MODEL AIRPLANE NEWS

Three View Drawings of
MODERN *and* WORLD WAR PLANES

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MAN'S FASTEST CONVEYANCE

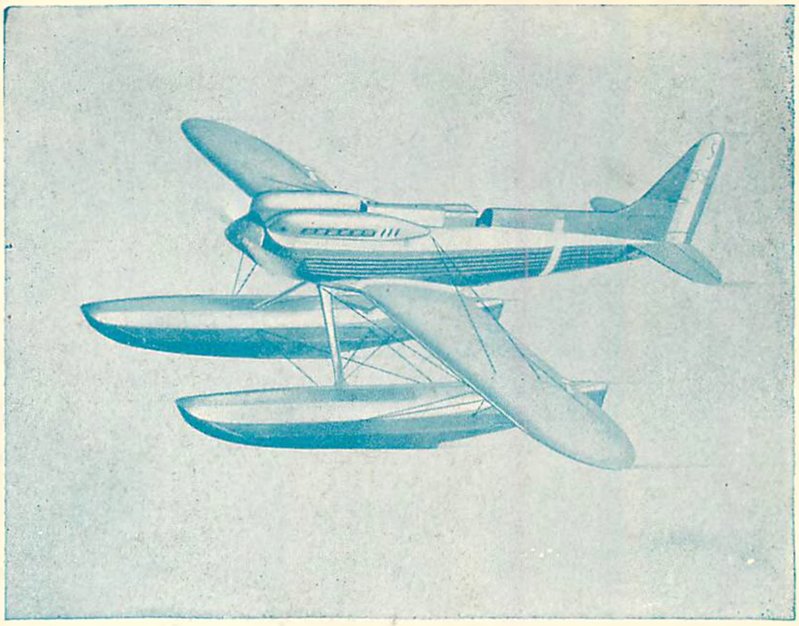
The Supermarine S.6.B

PLANS PAGE 22

By Popular Request - SUPERMARINE S6-B

IN RESPONSE to our appeal of "what new models do you want to see Cleveland-Designed," we are mighty happy now to offer these two great feature models—England's Famous Flying Radiator and Fighter. We have had so many requests from all parts of the country and the British Empire for these that we worked day and night to have them ready for this announcement. These Kits are two of the keenest we've ever produced—boy, oh boy, oh boy—and are now ready for immediate delivery. Be first in your town to own both of them. Send your order today for they're the last word in model airplane kit values.

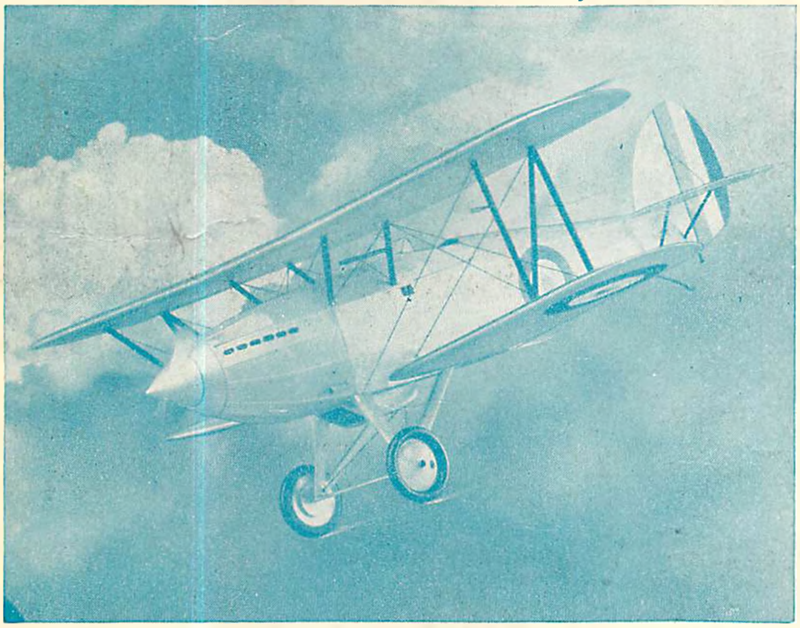
(Customers in Canada and foreign countries ordering any of these Kits, add 15% to all prices for foreign service charge. Remittances to be in U. S. dollars and fractions —your postmaster will tell you).



THE Cleveland-Designed Supermarine is a knockout. And it has plenty of that flying zip that has made its prototypes feared the world over in speed races. (The racer No. 1 (model of which is pictured here) you know won permanent possession of the Schneider trophy for England, flying at 379.05 m.p.h., while the No. 7 hung up in September, 1931, the world's official speed record of 408.8 m.p.h., an early lap was credited with 415.2 m.p.h.). Faithfully reproduced in practically every tiny detail (believed impossible to many, but not to Cleveland model engineers) even to the authentic fuselage side and bottom radiators and coloring of silver and blue for which we went to extreme measures in experimental work finally resulting in the discovery of silver, gold and white pigmented **model** dope (not pigmented **aircraft** dope which ruins most models). Authentic coloring of the S6-B was heretofore unknown to many, due to the fact that most news cameramen do not use panchromatic filters on their cameras—therefore the artistic blue design will be seen to stand out clearly on our photograph, the light portions are silver. Span 22½ in.; length over all 21⅝ in.; weight 2.9 oz. Complete Kit SF-19, **only $2.50** postfree.

All pictures on this page are of the actual Cleveland-Designed Models themselves. We NEVER use pictures of the big ships.

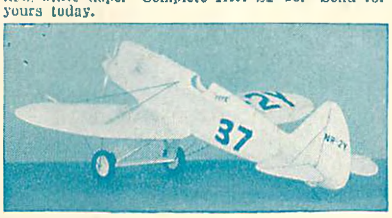
HAWKER FURY, too!



THERE'LL be a crowd of aeromodelists let out a cheer when they know they can get this powerful "beaut" of a model. It is an ingenious miniature of England's well known intercepter fighter (which has been credited with a screeching 205 m.p.h. performance). The masterly made Cleveland-Designed model is colored gleaming silver (with Cleveland's new pigmented **model** dope). Standard English insignia are supplied. Licensed numbers, squadron insignia of your pet squadron, etc., may be added if desired. Kit comes as all Cleveland ¾ in. scale Kits do, complete with all materials needed, all parts requiring machine work fully completed. Span 22½ in.; length 19¾ in.; weight 2.6 oz. Complete Kit SF-20, **only $2.50** postfree. (Customers in Canada and other foreign countries, add 38c for foreign service charge). Send your order in at once—spring a surprise on your friends.

Howard Racer $1

This Kit of Ben Howard's Racer met with such a demand that we are now able to offer them to everyone for price of $1.00 indefinitely. It's a honey for flights and looks. Span 15 in.; length 13¼ in.; weight 1.3 oz. Colored with Cleveland's new white dope. Complete Kit: SF-18. Send for yours today.



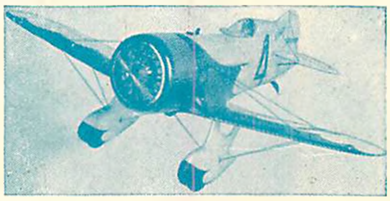
☞ Dealers! Write at once for new small-investment plan for orders over $7.00

"They Sure Look Real"

EVERYWHERE you hear aeromodelists saying this about Cleveland-Designed models. And every one of the pictures on this page are of these actual models, staged against a natural background. Even as strikingly real as these pictures show these models, they fall far short of the true beauty of the models themselves in their colorful trimmings and stunning symmetry. (Ever photograph one yourself? Try it out and see). Every Cleveland Kit brings you everything needed to build these master models—for Cleveland Kits are the last word in completeness.

GEE-BEE for $1

THE deadline on this extremely low price is April 30. No orders will be filled at this price if the envelope is postmarked later than April 30, 1932. After that the price goes up to its regular figure of $1.50—and all orders received with a later postmark than April 30 with only $1, enclosed will be held until the balance is sent by the purchaser. **So act quick!** Hundreds of Cleveland-Designed Gee-Bees and Howard Racers were sold the first few days of our April announcement. Everyone is crazy about them. Hurry, if you want to get an honest-to-goodness bargain! Scale ¾ in.; span 17½ in.; length 12 in.; weight 1.5 oz.; yellow and black; flies beautifully. Instructions for all lettering (not shown on photo) supplied. Order Kit SF-17.



FREE—GET YOURS

We will send, free, to anyone interested in model aircraft, information of vital interest if you have never received literature from us previously. We have 40 wonderful models to tell you about—only four are listed here. It will cost you absolutely nothing unless you do wish to send a 2c stamp to help cover mailing costs. (If you wish to write a letter instead of sending coupon, do so). Tell all your friends of this, too, for we want to know of everyone interested in building good models.

If your dealer cannot supply you, order direct.

CLEVELAND MODEL & SUPPLY COMPANY,
1866-N5 West 57th St., Cleveland, Ohio.

Gentlemen: Kindly send me your free model information. You (will) (will not) FIND 2c STAMP ENCLOSED.

I enclose..............................for the following kits:
☐ SF-17
Print Name ....
☐ SF-18
Address ....
☐ SF-19
City .... State.....
☐ SF-20

Age.... .....yrs.; Model Exp...........yrs.

I am pinning to this coupon a list of the models I would like to see you design in the order of those I like best at the head of the list.

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Model Engineers Since 1919

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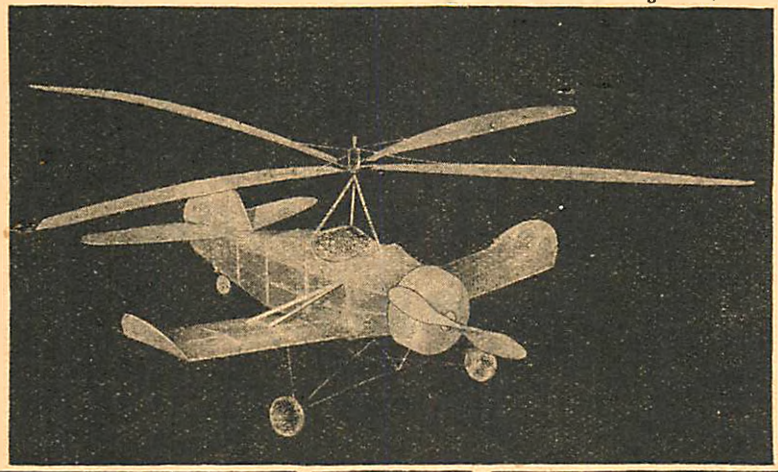
24 inch Rotor Span

A perfect flying scale model Autogiro at a popular price . . the result of many years of research and experimenting. Other concerns have tried to produce a flying autogiro kit but have failed.
This is the first flying scale model autogiro ever offered. Guaranteed to fly, when properly constructed according to our copyrighted plans. This Autogiro will fly from 200 to 500 feet, reaching a ceiling of about 75 feet. Rotors are NOT powered but work on the same principle as the original Autogiro, which rotate while flying.

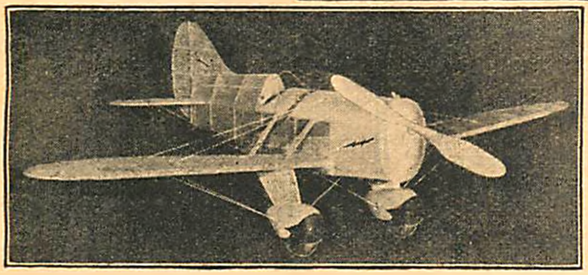
See free demonstration of SCIENTIFIC KELLETT Autogiro model at our factory. Pay us a visit if convenient for you.

BOYS! Here is the Model You Have Been Waiting For!

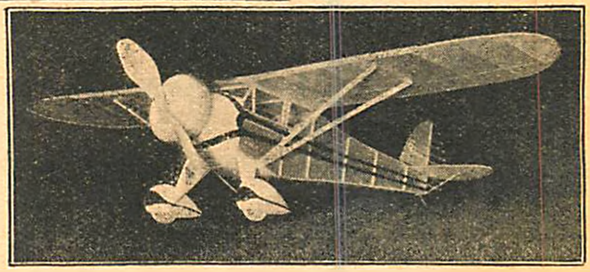


THIS Scientific Flying Scale Model Autogiro Kit contains:
—Full size plans and instructions.
—All ribs, wing tip, bulkheads etc., stamped on sheet balsa.
—Finished turned balsa cowling ready to attach to model.
—Finished turned balsa doughnut wheels.
—Rotor hub with light weight bushing and slots complete.
—All-ready formed wire parts and fittings.
—1 oz. banana oil, dope and glue.
—Large sheet fine Japanese tissue.
—Sufficient rubber motor for three models.
—Celluloid windshield.
—True pitch ready shaped balsa propeller block.
—All bamboo in kit ready split to 1/32 and 1/16 sq.
—All sheet and strip balsa cut to size (Scientific balsa throughout).

1.50 Postpaid



All Scientific Kits are Sent POST PAID



GEE-BEE Sportster D — 2 FOOT WINGSPAN

As sensational as the performance of its famous prototype. In the Gee-Bee Sportster-D are embodied features you'll marvel at. A perfect reproduction of the record breaking airplane, easy to build, perfectly balanced, graceful, and yet so strong, you'll have a hard time crashing it. How proud you'll be when your friends see it! Complete Kit includes full-size plans, ribs, bulkheads, pants and other parts clearly printed on balsa, bamboo, 1 oz. banana oil and glue, wire parts, and everything to complete a perfect scale flying model Gee-Bee. Complete Kit.... **1.25 POST PAID**

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36-inch lengths

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1/32 x 3	.08
1/16 x 2	.05
1/16 x 3	.09
1/8 x 2	.06
1/8 x 3	.11
1/4 x 2	.10
1/4 x 3	.17

Compressed Knockdown Motor Kit
1 Set Complete ... .99

Celluloid Wheels
Complete with bushings. All sizes come in red, yellow, white, green, blue and black.

¾ Diam., Pair	.06
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1¼ Diam., Pair	.11
1⅞ Diam., Pair	.16
3 Diam., Pair	.35

Acetone
Large 2-oz. Can.... .10
Per Pint .... .75

Clear Dope
Large 2-oz. Can.... .12
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SEND 5c for our latest 1932 GIANT FOLDER

Colored Dope
2-oz. Can .... .12
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Large 2-oz. Can.... .16
Per Pint .... .95

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For the Commercial Ship
Sheet 20½ x 21 .. .05

Scientific Balsa
36" lengths

1/16 x 1/16	.01	8 for .05
1/16 x 1/8	.01	7 for .05
1/16x3/16	.01½	6 for .07
1/16 x 1/4	.01½	6 for .07
1/16 x 1	.04	4 for .15
3/32 x 3/32	.01	6 for .05
1/8 x 1/8	.01	6 for .05
1/8 x 3/16	.01½	6 for .08
1/8 x 1/4	.02	6 for .10
1/8 x 3/8	.02½	5 for .10
3/32 x 1	.05	6 for .25
3/16x3/16	.02½	5 for .10
3/16 x 1/4	.02½	5 for .10
3/16 x 1	.06	3 for .15
1/4 x 1/4	.03	6 for .15
1/4 x 3/8	.03½	5 for .15
1/4 x 1/2	.04½	4 for .15
1/4 x 1	.06	3 for .15
1/2 x 1/2	.08	3 for .20
1 x 1	.17	2 for .30

Propeller Blocks

3/8 x 1/2 x 5		.01
1/2 x 3/4 x 5	3 for	.04
1/2 x 5/8 x 6	3 for	.05
5/8 x 3/4 x 7½		.02
5/8 x 1 x 8	2 for	.05
7/8 x 1½ x 11		.07
1 x 1⅝ x 12		.09

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Complete in Every Detail Including Full Size Plans — **.99c each Postpaid** — Easy to Build and Guaranteed to Fly

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Canadian Charges
5—Add 25c for packing and postage on orders up to $1.50. Over $1.50 add 15 per cent.
6—Postage stamps, Canadian or Foreign Coin not accepted as payment.
7—Remit by check, postal or express money order.

MONOCOUPE-110 — 2 FOOT WINGSPAN

Used by John Livingston and Phoebe Omlie in their victories at the National Air Races. Many prominent model builders have asked us to manufacture a construction kit for this famous plane. This is the most complete kit on the market today, regardless of price (other model concerns are still charging the same high prices of 1920). Kit contains: full-size plans, four sheets of balsa with ribs, bulkheads, pants, and other parts clearly printed on balsa; 1 oz. banana oil and glue; and everything to complete a real Scientific Monocoupe model. Complete Kit........ **1.25 POST PAID**

Colored Japanese Tissue
Red, Blue, Orange, Yellow, Brown, Green—
Sheet .... .05
6 for .... .25

Music Wire
Sizes .014, .020, .028 .0?4
3 ft. for............ .01

Scale Model Tissue
Sheet 21 x 25...2 for .05

Scientific Expert Rubber
.045 sq. 3 ft. for.... .01
1/16 Flat, 3 Ft. ... .01
3/32 Flat, 3 Ft. ... .01
1/8 Flat, 3 Ft. .... .01
3/16 Flat, 2 Ft. .... .02

Hand-Made Balsa Propellers
Guaranteed accurate—complete with wire shaft and washers. Ready to fly.
5" long, 20c.; 6" long, 25c.; 7" long; 30c.; 8" long, 35.; 10" long, 40c.; 12" long, 45c.

Dummy Radial Engines
Celluloid, 9 cylinders.
3" diam., each..... .30
1½" diam., each .. .20

N. A. C. A. Cowling
Each .... .25

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Takes any wheel from 1" to 2" diameter. In perfect proportion with our N.A.C.A. Cowling. Pair .29

Banana Oil
Large 2 oz. can ... .10
Per pint .... .75

Thrust Bearings
Large Size .035..... .02
Per Doz. .... .19
Small Size .025..... .02
Per Doz. .... .19

Aluminum Tubing
1/8 Outside Diam., Per Ft. .... .07
3/16 Outside Diam., Per Ft. .... .11
1/4 Outside Diam., Per Ft. .... .13

Brass Washers
⅛ Diam., Per Doz. .01½
Per Gross ..... .15
¼ Diam., Per Doz. .01½
Per Gross ..... .15

Sheet Aluminum
12-inch Wide
.005, Per ft. .... .12
.010, Per ft. .... .18

Wood Veneer Paper
For scale models.
Sheet, 20 x 30 ...... .15
Reinforced Winders.. .20
REINFORCED WINDERS .... .20

PLANS for Gee-Bee, Monocoupe or Autogiro sold separately, each 50c

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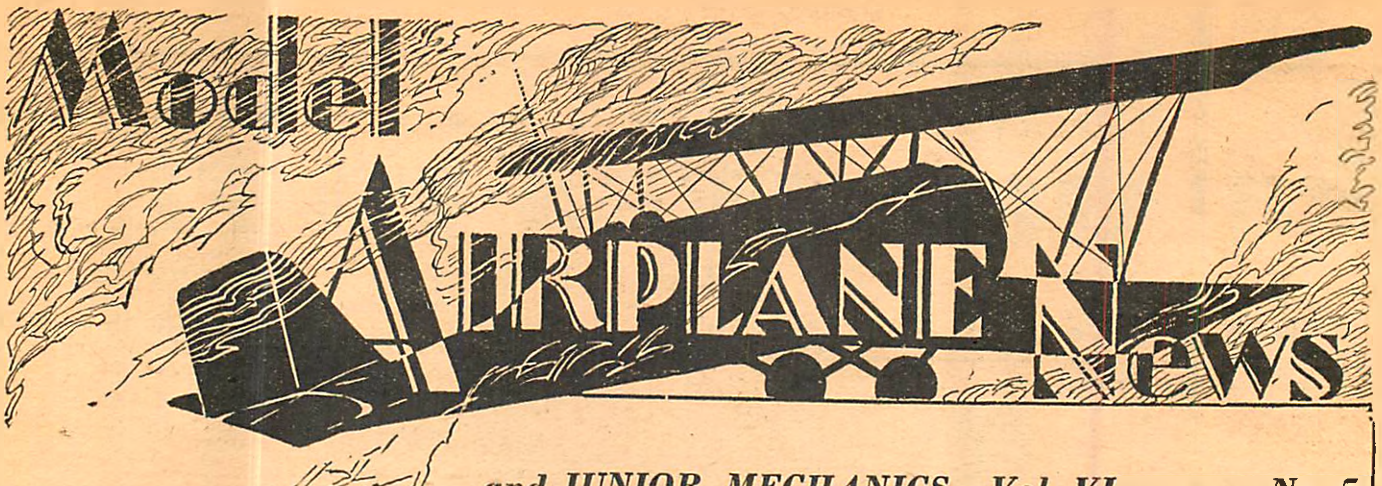
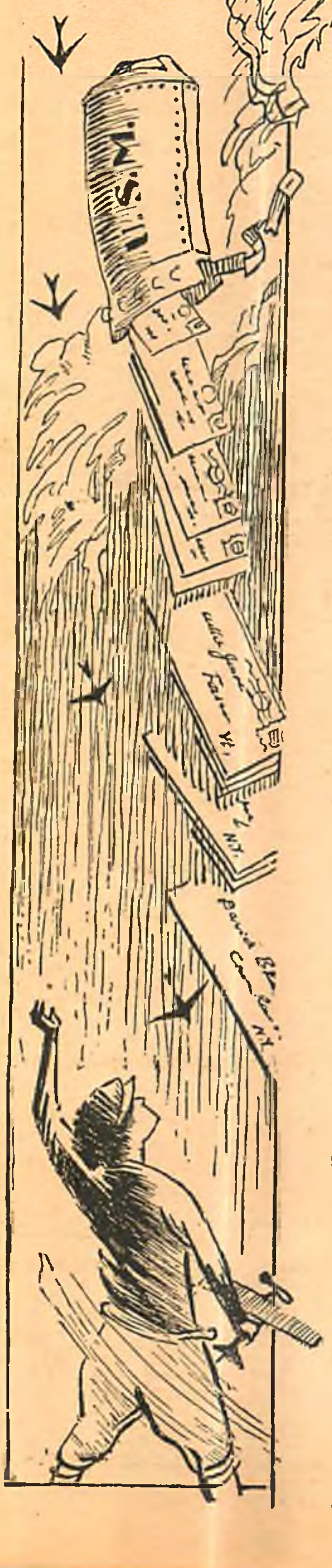


and JUNIOR MECHANICS—Vol. VI **No. 5**



Edited by Charles Hampson Grant

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MAY - 1932

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Full description, along with accurate and interesting plans for the

Curtiss A-8 Attack Plane
By HOWARD MCENTEE.

A "scoop" if ever we saw one:

The Autogiro

Complete plans for a record holding model never before presented
By J. TISKEWICZ.

Other novel features and plans will appear also, such as three view drawings of modern and World War planes, by Stockton Ferris, Jr., and The Flying Crescent, by Edwin O'Donovan, Jr.

Another big surprising Contest will start to test your knowledge of airplanes.

A feature up-to-the-minute:

The Secret of Microfilm

The very latest essential to model-building.

These and other features make the June issue of MODEL AIRPLANE NEWS one of the best and strongest issues that has appeared so far. To make sure you get your copy, order it from your newsdealer *now!*

And don't overlook the regulars —*Air-Ways,* latest news of *Airplane Clubs* throughout the country, *The Airplane Engine* by Lieutenant (j.g.) H. B. Miller; *The Aerodynamic Design of the Model Plane* by Charles Hampson Grant, etc., etc.

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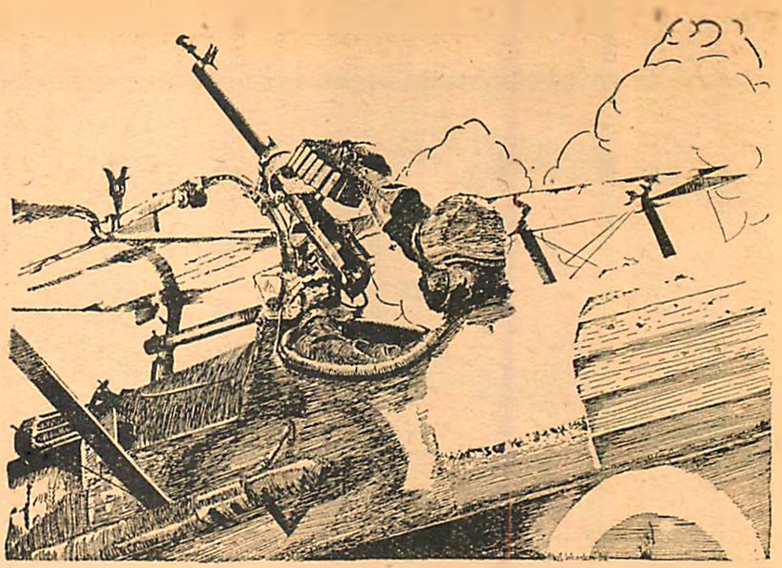
The Sky Hawk of Aerial Combat

On the Frontiers of Aerial Combat, Bert Hall Shows What a Real Aviator Can Do

By F. Conde Ott



Loading for the crucial moment

IN A corner of far-off China, the air is filled with smoke as cannons roar their message of destruction out across the battle line. Suddenly, through the dim blue haze, a plane appears. Sweeping low over the Chinese lines, it banks, the pilot seeking the friendly landing field below.

As the ship comes to earth and rolls to a halt, Chinese soldiers and mechanics rush forward to greet and lend their aid to the pilot. Someone nods in the direction of the new arrival. "That's General Chang Hui-chang, leader of the Chinese air armada." As the general lifts his goggles and slips off his helmet, we expect to see the customary Occidental features. But look! His face is white. He seems to be an American. Isn't that Bert Hall, Kentucky born and bred? Yes sir! But you said, "General Chang Hui-Chang." That's right, too. It does seem strange but not when you know Bert Hall. And there are stranger, and more thrilling things in the life history of this most interesting man.

"Did he fly in the World War?" you ask. "Could you keep him out of it?" would be a suitable reply. But it is a long story, replete with interesting and hazardous episodes. We'll get along with it.

A few years before the "Big Scrap" began in France, Bert Hall was drifting around in the Balkan states craving excitement but finding little to do to appease it. Abdul Hamil, then ruler of Turkey, was having a convenient war with Bulgaria. Bert applied to Mr. Hamil for a job as aviator. He not only got the position but became, in one stroke, the whole official Turkish air force. His pay was $100 per day. With no enemy fliers to fight, Hall and his mechanic had to content themselves with simple scouting expeditions, varied perhaps, with an innocent bit of bombing here and there. The crafty Abdul could not see $100 a day going to waste like that so he cut it down to $50. The next morning Hall took off as usual, but headed for Roumania and stayed there.

Immediately the Bulgarians got busy. "Would Mr. Hall care to fly for them?" "One hundred per," answered the laconic Mr. Hall. Whatever the Bulgarian for O.K., they said it and soon Hall, Pierce and Company were the Bulgarian Flying Corps. But then the Bulgarians began to filch bills from the pay envelope. Hall thought he'd take off again but evidently the Bulgarians were mind readers. In any event, he was arrested before he could get under way, jailed and sentenced to be shot next morning at sunrise. Hall sat in his cell, brooding and despondent. But his buddy, Andre Pierce, had eluded capture and soon some of those precious hundred dollar gold pieces so easily earned in the palmy days began to talk. Loose fingered prison guards had willing ears and Hall walked out of jail, unmolested, that night while the jailers "slept." As both men took off with the first gray streak of dawn next morning, rifle volleys behind the prison wall cracked out the sentences of death to the less fortunate inmates of the steel barred chamber Hall had occupied the day before.

Bert Hall in his uniform of the French Flying Corps. This picture was taken during the World War

By Acme Photo Service

"War is risky business," thought Hall as they flew on toward Paris. But just then Kaiser Bill was thinking otherwise and another conflict was in the kettle. So Mr. Hall landed in France, washed and shaved—and joined the Foreign Legion. But this meant sitting in muddy, wet trenches and Hall still hankered after flying. Was he not already a trained pilot, steeped in the arts of aerial combat?

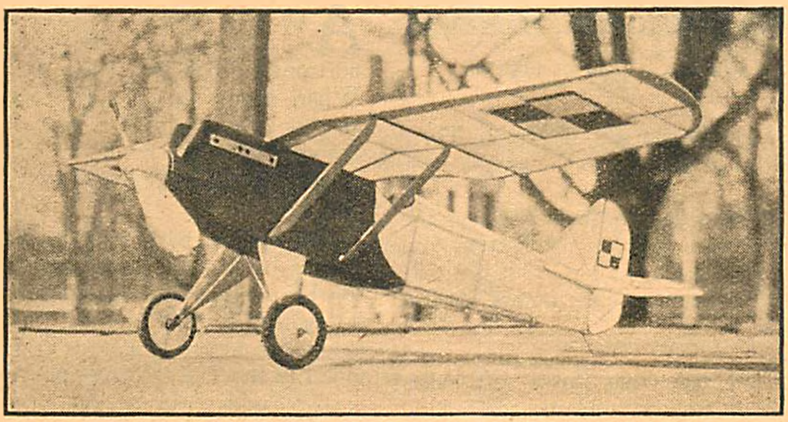
AT THAT time France had so many of her own blood who desired to enter the Air Service that admission to this branch of the fighting was denied to foreigners. Banding together with several other Americans in the Legion who had similar aspirations, Hall and his few companions formed the American Escadrille, the very first group of American airmen to participate in the World War. As we were then still on friendly terms with Germany, her ambassador at Washington objected to the name "American" for a unit fighting against his Fatherland. The objection was sustained on this side and the men ordered to select a new name for their enterprise. What better choice, then, than to honor the gallant Frenchman who, many years before, had offered his services to the United States. LaFayette! Thus it was that this famous escadrille was really (*Continued on page 44*)

Build Your Own "Polish Fighter"

Make a Flying Model of This Zippy Craft at Small Cost and Little Trouble. Here's How!

By Howard G. McEntee

THIS month we shall construct a very unusual model, the PZL-1. This Polish pursuit ship is one of the outstanding European fighters. Its construction and design are in line with the growing tendency, especially on the Continent, towards monoplanes for pursuit purposes. The United States has not done so much in this line in pursuit ships, but will probably do so in the near future, as several monoplane types have been accepted, such as the Curtiss A.8. Attack and the new Boeing Bomber.



Polish Fighter PZL-1 built from these plans

The PZL-1 is a product of the Panstwowe Zaklady Lotnicze of Warsaw, from which it gets its name. Great interest was shown at the 1931 Cleveland Air Races in the PZL-6 ship which Captain Orlinski, of the international acrobatics team, flew. This is a version of the PZL-1, but with an air-cooled motor. The latter was chosen as a model subject because it is a bit more unusual in this country. Its span is about 35 feet.

Both ships are of all metal construction throughout, including all coverings, corrugated dural being used on the wing and tail surfaces and smooth dural on the fuselage.

THE performance of the PZL-1 is a little better than that of the PZL-6 because of higher power and less head resistance. The motor is a 600 H. P. Hispano Suiza, giving a high speed of 191 m.p.h., with a climb of 16,400 feet in 8 minutes. The engine is cooled by a retractable Lamblin radiator. This is not shown on the model as it would cut down the performance and add weight. It may be added if desired, however, and goes just in front of the landing gear.

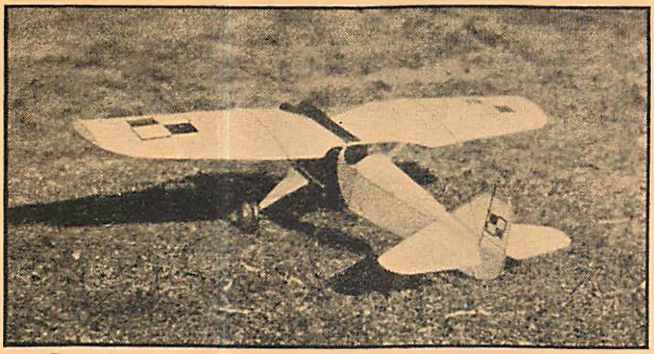
The foregoing history of the PZL-1 is short but will serve to acquaint the reader with the type of ship that is to be constructed. The builder will do well to keep in mind the necessity of reading over this article thoroughly at least once, and to study the drawings so that no mistakes will be made when construction is finally started.

Not a real "ship," just a model that performs like the real thing

Fuselage

The sides of the fuselage are made first as usual. The longerons, uprights and diagonals are all of 1/16" square balsa. After one side is laid out on the board and the glue is dry, outline along both sides of all pieces with a soft pencil. Then cut it off the board and lay out the other side. Since this fuselage does not have a flat bottom, a little different procedure is followed to assemble it. Therefore, when the glue is dry on the second side, do not remove it from the board. Instead, glue in place the formers, 1 (four of these), 4, 5 and 6 and a 1/16" square piece at the top of station No. 2. As the glue sets, straighten these pieces to a vertical position. When they are dry, put glue on the upper ends and put the remaining fuselage side in place, making sure all joints thus formed are well glued.

TAKE great pains to get the fuselage trued up correctly. Use a triangle or a carpenter's square for this and hold the assembly in position with small bottles, dope cans or other convenient means. Also two pieces, A and B, may be put in place between the lower longerons. They are both 1/16" square. When the work is well dried cut it off the board carefully with a razor blade. Formers 2, 3, 7, and 8 may now be put in place and glued, and the longerons glued together in the rear. Do not put in the rudder post, C, yet. The nose piece, D, with the hole cut and the motor stick clip in place is now assembled to the fuselage. The four longerons must be carefully cracked at station No. 2 so they will bend inward to meet D correctly. Place glue in the slots of D and also where the longerons were cracked, and use pins to hold the latter in place until the glue has set. Two bamboo pieces go from



This ship may be built to make a perfect take off.

each side of D back to the uprights at station No. 2. These are curved outward and serve to carry out the proper nose shape.

The stringers may now be glued in their slots on the formers. There are 3 the full length of the bottom and 5 from the rear of the cockpit back, on top. Cut the rear ends off approximately even with the ends of the longerons, but do not glue them yet.

THE motor blocks, E, are cut from fairly soft balsa. The best way is to start out with blanks, as we do with propellers. In this case, use two blanks 1" x 11/16" x 5/8". Cut them to the general outlines shown, then carefully cut to the correct cross section as shown. Be sure to make a right and a left. To the rear of the center the blocks are merely rounded off on both top edges. The bottoms are not rounded on either edge, nor are they hollowed out. They are glued on as shown in the drawings. The space left between the blocks is covered with a small piece of 1/32" balsa veneer, cutting it carefully to size and gluing in position. The finishing touches may be given after they are on, with sandpaper, to get them alike.

The cockpit outline of 1/16" reed finishes the work on the fuselage.

Landing Gear

The four struts of the landing gear are of 1/32" x 3/32" bamboo. The front struts, F, are bent at the upper ends so they can continue along the uprights at station No. 3 for 1/2". The rear struts, G, are simply glued to the bottom longerons allowing 3/16" or so for the glue to make a good joint. The struts are bound and glued at the lower ends.

The axle is one continuous piece and also serves as a third member for each side of the landing gear. It is made of No. 12 music wire and is glued, in the center only, to the bottom former which is 1/8" thick. The ends are held to the landing gear Vees with small rubber bands. These should be tight enough to hold the axle from wobbling, but loose enough to give shock absorbing action. This axle, by the way, is placed to the rear of the Vees and not in the center, for in our models, most serious shocks are towards the rear, and not vertically as in the large ships.

The Vees are now covered with 1/32" balsa veneer on both sides. Do not cover all the way to the bottom; leave 1/2" uncovered so the shock absorbing rubber can be run through. Also leave 1/32" between the wood and the bottom longerons. This space is left to make the covering job a bit easier.

The tail skid, H, of No. 8 wire may be bent now, but cannot be put in place until the rudder post, C, is on.

The wheels are 1 9/16" in diameter and are turned out from balsa. Celluloid wheels may be used, but the exact size may not be available. In this case, use the nearest larger size.

Tail Surfaces

ALL TAIL surfaces are made of bamboo, the outlines being about 1/16" x 1/32". Make both sides of the horizontal tail in one piece and split it in two afterwards. When the outline is made, the elevators and stabilizer may be assembled over a piece of wax paper placed on the drawing. Put the whole on a board, with pins to hold the parts in place. Apply glue to all joints and set aside to dry.

The rudder parts can be made now, but the stabilizer should be put in place first. It is glued directly to the top of the upper longerons and the forward edge should be against former No. 8. Be sure it extends far enough below the lower longerons so the bottom stringers can be glued to it. The stringers are now cut, and glued in place.

The rudder outline can now be put on, with the forward end glued to the top stringer at former No. 8 and the lower end against the rudder post. A small triangular block, I, will strengthen this point. The tail skid, H, which is also the motor stick support, may now be glued on.

Put the two elevator braces, J, in place, and glue in the rudder cross pieces, K.

Motor Stick

The stick is of 1/8" x 1/4" spruce. A regular propeller hanger is bound and glued to one end, and the rear hook of No. 12 wire fastened to the other. A small hole in the rear end serves to hold it on H.

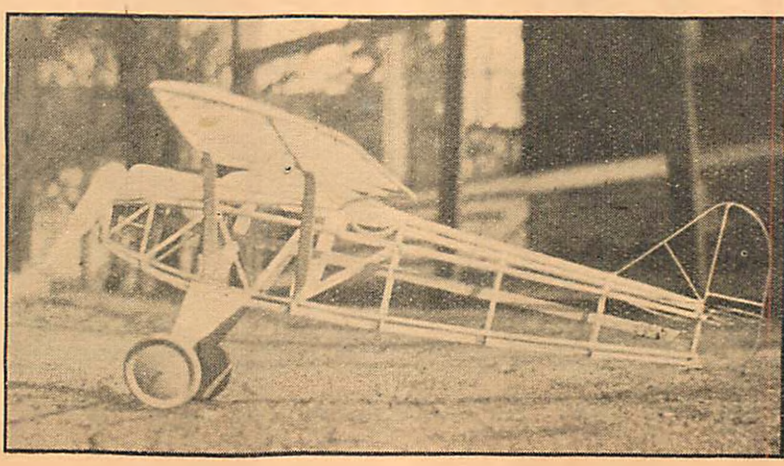
Propeller

The propeller is cut from a block of medium balsa, the size being shown on Fig. 5. The shaft is of No. 12 wire. The spinner is best made of balsa turned out with sandpaper on a fan motor. A slot of the proper size is cut in it to fit over the propeller and it is glued on. Any cracks left may be filled with a mixture of glue and very fine sawdust, which may be forced in with the tip of a knife blade.

A good going over with fine sandpaper will finish the propeller which should then be balanced. This is important for smooth running. The balancing is best done by sanding a little off the heavy blade, preferably near the tip, until balance is secured. Sometimes the spinner will throw it out too much to use this method. In such a case, tiny weights, such as pin ends stuck in the tip and secured with a drop of glue, will bring about balance.

Wings

The wings are the only parts apt to give trouble, especially to the inexperienced, but (*Continued on page* 40)



The uncovered skeleton shows excellent construction.

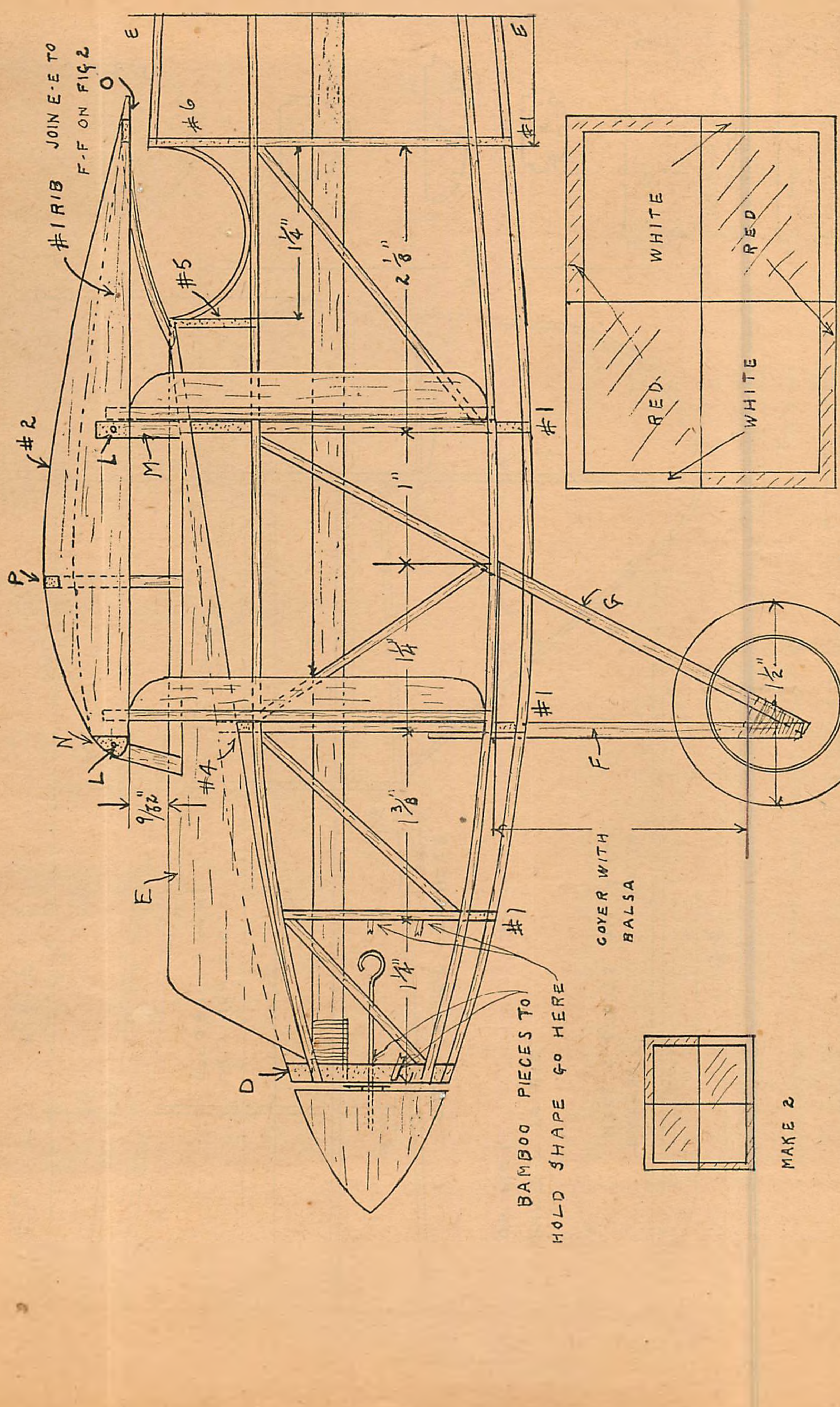
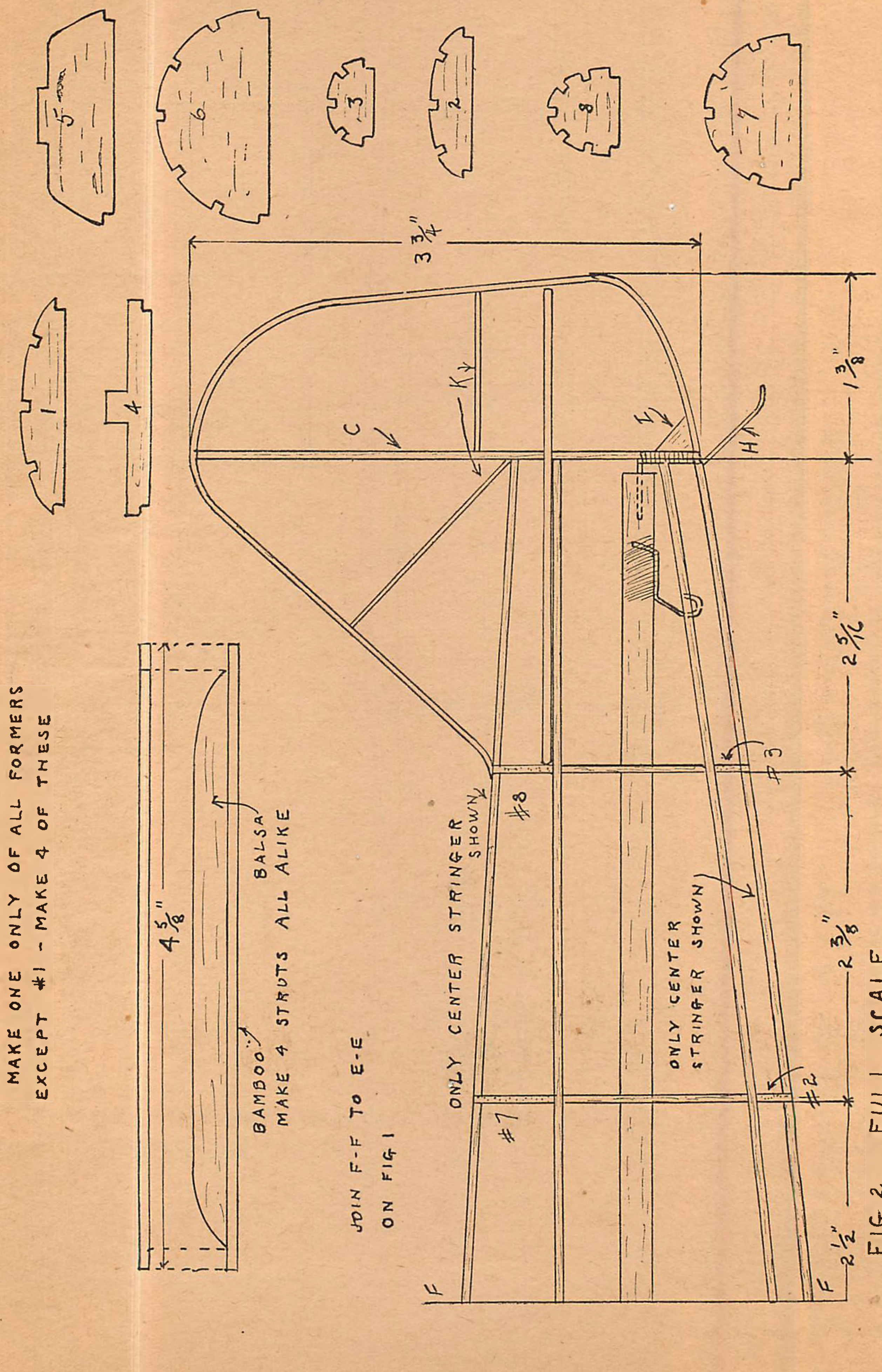


FIG I FULL SCALE


MAKE ONE ONLY OF ALL FORMERS
EXCEPT #1 - MAKE 4 OF THESE
BAMBOO
BALSA
MAKE 4 STRUTS ALL ALIKE
4 5/8"
JOIN F-F TO E-E
ON FIG 1
ONLY CENTER STRINGER SHOWN
ONLY CENTER STRINGER SHOWN
3 3/4"
1 3/8"
2 5/16"
2 3/8"
2 1/2"
C
K
H
I
F
F
#7
#8
#2
#3
FIG 2 FULL SCALE

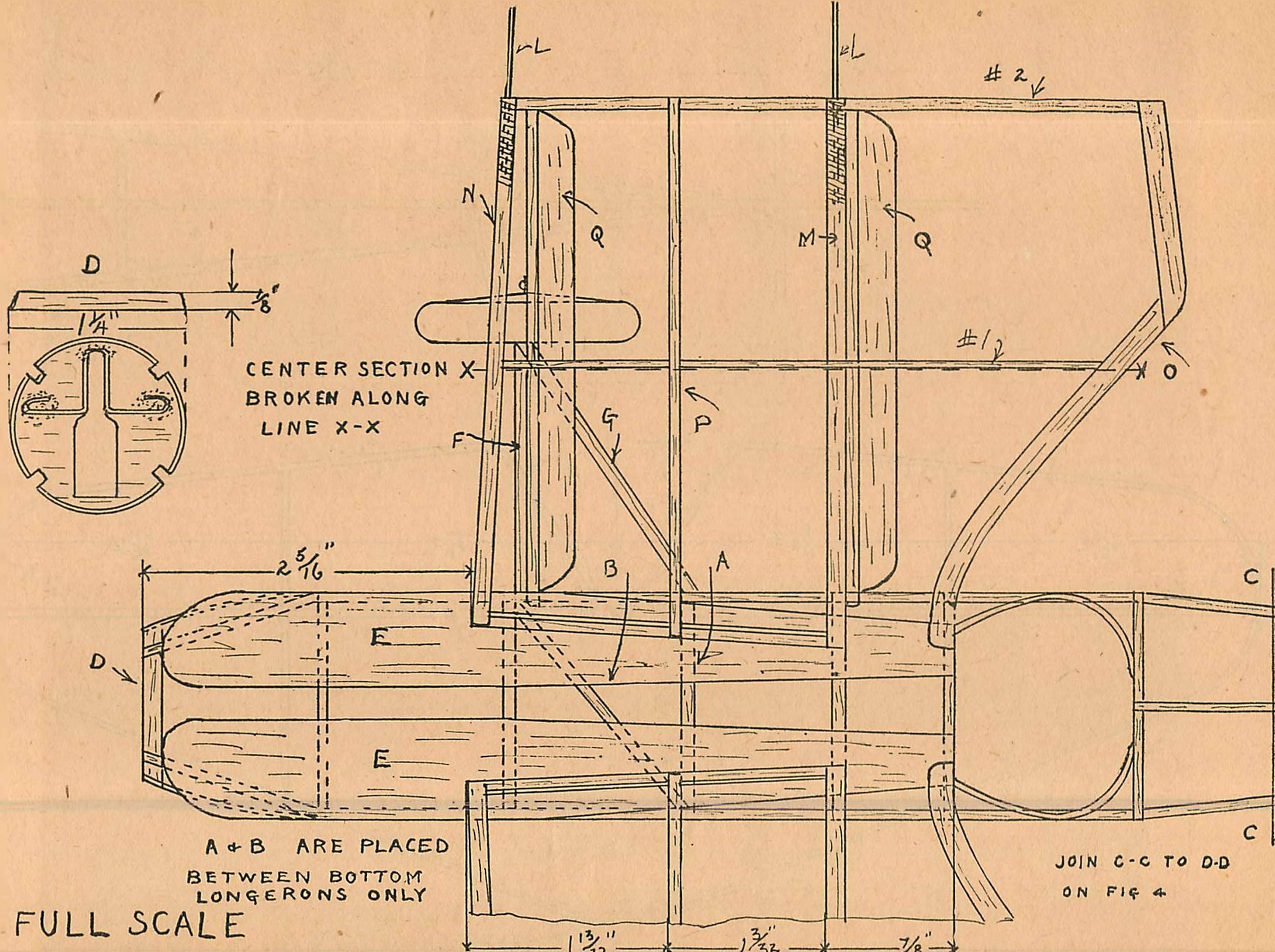


FIG 3 FULL SCALE

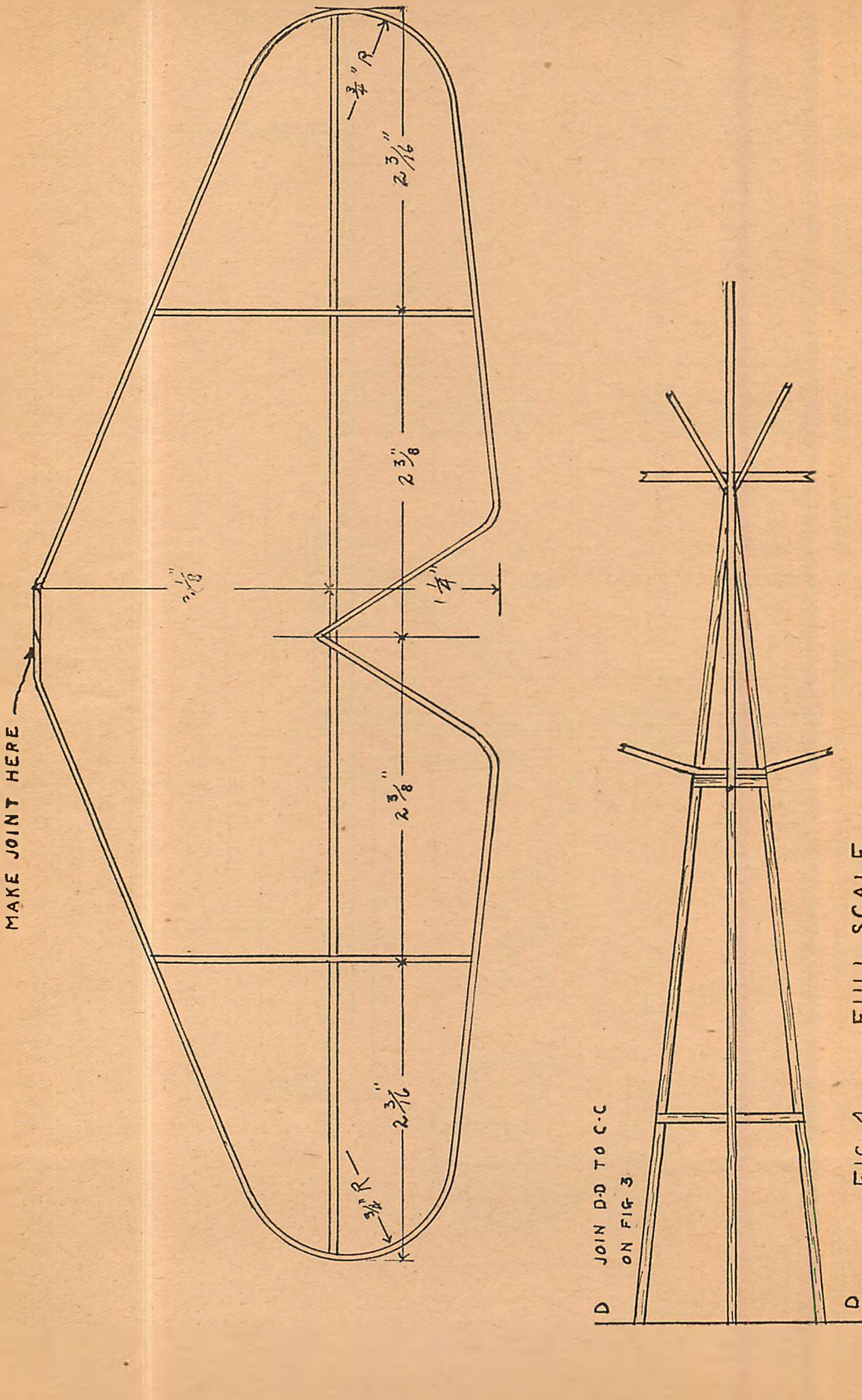


FIG 4 FULL SCALE

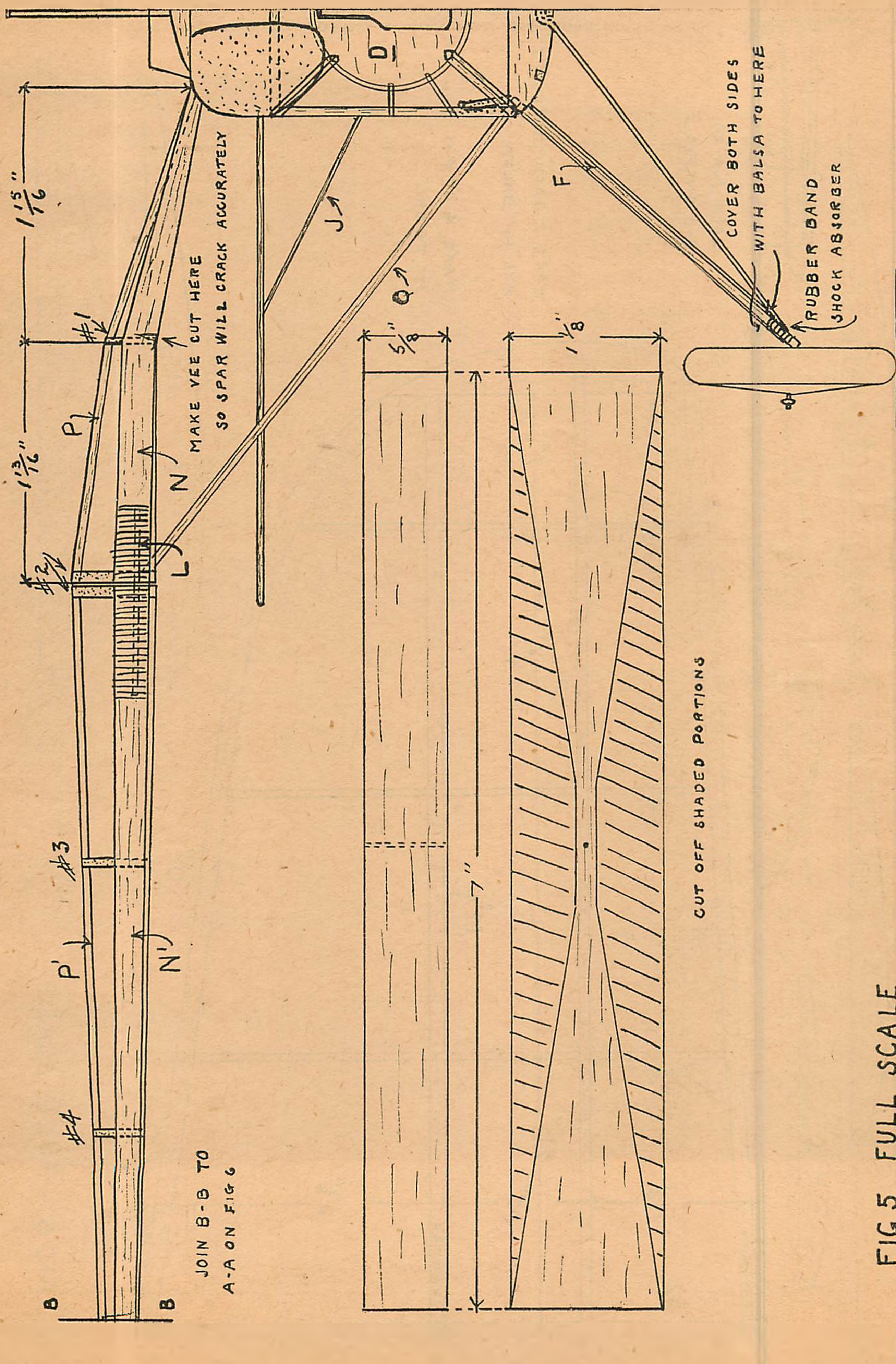


FIG 5 FULL SCALE

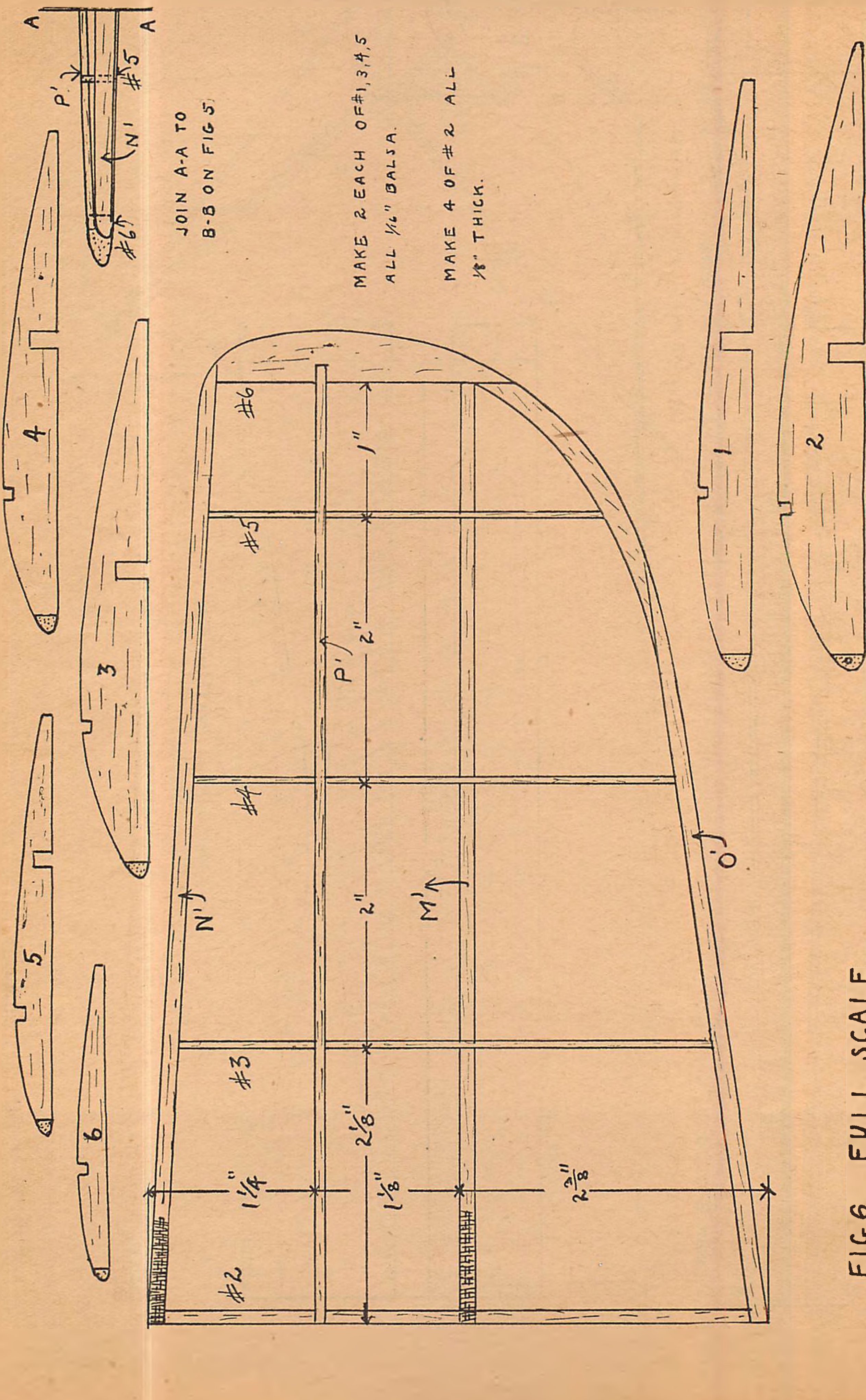


FIG 6 FULL SCALE

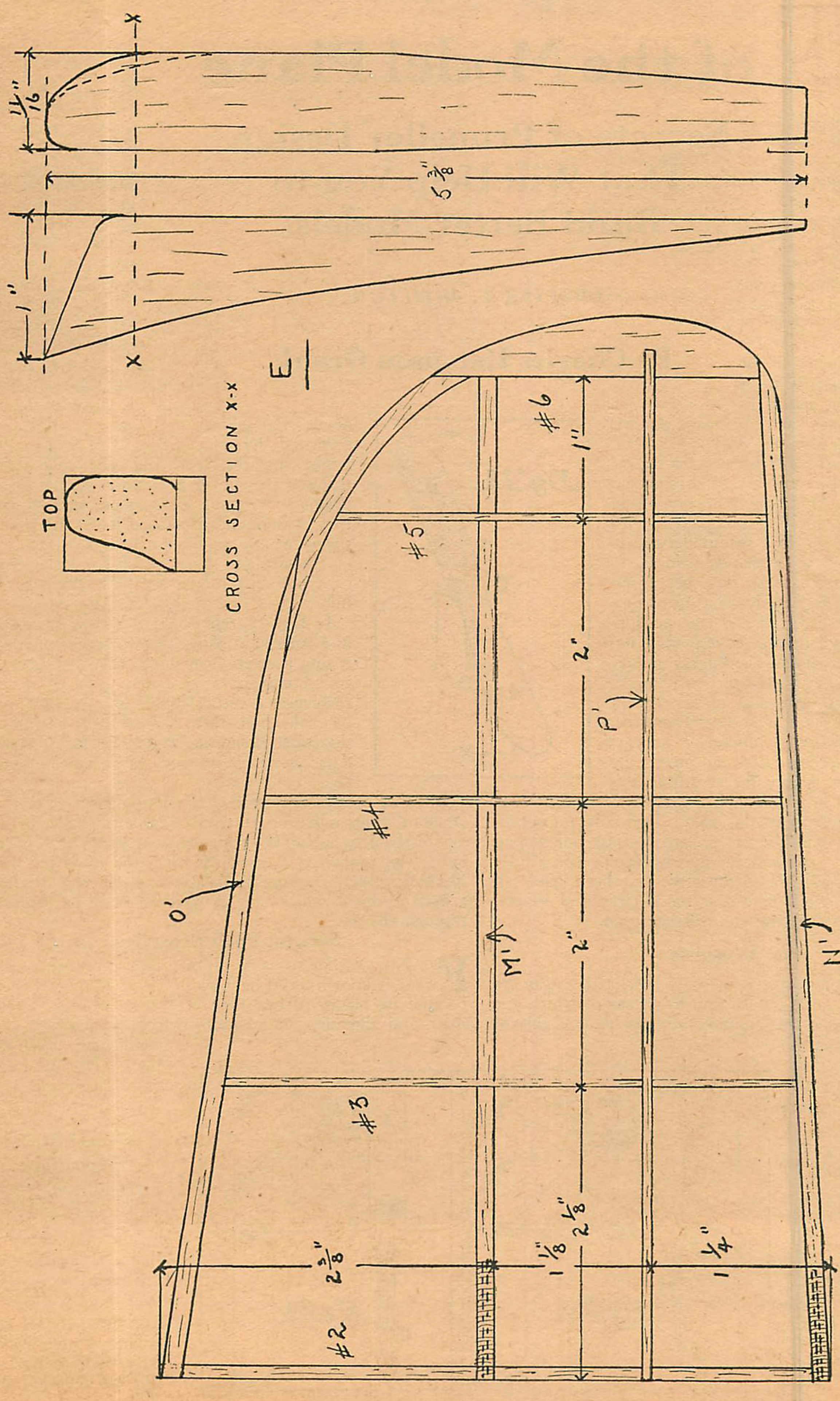


FIG 7 FULL SCALE

The Aerodynamic Design of the Model Plane

Secrets of Propeller Design That Will Help You to Build Better Models

CHAPTER 2 ARTICLE 4

By Charles Hampson Grant

Important Note

IN ORDER that our readers may have a clear and complete understanding of the important facts contained in the preceding first chapter a complete summary of the facts, in concise form, is given at the end of this article. In the foregoing installments in the article we have discussed and devised a way by means of which our airplane may be made to rise from the ground into the air.

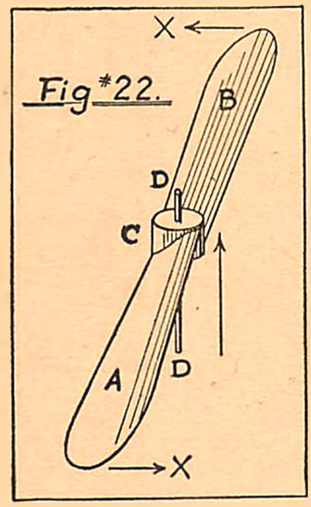
Now we have the difficult problem of devising some satisfactory way of driving our plane. A theory or a means of propulsion must be worked out and properly applied to our model plane. We will undertake to do this in the following chapter, No. 2.

The data connected with this very necessary factor of flight, namely a means of propulsion, is rather involved and may be difficult to understand. However, *it is most important* that you should thoroughly master it if you ever expect to build successful model planes without a great deal of experiment and waste of time and material. Therefore, if some of the following discussion appears complicated, do not lose heart, but master the information given. You will certainly do this if you are serious in your study of aeronautics and in your desire to be successful in this field. There are no opportunities for those who are not serious and are not willing to sacrifice a little time and energy in order to gain a little knowledge. However, a great effort has been made to make the explanations and discussions clear and simple. A close study of the diagrams will help you.

The Propeller

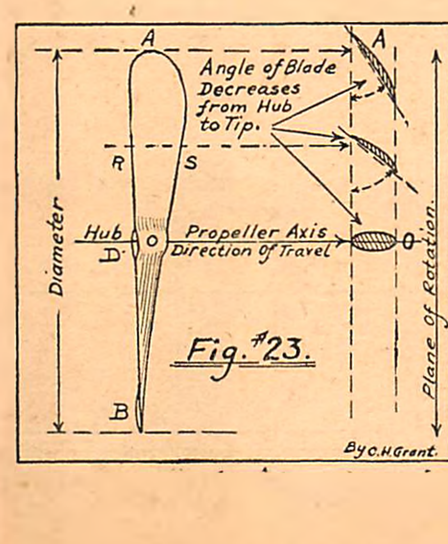
In the preceding chapter we have disclosed a way by which we may generate "lift" and by means of which our plane will rise from the ground, *provided we are able to propel it fast enough through the air.* So our problem now is to devise a means of propulsion, a mechanism which will pull or push our model efficiently, without the use of an excessive amount of power. We can create such a device by applying some of the facts we have learned in Chapter No. 1. For instance, it was shown that when an aerofoil or wing surface is moved through the air in proper attitude to the line of motion, the action of the air on it causes it to lift.

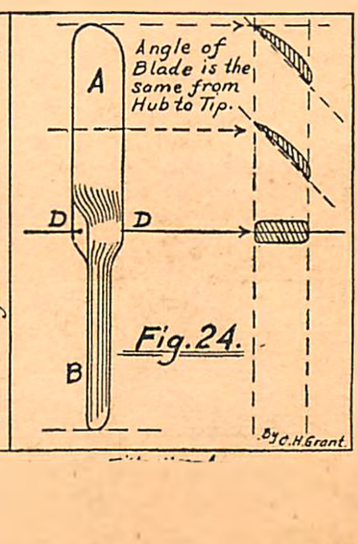
Now suppose we should take two wing surfaces, A and B in Fig. No. 22 and rigidly attach each one as shown, to the opposite sides of a hub (C), through which a shaft (D) passes. If the two wings and hub are made to rotate about the shaft (D) in the direction indicated by the arrow (X), then the wings surfaces (A) and (B) will move through the air in a manner similar to an ordinary wing of an airplane, except that they will be moving in a circle. They will therefore also generate "lift" as in the case of the airplane wing, which takes the form of a pull upward on the shaft through the hub.



In Fig. 22, our device is shown operating in a horizontal plane. Now suppose we turn it into a position in which the shaft is horizontal, and the wings radiating from the hub revolve in a vertical plane, Fig. No. 23, No. 24. The pull, then, will be in a horizontal direction along the shaft. In fact, in this device we have what we know as a "propeller."

In other words, a propeller is nothing more than two or more wings radiating outward from a central hub and mounted on a horizontal shaft which passes through the hub. The propeller is driven through the shaft by some form of power, rotating the blades and thereby creating a pull or thrust which may be used to drive an airplane through the air.





Straight Pitch Propeller

FIG. No. 24 shows a view of an ordinary propeller with what is known as straight pitch. It is given this name because its blades surfaces are at the same angle to the shaft and direction of rotation, which is sideways perpendicular to the shaft (D), at every point from the hub out to their tips.

Helical Pitch Propeller

However, the type of propeller commonly used is called a Helical propeller. In this type the angle of the blade surfaces is not the same at all points of the blades from the hub to their tips but instead, the blade surface radiates out from the hub with its chord parallel to the shaft and from this point outward toward the blade tips, twists around gradually and uniformly so that the angle of the blade chord to the plane of the propeller rotation, at each successive point, from hub to tip, becomes smaller. So we find that, while the blade surface is parallel to the shaft at the hub, (O), Fig. No. 23, at the blade tip (A) the blade surface is more nearly parallel to the plane of rotation perpendicular to the shaft.

This type is much more efficient than the straight pitch propeller and is always used in well designed models and on large planes. The reason for this fact is that in the case of the Helical or screw pitch propeller, the blades are parallel, at every point from hub to tip, to the direction from which the air flows against them, as the propeller screws itself forward.

Certain portions of the blades of the straight pitch propeller are actually passing through the air at a negative angle, the air striking the top or back sides of the blades and causing a push backward instead of a forward pull. The effect is to reduce its efficiency. The reasons for the particular actions of these two types of propellers will be taken up later under the *discussion of PITCH.*

Before we discover any more intricate but interesting facts about our propeller, let us state and define the Four Important Factors which enter into its design and performance.

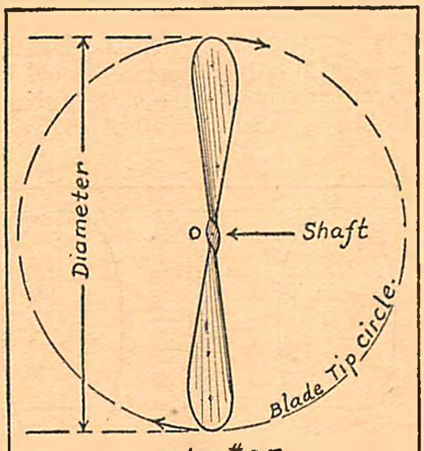


Fig. #25.

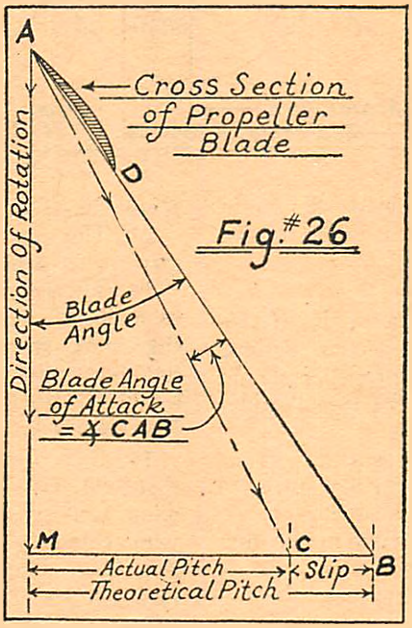


Fig. #26

Diameter Defined

The first is the "Diameter" of the Propeller, which is equal to the diameter of the circle made by the very tip of the blades as they revolve about the shaft, Fig. No. 25. Or if the propeller has only two blades instead of a possible three or four, then its diameter is the distance from the tip of one blade to the tip of the other, Fig. No. 25.

Pitch Defined

The second important factor is the propeller pitch. This may be defined as the distance the propeller will travel forward in one revolution if there is nothing to hold it back or retard its forward motion. We call this the *theoretical* propeller pitch, Fig. No. 26. When it is pulling a machine through the air, the airplane pulls back on the propeller which is trying to pull it forward, because of the air resistance. This backward pull causes the propeller to "slip" slightly and it will not travel forward as far in one revolution under these conditions. *This forward travel in one revolution* is called *actual pitch* which is usually from 75% to 80% of the theoretical pitch. Thus the slip is from 20% to 25% of the theoretical pitch. Fig. No. 26 shows the path of travel (AB) when there is no slip, and the path of travel (AC) when there is slip, as in actual flight. Fig. No. 27 shows you the path of the blade tips as they move forward and revolve one revolution. (Actual Pitch).

Blade Angle Defined

The next important factor is the blade angle. It may be defined as follows. The blade angle is the angle of the propeller blade to the direction of rotation of the propeller. In Fig. No. 26 the arrow (AM) indicates the direction of propeller rotation. The blade is shown at (AD). So in the figure, the blade angle is angle (B-A-M).

Blade Area Defined

We now have one more factor to define. It is the Blade Area. This may be defined as the total area of all the separate blade surfaces, bounded by the leading and trailing edges, (S) and (R) respectively, Fig. No. 23, the curved tip (A) and the center line of the hub (D). Thus, if we wished to determine the blade area of the propeller shown in Fig. No. 23 we would find the area of the surface, (ORAS) and then multiply it by the number of blades of the propeller. In the one shown in the figure, there are two.

Now that we understand something of the meaning of the terms diameter, pitch, blade angle and blade area, let us see what part they play in the design of our propeller. IMPORTANT NOTE. Some of our readers, however, may not care to follow through the technicalities of the explanation. For their benefit, a concise summary of all the important points of design with formulas and tables will be given at the end of the chapter. In this form, the important data may be quickly obtained for immediate use.

First, we can see that the larger the diameter, the greater will be the distance the tips of the blades will travel in one revolution. This distance is the length of the circle described by the blade tips, Fig. No. 25. It is equal to (3.1416) times the diameter. If we let π, (pronounced "pie,") represent (3.1416) and (D) the diameter, then we may say that in one revolution

The Tip Travel $= (\pi D)$

If the diameter of the propeller shown in Fig. No. 25 is 10 inches, then in one revolution

The Tip Travel $= (3.1416)\ (10) = (31.416)$ inches, which must be the length of the circle shown in Fig. No. 25.

From this we can readily understand that the larger the diameter, the more air particles the blade will strike per revolution, consequently the more power the propeller will absorb and the greater the thrust or pull will be at any given rate of rotation.

How Do We Find the Pitch?

"Pitch" is our next consideration. How are we to determine the amount of pitch our propeller has, or how we can design a propeller with a definite predetermined amount of pitch? In Fig. No. 28, the line (X-Y) is the center line of the propeller shaft. Line (AM) is the direction of rotation, perpendicular to the propeller shaft.

Now if we wish to design a propeller with a 15¾ inch pitch, we must first know what diameter our propeller is to be. For the sake of discussion we will select a diameter of 10 inches. The first steps, is to compute the sideways distance travel of the blade tips in one revolution, which equals under these conditions,

$(\pi D) = (3.1416)\ (10) = 31.416$ inches or practically 31½".

We now scale this distance off along line (AM), Fig. No. 28, measuring from the starting point of the blade tip (A). In laying this out in diagram form, we will measure down (31½) inches and indicate this distance from (A) by a point (M) on line (AM). (The diagram is drawn to a scale of ⅛" to the inch). This represents the *sideways* distance travel of the blade tips in one revolution. The propeller, at the same time, is to move *forward* 15¾ inches (as this amount of pitch has been decided upon), during this one revolution. So we therefore draw a line from point (M), at right angles to line (AM), 15¾ inches long, to point (B).

In other words, the motion of the tips of the propeller blades is a combination of a sideways motion of 31½ inches and a forward motion of 15¾ inches, so at the end of one revolution, the tips would be at a place represented by point (B). The path of travel of this tip may be then represented by the line (AB). The propeller shaft (XY) (the center of the hub) will travel on a line (XZ) to point (Z).

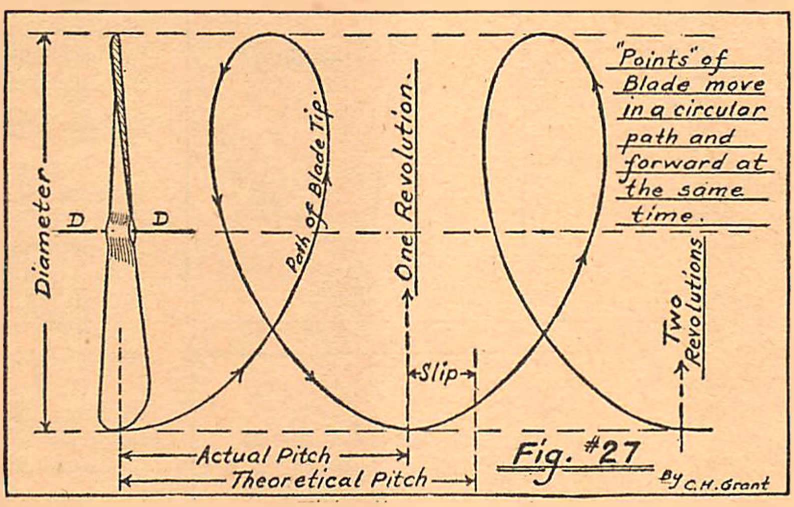


Fig. #27

As the line (AB) is the path of the tip of the propeller blade travel, it is obvious that the surface of the blade at the blade tip should be parallel to this line in order to follow its direction to point (B). Thus the tip blade angle of our propeller will be the angle (BAM). The figure, (No. 28) shows the cross section of the propeller blade drawn in the diagram at the proper blade tip angle in order to give it the desired pitch.

The parallelagram indicated by the lines (FR) (RE) (ES) and (SF) represents the cross section or end view of the wood block from which the propeller should be cut. You will notice that the blade (R.S.) runs "caddy-cornered" from corner (R) to corner (S).

This month we have just scratched the surface of our discussion about "the propeller," so you can look forward to some very interesting facts in our next issue.

A concise summary of the facts contained in the first chapter, on "A means of Lift," follows:

Summary

(Art. No. 1, 2 and 3.)

1. The factors necessary for flight are:
   - A. A means of lift.
   - B. A means of propulsion.
   - C. A means of acquiring stability.
   - D. A means of landing.
   - E. A means of holding all necessary parts or units of the airplane in their relative positions.
   - F. A means of control.

2. Lift is created by the reaction of the air on a moving plane surface, as it flows around this surface, which is inclined at a positive angle to the line of motion, or (to the direction of the relative wind).

3. Lift on the wing is directly due to the increase in air pressure under the wing and to the decrease in pressure, or partial vacuum formed, above the wing.

4. The increase in pressure under the wing causes ¼ of the total lift, while the partial vacuum above the wing causes about ¾ of it.

5. The two general types of wing surfaces are, *flat surfaces* and *curved ones*. The flat surface causes an uneven air flow. The air flows smoothly over a curved surface, and therefore is more efficient than the flat type.

6. The "lift" of a flat wing is equal to about *five times* its resistence.

7. The "lift" of a curved (parobolic) wing is equal to ten to twenty times the resistence or "drag."

8. The amount of lift generated, compared to the resistence, determines the efficiency of the wing, or $\frac{\text{Lift}}{\text{Drag}} =$ Efficiency.

9. The highest point of the curve of the upper wing surface should be about 1/3 of the wing chord back of the wing leading edge.

10. The two types of curved aerofoils are, single surface and double surface.

11. The double surface aerofoil (Wing Section) is from 50% to 75% more efficient than the single surface type.

12. The lift on the wings is approximately proportional to the sum of, the heighth of the lower surface curve plus (3) times the heighth of the upper surface curve (the amount of camber), for any given type of wing. In Formula Form.—L= K (3 Cu+Cb).

13. The greater the camber, the slower the speed necessary to lift a given weight.

14. The heighth of the camber for a speed wing should be about (1/16) the chord, for an average wing (1/12) the chord, and for a slow or weight-carrying wing (⅛) the chord, (for single surface wings). The camber should be (1/3) greater for double surface wings with a flat lower surface.

15. In order to produce a double surface wing section that will have the same lifting effect as a single surface wing section, make (3 Cu+Cb) of the double surface wing equal to (3 Cu+Cb) of the single surface wing. As (Cu)=Cb) in single surface wings, then, *single surface* (4C)=(3 Cu+Cb) *double surface*. If the bottom surface of the double surface wing is flat, then (Cb)=O, and *single surface* (4C=(3Cu) *double surface*, or *double surface* Cu=4/3 (C) single surface.

16. The most efficient angle of attack is about four degrees (4°).

17. The best angle of incidence to use is two to three degrees (2°) to (3°).

18. An elevation of (1/16) inch in (4) inches measured horizontally produces an angle of about *one* degree.

19. The center of pressure on a wing is the point on the wing at which the resultant force of all the smaller individual forces acts.

20. The center of pressure moves *back* as the angle of attack of a *flat* wing increases.

21. The center of pressure moves *forward* as the angle of attack of a curved wing increases.

22. The lift on a wing increases approximately as *the square of the speed*.

23. The approximate lift on any wing when the angle of attack is about *three* degrees, is given by the formula:

$$L=(0.002)\ \frac{(3\ Cu+Cb)}{4}\ A\ V^2$$

Where,—L=Lift in ounces, A=the total wing area in square inches, V=the speed or velocity in miles per hour, Cu=the camber of the upper aerofoil surface relative to the chord, as (1/12), and Cb=the camber of the lower aerofoil surface relative to the chord.

24. The approximate lift of a wing for any angle of attack up to about (12) degrees is given by the formula:

$$L=(0.002)\ \frac{(3Cu+Cb)}{4}\ A\ V^2\ \frac{(4+I)}{6}$$

25. High lift wings either have a high upper camber or a combination of a high upper and high lower camber.

26. The medium lift wing sections have a medium high upper camber and a flat lower, or a combination of a medium high upper camber and a slight lower camber.

27. Speed wing sections have very little camber both on the lower and upper surfaces. The lower surface is even curved or bellied slightly downward.

28. A high upper camber and a negative camber or downward belly on the lower aerofoil surface will produce a medium lift wing section.

29. The Aspect Ratio of a wing is the span divided by the average chord—

$$\text{i.e.—Aspect Ratio}=\frac{\text{SPAN}}{\text{CHORD}}$$

30. For reasonable efficiency, the Aspect Ratio should not be less than *six* or more than *twelve*.

31. Raking the wing ends reduces the drag and thus increases the efficiency.

32. Tapering the wing *reduces wing tip loss* and increases the efficiency.

33. The wings may be tapered in three ways. *One.* All the taper on the forward edge of the wing. *Two.* All the taper on the rear edge of the wing. *Three.* The taper may be produced by slanting the leading edge backward and the rear edge forward, from wing center to tips.

34. Too much taper will cause *lateral instability*, as the *effect* of the propeller torque on the airplane cannot be overcome sufficiently to prevent the plane from turning over sideways.

35. When two wings are arranged in combination, one vertically above the other, the airplane is called a Biplane.

36. The Gap is the vertical distance, that the leading edge of one wing is above the leading edge of the other.

37. The greater the Gap, the less the interplane interference and the greater the efficiency.

38. The Gap normally should be from *one*, to *one and one-half* times the average chord of the upper and lower wing.

39. Biplane wings are about 80% as efficient, as monoplane wings of equal area, aerodynamically.

40. The upper wing lifts about 60% and the lower wing 40% of the total load.

41. For use on the same machine under like conditions, Biplane wings should have 25% more area than monoplane wings.

42. When three wings of an airplane are used in combination, disposed vertically above one another, the airplane is called a Triplane.

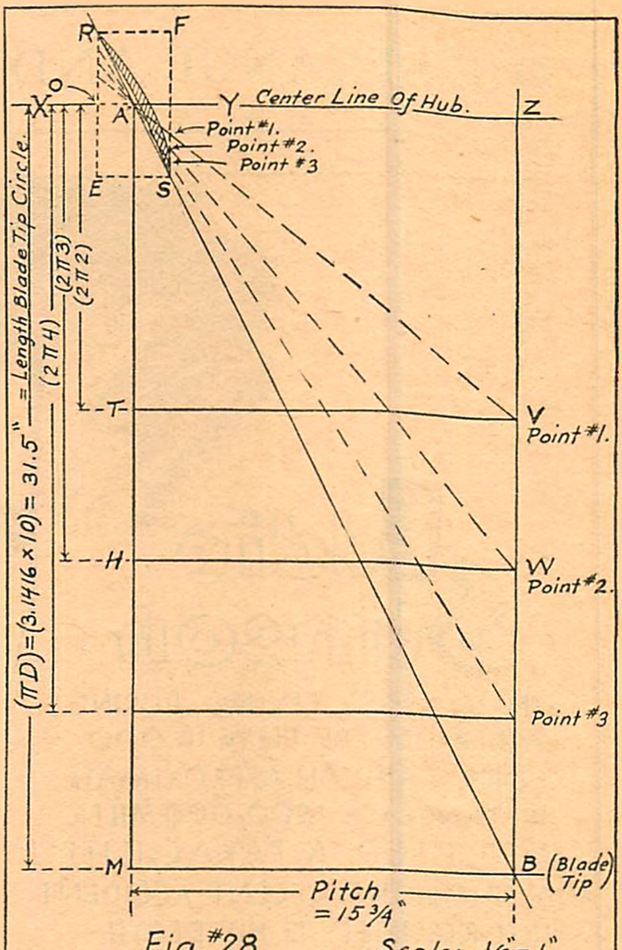


Fig. #28

43. The Gap between each wing should be, from *one*, to *one and one-half* times the average chord of the adjacent wings.

44. Triplane wings are about 75% as efficient, as monoplane wings of equal area, aerodynamically.

45. In triplane arrangements where all the three wings are the same size, the upper wing lifts about 43%, the middle wing 21.5%, and the lower wing 35.2% of the total load.

46. For use on the same machine under like conditions, *triplane* wings should have about 35% more area than monoplane wings.

47. Stagger is the state of relative position in which the leading edge of one wing is located forward of the leading edge of the other wing, or wings, when they are not in the same horizontal plane.

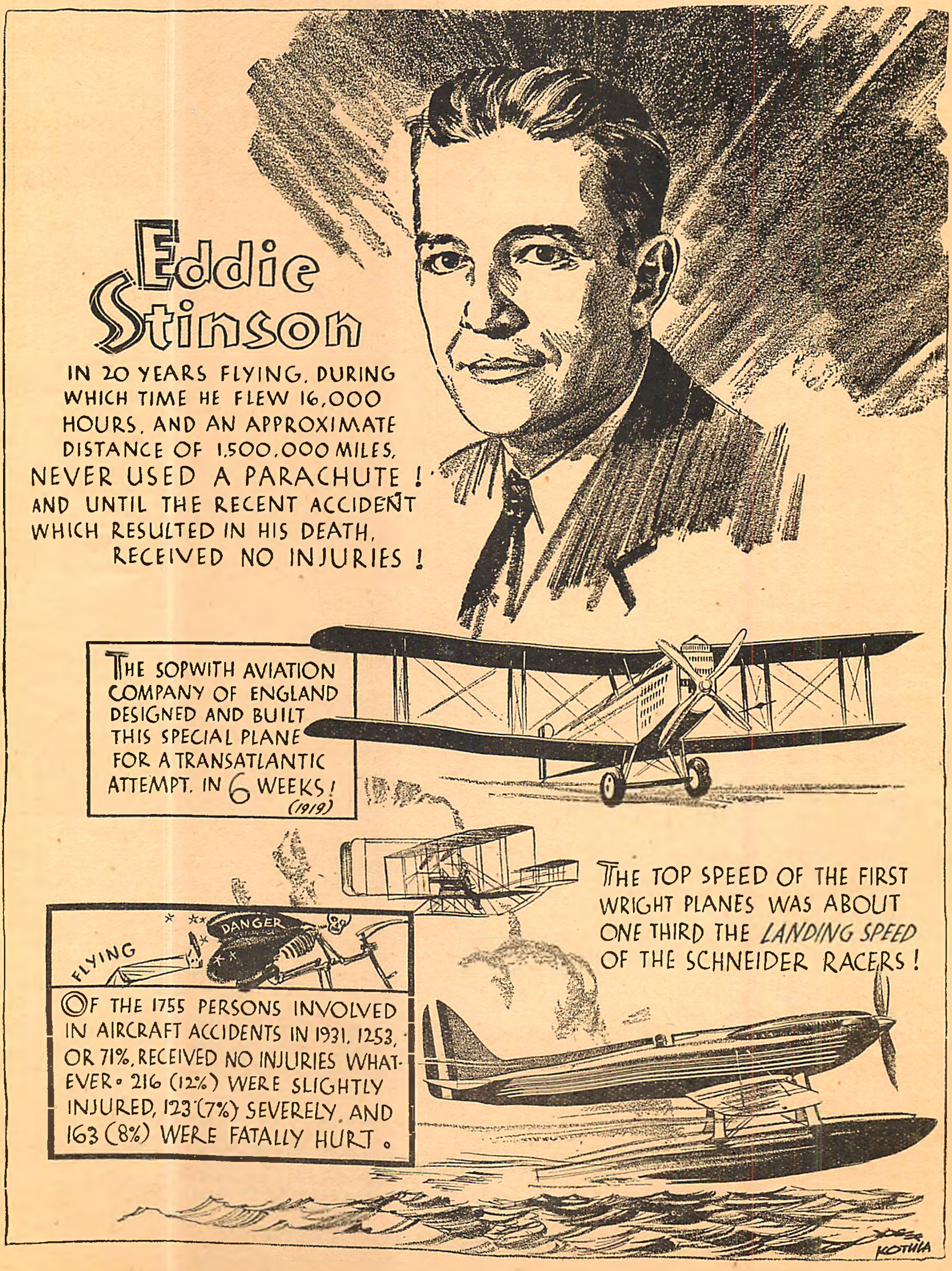
48. Wings may be staggered negatively or positively.

49. Positive stagger (upper leading edge forward of the lower one), increases lift and efficiency.

50. Negative stagger (lower leading edge forward of the upper one), decreases the lift and efficiency.

51. A stagger of (2/5) or (0.4) the average chord of the two adjacent wings, changes the lift and efficiency about 5%. Forward stagger increases the lift, negative stagger decreases it.

THE STRANGE AND UNUSUAL IN AVIATION



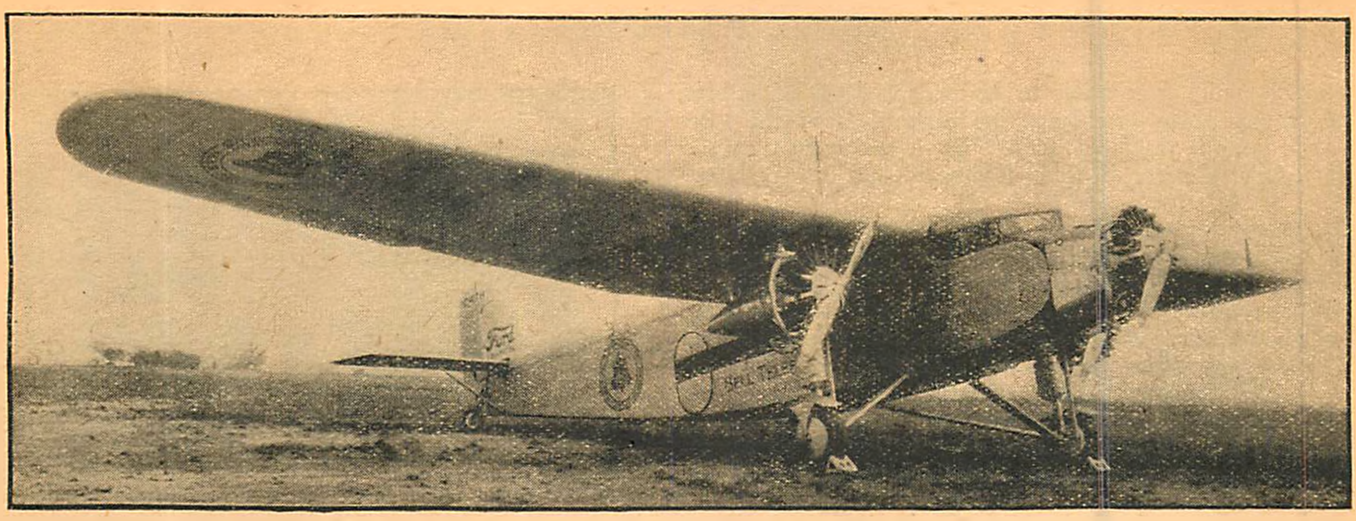


Fig. 10. Latest Types of Antenna Installments in a Transport Plane

Radio As An Aid To Aerial Navigation

A Special Course in Aerial Radio

(*Chapter 11*)

By Capt. Leslie S. Potter

LAST month we mentioned as the second principal function of aerial radio,—its usefulness as an aid to navigation. Some pilots are inclined to regard this feature as paramount, and most will agree that the usefulness of aerial radio as a navigational aid is limited only by the range of the receiving set, and the number of ground stations in operation. In the present article we will deal with this aspect of radio.

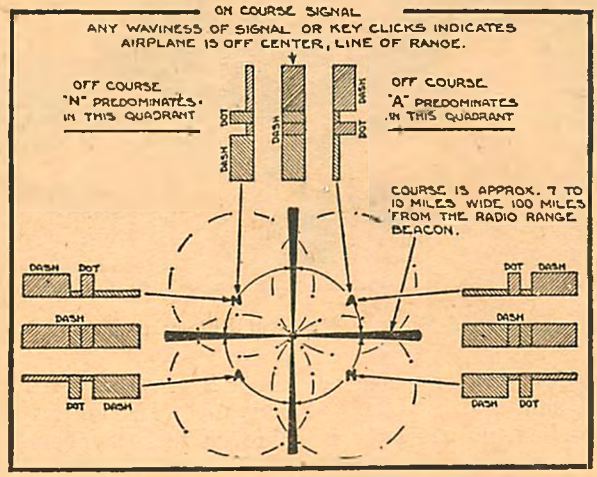


Fig. 1. How Radio Signals Mark Airways

As those who have followed this course from the beginning know, radio or electro magnetic waves travel over the earth's surface at a speed that is almost instantaneous, and set up reactions known as voltages in all receiving stations that lie in their path. When two vertical aerials are joined together at top and bottom, they form what is known as a LOOP AERIAL.

An example of a loop aerial installed on a plane is given in Figure 2. When a loop aerial is set in the path of a wireless wave with one of its masts immediately in front of the other, the one on front will receive a slightly stronger reaction or voltage than the one behind. Since a loop aerial is, to all intents and purposes, an electric circuit, when a higher voltage is impressed on one point of it than another, a difference of potential exists and an electric current flows. It is this current passing round the circuit that sets up the signals heard in the headphones.

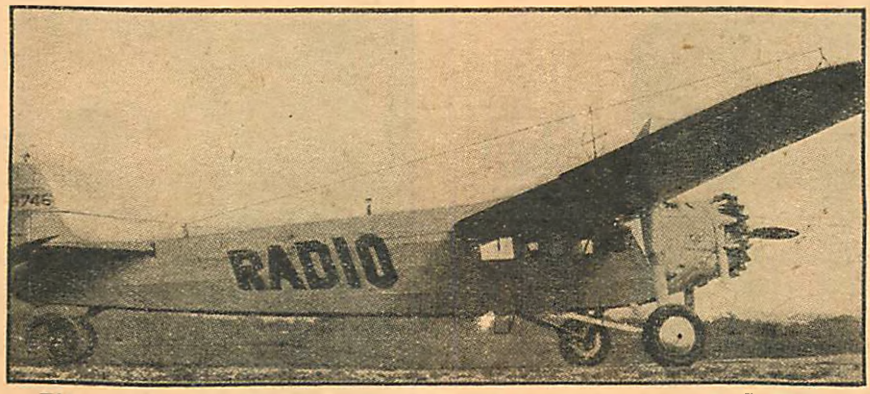


Fig. 2. Direction Finder Loop and Doublet Antenna on A. R. C. Plane

If the loop is turned round over an angle of 90° so that in magnitude and direction the same voltage is impressed on each aerial, no difference of potential will exist, and no current will flow. A moment's thought will make clear the importance attaching to these peculiarities. A loop aerial placed in the fore and aft line of the plane and connected to the pilot's headphones, produces the strongest signal when the aerial, and consequently the plane, is pointing directly towards the sending station, and signals will diminish in volume the farther off a direct course the plane steers.

In case anyone thinks the rest is simple, let me assure him that this is only the beginning of a series of steps which have brought radio navigation to its present level of utility. Much has been done since the early days of the loop aerial, but the principles underlying it still form the fundamentals of radio direction finding today.

IN THIS country, the radio range beacon is used extensively for direction finding. A map of the existing and proposed range beacons was given in last month's Model Airplane News. A radio beacon is a transmitting station, mechanically operated, employing the loop aerial principle. The letter A is signalled on one antenna loop, and N on the other. By appropriately directing the two loops, definite air tracks across the country may be covered. Figure 1 will help to make this clear. Within definite quadrants along the course either a dot dash or a dash dot will be heard in the headphones. When the plane is on a direct course, the two signals will mingle and a prolonged dash will be heard.

The pilot tunes in to the particular wave length of the beacon in which he is interested. If he hears a dot dash he will know that he is to the right of his course and must steer to the left until a prolonged dash is heard. He will then be steering in a proper direction. If clicks are heard or the dash is at all blurred, he should continue altering his course until the signals become clear. This system has very definite advantages and is well adapted to the present commercial needs of aviation in this country.

A simple receiving set is all that is needed, and the same set can be used to receive the Department of Commerce weather reports. Figure 3 shows a radio receiver for Department of Commerce weather broadcast reception and for use with the range beacons. It may be used in either transport or privately owned planes. Figure 4 is an exploded view of the same receiver showing the remote control unit.

With this method of direction finding, no navigator is necessary, no calculations have to be made by the pilot, and signals may be received by any number of planes at the same time. The disadvantages are mainly as follows:

Signals can only be received up to a minimum range and by planes flying along certain recognized routes. To a pilot setting off on a cross country flight which did not lie along any of the principal airways, the radio range beacon would be useless. Further, it will not indicate an exact position, merely the angle of a plane in relation to a certain beacon However, as more and more radio beacons are put into operation many of these limitations will disappear, and from the point of view of being the greatest use to the greatest number, radio range beacons are undoubtedly the best system for this country.

In addition to the aural method of receiving these signals through headphones, there is also the visual method. Figure 5 shows a visual indicator. The output of the receiver, instead of passing through the headphones as signals, operates two reeds in the instrument which have been painted luminous white. Attached to these reeds are electro magnets. When the

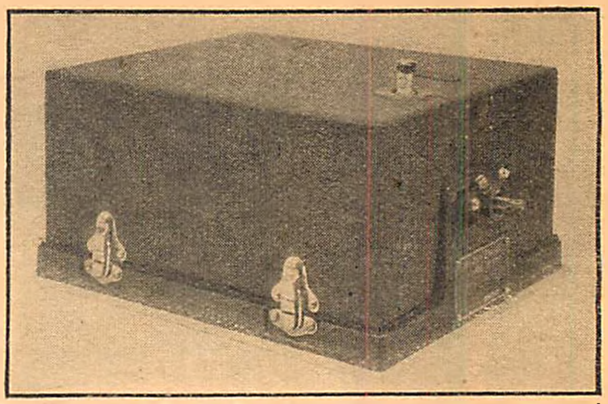


Fig. 3. Aerial Radio Receiver for Long Wave Reception

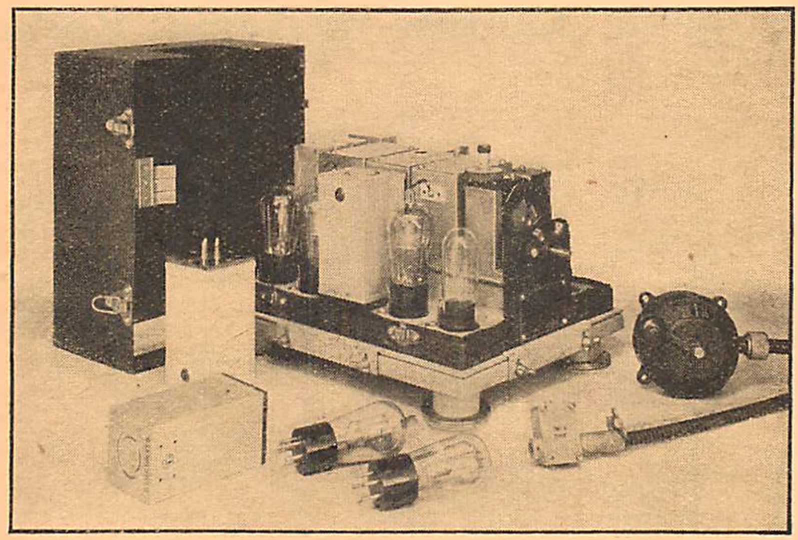


Fig. 4. Exploded View of Receiver Shown in Figure No. 3

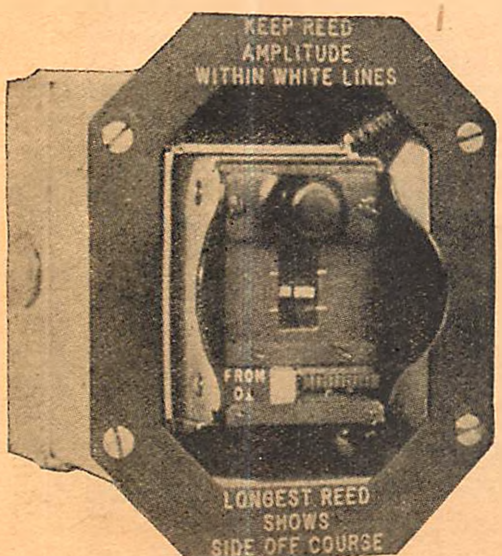


Fig. 5. Dunmore-Reed Course Indicator. *(Courtesy of Harper & Brothers)*

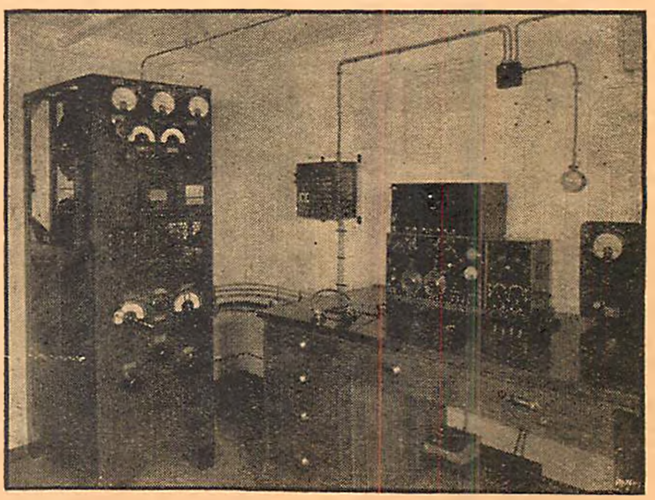


Fig. 8. Modern Radio Transmitting Station *(Radio Corporation of America)*

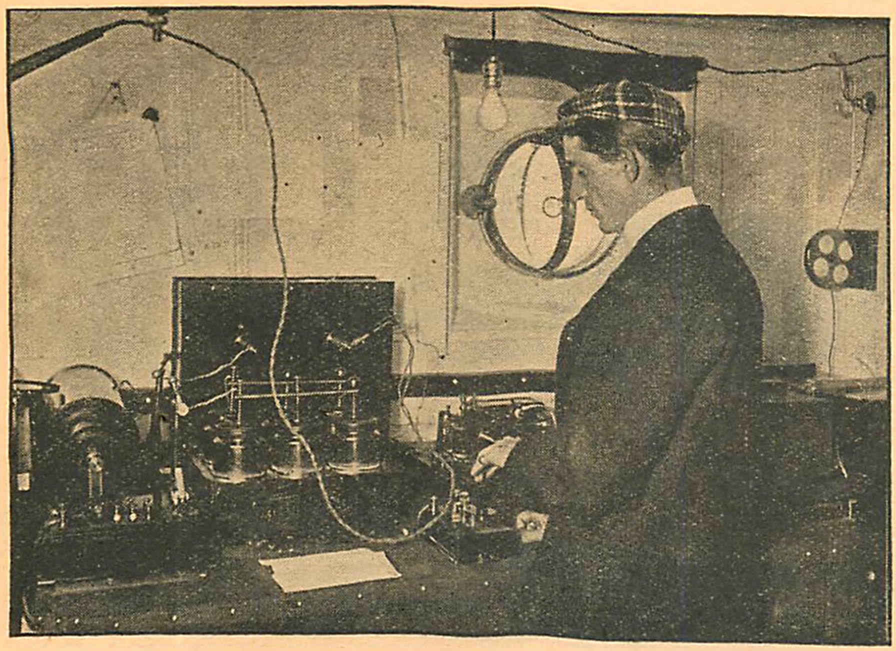


Fig. 7. One of the Earliest Types of Ship Installations
(*Courtesy of Radiomarine Corpn. of America*).

receiving set is tuned to the proper frequency, the incoming waves cause the electro magnets to vibrate, and this, of course, causes corresponding vibrations on the reeds. The white end of the reed as it vibrates gives the appearance of a line inside the instrument, the more violent the longer the line will appear to be.

With the receiving set correctly tuned then, both reeds will vibrate to an equal extent so long as the plane is exactly on the airway. One reed vibrating more than the other will indicate that the plane is off its course, and the shorter reed will indicate the side towards which the pilot must steer to get back on his course. Pilots who have used the reed indicator report it surprisingly easy and accurate to operate with.

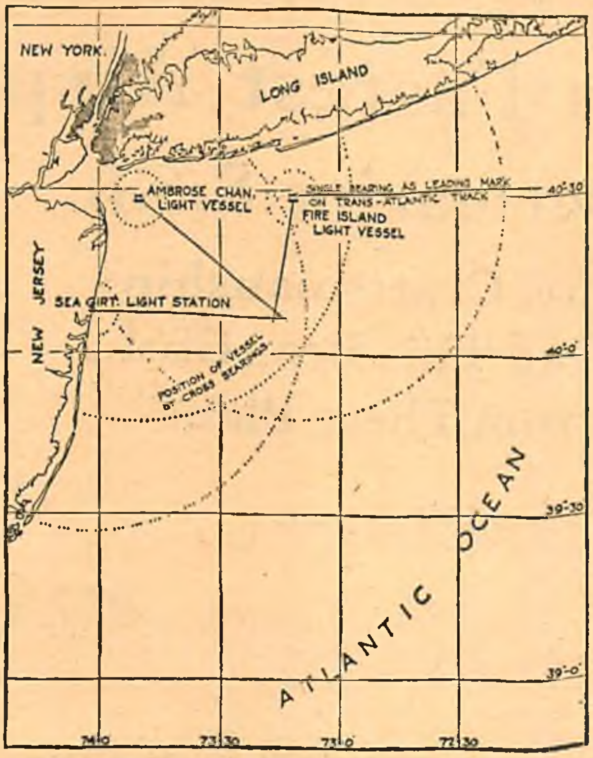


Fig. 6. Beacon Signals near New York

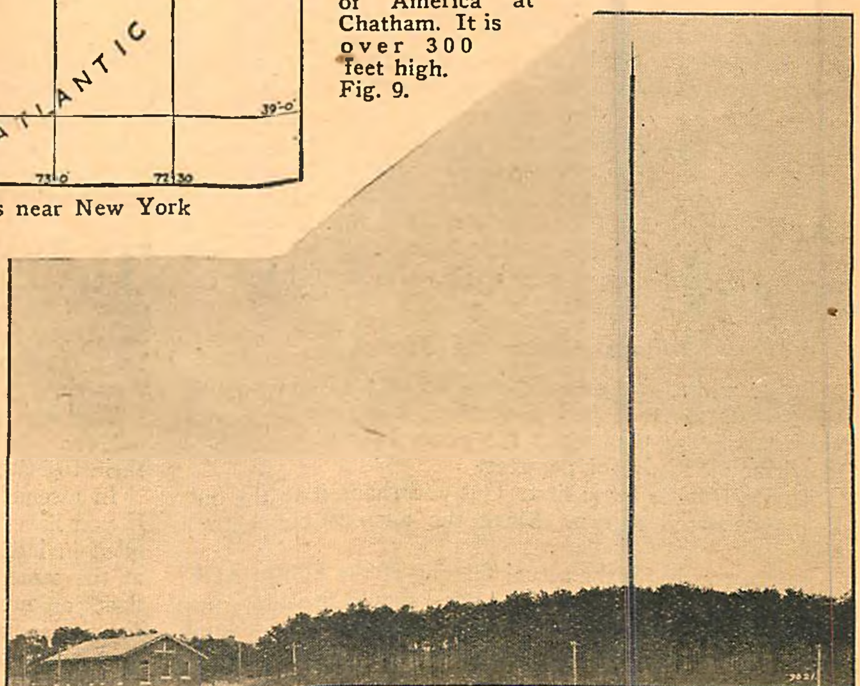
The direction system used largely in Europe is the Bellini-Tosi system, and this again employs the principles of the loop aerial. This method has many advantages from the pilot's point of view. He merely sends out a signal to the nearest control station "What is my position?" and in from one to one and a half minutes he receives a reply giving him his exact position. From a navigational point of view this sounds nearly perfect. No calculations to be made, no listening to lengthy signals, no wondering how far along a certain airway one is, exact position always obtainable on request, and this is how it happens.

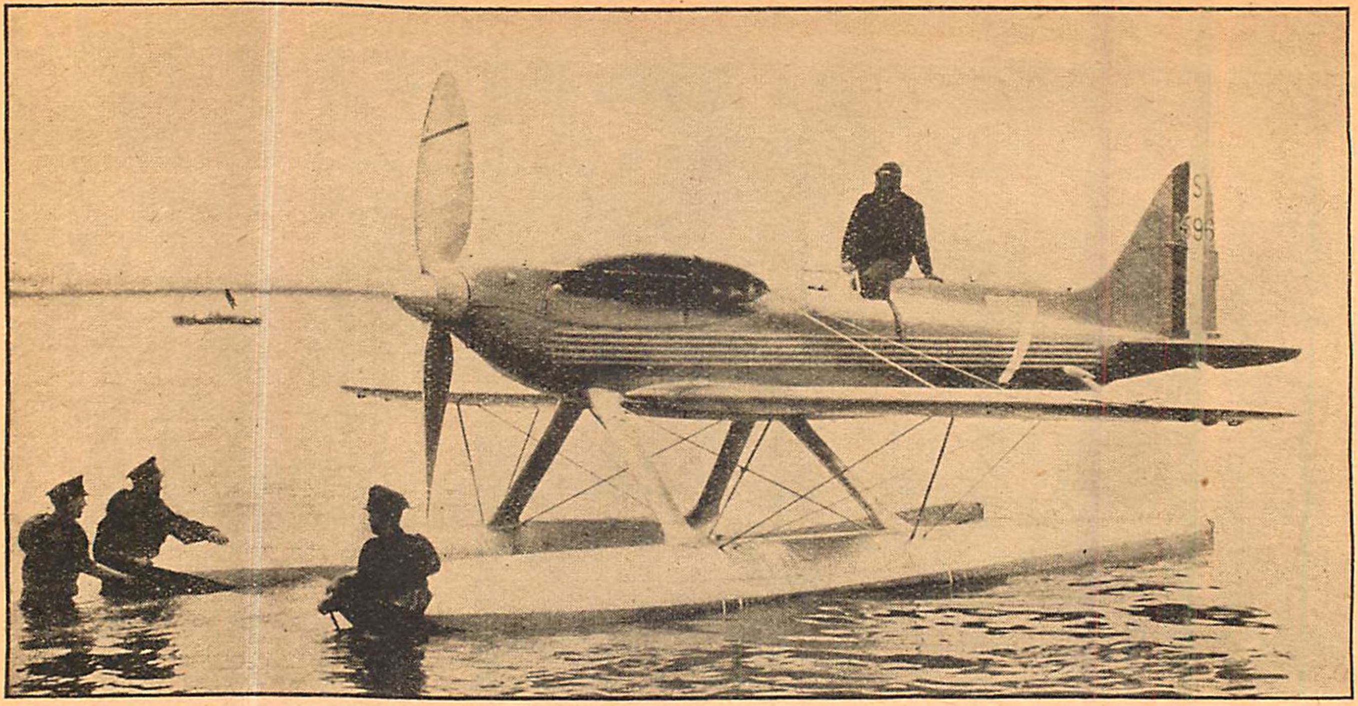
Two ground stations are connected with each other either by land wire or radio, and one of these stations is the control station. One of the two must also be considerably to the left or right of the course. As soon as a request for a position is sent out by a plane, each station prepares to take bearings, and the plane is instructed to send out its call sign for from 30 to 60 seconds. During this period each station takes bearings on the plane by means of the radio compass or radio goniometer. The control station receives the bearing from the other, and by means of triangulation the exact position is speedily plotted on a map.

The disadvantages of this method are the number of ground stations required, and the fact that with numerous planes calling for positions at the same time, the service may become somewhat congested and possibly slow. I have seen ten minutes or more given as a possible length of time which a pilot may have to wait for his position, I can only say that during several years I have used this method, the longest time taken to give me my position never exceeded half this period.

So far as numerous ground stations are concerned, it must be remembered that with this system the exact position is obtained. In order to obtain approximately the same results with the radio range beacon method, plans have been considered for erecting small radio marker beacons at intervals of ten miles along airways. A distinct buzz in his headphones as the pilot passes over each marker will tell him his (*Continued on page 38*)

Transmitting Antenna of Radio Corporation of America at Chatham. It is over 300 feet high. Fig. 9.





Grooming The Supermarine for the flight, on which Lieut. G. H. Stamforth drove it at the remarkable speed of over 400 miles per hour, at Calshot, England

The World's Fastest Airplane

The Supermarine S.6.B.

Test Your Craftsmanship by Building This Beautiful Model from These Plans

By Arnold Pearson

BEFORE proceeding to the construction of the Supermarine S.6.B., it might be well to give a few of its outstanding characteristics. The S.6.B. was developed from the S.6 of the 1929 Schneider Cup Race. These planes are low-wing-braced monoplanes built of steel and duralumin, equipped with twin floats. An increase in speed was obtained with the S.6.B., over the S.6., from 328.63 miles per hour to 340.08 miles per hour over the Schneider course, and from 357.7 miles per hour to 408.8 miles per hour over the three kilometer course. The increase in speed resulted from a higher wing loading and a lower power loading. The engine used was the Rolls Royce racing engine, developing 2,300 horsepower, 21 percent more than in 1929, though only 6½ percent heavier. When the new speed record was set, a new engine was used, which developed 2,600 horsepower.

Construction of Model

Either white pine or balsa may be used in constructing the model. As each part is finished, it should be sanded very smooth, so that when the plane is finally assembled it will be all ready for painting.

The WING is made first. Cut and shape it to the outline and airfoil shown. Mark the ailerons out with a pencil.

Before you begin the actual shaping of the FUSELAGE, cut the slot for the wing. The wing should fit snugly into this slot. Cut out the cockpit and clean it up with sandpaper. When the fuselage has been cut roughly to shape, glue on the cylinder banks and finish shaping. Cut out the cockpit streamlining and the windshield and glue them in place. The windshield can be made of celluloid. The oil radiators, located on the sides of the fuselage, can be made from two pieces of .005" aluminum or brass cut to the proper shape. They are then glued on in the position shown in the drawing.

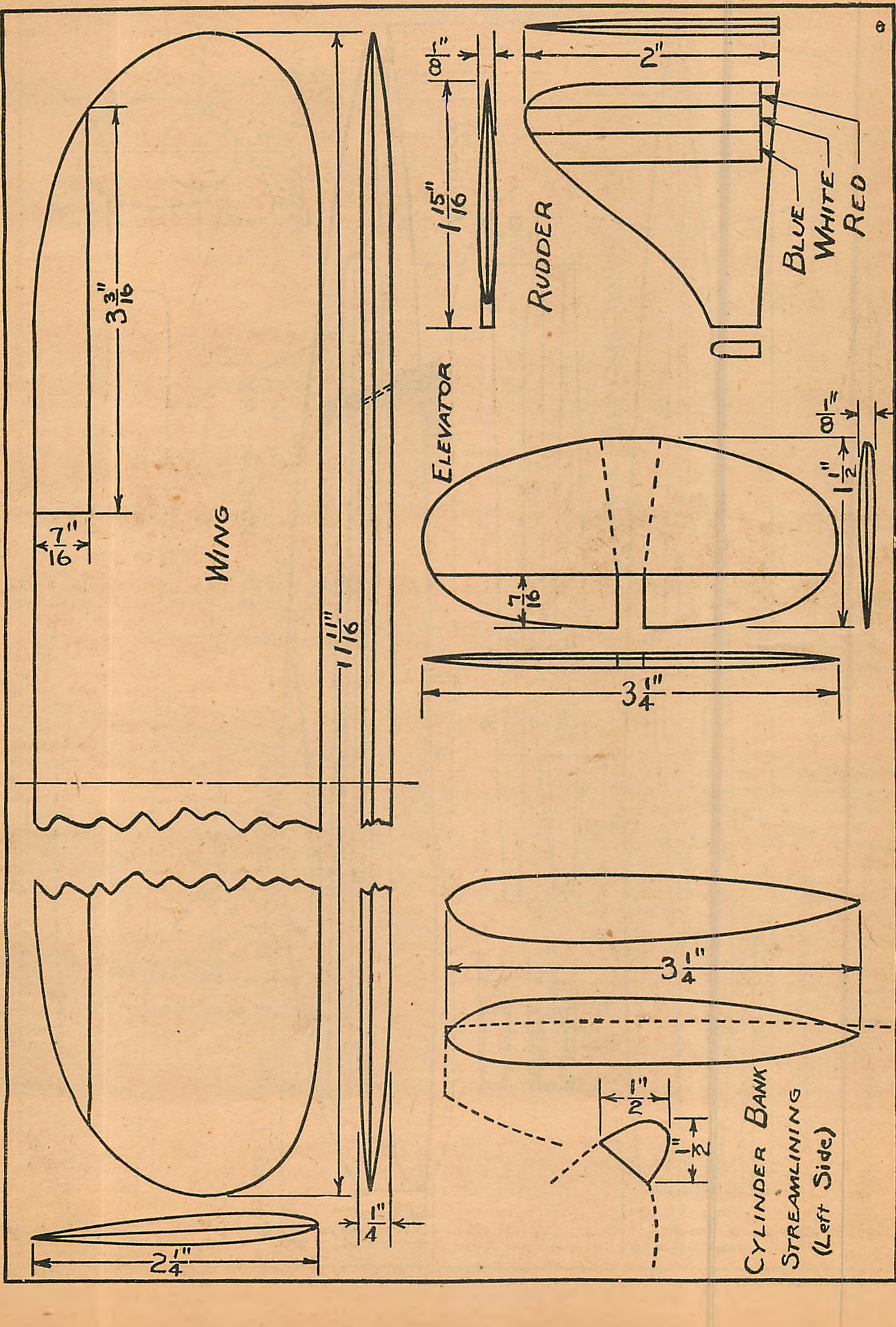
The ELEVATOR is made next. Mark out the flippers on the Elevator with a pencil. Cut a slot in the fuselage so that the Elevator will fit into it as tightly as possible.

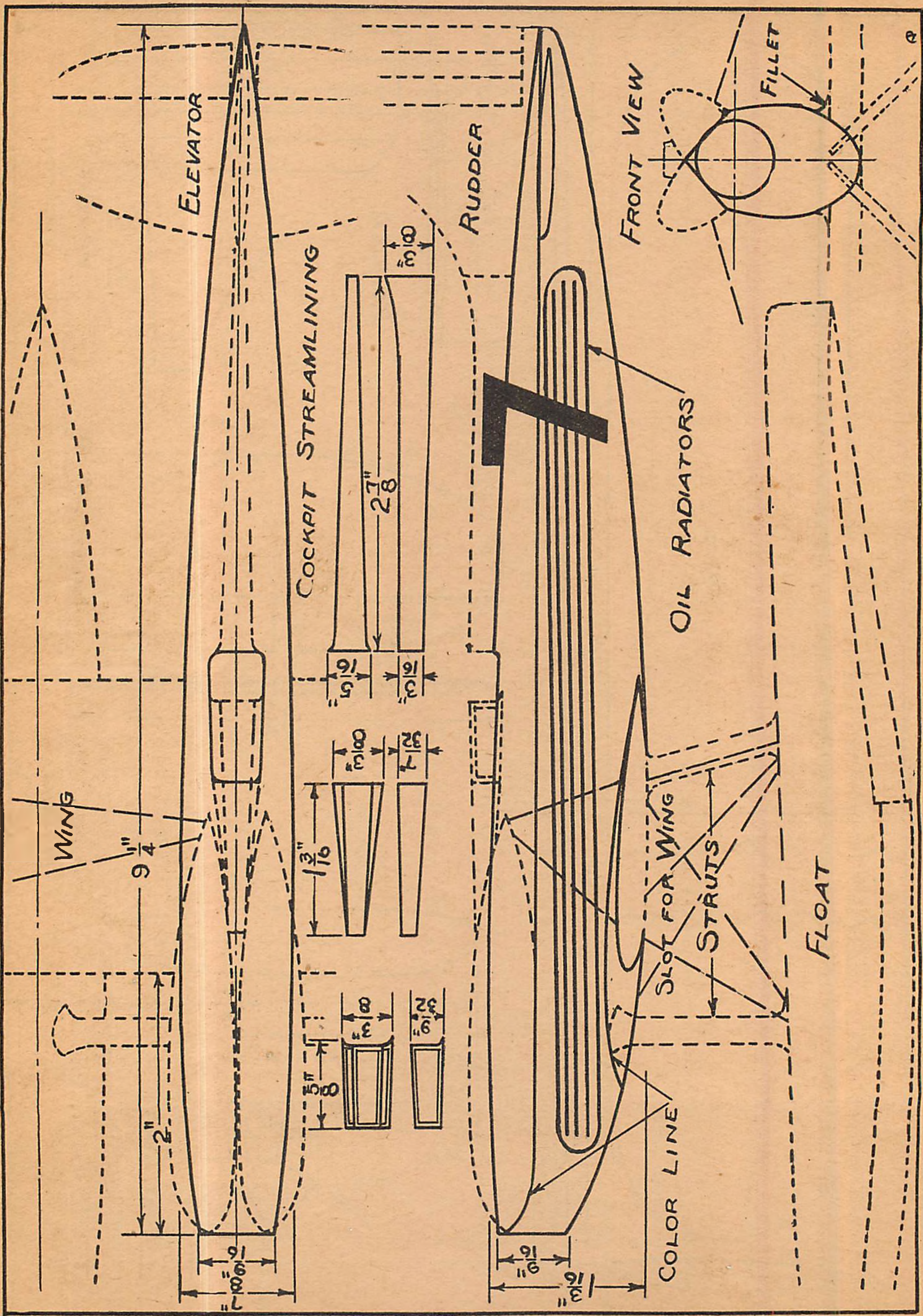
Make the RUDDER so that when it is glued to the fuselage, it will appear to be a continuation of the cockpit streamlining; see the diagram on page 24.

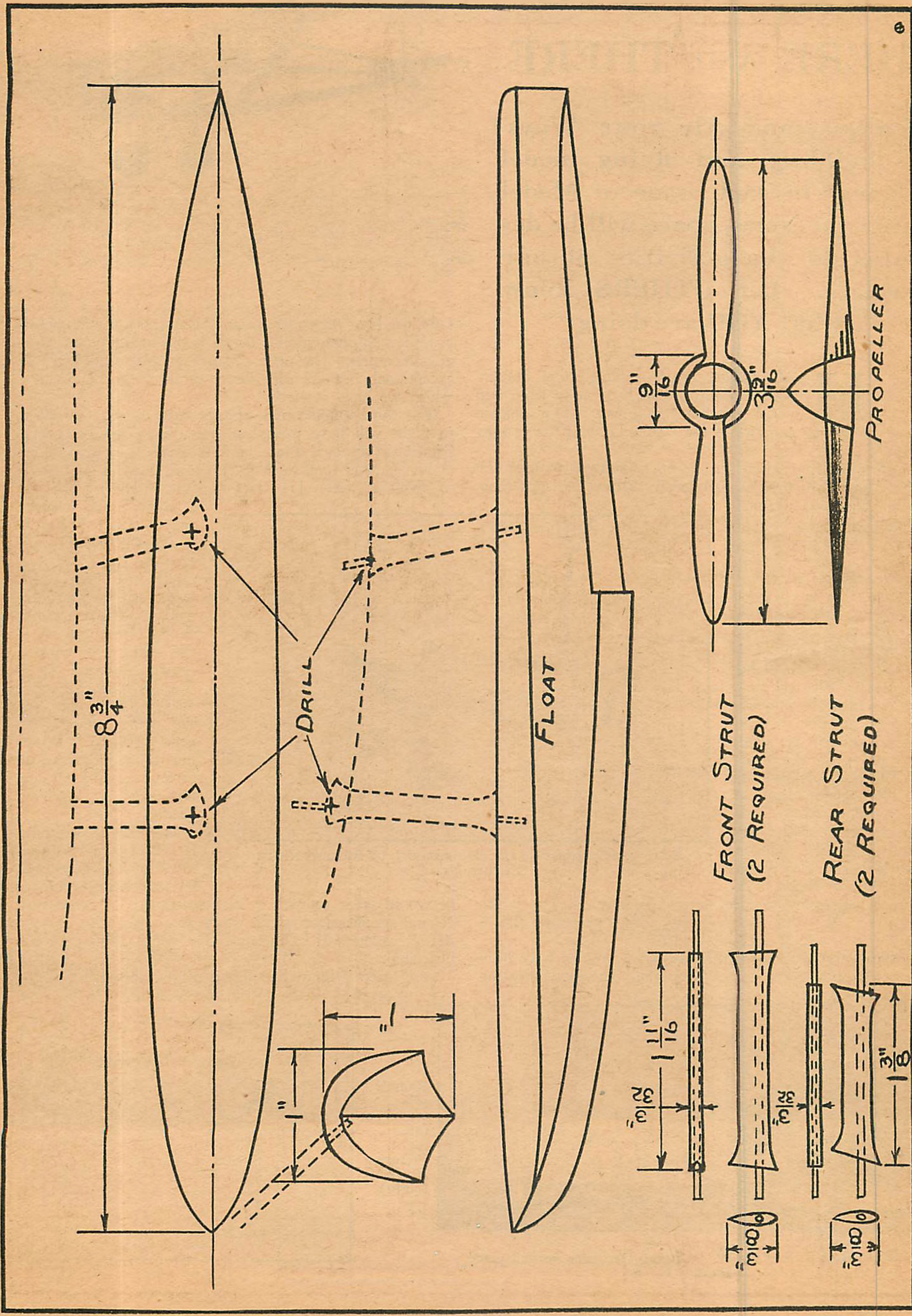
THE FLOATS come next. You will notice that on the bottom, forward of the step, the "V" becomes concave. This is known as a "scallop" bottom. In making the STRUTS, first drill a hole lengthwise through the strut, large enough for a piece of bicyle spoke to be pushed through.

The easiest way to make the PROPELLER is to carve out the spinner and the blades separately, and then glue them together.

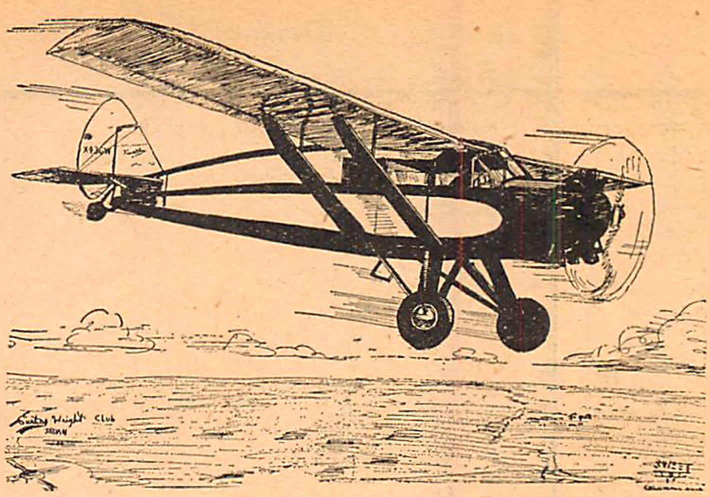
In assembling, first glue on the wing and the elevator. If you have made the slots a little too large, they can be filled in later with plastic wood. The fillets can be made at the same time. Next glue on the rudder. Fasten the floats on now by drilling holes in the fuselage and floats for the spokes, and pushing the strut ends in these holes with a touch of glue. (Continued on page 47)


WING
ELEVATOR
RUDDER
BLUE
WHITE
RED
CYLINDER BANK
STREAMLINING
(Left Side)
3 3/16"
7/16"
11 11/16"
2 1/4"
1/4"
1/8"
1 15/16"
2"
1/8"
1 1/2"
7/16
3 1/4"
3 1/4"
1/2"
1/2"


ELEVATOR
RUDDER
FRONT VIEW
FILLET
COCKPIT STREAMLINING
OIL RADIATORS
WING
SLOT FOR WING
STRUTS
FLOAT
COLOR LINE


8 3/4"
DRILL
1"
1"
FLOAT
9/16"
3 3/16"
PROPELLER
FRONT STRUT
(2 REQUIRED)
REAR STRUT
(2 REQUIRED)
1 11/16"
3/16"
3/8"
1 3/8"
3/16"
3/8"

AIR—WAYS
HERE AND THERE

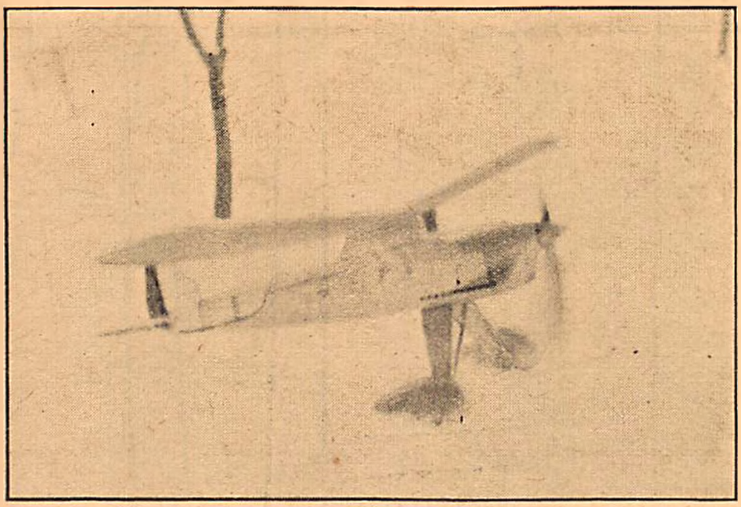


Get busy and "Air" your "Ways" of building and flying model planes. In each issue of Model Airplane News, space will be devoted to the activities of our readers. Let OTHERS know what YOU are doing

HERE we are again—talking from Station M-A-N, with a bunch of news from our model aviation "grab bag." Our biggest package, by far, is news of the results of the prize picture contest.

All those live young men who submitted pictures for this contest are probably anxiously waiting to learn their fate. You can imagine that there have been a great many entries. However, after a considerable struggle in weeding out "the sheep from the goats," the postman brought in an entry from Richard Rioux, 327 Vine Ave., Highland Park, Ill. We feel that his pictures are unquestionably the best that we have received. He wins first place, and the prize.

The first qualification in this contest is likeness to a full-size ship. You will notice from the pictures that the builder has adhered closely to large ship design. A rather interesting feature shown (picture No. 1) is the inverted "V" type dummy engine; the propeller also is spinning in a very realistic manner.



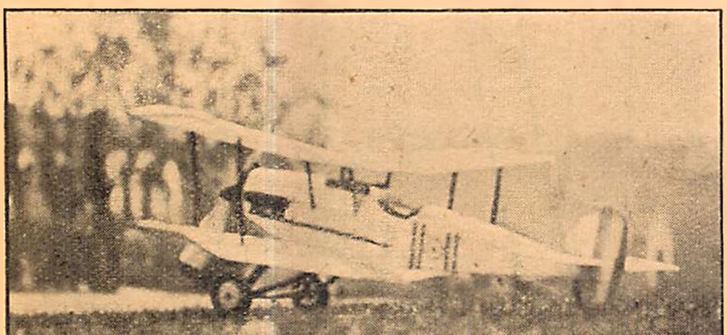
Prize Winning picture of a flying model, by Richard Rioux
Picture No. 1

Many of the pictures that we have received have been rather poor specimens of photography. The predominating fault has been improper focus. The quality of the picture in respect to photographic detail, is the second qualification of our contest. The prize pictures in this respect are not exceptional, but are superior to most of the photographs which we have received.

The third qualification, stating that pictures of planes in flight will have precedence, is a very important one. Rioux has obtained and submitted a very excellent picture of his machine (picture No. 2) in full flight at an altitude of about 35 feet. The trees showing in the right of the picture prove unquestionably that this model is flying in the open and that no trick photography has been used. We wish to draw the reader's attention to the very interesting detail of the wing construction shown in picture No. 2. The machine silhouetted against the sky shows up the wing construction very distinctly. This is not only indicative of careful workmanship, but also of ingenious posing.

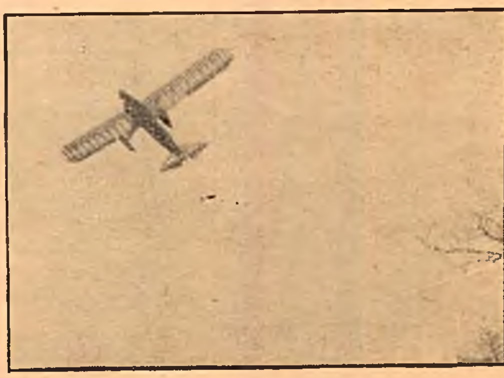
We wish to congratulate Rioux for his very excellent workmanship on this model. Perhaps he would favor us with a brief description of it, or with general specifications which we might print in this column. Many readers will be interested in building this very fine little ship.

Our space is limited in this issue, so we will be unable to print all of the entries in this contest. In the June

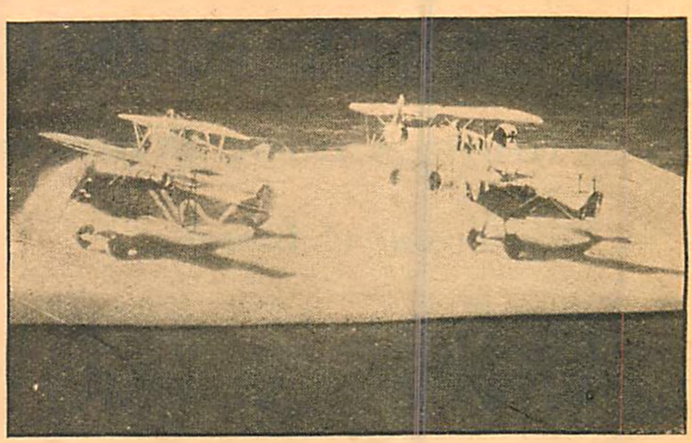


Picture of S. E. 5 by W. F. Losch, Jr., wins second place.
Picture No. 3

Rioux's prize model in full flight. Picture No. 2 (right)



W. F. Losch, Jr., winner of second place, and his S.E.5 in flight. Picture No. 4



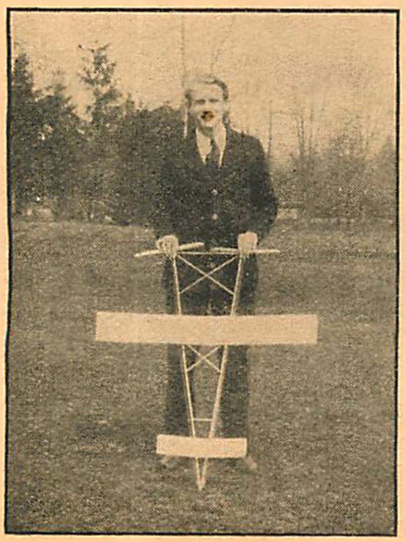
A fleet of snappy looking War Time models built and photographed by Stockton Ferris, Jr. Picture No. 7. (Right)

issue, you may look for a great many very interesting photographs that the contestants have submitted. We believe you will get a great "kick" out of seeing what the young fellows are doing throughout the country.

However, we feel it due to the second place winner to show him some recognition in this issue. We wish to congratulate W. F. Losch, Jr., of 2116 Kerwood Avenue, Los Angeles, California, for winning second place. Picture No. 3, of his machine resting upon the ground is quite realistic, though it might be improved in photographic detail. We have had many pictures which show detail more distinctly than this picture, but their builders have failed to submit a picture of the machine in flight. As an indication of the flying qualities of the model is one of the largest features of the contest, it has been necessary to give precedence to pictures that show models in the air. Picture No. 4 shows Losch's SE-5. getting under way. We are sure that our readers will be interested to know more about his activities in the model airplane field.

Model Airplane News has received a contribution which it treasures highly. In Columbus, Ohio, Robert Sweet, 17 years of age, has been ill for some time and, while confined, has indulged in a little artistic work. He has donated three of his drawings to embellish our AIR-WAYS column. We are indeed grateful for his contributions and feel they should have a place of honor in this column. Therefore, we are using his sketch to make our heading more attractive and realistic. As he has submitted three of these sketches, one will be used each month for the next three months. The plane shown opposite is a Travelair cabin "job," a Curtiss-Wright Club Sedan. Many other samples of Robert Sweet's work, we hope, will grace our pages.

Jack Limber, one of our youngest expert model builders. Picture No. 6



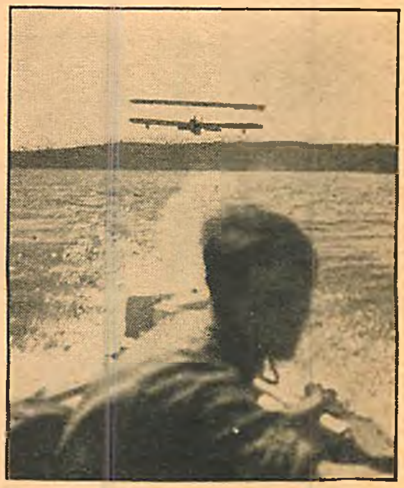
John T. Dilly, instructor of the Galt, Ontario, Model Airplane Club. Picture No. 5

HERE we have picture No. 5 from John T. Dilly, 18 Huron Street, Galt, Ontario. He is the instructor of the Galt Model Airplane Club. The picture shows him with one of his contest twin pushers. If we are to judge from the general design of this ship, we should say that it is capable of long flights and embodies excellent workmanship. He has sent no information as to flights that it has made, so we cannot tell you its performance exactly. We would appreciate it if he would let us know what this machine will do. Dilly tells us that they have one of the largest model clubs in Canada. If this is so, we should hear from him soon again in the future.

Picture No. 6 shows one of our youngest successful model builders, Jack Limber, who is 9 years old. He lives at 101 West 87th Street, New York. Though he has very few years to his credit, he is not to be classed as a novice by any means, for he won second place at the Gimbel Model Plane Competition last summer. The picture shows him with one of the models that he constructed. I might suggest that our staid, old model builders step on the gas, if they do not wish some of the younger boys to outstrip them. It appears that some of our older contributors have been satisfied to rest on their laurels attained in one or more competitions.

Stockton Ferris of 2328 Bedford Avenue, Brooklyn, has sent us picture No. 7 showing his flock of war planes. It looks as if he was starting an air fleet of his own. If he keeps on, he will be running a close second to France, England and the United States. The picture shows an SE-5., a Newport, a German Albatross D. III, and a Fokker D. VII. Great attention has been given to accurate measurement and detail in these models.

(*Continued on page* 47)



Bob Clary enjoys gliding at Camp Sokokus. Picture No. 8

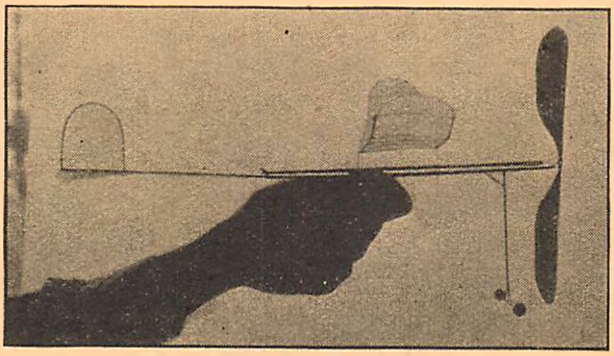
BUILDING A DURATION BABY R. O. G.

A Winner Among Winners

By Jerome C. Kittel

THIS new R. O. G. has a record of 5 minutes, 56.2 seconds to its credit. There is nothing radical about the design, but several details, the parasol wing, the monospar landing gear and the three dihedral angles in each wing, are unconventional. It is a very consistent flier and has a climb that will carry it up to the highest ceilings.

If care is taken in constructing this plane you will have a ship that will beat the best of them. Before starting the material list it should be emphasized that all dimensions of balsa used are for a clear, white and very light grade of wood. If you use any other grades, have no hesitancy in varying sizes to correspond with the strength of the wood.


Side view of the finished model

Material List

Balsa

1 1/16" x 1/8" x 8" for motor stick.
1 1¼" x ¾" x 8" for propeller.
1 1/32" x 2" x 8" for miscellaneous wood.
1 1/64" x 2" x 8" for miscellaneous wood.

Metal Parts

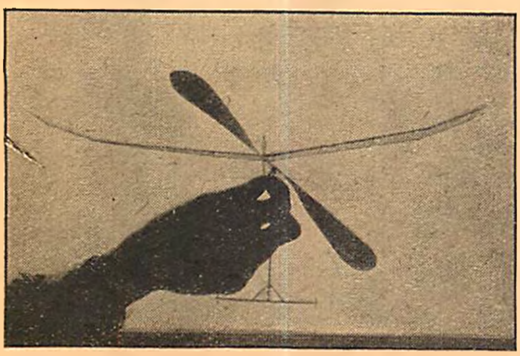
6" .010" music wire.
1" .008" music wire.
1" 1/16" x .012" dural for front bearing.
1 small brass washer or, preferably, a tiny glass bead.

Miscellaneous Parts

27" .045" x .045" rubber.
1 18" x 5" very best superfine tissue.
Rubber lubricant
Colorless cement.
Acetone.
Banana Oil.

Special Tools Needed Are:

1 .015" drill.
8 small steel bars for perfect alignment of surfaces (Optional).
Assorted sizes jewellers blue black emery paper (optional).
1 piece brass or tin 3"x1" x 1/32" for rib jig.


Note the large area propeller

Carve propeller from blank 8" x 1¼" x ¾". Carve in usual manner, first drawing diagonal guide lines on blank. Do not drill shaft hole in hub until propeller is completed. Finish blades to 1/100" at tips and 1/32" at hub. Smooth with jewellers paper. Now shape blades to the template shown in plans. The shape shown is very efficient.

Bend propeller shaft out of .010" wire. (Use rustproof music wire if it is available). Bend only the portion to be made circular. Now insert in propeller hub and complete bending. Push bent over spur end into prop. Cover hub generously with cement.

Drill .015" hole for the propeller shaft in the dural strip. Bend and cut the remnants off as in an ordinary bearing. Bend CAN out of .008" music wire. Bend rear hook out of .010" wire.

Taper motor stick as shown in plans. Finish smooth with jewellers paper. Mount fittings carefully. Looking at the motor stick from the rear, mount rear hook on the right hand side so that the rubber when wound up will remain above the stick instead of squirming over the left side of the stick.

Cut a strip out of the 1/32" wood conforming to the tail boom dimensions as shown on the plans. Finish smoothly. Out of the 1/64" wood cut a strip 1/64" square. This is for the rudder. Moisten wood and very carefully bend around a hot 100 watt light bulb. Pin this in place on bench after bending is completed and let dry. When dry cement on to boom. Now cover this with the superfine tissue. Use a 50-50 mixture of banana oil and acetone as an adhesive.

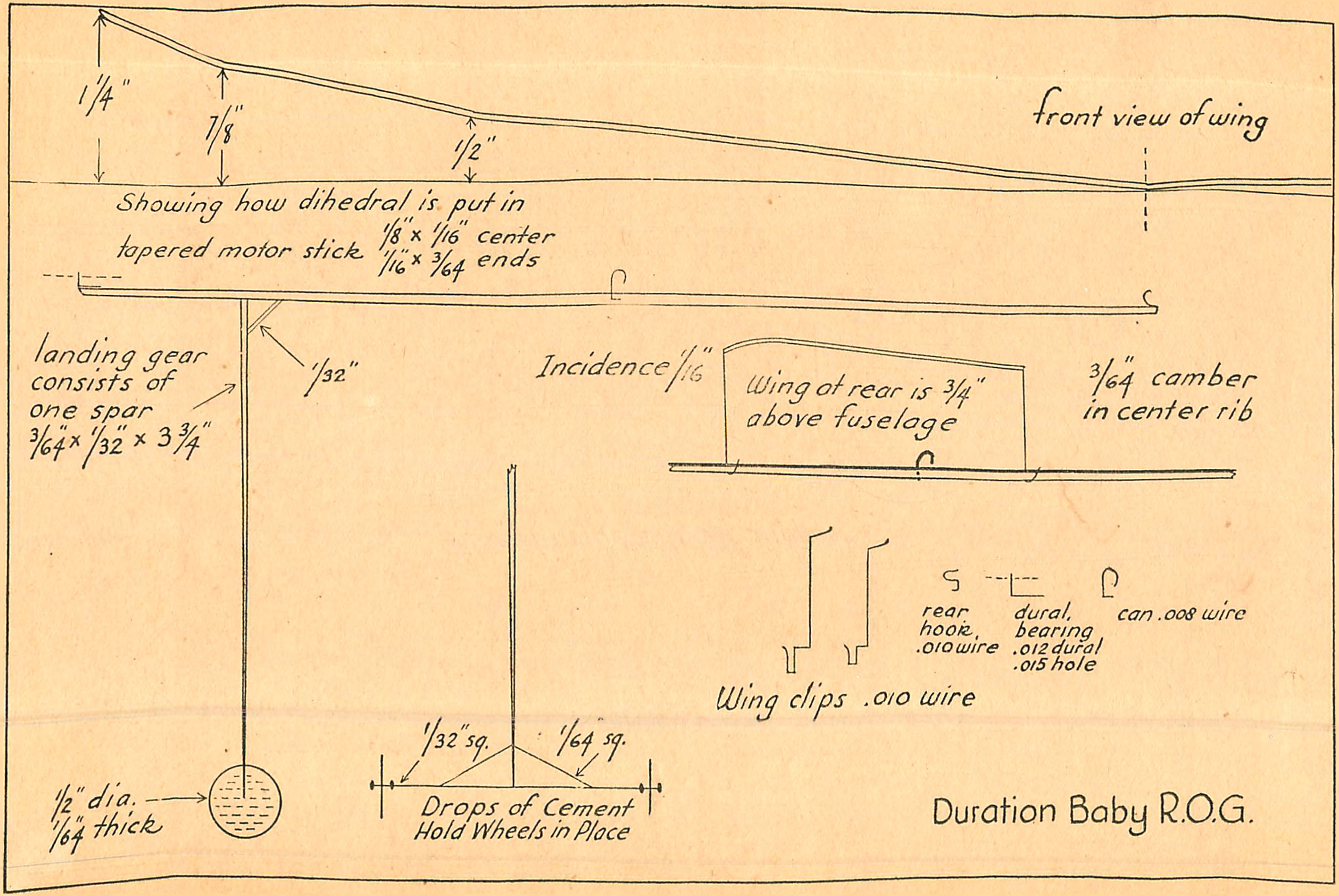
CUT A 1/32" square x 5" piece of Balsa for the elevator spar. Cement in place underneath the rudder. Now cut out the paper to the pattern shown in the plans. For a smooth covering of surfaces whose edge has no support, such as this, let the grain of the paper run parallel to the line of flight. Paint wood with the adhesive and lay on the cut-out paper.

Neatly cement tail boom to motor stick. Make sure that it is parallel to the thrust line. (Axis of the Rubber Motor.)

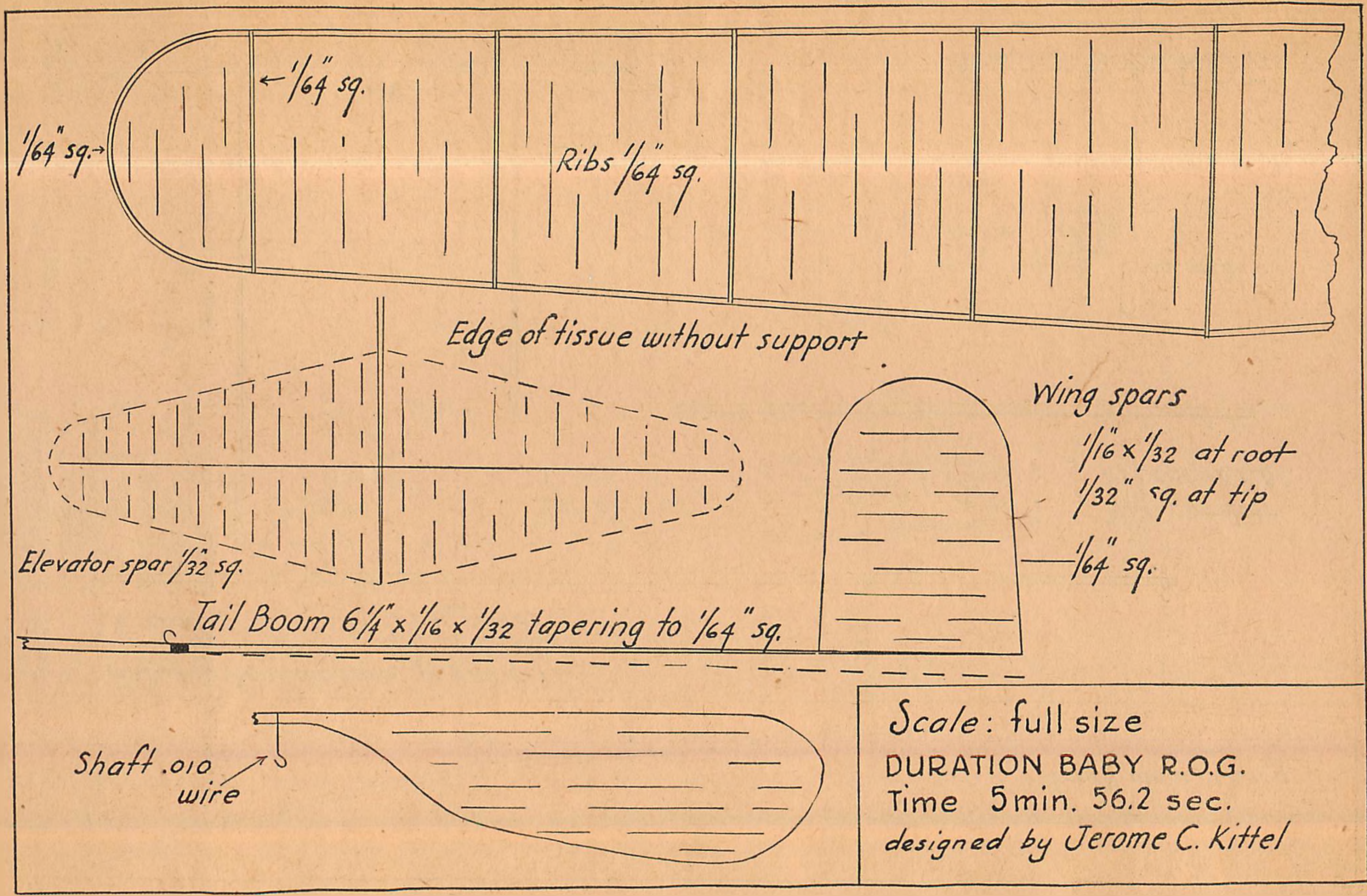
On a smooth piece of wood or cardboard draw out the wing pattern full size. On the 3" x 1" x 1/32" brass or tin, draw a line ¼" from each end. Bend the metal over double on these lines. Leave a clearance between the metal and the bent over end of 1/32". Now bend 3/64" camber in this metal jig. Cut out and sand 9 ribs 2¼" x 1/64" x 1/64" square. Moisten these and insert these in jig. Put jig over small gas flame for about 75 seconds. They will come out perfectly bent and will not lose their shape.

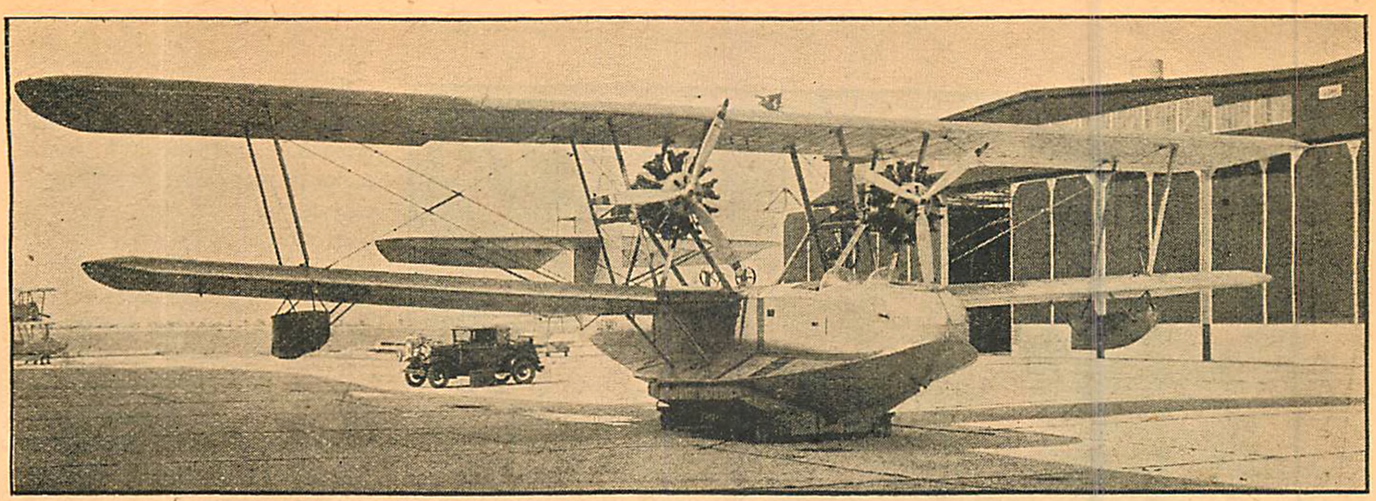
Bend the two wing tips out of 1/64" square balsa, using the same method that you used in bending the rudder tip.

Cut out and finish the 4 wing spars according to the plans. Assemble wing on a board using steel weights for perfect alignment. It is necessary to hand-fit the ribs because of the taper. Apply cement to joints and let dry 30 minutes. Then turn over and apply cement on the reverse side. After 30 more minutes, break joints at center. Leaving the wing tips on the (*Continued on page 43*)



Duration Baby R.O.G.


1/64" sq.
← 1/64" sq.
Ribs 1/64" sq.
Edge of tissue without support
Wing spars
1/16 x 1/32 at root
1/32" sq. at tip
1/64" sq.
Elevator spar 1/32" sq.
Tail Boom 6 1/4" x 1/16 x 1/32 tapering to 1/64" sq.
Shaft .010 wire
Scale: full size
DURATION BABY R.O.G.
Time 5 min. 56.2 sec.
designed by Jerome C. Kittel



"Openwork" Engines on this "Navy Boat" make "Trouble-Shooting" comparatively simple.

The Airplane Engine

Shooting Trouble With "The Gun" of Common Sense

By Lieut. (jg) H. B. Miller

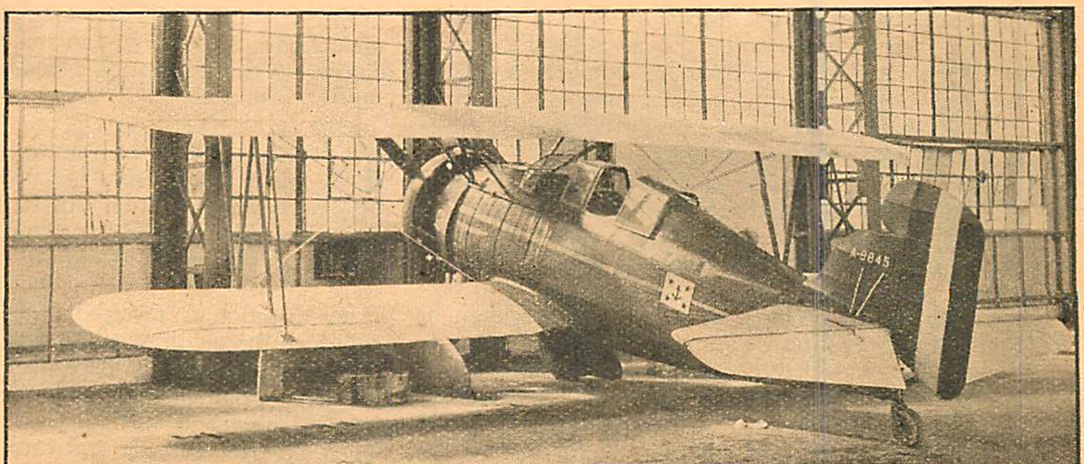
IN PREPARING for flight one thing above all must be considered. That is the necessity for safety not only for the pilot but for his passengers. If one has ever flown behind a failing engine in a locality which provided few landing fields, he can appreciate the comfort and confidence instilled by a powerplant that has been carefully maintained.

In spite of this, inexperienced pilots often take off without carefully checking their engine and plane. Occasionally, they take off even though their powerplant is not developing its full power because of a cylinder or two misfiring. Small engines have little enough power as it is without losing the additional power which could be contributed by a failing cylinder. In the case of a small three-cylinder engine the loss of one cylinder means more than the loss of one-third of the power, for the two remaining cylinders must deliver power to give compression to the missing cylinder. The experienced pilot will not take his plane in the air unless the engine is operating at full power. If the powerplant fails to function perfectly on the ground, there is no logical reason to think that the difficulty will clear up once the plane is in the air.

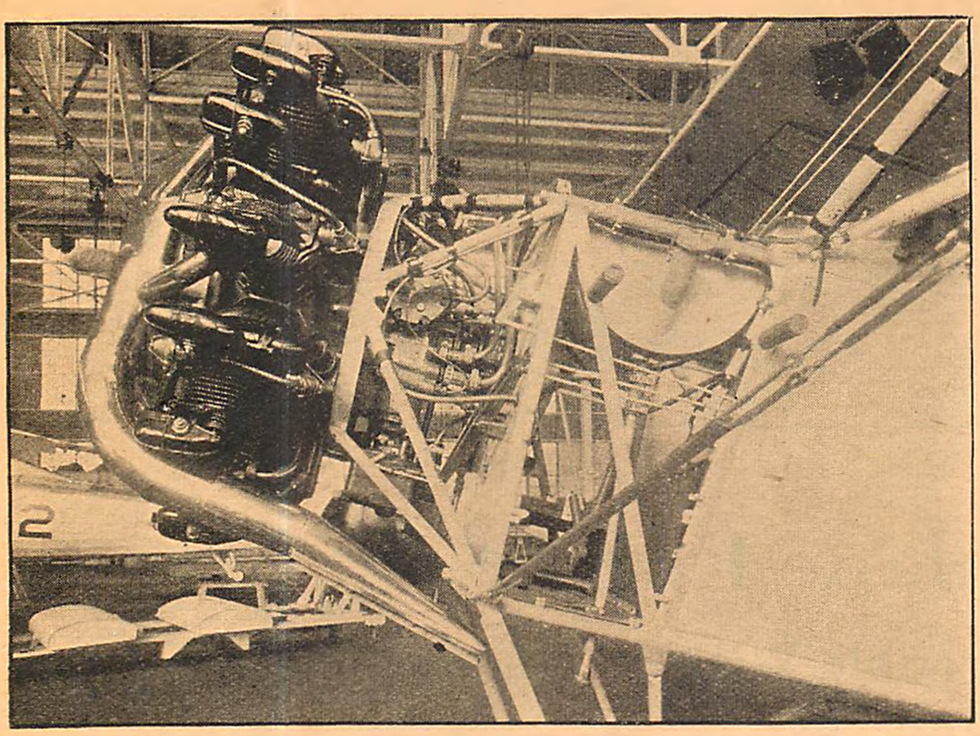
Fortunately, airplane engines are becoming more and more reliable, but their dependability is based primarily upon intelligent and careful upkeep. Nevertheless, during a long period of operation trouble of some kind may be expected to occur. No mechanism is perfect and it is only by constant labor and re-adjustment that it can be made to function properly at all times. If the valves and their operating gear, and the fuel, ignition, and lubrication systems are kept in good condition, one can be fairly certain that the engine will give good service during flight.

IT IS seldom that failure results from actual breakage of the individual parts. If the various mechanisms which go to make up the engine begin to wear excessively, a close inspection will disclose the surplus clearances in sufficient time to permit replacement of the worn parts. This in itself will eliminate complete failure of the engine at a later time. If the component parts fail suddenly, one can be fairly certain that the engine has been abused during the course of its operation. Thus, the pilot can assist materially in keeping aviation engines in good condition.

The pilot and the mechanic must work hand in hand in an endeavor to reduce engine troubles to a minimum and to permit a rapid repair of any difficulty that might arise. In order to effectively seek the cause of trouble the mechanic must know all of the symptoms of the difficulty. He should be familiar with past troubles of the particular engine for this frequently gives him an indication of the succeeding failure. He should study the log of the engine carefully for a replaced part may be the center of the trouble. The pilot who complains of the powerplant must



The "Ring" form of cowling makes it easy to locate engine trouble on this Hell-Diver.



Cowling that may be quickly removed makes for unruffled dispositions, and immediate location of difficulties.

make his report in detail. Does the engine miss regularly or intermittently? What cylinders appear to be affected? At what engine speeds does the trouble occur?

To be a good trouble-shooter a person must have a good ear, be an unusually attentive observer, and most of all must have the ability to think clearly and comprehensively. Obviously, one should have a good all-around knowledge of the internal mechanisms and functions of the engine. Not only must one have a practical knowledge of the individual powerplant, but he must also know a fair amount of engine theory.

TROUBLE-SHOOTING may be done in two different ways. The first is the case where the mechanic has encountered the various troubles so often that he can automatically place his hand on the failing part. The second method is for the mechanic to have such a thorough knowledge of engine operation that he can proceed in a logical and orderly manner to trace out the difficulty. The latter method is more apt to produce results in a greater percentage of troubles.

In the first case, if the difficulty is something that has never before occurred to the mechanic, he will probably be at a loss to make repairs. On the other hand the clear thinker will be enabled to continue his search even though his first clues prove to be erroneous. In this connection it is well to remember that many entirely different troubles may result in quite similar symptoms.

Time and experience have shown that it is wise to develop some very definite system for trouble-shooting. If one goes at it in a hit-or-miss fashion, the trouble may accidentally be located at the very beginning. On the other hand, a great deal of time may be wasted and possible solutions to the problem may easily be forgotten or overlooked. Aside from the failure of the powerplant to start, engine trouble will generally be one of three types: loss of power with all cylinders firing, loss of power with one or more cylinders missing, and rough operation. Obviously the fewer number of cylinders in the engine, the easier it is to identify the failing unit.

To inexperienced personnel it is frequently difficult to identify the cylinder which is not firing properly. Especially is this so of engines mounting exhaust manifolds. As a matter of fact, it may be necessary to remove the collector ring in order to locate the engine trouble. The exhaust of each cylinder should be heard in its proper order providing a proper charge of fuel vapor has been ignited in each combustion space. Most engines develop a rhythm which indicates to the well trained ear that the engine is operating properly. When a break occurs in the sequence of the exhaust noises, some cylinder is failing to function. However, the radial type powerplant exhaust reaches the ear at irregular intervals because of the traveling of the firing order around the periphery of the engine.

In order to locate accurately the cylinder which is missing it may be necessary for the mechanic to feel the exhaust gases with his hand. Naturally, the failing cylinder will emit a cold exhaust whereas the remainder of the exhausts are extremely hot. Moreover, the metal of the misfiring cylinder will be cold to the touch of the hand.

It is to be assumed that the mechanic is somewhat familiar with the type of engine he is to work on. If not, he should study an instruction book for that particular powerplant. He will thus learn the valve clearances, oil pressure, maximum revolutions, carburetor jet sizes and other pertinent data.

The three main sources of trouble are: compression, carburetion and ignition. The two remaining systems, lubrication and cooling may contribute a lesser amount of difficulty. Generally speaking, however, these troubles are of the simplest type and are generally readily apparent.

Unquestionably a discussion of trouble-shooting should begin with the case of the engine which fails to start. Here no symptoms are available and the mechanic is required to begin a systematic check upon the entire engine. Suppose the engine is primed a proper amount and a futile attempt is made to start it. This may be repeated a time or two, but if three attempts are unsuccessful it is clear evidence that something is wrong. The mechanic may as well save himself further cranking efforts and hunt for the difficulty. As a matter of fact, he should use the primer very cautiously for since it pumps raw gasoline into the cylinder it is very apt to run down the steel liner, thus destroying the lubricating film of oil and eventually scoring the piston.

IT MAY be possible that the engine has been flooded, that is, too rich a mixture has been produced due to overpriming. This condition can be remedied by pulling the propeller through three or four revolutions while the throttle is wide open. The prop may be turned either forward or backward though it will be slightly more effective if its direction is reversed. Obviously, with the throttle full open the air drawn into the cylinders by the extremely slow engine speed will be unable to draw any fuel from the jets. Consequently, only air will pass into the combustion space and will scavenge it of the gasoline fumes. Then close the throttle and turn the prop a few turns in the proper direction. This will induce a good charge of fuel vapor into all cylinders. Another attempt may then be made to start the engine.

Or, it may be that the primer is failing to inject any fuel into the cylinders. One can check this easily by removing a spark plug. If wet, a fuel vapor has been present in the combustion space. If the plug is dry, the carburetion system may be suspected of irregular action.

If the cylinders have been getting fuel as indicated by the wet spark plug, the operator should begin a systematic hunt for trouble. Of course, ignition will be the first thing to receive a suspicious glance, but there is one more factor which must be considered. It must be borne in mind that the three requirements for proper combustion are: good compression, accurate carburetion, and properly timed ignition. Carburetion and ignition may be in perfect order but poor compression permits a mixture to become so lean that it will not burn. Thus, the ambitious but inexperienced trouble-shooter would be led off on the wrong foot at the very beginning unless he begins a systematic elimination of the possible causes of trouble.

Compression is first checked. This can be done in two different ways. The first method is to remove one set of spark plugs from all but one cylinder. Then turn the propeller until the piston comes up on compression on this particular unit. If the mechanic is at all familiar with the type of engine, he can tell by feel whether or not the compression is normal. Sometimes a pressure gauge is fitted in one spark plug bushing to actually read the compression in pounds.

ANOTHER and quicker method of checking compression is to remove the valve housing. Again turn the propeller over by hand observing by the valve action which cylinder is on compression. To the mechanic this is as accurate as the more methodical way mentioned above. The experienced mechanic will not even find it necessary to remove the rocker box covers to tell him which cylinder is on compression.

Compression is of such great importance because if it is not maintained, a constant charge of fuel can not be taken or kept within the combustion space. For instance, suppose the exhaust valve is not seating properly. Then, during the suction stroke of the piston not only would a charge of good vapor be drawn in through the intake valve, but also a mixture of air and burnt gases would be sucked in through the exhaust valve. This would tend to make the total mixture much too lean to ignite.

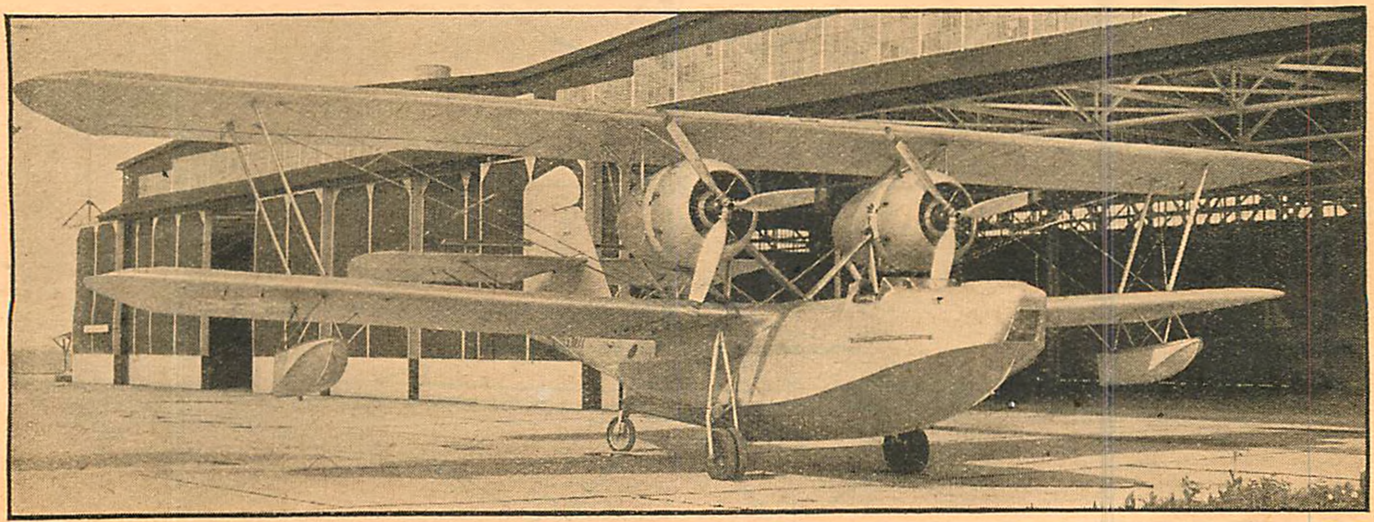
Or, again, let us imagine a leaking intake valve. Obviously, this would not interfere with the suction stroke, but upon compression much of the vapor within the combustion space would be blown back out through the leaking intake valve and even though the engine might start, it would never develop any degree of power. The same reasoning follows when there is a leak in the combustion chamber from any cause such as leaky spark plugs, improperly seating valves, and broken or improperly fitted piston rings.

While one can ordinarily expect one of these causes to result in missing within a cylinder, it is seldom that each cylinder will be affected in such a manner at the same time and thus prevent the engine from starting. There are, however, two things that might cause poor compression in all cylinders at the same time.

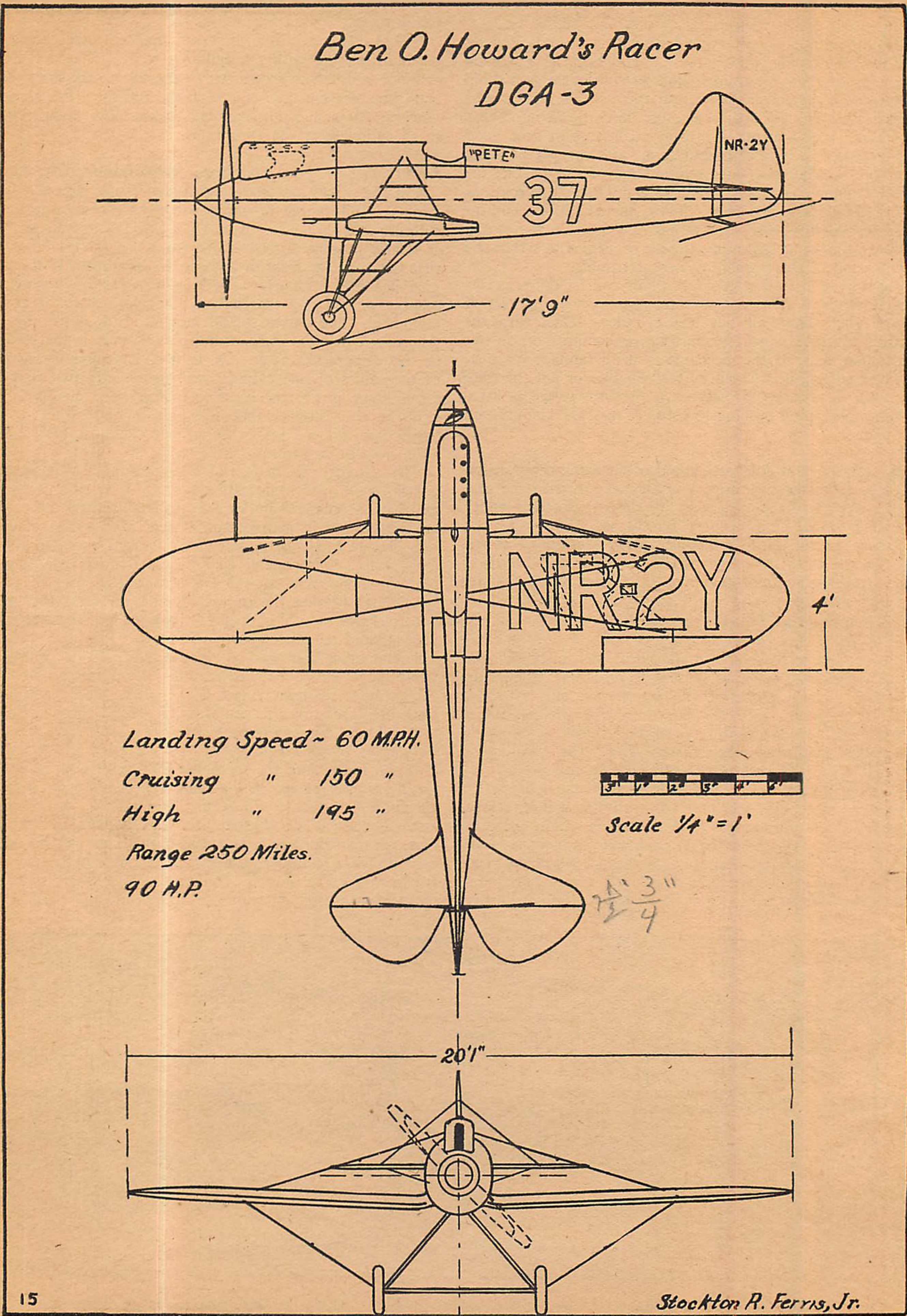
THE first of these is improper valve timing. Obviously, if the valves are operating at the wrong period of the stroke, a full charge of vapor will not be drawn into the cylinder and the engine would not develop its full power. It is also possible for the valves to be so far out of time that they cannot draw in any gas to compress. If the engine has just been overhauled or torn down, one might suspect immediately that it was not timed correctly when assembled. The valves should also be checked for proper adjustment, as too little clearance will permit the escape of the compressed gases. Of course, improper clearances of the valves of one cylinder will cause only that unit to misfire, but if the trouble-shooter finds this condition to exist he may suspect that the person who adjusted the valves last did not know the proper clearance and all of them may be in error.

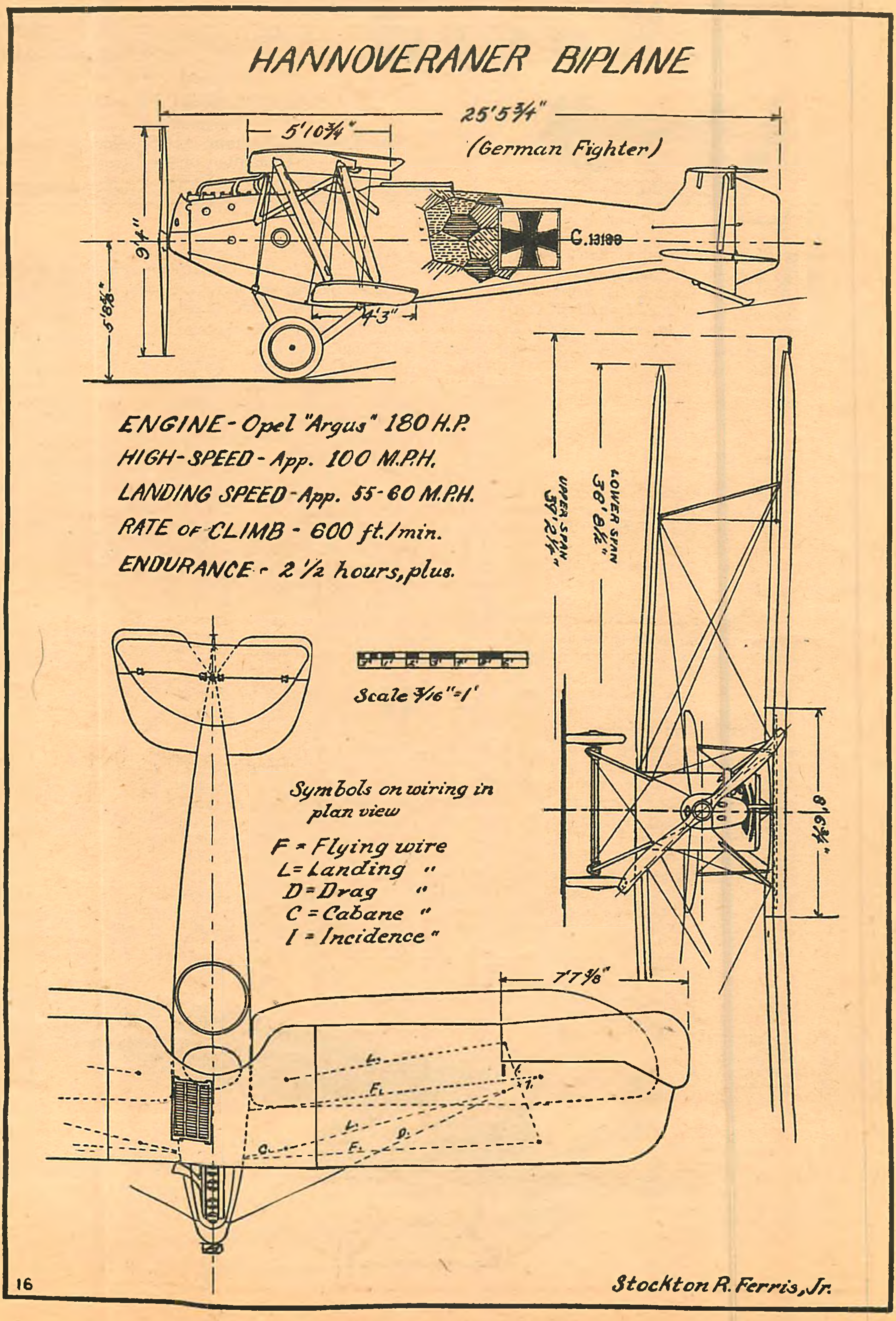
The second cause of loss of compression in all cylinders is lack of oil in the lubrication system. One must not forget that oil on the cylinder side walls and around the piston rings assists in maintaining a tight seal of the combustion chamber. If the engine has not been operated for a long period, it is possible that the oil has run back down into the sump, thus permitting compression to leak past. Or, it may be that the supply of oil is so slight that it is not freely thrown about inside the crankcase and has not accumulated on the cylinder walls.

Fortunately, the method of checking this is comparatively easy. Insert a small quantity of lubricating oil into the cylinder by removing a spark plug. Then, with the plug in place turn the engine over several times and try that cylinder for compression. If it is improved, one can be certain that he has found one source of his troubles. If, upon inspection, the mechanic then finds that he has a goodly supply of oil in his tank, he should look it over carefully for quality for it is likely that it has thinned down too much for efficient use. If this proves to be the case, the oil should be renewed at once. Then, by injecting oil into each cylinder, the engine should start with no further difficulty and as soon as the new oil is splashed about, it will assist in main- (*Continued on page 39*)



Latest type of Navy Boat with streamline engine cowlings. These increase efficiency but make "Trouble-Shooting" a laborious task


Ben O. Howard's Racer
DGA-3
"PETE"
NR-2Y
37
17'9"
NR-2Y
4'
Landing Speed ~ 60 M.P.H.
Cruising " 150 "
High " 195 "
Range 250 Miles.
90 H.P.
Scale 1/4" = 1'
20'1"
15
Stockton R. Ferris, Jr.


HANNOVERANER BIPLANE
25'5¾"
5'10¾"
(German Fighter)
9¼"
5'8⅝"
C.13199
4'3"
ENGINE - Opel "Argus" 180 H.P.
HIGH-SPEED - App. 100 M.P.H.
LANDING SPEED - App. 55-60 M.P.H.
RATE of CLIMB - 600 ft./min.
ENDURANCE - 2 ½ hours, plus.
UPPER SPAN 39'2¼"
LOWER SPAN 38'8½"
Scale 3/16"=1'
8'6¾"
Symbols on wiring in plan view
F = Flying wire
L = Landing "
D = Drag "
C = Cabane "
I = Incidence "
7'7⅜"
16
Stockton R. Ferris, Jr.

Aviation Advisory Board

Conducted by
CHARLES HAMPSON GRANT
Formerly of
The Technical Section, Air Service, U. S. Army.
Chairman of the Board.

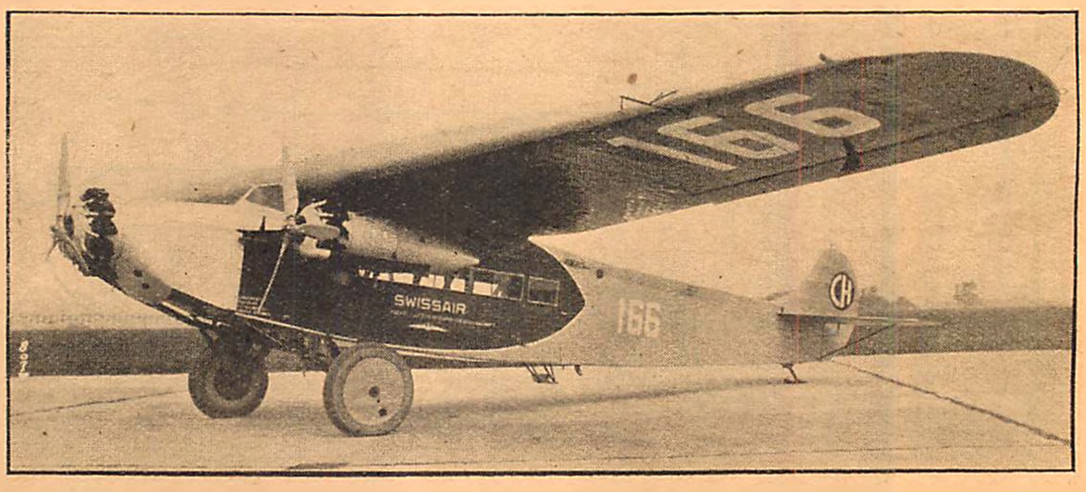
WELL, my friends, as usual we have a number of interesting questions to answer this month. It seems that many of our readers have had difficulty in building propellers. One of them, Russel Clark, of Loveland, Colorado, wishes to know what we mean when we say that the propeller blade should pass through the air at 4 degrees angle of attack in order to have it act efficiently. Suppose we consider a propeller of a machine which is spinning while the machine is at rest, and not moving forward. In this case, the blades are attacking the air at an angle which is usually about 30 degrees, and our angle is the angle between the plane of rotation perpendicular to the shaft and, the cord of the blade about 2/3rd distance out from the shaft toward the blade tip. Now, however, if our machine moves forward while the propeller is rotating laterally the blades will not attack the air at 30 degrees as was the case when it was standing still, but due to the forward motion of the machine in combination with the lateral motion of the propeller, the angle of attack decreases. If your propeller is well designed this angle should decrease to approximately three degrees angle of attack while the plane is in flight.

You should know that the wing must have an angle of attack or angle of incidence in order to create lift. In the same way the propeller blade must have an angle of attack or angle of incidence in order to give thrust. The area of our blades should be of such an amount that the propeller slips just enough to allow an angle of incidence or angle of attack of 4 degrees. I suggest that you follow closely the course in Aerodynamic Design running as a serial in MODEL AIRPLANE NEWS, in order to get the full details of propeller design. This issue contains the first article on the propeller.

Mr. Clark also asks the question, "If you deepen or increase the angle of the blades does that increase the efficiency?" To this I can answer, yes, it does sometimes, and other times it does not. In other words, efficiency does not depend upon the angle of the propeller blade, generally speaking, but rather upon the relationship of the angle to the area of the blades. The larger the propeller blade angle on any machine, the more area will be required in the propeller blades. If the angle is doubled, then the area should be increased by the amount $2\sqrt{2}$. This means that if the angle is doubled the area should be increased so that it is a little more than double the previous area. If the angle is increased by one half, increase the propeller blade area by one half and then add a little more to that. This will be approximately correct. One of the chief difficulties with biplanes and triplanes and, I may say, the reason why most of them will not fly as well as a monoplane, is the fact that the propeller blade area is not large enough. Approximately, the propeller blade area should be 10% of the wing area.

Clark also asks the question, "What is the ratio of the depth, to the width of the block in order to make the pitch 1.8 times in diameter?" The width of the block is proportional to approximately three times the diameter and the depth of the block proportional to the pitch, so in this case, the *width* should be proportional to the *depth* in the ratio of 3 to 1.8. In other words, if the width were 2" the depth should be 1.2".

HERE is another question which may be of great advantage to those entering models in National Contests, where the wing area must be within certain limits. How do you find the area of biplane wings when they taper, and have round tips? The best method to use is to take one half of one wing and measure the length of it, from the center point of the wing, over the center of the fuselage, to the point where the leading and trailing edges start to curve. The front and rear edges of this part of the wing are straight. If you will now take the length of the chord at the midpoint of this section of wing and multiply it by the length of the section it will give you the area of that part of the wing with straight leading and trailing edges, even though the wing (*Continued on page* 42)



One of the Tri-motored Fokkers used by the Swiss Air Traffic Ltd., Company of Zurich, used for fast delivery of Trans-Atlantic mail to all parts of Europe. Note the American Engines. They are used because this company believes them to be more dependable than other makes of foreign designs.

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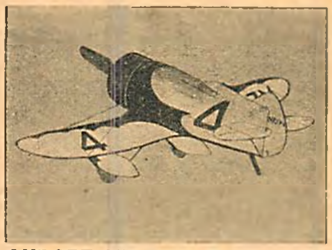

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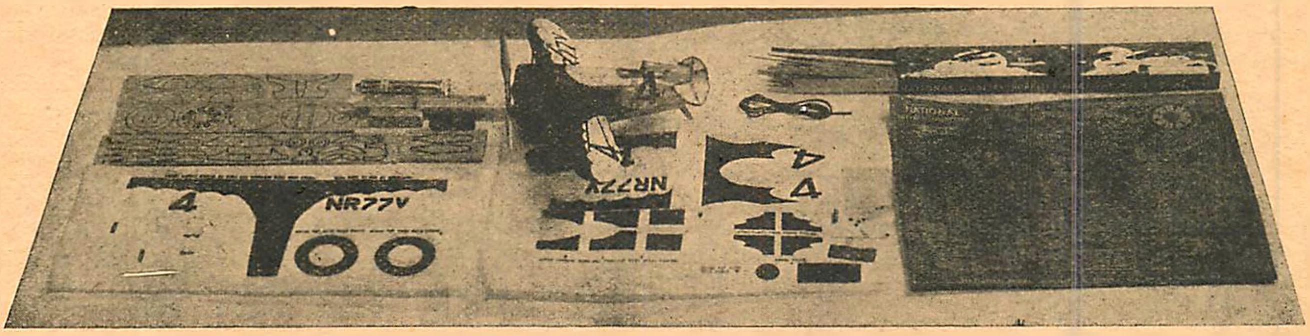

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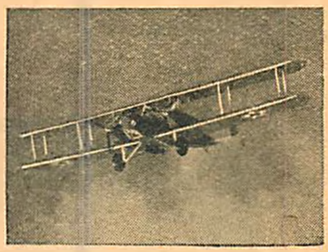
WHAT A NATIONAL KIT CONTAINS

For example, in Midget Gee-Bee Sportster, it contains: Fullsize blueprint with instructions; 2 sheets of tissue with complete trimmings and numerals in maroon color; waxed paper; 4 sheets of balsa with ribs, stations, pants, and other parts clearly printed on; sticks of 1/16 sq. balsa, other pieces of balsa, bamboo, reed, etc. as needed; rubber motor; envelope, containing washers, beads, shaft, rearhook, pins, lead for balancing, propeller hub, and other parts; cellophane; tube cement; sandpaper; odd sizes of wood.

Midget Models with pants have wood wheels. All other models have celluloid wheels.



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Heath		

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A Special Course In Aerial Radio

(*Continued from page 21*)

exact position. To add these to the radio range beacons would involve a greater total number of stations (though probably less personnel) than would be needed under the Bellini-Tosi method, and the results from the latter would be more complete.

MENTION was made just now of the radio goniometer. Most surface vessels are equipped with suitable radio direction finders to determine the bearings of incoming signals. These direction finders used on ships are too heavy and cumbersome to be of any use in aircraft, and will not, therefore, be discussed here. At the ground stations, however, operating the Bellini-Tosi method, a somewhat similar apparatus is being used. Two loop aerials at right angles to each other are connected to two field coils, also at right angles to each other.

In the centre of these coils is a small search coil which can be rotated by a handle at the top, the whole device being known as a radio goniometer. Incoming signals are concentrated in the goniometer, and by rotating the search coil the exact direction of the signals can be found by the points at which they reach their maximum or minimum strengths, depending on which method is being used. Figure 6 illustrates a method of plotting bearings received from two or more stations.

Yet a third method of radio direction finding is the rotating beacon or wireless beam method. For general use when the service is not aimed solely at one airway, or where navigators or co-pilots are carried, this is probably the best system yet evolved. It must be remembered that the strongest signals are heard in a loop aerial when it is pointing directly towards an incoming wave. The rotating beacon is nothing more than a large loop aerial rotated by mechanical means at an exactly uniform rate of one complete revolution per minute. As it rotates it sends out a continuous signal. When it is pointing directly towards a plane the signal will be strongest, and as it steadily turns over an angle of 45° it will fade away and then increase in strength as it completes a half revolution, when it will be pointing directly away from the plane.

It has been found that it is easier to judge a minimum signal than a maximum signal, so that a system has been incorporated in this method, whereby a listener receives a minimum signal when the beacon is pointing directly towards him. The beacon sends out a particular letter when it is pointing true north, and another letter when it is pointing true east. This extra letter on east is necessary because a plane flying due north or due south of the beacon would not hear the north signal.

THE method of operation is simple. Since the beam makes one complete revolution of 360° in 60 seconds, it follows that it turns over an angle of 6° every second. The operator tunes in to the wave length of the beam from which he requires a bearing, and listens, stop watch in hand, until he hears the north signal. He then immediately starts the watch until the signals fade away, when he stops it. The number of seconds elapsed, multiplied by six, will give him the true bearing of the plane from the beam. If the north signal were not heard, the stop watch would be started on the east signal, and after multiplying the number of seconds by six, 90° would be added to the answer, since the beacon had already turned over an angle of 90° before the watch was started. Several readings should be taken for greater accuracy, and the set tuned in to the wave length of another beacon, and a second bearing obtained in a similar manner. The plotting of these bearings, on a map will give the exact position.

The advantages of this system are that the ordinary receiving set is sufficient, that signals can generally be received at greater distances than by other methods, though this, of course, is mainly a question of power of the respective sets, and that any number of planes can use the same signals at the same time from any direction.

Disadvantages lie in the fact that although a pilot at the controls could maintain a correct course to any particular beacon without recourse to calculations, yet full use can only be made of this method by plotting the bearings taken, and this requires an extra pilot or operator.

Such strides have been made in radio during the past few years that it is impossible to forecast the future.. Figures 7 and 8 are given as an interesting comparison between the radio of yesterday and today. Figure 9 is a modern transmitting antenna at Chatham owned by the Radiomarine Corporation of America, and Figure 10 shows one of the latest types of antenna installations on transport planes.

Aerial Radio as a means of two-way communication from plane to plane and from plane to ground will be dealt with in the next and last article of this series.

Airplane Engine

(*Continued from page* 33)

taining future compression.

Of course, a sticking or improperly seating valve will cause loss of compression, but it is hardly likely that this would occur in all cylinders at one time.

A very lean mixture may prevent an engine from starting and is indicated by the failure of the engine to run after the priming charge is burned out. Other lean conditions may occur as explained during the discussion of loss of compression and the correction of the compression difficulty should also have corrected the mixture trouble.

MAKE certain the carburetor float level is such that the in-going air can suck a good charge of fuel from the jets. The jets also may be suspected of being clogged up. These can easily be removed from the carburetor.

The weather may be so cold and the grade of fuel so poor that it fails to vaporize without the addition of some external heat. This function is ordinarily taken care of by the hot-spot when the engine is running. In the water-cooled engine it may be necessary to drain the cooling system and fill with hot water.

The air-cooled engines of today are designed so that the hot outlet oil passes around the intake manifold to assist in vaporizing the charge. If cold weather is expected, the operator will be wise to drain the hot oil from the engine when it is shut down. When it is desired to start the powerplant the oil is heated and then poured into the lubrication system. The propeller will have to be turned several revolutions in order that the oil pump may force the hot oil throughout the system. This is almost a certain means of starting in extremely cold weather.

With good compression available and the carburetion system apparently in serviceable condition the mechanic next inspects the ignition. One should first ascertain that the magnetos are accurately timed in order that the combustion will take place at the proper instant in the engine cycle. It is seldom that the spark plugs will be fouled or damaged to the extent that they will all fail at the same time. However, one plug may be pulled out and placed on the engine frame. The engine is then turned over by the starter in order to see if any spark reaches the plug. The booster magneto must also be checked over similarly to the main magneto.

If one is certain that no voltage reaches the plugs, the trouble is in the magneto circuits. A likely place to look is in the switch. It must be remembered that the powerplant is designed to operate when the switch is open; that is, when the primary current is forced to flow through the breaker points.

Perhaps when one switches "ON" he is failing to break the switch ground which is essential if the primary field is to be broken down. It may be necessary to search for grounds in the switch and all along the ground wire leading to the switch from the primary side of the magneto.

If this lead is in good condition, the breaker points must be carefully inspected for if they are inoperative no secondary voltage will be set up. It may be that they are actually welded together or that they are arcing badly as the rotor is turned over. This shows conclusively that the condenser has shorted through and is not acting efficiently.

IT MAY be necessary to open up the magneto and check the circuit over carefully in order to find some other ground that may be eliminating the breaker points from the circuit. If, after this inspection, the magneto continues to fail to produce a spark sufficiently hot to ignite the charge the magnet is weak and must be recharged, although a shorted secondary coil would also reduce the strength of the built-up voltage available at the spark plugs. If this proves to be the case, it must be rewound or replaced. Or the safety gap may be so reduced that it absorbs the high voltage and prevents it going to the spark plugs.

The troubles that occur while the engine is running offer more room for the exercise of one's mind and knowledge of the engine. On the other hand, they at least provide the trouble-shooter with very tangible symptoms which he can analyze more or less quickly depending upon his skill.

The order of searching for trouble after an engine is running is the same as for a powerplant that fails to start. Here individual cylinders may cut out for the same reasons enumerated in the failure of the engine to start.

One other reason for loss of power which has not been discussed in detail is that of the fuel mixture.

THE lean mixture is indicated by a yellowish exhaust flame and backfires

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Polish Fighter

(*Continued from page 6*)

if the construction is carried out as outlined below, no trouble should be had.

The center section, or rather sections, will be made first. They are first assembled flat on a board and glued. Then they may be removed and the spars bent and glued. First make all four wing pins, L. These are of No. 12 wire, each 1¾" long. Bend back ⅜" on end of each, so they may be fastened securley in the spars.

Cut four spars of ⅛" x ¼" balsa, 4" long. Make a slot in each one ½" long as shown on Fig. 5 for the pins, L. Then starting 1¾" from the slotted end, taper all four from ¼" down to ⅛" at the opposite end. Now on the under side, but not the tapered side, cut a very narrow Vee half way through each spar. This will enable you to break them very accurately later. Do not break them now, however. Set two of these prepared spars aside for use as rear spars, M. Round off one side of the other two to form the leading edges, N. Be sure not to make both alike, but make a right and a left. The tapered edge should be up and the V cut at the bottom. Put the wing pins in all four spars and bind with thread, covering with plenty of glue.

While the spars are drying, cut out all the ribs, including those for the wing tips. The No. 6 ribs are cut from blocks 2¼" x ⅜" x ¼". They should be cut to shape roughly and finished after the wings are entirely assembled. Remember to make two end ribs No. 6 with curves opposite, two of No. 1, 3, 4, and 5 of 1/16" balsa, and four of No. 2 of ⅛" balsa. It will be found that the ribs shown on Fig. 6 are of exact size, except that the trailing ends are a little too long. These are left this way purposely because it is very easy, when building a tapered wing, to make ribs too short, making it necessary to cut new ribs. When the wings are laid out, the leading and trailing edges should be pinned down first, then the ribs may be cut off at the small end to the correct length. This applies to both wings and center sections. All of these should be made directly on top of the patterns, which are covered with wax paper, and with a board underneath.

The center sections may now be assembled as described above. Only one side is shown. The other may be traced on a separate sheet, using carbon paper. The tracing is then cut out and turned over so a left side may be made. The trailing edge piece, O, should be soaked in water and bent to the shape shown, with pins to hold it.

When dry, the spars, M, N, and O, should be carefully cracked, with the free ends down. Place the whole center section on a block or other convenient support 1/2" high, so that the spars from No. 1 rib inward hang over the edge and touch the table top at inner ends. Thus the No. 1 and No. 2 ribs are 1/2" higher than the inner ends. Put glue around the cracked part and set aside to dry. Do not put in the small top spar, P, until the wing is on the fuselage.

The wings themselves may now be made. The two rear spars, M', taper from ¼" to ⅛" at the outer end as do the front spars N'. The latter are rounded off on one side so as to carry out the curve of the ribs. A small hole is drilled ¾" into the large end of each spar with a No. 60 drill for the pins, L. Wrap over the holes with thread and coat with glue.

Assemble the same as with the center section, pinning down the outline first and then cutting the ribs to the correct size. Glue the ribs in as you go along and put in the spar, P′, last. The trailing edge, O′, is best made in two pieces, although a single piece could be bent if soaked in water first. When dry, finish off with fine sandpaper.

The center section is assembled to the fuselage by rounding off the ends of M and N and sticking them in holes made in the motor blocks. The ends are made long enough for this. Use plenty of glue, but before it has set, glue on the wing struts, Q. These are 1/16″ square bamboo with a trailing edge of balsa, rounded off front and rear. It is best to measure your own model before cutting the struts, as any small variations in construction would be apt to make the struts shown on Fig. 2 fail to fit.

Use great care in trueing up the center section, as the success of the model depends on it. The angle of incidence is zero degrees, and imaginary lines along the bottom outer ends of both M and N should be parallel with each other and the table top, when the tail is in flying position.

When the glue is entirely dry, slide on the wings and put in the motor sticks to be sure that they fit correctly before covering.

Covering and Decorating

Cover a little at a time, using pure banana oil as an adhesive. The author recommends covering the fuselage top and bottom with a separate piece between each former. Cover the sides next, then the tail surfaces, and the center sections last. Use a single piece on the bottom of the latter and two pieces on top of each. The wings may be covered with a single piece on top and the same on the bottom.

When finished, spray all covering lightly with water from an atomizer. Put little or no water on the tail surfaces or they will warp.

Since all wing surfaces of the large ship are covered with corrugated dural, the author drew lines $\frac{1}{8}''$ apart with India ink on all paper used for the wings and tail, making it resemble the dural. Of course, this was done before covering. It is a tedious job, but looks very well on the finished ship.

All wooden parts, such as the propeller, wheels, motor blocks, struts, landing gear Vees and wing tips, should be coated thinly with white paste, rubbed in well. Then paint as follows:

Black: Tires; entire fuselage from cockpit forward, including motor block; wing tips.

Aluminum: Wheel centers; propeller and spinner; struts; landing gear; wing leading edge, $\frac{1}{2}''$ wide at center, tapering to $\frac{1}{8}''$ at tip; leading edge of fin and stabilizer, $\frac{1}{4}''$ wide; wing and tail tips, $\frac{1}{2}''$ in from the tip.

Also, a rectangle of aluminum paint on each motor block, with four black dots for exhaust pipes. Outline the cockpit in black and install a rectangular celluloid windshield.

The insignia, as shown on Fig. 1, are painted on thin paper and glued in place.

This decoration scheme is as near the original as possible without adding excessive weight. The original model weighs $1\frac{1}{4}$ ounces unfinished, and $1\frac{1}{2}$ ounces with all decorations.

Conclusion

The model should be flown with about six strands of $\frac{1}{8}''$ flat rubber.

It will probably be necessary to bend the wing pins so that there is a dihedral of at least $\frac{1}{2}''$ on each tip. That is just why the tips were designed to be detachable.

Keep at it and you will have a fine model, and one which, on the ground or in the air, is about as fine a looking one as it is possible to make.

Materials

Balsa (3 feet in length):
- $\frac{1}{4}'' \times \frac{1}{8}''$ (2)—wing spars M, N, M′, N′
- $\frac{1}{8}'' \times 1/16''$ (1)—trailing edge, O, O′
- 1/16″ square (6)—longerons, uprights and wing spar P, P′
- $1/16'' \times 2''$ ($\frac{1}{2}$)—ribs, formers
- $\frac{1}{8}'' \times 2''$ ($\frac{1}{3}$)—ribs
- $1/32'' \times 2''$ ($\frac{1}{3}$)—landing gear.

1 propeller block—$7'' \times 1\frac{1}{8}'' \times \frac{5}{8}''$ balsa.
2 motor blocks—$1'' \times 11/16'' \times \frac{5}{8}''$ balsa.
2 wing tip blocks—$2\frac{1}{4}'' \times \frac{1}{4}'' \times \frac{3}{8}''$ balsa.
1 spinner—$1\frac{1}{8}''$ diameter, balsa.
1 spruce motor stick—$14'' \times \frac{1}{4}'' \times \frac{1}{8}''$.
Five 12″ lengths bamboo.
1 pair lightweight wheels $1\frac{3}{4}''$ diameter.
10 feet $\frac{1}{8}''$ flat rubber.
2 feet No. 12 music wire.
6 inches No. 8 music wire.
2 sheets superfine paper.
Banana oil, glue, washers, pins, etc.

Airplane Engine

(Continued from page 39)

through the carburetor. The latter symptom results, of course, because the slow combustion keeps flames within the cylinder even as late as the opening of the intake valve. Consequently, the flame travels back through the intake system and burns the vapor in the carburetor.

The most likely cause of too lean a mixture is an air leak in the induction system between the carburetor and the cylinder. The additional air drawn in by the suction dilutes the normal mixture thus thinning or leaning it.

A restricted fuel supply will also result in a lean mixture. One must check the entire fuel supply line to eliminate any possible obstructions. Is there a sufficient supply of fuel available? Is the fuel delivered to the carburetor under high enough pressure? Are the carburetor jets clogged up? Is the fuel level high enough to maintain a good supply of fuel in the carburetor jet? These difficulties will again lead to a diluted mixture to all cylinders.

Too rich a mixture is indicated by a heavy, dark exhaust. Excess oil passing by the piston rings will also give off a dark smoke unless in extremely excessive amounts when the exhaust will turn white. Also, if the mixture is too rich, the smoke will be reduced as one opens the altitude adjustment slowly. Further, as the mixture becomes more nearly ideal the engine will gain revolutions and power.

If the float adjustment permits too much fuel to get to the carburetor jets, a rich mixture results. Too much fuel pressure will also force the gasoline from the jets. Or, the main air passages may be stopped up in such a way that the amount of air is restricted. A leaky carburetor float will also permit the free passage of fuel through the jets and thus will richen the normal mixture.

It is seen that trouble-shooting is a result of a routine and logical search to ascertain if the three main requirements for combustion are present within the engine. If these necessary conditions are fulfilled, the engine will operate in a normal manner. Some troubles, however, arise from peculiar conditions of heat or weather. For instance, when the engine warms up the expansion may open some part of the primary circuit of the magneto. Thus, the engine would apparently be normal except when operated for a certain period at which time the difficulty would begin to appear. These are the most tantalizing of all troubles and only the clear thinkers will be enabled to trace out and repair the difficulties.

* * *

The succeeding article will discuss the details of the engines produced by the Wright Aeronautical Corporation. These powerplants are the J-5, J-6, and the larger Cyclone.

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may be tapered. In order to determine the area of the curved end, I suggest that you divide it into triangles. This may be done by drawing lines from the center point of the chord of the straight side, out to the curved edge of this area, drawing these lines so that they terminate at the curve, each approximately ⅓″ to 1″ apart.

Now you have the wing tip divided up approximately into triangles, the base of which will be a slightly curved arc formed by the curved edge. If you take the width of this base and multiply it by one half times the distance from the curved edge to the center point of the straight side, it will give you the area of one of the triangles. The total area may then be calculated by multiplying the area of all the triangles composing the curved end.

ORVILLE M. SOMMER, of Pekin, Ill., writes to us and wishes to know the kind of material that should be used to construct a non-flying scale model. This depends entirely upon whether you wish to build a solid scale model or a built-up scale model. If your model is of the solid type, the wings, fuselage, tail surfaces and struts may be made of solid pine or balsa wood, whichever you prefer to work with. The advantage of pine is that the pores of the wood may be easily filled by a coat of shellac which is sandpapered when thoroughly dry. Varnish on top of this will give a very beautiful finish.

If the model is made of balsa wood the finish usually is not all that might be desired. However, I shall tell you here about a little trick, which we have learned. In order to get a high luster on balsa wood, the best material to use to fill the wood successfully, is a very thin solution of sizing glue. This is a granulated glue which must be dissolved in water and heated to about the boiling point. Then, while the glue is still hot, the part to be "sized" should be dipped into it until it is thoroughly covered, and then withdrawn, allowing the residue to drain off. The glue should not be so thick that it will not run off the object which is being sized, readily. The wooden part should be hung up until the glue is thoroughly dry, preferably in some warm place. After several hours sand the surfaces down lightly, until they are smooth. Be careful however not to sand away too much of the wood and take off the coating of sizing entirely.

After the wood has been prepared in this manner paint it with a coating of shellac and when this is thoroughly dry add a coat of varnish. A second coat may be necessary. If this procedure is followed carefully and correctly a beautiful, glossy finish should result equal in all respects to the finish on white pine.

If you are constructing a scale model which is of the built-up type, balsa wood may be used throughout for the framework. It is usually covered with paper when this construction is used. If silk is to be the covering I suggest that the frame be built of white pine. Joints are usually made with quick drying water-proof cement. Cowlings are usually made of metal. I suggest for this purpose that you use 5/1000" thick, *aluminum sheet.*

Duration Baby R.O.G.

(*Continued from page* 28)

bench, elevate center of wing 3/4". Coat broken joints generously with cement. Let dry.

Cover wing very carefully, using 2 pieces of tissue. Start covering at center rib and work outwards. Smooth all wrinkles out as

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Duration Baby R.O.G.

(Continued from page 43)

you go. Do not stick paper to the interior ribs, only to the spars, center rib, tips, and tip ribs.

Break dihedral into wing at tips and near tips as shown in plans. Bend wing clips out of .010" wire. Note the 1/16" incidence. Cement clips on to bottom of spars.

The landing gear is simple and light. It is not very strong, but do not forget that this is a contest plane and we cannot worry about strength in a piece of equipment that performs no useful job. Cut out the wood as shown and sand carefully to a round or streamline section. Make this landing gear extremely light. Make a neat job in cutting out the wheels. On the hub of them place a drop of cement and pierce this with a pin hole. Mount the wheels on the balsa axle and put a drop of cement on the ends of the axle to hold the wheels on. Be sure that the wheels revolve as this is one of the National Aeronautical Association's requirements for a R. O. G. Mount the landing gear on the body. Connect ends of rubber with a square knot. Lubricate rubber well. Put bead or washer on propeller shaft and assemble plane. Weigh it if you have a scale. My model weighed .043 ounce, complete with 5" slack on lubricated rubber.

Wind the rubber 1,500 turns for a good flight. The rate of climb of the ship for the first 70 feet is about 10 feet per second. This is with the motor tightly wound, of course. Rubber should be changed after every real flight. This plane comes under Class A of the National Aeronautical Association.

THE SKY HAWK

(Continued from page 4)

christened. And Bert Hall was one of its six original organizers. After a short training period under French officers, the unit was moved up to the front, right into the thick of battle at Verdun, where at that time, there was a heavy concentration of German Fokkers. A big push was on. Fritz was making his bid for the famous fortress and France had her best troops, her most intrepid fighters thrown into the breech to repel the stalwart invaders. The Allies were making every effort to repel the advance. The newly arrived LaFayette Escadrille found itself in famous company. Stationed on one side of them were Nunguesser's renowned Escadrille N 65 and on the other side camped France's beloved Cigognes, whose brave and heroic deeds were told in last month's MODEL AIRPLANE NEWS.

France had just developed and perfected the Nieuport, a revelation in early battle craft. Bert Hall was awarded one of the first twenty to come off the assembly lines, a signal honor for any man and especially so for an American on French soil at that all-important time. With an exceptionally small wing spread, these new machines were then considered tricky and difficult to handle.

Hall answered the challenge of difficulty by going up single handed and sending down an enemy observation plane to destruction as his first contribution to the cause.

On one of the first group flights with the Escadrille, they were sailing along in formation when an enemy squadron was sighted. Then, through a misunderstanding in signals, Hall dove and headed for the boys from across the Rhine only to find that his comrades had not followed suit. As a result of previous encounters on that particular patrol, Hall had run low on ammunition supply so found himself alone in the air at 12,000 feet surrounded by enemy ships; 150 cartridges in a machine gun that ate them up at the rate of 650 a minute. The cool-headed lieutenant was an experienced enough campaigner to know what to do under the circumstances. He dove, squirming here and there, dodging and twisting away where he could and letting the gun speak only when he had to, and then sparingly. By his adroit maneuvering he eluded the foe without suffering anything worse than the loss of altitude. But that had receeded from its original 12,000 feet to a mere 1,800 feet in a very few minutes. However, Hall was away and his ship was safe. The next important event was a "sortie." On June 22nd Hall received his typewritten orders, "Scout the forts at Vaux. Leave at 3 A.M. You are to go alone." With the first faint trace of day tinting the eastern sky, Hall was off and away. His altitude was already 16,000 feet before a blaze of light proclaimed the actual rise of the sun. With the coming of light, however, the anti-aircraft guns awoke to the day's activities also. Puffs of black smoke below him told Hall that he was already well over the German lines. (Allied anti-aircraft shells burst in white smoke.)

Bert dove into a huge cloud and flew through, to be greeted by a trio of German ships beneath him when he emerged. One Boche, a two-place fighter, rose to meet Hall while the others hung back. The enemy let loose with a fusillade of shots from far off but Hall merely smiled at such amateur tactics. Aviators don't usually score hits from a long way off and every bullet is precious to an air fighter. But when the German's shots, at closer range, began to tear through his own wings and fuselage, Bert replied in kind. Flying in from the side, he let loose with a torrent of steel at the men in the German plane. The gunner in the two-seater was done for and the pilot quickly withdrew from the fray.

But the German's comrades were ready to assume his relinquished task and Hall had just time to spin about and face the second antagonist who was speeding in to take up the gauntlet. Both men opened fire on each other simultaneously, and the Fokker was suddenly enveloped in flames. It left a ghastly trail of smoke and fumes as its nose pointed earthward and the helpless craft with its doomed cargo of shrieking humanity, headed for the inevitable crash. That was two of them accounted for but where was the third. Hall could see him nowhere and no wonder.

Fritz number three had taken due advantage of the American's busy moments to creep up under his tail. A brilliant maneuver took Hall out of the dangerous and helpless line of the enemy's rifle fire and left him in position to attack himself. But with only a few shots left in the cartridge belt, Hall spared his shooting as much as possible, awaiting the best opportunity. After a spell of wild and harmless firing, the Boche also silenced his gun and both planes were seen to be juggling around in the air waiting for the perfect opening. Evidently the Boche, too, was running low in shells for, after another circle or two, he finally darted away.

It was still a long way home, however, and a hazardous one, for the fight had attracted much attention and every German anti-aircraft battery on the way home peppered Hall's pathway with potshots. When he finally did succeed in landing at the home air base, his plane was so badly riddled and torn with shot and shell that it only barely bore his own weight. But what the enemy had seen in the sky, friends had witnessed also, and Hall landed to find his victories already reported officially. A new citation and another palm leaf for the Croix de Guerre he already proudly wore.

All available information on enemy movements was vitally needed by the Allied command. Spies were frequently resorted to. A favorite way of getting them over and back across the German lines in a hurry was to fly them there. So often, on a morning, Hall would leave the airdrome with an officer duly disguised, fly to a predetermined destination behind the German lines and alight to deposit his cargo. The latter was to be called for at another carefully selected spot later in the day or evening. It was extremely dangerous work and the penalty, if caught, both sudden and severe.

Hall had gotten by nicely on several trips. Then he landed, as arranged, one evening, far behind the German lines to pick up the officer he had left earlier in the day. As his ship touched the ground, steel spiked helmets burst from hiding on all sides. A German trap. Ever alert, Hall had his motor still running and, giving her the gun, shot skyward amid a salvo of rifle bullets that whizzed by his ears all too close for comfort. But it was all in a day's work for Bert Hall.

Another favorite sport of Hall's was hiding in the clouds until an unsuspecting enemy came along below, whereupon the dauntless Bert would swoop down to annihilate him. On one such occasion, in the Verdun sector, he was engaged in this latter pleasantry. Wrapped in the vapory protection of a huge cloud, he was cruising along when a slight break in the haze revealed a Fokker below. Plunging quickly after the foe, Hall descended from the baffling cloud protection to find what he thought was a lone enemy to be the leader of a squadron of fourteen.

A furious encounter ensued, the frightfully ridiculous odds making it impossible for Hall to do anything but defend himself as best he could while he sought escape from the unhappy venture. The Germans were almost in each others way in their frenzy to destroy Hall. He readily took advantage of this situation to head one Fokker down to a fiery crash between the battle lines. While the Germans pondered, then, over the sheer deviltry of the heroic allied birdman who fought back so valiantly despite such odds, Hall used their momentary hesitation to effect his escape with a dizzy spin to earth. Their vicious onslaughts and his skilled evasion of their every effort to destroy him was witnessed by none other than Marshall Joffre who happened to be at Verdun at the time.

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THE SKY HAWK

(Continued from page 45)

The bravery and daring of the American he ordered rewarded with a bestowal of the Medaille Militaire, France's highest honor to a soldier.

Toward the latter part of 1916 Hall was transferred by the Allied high command to the Eastern Front in Russia at the request of the latter government for seasoned fliers to train her own inept airmen. Hall was not long in finding out why the Russians were not making much of a success of military aviation. A few days after his arrival at the Russian airdrome, during which time nothing was done, a German plane came flying lazily along overhead. The Russians sat nonchalantly about, gazing unconcernedly at the visitor. Fresh from his activity on the Western Front, Hall hopped into his machine and sped aloft to give battle to the invader. A few shots from Hall's gun and the Boche turned tail and slipped off, apparently much surprised at the reception.

Upon returning to the ground, Bert was equally stunned to receive a cold, unfriendly reception from his bewhiskered comrades of the local air forces. "You should not have done that," they told him, "if you shoot at the Germans here it makes them mad and they come back and drop bombs on us."

Thus denied in Russia the activity he was used to in France he petitioned for another transfer, this time to Roumania where, he hoped, a little more action would be forthcoming. He arrived at his new post just in time to join a merry party. A meeting of the crowned heads of the Teutonic forces was scheduled to take place in Sophia, in Bulgaria. Bert accepted with alacrity. He felt that he had an old score to settle with the Bulgars. And to be able to pay his personal respects to Wilhelm der Kaiser and his cronies with a bit of fancy bomb dropping at the same time was a real break. It was just one long battle all the way there and back for, of course, the entire countryside was heavily guarded both with troops and air equipment, but despite the opposition encountered, the trip was a huge success and untold damage was inflicted at strategic points all along the way. The King of Roumania decorated him with the St. Stanislaus Medal and the Vertu Militaire which, with the Cross of St. George of Russia and his many French decorations, made a fitting testimonial both to the value and breadth of his services in the allied cause.

Worn by his unceasing efforts in the Balkans since long before the war and then his constant, unflinching service through the major share of the great conflict, Hall received permission to return to America for a well deserved rest.

But such a roving spirit could not allow the body to remain idle long and so, long before the actual outbreak of hostilities in China, Bert Hall's keen nose for scenting trouble had already brought him to the scene of conflict. While the unhappy Chinese nation was still torn with internal strife and civil war, Hall was in the thick of it.

Finally, when all the internal difficulties were straightened out, Hall received a high commission with the Canton government as head of the Air Corps where his duties called upon him to organize and train China's air fighters along modern lines under his newest title of General Chang Hui-chang. And so, as young Chinese air cadets shrink, perhaps, at the sound of their cannonading, their white General Chang may be seen to smile. The booming of the guns that talk only of death and destruction seems like a lullaby to him. He's heard it, now, since 1912 and still flies on to further fame and glory.

WORLD'S FASTEST AIRPLANE

(*Continued from page* 22)

The model may be painted with either lacquer or four hour enamel. The wing, elevator, struts, propeller, the floats above the color line, and the fuselage above the color line are painted silver. All the rest of the plane is painted blue. The blue stripe on the rudder should be darker than that on the rest of the plane. The number "7" should be painted white.

There is a model!

AIRWAYS

(*Continued from page* 27)

The photograph alone does not really do them justice. All the models are less than seven inches in span.

Some of our readers have not confined themselves entirely to model airplane building. Picture No. 8 shows Bob Clary, of Englewood, N. J., taking off the surface of the lake while being towed behind a motorboat at Camp Sokokus. If any of our readers have had any experience in gliding, they will know how very interesting it is.

We have some interesting information from Robert V. Smith, Norwich, N. Y. The Central New York Model Airplane Contest was held some time ago in the State Armory. Smith won the contest by scoring a total of six points. There were 25 boys entered. He won the Junior R. O. G. contest with a flight of 2 minutes, 30 seconds. John Goodwin of Rome, N. Y., won second place with 2 minutes, 18 seconds. The Senior R. O. G. contest was won by Eldredge Willet of Auburn. His model took 2 minutes, 50 seconds. J. Saddlin, Little Falls, was second with 2 minutes, 22 seconds. In the Junior Commercial Contest, Adolph Duda, of Rome, carried first place with 2 minutes, 10 seconds. Utica was represented also in this contest. John A. Glisha, of that town, won first place in the Senior Commercial Contest with a 3 minute, 12 second flight. He should be commended for this performance.

The Model Airplane Club of Galt, Ontario, seems to be coming into the limelight. Here we have a request from Leslie Taylor, Secretary and Treasurer of the club. He is wondering if some of the Sky Cadets will not correspond with him. An exchange of ideas with Taylor might prove beneficial to some of our young readers.

For Model Building Readers Only

Do not forget that we will publish, each month, a list of names of young men and the models that they complete. In this way, we will learn who are the really active model builders.

For the benefit of those who did not read our announcement in the April issue, I had better explain. In every issue, we will publish a list of names of boys who have built

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Air—Ways

(*Continued from page 47*)

models during the preceding month; also a description of the model, or models, that they build. A complete record will be kept from month to month. This will be sort of a race. See what you can do to have the greatest number of models listed after your name.

All models must be different, of course, and two adults must sign your statement, before you send it in to us, that the model has been built by you on the date, or dates. Let others see how good you are.

Club News

We have some interesting news concerning the Model Autogiro Contest held by the Hartford Aero Model Club in the State Armory of that city. We are indebted to John Tyskewicz for this information and also for established what looks like a record for autogiros. His ship floated about the armory for 48 2/5 seconds.

Considerable progress is being made with this particular style of model plane. The problem of building a successful autogiro is much more complicated than that of the ordinary aeroplane, and those who solve it successfully deserve a great deal of credit. Carl Shearer of the same club won second place in the flight, with 22 1/5 seconds. These two models were the only two autogiros that flew successfully.

In a contest between the Hartford Club, the New Britain Model Airplane Club, the Meriden Model Airplane Club and the Southington High-Hatters, Herbert W. Owen, of New Britain, won the contest with a flight of 3 minutes, 47 1/5 seconds. Leslie E. Martin, of Hartford, won second place. His model flew 1 minute, 51 2/5 seconds.

A Construction Hint

A very interesting contribution comes from Leslie Davis, of Waco, Texas. He submits the following information regarding a unique way of making thrust bearings. He says: "As thrust bearings are a very important detail in the construction of model planes, I believe the following method of making them will be of value to other model builders. The bearing is formed from a bicycle spoke and phonograph needles are used to make the correct size hole for the propeller shaft. The procedure is as follows:

First cut off the threaded end of the spoke and flatten out about 1¼ inch of it until it is slightly less than 1/32 of an inch thick. Cut off this flattened part and place it upon a solid piece of iron. Before attempting to make the hole in the end of the bearing, you should slightly dull and then sharpen again the needles you use to make the hole. This prevents the points from breaking off too easily. Hold the needle between the first finger and the thumb and place it on the flattened piece of spoke at the point at which you wish the hole. Now tap the needle gently with a light hammer till a small hole appears on the *under* side of the bearing strip. Next turn over this strip and repeat the procedure until the hole is the desired size, and then the grinding wheel may be used to dress down the strip to the correct width, which is 3/32 of an inch. It may then be bent, as may be required for the particular machine on which you wish to use it."

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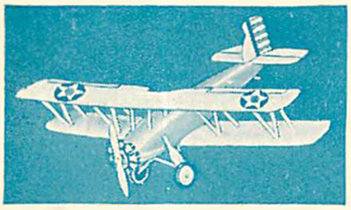

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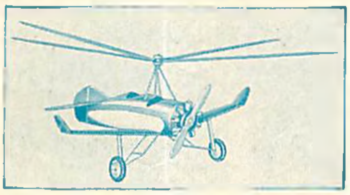

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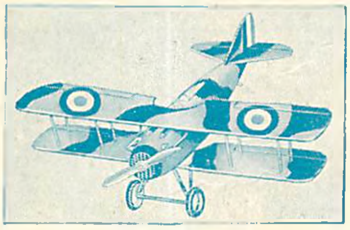

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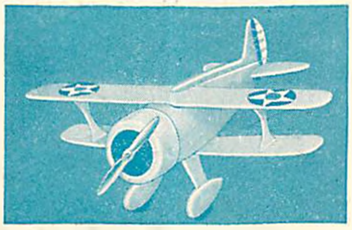

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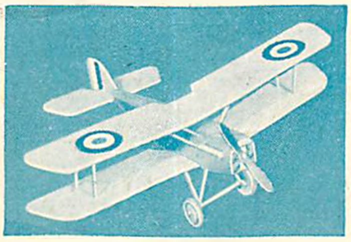

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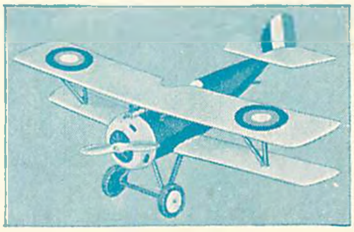

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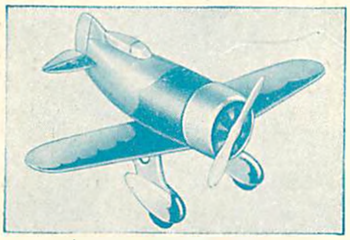

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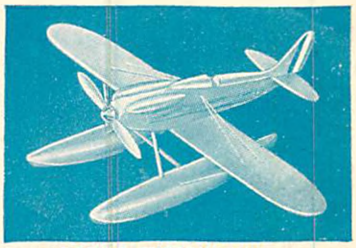

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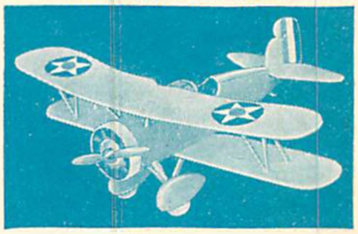

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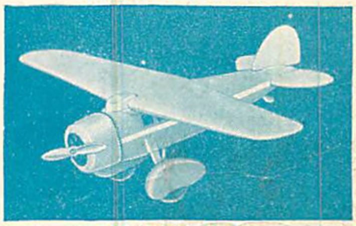

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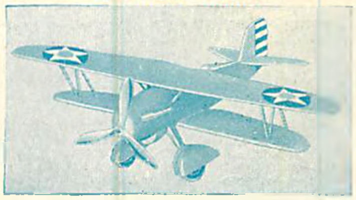

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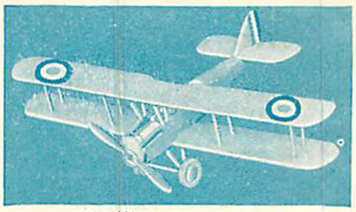

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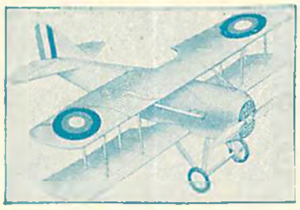

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