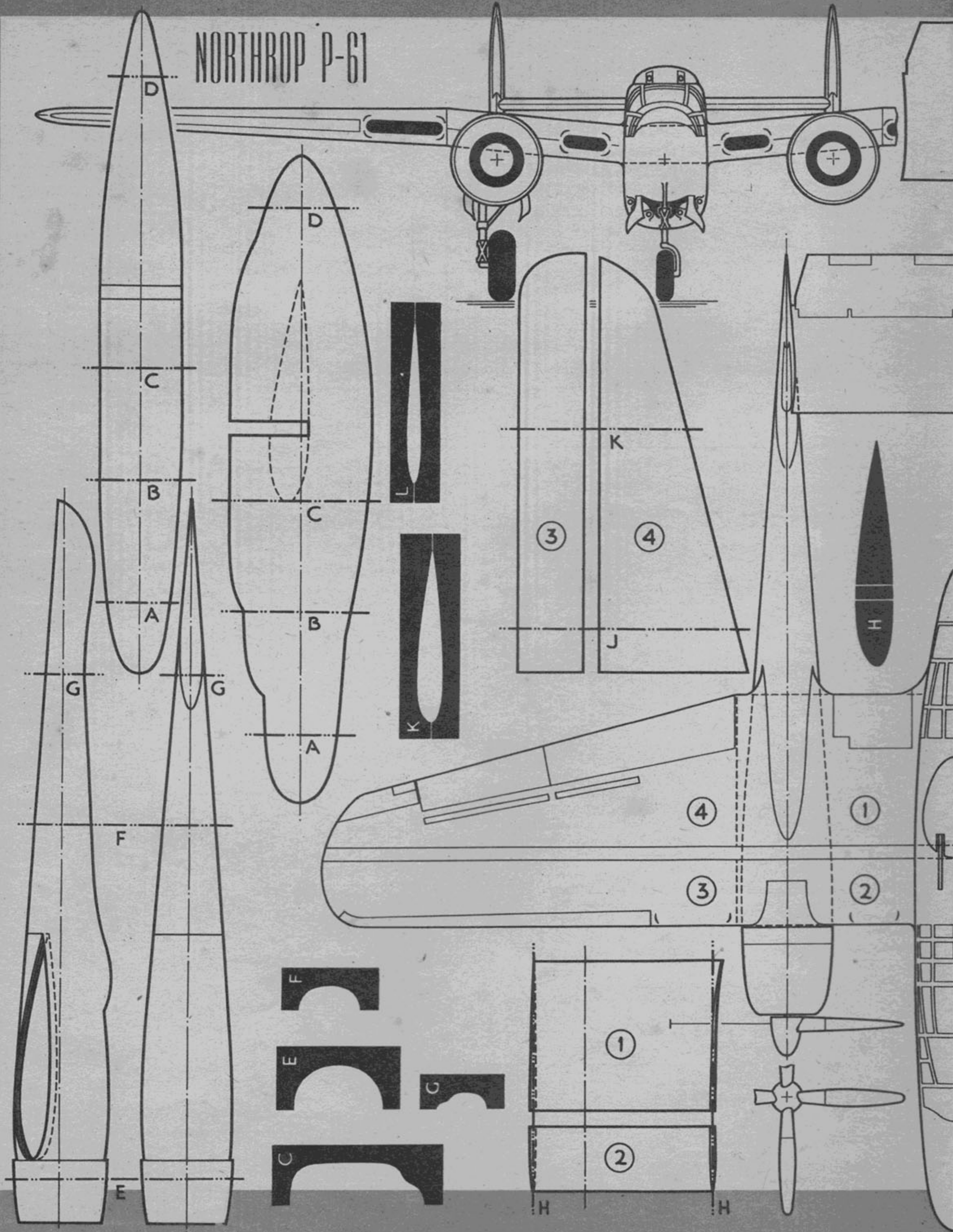
SOLIDS

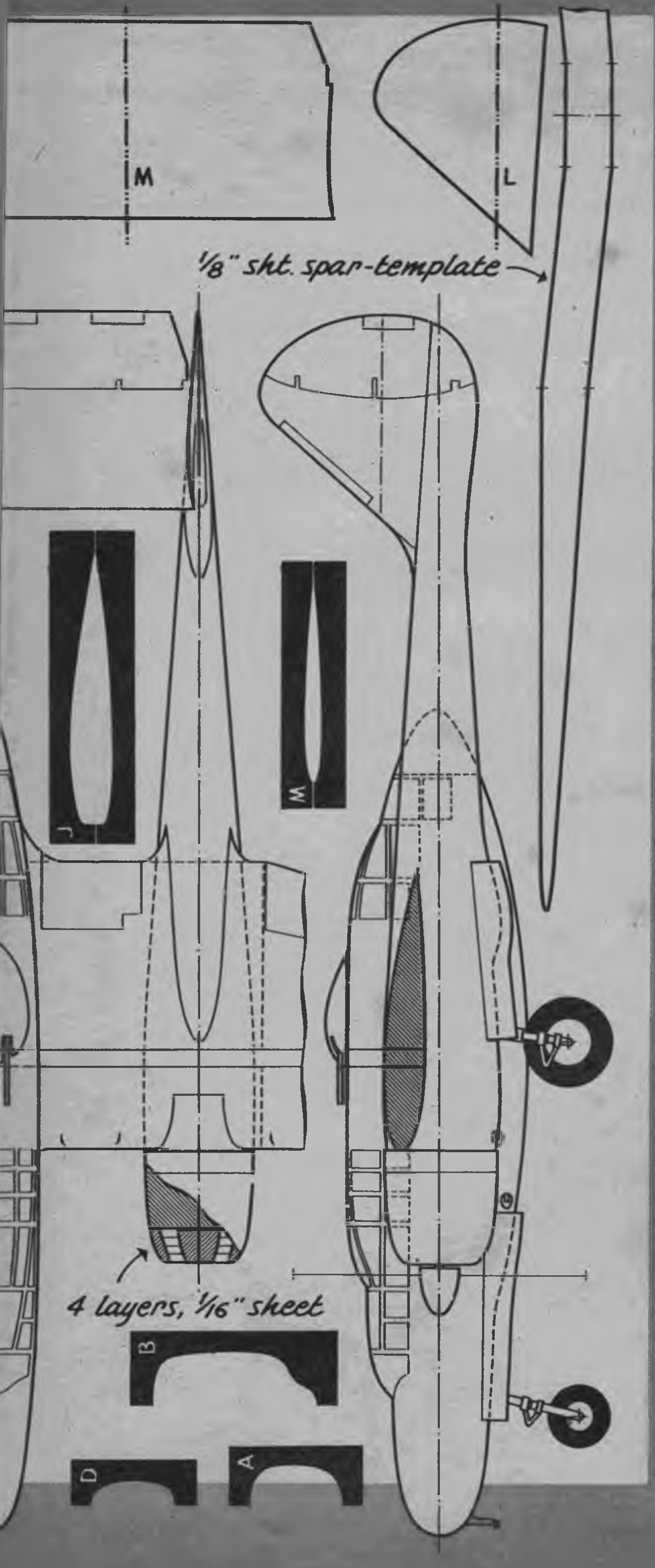
ALWAYS a stepchild, it took a war with all its attendant shortages and rationing of materials to bring the solids into their own.

It will take more than a war, however, to blast them out of the position they have established in the hearts of all modelers. Like Cinderella, they have blossomed out in all their glory and have become a permanent part in the scheme of things. Who could foresee that the 5/16"-1' solid series in Air Trails Pictorial would be the most popular models yet published. Of course, the mature treatment they received has aided in the transition from a temporary to a permanent niche in the modeling world.

Many manufacturers can be thankful for the way the solids filled the gap when the shortages and priorities came along. From all indications, some of them would have had to suspend operations for the duration if they hadn't transferred to this phase of modeling. To their credit, it can be said that the majority turned out exceptionally fine items. The authenticity of scale and the preparation of finely detailed plans gave the model builder everything that could please his meticulous nature. Another feather in the cap of the manufacturers is the fine job they performed when the government called upon them to develop a program for the building of identification models for the armed forces. The success of their material is clearly evident in the fashion in which the modelers more than filled the needs of the armed forces and the professional manner in which the models were prepared and finished. So let's all extend a hand of welcome to our new big brother.

NORTHROP P-61





P-61 BLACK WIDOW

By H. A. Thomas

THIS MONTH'S FAVORITE IN THE 3/16" SCALE SERIES IS THE BLACK WIDOW NIGHT FIGHTER

THIS powerful night fighter is one of the most unique of modern war planes. Its twin boom arrangement, its broad wing with straight leading edge, and its odd fuselage lines set it apart from other planes in appearance, as do its equipment and armament in tactical use.

Twin-row Pratt and Whitney engines, of 2,000 horsepower each, with four-blade electric propellers, power the P-61. Most unusual design feature is the radically new spoiler-type aileron which permits use of near full-span flaps. The speed range is thus broadened, enabling the P-61 to operate from small fields.

Other than requiring a more painstaking assembly job, the Black Widow solid scale model is no more difficult than others in the series.

The nacelle and fuselage blocks are first cut to side, then top outline, and are carved to general shape. Final contours are checked by the templates during final sanding.

(Turn to page 112)

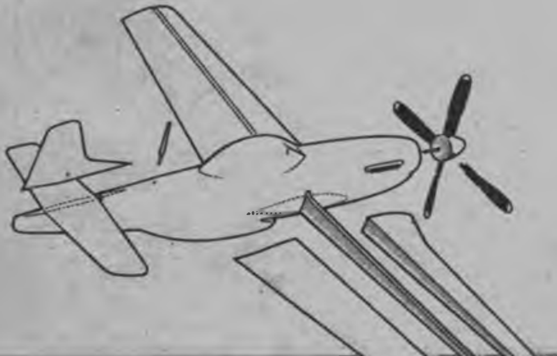
P-51H MUSTANG

By H. A. Thomas

HERE IS THE MOST POPULAR OF ALL IN OUR 3/16" = 1 FT. SOLID SERIES

"FASTEST propeller-driven plane" is the claim made for the P-51H Mustang. First to utilize the revolutionary laminar-flow wing section, this sleek fighter's war record helped make America supreme in the air.

While succeeding models of most contemporary warplanes tend to become heavier with the addition of new gadgets, armament, and reinforcement, the Mustang has steadily been lightened through careful engineering. Its relatively low wing loading and power loading make its fine performance possible.



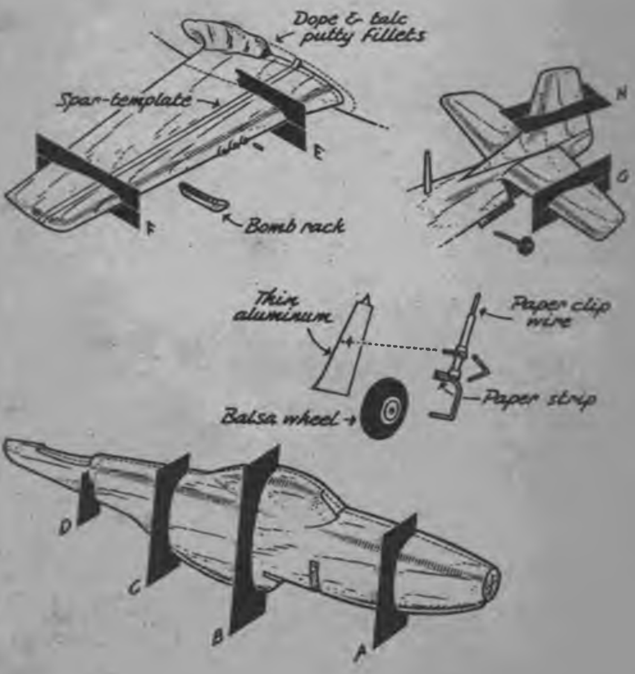
Like most American fighter planes, the Mustang has varied armament. Six fifty-caliber machine guns, two 500-lb. bombs, and batteries of rockets give the P-51H a heavyweight punch.

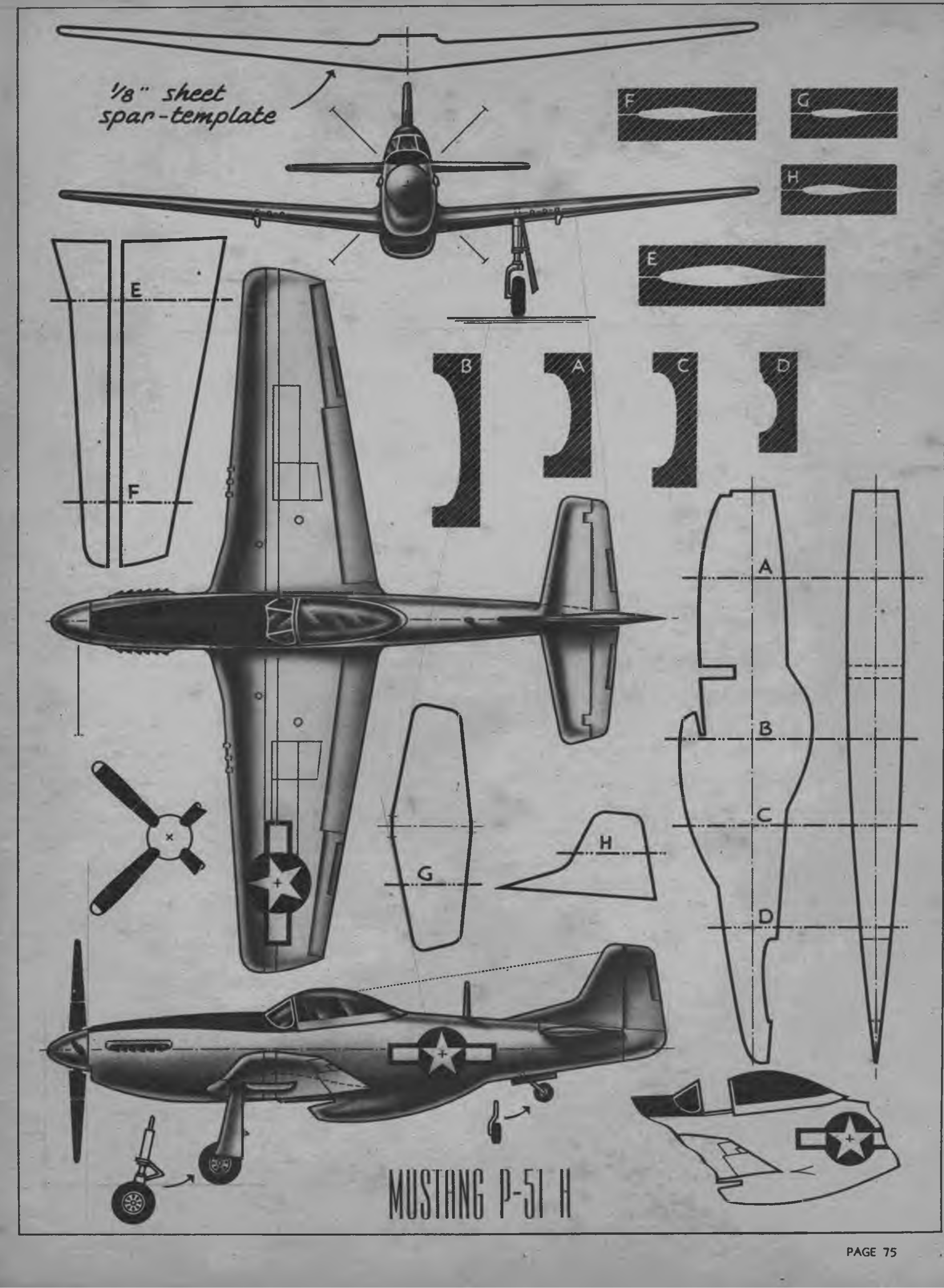
A Packard-built Rolls Royce Merlin provides ample power at an economical rate of fuel consumption. When auxiliary wing tanks are fitted, the Mustang is capable of extremely long-range missions. The full-view bubble canopy, the underslung radiator, a new vertical fin fillet, and the blunt tipped wing and tail characterize the new Mustang.

Medium texture balsa is recommended for all parts. The fuselage should be cut to side, then to top view outline, before being carved, sanded, and checked for proper shape. The spar-template is first cemented into the fuselage slot and the four wing pieces are fitted to it. Tail group is of conventional, simple construction. Dope and talc putty fillets should be molded to wings and tail before applying wood filler to the entire model. Sand the model to a smooth finish before adding final detail.

The canopy may be made in closed or open position. Landing gear is composed of paper clip wire struts wrapped with paper strips, balsa or plastic wheels, and aluminum fairings. The propeller may be a plastic one, purchased from your model dealer, or it may be made by fitting pine blades into a balsa hub.

Paint the Mustang silver with flat black propeller blades, canopy, and recessed parts. The anti-glare panel atop the nose is dark green. Finally, AAF decal insignia may be attached to wings and fuselage.





MUSTANG P-51 H

LOCKHEED P-80

By H. A. Thomas

AS FAST AS SOUND, THIS JET-PROPELLED FIGHTER IS A HANDSOME ADDITION TO YOUR SERIES

(The P-51 Mustang, the TBF-1, and the Lockheed P-38 are running one, two, three in the popularity poll. Any small number of votes can change their position so continue voting to get your favorites up there in the running.—Editor)

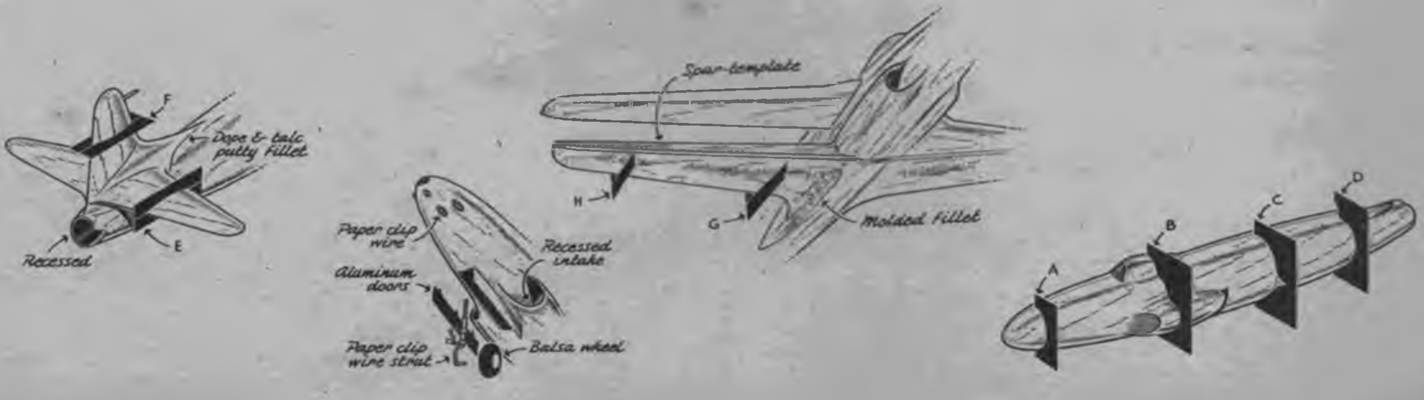
THE P-80 has been designed from the ground up as a super-speed, jet-propelled aircraft and consequently differs from several previous jet craft which closely followed conventional design.

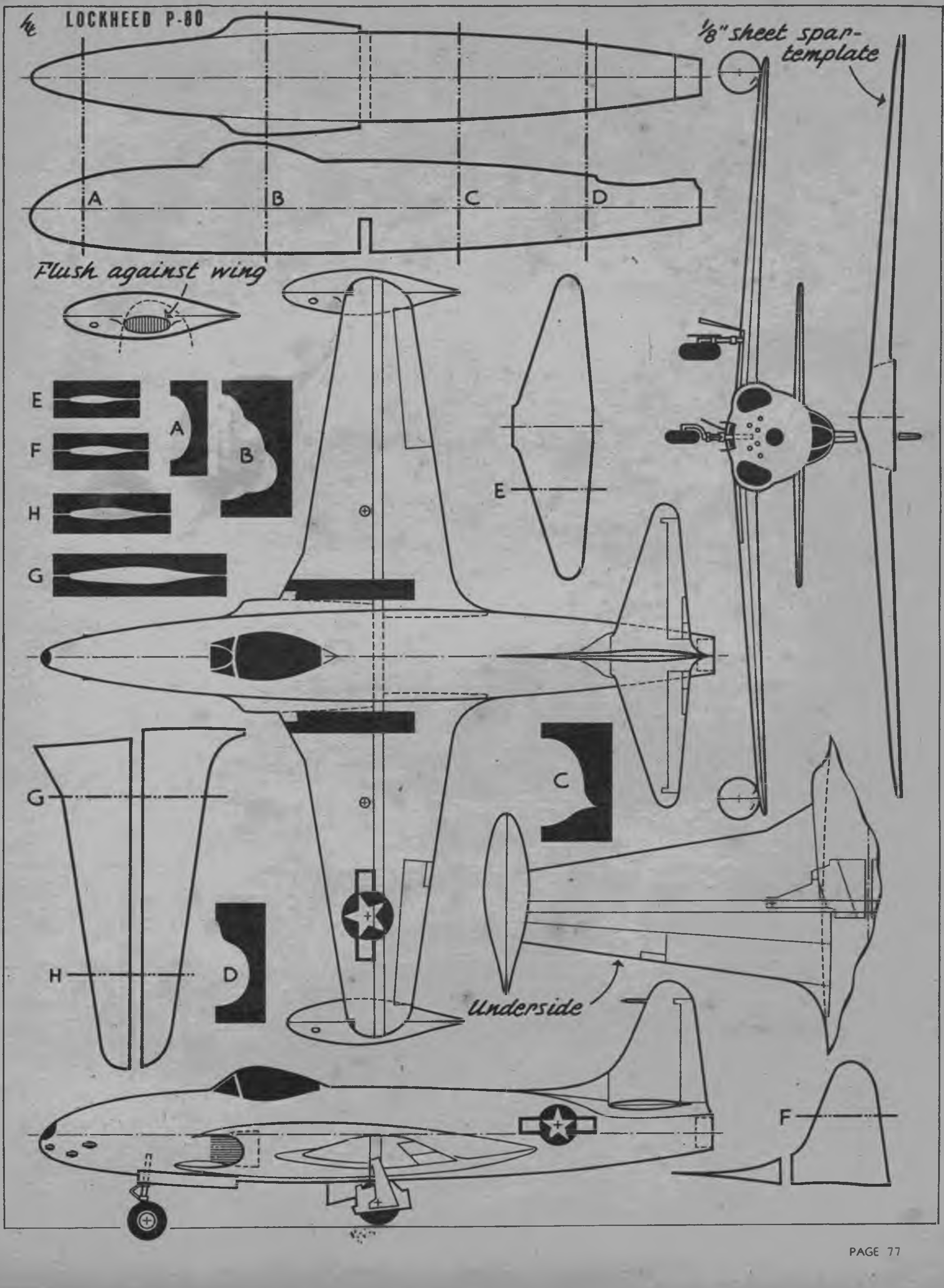
Its proportions, its knifelike aerofoils, its glazed finish are all broad steps forward in design; these, plus the tremendous thrust of its General Electric reaction-type powerplant, make possible speeds near that of sound.

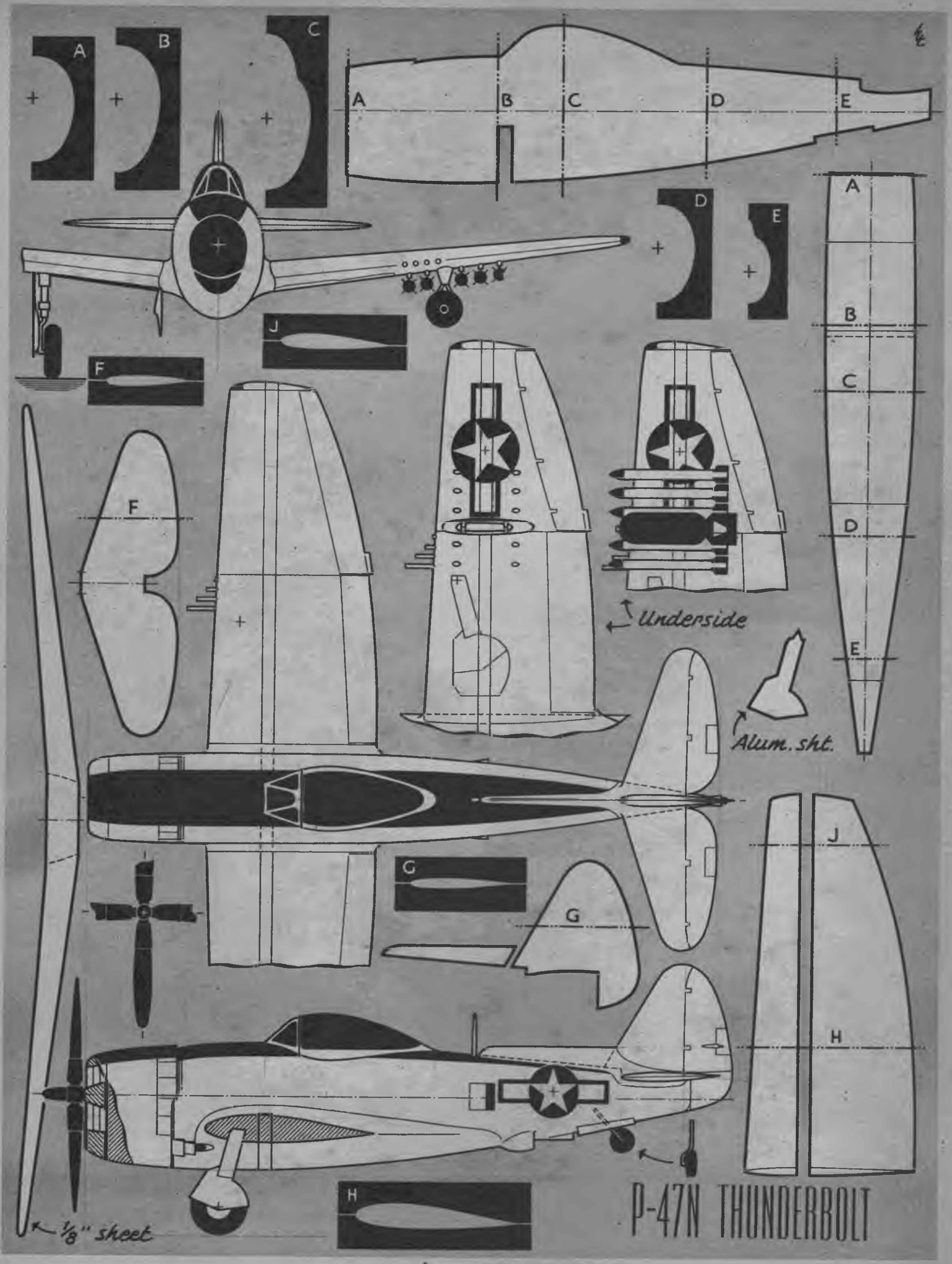
A solid model Shooting Star will stand out in your collection in size, in proportion, and even in color from other military models. Medium texture balsa is suitable for the fuselage, but the thin wings and tail require harder wood for adequate strength. Shape the fuselage block to side and top view outlines; carve and sand it to conform to cross section templates. Fit the spar template into the fuselage slot and cement the wing parts in place. Perfect joints against the fuselage are unnecessary as the talc and dope putty fillets cover the junctures. Shape and attach the tail group parts. The auxiliary fuel tanks are carved of balsa and fit flush beneath the wing tips. Tail pipe and air intake openings are recessed for realism.

Dope the assembled model lightly and apply two coats of wood filler. Sand this down smoothly and add another coat if necessary. Landing gear recesses may be trimmed out and the soft wire struts, wrapped with paper strips, are forced into the wings and fuselage. Wheels are balsa and landing gear doors are thin aluminum.

Paint the model with white model dope to which has been added small quantities of silver and black. Bubble cockpit canopy, wing walks, and recessed parts are flat black. Complete the model by adding decal insignia to wings and fuselage sides.



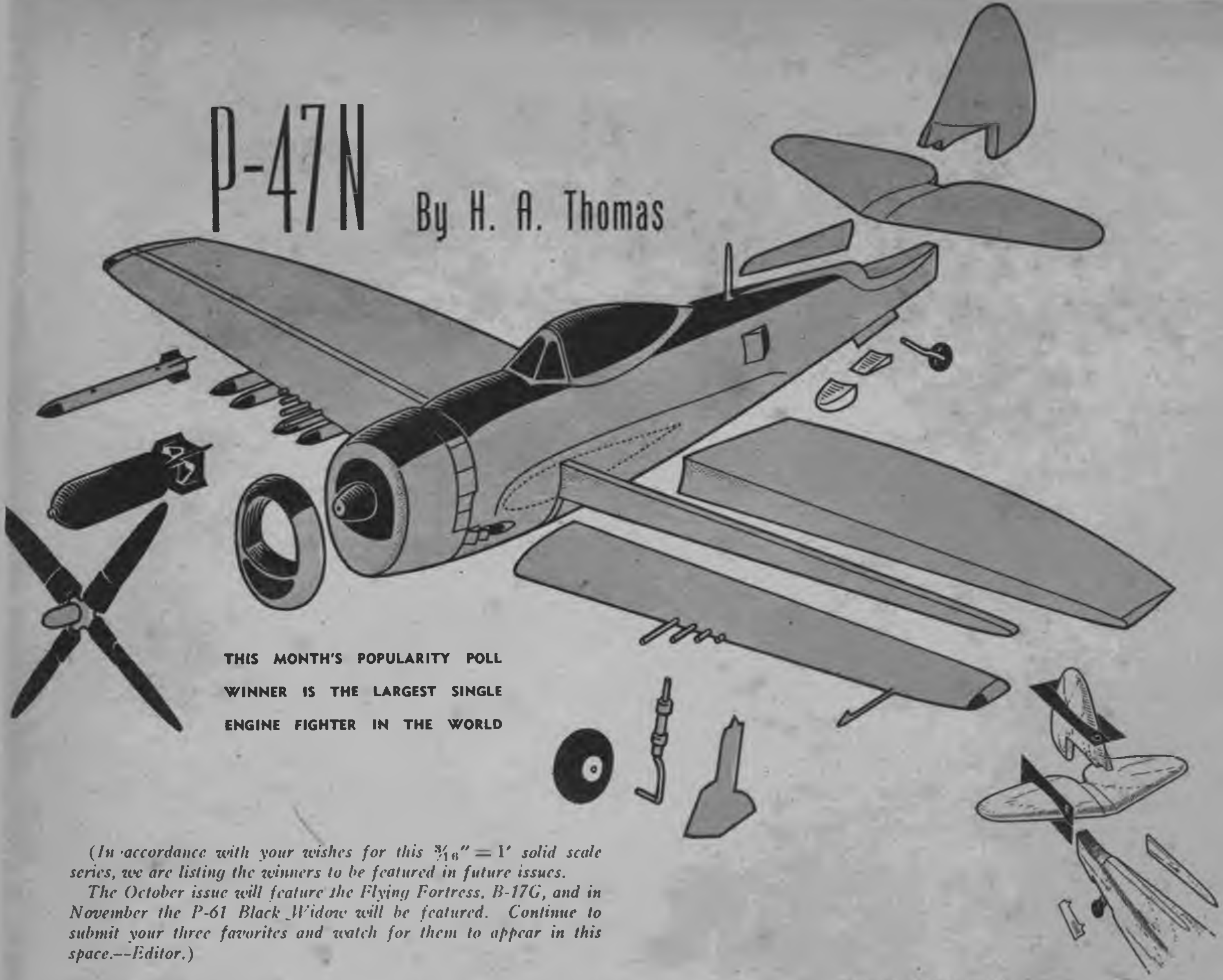

LOCKHEED P-80
1/8" sheet spar-template
A
B
C
D
Flush against wing
E
F
H
G
A
B
E
C
G
H
D
Underside
F



P-47N THUNDERBOLT

P-47N

By H. A. Thomas



THIS MONTH'S POPULARITY POLL WINNER IS THE LARGEST SINGLE ENGINE FIGHTER IN THE WORLD

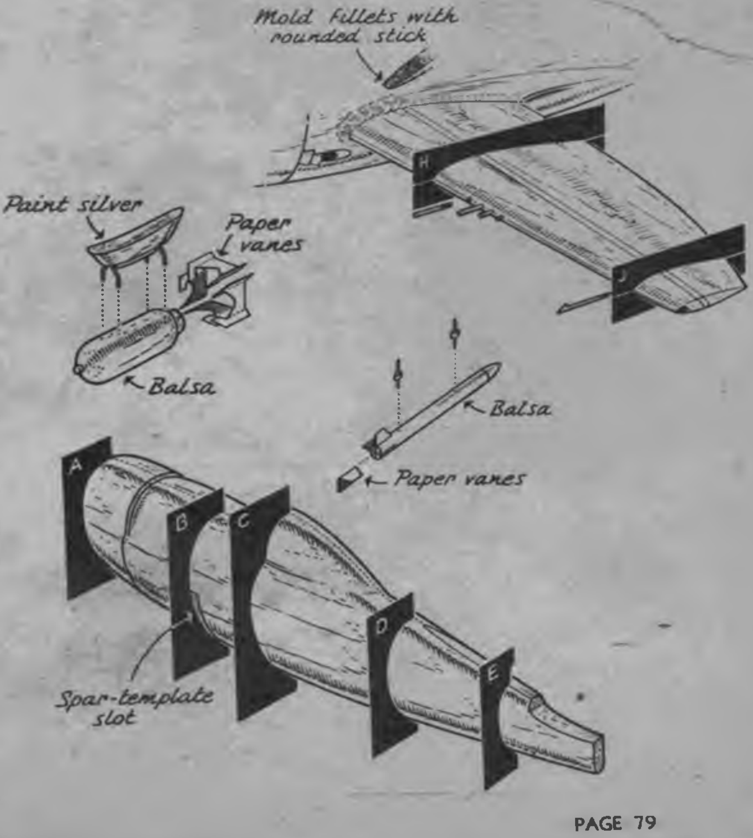
(In accordance with your wishes for this $\frac{3}{16}'' = 1'$ solid scale series, we are listing the winners to be featured in future issues.

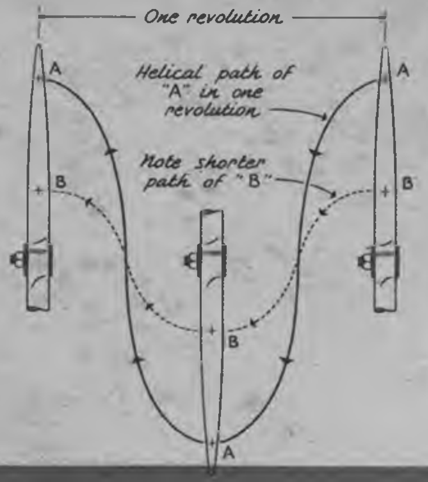
The October issue will feature the Flying Fortress, B-17G, and in November the P-61 Black Widow will be featured. Continue to submit your three favorites and watch for them to appear in this space.—Editor.)

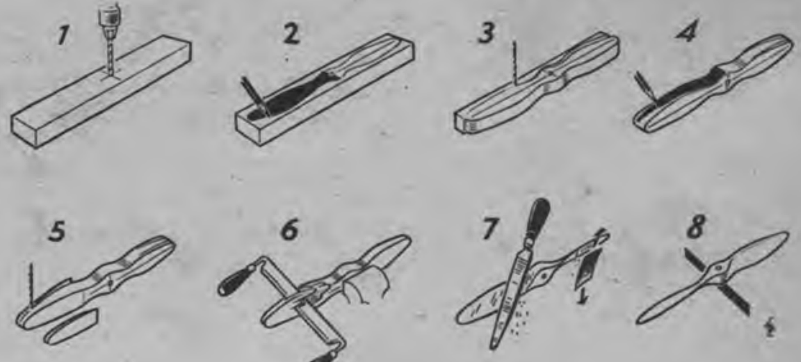
THE average fighter plane usually rolls out of the factory clean-lined and graceful in appearance, but after several modifications, plus the addition of all the gadgets, mostly external, which make it most effective as a weapon, it loses considerable of its original beauty.

The current P-47N Thunderbolt is no exception. Now equipped with a new dorsal fillet, longer wings with blunt tips, large bombs or wing tanks, and wing racks for numerous rockets, it exceeds previous models in every respect other than in appearance. The same engine has been boosted in power output and Curtiss electric propellers are used again. Speed, range, and utility have been improved and the chief task for P-47N's will be to escort long-range bombers.

The scale model P-47N follows the construction *(Turn to page 100)*







J. L. Sadler, Little Rock, Arkansas, uses procedure shown in Fig. 1 and these tools in making gas model propellers: 1) mark centerlines on straightgrained block and drill shaft hole; 2) trace blade outlines using cardboard pattern; 3) cut block to outline shape with jigsaw or bandsaw; 4) trace side patterns to block; 5) taper block by sawing to side outline; 6) clamp block in bench vise; rough out blades with drawknife, lower surfaces first; 7) rasp and sand blades to final shape; 8) check balance on a sharp edge, apply finish, then balance again.

ESSENTIALLY the same problems are posed by gas model propellers as by those of full-scale aircraft. The modern controllable-pitch, constant-speed propeller is designed to operate with efficiency at low forward speeds, during acceleration, and also at top speed when full momentum has been reached. Thus, a free flight model can be compared to the modern fighter plane at take-off. Here speeds are relatively low, even during climb, and low-pitch propeller settings are necessary for acceleration and motor efficiency. Conversely, fast control-line models require high-pitch propellers. The control-line flyer can tolerate some inefficiency from a high-pitch propeller during take-off for he expects best performance at top speed.

In one revolution, a propeller blade moves forward a distance equal to the amount of forward movement of the plane during that time. It is obvious, then, if the speed of the plane is high, that pitch must be considerable to keep the blades working efficiently. If the pitch is high and there is not sufficient airspeed, the blades are operating at too steep an angle of attack for efficiency.

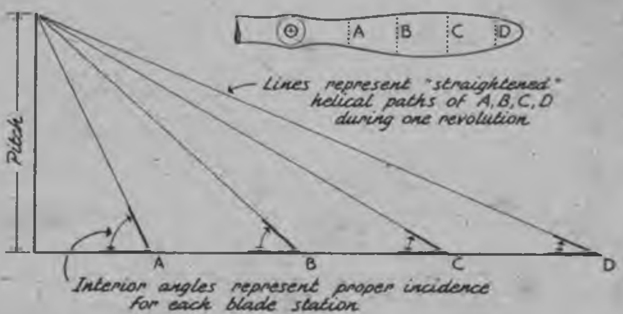
Consider the fighter plane again. After take-off, during the climb, with propeller in low pitch, the airspeed may be 200 mph at 3,000 rpm. By comparing rpms to distance covered, this means that in one propeller revolution the plane moves forward less than six feet. After reaching altitude, levelling off, and attaining full speed at high pitch, the plane may be making 400 mph at 3,000 rpm. In one propeller revolution the plane now covers more than eleven feet. A fixed-pitch propeller could not be expected to operate efficiently at both of such contrasting airspeeds.

When fitted with a very high-pitch propeller, the engine of a free-flight model may be unable to reach its best operating speed and the propeller blades may be literally "stalled out" due to lack of airspeed. A low-pitch propeller on a control-line plane may cause the engine to race excessively without too great a forward speed. So the experienced model builder lets the speed of his model largely determine the pitch of the propeller he uses.

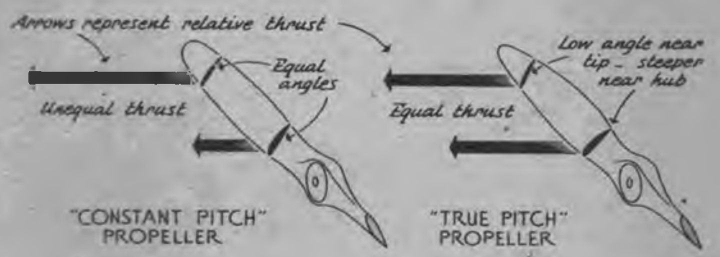
Gas model propeller pitch is designated in inches—the implication being that the propeller is of "true pitch" with tips designed to deliver proportional thrust to areas near the hub. If a propeller is improperly designed, its pitch in reality should be designated in a series of figures; each point along the blade may be of different pitch.

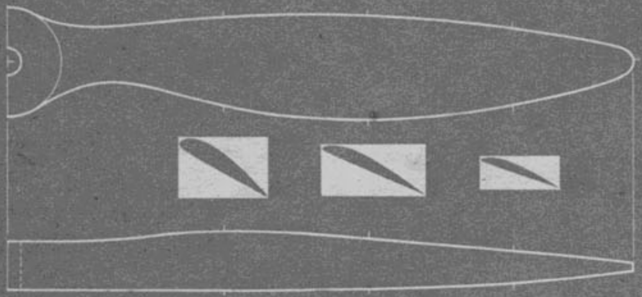
A propeller blade carved with uniform pitch from hub to tip is probably the most inefficient type conceivable. Here the tip has excessive pitch when we consider the longer path it covers in revolving due to its radius being greater than points nearer the hub. These unequal "helical" paths leave only one alternative to achieve "true pitch"—the systematic reduction of blade incidence toward the tips. For efficiency and strength, blade thickness and width are also reduced toward the tips.

Other factors of importance relative to propellers are balance, blade section, blade outline shape, and finish.

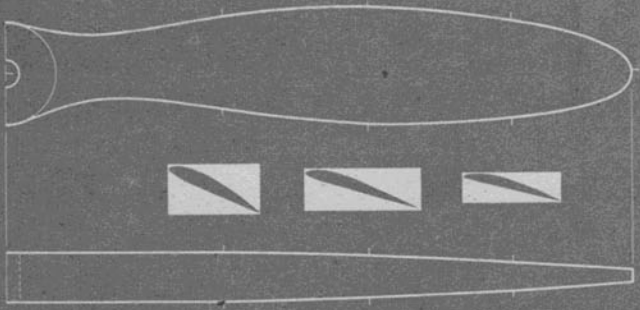


BASIC DIAGRAM *for* "TRUE PITCH" PROPELLER





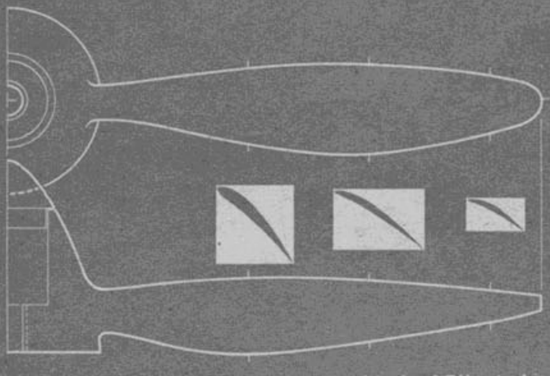
Hi-thrust, 13" dia. 10" pitch



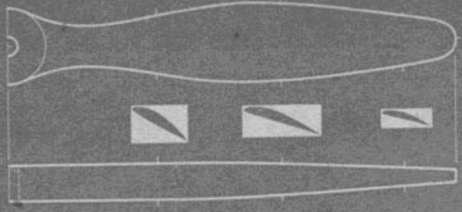
Flo-torque, 13" dia. 10" pitch

PROPS — GAS

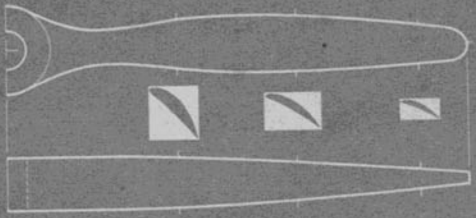
GAS model propellers have two functions to perform: to translate engine power into torque or thrust and to serve as an engine flywheel. For smoothest engine performance and easy cranking, a well balanced propeller of heavy wood is ideal, but with an eye toward possible crack-ups, the wise model builder selects wood which will break before bending the crankshaft or otherwise damaging the engine. Gum, walnut, maple, mahogany, and poplar are good materials, being easily worked and of sufficient weight for good flywheel action. Smooth finishes add to propeller efficiency and streamlined spinners often increase speed noticeably in the case of control-line models.



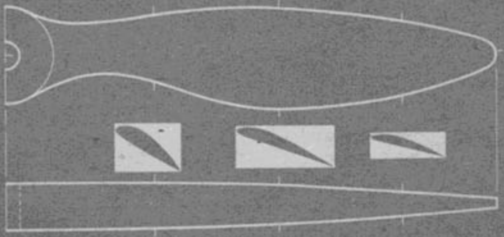
Topping, 11" dia. plastic, three blade 15" pitch



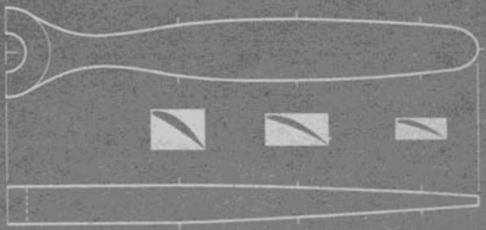
X-cell, 9" dia. 6" pitch (estimated)



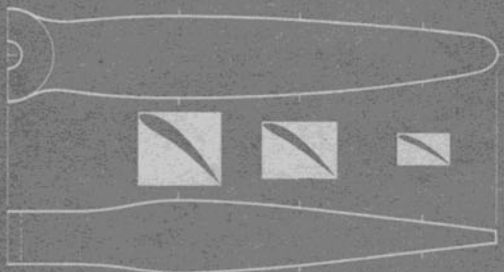
Greene (Hornet), 9½" dia. 13" pitch (estimated)



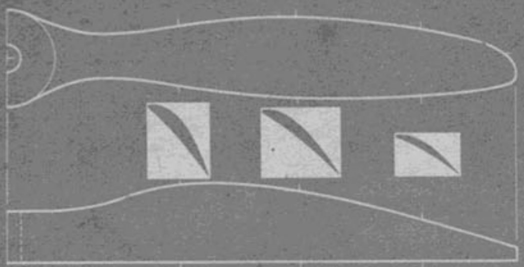
Hi-thrust, 10" dia. 6" pitch



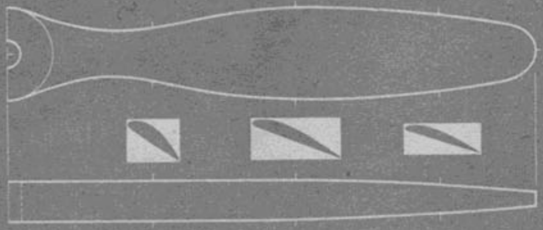
Greene (Hornet), 9¾" dia. 11" pitch (estimated)



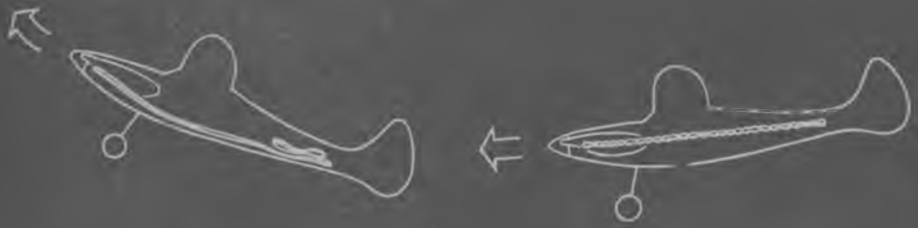
Snafu #75, 10" dia. plastic, 14" pitch (estimated)



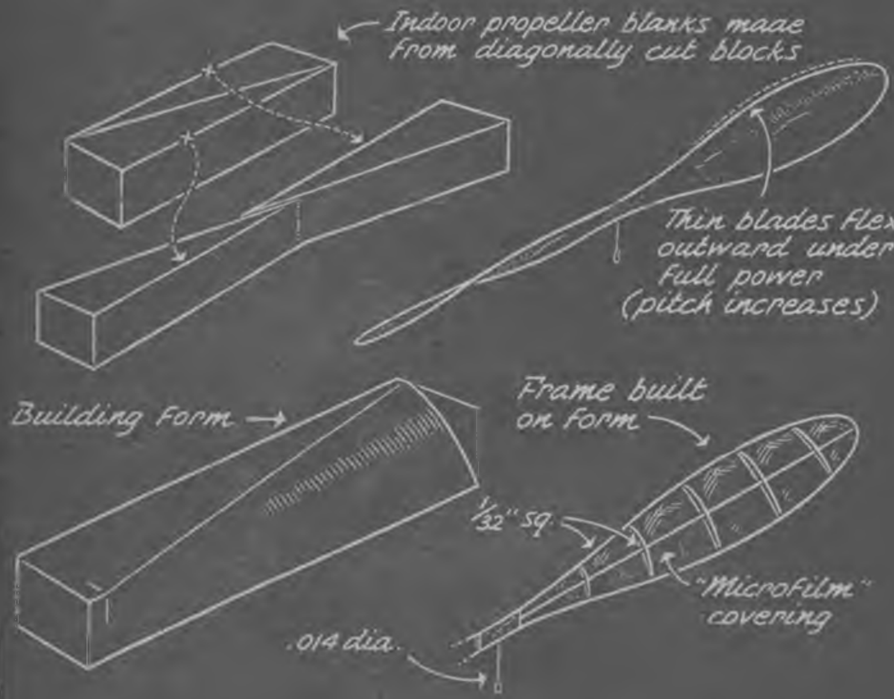
Thomas "Skyhook," 10½" dia. 15" pitch



Air-flo, 11" dia. 8" pitch



"Rubber tensioner" retains few turns on motor, preventing slack from sliding to rear and upsetting fore and aft balance.



Indoor model propellers

Simple hand-carved propeller

PROPS
RUBBER

THE simplest stick model can demonstrate most effectively the vital part propeller design and efficiency have to do with over-all flight performance. By alternating propellers of proper design and construction with others less carefully made, you can observe the startling difference in flight.

Generally, rubber model propellers are high-pitched, designed for slow, varying rotation speeds. Balance and finish are still important as in the case of gas model propellers. For these relatively slow speeds, undercamber is favored and it serves also to stiffen the thin, balsa blades.

Freewheeling in it's simplest forms is adaptable to even the smallest outdoor stick models and duration can be thus increased by at least twenty-five percent.

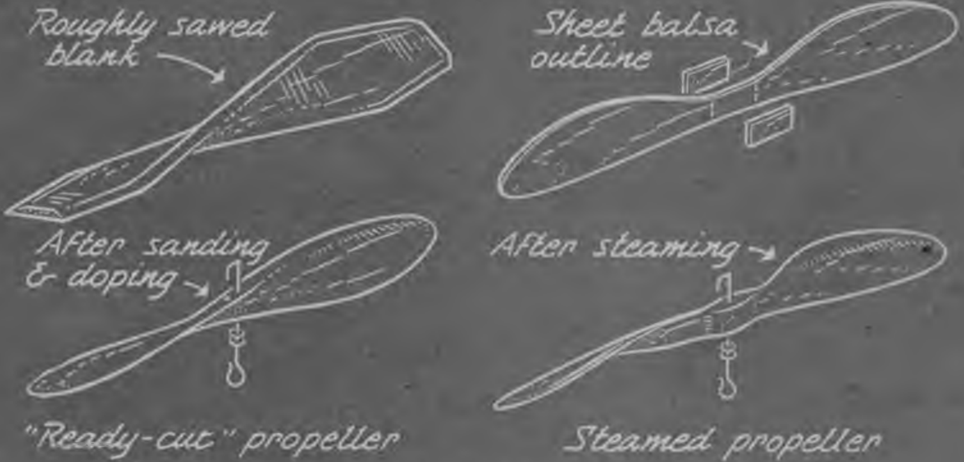
Indoor propellers call for careful workmanship in both the solid balsa types and those of delicate, microfilm-covered structure. The nearest model builders have come to controllable pitch and feathering propellers has been with indoor models using flexible blades and small spring-loaded mechanisms.

Experienced model builders, having worked with all types, contend the Wakefield-size outdoor propellers with folding blades and rubber tensioners are the toughest to build and adjust. But here their efforts are well rewarded, for flights are so vastly improved as to virtually eliminate from competition other models with ordinary non-folding propellers. Korda, Lanzo, Lidgard and other rubber model experts concentrate on propellers. These are finely finished and the folding and tensioner mechanisms work flawlessly.

If you have never tried these latest improvements, work up a propeller incorporating them and let your stop watch convince you it is worth all the bother.

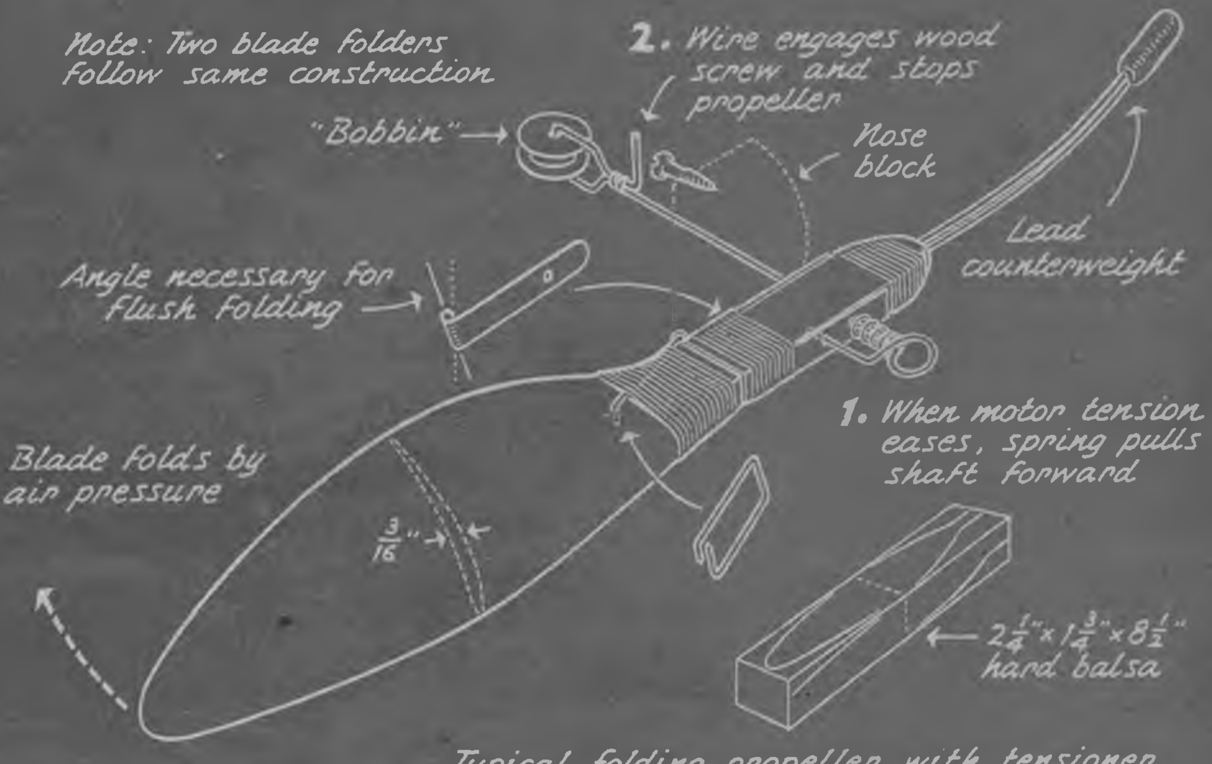
"Ratchet" type "Latch" type "Spring" type

"Freewheeling" devices

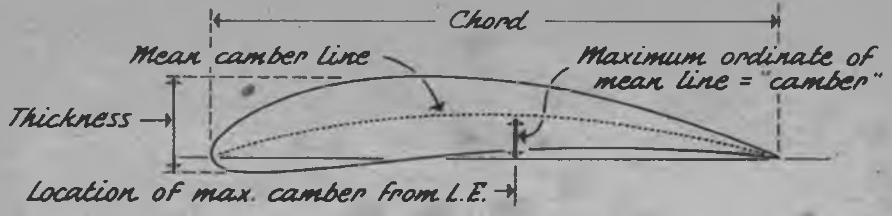


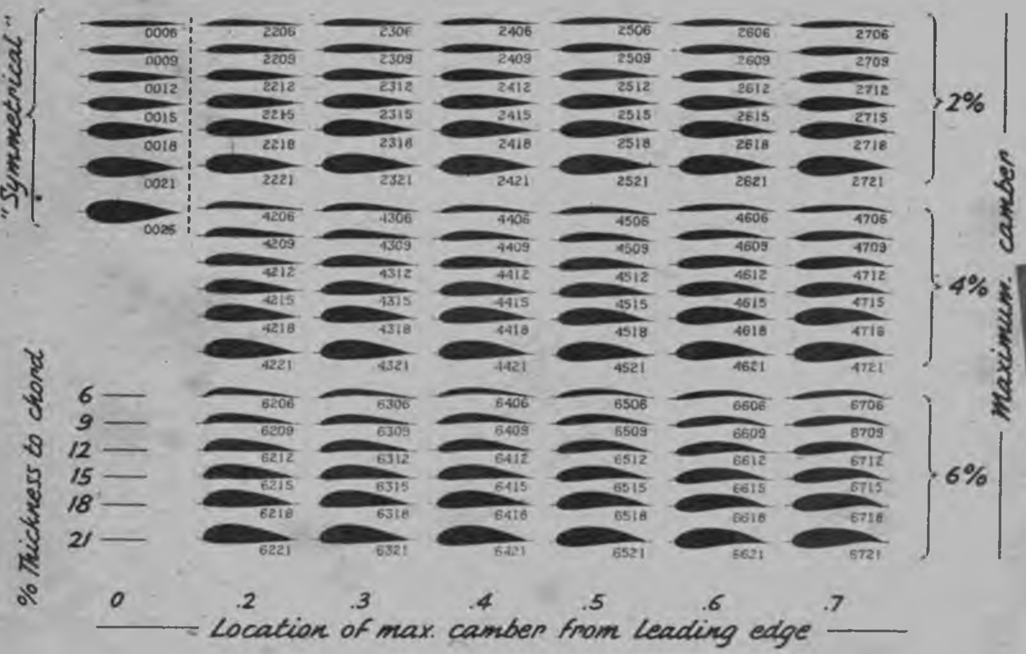
"Ready-cut" propeller Steamed propeller

Elementary propellers



Typical folding propeller with tensioner
(Korda's 1939 Wakefield winner)





AIRFOILS

By

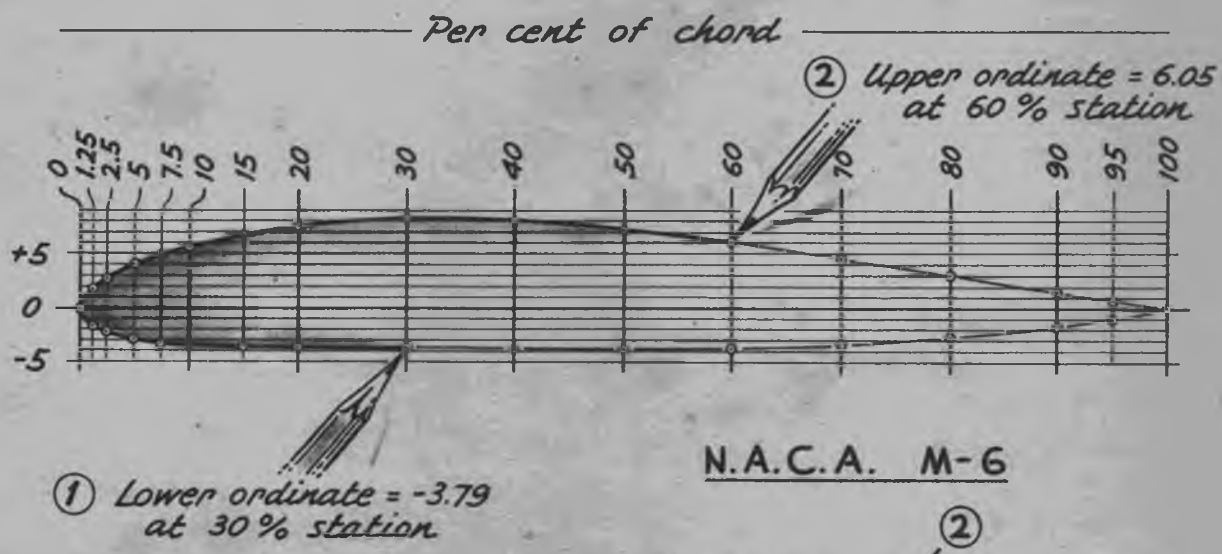
H. A. Thomas

N.A.C.A. AIRFOIL PROFILES

From N.A.C.A. Report #460

PLOTTING AIRFOIL SECTIONS

To translate the table of ordinates into the wing section outline, the first step is to divide the desired chord into tenths. Further subdivide the chord to match the stations given, beginning at the leading edge. From the base line, step off ten or fifteen of these same units of measure above the base line and about five below. Spot the leading edge ordinate; this is usually on the chord line or slightly above. Proceed to locate the ordinate, first spotting the vertical line which indicates percent of chord from the leading edge, then locating the dot the correct number of units above or below the base line. When all points are established, connect them with smooth flowing lines.



N.A.C.A. M-6

②

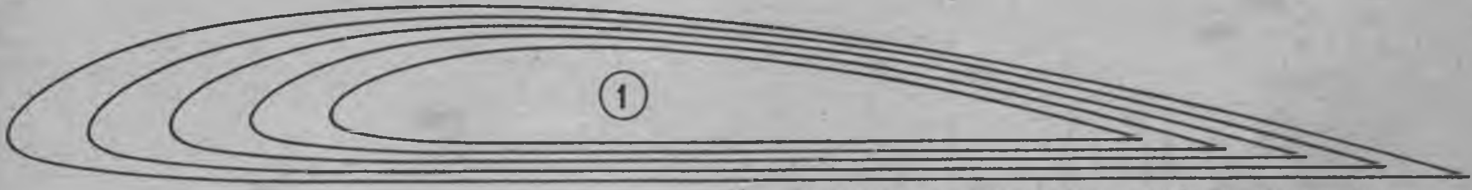
Per cent chd.	0	1.25	2.5	5	7.5	10	15	20	30	40	50	60	70	80	90	95	100
Upper ord.	0.00	1.97	2.81	4.03	4.94	5.71	6.82	7.55	8.22	8.05	7.26	6.05	4.58	3.06	1.55	.88	.26
Lower ord.	0.00	1.76	2.20	2.73	3.03	3.24	3.47	3.62	3.79	3.90	3.94	3.82	3.48	2.85	1.77	1.08	.26

①

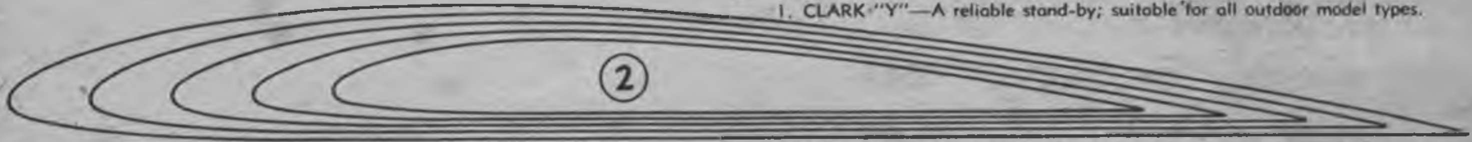
AIRFOIL characteristics vary somewhat between those of model-size and those of full-scale aircraft and, unfortunately, the usual difference is a relative lowered efficiency of the small sections. Engineers deal with this factor by the use of varying "Reynolds numbers," and most modelers are familiar with it as "scale effect." Pessimists argue that almost any airfoil section will serve for model use, but virtually all record-breaking models are those employing carefully selected sections.

Goldberg, Marquardt, Ritzenthaler, and others have developed airfoil sections expressly for models, and the success of these would seem to warrant further experimenting now that control-line flying permits extremely high model speeds. Here the model designer is concerned with the selection of airfoil sections which produce adequate lift with a minimum of drag and yet are so proportioned as to allow the necessary structure within the airfoils.

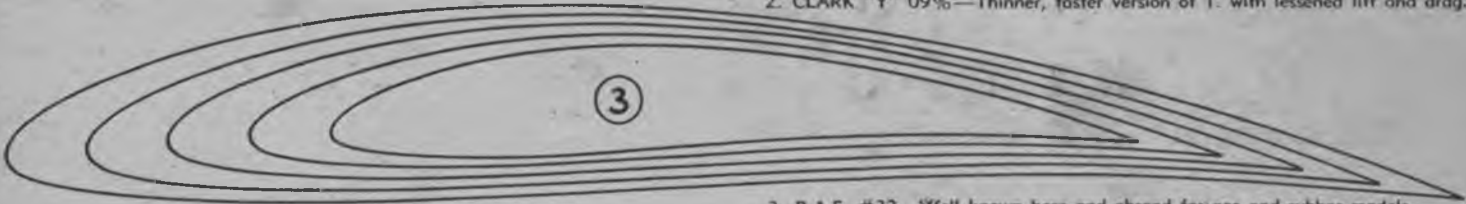
The group of sections on these pages includes many of those best suited to various types of models, from gliders to control-line speedsters. But unless wing construction (leading edge sheathing, use of false ribs, or close rib spacing) is such as to retain the desired section throughout the span, the modeler is wasting his *(Turn to page 108)*



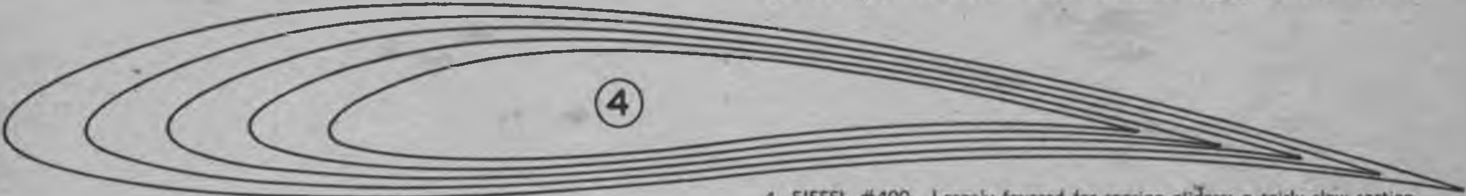
1. CLARK "Y"—A reliable stand-by; suitable for all outdoor model types.



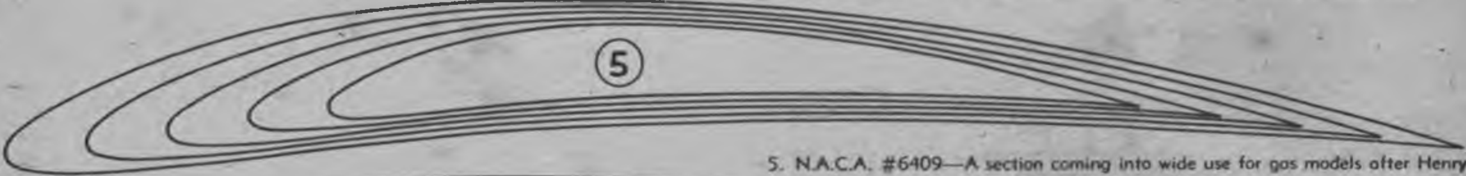
2. CLARK "Y" 09%—Thinner, faster version of 1. with lessened lift and drag.

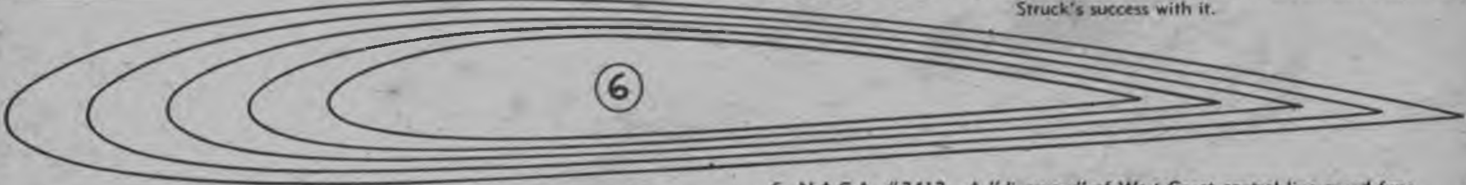


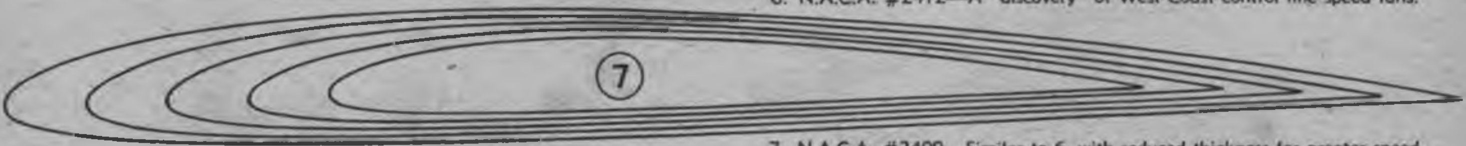
3. R.A.F. #32—Well known here and abroad for gas and rubber models.



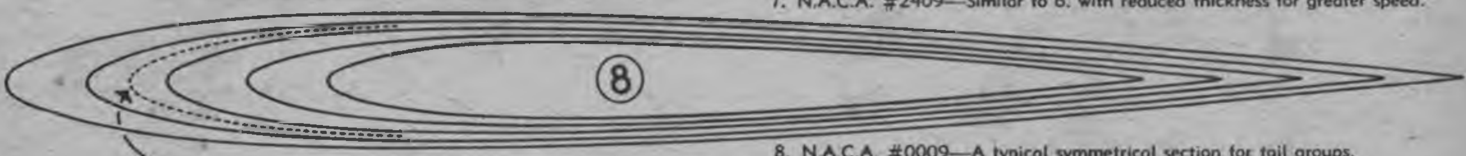
4. EIFFEL #400—Largely favored for soaring gliders; a fairly slow section.



5. N.A.C.A. #6409—A section coming into wide use for gas models after Henry Struck's success with it.

6. N.A.C.A. #2412—A "discovery" of West Coast control line speed fans.



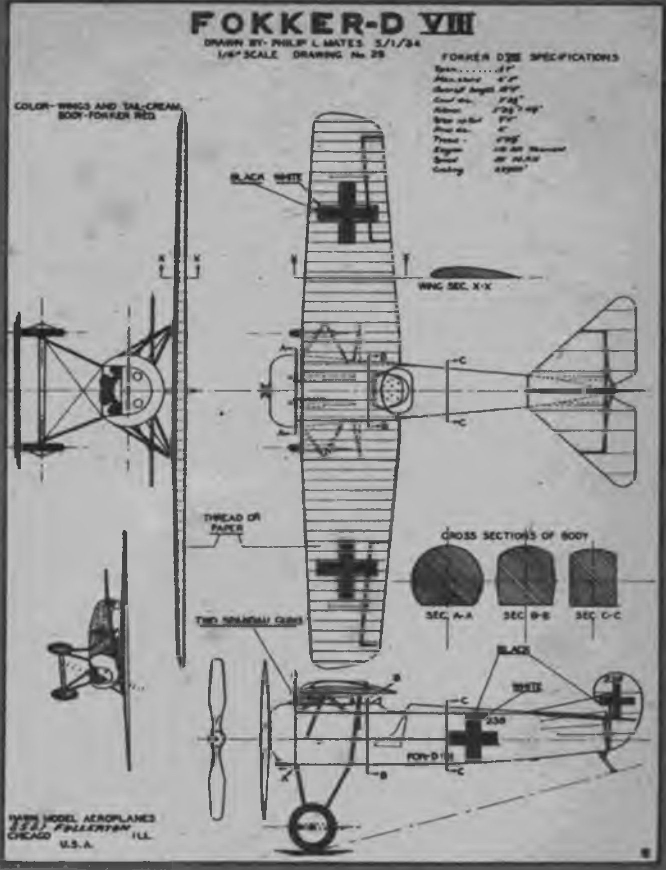
7. N.A.C.A. #2409—Similar to 6. with reduced thickness for greater speed.

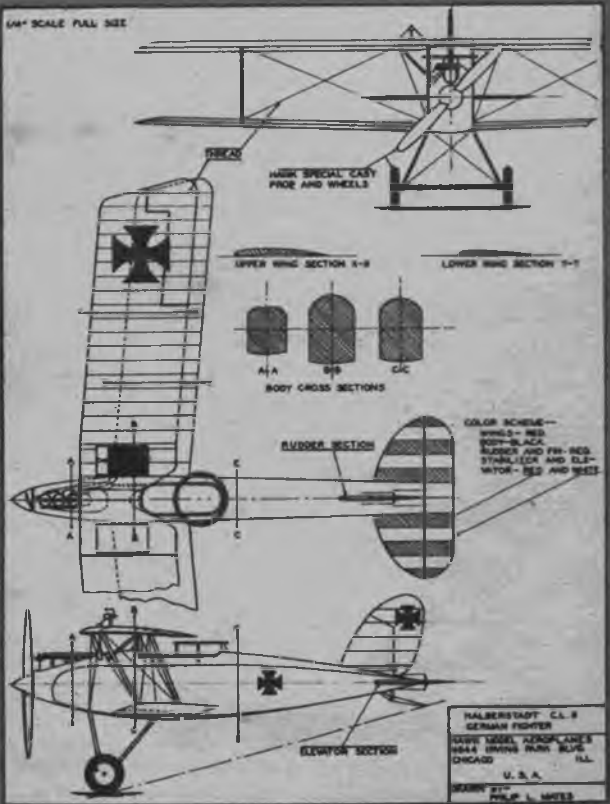


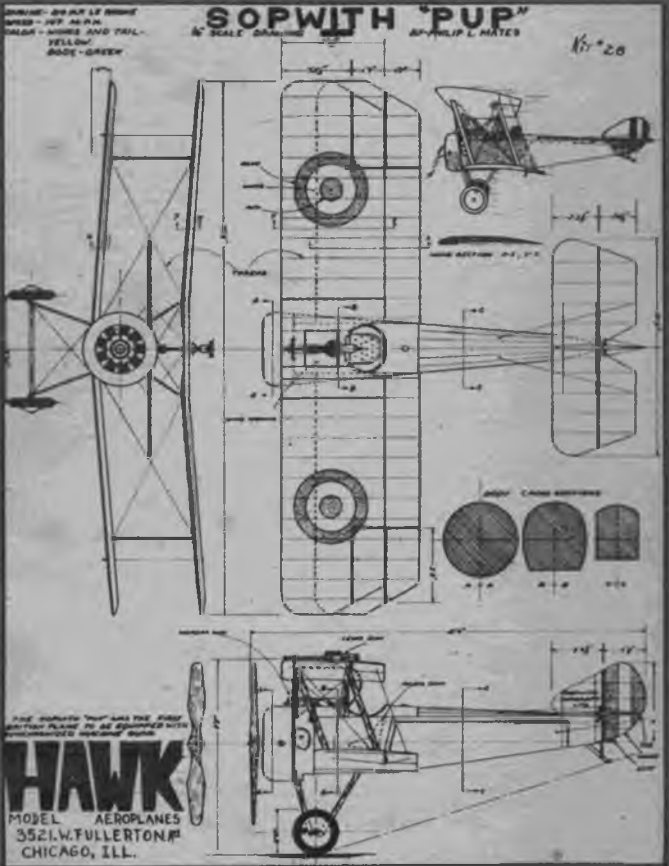
8. N.A.C.A. #0009—A typical symmetrical section for tail groups.

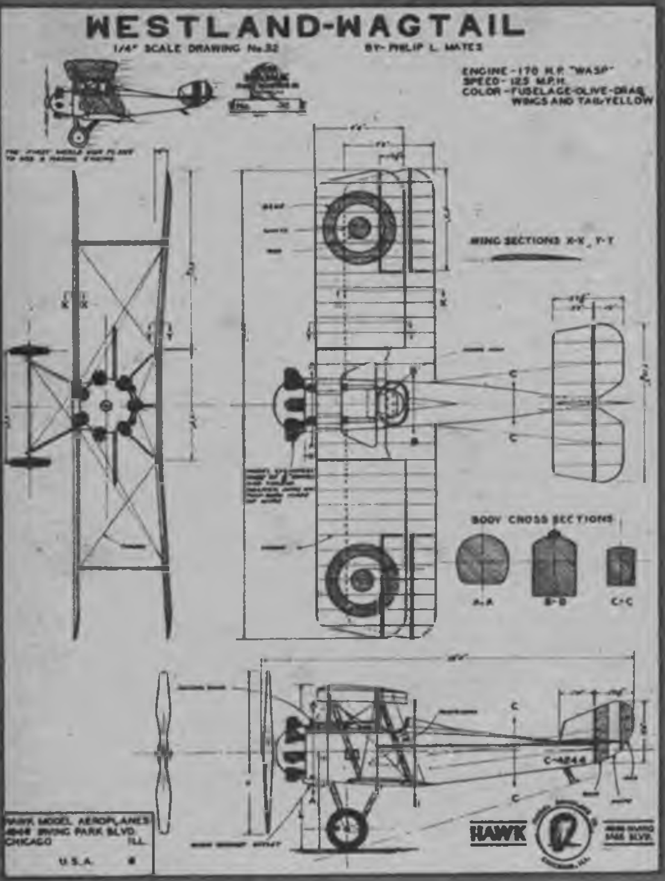
Interpolate for intermediate sizes.
Enlargement or reduction to special sizes
may be done by photostating.

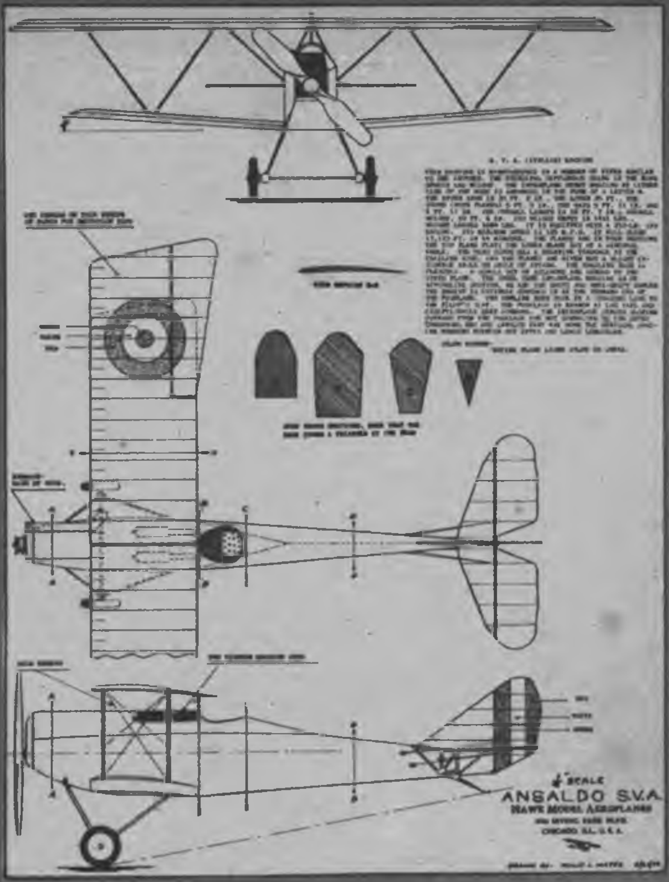
HISTORIC THREE VIEWS

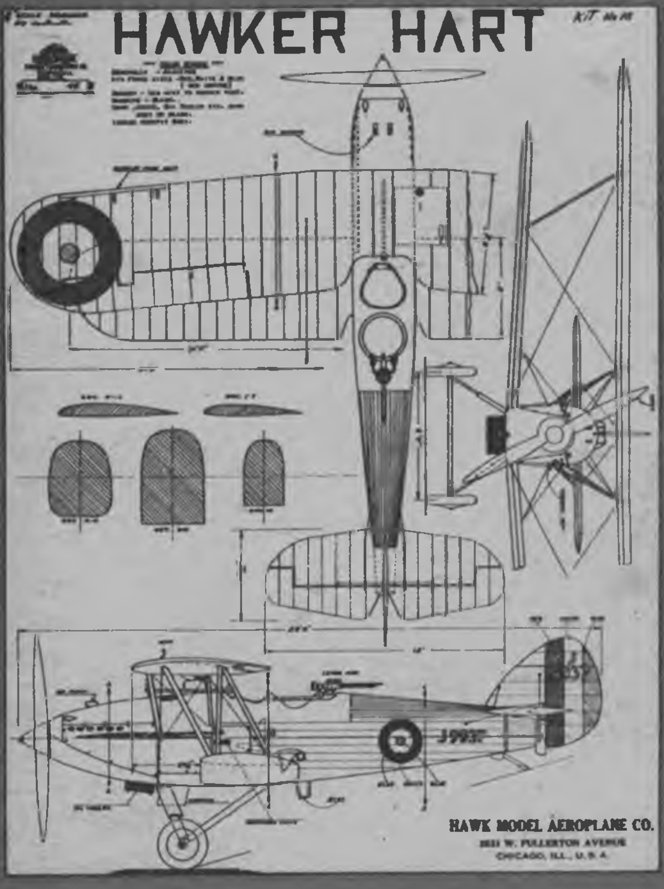


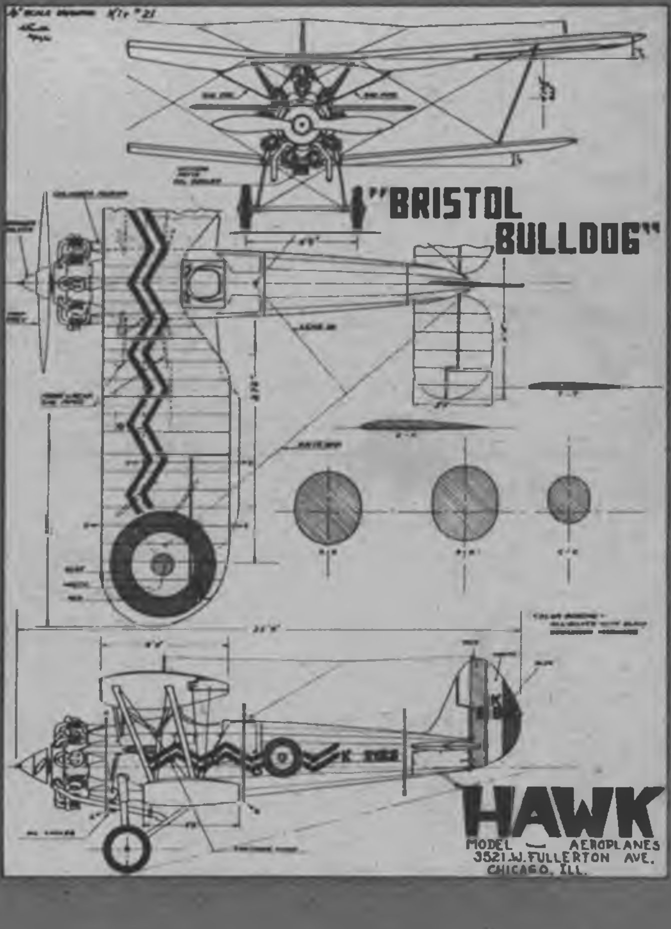





WESTLAND-WAGTAIL
1/4" SCALE DRAWING No.32
BY- PHILIP L. MATES
ENGINE - 170 H.P. "WASP"
SPEED - 125 M.P.H.
COLOR - FUSELAGE-OLIVE-DRAB
WINGS AND TAIL-YELLOW
WING SECTIONS X-X , Y-Y
BODY CROSS SECTIONS
A-A
B-B
C-C
C-4244
HAWK MODEL AEROPLANES
4848 IRVING PARK BLVD
CHICAGO ILL.
U.S.A.
HAWK


S. V. A.
¼" SCALE
ANSALDO S.V.A.
HAWK MODEL AEROPLANES
CHICAGO, ILL., U.S.A.


HAWKER HART
KIT No 18
J9937
HAWK MODEL AEROPLANE CO.
W. FULLERTON AVENUE
CHICAGO, ILL., U.S.A.


KIT # 21
"BRISTOL BULLDOG"
K 2182
HAWK
MODEL AEROPLANES
3521 W. FULLERTON AVE.
CHICAGO, ILL.

Banshee

(Continued from page 61)

is one of the most important factors that can induce long, contest-winning flights. This requirement was given prime consideration in the design, with the existing AMA rules kept in mind.

To allow the finished design to climb exceptionally fast for the power used, and to permit flat glide as well, demanded that the frontal area of the model be as small as possible. Few designers take the frontal area into consideration. I can safely state that frontal area, wing loading, and power loading are the three factors which directly determine the qualities of a sound design. The smaller each is in quantity the more efficient the model. The frontal area of the Banshee was kept to a minimum by careful design of all three components of the plane. The wing was designed using an exceptionally thin and stable airfoil with a simple and sturdy construction, light in weight. The fuselage was to have an exceptionally clean curvature which, along with its small frontal area, would disturb as little air as possible in its forward flight. This demanded a type of structure that previously had never been used. (The structure is covered later on in this article.) The tail surfaces were to have a thin cross-section, as is practical for warp-free surfaces. A symmetrical airfoil was used to keep drag down to a minimum. All this took into account the general features of the basic design.

The center of gravity, center of lateral area, line of thrust, center of lift, and center of resistance had to be located so that all these forces would work in harmony to insure a smooth flight path. With the center of gravity as the basis for locating these forces, the center of lateral area was placed slightly behind and above the center of gravity.

The line of thrust was placed in a line with the center of gravity and the center of lateral area. This angle of the line of thrust to the horizontal base line was found to be five degrees. The center of lift was located 10% of the fuselage length in front of the center of gravity. This position was chosen to insure a smooth flight path under most flight conditions. This location would allow the model to have a graceful flight curve from take-off to landing. Locating the center of lift farther forward would cause the model to have an erratic nosing up or looping tendency at high speeds (while climbing) and, when stalled, to fall farther before it would recover. Placing the center of lift farther back would not allow the model to climb at a satisfactory angle and would cause a steep spiral turn downward in event of too much rudder offset. The center of resistance was located about 5% above and in a line vertical with the center of gravity. This too allowed for a fast climb and, in general, a smooth flight path without any erratic tendencies.

A tail moment of 55% of the wing span has proven very satisfactory in past designs and also was employed in the Banshee. A stabilizer having about 35% of the wing area has also proven ample in the past and was used on the design. The symmetrical airfoil cross-section of the stabilizer and the two-degree positive incidence setting would allow all the forces to exert their desired effect. The rudder was designed using a thin cross-section so that it, too, would not increase the induced drag. The sub-rudders were made larger than usual to allow take-offs in a short space and landings with minimum damage. The sub-rudders allow the model to stand at a slight positive angle so that the ship would jump off the ground, eliminating a long roll on one wheel, before being air borne.

The wing outline was to be of the tapered trailing edge type so that the center of lift could still be kept forward on the fuselage and a low-drag, yet pleasing, outline be used.

Facts on Construction: This radically new type of structure I have named the "X" Type structure. This was the method of construction developed after many previous experiments, and its success and practicability assure that the Banshee fuselage may be built in one-third the time and with one-third the labor required to build the present type. The completed fuselage, when covered, includes the motor bearers, and houses all the ignition units rigidly so that vibration or even major crashes will not damage the ignition system. At a contest, this feature is extremely important since soldering wires cannot be readily accomplished on the field. A trap door is used on the bottom of the fuselage so that the battery box is easily accessible. The fuselage covering has a smooth and lasting finish with two cross layers of light Silkspan or one layer of silk. Either type of covering when applied wet makes an easier and neater job of it. The motor bearers are built right into and are part of the structure. The motor mounts are cut to size so that any class "A" or class "B" engine can be used. This type of mounting has a great tendency to absorb engine vibration and yet allows moderate thrust adjustments on the field. An added feature is that another or different engine can be placed in the nose in a matter of a few minutes. This allows the same plane to be powered by another engine in an emergency.

The wing structure presented a problem since a very thin airfoil was used. A deep spar couldn't be used since it would cause the airfoil to be distorted after covering and aging. A thin spar is used instead and only on the upper curve. The thin spar and sheet balsa leading edge provides sufficient strength.

The tail surfaces are conventional in structure. A deep sturdy spar and ribs sanded to shape from strips of balsa give the stabilizer a simple and strong structure. The straight tapered leading and trailing edge further simplify the building and allow for a warp-free surface. The rudder is triangular in shape and being flat in cross-section the building time is merely a matter of a few minutes.

The wing and tail surfaces should be covered with Silkspan and given two coats of thick dope or three coats of thin dope. No more than this amount is needed since it would further tighten the covering and make it less flexible. The fuselage should be doped twice that amount since less rough treatment is afforded it.

Flying the Banshee: With common sense and good judgment, test flying the Banshee is like taking out your old favorite model and putting it through its paces. If the incidence and thrust adjustments are used as shown, the Banshee will require very little adjusting.

A slight amount of right rudder and warp-free surfaces will allow the Banshee to climb up with a slight right turn and gracefully soar into its right-turning glide after motor shut-off.

Are We In A Rut?

(Continued from page 34)

planes with other multiple units. Group three includes such types as stick, fuselage, gas, and scale models.

Then there are models that are classed under two or all of the three groups, such as, a high wing, twin propeller, fuselage model, or a pusher, biplane, stick model.

Now let us consider important types of planes under group one, and some of their flying characteristics.

Single-Propeller Tractor: The single-propeller tractor is built by more modelers than any other type. This seems to be the standard flying model plane both for contests and general flying. It is composed of the basic units in their simplest form, one wing, one propeller, one set of tail surfaces, one fuselage and a landing gear. It is called "Tractor" because the propeller is in front and pulls the machine with the motor driving it from the rear.

However, some tractors have certain disadvantages. Hand-launched tractors have no landing gear to weight the nose, consequently the nose must be long, relative to the distance from wing to tail, in order to balance the plane properly in flight. This produces instability, requiring large tail surfaces. In such machines cambered stabilizers are essential, giving lift at the tail and making it possible to place the wing nearer the propeller. In other words, special tricks of design must be used to make the plane stable.

Single-Propeller Canard Pusher: For hand-launch events pusher design has advantages over the tractor because of the instability of long-nose tractors. This type of ship has one rear main wing and a smaller forward wing, both mounted on a central motor-stick or fuselage, at the rear of which the propeller is attached. This type has the advantage of excellent stability and climb when properly designed and adjusted. However, they have proved in the past less efficient than tractors when gliding, due to improper design. This is one of the types that experimenters have neglected. Unquestionably it has great possibilities if it is equipped with a folding propeller similar to those used on contest tractors. It can be expected then that this plane would have excellent gliding qualities and match the performance of tractors.

Single-propeller Pusher: Another unique type with excellent performance possibilities is the single-propeller pusher, often confused with the Canard Pusher. It is similar to the tractor in general design except that the propeller is placed at the rear of the motor-stick, the motor driving it from the front. Usually, however, it is located back of the wing.

The fuselage is mounted on the wing as a separate unit, unlike the normal tractor plane. Long motor run may be obtained by extending the fuselage well forward, its weight balancing the weight of the booms and tails. It also has structural advantages. The wing with tail and booms can be built as a unit. The central fuselage, enclosing the motor with the propeller at its rear end, can be built as a single unit and attached flexibly to the center of the wing. This allows the motor unit to be shifted forward or back to give the plane correct flight balance; also it may be twisted sideways to give right or left thrust, as desired, for adjustment. On the whole, it has excellent climbing, gliding, and structural features and would prove superior as a contest winner.

Its only disadvantage, which is a comparatively slight one, is a reduction in stabilizer effect. This reduces longitudinal stability slightly and is caused by the slipstream from the propeller's passing over the stabilizer at a constant angle, regardless of the flight angle of the plane. Usually, in a stall, the stabilizer's angle of attack increases, causing it to lift and right the plane. However, this angle of attack relative to the angle of the ship is less in this type of plane due to the constant angle of the slipstream. Instability caused by this condition, however, is so slight that it may be corrected by giving the stabilizer greater span and placing it as far from the wing as possible.

Biplanes: Contrary to popular opinion, biplanes can be designed to be as efficient as monoplanes. Usually the reason why most model biplanes are less efficient than monoplanes is that the builder has applied monoplane proportions to biplane design with the inevitably poor results. When these misapplied features are eliminated, a biplane can be just as efficient as a monoplane, or even more so, because of its lighter structural weight.

Most model biplanes lose about 20 percent of their possible efficiency because of the small gap between the wings. By increasing the gap to approximately twice the wing chord, biplane wings become approximately as efficient as monoplane wings. Unlike real biplanes, models do not have to have inter-plane struts and wires that materially increase drag.

By applying monoplane proportions to the biplane the wing span is reduced so that small propellers and short motors are used. This further reduces duration and adds to the popular assumption that model biplanes are not efficient. First, the span of a biplane should be nearly as great as that of a monoplane of the same wing area; only the wing chord should be reduced to any extent. Aspect ratios of 12 or higher should be used.

By placing one wing above the other, thereby reducing the wing chord, for any given area, and the resulting center of pressure, a much shorter and consequently lighter fuselage may be used. Because of the lessened weight of the total structure, a greater weight of rubber may be added, thereby improving the performance of the model. Care should be taken to make the propeller area equal to at least 12% of the total wing area. On contest models this could run to as high as 20%. If the area is too little the prop will churn the air, creating excessive torque and little thrust.

Don't forget that the biplane has two wings instead of one when designing the stabilizer area. The stabilizer should contain at least 25% of the total wing area for proper stability. If it is increased to 30%, just to be on the safe side, your plane will be exceptionally stable and much steadier than the average monoplane.

Future types may also be developed by reducing the number of structural units. Tailless planes have already been flown, but to date are still not as efficient as the conventional monoplane. However, through added research and experiment, it is possible, no doubt, to build efficient high-performance flying wings. Up to the present time, all efforts to stabilize these planes longitudinally have resulted in reduced efficiency. One of the tricks that have been overlooked, however, is the slotted flying wing.

Megow's Gas Model WOG designed by William Winter, Editor of Air Trails Magazine. A balsa Kit distinctly new in gas-flight performance . . . gives better control Wingspan 60 inches. Chord 5⅝ inches. Complete Kit, less liquids and power plant.

WOG

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- Completely turned balsa nacelle booms
- Crew nacelle cut both ways to outline shape
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- Two large sheets of Plans — 22x34" — with *complete* 3-view drawings, building instructions and technical data.
- Die cut jig for final assembling of sub-assemblies (just the way real planes are built), insuring accurate alignment of all parts.

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Wog

(*Continued from page 56*)

thrust augments the torque effect which on any but a very high wing arrangement—this will be explained later—depresses the left wing tip). The result of the left-offset motor and right rudder is to give a left circle under power—theoretically the right rudder prevents this left circle from becoming too tight to control—and, with power off, a right turn. Thus, at the top of the climb the ship describes an S-shaped flight path before going into very tight right-hand glide circles. This adjustment is commonplace with contest flyers, who, by trial and error, find the proper combination of amounts of left-engine and right-rudder for best results with their particular airplane.

There are other methods of adjusting. Henry Struck's New Ruler (Air Trails Pictorial, April and May, 1940) had a combination of right-rudder and washin (positive twist to increase the angle of incidence) in the right wing tip. It is the author's recollection that Henry also used right-engine thrust offset. The effect here was to get a tight right climbing circle under power—the wash-in prevented the right wing tip from being depressed into a spiral dive—and, when the power died, the ship, still under the influence of the right rudder, assumed right circles of moderate diameter. Both these systems of basic adjustment were considered for Wog but were abandoned at the eleventh hour. Truth of the matter was that the designer could not make up his mind! Fortunately, the ship proved perfectly controllable by rudder alone when powered by the Ohlsson "23." The high aspect ratio placed ample area far enough out from the center line of the airplane to support the inside tip in a power turn. Try rudder control only on a high-powered low aspect ratio gas model and the results are apt to be disastrous. This control by rudder only—no wing warps or offset thrust—was problem number three.

Gyroscopic effect which, to the designer's best knowledge, was first appreciated for its real importance by Jim Walker, as shown in his early U-Control experiments, affects the power flight characteristics of a gas model and, consequently, adjustments. The article, "Props Are Gyroscopes" (Air Trails Pictorial, January, 1944), based on suggestions from Jim Walker, information from George Tweney of the University of Detroit, and research by Ed Yulke and Art Mansfield, proved that a force exerted rearward—at any point on the propeller disk (the area of the circle swept by the revolving propeller blades) above the thrust line—creates a force about five times as great in a parallel direction 90 degrees around the circumference of the propeller disk (toward the right). In simple English this means that, looking toward the nose of the model from the rear, there will be a rearward force at the right side of the propeller disk about five times as great as the drag of the airplane multiplied by the moment between the center of drag (in any orthodox high wing the C of R—also called center of drag—is above the center of gravity as well as the thrust line) and the thrust line. In high-powered gas models with moderately high-positioned wings, the propeller torque, which tends to turn the model left, is greater than the gyroscopic effect, which tends to turn the model right. In a pylon or fin-type model with an extremely high wing location the gyroscopic effect is sufficiently powerful to compel the model to make right-hand turns under power, thus often leading to a spiral dive. This was one minor point in the selection of only a moderately high wing position on Wog.

The major reason, however, for the location of Wog's wing was to avoid the extreme nose-up moment which is present on any high-powered model with a very high wing location. In such models the drag of the wing (which is a substantial part of the total drag of the airplane!) is located so high above the thrust line that the distance (moment arm) between the center of resistance of the airplane and the thrust line, multiplied by the thrust, provides a powerful nose-up or tail-heavy moment. Many contest builders prefer the wing high to provide the copious doses of pendulum stability needed to handle the power. They compensate for this tail-heavy moment by using a lifting tail. The lift of the wing added to that of the tail (which it is claimed may be considered another wing) is greater than that of the wing alone and hence is supposed to make for a more efficient model. The designer considered this arrangement as being basically an inefficient set-up in that the nearer the wing is to the thrust line and the center of gravity the more efficient the airplane becomes since large forces are not being used to counterbalance each other. (This theory is admittedly open to question.)

On Wog, problem number five became avoiding the ultra-high wing position commonly used for high-power models, which, in turn, obviated the lifting-section stabilizer. (It should be understood here that contest gas models of this type, if permitted to fly straight ahead, would loop, as they often do.) Such models are flown in tight power circles to maintain control. This is considered the best method of attaining good climb. Unfortunately, the maximum angle of climb may not be the best angle of climb. On Wog, perhaps purely as a matter of opinion (the designer is really a die-hard rubber man), wide shallow turns were desired. This characteristic, it was felt, would come with the shoulder wing arrangement (which reduced the tail-heavy effect under power) and with proper proportioning.

All these "radical" departures (ironically, they resulted in a more conventional airplane from an aesthetic point of view) led to the biggest pre-flight worry: would Wog absorb full power in a turn and still climb—not descend in that fatal spiral dive? This, the sixth design problem, was solved by two more highly debatable decisions. One was to use a nonretracting landing gear with two wheels to lower the CLA (the designer has been heckled to switch to one retracting wheel to prevent the drag which would result from such a feature) and the other to use an extremely *high* center of gravity; this last is contrary to the maxim that lowest possible center-of-gravity position is needed for maximum "pendulum stability." The high CG position, considering the shoulder-positioned wing, may seem daring; it could be accomplished here because of the high aspect ratio. The two wheels are a throwback to old rubber model experience. Most builders favor a low center of lateral area position (known as CLA or side or profile area) because, as may be discerned from a study of an airplane in a banked position, there may be a blast of air against the side of the fuselage; thus, if the profile area is concentrated high on the fuselage above the center of gravity this flow of air tends to force the airplane over into a steeper and ever-increasing bank. In Wog, the fuselage was bellied deep and two wheels were used (in calculating the position of the center of lateral area, a cardboard profile of the airplane, including dihedral, vertical tail, and the wheel or wheels, is pierced with a pin until a balancing point is found; this is the CLA) in combination with a high CG location. This high CG was achieved by using an upright engine, locating the coil between the motor bearers and placing the batteries directly under the wing.

In addition to these decisions, Vee-dihedral, rather than the familiar polyhedral, was used on the first version of Wog. This attempt to disprove popular experience was destined to fail. The first Wog had a planked fuselage with a crutch and oval-shaped bulkheads (this was kept throughout), a monospar wing covered on its top surface with 1/16-inch sheet balsa in two 3-inch-wide pieces, and a conventional built-up tail. Since everyone who saw the sketches prophesied that the thin rear section of the fuselage would snap off, a top and bottom keel of ⅛-inch sheet balsa, tapering from ⅜ inch to ¼ inch, was added. The crutch cross-section was made ¼ x ½ inches. Thus built, the airplane proved capable of dropping on its nose out of trees without damage so, in the final design, the top and bottom keels behind the wing were eliminated to save weight. The sheet balsa covering of the wing was expected to give strength to prevent twisting of the wing tips during high-speed flight and to give structural strength to the long, thin wing. Actually, the 1/16 inch added thickness was in addition to the normal thickness of the NACA 6409; the thicker 6412 had been recommended for strength so, in effect, this was a compromise. Greater flight prowess was expected from the thinner airfoil. It was felt that the rigid covering afforded by sheet balsa surface would eliminate sag between ribs, thus preserving the true airfoil shape from tip to tip. Also, fabric or paper fluctuations in flight—you get them on any thin-skinned wing even in full-scale aircraft—are detrimental to efficiency. Whether or not this actually occurs in a model wing in flight is a moot question. Rubber-powered models built by the author with this construction had shown excellent performance capabilities. The sheet covering in Wog was heavily sanded toward the edges, probably being no thicker than 1/32 inch near the trailing edge. Incidentally, the sheet balsa was carried back over the 3/16 x 1 inch trailing edge, the material being tapered to a knife edge. Later, when silk covering was applied to the bottom surface only, it depressed the trailing edge slightly, like a flap, so in subsequent wings we left the trailing edge rounded. Paper covering is okay. In that first wing, ribs were spaced three inches apart, but a collision with a tree snapped the front section of the wing downward so rib spacing was decreased to 2½ inches with medium hard balsa ribs (instead of soft 1/16-inch thick ribs) and this proved adequate. The aerodynamic set-up consisted of a tail moment arm equal to ⅖ of the wing span, a ⅒ nose moment arm, 2½ inches per foot of Vee-dihedral, a ten percent rudder, and a thirty-two percent stabilizer of symmetrical cross section. The wing area was 320 square inches; the wing loading turned out to be 12.15 ounces per square foot; the power loading 117.2 ounces per cubic inch displacement. The streamlined cross-sectioned stabilizer was chosen simply because the designer disliked lifting-type tails; minimum drag of the airplane was the goal. Even if the L/D (lift to drag ratio) of the airplane could be improved, the ratio of drag to power was to be kept as low as possible. If the wing is responsible for a large part of the total drag, then a 30 percent stabilizer with a lifting section would contribute extra drag. We admit that the lifting tail contributes to the total lift but our contention on this was that it also contributed drag.

Hand glides of the finished airplane revealed an extremely flat and fast glide. The first power flight (the engine, being new, was prone to "seize" so the throttle was advanced a shade more than was judicious for the first test flight) was good—a nice climbing right-hand turn. The glide was exciting but seemed fast for a contest ship that must catch thermals to win. With minute adjustments of the rudder the ship would circle under moderate power in either direction. Rudder control was positive but overly sensitive. At this point the kibitzers, assorted editors, and the designer all had ideas. While the Vee-dihedral seemed okay, both Ed Yulke and Walt Schroder observed a slight skid (which would be worse with added power); the designer, having misgivings about the Vee-dihedral, thought the inside wing under power was inclined to ride too low. It was decided to reduce the rudder area from 10 to 7 percent to reduce its sensitivity—its powerful effect was contributing to the skid—and to increase the Vee-dihedral to three inches per foot of span. The results, as far as dihedral was concerned, were almost disastrous. First, the added dihedral caused a terrific loss of lift so that to keep the nose of the ship up in a glide the trailing edge of the stabilizer had to be raised 3/16". Under power the ship did tremendous zooms both because the added dihedral raised the center of resistance and because of the nose-up effect of the negatively angled stab. While this zoom might have been handled by large doses of rudder, making the ship climb in tight-banked circles, it was decided to abandon the Vee-dihedral for polyhedral.

Something not realized by the designer was that for the equivalent effect the polyhedral actually raised the wing tips less than did the original 2½-inch-to-the-foot dihedral! This low-

(Turn to page 96)

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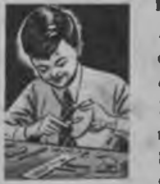
Here you see him, working on his newest design. And you notice he's using an X-acto Knife. He says he doesn't see how any modelmaker can get along without an X-acto. He likes its scalpel-keen edge, the variety of interchangeable blade shapes. With X-acto, you can get true accuracy in even the smallest detail. *"Most useful tool in a modelmaker's workshop!"* That's what this young expert calls X-acto Knives.



PARENTS PLEASE NOTE! As a teacher of craft classes for young children (aged 8 to 12), Mr. Powell found the razor blades they'd been using meant cut fingers and too much spoilage. "X-acto Knives were the answer to that," he says. "The firm-grip handles permitted the children to carve safely, and turn out better work. That means a lot more fun!"

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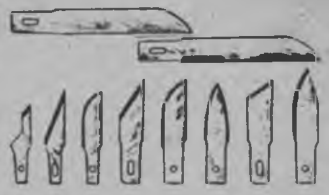

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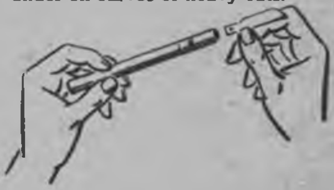

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(Continued from page 92)

ered the center of resistance an important amount and the center of gravity slightly. Now we had back the old flat but fast glide and, with the new rudder, just the right degree of control. The polyhedraled tips definitely improved the turns under power and actually helped the ship to pass smoothly from power flight into the glide. With Vee-dihedral we were troubled with a persistent slight dip when the power cut out. The ship climbed and glided well in right-hand circles under low power. We decided *not* to leave well enough alone. That glide had to be slowed down. Flight efficiency in a contest model is more important than aerodynamic efficiency. For the moment, the designer suspected that "boxes," those slab-sided airplanes, were more efficient competitors than the streamliners (however, the streamliners can outclimb a box so we stuck with Wog). By flight efficiency is meant the correct blend of climb, turn, and glide to achieve maximum duration in the presence of thermals. A slow, tight-circling job stays in a thermal longer than the ship with a fast wide-circling glide. The experts achieve a slow glide by increasing the angle of incidence of the wing or by raising the trailing edge of the tail, the last a dangerous adjustment since it is more apt to cause a loop under power than to add incidence to the wing. Sometimes the perfectly obvious can be under one's nose, for only now did we increase the incidence of the wing from four to six degrees. Interestingly enough, this amount of incidence has been found desirable for a 6409 section by many builders. This was the answer. Under low power, with a stuck timer and approximately thirty seconds of fuel, the climb was in flat, tight circles—not unlike the peculiar wheeling circles described by sailplanes and other long-winged craft. Altitude reached was high, and the ship floated out from its climb into a flat, circling glide. The duration was something over three minutes in the early morning air.

Though the flight was good it was peculiar in that for the first time the ship circled left under power, despite a fairly generous right rudder setting. Investigation showed that high pitch prop had been substituted (fortunately!) for the low pitch so-called "climb prop," thus increasing the torque effects. From this first-hand experience it was decided that the best climb does not come with a wide-open engine with a low pitch prop. The engine scream is wonderful to hear but the thin prop is only beating the air and does not absorb the output of the powerplant. We got results with moderate power and a high-pitch prop, and a normal angle of climb for altitude was gained quickly. The fact that the torque of the prop turned the ship left under power pleased us for it gave an assured flight characteristic so that we knew what the ship would do. With the prop dead the right rudder turned the ship through an S-shaped flight path into a glide. (Many builders prefer this flight pattern because it sometimes keeps the ship over the field on a windy day.) With the same rudder adjustment and an almost wide-open engine, Wog went into steep, almost perpendicular banks, but gained altitude and did not spiral in. This was what we had been waiting to see. The long-winged design had licked the "too-much-power" villain. It was a simple matter to open up this tight bank by adding more right rudder. Reflect and you will realize why this is so: torque depresses the left wing tip on a ship that does not have an extremely high wing location (remember the gyroscope stuff?), thus tending to cause a left bank and circle. Right rudder turns the ship into a tighter right-hand circle in the glide, a desirable condition for hooking thermals.

Now that Wog has proved itself, the editors are again embroiled in a ruckus. Editor Walt Schroder thinks Wog is perfect as is. Ed Yuke and Bill Tyler feel that an inverted engine with a slight parasol-located wing—they would keep the present location of wing and tail but would alter the fuselage profile to permit these design changes—would make a more efficient airplane. The designer, not too sure, sticks by his guns that Wog is better the way it stands. Here are some of the pros and cons. For the change: the elimination of the high nose block would eliminate air flow disturbance over the center section; this disturbance admittedly fans out at a thirty-degree angle from the point of disturbance at the leading edge until it strikes the trailing edge reducing lift in the affected area. The parasol wing with a conventional small pylon, it is claimed, would cause less disturbance between wing and fuselage. The high thrust line would further reduce the thrust moment about the center of resistance. The ideal theoretical set-up is to have the nose-up thrust moment about the center of resistance partially cancelled by a nose-down thrust moment about the center of gravity of the airplane. For leaving it alone: the shoulder wing position of the wing, it is claimed, is the nearest thing to a midwing, which is known to present the smallest amount of loss by interference between the wing and the fuselage. Inverting the motor would lower the center of gravity and change the position of the thrust line. The latter is a theoretical improvement which can be proved only by building still another airplane; the change in profile, plus changes in CG and CLA and the line of thrust, plus the addition of a pylon means, from the designer's point of view, an entirely new airplane. This new design would seem to be another pylon design, which was one of the things we started out to avoid.

Two new design modifications are projected. One, by the designer, may feature the inverted motor, provided the same force diagram can be adhered to, and will attempt to save some additional weight. The plans, however, show most of these weight savings. The ¼ x ½ inch crutch members of the original Wog are entirely too heavy and needlessly strong; the plans show ⅛ x ½. Top and bottom master stringers are eliminated on the plan with the single exception of a keel-like member near the front end; and various other odds and ends, originally much heavier, have been lightened as shown on the drawings.

Though the ship was designed for the Ohlsson 23 and performs well with that powerplant—and should perform even better with the lightened construction—the power loading will permit a Foster 29. An inverted "29" is Ed Yulke's intention. With this amount of power the higher thrust line of the inverted motor may prove its worth (the mounts would be raised). It is quite probable that 1/16 inch washin should be used on the left wing tip for a 29-powered job. One thing is sure, a 29-powered Wog should prove a formidable contender in any contest.

It is not too late for readers to join the fray. As many letters as possible will be answered. We'd like your thoughts in this discussion.

Stinson 125

(Continued from page 46)

the other, then separate and rejoin them by 3/32" cross-members using the top view as a guiding jig. Cut the formers and center-section ribs from 1/16" sheet and attach them to their respective positions; note how the center-section ribs are inclined at an angle for a neat joint when the wing dihedral is added. Stringers are 3/32" sq. strips on top and from the center of the fuselage down, 1/16" sq. Cover the nose by planking with many strips of 1/32"-1/20" thick balsa—use strips as wide as possible for the area being covered (wide strips on the top's gentle curve, narrow on the bottom, etcetera). The nose block is laminations of sheet balsa and it has a square hole cut in it to receive the nose plug. Cement the block to the nose and shape it to blend with the curvature of the whole front. Scraps of balsa are used for the window outlines as well as the balsa retainer for the removable bamboo dowel that holds the rubber in the rear.

Make the nose unit next. The nose plug consists of a disk of 1/32" plywood in the front and laminated squares of balsa sheet in the back. Washers cemented to either end of the tiny hole; through it fix the line of thrust. Carve the balsa propeller from a hard block 1" x 1⅝" x 10" (a half size model needs a block ¾" x 1¼" x 5½"). These are the flying model propellers and they should have a bearing surface on the back and a free-wheeling gadget on the front so the propeller can spin freely once the power is spent and the model is gliding. A free-wheeler of the type shown is made from 1/32" thick brass or steel. To improve the model's appearance a spinner should be shaped from balsa and fitted over the hub. The shaft joining the propeller and rubber motor is .040 music wire. A scale propeller is shown and can be used when the model is being displayed.

Wings, stabilizer, and rudder are of the usual construction. An RSG airfoil is employed for the wing and this is one of the finest, most efficient airfoils ever found for wind tunnel models that are flown at speeds comparable to the average model. It should be noticed that the stabilizer is made in one piece. Once the frames are assembled, sand them carefully so a neat covering job can later be made.

The landing gear is scale but is shown in the extended flight position to permit as large a propeller as possible to be used. Make the main strut from .040 music wire and attach it to the underframe by binding neatly with thread and then cementing firmly. Sheet balsa of the correct thickness is used to make the heavy, scale struts and they are grooved to fit over the wire legs. Wheels are made from laminated balsa disks and the covers or pants are laminated balsa too. Shape all parts carefully to enhance the appearance. Wheels should have bearings or washers cemented to the sides so they will revolve freely. Incidentally, don't attach the struts, pants, or wheels until after the fuselage is covered.

Before starting to cover the frames, sand them thoroughly to remove all flaws and roughness. Colored tissue is used and many individual pieces, neatly lapped, must be employed to avoid unsightly wrinkles on curved parts such as the fuselage and wing tips. Lightly spray the covered parts with water to tighten the tissue but don't apply any clear dope until they are assembled. Incidentally, the model pictured was colored yellow and red with black trim.

Now to complete the model. Make paper patterns of the windshield and windows exactly to shape before cutting them from celluloid (cleaned photo film negatives will do). Cement them to place, carefully avoiding cement smears which will mar the surface. Cement the balsa landing gear struts over the wire legs and reenforce the junction with a thin strip of silk, or other cloth, or even tissue if necessary. Note that the top of the strut is not attached to the fuselage but rather is free to spring and thus absorb shock. To get the stabilizer in place, the rear fuselage structure and tissue covering must be temporarily cut. Set the stabilizer flat upon the underframe longerons and then cement it fast; now recement the separated fuselage structure. Off-set the rudder a bit for a right turn in the glide; be sure it is perpendicular to the stabilizer. Wings for the flying model have 1⅝" dihedral at the tips. Wing struts are shown and they are shaped from balsa as are the carburetor intake, tail wheel, steps, and the like. Paint any exposed wood parts to match the covering. Details such as license numbers, control surface outlines and other trim are cut from contrasting tissue and doped to the surface.

The amount of rubber required for each model will be determined by the completed ship's weight and general efficiency; however, twelve strands of ⅛" flat brown rubber should be about right as this was the amount required for the original. Lubricate the rubber strands with a mixture of tincture of green soap and glycerine before placing them within the fuselage, but be sure to wipe off the excess, otherwise it will splash on the sides. To insert the motor, hook one end of the loops to the prop shaft and then drop the other end (that has the strands held together by a loose thread binding) through the nose and into place where it is held by the removable bamboo pin.

Undoubtedly the most important factors in obtaining fine flights from any flying scale model are patience and good judgment. A well built model, if properly handled, will provide countless realistic flights if given the proper chance. With this in mind, strive to get the maximum fruits from your labors. It is important that the glide be reasonably good before any power flights are attempted, so try a few shoulder-height glides and, if necessary, add a corrective weight to the nose or tail, as required, to get a long, smooth descent. (The test ship needed a small piece of lead cemented within the cowl to achieve this.) Now, once the glide seems okay, try a few power turns; minor adjustments may be made by slightly warping wing tip or the tail surfaces but corrections for serious misadjustments should be made at the nose plug. Right or left thrust will control the amount of circle while under power and slight down thrust will iron out a stall. In all probability, your Stinson will need a bit of both right and down thrust to achieve a fast, smooth, climb with a gradual sweep to the right, ending in a spiraling, flat glide. Once adjustments seem satisfactory, hook a mechanical winder to the loop on the nose and stretch the rubber motor out before beginning to store up power. Many hours of enjoyment are in store for you with your "Voyager."

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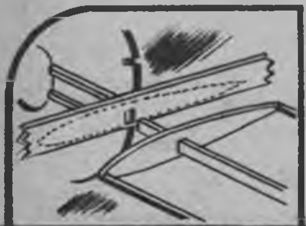

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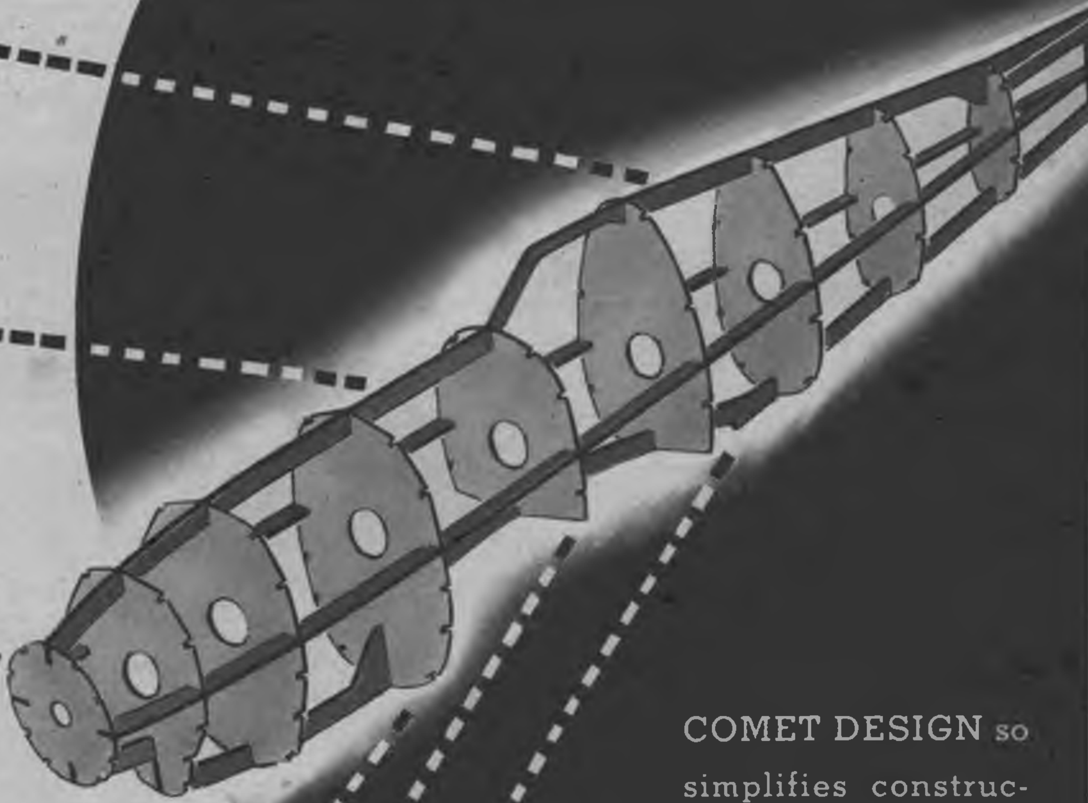

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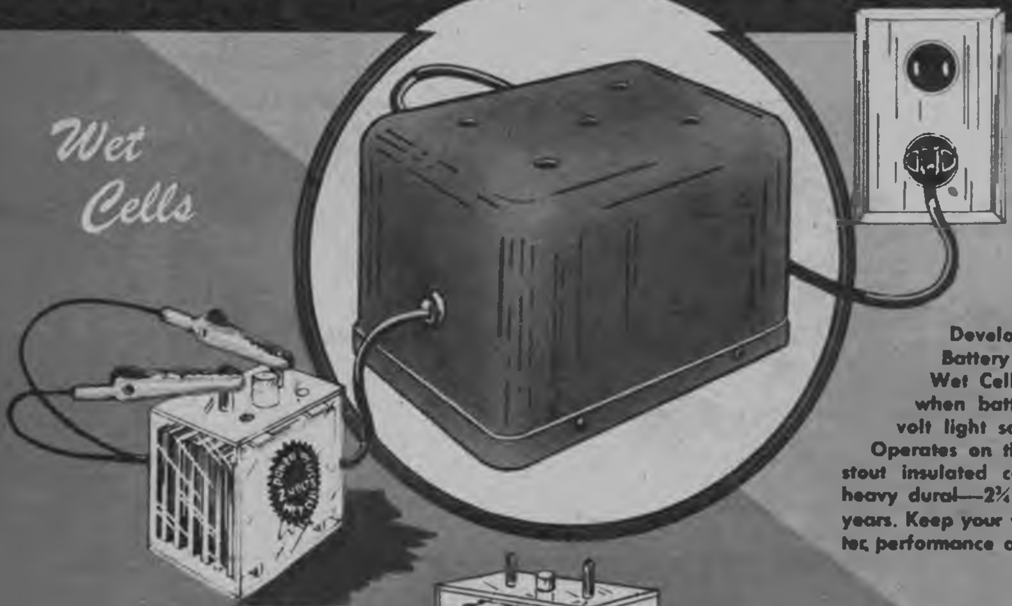

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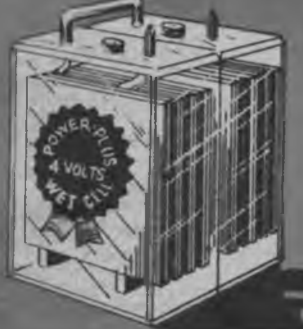

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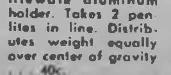

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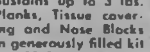

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Trends—Essentials Of Gas Model Design

(*Continued from page 12*)

on the vertical placement of the wing; should always be above the C.G. Wing Area and Section (E) determine speed and many flight characteristics of the model, while Aspect Ratio (F), or span-to-chord ratio, has a lot to do with wing efficiency. Dihedral (G) affects lateral stability as well as the center of lateral area. Tail Group Areas and Sections (H) have virtually the same importance as (E). The length of the nose, or Nose Moment (I), is important in determining the effect of engine torque; the longer the nose, the greater the torque reaction. The Tail Moment (J) has to do with general stability, particularly with respect to stall characteristics; the greater the distance, the greater the leverage the tail has in stabilizing the model. Fuselage Lines (K), along with (H), (E), (G) and (L), fix the center of lateral area, which should fall above and behind the C.G. Of somewhat lesser importance is the Landing Gear (L); its location governs take-off and landing characteristics, and the area of the wheels also affects the location of the center of lateral area.

Trends

(*Continued from page 11*)

funny thing is that the idea to increase wing loadings in order to reduce out-of-sight losses really back-fired. The smaller, more heavily loaded models with the *same* power as the big jallopies started to climb straight up to tremendous heights, from which they too easily soared out of sight.

Eventually, power loading rules were imposed. For every cubic inch engine displacement, a model had to weigh 60 ounces. Later, this was altered to 80 ounces. Thus, for a .60 engine, the required weight was 48 ounces. New engines, like the Rocket, which has only .46 inches displacement but the power of a .60, threaten to make the rules even more ineffective than they already have been proved to be. Until power loadings go up to something like 120 ounces or more per cubic inch displacement we shall have frequent crack-ups due to complete lack of control, plus high percentage of out-of-sight flights.

Though the more-power trend affected both rubber and gas, both fields of design took separate courses. In gas, the perpetual problem was how to handle the excessive power for the size airplanes being flown; in rubber, the problem, since there can be no limited motor run, was how to extend the motor run to get higher climb. Carl Goldberg's Zipper, designed for Comet, revolutionized gas model design in 1939. By placing the wing high on a pylon and using a lifting-type tail, Carl was able to control the tendency to stall under power well enough to get a straight-up climb. Pylon models dominated things for years and are still quite popular. One virtue of the Zipper idea was that the pylon which supported the wing had a good effect on the power-turn characteristics of the model. The same feature applied to home designs offset some unfortunate but mistaken practices, namely, the idea that by placing heavy objects low in the airplane a great amount of "pendulum stability" was obtained. It has since been proved that it is important to have a fairly high center of gravity with a deep-bellied fuselage. This combination gives safe turns with a powerful motor, eliminating the need for the pylon. This is why the present trend is toward the cabin model: the one with the wing on top of the fuselage, and the shoulder wing affair. Probably the worst thing that ever happened to gas modeling was when the rules eliminated the requirements for a minimum fuselage cross section of Length Squared, divided by 100. The result was the "pencil bomber," an airplane with a stick-like fuselage. With its wing mounted high on a pylon, and with great forward and climbing speed due to its very small resistance, this model required a lifting tail with an area equal to half that of the wing! That rule, thank goodness, was rescinded in 1944.

Until 1938 there was no wing loading rule for rubber-powered models. In 1938 a wing loading of 60 ounces per square foot was imposed. This had to be increased to 80 ounces in 1939. Like gas, the net result was to substitute for the old-fashioned "floater," or ultra light weight model, a more efficient job that, despite heavier loadings, flew out of sight just as easily as its more fragile ancestors. Increased motor runs were achieved, not by gearing and multiple motors, as one might expect, but by rubber tensioner devices which, by preventing the motor from completely unwinding, made it possible to use over-length motors. Thus, a four-foot rope of rubber could be installed in a 30-inch-long fuselage without sagging.

Though streamlining never really took in either gas or rubber, some concessions have been made in the interests of better glide. On rubber, free wheeling props came in, followed quickly by the "folders," themselves made possible by rubber tensioning devices and propeller stops which always stopped the prop in the same position, after which the wind blew back the hinged blades. Retractable, single-wheel landing gears have become fairly popular. Usually, a rubber band snaps back the landing gear into a slot in the fuselage when the weight of the model becomes airborne. Serious streamlining for gas models seems to have been halfhearted, stopping at an occasional folding landing gear, fairing stringers on a fuselage, the use of cowls around the motor.

The editors believe that, for rubber, a box fuselage is adequate, but that folding landing gears help considerably. Folding props are a must. For gas, boxes are adequate, but it is recommended that they be faired to a cross section that approaches an oval. Motors should be cowled, at least underneath and on the sides. Landing gears should be short as possible and yet protect the propeller. A folding landing gear helps. A folding prop for gas is very dangerous and should not be used.

P-47N

(*Continued from page 79*)

style of previous models in this series. Use medium texture balsa throughout. If you make use of parts supplied by your dealer, such as propeller, wheels, etc., check them closely with the plan for size and shape. Such parts can sometimes be trimmed to accurate size.

To get a smooth finish with a minimum of time and effort, try this procedure. First sand the assembled model carefully and form the fillets to wings. Mix the talc-dope filler and add considerable thinner (this makes for easier sanding). Using the thickest mixture that can be smoothly brushed, apply two coats to the entire model. This builds up a thick layer of talc and dope which, when dry, can be sanded to a smooth finish without reaching the wood surface.

To display the rockets and bombs most effectively, the model may be built on a pedestal with landing gear in retracted position. Details are included, however, for construction of the extended gear. Landing gear struts can be made of paper clip wire, wound with paper strips to stimulate the recoil struts. Landing gear covers are of aluminum sheet and bombs, rockets, wheels, etc., are of balsa. Rockets are finished white with black vanes and noses. The entire model is finished silver with bombs, wheels, propeller blades, recessed parts, and the anti-glare panel atop the fuselage a flat black.

Knight Twister

(*Continued from page 25*)

to receive the ⅛" landing gear wire. The pants and fairing are made independently so that they may be removed when flying. The lower wing is mounted by inserting the main spar into a box made of 3/32" sheet glued to former at station $4. (The planking on the ship is the bottom of the spar box.) Piano wire is used to brace the lower wing after it is glued in place. (.040 dia.) Drill the wing fillet block at the base of station $3 and insert the piano wire through the fuselage. Bend both ends of the wire at right angles; groove the leading edge of the wing and insert the right angle bends into the grooves.

Wings: The upper wing is constructed in one piece as no dihedral is used. Do not cover between ribs $1 and $2 until the wing is glued in permanently. Make 1/16" sheet gussets and glue against spar and rib $2 to prevent the rib from warping when doped. Gussets are also used on the lower wing at rib $1; glue them against the main and auxiliary spars. The lower wings are also covered before glueing.

The main wing struts are made of ¼" sheet, shaped to the outline on the plans, sanded to a streamlined shape, and then glued as shown on the plans. The auxiliary "N" struts are made of ⅛" x ¼" soft balsa.

Both the stabilizer and rudder are of conventional design and require no special instructions. The stabilizer hinge rod is made of an ordinary straight pin bent to right angles at both ends. The hinge is made of sheet aluminum drilled at one end and inserted over the pin. The front spar of the stab is notched to receive the head of the hinge and also the hinge rods, which are pushed through the spar at the ends and inserted into the notch on the spar. The long end of the hinge is glued against the stab rib. The rudder hinge is made of thin-gauge sheet aluminum and pressed through the two rudder spars, where both ends are bent at right angles to the spar and glued in place.

The landing gear is fastened to the ⅛" plywood former at station $3 in the conventional manner, using light gauge sheet aluminum strips over the wire. It is then bolted in place with 3/16 rd. head brass or iron machine screws. Cooling louvers are made of tin rescued from the salvage heap and bent to the outline shown on the plans. The wing mount for the upper wing is made of medium soft balsa to the outline shown on the plans and glued on top of the fuselage planking. The top of the mount is recessed to receive the center wing rib and the main and auxiliary spars.

The engine cowling hatch is cut after the planking has been finished, sanded, and covered. The cowling hatch is split through the center of the fuselage for the main opening and is cut from the side of the fuselage at the position indicated on the plans. Crinoline hinges are used. Rubber-band hatch springs are fastened to hooks on the inner side of the hatch and to hooks fastened to the firewall.

The upper stringers of the fuselage are glued in place and allowed to stick out at the rear without being fastened to the rudder uprights until the finished stabilizer is glued in place. The rudder is then glued in place on top of the upper stringer and the main rudder spar butt-joints on top of the tail block. The free stringer ends are then butt-jointed against the inside of the main rudder spar.

When making the control rod pivot,

(Turn to page 112)

● The "Twister" is the most popular of all control-liners published in Air Trails. Here is M/Sgt. H. James and his model, which performed successfully.


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ARISTOCRAFT'S ebony-black plastic finish excellently takes camouflage coloring.

Hole is drilled at center-of-balance for suspension by cord or mounting on stand.

B-32 DOMINATOR (illustrated below)

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Distinctive Miniatures

DEPT. AT A — NEWARK, N. J.

Thermic 70

(*Continued from page 68*)

rudder area was not the delicate determining factor for spiral stability in the turns.

Using 3° difference between the wing and the stab provided good recovery during the testing period. The success of these tests was such that the 3° trim was continued. The original of this model flew well from the start. The main check was for spiral stability and it was found that the Thermic could take the tightest possible turns without spinning. It was also found that it was possible to tow the glider straight over the head and that a mere walk is all that is needed for towing. Simply use a side hook for counter-rudder control and have it along a 45° angle from the center of gravity.

A great many 70's have been built, and reports from the field bear out the original tests. This design has held most of the class "E" national records for the last few years. The only change has been the name of the record holder. At the moment, all three divisions, Junior, Senior, and Open class "E" records are held by members of the Queens Thermal Thumbers and their Thermic 70's.

The Wanderer

(*Continued from page 58*)

lances properly. A realistic type like this should balance at about 40% of the chord from the leading edge. Any nose or tail heaviness discovered in balancing can be remedied by inserting incidence blocks under the leading edge of the wing for a nose-heavy condition, and under the leading edge of the stabilizer for a tail-heavy condition.

Tall grass is preferable for the test glides. If there is no grass available, glide the model from kneeling position. When gliding, point it into the wind and give it a straight toss with the nose slightly depressed. While a three-point landing is ideal and very pretty to see it is not the proper angle for any model to assume. It should follow a 5- or 6-to-1 angle and should strike the ground landing wheels first and continue running along the ground, gradually setting the wheel or tail skid on the ground. While gliding, be careful to note the turning tendencies of the model. The normal turn tendencies of the realistic type is to turn left under power (this turn effect in most cases is the result of propeller torque) and turn to the right in the glide. If you intend contest flying, it would be wise to attempt as tight a turn as possible, short of spinning. This method will help your model seek out the thermals. And once in the thermal, keep it there. As a guide, offset the rudder to a right turn of no less than 75 feet and no more than 125 feet. For ordinary sport flying, offset the rudder to the right for turns of 200 to 250 feet maximum. Any more turn would tend to make your model fly off the field, and bring about unnecessary chasing and eliminate the sport from this type of flying.

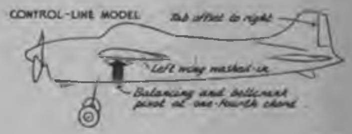
Make a last-minute check to see whether the wing is mounted straight and that all surfaces are held snugly in place with sufficient rubber bands. Have the engine running smoothly with the spark at almost a fully retarded position, and the timer set for ten or fifteen seconds. Run alongside the plane, guiding it with both hands on the wing tip until it reaches flying speed. If the model assumes a gentle left turn under the low power of the test and climbs in a steady, shallow climb it can be given more power the next time. For best results, this type of model should climb in a spiral, as it can gain more altitude this way without stalling, and the greater flying speed helps it when the motor cuts off. Good Luck.

Control-Line

(*Continued from page 19*)

It had pits for every contestant. Real pits, too, approximately 70' long by 3' wide, with stakes at all 4 corners. Heavy twine or rope was fastened to these stakes about 10" from the ground. The pits were laid out at an angle of about 30° and were one to a contestant.

Not once during the entire day was there a protest of lines being trampled or walked on. Three flight pits were operating at the same time, and there were two flight pits for those who wanted to test their models. One contestant was in the flight circle, one was in the pit (the same type of pit as mentioned above) just outside the flight circle, and the number three contestant was being alerted to take his position. In this manner all contestants were processed and handled with a minimum of effort on the part of the officials. To repeat, it was the best-managed contest to date. This, gentlemen, is the solution.



Design

(*Continued from page 29*)

powered rubber models and for gas models. Polyhedral is where the wing has a dihedral break at the center and again about ⅔ to ¾ out on the wing. The uptilted wing tip makes for better turns and, when the model loops or stalls severely, polyhedral will make the airplane roll, usually into a normal flight position. Always attach your wings with rubber bands stretched about pegs or wire jutting out from the fuselage; this enables the wing to jump off in a crash, minimizing damage. For maximum performance always place your wing on the top of the fuselage, or above it on struts or, better still, on a pylon. While it is believed that gas models should have their wings quite high above the fuselage, there is no need to fear putting your wing directly on the fuselage, even in a high-powered gas model.

The fuselage, believe it or not, is at the root of 90% of the evils that plague model builders. Study the two diagrams which give the average proportions of the contest gas model and the contest rubber model. The biggest difference between the two comes from the position of the center of gravity, which is influenced by the disposition of weight. On a rubber model, for example, the weight is scattered all along the fuselage —the rubber itself being the heavy object, so that the wing is placed almost at the midpoint of the rubber motor. This gives a very long nose. A gas model, on the other hand, has a good part of its weight concentrated in the nose. There are a heavy engine, a spark coil, batteries, and one or two fairly heavy wheels. So the wing is placed right behind the motor, giving a nose that is approximately ⅒ the wing span. Either model should balance when two people support the airplane on their finger tips, at a spot on the wing tip about ¼ the wing chord back from the leading edge. The side shape or profile of the fuselage is vital, since the side area has a direct bearing on the spiral stability of the model. Always place your thrust line fairly high on the fuselage, and put your heavy objects, like coils and batteries, above C/L of the fuselage (*not the bottom*), and belly down the fuselage. Such design helps prevent spiral dives and crashes and still affords more than enough stability for any flight condition. You may have noted that rubber models seldom have bad spiral stability characteristics. This is because the heavy rubber motor has to be directly behind the prop, automatically achieving proper design, though the builder may not realize what is happening. On gas, unfortunately, the builder can move things around to suit himself and, like as not, does more harm than he does good when he puts the weighty stuff on the bottom of the fuselage for that so-called "pendulum stability."

There are two schools of thought when it comes to tails. One type of tail is symmetrical in cross section; in other words, it has a streamlined rib or airfoil. The other type is the lifting tail, which has a wing rib cross section. On rubber models, a lifting tail should have a section resembling the Clark Y; on gas it should not have so much camber but should be gently curved on top. Lifting tails are popular on large, high-powered rubber models, since such a tail combats the stalling tendency of such a model when its powerful motor kicks out that first burst of power. With this tail, the wing is moved slightly forward: often the center of gravity is under the trailing edge, or at least is ⅔ back on the wing instead of just ⅓. On the pylon-type gas models a lifting tail is used to overcome the natural stalling tendency of the model due to its high wing position. The further the thrust line is beneath the wing the more the model will tend to stall or loop; hence the lifting tail is a help in this case. But on gas models with a wing on top of the cabin, use the symmetrical section in the tail. Use 30 to 35% of the wing area for the horizontal tail and you will keep out of mischief. The vertical tail ranges from 6% of the wing on gas to about 15% for rubber. Vertical tail area can be critical on a gas model. If you find that the tiniest movement of the rudder steers your gas model in either direction, your vertical tail is a bit too large. It is good practice to locate the horizontal tail fairly low in relation to the wing; if need be, put the tail under the fuselage. Attach the stabilizer with rubber bands as you did the wing. Keep your rudder very high and thin. Place some of your rudder area beneath the fuselage.

Landing gears should be placed fairly far forward to protect the propeller and to prevent the model from nosing over. On gas models, it is good practice to attach the wire axle to the firewall, which is just behind the motor. Rubber models should have the wheels located further back than gas models. Roughly speaking, about ¼ to ⅓ the length of the rubber back from the nose will do the trick. The distance between the wheels should be ⅙ of the span on small models to ⅓ of the span on large models. The most serviceable landing gear is the conventional two-wheeled affair; for both gas and rubber the wheels may be placed on a single music wire axle that extends through the fuselage (check some of the plans). Sometimes one wheel may be used. This requires two other points of contact with the ground so that the model can stand level of its own accord; twin tails is the usual solution. Single-wheel landing gears are easily made retractable by having a rubber band to pull them back into the bottom of the fuselage when the weight of the model is shifted to the wing on take-off. However, whether or not you should use a retractable landing gear depends mainly on the degree of streamlining of the model. This, of course, is one of the most arbitrary questions.

It is a fact that a model can be streamlined more than is necessary to make consistent winning flights. Some of the best models ever built were "boxes," witness Dick Korda's amazing champions. On gas, though, a little streamlining seems to help. Don't leave your motor completely exposed in front of a firewall like a built-in headwind. Round off your fuselage with a few sturdy stringers to give it an oval cross section. Don't make the landing gear unnecessarily long or use oversized wheels. Do these things and you won't need a retractable gear. Any high-performance rubber model should have a folding propeller. This requires a rubber tensioner to keep the motor from winding out all the way. To fold properly, the propeller has to be stopped in a definite position on every flight. The importance of having a folder on a rubber job may be realized from the fact that the prop diameter is from ¼ to ⅜ of the span in length. Also, the wide blades mean plenty of drag in the glide. You can't beat the folder. Folders for gas models, however, should be discouraged. They are unnecessary and very dangerous. The centrifugal force of a powerful motor often throws a blade, even on the best-made propellers.

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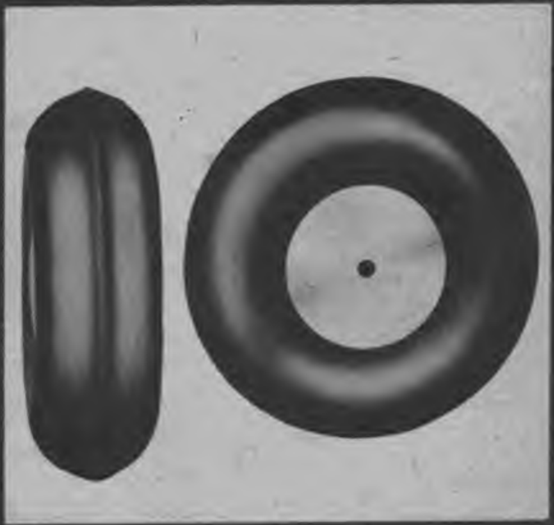

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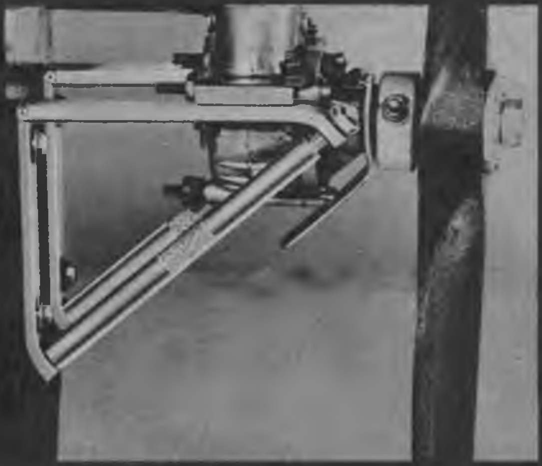

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Airfoils

(*Continued from page 84*)

time with careful rib selection and plotting.

The National Advisory Committee for Aeronautics has published pamphlets including "families" of airfoils. Closely related, these vary in thickness, in camber, and in position of maximum camber. The NACA 6409, a favorite of Bill Winter's, is one of these. The first figure of its series number, 6, indicates that the mean camber line is equal to six percent of the chord; the second number, 4, indicates that this maximum camber occurs .3 or 30 percent of the chord from the leading edge; and the last two numbers, 09, refer to maximum thickness in percent of chord, the section being .09 percent as thick as it is long.

The mean camber line coincides with the base line in symmetrical sections; thus the first two digits of these are always 00. Example: the NACA #0012 is a streamline or symmetrical section having a thickness-to-chord ratio of 12 percent.

Nothing is more important than the airfoil you select for your model. While it is probably true that minor inaccuracies may not matter too much, it is highly important to use the best airfoil for the purpose in mind. A thick airfoil gives great lifting capacity but consumes a large amount of the power (keep in mind that the wing sometimes creates as much as 2/3 of the total drag of the airplane). Such an airfoil should be used only for very slow flying or for weight-lifting models such as radio control.

Both in rubber and gas it has been well proved that a thin, efficient section is desired. This because the low drag of such a section leaves more power available for climb, hence permitting greater altitude from which to start the glide. Most popular section for gas is the NACA 6409. On smaller-sized gas models, especially with very high-aspect ratio wings, this section may prove a bit too thin for structural strength. In such cases the RAF 32 is a good section. For rubber-powered jobs it has been found that the Eiffel 400 or the RAF 32 is a good bet. Since the chord on a rubber model of about 40 inches span is in the neighborhood of four to five inches, these two sections give enough depth to enable strong spars to be used. At the same time they have a reasonably low drag, a high lift, and consequently have a high ratio of lift to drag or L/D, which is the keynote of a good design.

A thing to keep in mind is that a thicker section on a gas model will increase stalling and looping tendencies, both because of excessive lift and the high increased wing drag which centers well above the thrust line. When using such sections, increase the camber of the lifting stabilizer. Note that all these sections have generous undercamber. For model purposes, it has been found that such sections have improved glide characteristics, though they are, of course, harder to build. In making such wings, raise the spars the desired amount from the table top by placing small blocks beneath them. It is very important to put the leading edge in the right place; raise it from the work table precisely the proper amount. Also, use a wide trailing edge that can be shaped to match the contours of the ribs.

Control-Line Types

(*Continued from page 20*)

At the model, these lines are wound round a roller which is held outward from the longitudinal axis and just ahead of the center of lift by a steel control arm. Separate lines, wound on the same roller, pass into the fuselage, turn ninety degrees via pulleys, and connect to the elevator horn.

Thus, upward or downward movements of the Directional Control Stick cause the roller to revolve, which in turn moves the inner control lines which move the elevators.

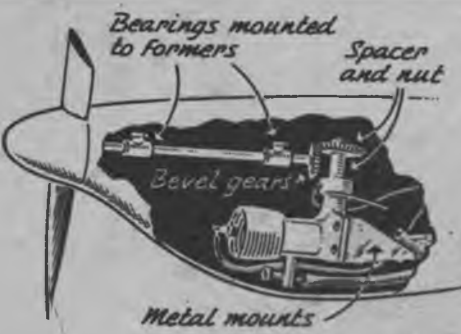
One important feature of this system is that yawing or rolling actions of the model in flight do not disturb elevator control.

FLIGHT-CONTROLLER

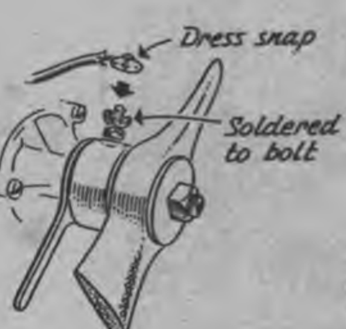
One of the newer forms of control line flying is that employing a device known as the Flight-Controller. It is probably the simplest of all control systems and it has two principal advantages.

First, the control lines are directly fastened to the elevator horn, eliminating any play or lag in movement. Second, the elevators are hinged to the stabilizer with lengths of thin, flat steel, a safety factor in the event of the lines slackening. Elevators are thus held in a neutral position unless tension is applied to the control lines.

Friction is minimized in the Flight-Controller system by running the control lines through gently curved tubes. Air resistance is also lowered by passing the lines through the wing. There are no bearings, shafts, bellcranks, or pushrods in the Flight-Controller and this simplification should be a boon to the beginner and an assurance of reliability to the expert.



TIMELY TIPS



Garami's Giro

(*Continued from page 52*)

forward speed which in turn revolved the rotors at a greater speed with increased lift. Another aid for torque is to tilt the rotor bearing wire 5° opposite to the torque. A small pair of pliers will bend this wire very effectively. The bend in the wire should be directly under the rotor. Rudder effect is quite negligible, but it can be used for very fine adjustments. The center of gravity should be directly in line with the center of the rotor column. To test, remove the rotors and grasp the rotor bearing and check the balance of the model. It should hang absolutely horizontal on a fore-and-aft plane.

Too many designers have the mistaken theory that the rotor blades should be set at a positive angle of incidence. Using this angle of incidence the rotors would move with the trailing edge forward, consequently forcing the model to descend rather than lift. To overcome this condition, the rotors are set at a 3° negative angle of incidence. With this setting, the rotors move with the leading edge forward and the air spills out under the trailing edge. Any airfoil will generate lift even at settings from 10° positive to 5° negative angle of incidence. It is most important to have the rotors turning in the direction to induce lift. The dihedral shown was proved to be adequate, because as the rotors speed up the lift is increased and the rotors tend to flex upward increasing the dihedral.

To flight test the model, stand up on a chair and give the rotor a spin in a counter-clockwise direction. As soon as the rotor is spinning quite rapidly, let the model drop and observe the speed with which it sinks. If the sinking speed is too great, increase the negative angle of incidence of the rotors slightly. The right sinking speed is about the speed of a paper parachute. It should not fall but should settle gently. Eight strands of 1/8 flat rubber is used for forward motive power. Tests with the power on should be started with the model balanced right on the rotors, a 5° downward thrust built in the noseplug and the rotor shaft offset 5 degrees against the torque. If a power stall occurs, more down thrust should be used until the model climbs at about a 10° angle and the forward speed is comparable to a conventional model. If the model spins in either direction it should be corrected by adjusting the tilt of the rotor shaft in the opposite direction from the spin. The model is designed to be very durable, and if it is built right it will take all the punishment, hard luck, and wrong adjustment dealt it.

The construction is quite simple, and the exploded plan plus the completely dimensioned three-view should take care of any building problems. The rotor post and vane joiner are most important and great care should be taken with their construction. The rotor must revolve freely and a drop of Three-in-One oil occasionally will help.

Build the rotor square on the workboard and use a small pair of needle-nose pliers to bend the negative incidence in the .035 wire vane support. Bend all the rotors at the same time to guarantee the accuracy of incidence. After the rotors have been adjusted properly place a drop or two of glue on top of the rotor bearings. This will hold the rotor in place when flying.

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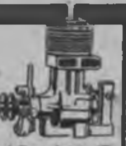

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AMERICA'S GREAT HOBBY AND MODEL FAIR

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(*Continued from page 100*)

the control rod is held in place by spots of solder or glue on either side of the pivot to prevent movement of the control rod when in action. This same method is used when fastening the control rod to the stabilizer horn.

Before flying, check the position of the CG, which should be located at approximately ¼ of the top wing chord. Any necessary adjustments can be made by moving the position of the coil and batteries. Are the surfaces free from warps? Does the control mechanism operate smoothly? Are the lines securely attached? Ask yourself other questions of this type and, what's more important, make any needed corrections *before* testing. Try the first hops at fairly low speeds and keep the model close to the ground, just in case. If you're unfamiliar with control-line models, why not get one of the more advanced builders to assist you? Finally, after many test flights of increasingly accelerated speeds, give her the works, wide open. Now she should jump to speeds as high as fifty miles per hour which is plenty fast for a realistic mode of this type. Super speed fans can do even better than this, by using larger engines such as a Forster 29 (the original model was test-flown with a Bantam and also an Ohlsson 23), but a larger engine has to protrude outside of the cowling, thus detracting from the authentic appearance of the job. If you are a true lover of scale models, stick to the smaller engines, and get your kicks out of the flight maneuvers that *can* be done—loops, rolls, fun galore! (*The control mechanism shown with this plan is patented by American Junior Aircraft Company and should not be used for commercial purposes without permission of the owners.*)

P-61 Black Widow

(*Continued from page 73*)

Assemble the fuselage, spar-template, and the complete wing first. Next, fit the nacelles in place, pinning the stabilizer in position to check alignment during final trimming of the recesses for the wing. Add the cowl front portions and mold wing and tail fillets of dope and talc putty.

Dope the entire model lightly, sand it smoothly, then apply several coats of dope and talc filler, adding thinner to make sanding easier. The cabin windows are first painted silver, later masked with Scotch tape strips before painting the remainder of the model black. Crankcases and landing gear struts may be painted silver. Polish the model to a gloss with fine rubbing compound. Attach the propellers—plastic ones if your dealer has them, or white pine ones if you have to make your own—and add the AAF decals.

Bobcat

(*Continued from page 21*)

The landing gear, built into the wing spars, was capped in with pine blocks. The wing spars were made of 1/16 inch plywood laminated on both sides of ⅛ inch balsa sheet. In order to make the wings removable, I bolted the main wing spars to the fuselage plywood formers.

Using brass or aluminum tubing for the U-control arm simplifies the work usually involved in the construction of most designs. The tubing, being light and rigid, does not allow any flexibility. The control arm was made by flattening the ends of the tubing, as shown in the illustration. Then two holes were drilled in the flat ends—one hole for the bolt at the control plate and the other hole for the wire used for the elevator control.

Before I installed the steel wire in the elevators, the wire was passed through the hole in the tubing. This eliminated the usual soldering of the control arm to the elevator wire. I then completed the control system by installing a small block between the engine mount and the fuselage. The block extends ⅛ inch over and above the engine mount. A hole was drilled through this block and engine mount for the bolt holding the control plate. *Note:* Two nuts were used at the control arm and plate connections to allow setting of free movement of controls.

First Test Flight: The first flight was made in a Randolph Field hangar on 30-foot control lines. The engine was set at three-fourths speed, and the model took off by itself in 20 feet. It climbed gradually and smoothly, with little need for control. It reacted beautifully to the controls, circling three times before the engine cut out. Then it made a perfect landing. The next flight, which consisted of gradual climbing and diving, proved to be more exciting.

The excitement resulted from artificial "hazards"—light fixtures about 12 feet above the floor. In one of its climbs, the model headed for a fixture and almost struck it. I gave it full down elevator and it missed the fixture by inches. But then it went into a deep dive for the floor. I was unable to pull it out of its dive in time, and the landing gear had to take all the shock. (Not to mention the shock it gave me.) It bounced two feet in the air, dropped again on the landing gear, and rolled over on its nose and tail, skidding to a stop. Fortunately, nothing was broken.

The rest of the flights were made outdoors with 50-foot lines. The first flight outdoors was made at sundown. There was very little wind. The field was fairly rough, but landings were made with ease.

I put the plane through its paces on many flights in order to give it a thorough check before starting the speed tests. At its best on a perfect day, the Bobcat reached 74 mph. Its average speed is 60 mph. In my opinion, it could be better than 74 mph with a speed wing and a higher pitched speed prop.

It is an easy flyer and it has proved the primary objective of its design—to withstand a lot of punishment. The landing gear has stood up under rough treatment. The removable sections have proved very satisfactory. Valuable time has been saved in refueling and battery changes.

The Bobcat also has been a good display model. It won first prize in the Model Section of the Randolph Field Hobby Show which was held in February, 1945. Its eye-attracting finish is the result of four coats of light oak stain varnish. Between coats it was sanded and rubbed down with compound; afterward, it was waxed. The fairings and upper cowling exhaust ports are merely decorative devices. The fairings are removed for flight.

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