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MODEL AIRPLANE NEWS

and JUNIOR MECHANICS

A MACFADDEN PUBLICATION
PRICE 15 CENTS

FEBRUARY

CONTINUING

MYSTERY OF THE SILVER DART

GLIDING AND SOARING

AIR NAVIGATION

AIRPLANE DESIGNING

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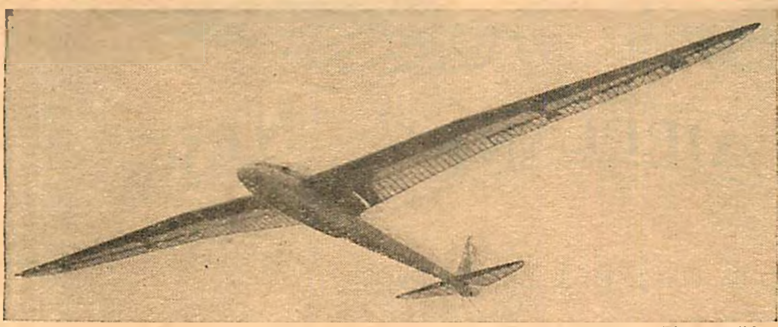

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MODEL AIRPLANE NEWS
Vol. IV No. 2

EDITED BY CAPT. H. J. LOFTUS-PRICE

CONTENTS, FEBRUARY, 1931

Cover Design by Ray Creena—Drawn by Norman E. Jennett.

In Our Next Issue

Let's talk about our March cover first. It's a peach! Ray C. Wardel, one of America's best aerial artists, has depicted for you a German *Albatross D5A* (1918) in a scrap with a *Nieuport* single-seater scout. Both planes are camouflaged and authentic in every detail.

* * *

Then there's Lieutenant H. B. (jg) Miller's instructive article on airplane engines, entitled "*Airplane Engines—What They Are, and Why*". Lieutenant Miller, by the way, in addition to being the author of "*The Air Goin' Navy*" and "*Prisoner of the Air*", which you'll all remember, is Instructor in the Engine Section of the Ground School at the U. S. Naval Air Station at Pensacola, Florida.

* * *

The *Aviation Advisory Board* will include some more on that thrilling subject of Air Corps insignia, with some more photographs for your scrap-book.

* * *

Plans in the next issue will be for a flying model of the Curtiss-Bleecker *Helicopter*. Prof. T. N. de Brobovsky has gone to great pains to make this an outstanding model for your collection. Also there will be plans for the Grant *Minute Man*, a speedy and good flying model.

* * *

Of course, *Gliding and Soaring*, *Aerial Navigation*, *Airplane Designing*, and that real thriller of the Secret Service, "*The Mystery of the Silver Dart*," are continued.

* * *

If you miss the March issue of MODEL AIRPLANE NEWS—on all news stands February 23 next, and only 15c a copy—you'll miss something you'll never be able to replace.

Read column 2 on the opposite page, and be convinced of this!

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Contributors are especially advised to be sure to retain copies of their contributions, otherwise they are taking unnecessary risk. Every possible effort will be made in our organization to return unavailable manuscripts, photographs and drawings, (if accompanied by postage), but we will not be responsible for any loss of such matter contributed.

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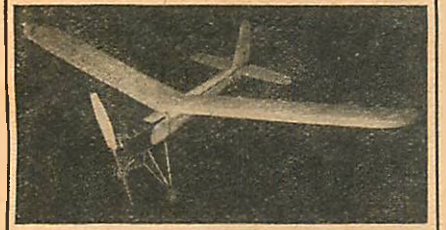
HERE IT IS



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Specifications: All balsa construction, five foot wing span, 1/32" balsa monocoque fuselage hand moulded to correct shape, detachable nose block and tail assembly, shock absorbing landing gear equipped with 3" celluloid wheels, adjustable fin, and the heart of the plane—COUNTRY CLUB NU-HI POWER, an ingenious dural gear operated device, which permits flying the plane with one, two or three separate and distinct sets of rubber motors, so connected that their power is cumulative. We recommend using one motor for small flights of one or two minutes duration. Three motors should only be used when flying the plane in light winds at an airport.

Performance: The model will glide, hand launched in still air, 30 to 40 feet. Using three motors, flights ranging from four to eight minutes have been obtained. Due to its high gliding angle, the plane will soar for long periods after the propeller has run down.

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MODEL AIRPLANE NEWS is proud to announce that from a shaky take-off in 1929, we are now solo-ing with gusto and doing outside loops for joy at our progress—thanks to co-operation of both our readers and advertisers.

* * *

We've moved to our new home at 25 West 43rd Street, New York City, and Harold Hersey, eminent aviation enthusiast and famous as the prime mover in the organization of the Quiet Birdmen is the new publisher starting officially with the March issue of MODEL AIRPLANE NEWS. *Captain H. J. Loftus-Price, ex-British war flyer, world traveller and foreign correspondent, continues as Editor, and also Chairman of the Aviation Advisory Board.*

* * *

With the change in home there is a change in policy! And what a change! First: Watch our covers. Ray C. Wardel and Elliot Dold, two American war veterans, have been commissioned to do a series of covers, which will depict all the famous planes of the Great War—British, French, American, German, Austrian and Italian; Spads, Nieuports, S.E.5's, Camels, Dolphins, Fokkers, Albatrosses, Rumplers, L.V.G.'s, and others. Furthermore the covers are being done in such finish—real war-time camouflage, etc., and in a frame—that they can be clipped and mounted as photographs for your den! How's that for a start?

* * *

Then the articles. No more fiction—after the present serial—is our motto henceforward. Every article appearing in the magazine will have a definite place in the study of aerodynamics, though written in simple, understandable language. For instance, we are making plans for a year's course in airplane engines, and radio, and also, if obtainable and satisfactory, a series on the application of model building with reference to the real plane. Also each month there will be a section devoted to material of a mechanical nature for those readers whose model building activities are not confined to airplanes.

* * *

Both the publisher and editor hope that you all will stick with us in the future as in the past, and that between us MODEL AIRPLANE NEWS will retain its position as the wonder-magazine for the air-minded youth of today, who tomorrow will fill the shoes of the pioneers of aviation.

* * *

Thanks, everybody.

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25 sticks	1/4x3/16x40"	.50 or 2 sticks for 5c
25 sticks	1/8x3/16x40"	.50 or 2 sticks for 5c
25 sticks	1/16x1/4x40"	.50 or 2 sticks for 5c
25 sticks	1/16x1/16x40"	.35 or 3 sticks for 5c
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FL-103 Span 16⅞"; length 12⅛". Green.

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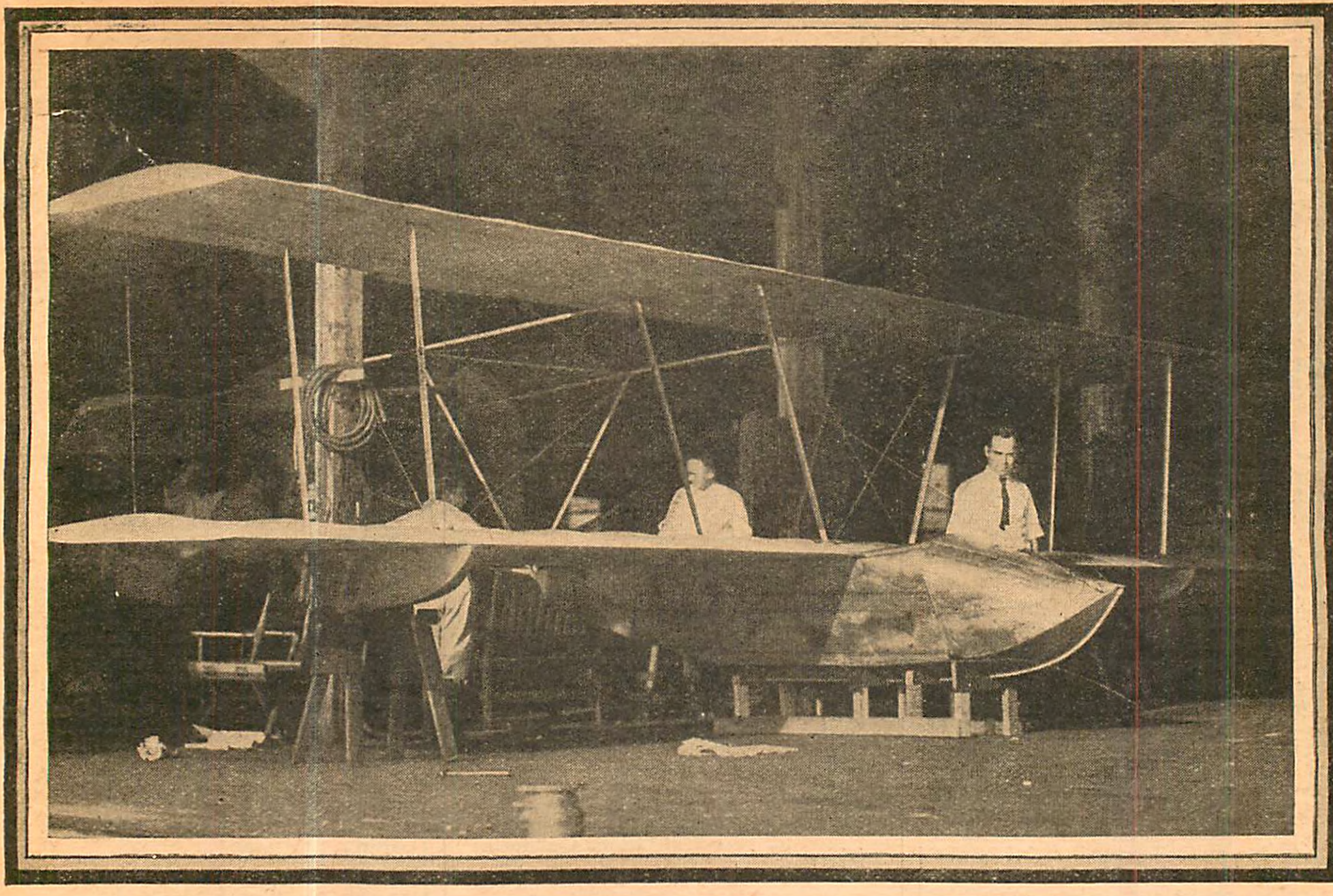


GLIDING and SOARING

A Manual of Motorless Flight

By

PERCIVAL WHITE and MAT WHITE

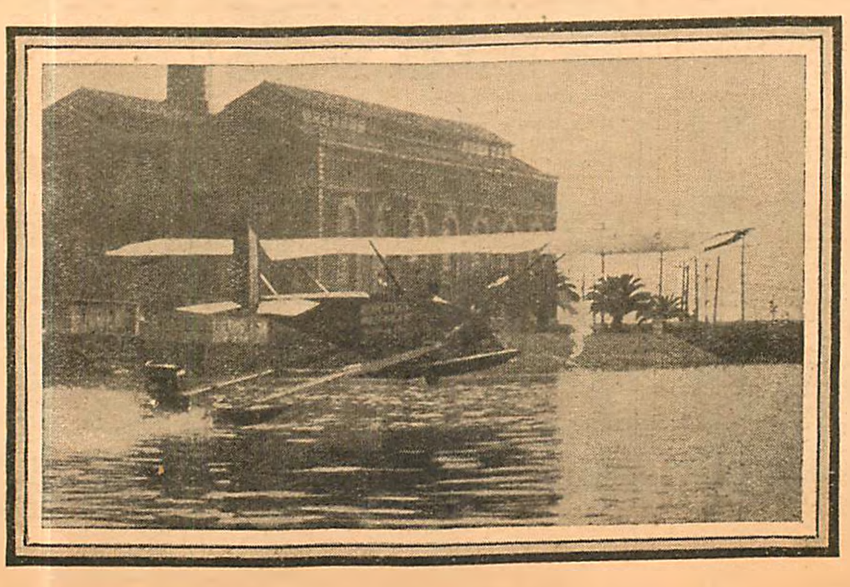
WATER GLIDERS

A WATER glider is a glider which takes off from, and lands on, the water. Water gliders are to two general types: gliding boats, i. e., gliders with a fuselage which rests directly in the water, and float water gliders, which rest on the water on a float attached below the fuselage. Water gliders may also be classified as monoplanes and biplanes.

Since water gliders are necessarily heavier than land gliders, none have yet been built which have a high enough performance to soar. In fact, the experiments made with water gliders of any sort are comparatively few as yet.

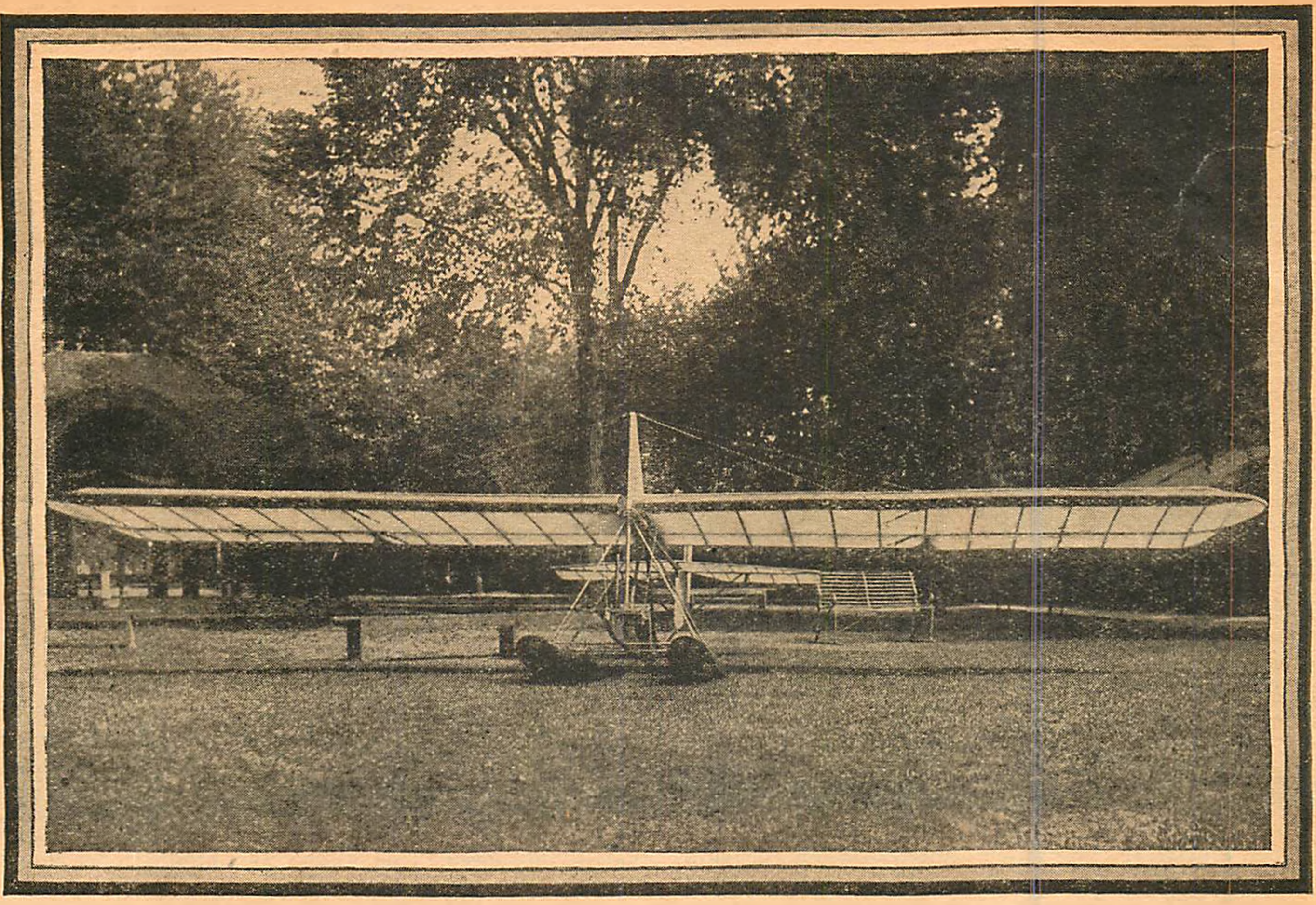
What Does a Water Glider Look Like? In general, the water glider differs from the land glider in only one significant respect: the under-carriage. The skid or wheels are replaced in a water glider by a float and wing tip pontoons or by a water-tight fuselage.

A float water glider commonly rests on one boat-shaped float. This is usually built of ply-wood, covered with "doped" cloth, or sometimes with duralumin. Two pontoons, running parallel to one another, such as those used on



Top—A close-up of a water glider

Below—A "speed-boat" water glider



many motored seaplanes, have been reported to be less satisfactory than a single float. The fuselage of a gliding boat is stream-lined, and covered with fabric treated with dope, or built of metal.

Most water gliders are equipped with a small pontoon fastened under each wing tip. These pontoons prevent the wing's striking the water in case lateral balance is lost while the glider is afloat or when landing. The float or fuselage of a water glider is ordinarily stepped like a hydroplane. A float water glider and gliding boat are shown in illustrations.

This is the eighth instalment of this absorbing series on Gliders and Gliding.

The appearance of a water glider sometimes differs from that of a land glider in other respects. In the first place, the fuselage of a water glider is nearly always closed, in order to give greater efficiency and to protect the pilot from the spray. Gliding boats must, of course, always have closed fuselages. In the second place, water gliders are more usually biplanes, whereas most land gliders are monoplanes.

Experiments have been made with many kinds of winged boats, some of which cannot strictly be called gliders as they are not designed to rise from the water, but they use their wings for lifting power. Others are designed always to be towed and lift only a few feet.

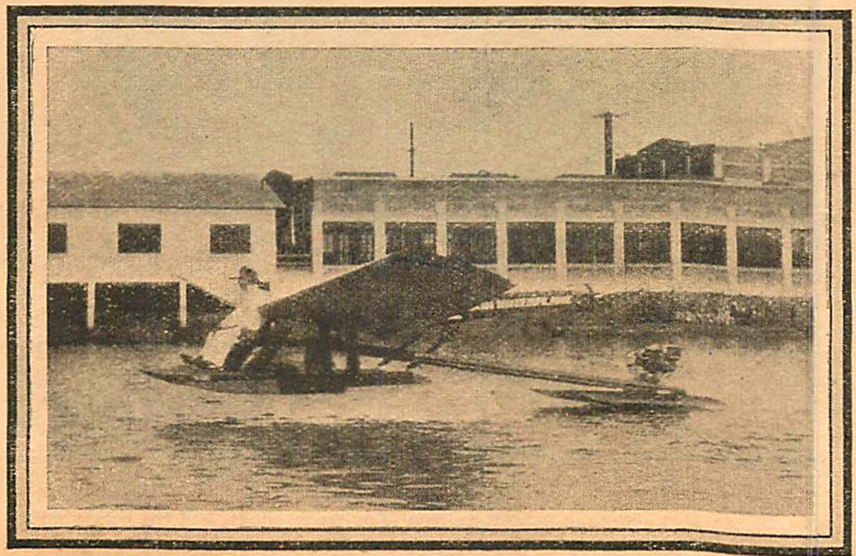
The controls of such semi-gliders at these differ in some instances from those of a land glider. Gliding boats have been built, for instance, which are equipped with outboard motors; one of these has a fixed rudder, and the other has no vertical fin whatever.

Take-Offs. A water glider is usually launched into the air by being towed behind a speed boat. The procedure here is much the same as when a land glider is towed behind a motorcycle or an automobile.

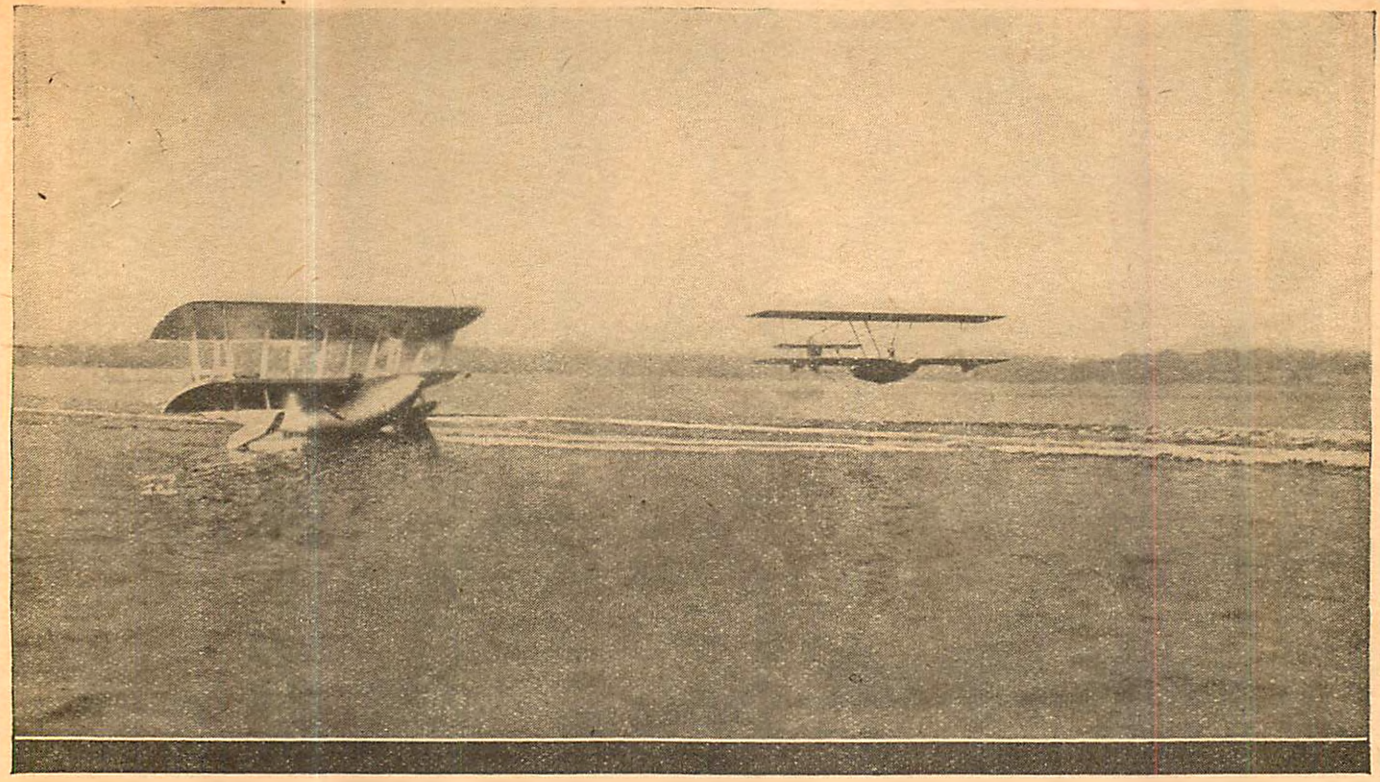
It is preferable that the tow-line be of wire, since when a rope is used, its friction dragging through the water is too great a handicap for the motor boat.

A suitable position for the take-off must be chosen in the water, as on land. A water glider should be launched directly into the wind. This rule may easily be adhered to, since the water glider is not dependent on the contour of the land and may be towed in any direction. (In riv-

Top—A light, neat seaplane glider



Below — Another "speed-boat" glider



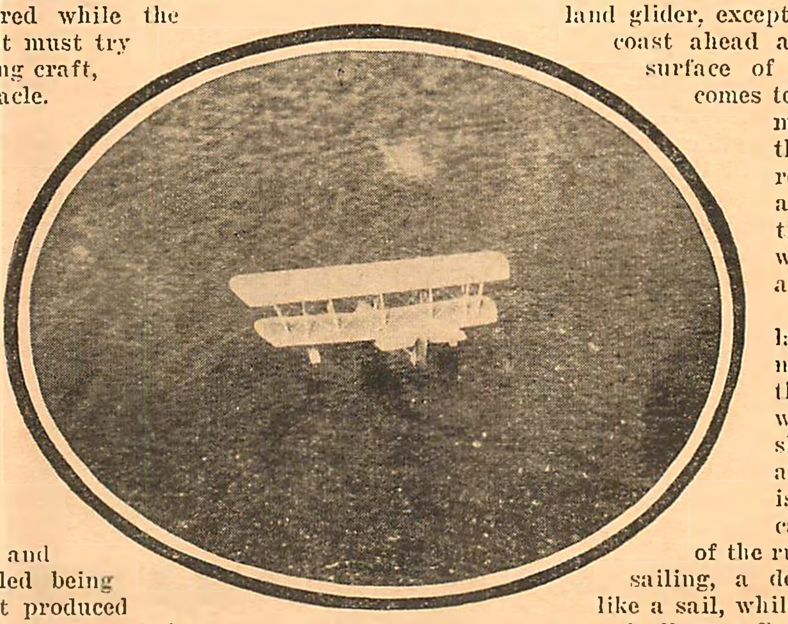
ers, of course, this does not apply.) When the ship is allowed to float on the surface of the water, it will tend to turn, of its own accord, until, like a weather vane, it is headed into the wind.

The intended path of flight should extend over a long stretch of water unobstructed by boats, buoys, etc. The path should be even longer than that planned for a land glider, since the water glider may have to be towed several hundred feet before it takes off. Even slight obstacles may injure the float. If an obstacle is encountered while the glider is in tow, the pilot must try to cut loose from the towing craft, and turn to avoid the obstacle. Turns are effected by use of the rudder and ailerons as in flight.

As soon as the glider begins to gain speed in the water, the pilot should pull the stick back to aid the take-off, and to prevent the nose from dipping under the water. If the float or hull has a step, the bow will rise from the water while the ship is still afloat, so that there is a pocket of air between the float and the water. This is called being "on the step." The effect produced by the step reduces the resistance of the water against the float, and offsets the suction which tends to hold the ship in the water.

When the glider leaves the water, the stick must be held somewhat forward, so that altitude will not be gained too quickly.

Before taking off in a water glider for the first time, it is a good idea to be towed about for a while at slightly less than flying speed. This allows the pilot to accustom himself to the use of the controls.



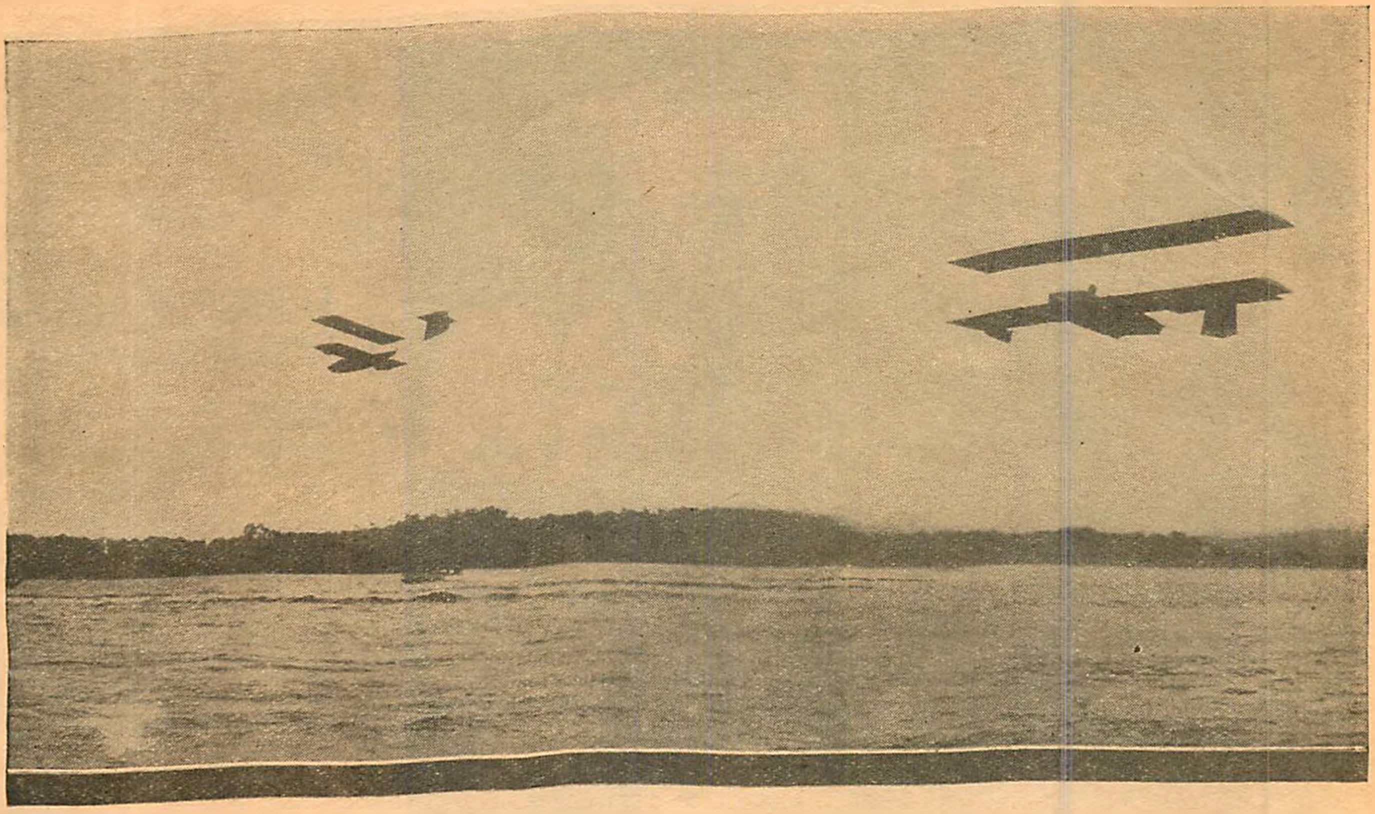
Two views of water gliders in action are seen above, one afloat, and the other being towed-off. In the oval is a view taken from above of a water glider about to land

Flight. Once the glider is in the air, the land glider pilot will have no difficulty in maneuvering it. He may either cut loose from the speed boat and glide down or his ship may be towed like a kite at the end of a several hundred foot rope fed from a reel on the motor boat.

Landing. The landing of a water glider is effected in exactly the same way as that of a land glider, except that the former will coast ahead a little way over the surface of the water before it comes to a full stop. The ship must be stalled so that the heel of the float reaches the water first, and drags until the entire float is level in the water; in other words a "nose up" landing.

Sailing. After the last landing, the glider must be beached. If the wind is in the wrong direction, the ship has to be towed ashore; but, if the wind is right, water gliders can be "sailed", by use of the rudder and ailerons. In sailing, a depressed aileron acts like a sail, while a raised aileron has practically no effect. The rudder serves to steer. A water glider can be made to tack to the right, for example, while facing into a head wind by lowering the right aileron.

The Waterplane. The planes already referred to which have either a fixed rudder or none at all, are equipped with outboard motors. The outboard motor rests on a pontoon, and the pontoon is hinged to the flying boat



by shafts or arms. As soon as the contrivance gains speed, the boat and its pilot take off, leaving the pontoon with the motor in the water to push it ahead. Speeds of forty or fifty miles an hour can be gained this way. Water planing is an exciting sport and has some training value in the manipulation of controls.

Another form of planing boat is one with a narrow, inclosed hull equipped with an outboard and glider wings.

In still a third one, an ordinary Sea Sled Boat had glider wings mounted on it and used an outboard motor for power.

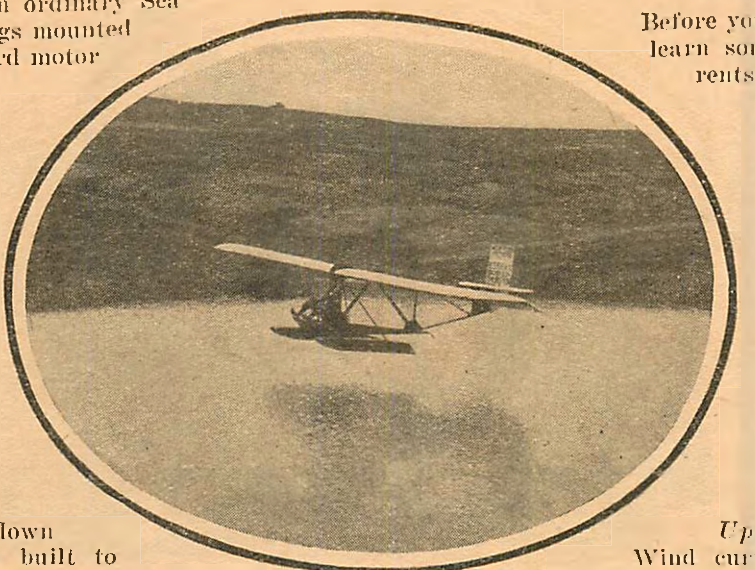
In neither of these latter types does the boat leave the water because of using a water prop, but considerable speed is obtained due to the lifting power of the wings and makes excellent practice in learning wing control as well as providing good sport.

Amphibians. An amphibian is a combination water and land glider. The first successful amphibian was flown by William Van Dusen, built to take off from a hill or mountain and to land in a lake or on the ocean. It has rugged pontoons, which serve on land as skids.

Although pontoons necessarily add to the parasite resistance, this type of glider has obvious advantages, as it will greatly increase the amount of soaring terrain available and add to the safety of the sport.

Conclusion. Water gliders have not yet been widely used, due to their lower performance and the relatively high cost of construction.

Mr. Glenn H. Curtiss, a pioneer of American gliding, said of the water glider which he built a few years ago, "It was an interesting plaything and taught something in the way of light construction; otherwise, I do not consider it much of an achievement." This machine, however, did more than Mr. Curtiss realized, by pointing the way which others were later to follow.



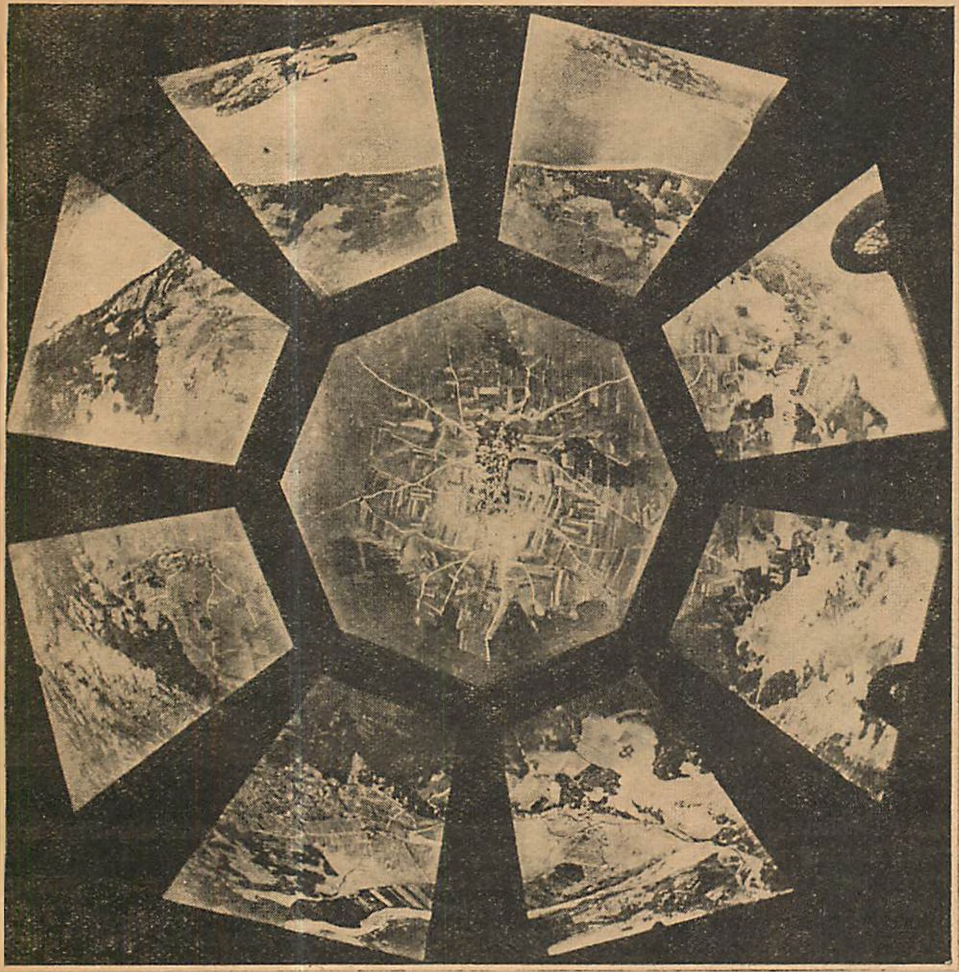
An extraordinary photograph of two biplane water gliders about to land at the same time is depicted above; while below is shown a seaplane glider about to make a landing

WIND CURRENTS

Before you begin to soar, you must learn something about wind currents: what currents can be utilized in flight, where they are found, and how they may be recognized. Wind currents have only recently been studied in detail, hence knowledge about them is still slight.

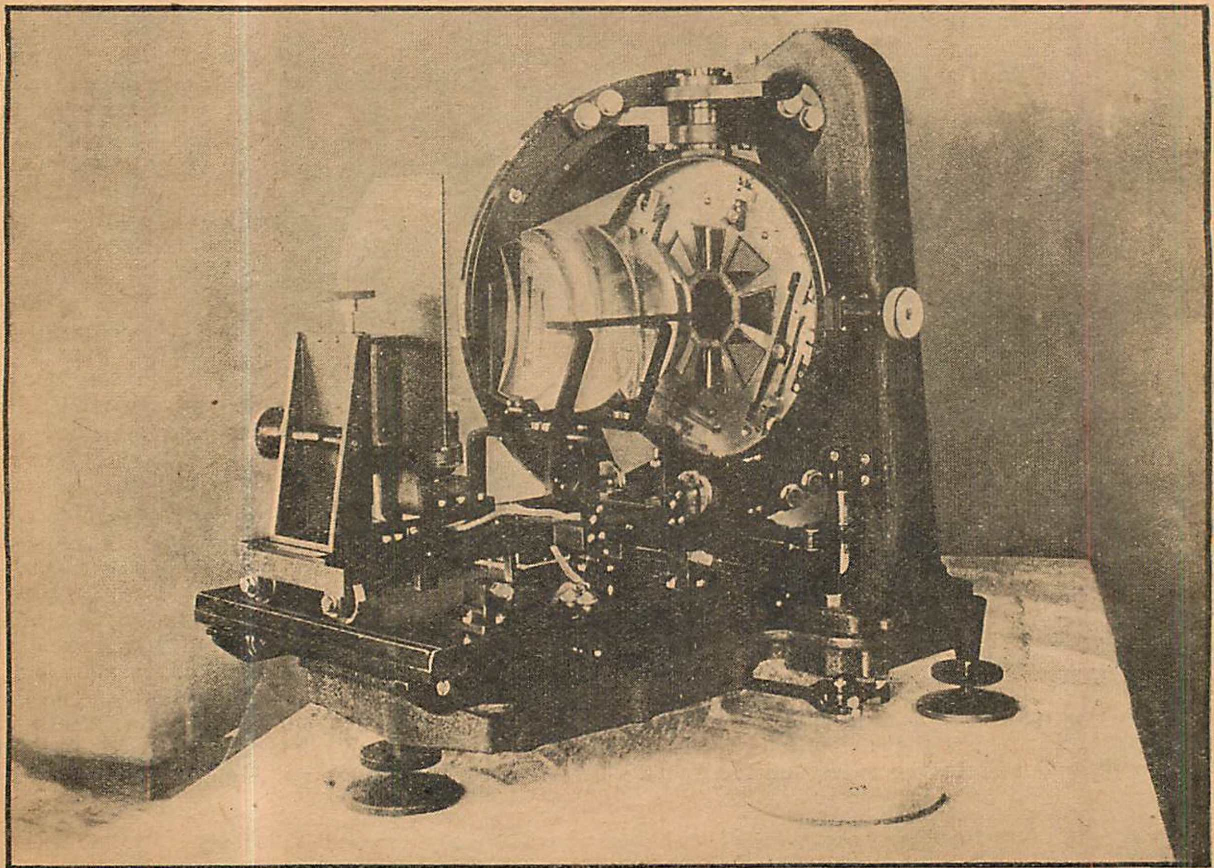
Every soarer pilot should consider it his duty to read all available material on the subject, and to add to the science whatever discoveries he can make in his own flight.

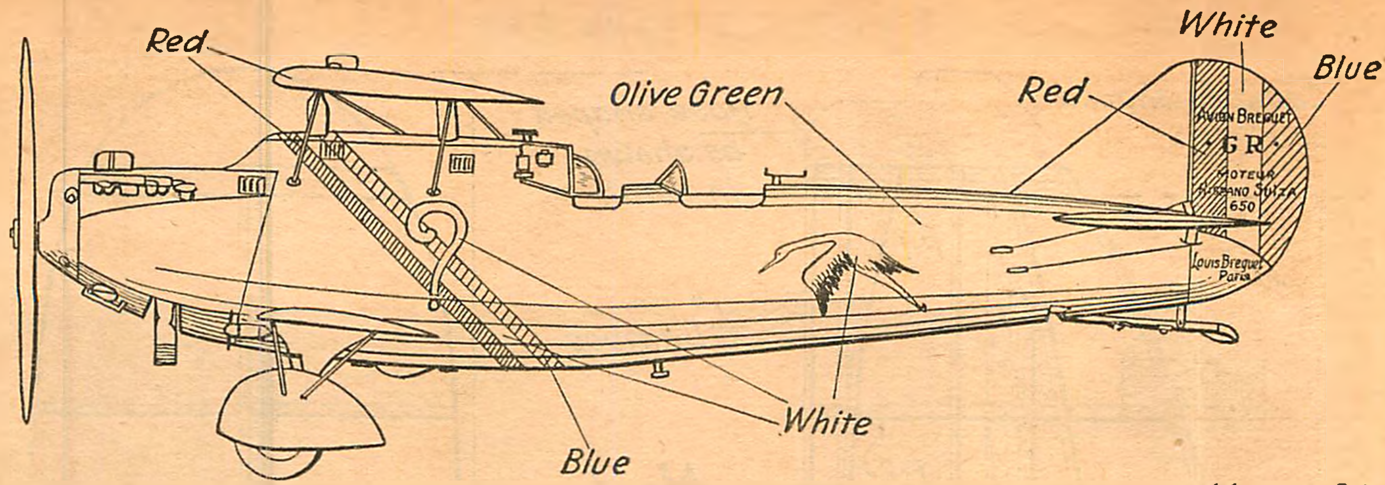
Upward Currents of Air. Wind currents may be placed in several different categories; according to the direction of the compass, velocity, duration, and the plane in which the currents are blowing (i.e., whether they are vertical or horizontal). The distinction between vertical and horizontal currents is important to the soarer pilot. He avails himself of the former according to the principles of static soaring, of the latter in accordance with the principles (*Continued on page* 39)



PROGRESS being made in aerial photography is clearly depicted in these photographs. At the left are shown original photographs of the nine-lense panoramacamera which were taken from a height of approximately 10,000 feet. (Note how even sections of the wheels of the plane are in the side of the pictures.) Below is a view of the camera showing its multi-lense arrangement. It is believed that this will revolutionize aerial photography, particularly if used in conjunction with the United States Government's 200-mile-range camera

News Events





How to Build the Trans-Atlantic "?"

A Flying Model of Costes' Famous Sesquiplane

By
MORTIMER ROSENBAUM

THIS model is a copy of the famous French plane, the first to make a Paris-New York flight. The *Question Mark* holds many other records besides the trans-Atlantic one and is truly a remarkable airplane.

This model, if constructed properly, resembles the original and has also many of the larger machine's good flying qualities.

Before starting construction, make sure all materials are at hand and read the directions carefully.

FUSELAGE

The fuselage is built up of formers of 1/16″ sheet balsa and stringers of 1/32″ bamboo. Formers F-1 to F-9, inclusive, are cut from the 1/16″ x 3″ x 12″ sheet balsa. After this has been done, split up one of the pieces of bamboo into 1/32″ strips and ambroid them to the top and sides of the fuselage, as shown in the main drawing.

The nose is shaped from the 1/2″ x 1-5/8″ x 1-3/8″ piece of balsa with razor and sandpaper. The nose is fastened to the fuselage with dress snaps. The motor-stick of 1″ x 1/4″ x 12-1/4″ spruce is ambroided into a slot 3/16″ under the centre line. The bearing and rear hook are then ambroided on.

The cockpit former is cut out from the 1/32″ x 1/2″ x 8″ sheet balsa and is ambroided on to formers F-7 and F-5. The windshields are cut from celluloid and are ambroided on in the position shown in the drawing. The radiator is cut from the 1/4″ x 3/4″ x 1-3/8″ piece of balsa and is ambroided to former F-2. The tail skid and brace are of 1/16″ bamboo. The centre strut carrier is a piece of 1/8″ x 1/4″ 2-3/4″ balsa ambroided between formers F-3 and F-5.

TAIL SURFACES

The tail surfaces are of the immovable type. The outlines are of 1/16″ bamboo and the ribs, shaped as shown by the dotted lines, are of 1/16″ balsa. The lower part of the rudder is faired in line with the fuselage by means of fine bamboo strips. The rudder spar is shaped as shown by former F-10 of 1/16″ balsa. The elevator spar is 1/8″ square balsa.

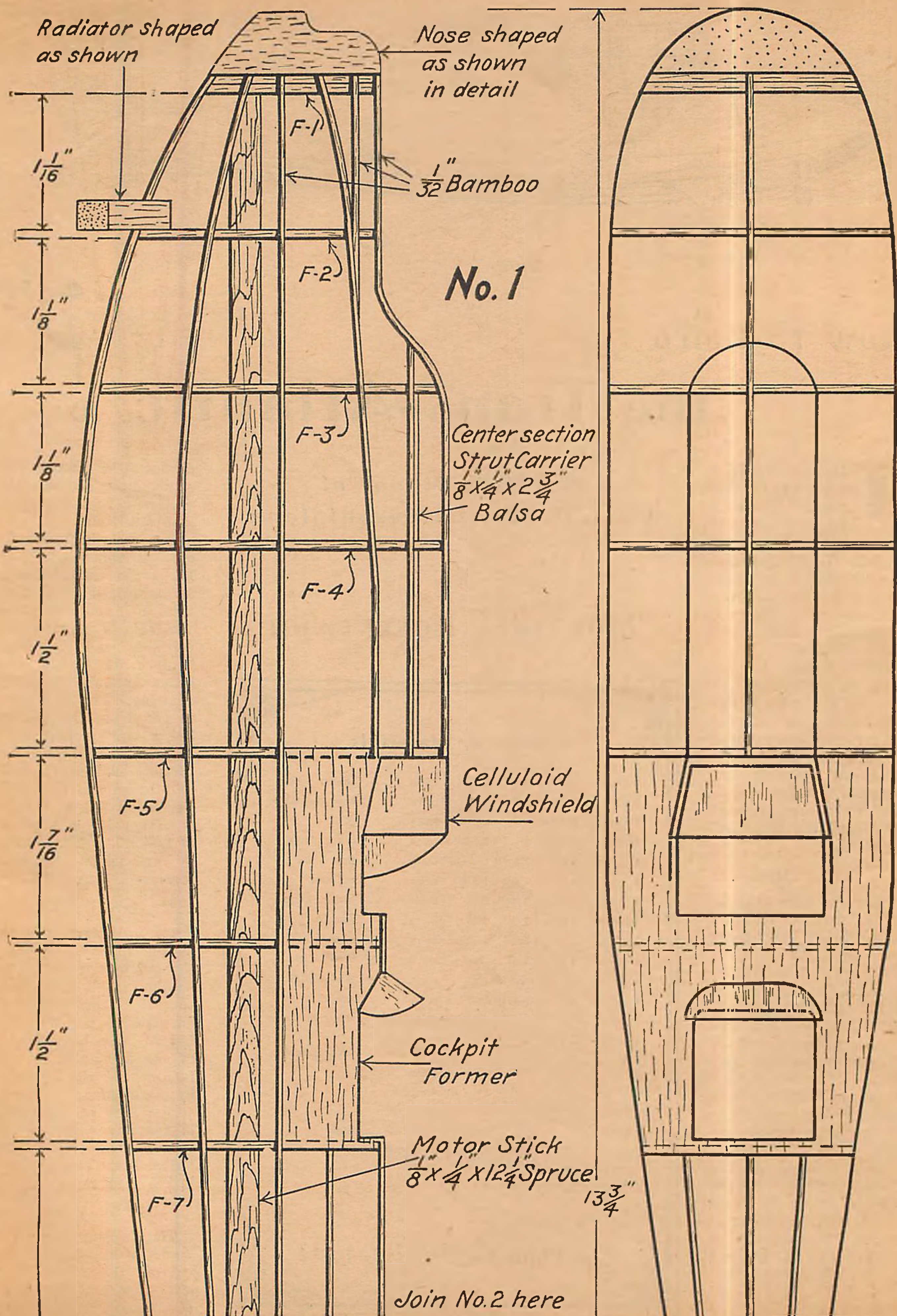
UPPER WING

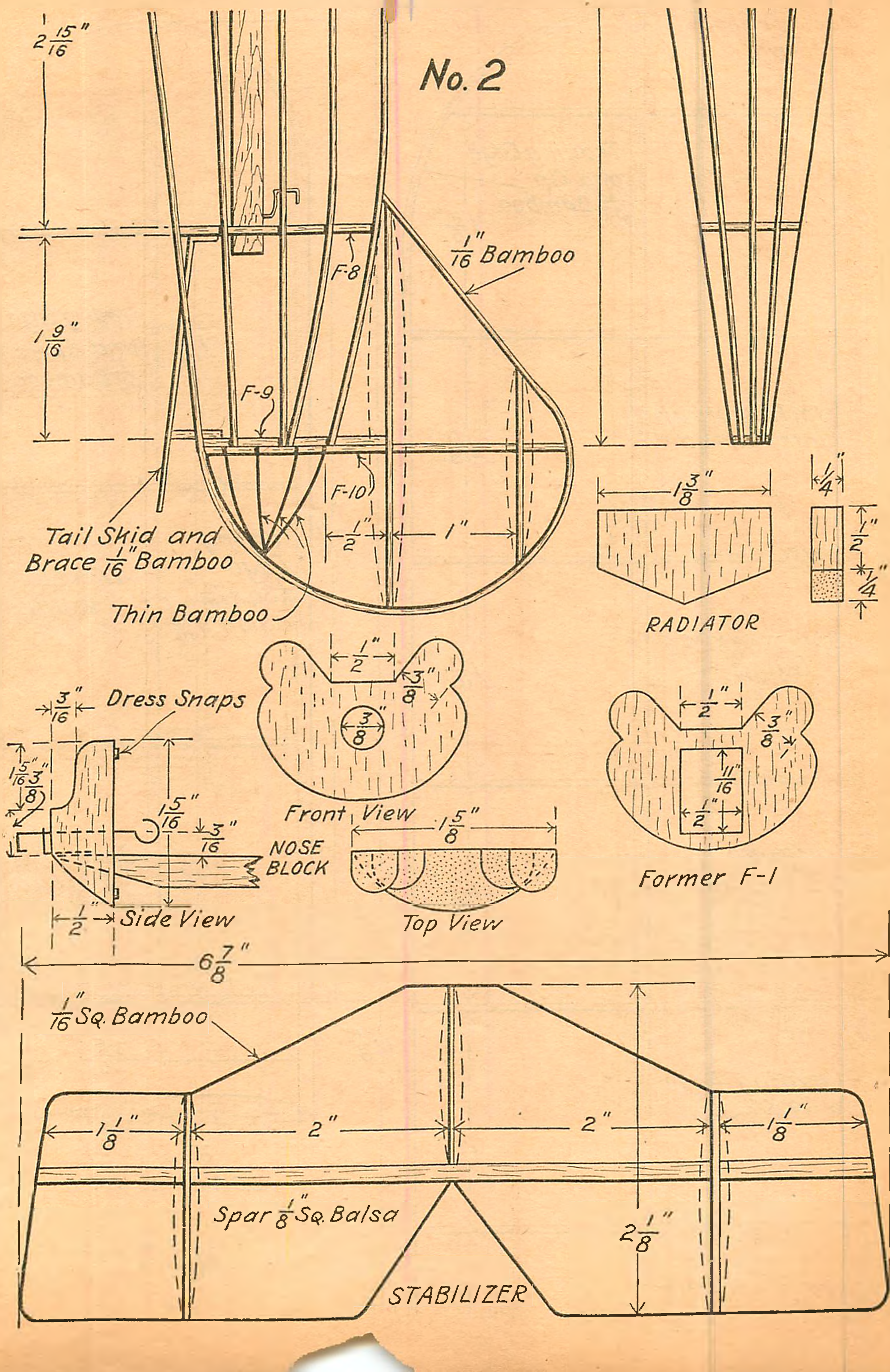
The upper wing is made in one piece. First cut out the twelve full-size ribs and the two (*Continued on page* 45)

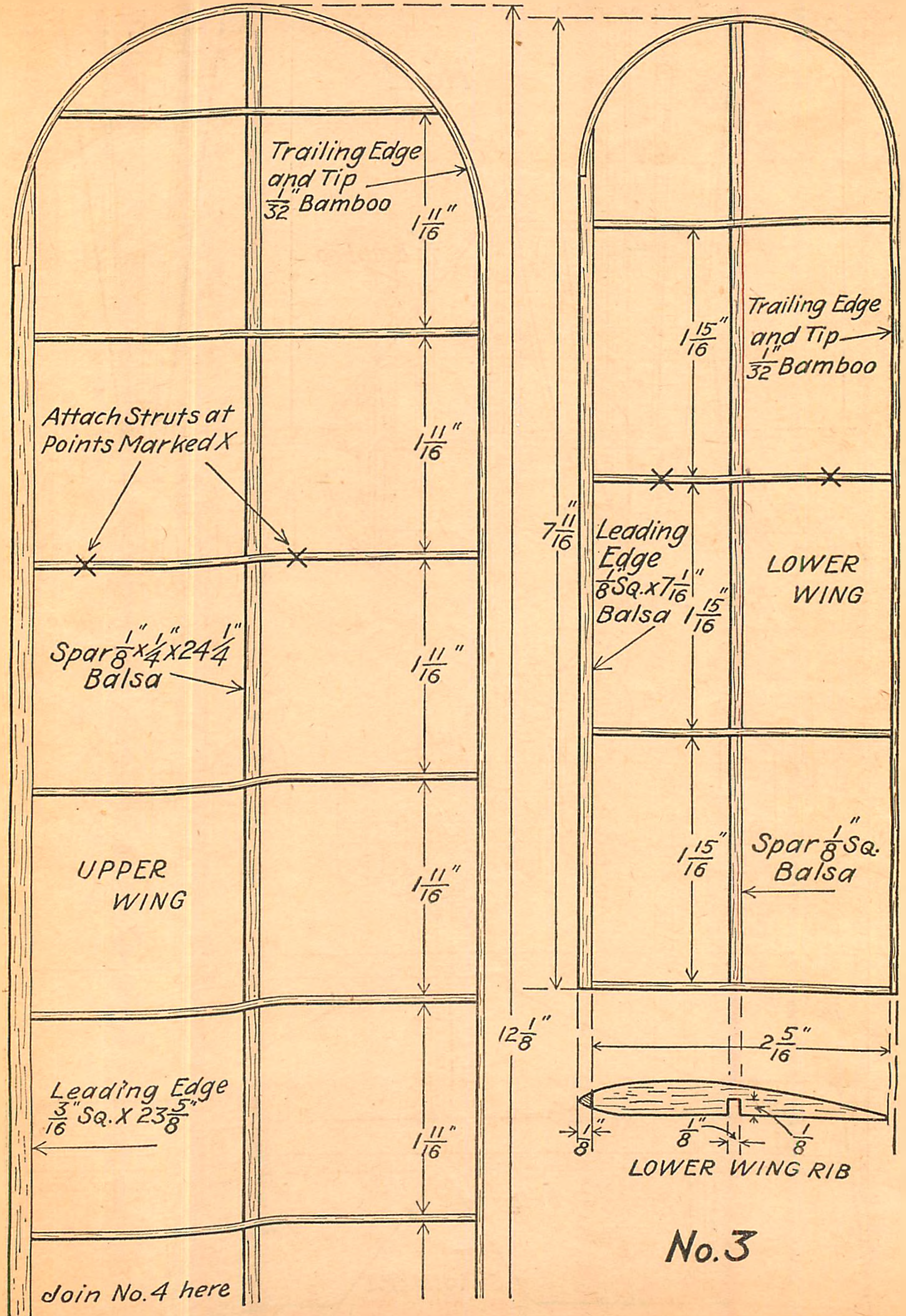
Necessary Materials

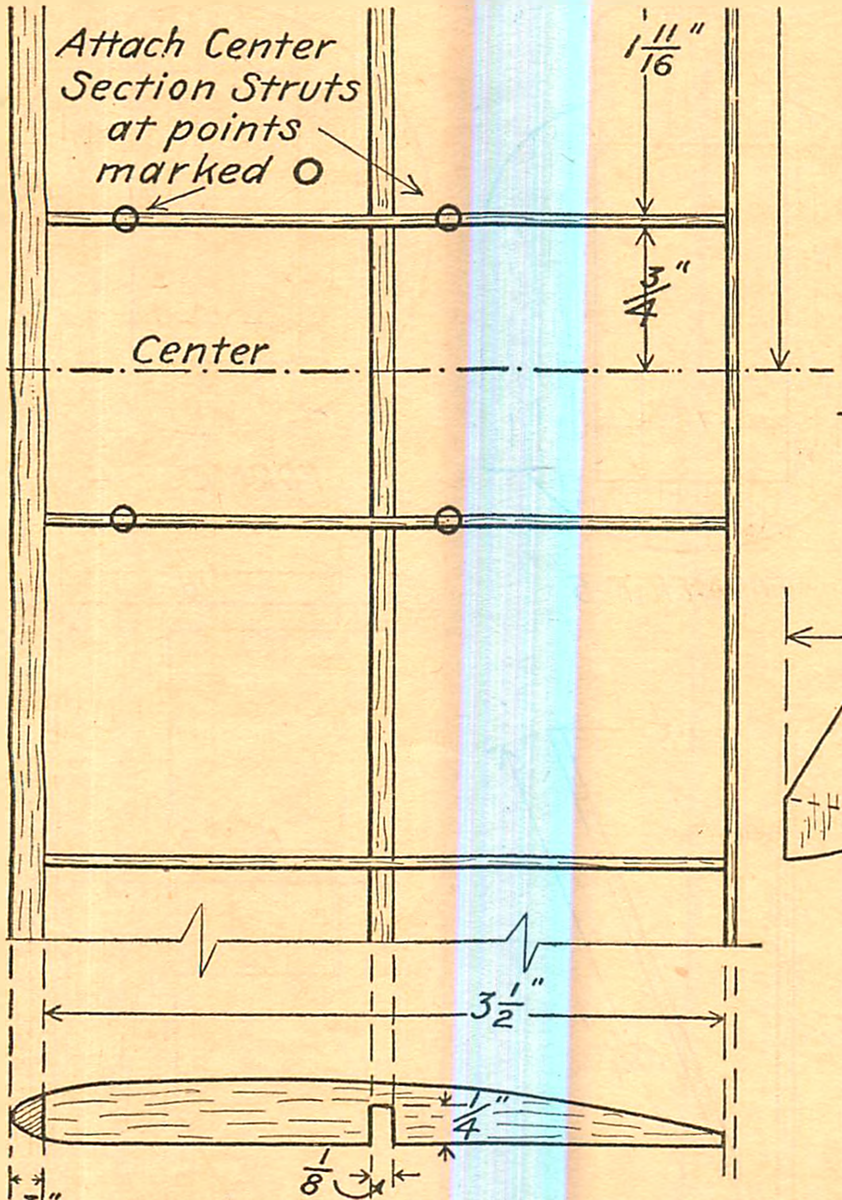
3 pieces	1/16" x 3'	x 12"	balsa	former, ribs
1 piece	1/32" x 1/2"	x 8"	balsa	cockpit former
2 pieces	5/8" x 1"	x 2"	balsa	pants
1 piece	3/16" x 1"	2-1/2"	balsa	cover plates
1 piece	1/2" x 1-5/8"	x 1-3/8"	balsa	nose block
1 piece	1/4" x 3/4"	1-3/8"	balsa	radiator
1 piece	3/16" x 3/16"	x 24"	balsa	leading edge
1 piece	1/8" x 1/4"	x 36"	balsa	spar and strut
5 pieces	1/8" x 1/8"	x 12"	balsa	spars
1 piece	1/8" x 1/4"	x 12-1/4"	spruce	motor stick
1 piece	2-1/2" x 2-1/2"		sheet celluloid	wind shields
1 piece	9/16" x 1-3/16"	x 8"	spruce	propeller
4 pieces			split bamboo	stringers, etc.
1 piece	1-1/4"		celluloid wheels	landing gear
1			thrust bearing	
2			washers	
1 foot	No. 14		music wire	
1 package			model making pins	
3 sheets			Japanese tissue	
1/4 ounce bottle banana oil				
1/2 ounce can colorless glue				
Artists oil color				
10 feet 1/8" flat rubber				

See Plans on Pages 10 to 14


Radiator shaped as shown
Nose shaped as shown in detail
F-1
1 1/16"
1/32" Bamboo
F-2
No. 1
1 1/8"
F-3
1 1/8"
Center section Strut Carrier 1/8" x 1/4" x 2 3/4" Balsa
F-4
1 1/2"
F-5
Celluloid Windshield
1 7/16"
F-6
1 1/2"
Cockpit Former
Motor Stick 1/8" x 1/4" x 12 1/4" Spruce
F-7
13 3/4"
Join No. 2 here

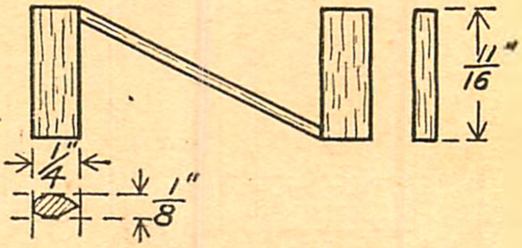

No. 2
2 15/16"
1 9/16"
F-8
1/16" Bamboo
F-9
F-10
1/2"
1"
Tail Skid and Brace 1/16" Bamboo
Thin Bamboo
1 3/8"
1/4"
1/2"
1/4"
RADIATOR
1/2"
3/8"
3/8"
Front View
3/16"
Dress Snaps
1 5/16"
3/8"
1 5/16"
3/16"
NOSE BLOCK
1/2"
Side View
1 5/8"
Top View
1/2"
3/8"
11/16"
1/2"
Former F-1
6 7/8"
1/16" Sq. Bamboo
1 1/8"
2"
2"
1 1/8"
Spar 1/8" Sq. Balsa
2 1/8"
STABILIZER


Trailing Edge
and Tip
1/32" Bamboo
1 11/16"
1 11/16"
1 11/16"
1 11/16"
1 11/16"
Attach Struts at
Points Marked X
Spar 1/8"x1/4"x24 1/4"
Balsa
UPPER
WING
Leading Edge
3/16" Sq. X 23 5/8"
Join No.4 here
12 1/8"
7 11/16"
Trailing Edge
and Tip
1/32" Bamboo
1 15/16"
1 15/16"
1 15/16"
Leading
Edge
1/8 Sq. x 7 1/16"
Balsa
LOWER
WING
Spar 1/8" Sq.
Balsa
2 5/16"
1/8"
1/8"
1/8
LOWER WING RIB
No.3

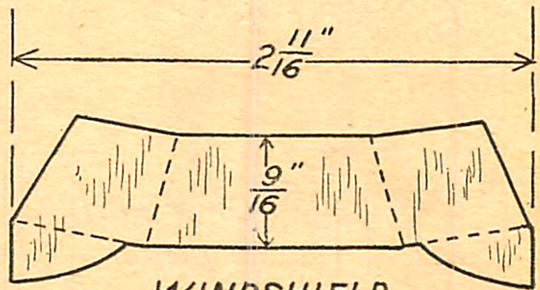


UPPER WING RIB

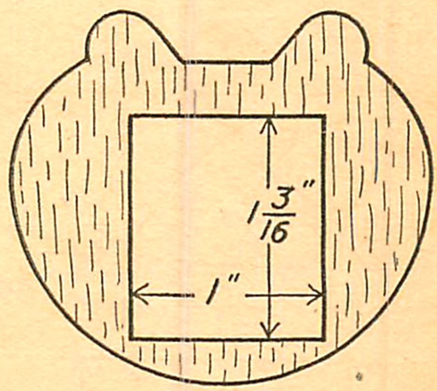
REAR WINDSHIELD



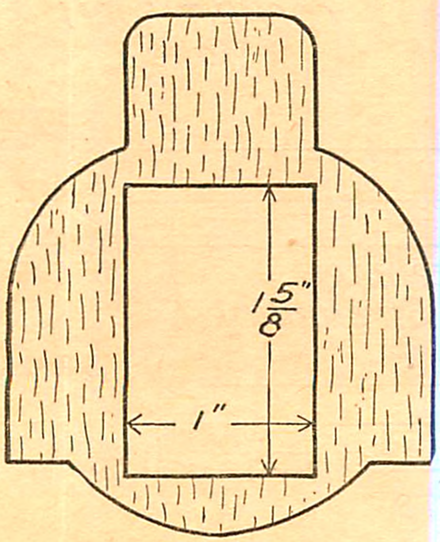
CENTER SECTION STRUT



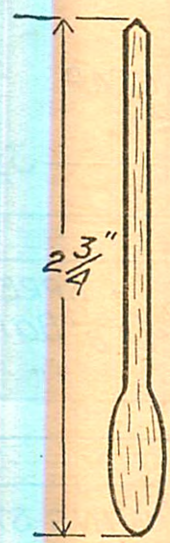
WINDSHIELD
Bend on dotted lines



FORMER F-2

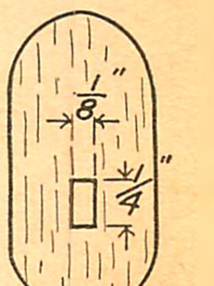


FORMER - F-3



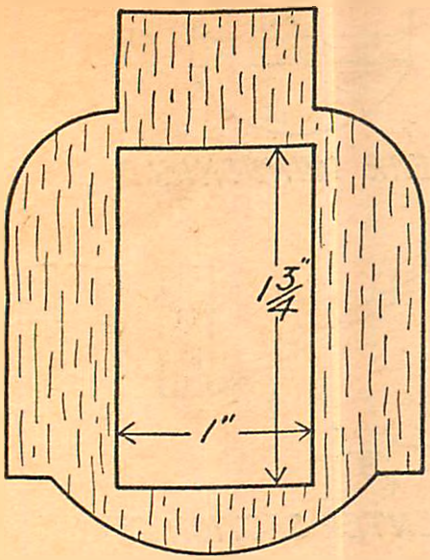
FORMER F-10

FORMER F-9

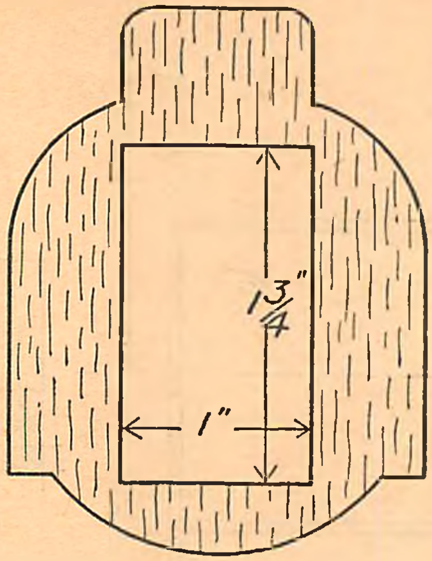


FORMER F-8

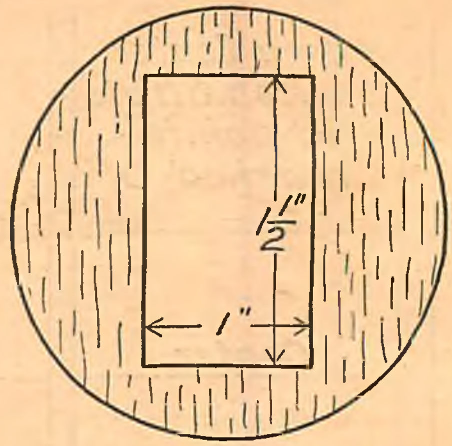
No. 4



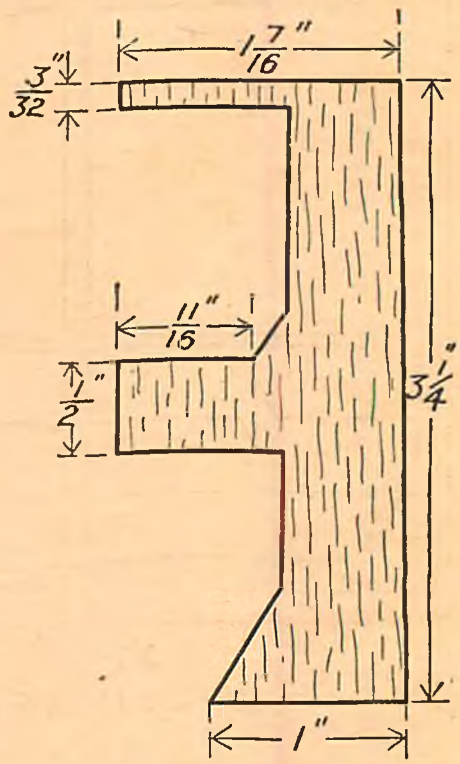
FORMER F-4



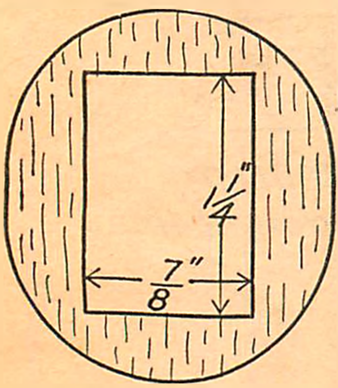
FORMER F-5



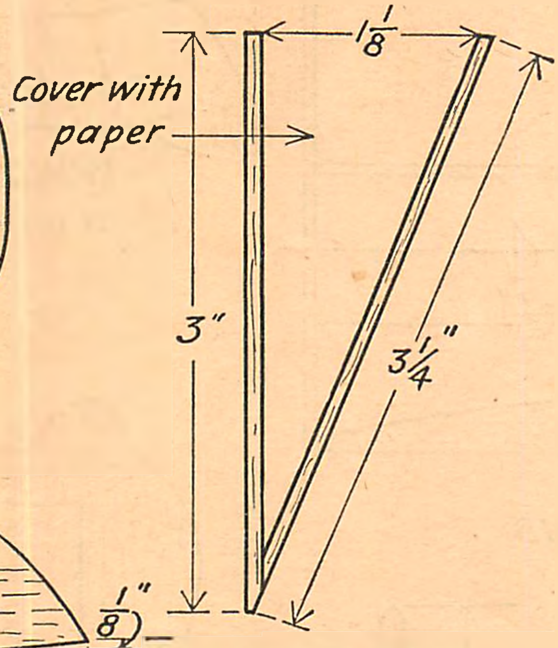
FORMER F-6



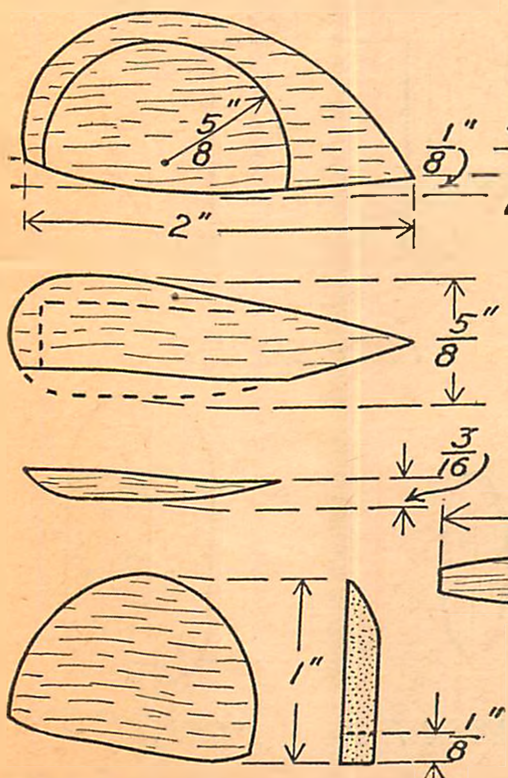
COCKPIT FORMER
Make 2



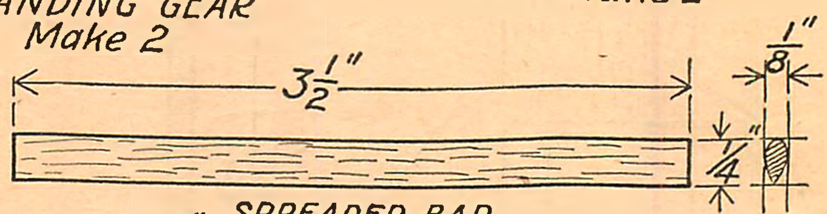
FORMER F-7



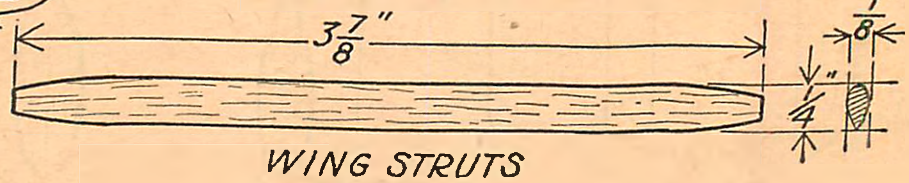
LANDING GEAR
Make 2



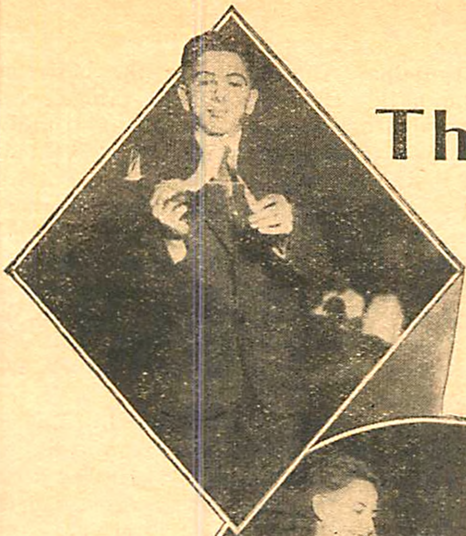
PANTS AND COVER PLATES



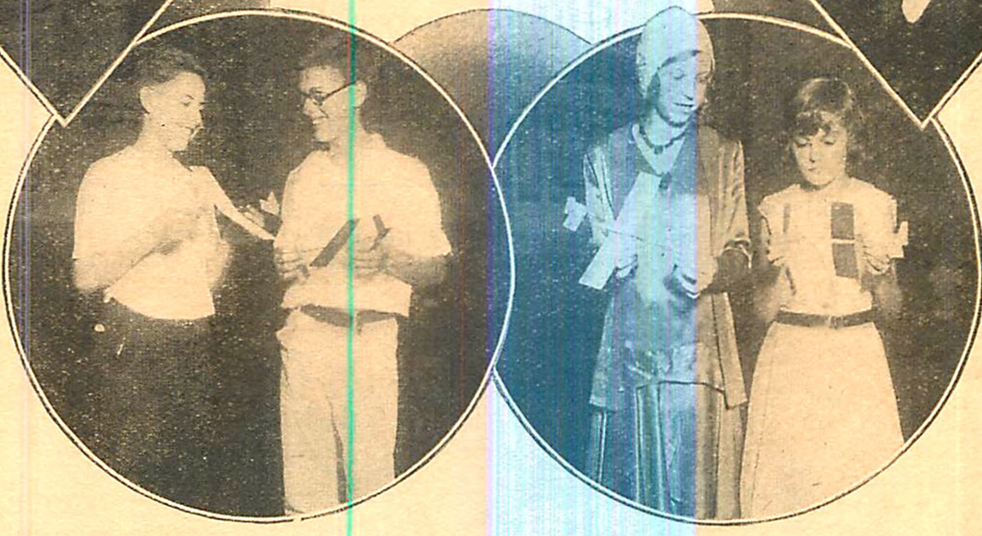
SPREADER BAR
1/4" x 1/8" Balsa, Streamlined



WING STRUTS
Make 4



The American Sky Cadets



Detroit comes forth with enthusiastic model airplane club sponsored by the *Detroit Daily*. Our photograph shows recent prize winners. Top (left) is Henry Rainey and (left to right) Vernon Hoisfield, commercial winner, Mr. J. J. Sullivan, Detroit model instructor, and George Chilles, third place. Below, left, (l to r) are Kenneth Triggs and Gordon Plexton. Below, right, (l to r) are Mary Roll, winner of girls' event, and Lillamac Price, runner-up

AT Atlantic City recently, the Fourth National Playground Miniature Aircraft Tournament was held under the auspices of the National Recreation Association, in connection with The Seventeenth National Recreation Congress.

Thirty-seven boys became eligible as the result of winning previous local contests held in their own cities and towns. Certified endurance flights were sent to the New York Headquarters and those turning in the best times throughout the country were declared eligible. The result was that some cities sent several boys to compete at Atlantic City.

Providence, R. I., and Washington, D. C., led the field by sending five contestants each, while Knoxville, Tenn., registered a close second with four. Evanston, Ill., Boston, and Philadelphia each sent three representatives, while San Francisco, Baltimore, and Topeka, Kan., sent two. Newark, N. J., Maryville, Tenn., Holton, Kan., Elmira, N. Y., Wilkes Barre, Pa., Paterson, N. J., Montclair, N. J., and Moorestown, N. J., made up the thirty-seven contestants by each sending one boy. Eighteen cities and eleven states were represented at the meet.

All the contestants were accommodated at the beautiful Haddon Hall on Atlantic City's famous Board Walk, where many of its attractions were free for them.

After a special meeting of all contestants, the boys were driven to Bader Field, where the meet started at 1:30 in the afternoon.

At the field, the contestants were divided into three groups, with two sections to each division, a junior and senior. The junior class consisted of boys under sixteen, while the seniors were over sixteen and under twenty-one. The weather was clear and windy, and the tiny models zoomed, dived, banked and did numerous tail spins, so that after it was all over, considerable wreckage covered the ground.

The outdoor meet was most exciting, though the weather hardly gave the competitors a fair chance. The first event run off was the hand launching contest. The winner in the junior division was William Hice, of Philadelphia, whose model established a sustained flight of 2 minutes and 26 seconds. Second place was captured by Guy Darst, of Knoxville, who flew his model 1 minute and 54 seconds. Third place went to Eugene Nuss, of Paterson, 1 minute and 41 1/5 seconds; fourth to Robert Bonner, of San Francisco, 1 minute and 32 seconds, and fifth place was captured by Ernest Cooper, of Providence, with a flight of 1 minute and 26 seconds.

In the senior division for the hand launched contest, first place was won by Eugene Lincourt, Providence, with a flight of 4 minutes and 43 seconds; second place by Paul Paulson, Providence, 4 minutes and 40 seconds; third by Glen Hainer, San Francisco, 3 minutes and 55 4/5 seconds; fourth by Oleg Petroff, Montclair, N. J., 3 minutes and 36 3/5 seconds, and fifth place went to Ferris Thomas, Knoxville, Tenn., 3 minutes and 4 2/5 seconds. The second event of the outdoor contest was the fuselage models, R.O.G., for both junior and

Fourth National Miniature Aircraft Tournament Results

senior classes. In the junior class, Robert Bonner, San Francisco, won first place with a sustained flight of 2 minutes and 48 seconds.

Second place went to Guy Darst with a flight of 2 minutes and 31 seconds; third to Leonard Hollis of Holton, Kans., 1 minute and 52 1/5 seconds; fourth to Frank Salisbury of Washington, D. C., 1 minute and 37 4/5 seconds, and fifth place was awarded to John Sullivan of Washington, D. C., with a flight of 1 minute and 31 seconds.

The winner of this event in the senior class was Ferris Thomas, first, 4 minutes and 21 4/5 seconds. A. N. Other was second, 3 minutes and 28 1/5 seconds; third, Paul Paulson, 3 minutes and 23 seconds; fourth, Bernard Collins, Providence, 1 minute and 45 seconds, while fifth place was given to Harold Zeitland, Boston, for a flight of 1 minute and 15 3/5 seconds.

Detroit Daily Aviation Club Grows Apace

The last event in the outdoor contest was one calling for motive power other than rubber: type of launching optional, which was run off in the gathering dusk and subsequent darkness.

These models were powered with compressed air tanks that hissed and whistled as the air escaped from cylinders attached to the wing and fuselages, rapidly turning over the propellers. As the darkness came, the fliers were aided by motorists who turned on their headlights and threw sufficient light in a semicircle to illuminate the scene.

The senior event was captured by Bernard Collins, whose "hisser" hissed for 28 1/5 seconds before it crashed to earth. Another crash followed when Richard Evans, of Maryville, Tenn., won second place with a flight of 24 1/5 seconds. Evans had a good chance to better the first place time, but he was too anxious to prevent another crash. He clipped off the deciding seconds by retrieving his entry before it hit the ground. Third place was won by Robert Loper of Topeka, Kans., whose model remained in the air exactly 20 seconds. Fourth place went to Harley Rich of Knoxville, Tenn., with a time of 15 3/5 seconds, while last place was won by Paul Paulson with a flight of 12 seconds.

The junior class of this event was won by Guy Darst in 15 3/5 seconds. Second place went to John Sullivan in 7 2/5 seconds; third place to Elliot Hood, 6 1/5 seconds; fourth to Alphonse Nathewitch, 3 seconds, and fifth place went to Leonard Hollis with 2 and 2/5 seconds. On the following day, Saturday, the indoor meet was held at the Atlantic City Municipal Auditorium in the ballroom of the convention hall. By nine o'clock, things were well under way, and progress was so swift, as to allow the dinner and the awarding of prizes to be held at noon, instead of in the evening.

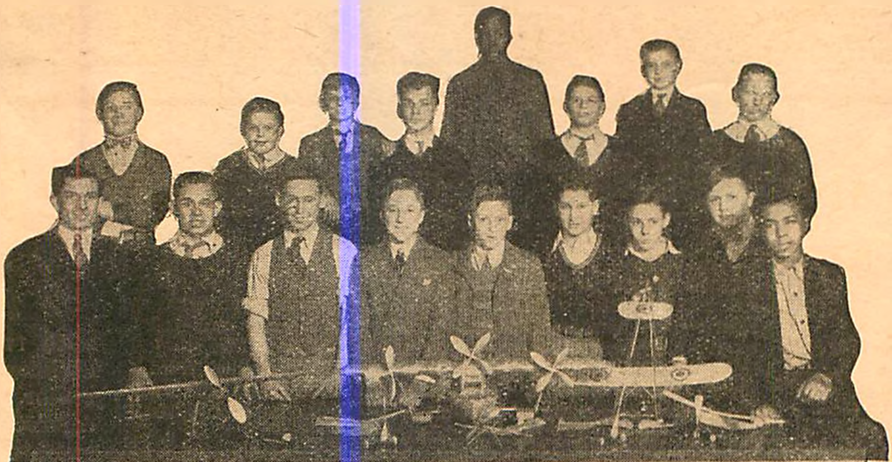
The first event was the hand launched contest for both juniors and seniors. In the senior division, Harold Zeitland of Boston, Mass., won first place when his mondel flew 6 minutes, 14 4/5 seconds, which broke the old senior record for this class of flight. Robert W. Davies, Philadelphia, was awarded second place with 5 minutes, 36 1/5 seconds.

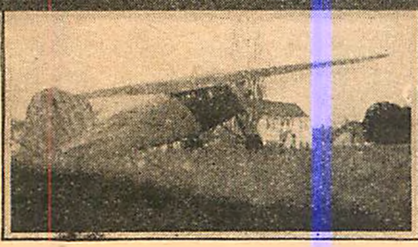
Third place was taken by Robert Loper, of Topeka, Kans., who averaged 4 minutes and 35 seconds. Harley Rich, of Knoxville, Tenn., was rated fourth with 4 minutes and 25 seconds, and Eugene Lincourt, of Providence, R. I., secured fifth place with a flight of 4 minutes, 21 and 2/5 seconds.

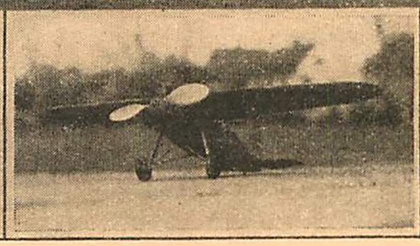
In the junior class of this event, William Hice, of Philadelphia, broke the previous record of 4 minutes and 27 seconds, established last year at Louisville, with a flight of 6 minutes, 17 and 2/5 seconds. Second place was won by Robert Bonner, of San Francisco, who also broke the old record when his model flew around the auditorium ballroom for 5 minutes and 58 1/5 seconds. Only a half second separated the winner of third place in this event when Donald Brunton, of Boston, was given a rating of 5 minutes, 32 1/2 seconds of flight. Fourth place was taken by Julius Martini, of Providence, with a time of 5 minutes and 32 seconds. The judges awarded fifth place to Alphonse Nathewitch, of Baltimore, with 3 minutes and 56 seconds.

At this point the attendants erected a miniature water hazard for the second event, which called for models rising off water. Spectators were entertained by the efforts of the future Lindberghs, who attempted to fly their model R.O.W.'s from the water.

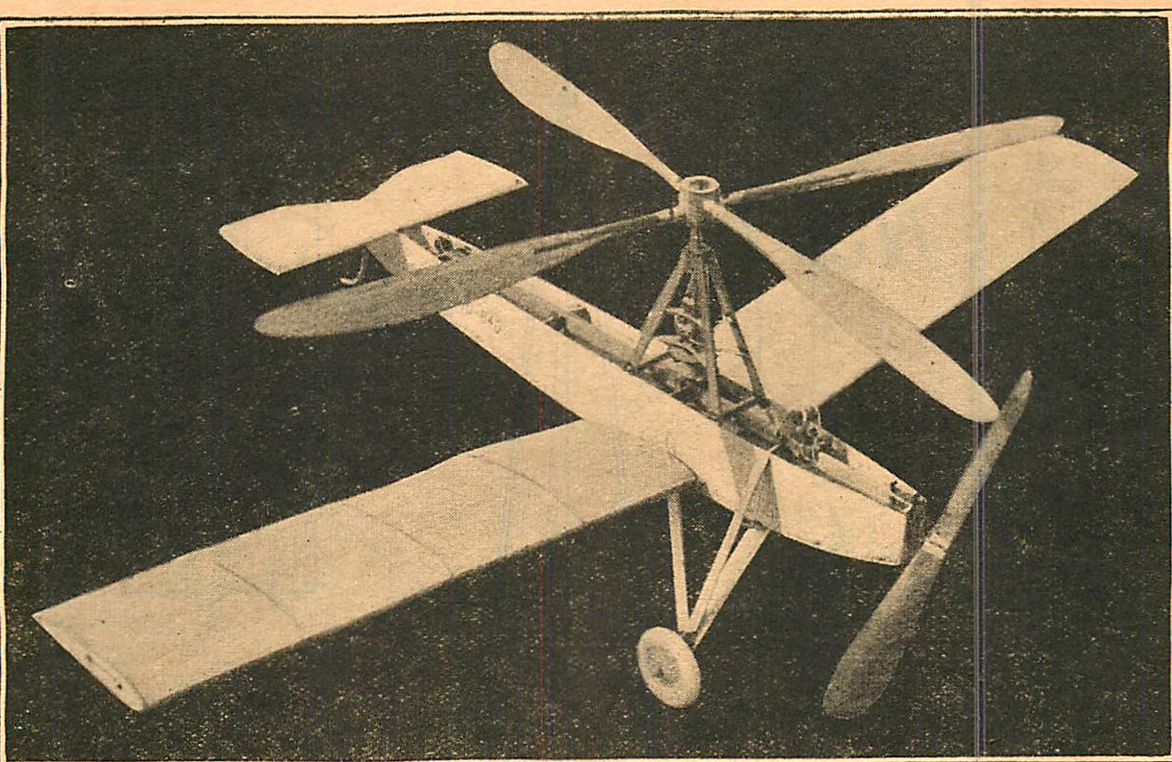
Robert Bonner captured the junior event when his model R.O.W. rapidly took off and spiraled to the ceiling, remaining in flight for 4 minutes, 40 seconds, which broke the best previous mark of 2 minutes and 32 4/5 seconds. Second place was taken by Julius Martini, whose model flew for 3 minutes and 37 3/5 seconds. Frank Salisbury, of Washington, D. C., won third place with 3 minutes and thirty seconds. Fourth place went to Ralph (Continued on page 46)







Hamilton, Ohio, Y. M. C. A. boys' department Model Airplane club, are shown above. They are, bottom row (left to right), Jess Jones, advisor, Corliss Welch, Bob Rathgens, Wilmer Weiss, Bill Leifheit, William Yeakle, John Morner, Joe Blevins, and Martin Lewis. Back row (left to right), Don Schoenberger, Don Hooven, Jr., Charles Millice, Bob Bronson, Ralph Brown, Charles Deem, Harold Schmitt, Homer Dowrey, and Calvin Fuhrman



HOW TO BUILD A MODEL

AUTOGYRO

By Prof.

T. N. de BOBROVSKY

Aeronautical Research Expert

MANY inventors in hundreds of ways have tried to solve the problem of vertical and horizontal flight without satisfactory results.

It is well at this point to stress the fact that helicopters are not to be confused with helicoplanes, nor with the *Autogyro*. In short, the helicopter is a flying machine which can fly vertically up or down and which uses propellers or some other type of surface for horizontal flight, distinctly different from those used on airplanes. In view of the fact that so much effort was made to effect horizontal flight, forward speed was impeded.

Under the classification of helicoplane is the mechanism which does not differ greatly from an airplane and which, in addition to vertical ascent and descent, flies with almost the same speed as an ordinary airplane.

The *Autogyro* is not able under normal conditions to achieve actual vertical ascent and to hover in a certain position. The "windmill" (or rotating planes) of the *Autogyro* is not driven directly by the motor and when this is the case such a machine cannot be classified as an *Autogyro*, but more as a helicoplane.

The model (known as K-10, 840) in the photograph has a four-bladed propeller which is driven by a rubber motor, as is the regulation two-bladed tractor propeller shown in front. This model clears up all the problems which could not be solved hitherto and it is my hope that all model builders will construct a flying model so that they can see for themselves how the problems which have confronted thousands of inventors have finally been solved.

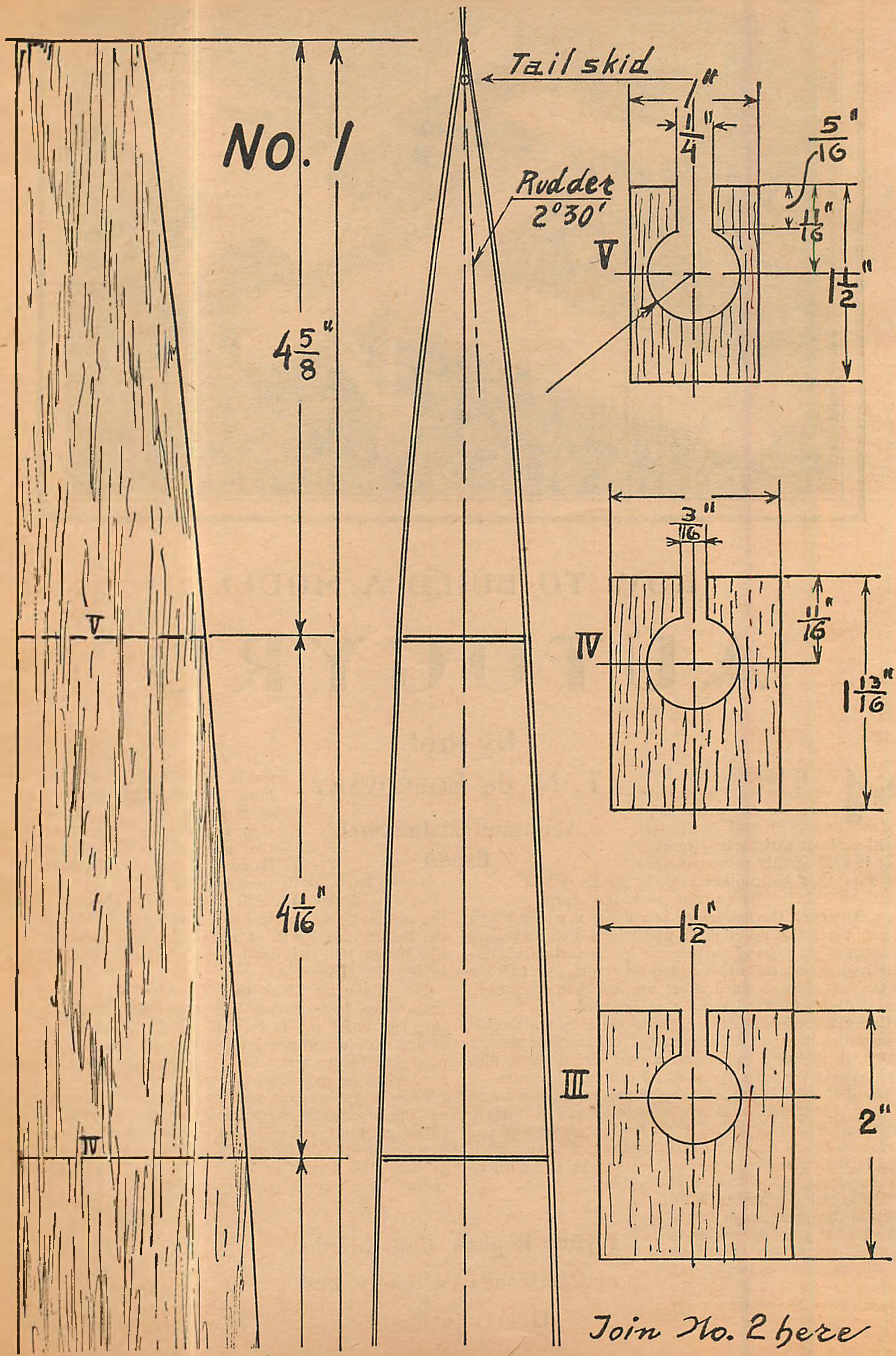
I should like to point out that this model and the automatic mechanism is my own patent, though not the helicoplane itself. I tested the first model before the World War but used some of the theories on my later types of models.

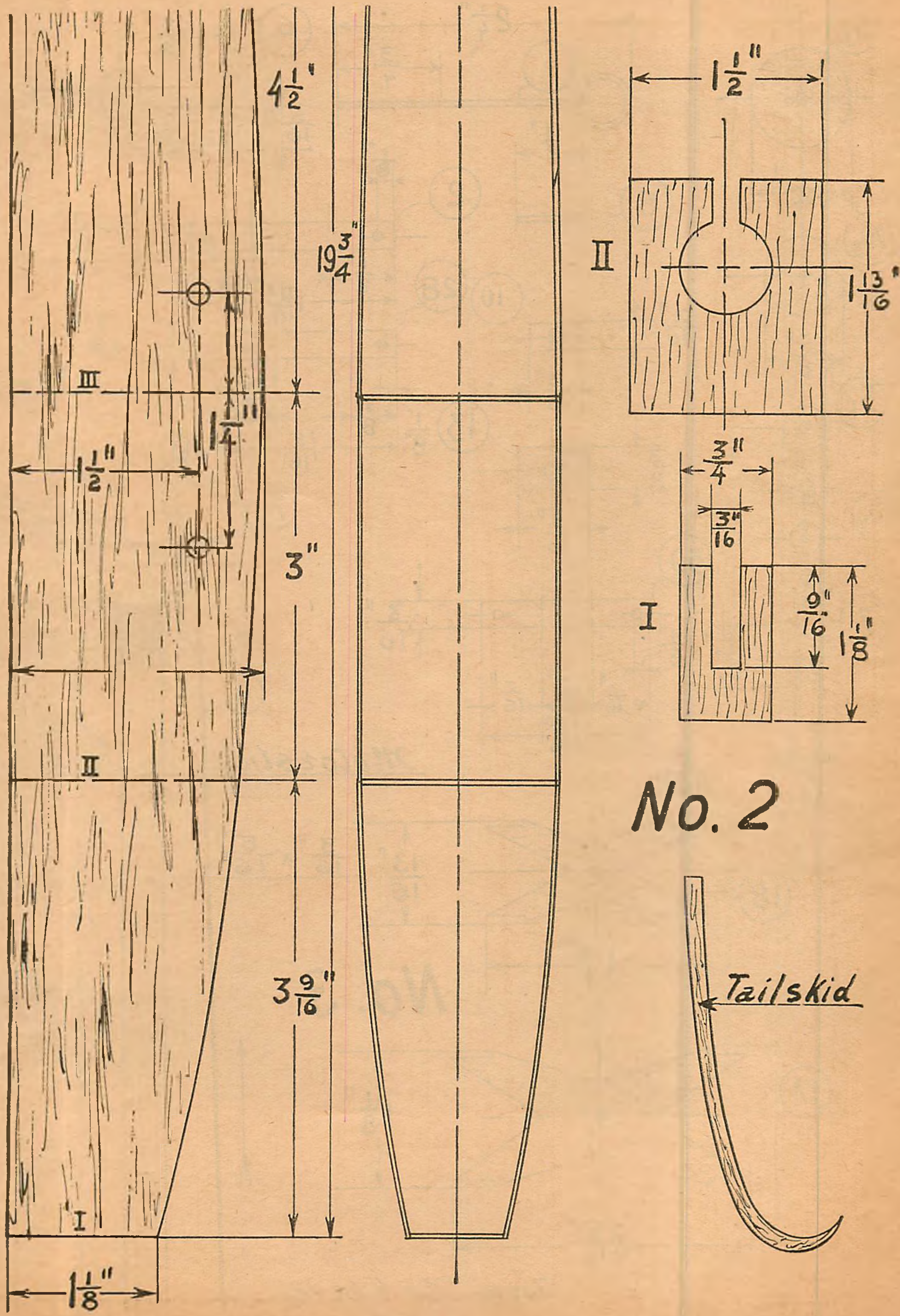
This plane may look complicated at first sight but the average boy who has had some flying model experience can build it. It is well worth the effort to construct such an unusual model which has never been published before and which is a development of intensive scientific experiment.

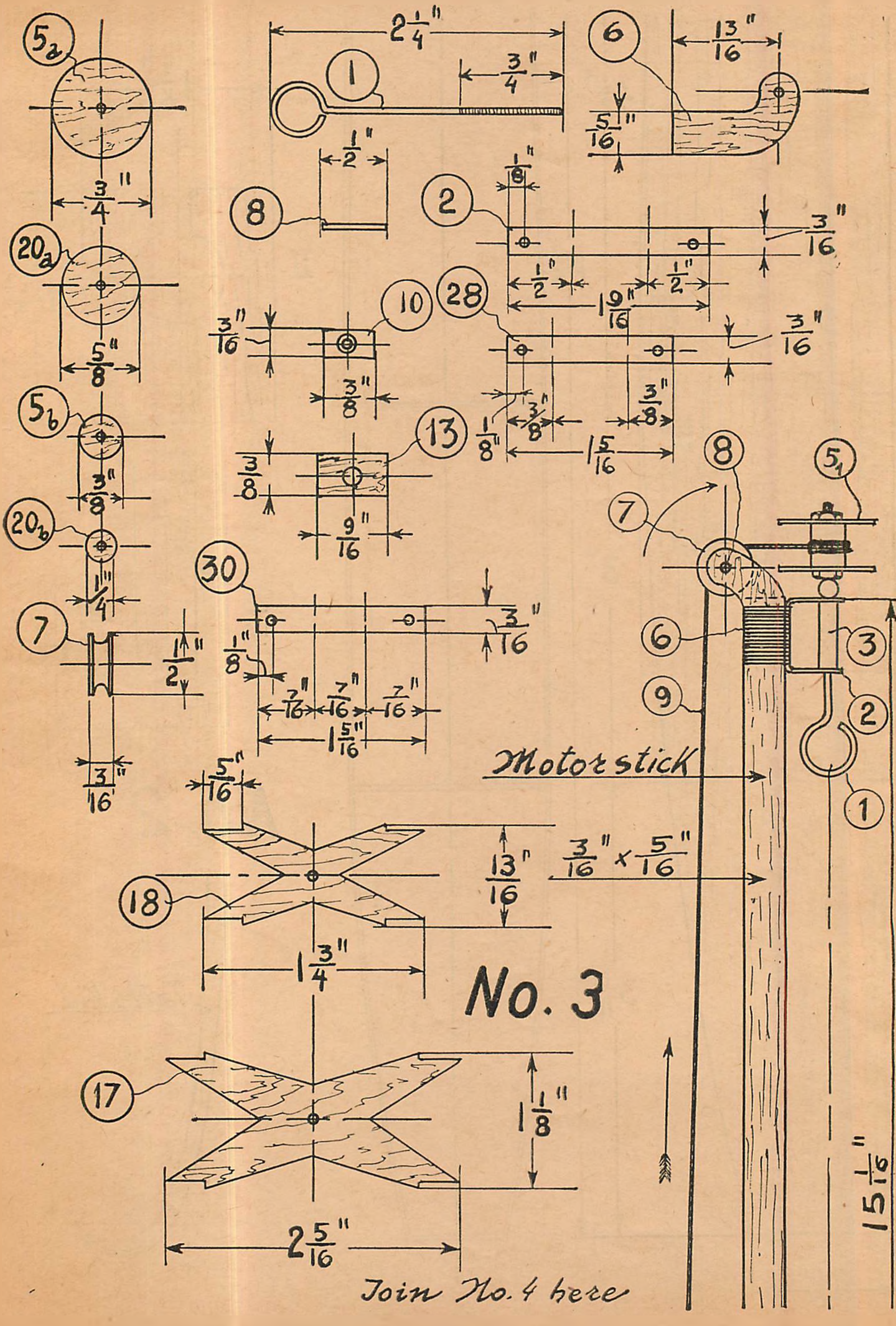
Now let us examine our model closely. As you can see, the fuselage is normal and does not differ in structure from the fuselage in conventional types of models. The upper side of the fuselage is purposely uncovered to show the details of the mechanism. It should, of course, be covered in your own model.

Flying Replica that Climbs and Descends Vertically, and Hovers in Flight

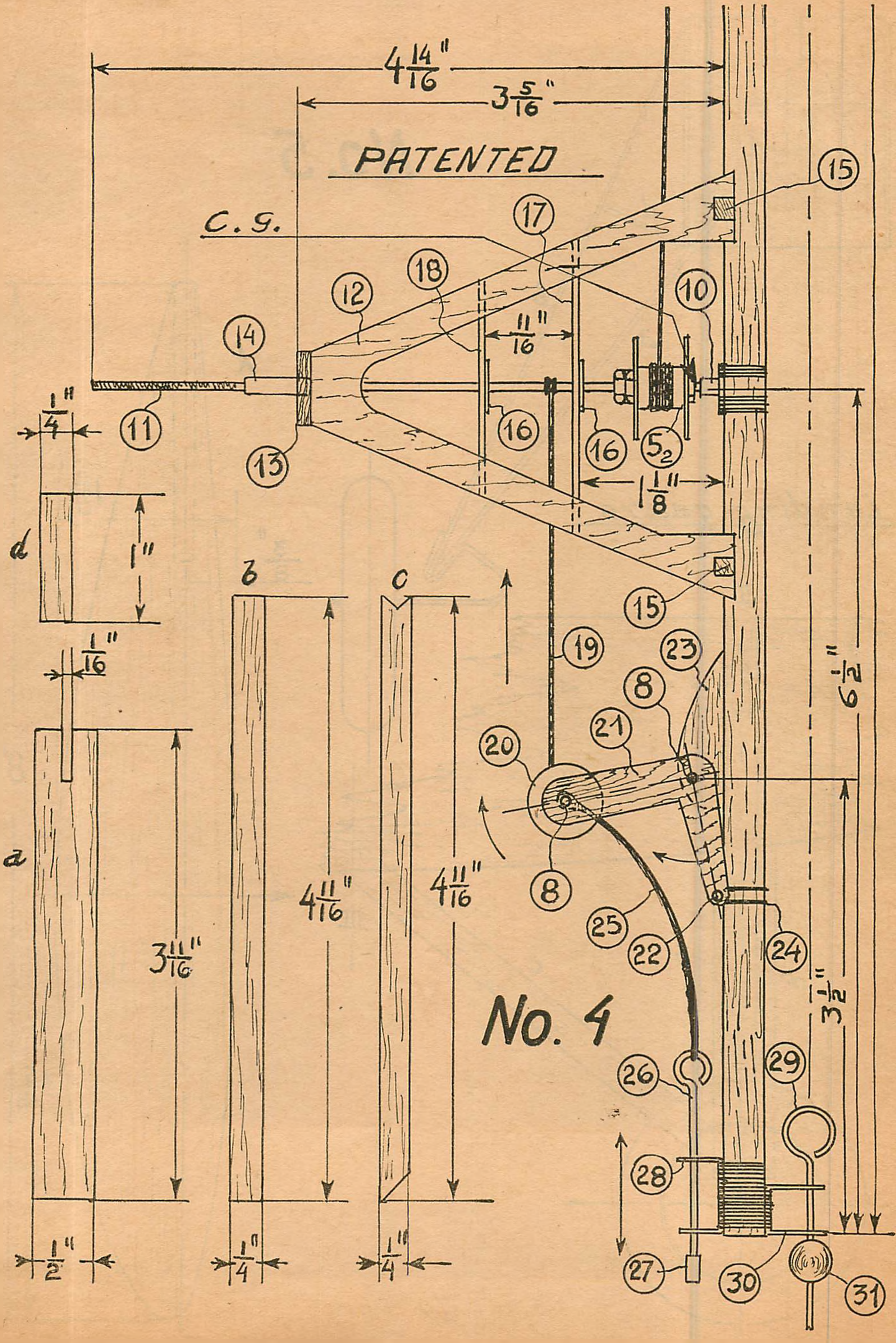
A tractor type propeller is fitted to the nose, and the tail group is normal. The general outline is of a low wing monoplane. The landing gear is normal except that it has a larger tread than used on other (*Continued on page 47*)


NO. 1
Tail skid
Rudder 2°30'
1"
1/4"
5/16"
11/16"
1 1/2"
V
4 5/8"
3/16"
IV
11/16"
1 13/16"
4 1/16"
1 1/2"
III
2"
Join No. 2 here

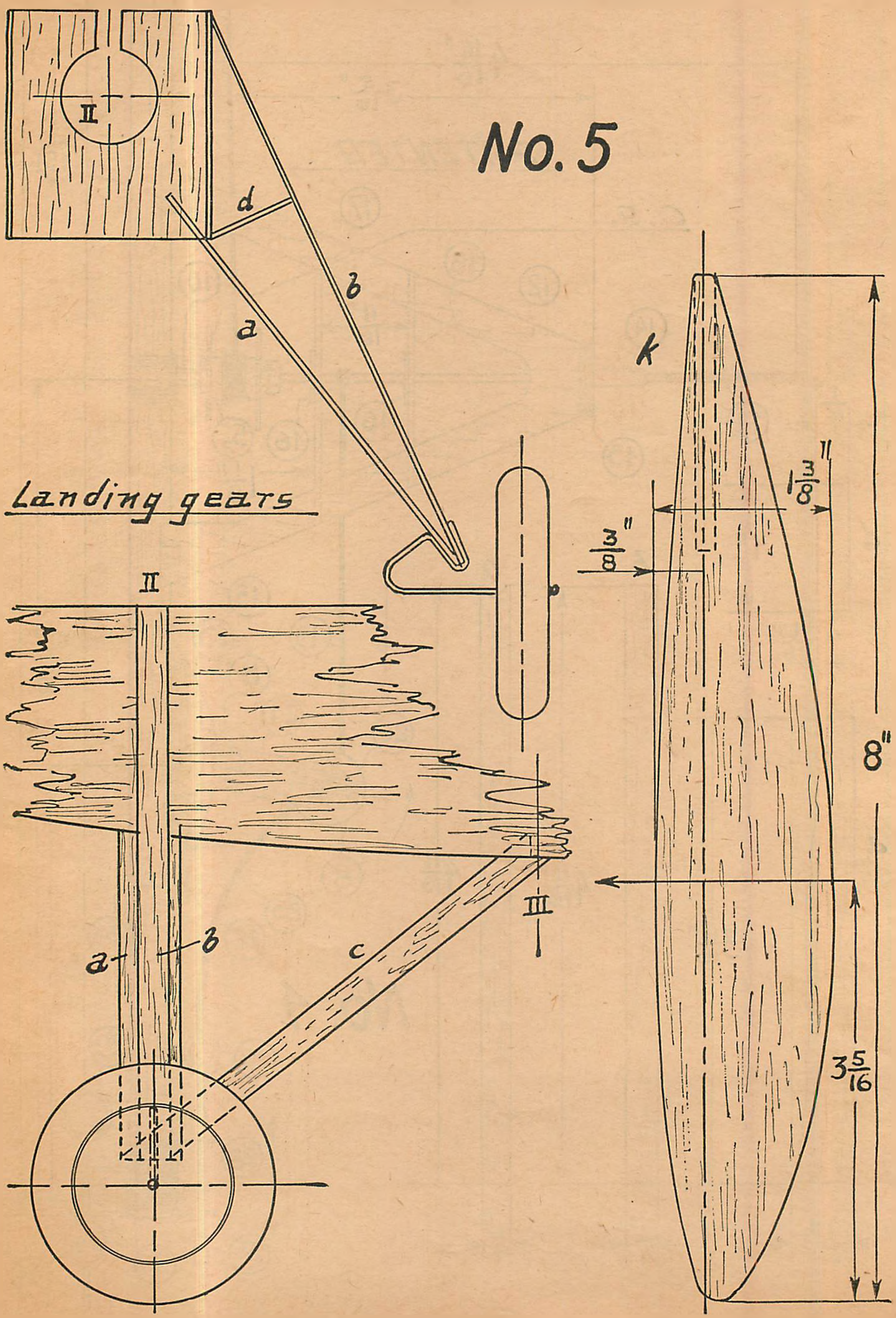

4 1/2"
19 3/4"
III
1 1/4"
1 1/2"
3"
II
3 9/16"
I
1 1/8"
1 1/2"
II
1 13/16"
3/4"
3/16"
I
9/16"
1 1/8"
No. 2
Tailskid

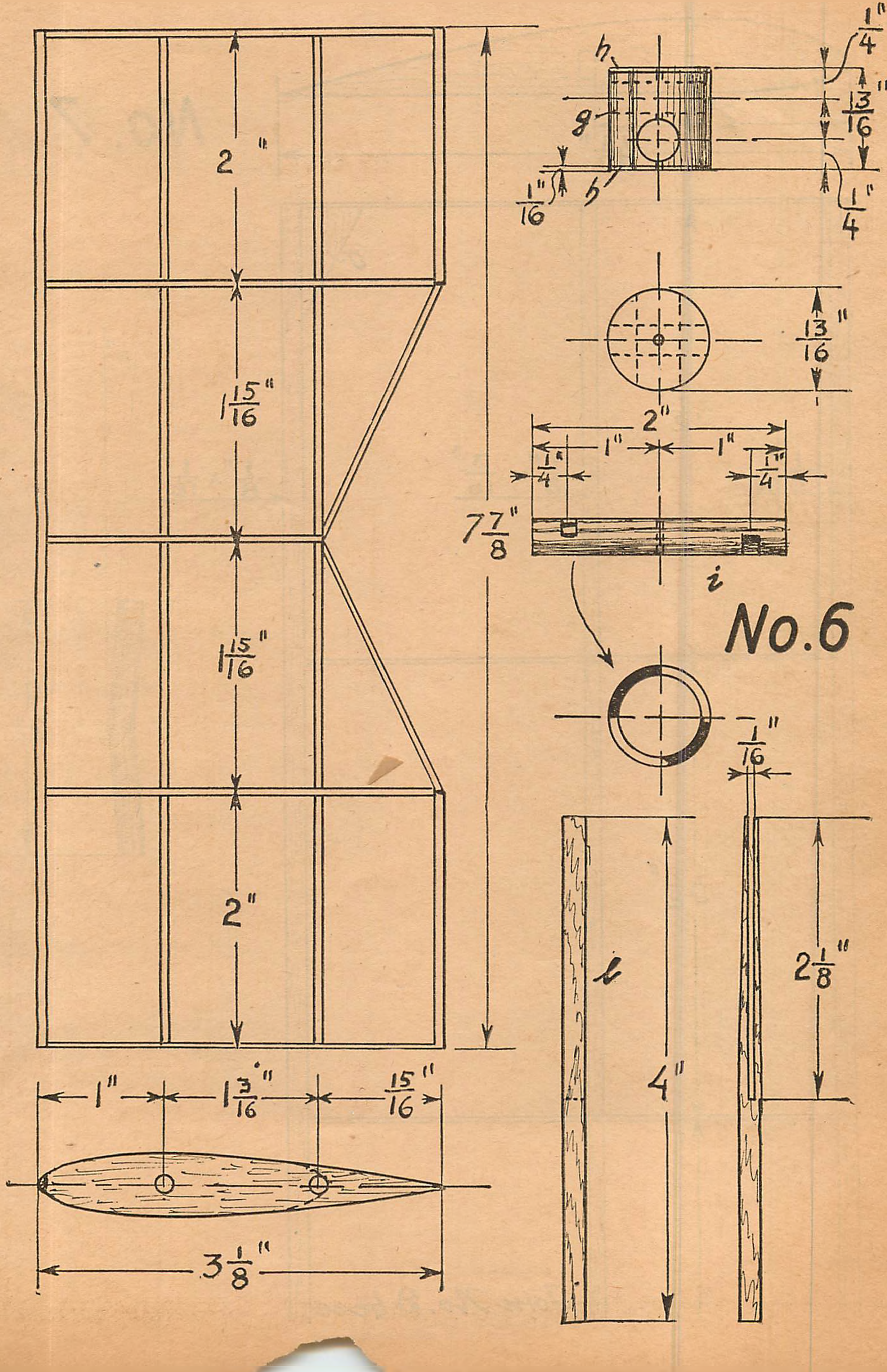


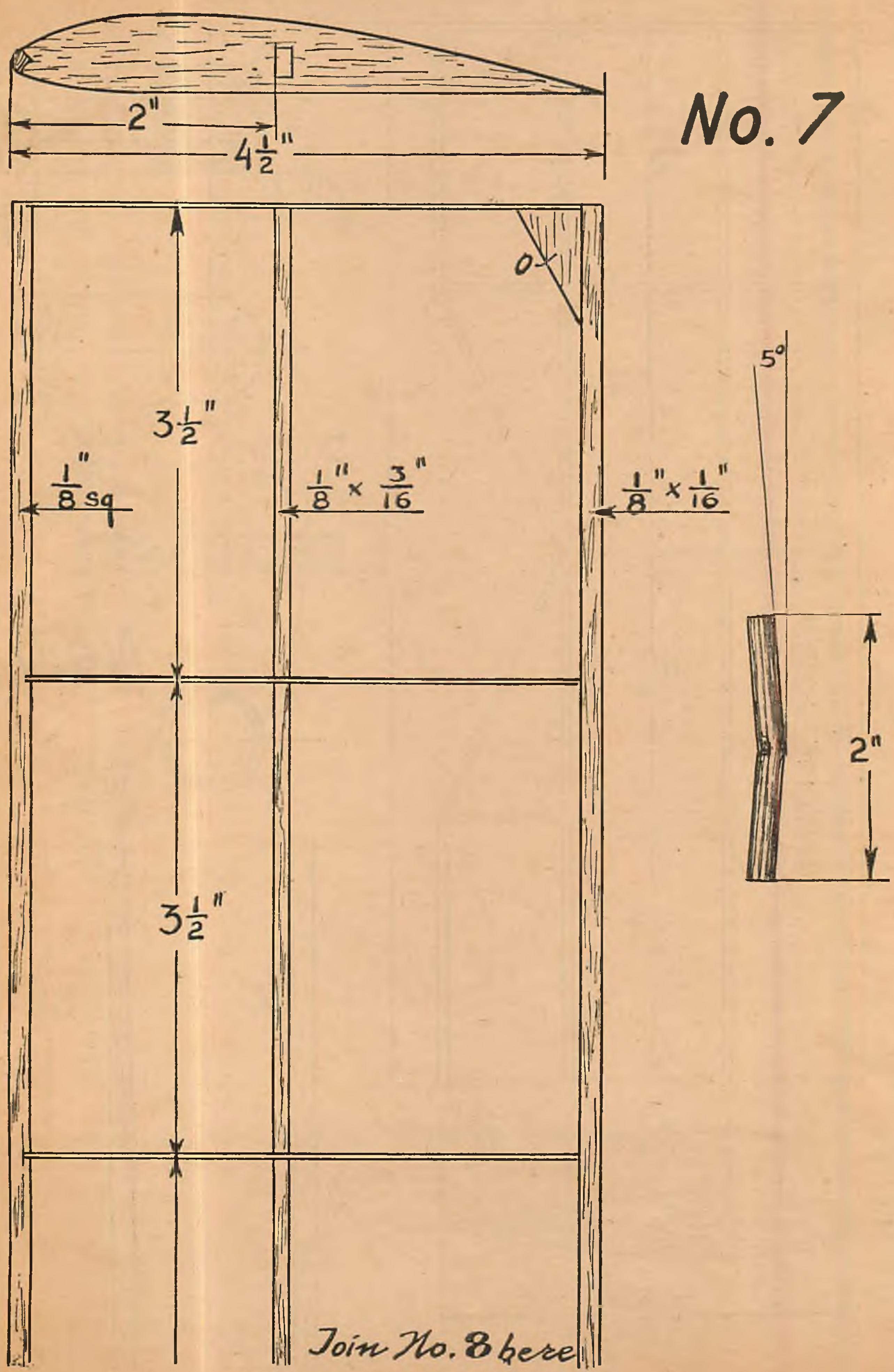
5a
3/4"
20a
5/8"
5b
3/8"
20b
1/4"
7
1/2"
3/16"
1
2 1/4"
3/4"
8
1/2"
6
13/16"
5/16"
2
1/8"
3/16"
1/2"
1/2"
1 9/16"
10
3/16"
3/8"
28
3/16"
3/8"
3/8"
1/8"
1 5/16"
13
3/8
9/16"
30
3/16"
1/8"
7/16"
7/16"
7/16"
1 5/16"
8
5₁
7
6
3
9
2
Motor stick
1
5/16"
18
13/16"
3/16" x 5/16"
1 3/4"
No. 3
17
1 1/8"
2 5/16"
15 1/16"
Join No. 4 here

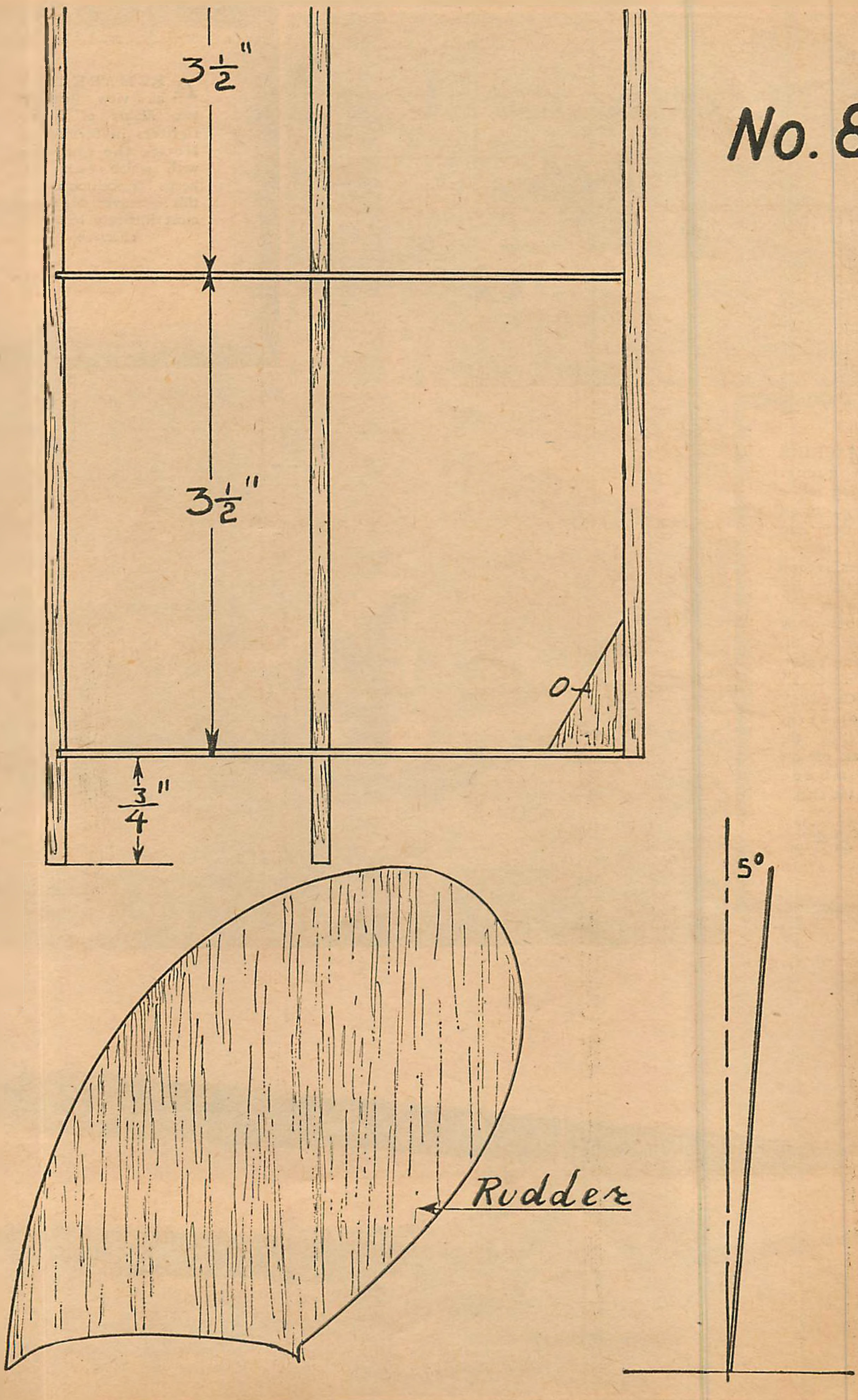

4 14/16"
3 5/16"
PATENTED
C. G.
15
17
18
12
10
14
11
1/4"
13
16
16
5₂
1 1/8"
11/16"
d
1"
b
c
15
19
23
8
21
20
8
25
22
24
1/16"
a
3 11/16"
4 11/16"
4 11/16"
6 1/2"
3 1/2"
No. 4
26
29
28
27
30
31
1/2"
1/4"
1/4"

No. 5




2"
1 15/16"
1 15/16"
2"
7 7/8"
1"
1 3/16"
15/16"
3 1/8"
h
g
b
1/16"
1/4"
13/16"
1/4"
13/16"
2"
1"
1"
1/4"
1/4"
i
No.6
1/16"
l
4"
2 1/8"


2"
4 1/2"
No. 7
3 1/2"
3 1/2"
1/8" sq
1/8" x 3/16"
1/8" x 1/16"
5°
2"
Join No. 8 here

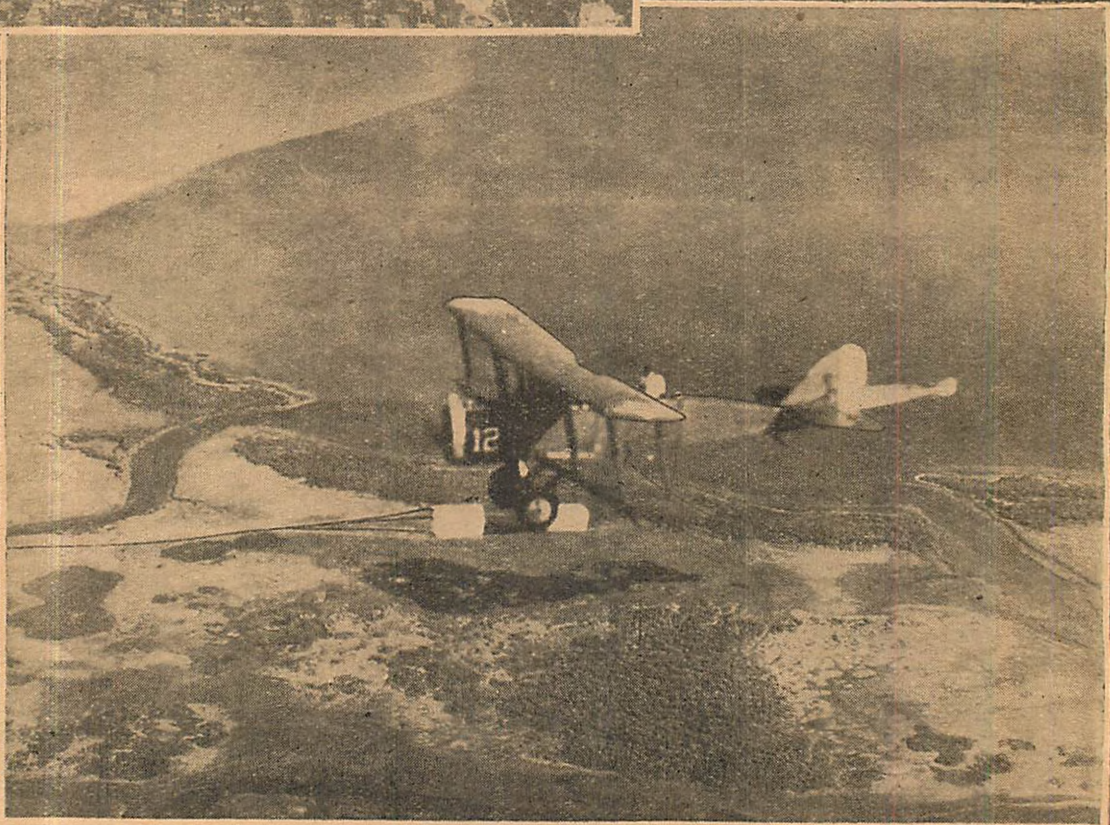

No. 8
3 1/2"
3 1/2"
3/4"
0
5°
Rudder

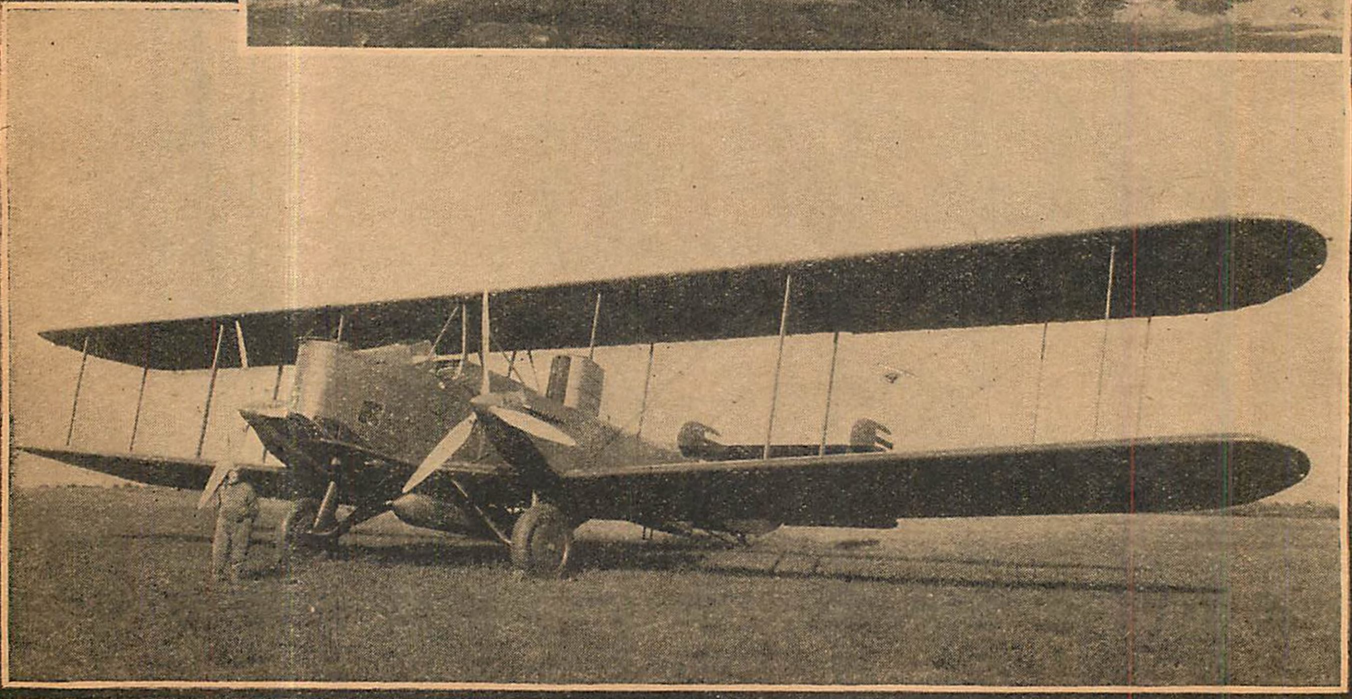
A REMARKABLE air view (left) of two flights of Boeing fighters in formation. Notice the precision with which each pilot keeps his position during this maneuver, one of the most intricate but most effective

Courtesy U. S. Army Air Corps

MACHINE gunner firing at a towed target during recent air maneuvers is shown at right. Below is seen close-up of one of the Army's giant Curtiss "Condor" bombers. Notice the size of the bomb and the man

Courtesy U. S. Army Air Corps





Special Course in Air Navigation

The Mainstay of Successful Piloting

By

Captain

LESLIE S. POTTER

IN this series of articles, the author has endeavored to set out as clearly as possible, and in as simple words as possible, the art of navigation in the air.

Your interest in these will depend on your interest in flying, and whether you will consider yourself a pilot when you have learned to take a plane off the ground and bring it down again without breaking anything.

To those who do, these articles will be valueless, but to those who aspire to be more than fair weather pilots, to be able to fly from place to place without sole recourse to roads and railways, to be able to fly above the clouds with safety if they are too low to admit of safe flying beneath them, an intelligent interest in these articles will be of incalculable value.

If some of the points seem too elementary, do not pass them by, there is a reason for their inclusion; if some points do not seem clear, be patient, you will generally find some information further on that will clear them up as you proceed. Answer the questions at the end of each article and wait for their solutions in the next issue, and should you find any points requiring further explanation, send a letter with a stamped addressed envelope to the editor setting out your problems and a reply will be sent you explaining the points raised.

THE EDITOR.

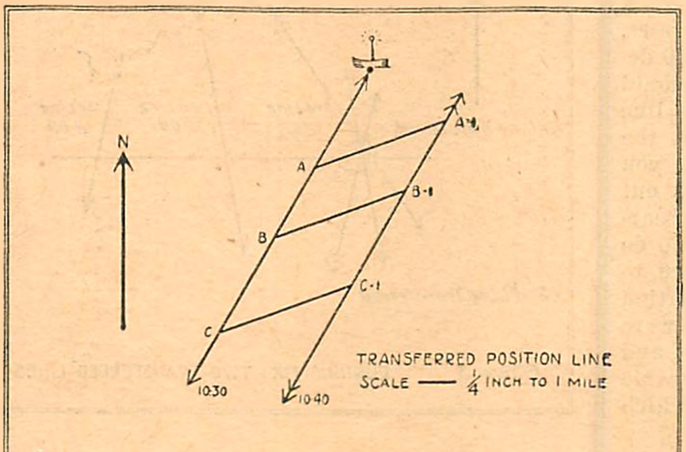


Figure 1.

IN the first article of this series an explanation of the definition "position line" was given, but for the benefit of those who may have missed it, a position line is a line obtained from the bearing from an airplane on some object on the ground, when it is known that the airplane must be somewhere on this line.

Obviously the object of every navigator—whatever means he may adopt to achieve this object—is to know his position as accurately as possible at any time during a flight, and as an aid to this, position lines are often invaluable. The easiest way of locating your position is when you fly over some object on the ground which you can pin-point on the map, but often you will find that this is not possible.

You may think that if you recognize some object in the distance from which you can draw a position line, you already have a sufficient accurate knowledge of your position without requiring anything further. However, it may happen that you have set your course for a destination and that your course lies over mountainous regions, or desert or sea, where it will be highly desirable for you to be able to pin-point your position with accuracy during the flight and to see what track you are making good. Since position lines are obtainable by wireless bearings as well as visual bearings, these are also of the greatest value when flying through cloud, fog or mist.

POSITION lines from visual bearings are obtained with the aid of either a bearing plate or a bearing compass and their object is to obtain a fix from the intersection of two or more of them. Owing to the accuracy required, it will not generally be practicable for this method to be adopted except in ships where a navigator or a co-pilot is carried.

Maps or charts should be carried inside celluloid covers so that lines or markings may be drawn over them without injury. Bearings should not be taken on objects too far away, as the farther away an object is the greater will be the result of any error. Before you take a bearing be sure that the object on which you are taking it is marked on the map, and remember that the bearing you get will be that of the object from you; when you plot it out on the map or chart you must add or subtract 180 degrees so as to

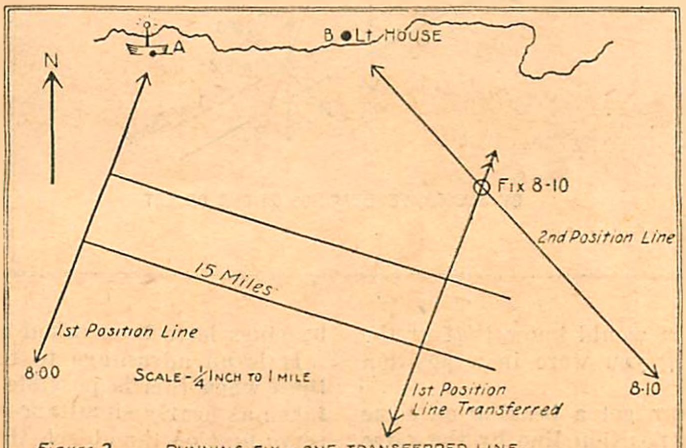


Figure 2 RUNNING FIX - ONE TRANSFERRED LINE

get your bearing from the object, whatever it may be.

When you obtain bearings with either bearing compass or bearing plate an allowance must always be made for the deviation applicable to the course you are steering. *The position lines you draw on your map must be true bearings.*

Suppose you took a bearing on some object with your compass while you were steering a course of 180 degrees, and found it to be 90 degrees. Before you could draw this position line on your map from the object in question, you would have to work out the reciprocal true bearing of 90 degrees. To do this you would have to allow for the deviation of the course you were steering, 180 degrees, and the variation applicable to the locality in which you were in.

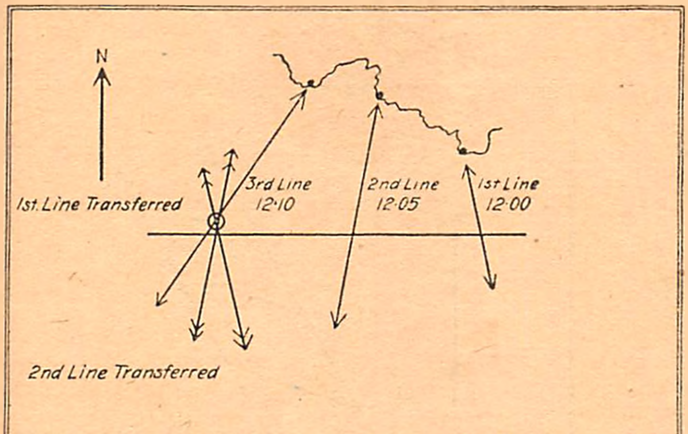


Figure 3 RUNNING FIX - TWO TRANSFERRED LINES

In the following example the compass bearing of an object from your plane is 250 degrees. You find that when you took this bearing you were steering a course of 150 degrees. The variation in that locality is 20 degrees west, and according to your deviation card, the deviation on 135 degrees is +2 and on 180 degrees —3. What should be the bearing of the position line you would plot out from the object?

Deviation on 135°	+2
Deviation on 180°	—3
Change in deviation between 135° and and 180° (45)	=5° decrease
Change in course between 135° and 150°	=15°
Change in deviation between 135° and 150°	15 / =45×5
	=2 nearly
Hence deviation on 150	=+2 —2
	=0

The magnetic bearing of your compass bearing of 90° will still be 90°, since there is no deviation	90°
Deduct westerly variation	20°
True bearing	70°
To obtain reciprocal bearing	180°
Reciprocal bearing. (True)	250°

So that having got your bearing of 90 degrees with your bearing compass, you would draw a position line at an angle of 250 degrees from the object, having worked it out as shown in the example above, and you would know that at the moment you took the bearing you were in a position somewhere on that line.

If at the same time you can get a bearing on some other object and work out a position line by the same methods, you will know, having drawn them on the map, that the place where they intersect each other is your position at that moment.

The objects on which bearings are taken must be so selected where possible, that the position lines cut each other at angles of 90 degrees, as no reliance can be placed on a fix where the lines meet at an angle of less than 30 degrees.

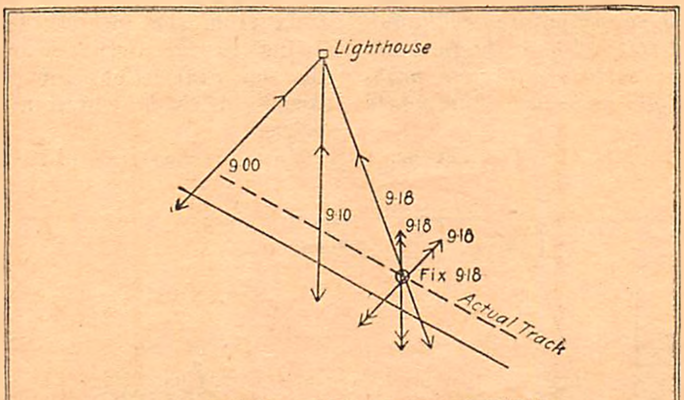
Position lines should be drawn with single arrow heads at each end and it is always of the utmost importance to write the exact time you took the bearing against each line.

It sometimes happens that at the time you take a bearing there is no second object on which you can take another observation and so get a fix. In these circumstances, provided you know your track and your ground speed, you can transfer the first position line.

A transferred position line should be distinguished by two arrow heads at either end, and the distance between a direct and a transferred position line is called the run. It is not recommended to transfer position lines where this can be avoided, since the track and the ground speed are rarely accurately known, and the reliability of any position line transferred for a considerable distance can be reckoned as very slight.

IN Figure I you got a bearing on a lightship of 30 degrees at 10.30 and plotted out a position line on your map accordingly. There was no other object on which you could get a bearing at that moment, but 10 minutes later there was and so you transferred your position line. Your estimated track and ground speed at that time were 70 degrees at 90 miles per hour.

In 10 minutes you will have traveled 15 miles, so you draw two or three lines, 15 miles to scale in the direction of 70 degrees, from your first position line,—A.A1, B.B1 and C.C1 in the diagram,—and then connect these up with a line parallel to the first position line. Ten minutes later therefore you are somewhere on the new position line A1, C1. and here then is your transferred position line.



BY SUCCESSIVE BEARINGS ON ONE OBJECT

Figure 4

Fixes. It has already been explained that the point of intersection of two or more position lines constitutes a fix, and if any of the position lines have been transferred, it is called a running fix. The best results in plotting fixes are always obtained when bearings have been taken on objects ahead and abeam.

It is an advantage to take more than two position lines when this is possible and the bearings should be taken as nearly simultaneously as possible. Always observe first on the object, the bearing of which is changing most rapidly. When three (*Continued on page* 38)

AVIATION ADVISORY BOARD

Conducted by Capt. H. J. LOFTUS-PRICE

"SAY, how can you pilots tell your friends when you get to scrappin' 'way up in the air?"

This question was asked at a large airport on the Pacific Coast, where practically all the fighting units of Uncle Sam's Army Air Corps were assembled in an organization known as the Provisional Wing. They were demonstrating to the people of a Southern California city how the Air Corps operates, how the various planes fly and fight, and what the highly trained pilots can do with their machines in the way of combat, formation, bombing, and other types of flying for which the planes are designed and built.

On a tower near the Administration Building of the airport, two tensely busy officers alternated in watching the planes and broadcasting to the crowds a description of these planes and the meaning of their bewildering evolutions. First on the program were the planes of the 3rd Attack Group, demonstrating how Attack planes would "strafe" ground troops. The whole array of 150 participating aircraft had taken off from the field and retired to some distant point.

Suddenly over the treetops—"hedgehopping," to use an air term—swooped a formation of nine planes at full throttle. On their flanks they all bore the same design. Speeding up to their maximum of 151 miles an hour, they dove at the field, not ten feet off the ground, and in a twinkling they were gone, being in view not more than a few seconds.

However, the officers at the "mike" had spotted the designs and over the loudspeaker came the announcement:

"Attack planes of the 8th Squadron!" Then, as another formation swept past, coming from the direction the others had departed, the loudspeakers rumbled: "——followed by those of the 13th Squadron." After a momentary pause, during which a third group of planes swooped from nowhere and were gone in a screaming dive; "——and then by those of the 90th Squadron."

To the onlookers the Attack planes all looked alike. In fact, the announcement conveyed the information that they were all Curtiss "Falcons". That the announcer knew in advance the sequence of the attacking squadrons and could so announce them was quite possible. Later, however, when one among the 75 Pursuit planes then in the air came down because of motor trouble and the announcer called its squadron as it taxied to the line, the average spectator doubtless was puzzled to know how the ship was identified so readily.

When all planes were once more parked on the field after the demonstration, a closer inspection was made by many of the spectators. From a distance every plane of the type looked exactly alike. For instance, one Boeing Pursuit plane looked like another, as did a Curtiss "Hawk". One Keystone Bomber looked like another Keystone Bomber. One Attack plane looked like another—or did they really? What was that spot on the side of the body, or fuselage, of the Attack plane parked at that end of the line that made its appearance differ from that of an Attack plane parked elsewhere on the field? Why should that mark on the nose of one Bomber differ so from the mark on another Bomber's nose?

"INSIGNIA," laconically explained one of the leather-jacketed flyers. "Each Group and each Squadron within a Group has its distinctive insignia. Each flying officer, in fact, has his squadron insignia painted on the breast of his leather jacket. That's so the squadron commander can quickly call his men about him for a conference before taking off.

"See this?" pointing to a bomb-throwing pirate realistically poised in paint on his jacket. "That's the insignia of the 20th Bombardment Squadron, the best outfit——"

"Yeah, after the 96th!" cut in another sun-tanned airman. "Here's ours," and he pointed to a nose-thumbing, bomb-clutching devil all in vivid red.

This sounded fine. Seeking more information, the inquirer was obligingly escorted on a tour of the parked planes by the pair of friendly rival aviators. Insignia, it was soon learned, stood for something besides just a means of identification. Each design represented either the duty engaged in by the outfit that bore it or the achievements of that outfit, and sometimes both. They might be beautiful, artistic, grotesque, formal, or almost ribald, but they all had a meaning.

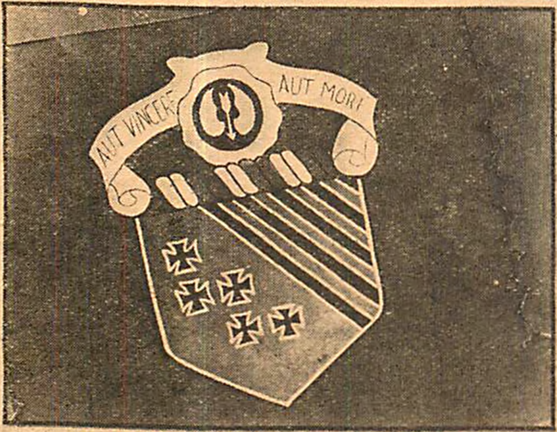
Usually only one plane had the insignia of the Group, a Group being composed of one or more squadrons. This was the Group Commander's (*Continued on page* 46)

THE Aviation Advisory Board will endeavor to answer questions concerning model building and aviation in general, where the questions do not apply to contests being conducted by this or other publications. Address all questions to

The Aviation Advisory Board,
MODEL AIRPLANE NEWS
25 West 43rd Street
New York City

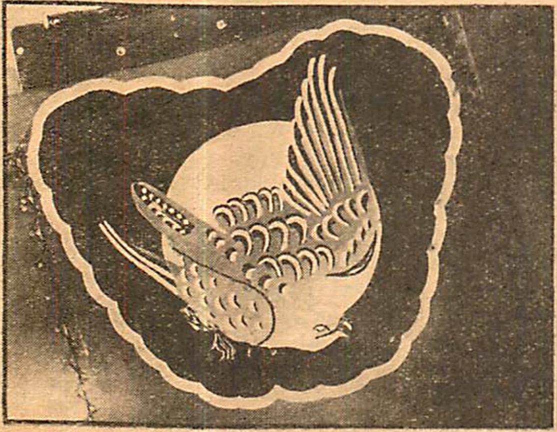
Enclose with your letter a self-addressed and stamped envelope to facilitate an answer. Space is limited and all letters can not be answered in these pages.

INSIGNIA OF ORGANIZATION OF 1st PURSUIT GROUP SELFRIDGE FIELD, MT. CLEMENS, MICH.



1st PURSUIT GROUP

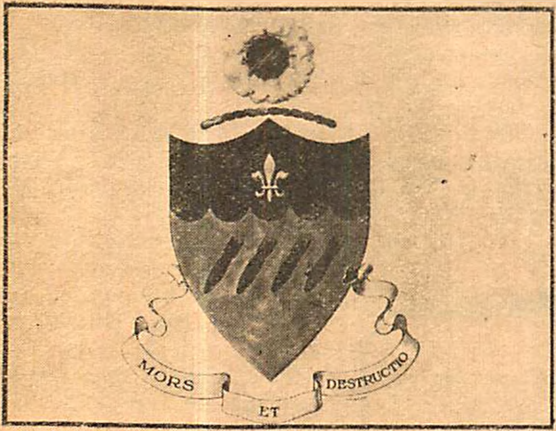
17th PURSUIT SQUADRON



27th PURSUIT SQUADRON

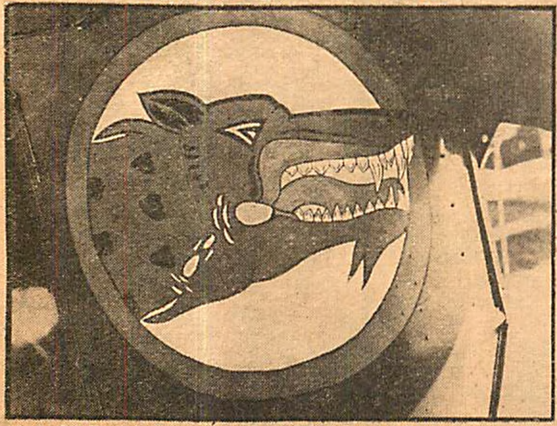
94th PURSUIT SQUADRON

INSIGNIA OF ORGANIZATION OF 2nd BOMBARDMENT GROUP LANGLEY FIELD, VA.

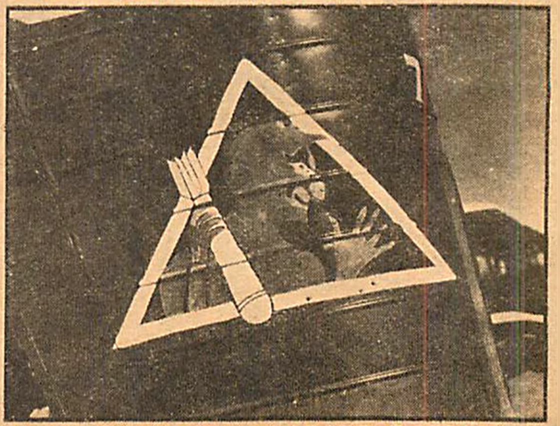


2nd BOMBARDMENT GROUP

20th BOMBARDMENT SQUADRON



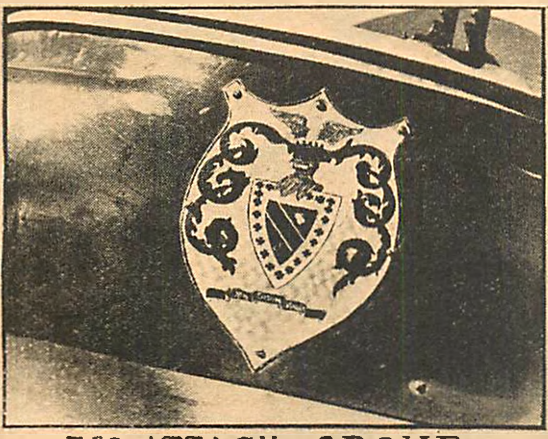
49th BOMBARDMENT SQUADRON



96th BOMBARDMENT SQUADRON

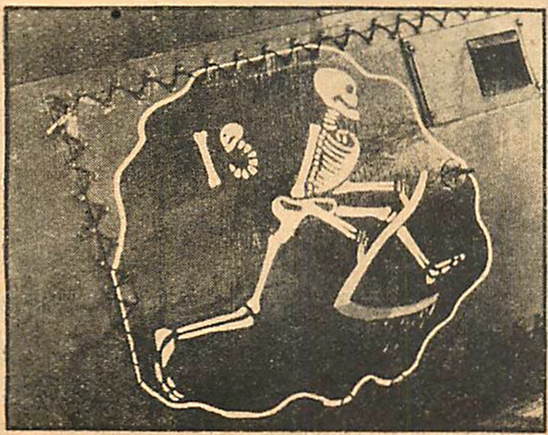
(Photo Courtesy U. S. Army Ai

INSIGNIA OF ORGANIZATIONS OF THE 3RD ATTACK GROUP FT. CROCKETT, GALVESTON, TEXAS

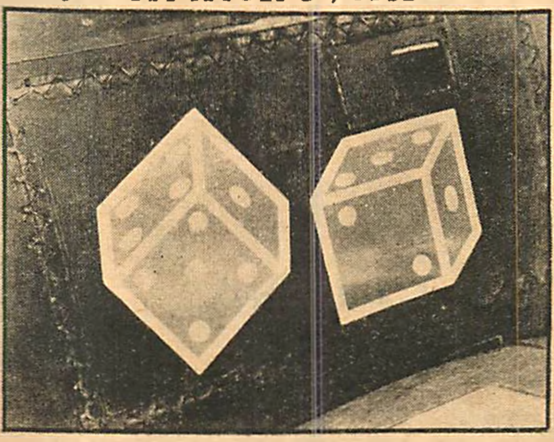


3RD ATTACK GROUP

8TH ATTACK SQUADRON

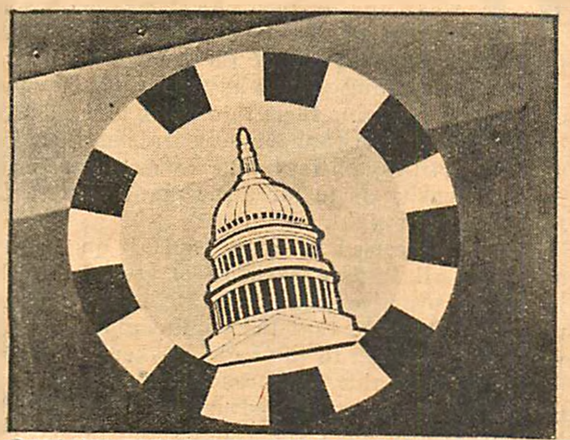


13TH ATTACK SQUADRON

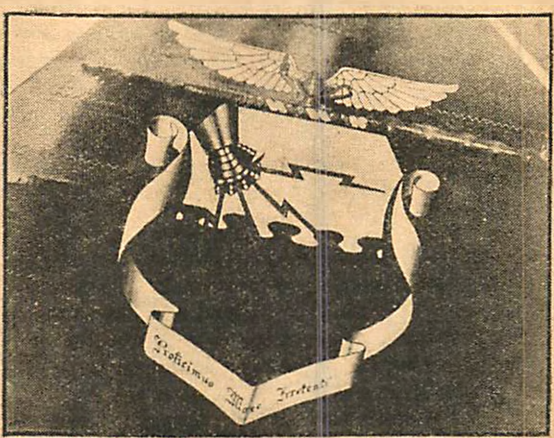


90TH ATTACK SQUADRON

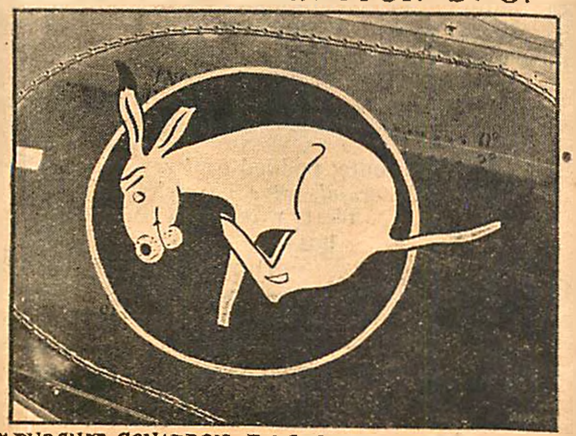
AIR CORPS INSIGNIA



BOLLING FIELD WASHINGTON D. C.



AIR CORPS TACTICAL SCHOOL, LANGLEY FIELD, VA.

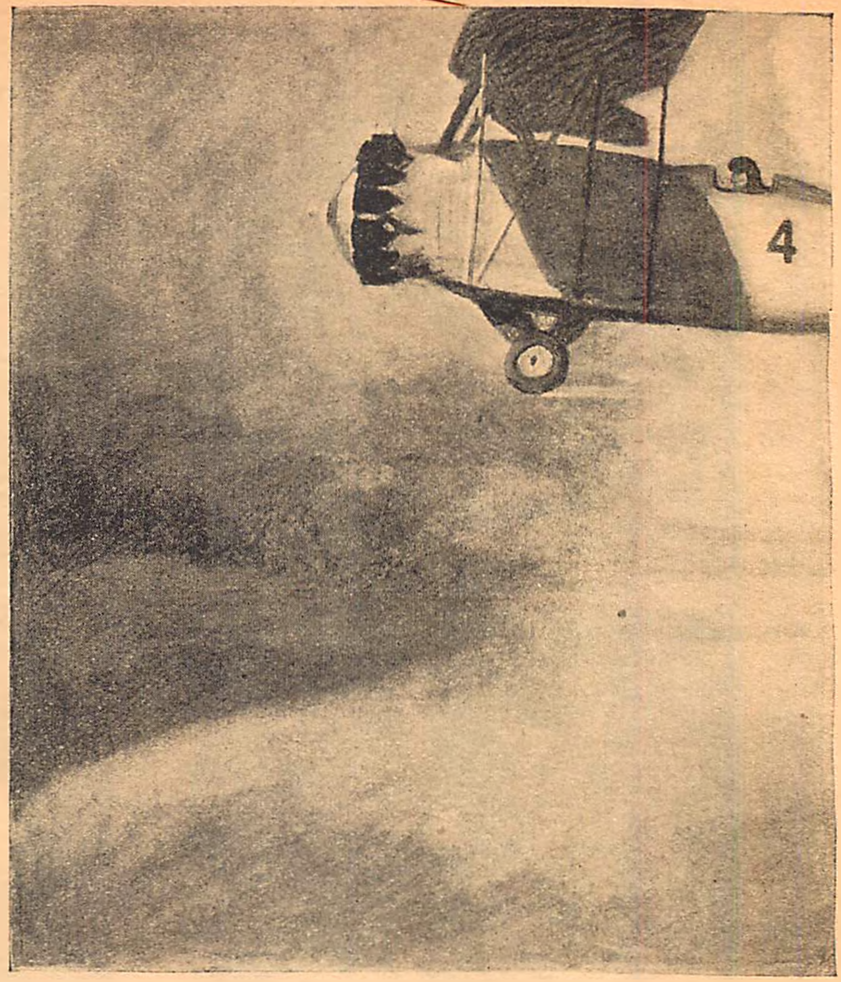


95TH PURSUIT SQUADRON. ROCKWELL FIELD, CAL.

11TH BOMBARDMENT SQUADRON. ROCKWELL FIELD, CAL.

(…oto Courtesy U. S. Army Air Corps)

THE MYSTERY of the SILVER DART



By
RAY CREENA

IAN POTTER, a prominent young ace and "America's bad boy of the skies", while week-ending with his friend, the Genii, at Commander Stevens' home, is puzzled by a code message he picked up seemingly without the aid of a station.

Potter is aware that official Washington is very perturbed about some mysterious losses the Government has suffered but about which it is not saying much. He is pretty sure the mystery has something to do with a plane.

The Genii advises Ian to report to Rear-Admiral Beecham of the U. S. Secret service. Ian and Rear-Admiral Beecham work on the five-letter code that Ian has picked up and soon they derive a clue from it.

Ian was not mistaken; the missing plane which entails tremendous losses to the Government is involved. The Silver Dart *had been built in complete secrecy and possesses devices which place United States far and away ahead of all other nations in aeronautics. It must not fall into possibly hostile hands and it must be recovered with all possible speed.*

It is agreed that Ian ostensibly is to be discharged from the air service, after which he is to undertake a private commercial expedition to Bog Walk in West Indies, which figured in the message Ian had picked up.

Ian then proceeds to work with all caution. He gets his friend, nicknamed Mournful Moe, though as good a scout as ever flew the skies, to borrow an old Fokker. Together they fit it out for the expedition—which for newspaper purposes is just another flight—and having taken care of the minutest details, they take off. The first part of their flight is uneventful. However, the caprice of weather can not always be foretold. A gigantic storm threatens them both with disaster in mid-ocean.

A Fight for Life—a Meeting at Sea—and the Rest Is Left to Fate

HAD they seen those dark clouds earlier in the evening, they would have been prepared for what was to come. As it was, with suddenness typical of the tropics the storm burst upon them from all quarters of the compass.

Forked lightning played havoc round the edges of the clouds, transforming them into weird and ghastly threatening shapes; the thunder rolled about them like some monster artillery battery gone berserk, and the rain fell in such density as to force the plane down a thousand feet by sheer weight.

The wind seemed to come from all quarters at once, and with all Ian's experience of stunting with planes in battle practice and aerial fighting maneuvers, he never had believed that the wind could do with a plane what it was doing to their old Fokker.

The impenetrable darkness served to add intensity to the awesomeness of the situation. Nor was that all. Rain leaked through the roof of the fuselage and put the radio out of commission, and it required all Ruddy's courage to scrawl a note and pass it to his companion telling of the trouble.

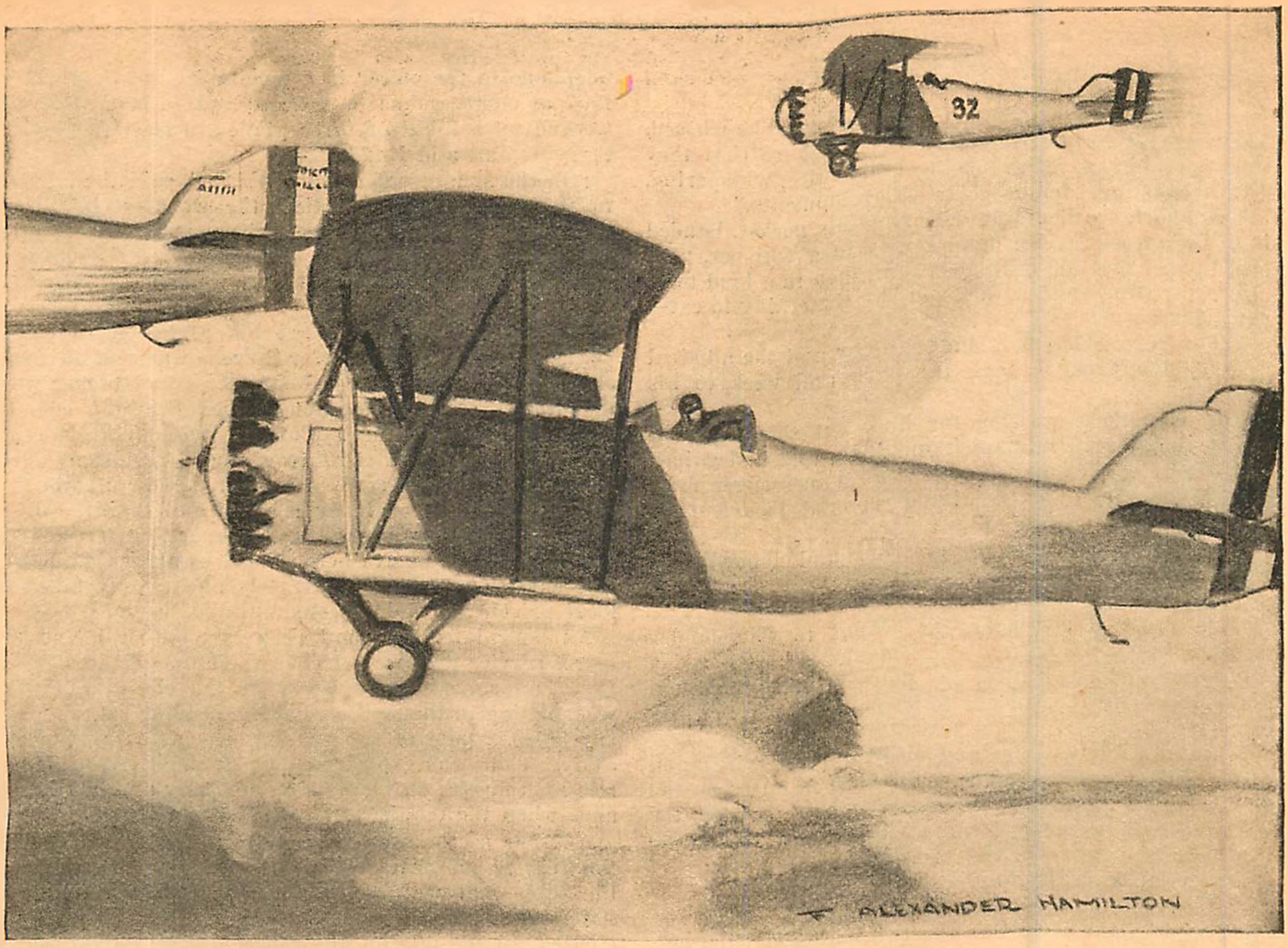
"Last message through," the note read, "received from Key West, Florida. Warns of storms sweeping over Haiti and southern end of Cuba. At this point radio fizzled out. What'll we do?"

Ian read the note, nodded and scribbled across it:

"Stick it, Mournful, we're not dead yet."

That was true to a certain extent, but—

During the next half-hour, Ian sat pale and grim at the controls. Try as he would, he could not keep the plane on even keel. The wind buffeted it about like a cork on a swirling ocean. Fear gripped him.



The sky at times was filled with planes scouring the waters below for a sign of the submarine

Pitch black around and above them. A treacherous ocean below. Ian looked over his instrument board and nearly froze with horror when he noticed that the earth inductor compass indicator needle had been shaken from its pivot. . . . The oil feed line, too, was vibrating like a miniature earthquake. "Heaven help us if that breaks," he muttered between clenched teeth . . . then—

Wrrrrrrruumph—a gust of wind hit the Fokker under the left wing, lifted the plane up and over on its side, and swept it over until it was nearly on its back. Ian was thrown from his seat against the side of the cockpit and was forced to let go the control stick. The force of the impact dazed him, and when he recovered it was to realize with trepidation that the plane was in a deadly tail-spin, headed for the ocean below seething with sharks, and the tail swishing round like some alligator striking at a foe.

IAN grabbed the control stick, stuck his feet on the rudder pedals, and then set all controls neutral. He waited for the plane to go into a straight dive as it must do many times during a tail-spin, although such dives are of short duration.

However, Ian was alert, caught the plane at the right moment and gently pushed forward, and then back, on the stick. His action saved the day, as the plane responded to the aileron pressure and slowly but surely flattened out.

So preoccupied had been Ian pulling the plane out of the spin that he had not looked at his instruments. When he did, he gasped; the altimeter read 250 feet!

"Phew! That was a narrow one," he gulped.

It seemed as if fate decided to be kind at last, for not more than fifteen minutes later, and with suddenness equalling its start, the storm abated. The skies cleared up and the stars and moon began to shine once again.

Ian looked around to wave an, "Ah, that's better" sort of thing to Ruddy, but that worthy was nowhere to be seen, and it was some minutes before he rose from the floor of the fuselage and passed a note saying:

"Got thrown off my feet. Head struck corner of chart table. Table harder than head. Result—oblivion till now!"

Ruddy then took a sight on the stars, did his calculating and slowly whistled through his teeth. Hastily scribbling a note, he then informed Ian that they had been blown 250 miles off their course.

"That'll help," was Ian's facetious comment. "We used up enough gas during the storm to float a battleship, so here's hoping."

* * *

LET us return to Washington and Admiral Beecham for a moment or two, and see what has transpired since Ian was given his marching orders.

No sooner had our hero left his office than Admiral Beecham set into operation the secret service machinery at his command. "Track everything down, overlooking nothing, but take no action until you get orders to do so from me," were his instructions.

Within a short space of time human blood-hounds, each of whom did not know the others, were following up every possible clue contained in Ian's amazing code message so luckily picked up at Commander Stevens' country house.

A week from the day that Ian left, Admiral Beecham was taking a stroll through the park. He stopped to gaze at the swans floating on the lake and noted their grace, which acutely reminded him of the thought ever in his mind, the *Silver Dart*, the wonder-plane and cause of all his troubles.

Suddenly he was accosted by an unkempt, unshaven and dirty looking beggar.

"Spare a nickle for a cup of coffee, mister," he whined. Then peering around furtively to make sure that they were not seen, the beggar changed his voice, whispering, "*A-70* reporting, sir. Important developments."

The admiral pulled a quarter from his pocket, handed it to the secret service man, saying in a whisper, "Report to my office in a half-hour," and then in a loud tone, "Here, my man, and see that you buy something to eat—not drink."

The secret service man shuffled away and the admiral walked slowly on through the park and back to his office.

A-70 was there waiting for him, but this time the secret service man was spick and span, and had gained admission to the admiral's office as a messenger from the Air Board with a special and personal document for Admiral Beecham.

The admiral smiled his greeting and immediately asked for details.

A-70 wasted no words.

"Impersonated a beggar, sir. Went to Commander Stevens' home. Found only two maids, a butler and a gardener left to look after the place. Obtained a meal and persuaded the gardener to let me help him for fifty cents for the day.

"Tapped all telephone and electric light wires and discovered a ground lead from the kitchen outlet to the old oak tree bordering the tennis court. Tapped the lead, which apparently terminated in the antique-looking chair at the root of the tree.

"Disturbed nothing, sir.

"DURING the afternoon the two maids and the butler went out. I entered the house through a scullery window and traced a few wires in. One led to the grandfather clock in the dining room, in which I discovered an indoor aerial fixed to a receiving set.

"The set was equipped for a light and not a buzzer or spark. A periscope reflected the light through the key-hole in the face of the clock, thence to a small mirror fixed as a crystal on the chandelier hanging over the table.

Anyone knowing the secret had merely to sit at the table and by glancing at the mirror in the chandelier, read any message coming through.

"While I've nothing more than observation to go by, I'd say that the butler knows a thing or two. He's a swarthy chap, and dark enough to be of foreign origin."

"Good," commented Admiral Beecham. "In three days time go back to the house as a beggar and hang around for a bit. . . . If someone should hail you as 'Brother Jack', welcome him as a brother — and — follow his instructions."

Left alone, Admiral Beecham swung into cool, calm and methodical action as befitted one in his position. He first got through by telephone to the officer in command at the U. S. Naval Base at Guantanamo Bay, Cuba, and, in brief, told him to send up a flight of three planes to meet the Fokker carrying Ian and Ruddy.

"On the side of one of your planes", said the admiral to the commander, "see that the words 'KLAWGOB APPEARS DEFINITE' are written and that the pilot of the Fokker signifies that he has received the message. This is confidential, so choose your men carefully."

THE admiral then turned his attention to events nearer home. Commander Stevens was sent on a special mission to San Diego. Four secret service men were dispatched at once to Commander Stevens' country home. One, dressed as a plumber, walked through the grounds, picked out *A-70* from the description given, went up to him and said, "Hello, Jack, how are you?"

A-70 replied in ordinary manner and then the other man whispered, while "Jack" lounged under a tree, "Four others of us are here. Chief wants maids, butler and gardener arrested separately and quietly taken to local prison and held incommunicado."

An hour later this had been accomplished, and the secret service men were left to their own devices. Soon they had solved the mystery of the chair under the tree, finding in the seat a complete sending set, with the key being a part of the scroll work on the arm of the chair. Thus was explained Commander Stevens' drumming his fingers on the arm of the chair and his annoyance when the tennis ball smashed into the chair.

Another secret service man stationed himself inside the dining room, sat down in the commander's chair at the table and watched the mirror in the chandelier. After what seemed years, he saw what had been anticipated. In the mirror was reflected a tiny light which bobbed on and off in Morse code.

He took down the message, which was easy to read as he had in his possession the code discovered through Ian's message. An emergency call was put through to Admiral Beecham and the secret service man read to him the following message as received in the mirror:

"*SUBMARINE* W9 *MAKING FOR MANGROVE SWAMP HUNT BAY FULLY EQUIPPED TAKE* DART *ABOARD STOP ARRIVES TWO WEEKS HENCE STOP*

AD ASTRA".

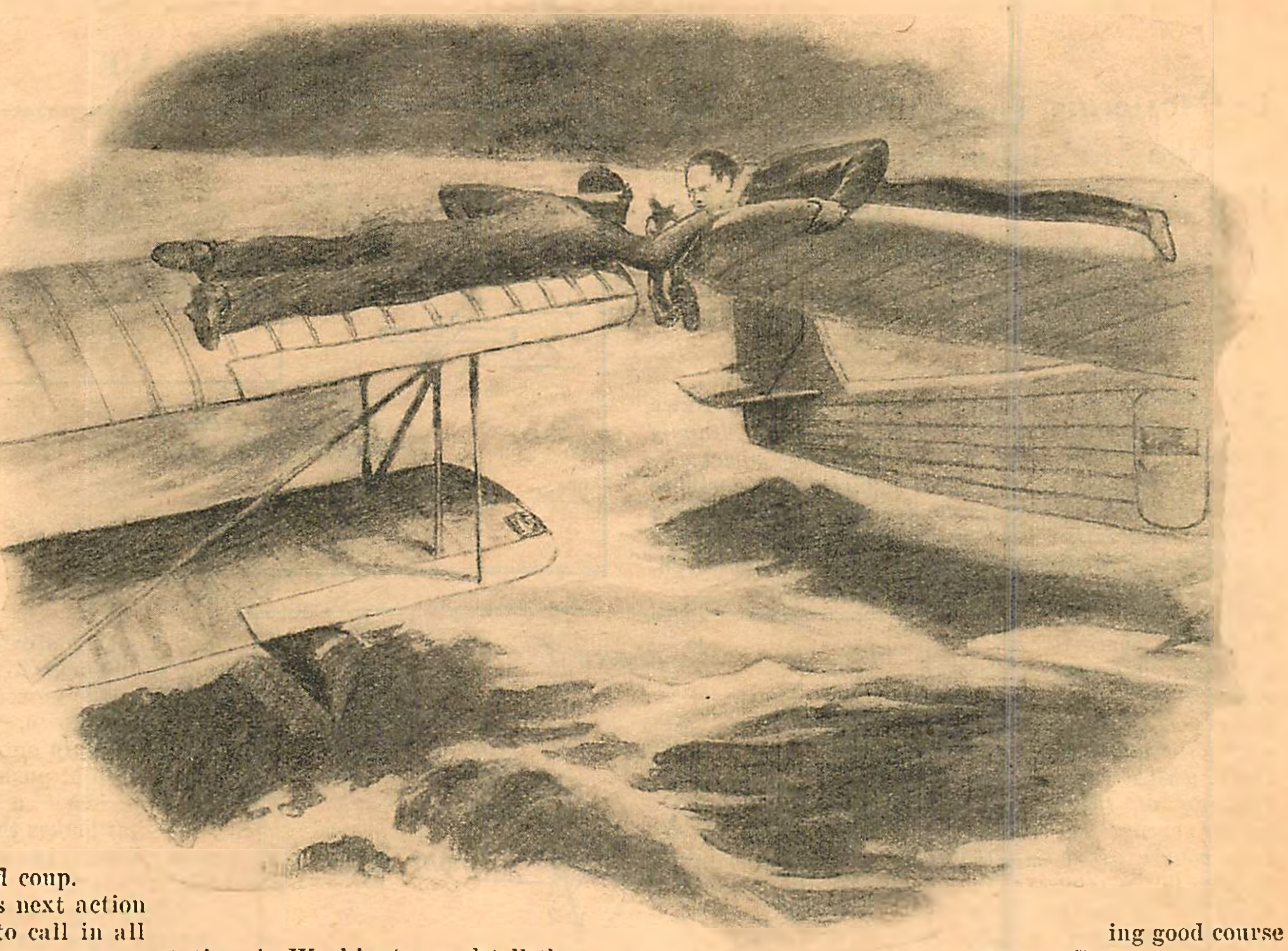
The admiral whispered to the man and then in a loud tone said, "Here, my man, and see that you buy something to eat—not drink"

Admiral Beecham did not even stop to say Good-bye. He slammed up the receiver and immediately put a call through to the naval authorities. Within two hours of that call three of the U. S. Navy's swiftest cruisers, accompanied by the aircraft carrier *Saratoga*, steamed out of Pensacola harbor, ostensibly to carry out some fleet spotting maneuvers.

It was fleet spotting all right, but that spotting meant life or death to several men confined in a submarine known as *W9* somewhere in the Caribbean and making for Hunt Bay, in Kingston Harbor, Jamaica.

The lid was off with a vengeance, now.

While the three cruisers and the *Saratoga* plowed their way through the gulf of Mexico, Admiral Beecham continued his preparations for a



"Here, take these, you'll probably need 'em." He handed Ian the two revolvers and the ammunition

grand coup.

His next action was to call in all newspaper representatives in Washington and tell them in strict confidence all that had transpired up to the present and also what he expected to happen within a short time.

"You understand, gentlemen," he said, "that all this directly concerns the government, therefore not a word must appear in print until official permission is given. I am telling you all about it so that you will not start conjecturing a lot of things which are not true, and through printing a lot of surmises perhaps betray our plans to the persons who apparently have stolen the *Silver Dart*."

The newspaper men left, giving their word to withhold all news until it was officially released and also, being true adventurers as befits their calling, pleaded for permission to take an active part in recovering the mystery plane. The admiral reluctantly denied them this opportunity but thanked them sincerely for their offer.

"One thing you can do for me, though," he added, "is treat this Jamaica non-stop flight as another of these foolhardy things which mean nothing. Potter and Arnold will be missing for an hour or two. Play that up as big news, and delay as much as possible the actual news of their reaching Jamaica or their progress en route."

Alone, once again the admiral immediately put another call through to the commander at Guantanamo Naval Base.

"Any news of the Fokker flying to Jamaica?" asked the admiral.

"Up till a few minutes ago, no," replied the officer at Guantanamo. "However, I've just finished reading a wireless message picked up here from the Fokker. Signals were very faint. Message stated, 'Just made South Point lighthouse after being blown 250 miles off course stop Storm temporarily busted wireless stop Now making good course 185 for Guantanamo stop All well though severely shaken up. Potter.'

"They should be passing overhead any time now," the commander added.

"Good," said Admiral Beecham. "Listen carefully. Cancel all previous instructions. Don't let the escort leave the ground. Take your fastest plane. Go yourself and meet the Fokker. Don't let Guantanamo report it passing over. Escort the Fokker fifty miles off-shore and then force Potter to land at sea. Use a couple of bursts from your Brownings to let him know it's urgent.

"Don't communicate by radio, as all stations might intercept and relay your signals, and some amateur might pick up the messages and spread the news around.

"While I think of it, take revolvers and some spare ammunition with you for Potter and Arnold. Land as near them as possible and give them full details of what's happening. You might as well know now—Potter's discharge from the service was prearranged. It was he who first put us on the right track of the *Silver Dart*. Keep this under your hat, though.

"He'll know what to do, I've no doubt. Anyway, he knows what it's all about."

That ended the conversation. The commander hastened to the hangars and called for the Flight-Sergeant.

"Oh, Sergeant," said the commander, "prepare my plane for a flight of about five hours. Take out everything possible to allow for the extra fuel. I want you to attend to this yourself, Sergeant, and nobody is to know anything. Understand?"

The Sergeant saluted. "Very good, sir," he replied.

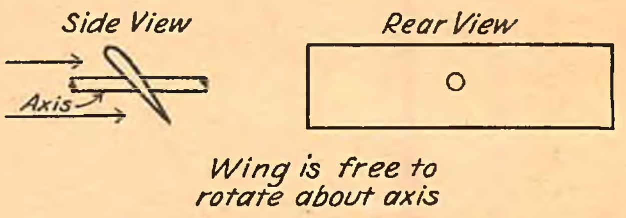
The commander turned to leave, and then remembering Admiral Beecham's suggestion, returned and whispered to the sergeant: (*Continued on page 44*)

A Course in Airplane Designing

By KEN SINCLAIR

By Mastering This Valuable Course, the Model Builder of Today Lays the Cornerstone for His Career as the Aeronautical Engineer and Designer of Tomorrow

Figure 1.



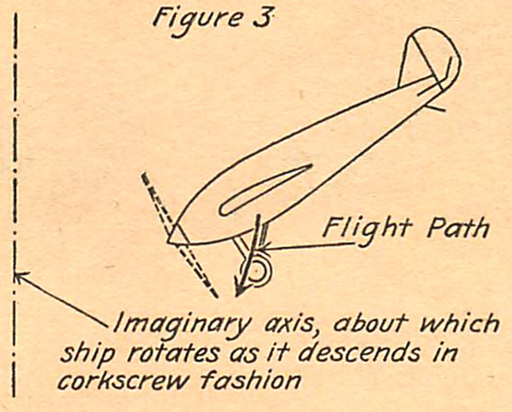
AUTOROTATION

IN presenting this course, MODEL AIRPLANE NEWS *wishes to stress the fact that model building is more than a mere sport. If the builder of model airplanes learns the fundamental principles underlying airplane flight and design, he prepares himself for a future career in the most profitable phase of aviation.*

The policy of MODEL AIRPLANE NEWS *is not to encourage or teach its readers to become pilots, but rather to become aeronautical engineers, designers, salesmen, manufacturers, or equip themselves for any other positions which require the training of the specialist or executive. Study this course from month to month, master it in every detail and you will gain a fundamental knowledge of the how and why of airplane design which will be second to none.*

THE EDITOR.

Figure 3



WE see an airplane, flying high, suddenly nose upward and stall. For a moment the ship hangs there, seemingly stationary, and then one wing drops, the ship noses down and in the twinkling of an eye it is in a "spin". The nose is down, the tail is up, and yet the pilot has the stick all the way back! The whole ship is whirling around as it descends, losing hundreds of feet of altitude in every turn.

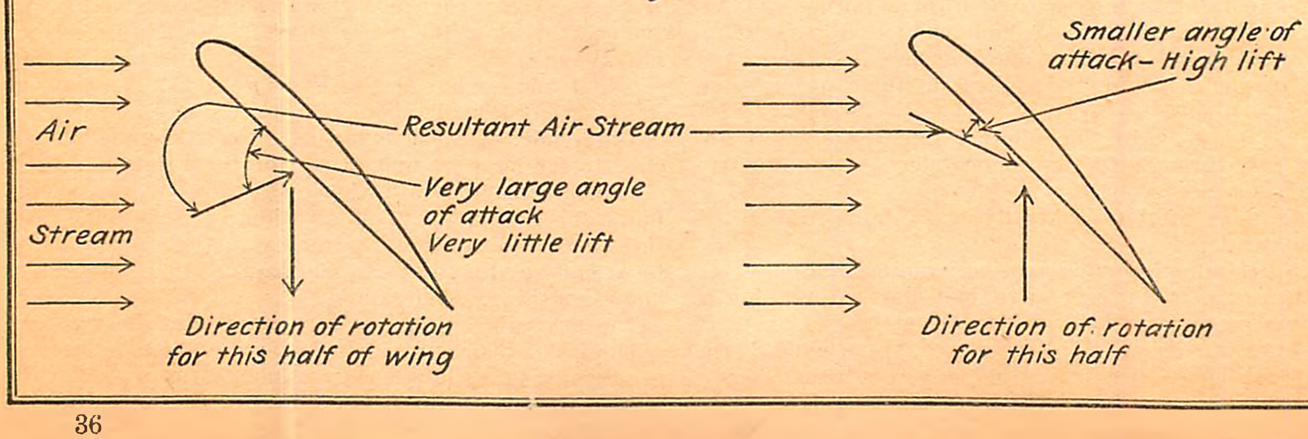
Then the pilot, when he wants to come out of the spin pushes the stick a little forward of neutral, kicks rudder opposite to the direction of the spin and the ship straightens out into a nose dive. Remember, the nose was at all times down, yet to bring the ship out of the spin the pilot pushed the stick *forward*, a movement that makes the ship nose down in normal flight.

Why the unnatural control movement to bring the ship out of this thing called a tail spin? What makes the ship whirl around and why can't the pilot stop the ship by pulling back the stick which should raise the nose?

Don't let these questions frighten you. There is nothing mysterious about the spin, when one delves into it, and it is absolutely essential that the airplane designer understand the spin and its causes. Moreover he must know the methods of designing a ship so that it will come out of spins easily without too much loss of altitude.

These things are necessary because the tail spin is an uncontrolled maneuver. I mean by this that, when in a spin, a pilot cannot make his ship do what he wants it to; he must first get it out of the (*Continued on page* 41)

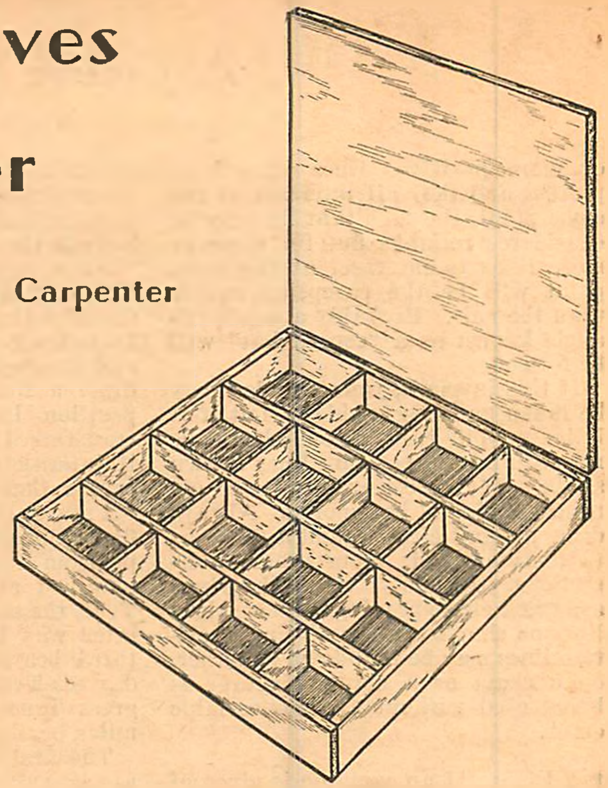
Figure 2



A Nail Cabinet Saves Time and Temper

Every Nail and Screw in Place for the Home Carpenter

By EDWIN T. HAMILTON



IF time is money, as many say, then a good carpenter cannot afford to hunt for a particular nail or screw he may wish to use within a drawer, box, or tray, where a hundred different lengths, shapes, and sizes are kept in a scrambled heap. He cannot afford to do it, and a good carpenter refuses to do so. He has a place for everything, and everything is in its place.

With this problem in mind, the nail cabinet has been designed. Here is a single box, simply and inexpensively made, which will keep your nails and screws in orderly fashion, so that the desired size can be found at a minute's notice. It also acts as its own keeper, for it tells its owner when he is getting short on any particular size, and does so before he has used his last one.

Tiny files, bits, baby-size clamps, and a half-dozen other small articles, which are so often misplaced or lost, can be kept in the box as well. I venture the opinion that all who make this nail box will wonder how they ever got along without it, after a week's use.

A padlock may be applied, if the owner sees fit, but it will easily fit into the drawer of your work bench, where it may be locked away from outsiders.

Any kind of wood may be used in its construction, but white pine is recommended, as it is easily obtained and simple to work with. Follow these instructions carefully, for while the box looks easy to build, there are several points of construction which need close application.

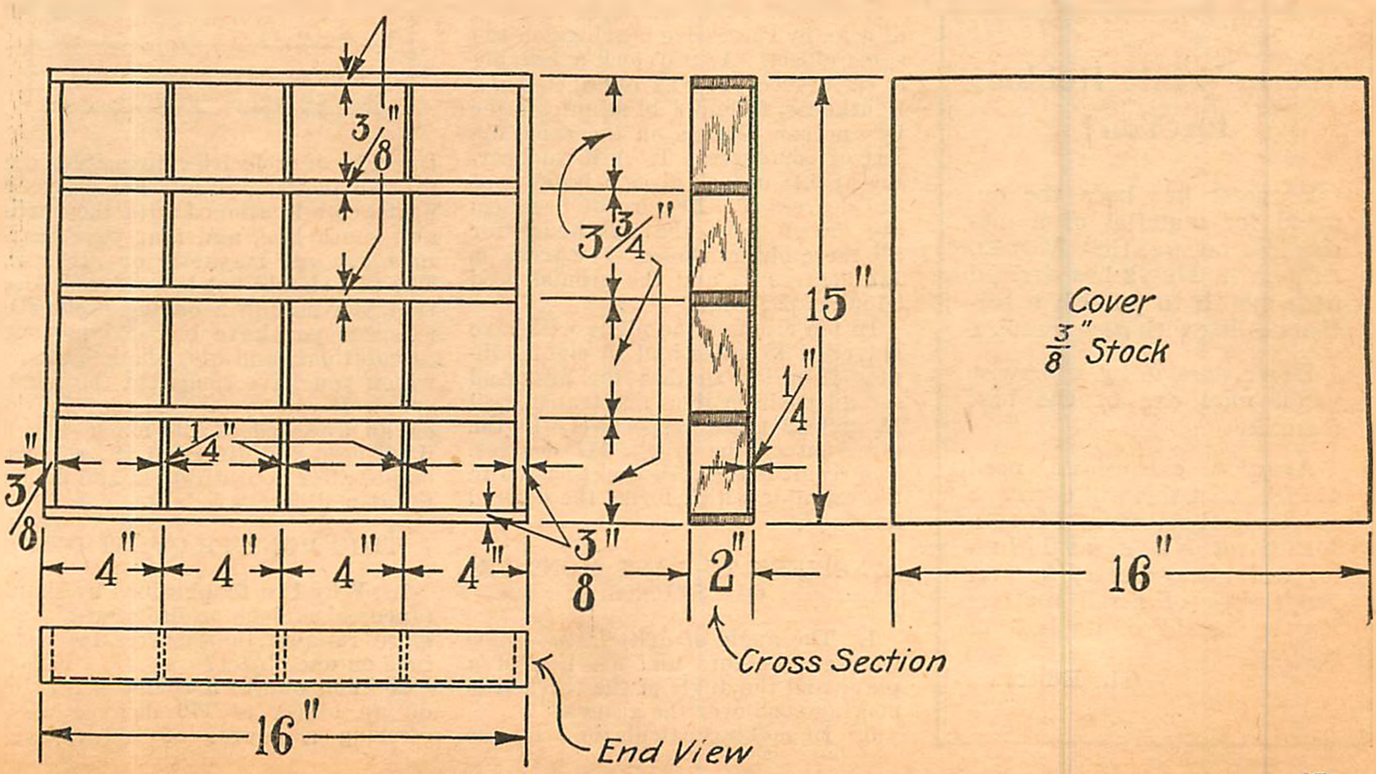
BOTTOM

The bottom of the box is constructed of 1/4″ stock and measures 14 1/4″ wide and 15 1/4″ long. If material of this width cannot be obtained, make the bottom of two equal widths, 7 1/8″. Plane both faces of the piece and finish with a thorough sanding. Set aside, after testing with a try-square to insure squared corners.

SIDES

The sides of the box are made of 3/8″ stock, two of which measure 2″ x 16″, these making up the front and back side pieces. The other two measure 2″ x 14 1/4″, as they fit between the front and back side pieces.

Cut the four boards to the above sizes, plane both faces of each and finish with a thorough sanding. The try-square should also be used (*Continued on page 43*)



A Course in Air Navigation

(*Continued from page* 28)

or more positions lines have been plotted and they all intersect at the same point, the resultant fix may be considered reliable, but for three or more lines to intersect at the same point will be the exception rather than the rule. Probably a small triangle known as a "cocked hat" will be formed.

If this is small, your position may be taken as being inside it, but if it is large, your calculations should be revised and the position lines drawn again. If no better result is obtained it should be ignored. Always draw a small circle round a fix so as to distinguish it from other intersections. Although visual bearings are great circle bearings and straight lines on charts are rhumb lines, position lines may be laid down as either, on a chart or a map whichever is being used without any appreciable error.

IN Figure II an example is given of a running fix with one transferred position line.

8.00. Bearing of Lightship A, 39° compass.

Course 95° compass, variation 22° W.,

Deviation 3° E., track 132° (magnetic)

Groundspeed 90 m.p.h.

8.10 Bearing of Lighthouse B, 337°

Deviation 5° E.

The True bearing of the Lightship A at 8.00 was 20°, so a position line is laid down on the chart in the direction of 200° True, from A. Ten minutes later a bearing was obtained on Lighthouse B of 337° compass which becomes 320° True. A line is therefore drawn from B in the direction of 140°. In the meanwhile, during the intervening ten minutes the plane has traveled 15 miles at 90 miles per hour in the direction of 110° True.

From any point in the first position line draw one or more lines in the direction of 110° True. Measure 15 miles to scale along these lines and through the points so obtained, draw a line parallel with the first position line. This will be your transferred position line, and where it intersects the 8.10 line gives the fix for that moment.

Figure III illustrates a running fix by one direct and two transferred position lines. The first bearing was obtained at 12 o'clock, 350 degrees True, the second bearing five minutes later was 12 degrees True, and the third bearing at 12 o'clock was 35 degrees True. The track was 275 degrees True and the groundspeed 70 miles per hour.

The first and second position lines are transferred a scale distance of 6 and 12 miles (the approximate distances the plane would travel in 5 and 10 minutes respectively), along a track of 275 degrees, and the resulting intersection of the three lines forms a small triangle which represents an accurate fix of the plane's position at 12.10 o'clock.

There are occasions when only one object is available on which to take bearings, in which case it is possible to obtain a fix by successive bearings, on the same object; but for the reason already given of the possible inaccuracy of transferred position lines—which are necessary in this method—it is one that is only recommended when no alternative means of locating your position are available.

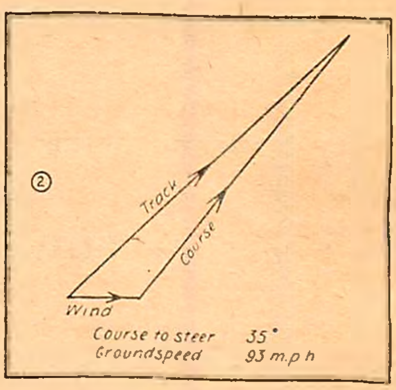
In Figure IV an example is given of a fix by successive bearings on the same object. At 9 o'clock a bearing of 42 degrees T. was obtained on a lighthouse, followed 10 minutes later by another bearing on the same object of 360 degrees T. A third bearing at 9.18 o'clock gives a bearing of 340 degrees T. Reciprocal bearings are drawn from the lighthouse for all these observations. The track is 117 degrees T. and the groundspeed 90 miles per hour.

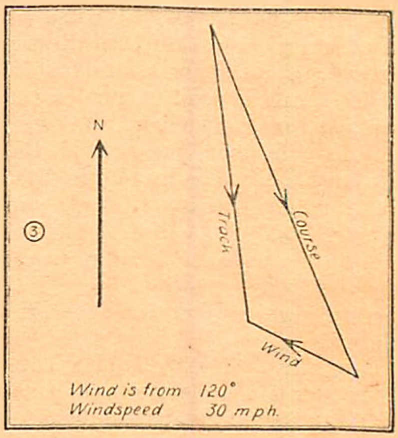
In ten minutes the plane will have travelled 15 miles and in eight minutes 12 miles, so that the first and second position lines are transferred 15 and 12 miles respectively in the direction of the track, 117 degrees. The result is the cocked hat shown in the example which forms the desired fix.

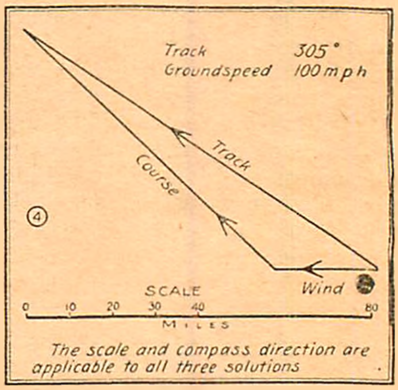
ANSWERS TO LAST MONTH'S QUESTIONS.

1. The angle of drift is the angle between the fore and aft line of a plane and the angle of the track it is making good over the ground.

5. In making calculations on the triangle of velocities principle, see that in plotting your bearings, your protractor is aligned with the north and south line, and that your bearings are all magnetic or all true. The two should not be confused. See that you maintain during flight the airspeed you have included in your calculations, and also the height for which you have computed the windspeed. If you have based your figures on an airspeed of 100 m.p.h. and a windspeed and direction at 2000 feet, do not alter your airspeed and do not fly at a different height.







THIS MONTH'S QUESTIONS

1. Why is a fix obtained by simultaneous bearings on different objects more reliable than successive bearings on one object?

2. You obtain a compass bearing on an object of 170 degrees while steering a course of 230 degrees.

Worth While Hobbies for You!

So great has been the demand for material of a mechanical nature, that MODEL AIRPLANE NEWS has decided each month to publish a section dealing with such matters.

Don't pass it by otherwise you'll miss one of the best features.

Aviation enthusiasts need not fear that this will encroach on their territory. MODEL AIRPLANE NEWS, as hitherto, will always carry a preponderance of aerial matters for the benefit of its host of readers.

The Editor.

Your deviation card shows a deviation of +3 on 180 degrees and —1 on 270 degrees. The variation is 14 degrees west. What should be the bearing of the position line you should lay out from the object?

Gliding and Soaring

(*Continued from page 7*)

of dynamic soaring. Vertical, or upward, currents of air provide the less difficult means of soaring.

Where Upward Currents Occur. Soaring is usually done on the windward side of hills or even mountains, because upward currents are prevalent there. When the wind blows across a plain, it moves nearly horizontally; when it strikes the side of a mountain, however, it is deflected upward.

Although mountain regions are most used by soarers, rising air may

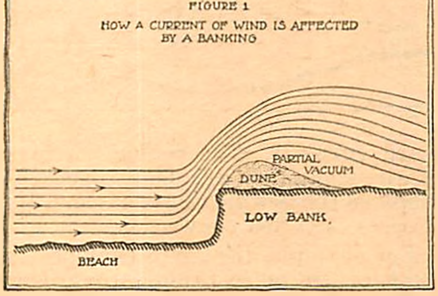


FIGURE 1
HOW A CURRENT OF WIND IS AFFECTED BY A BANKING

be also found on the windward sides of low hills and at the edges of bodies of water. There are three general causes of vertical currents of air.

Upward Currents Due to Irregularities in the Terrain. The irregularities of the earth's surface force the lower strata of the wind into undulating courses. Even low hills, houses and forests divert the wind slightly upward.

The wind does not follow exactly the contour of an irregularity of terrain. This is illustrated by the dune formation on top of a low, steep

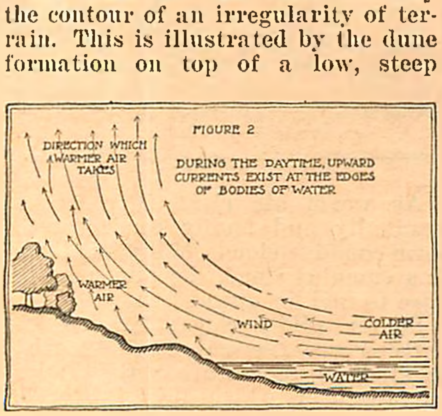


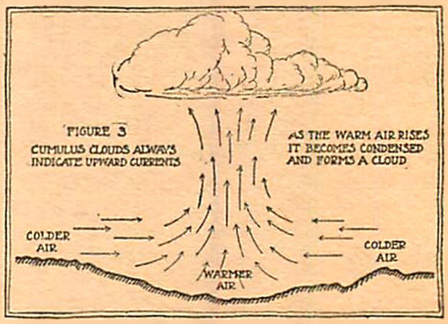
FIGURE 2
DURING THE DAYTIME, UPWARD CURRENTS EXIST AT THE EDGES OF BODIES OF WATER

bank on the sea coast. The wind, coming from the water and carrying sand with it, strikes the bank and goes upward, its flow lines, so far, parallel to the contour of the bank.

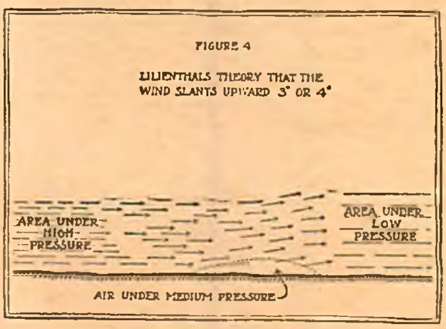
However, instead of clinging to the plateau at the top of the bank, the wind continues upward, leaving a partial vacuum between itself and the embankment, into which the sand falls, forming the dune. The flow lines of the wind gradually sink behind the dune, and resume their horizontal course, as sketch shows. The upper strata of the wind are affected less and less by irregularities of terrain as their altitude increases.

Pictures of the way in which stream lines follow the contours of several mountains have been made by photographing the clouds and ammonia smoke from rockets.

Thermal Currents. Convection is another cause of upward currents of air. Portions of the atmosphere over certain kinds of terrain are heated by the sun to a higher temperature than are other parts. The warm air is lighter and therefore rises in upward currents. The colder portions of air, since they are denser, rush to displace those which have risen. This process is called convection.



For example, the earth changes its temperature more rapidly than does water. Consequently, during the day, the air over a body of water is not so warm as the air above the shore. As a result, there is a constant rising current of warm air along the water's edge.



As warm air rises, it cools off gradually and finally condenses to form cumulus clouds. Wherever there is a cumulus cloud, the pilot may be sure to find an upward current.

Soarer pilots can determine exactly where thermal currents exist by studying the nature of the earth's surface over which they intend to soar, and by learning the relative rapidity with which forests, sand, fields, etc., are heated by the sun. These currents are, of course, found only during that part of the day in which the sun is warm.

Further details concerning wind currents are discussed in the next instalment.

A Course in Airplane Designing

(*Continued from page 36*)

spin if he wishes to do some other maneuver. The spin itself and the recovery both use up quite a bit of altitude.

That is why the spin is dangerous. That is why the ship must recover from a spin easily and quickly. That is why the designer must make his ship easy to control in a stall, so that it may be kept out of spins. To design a ship so that it will do these things one must first understand the basic cause of the tail spin, and he must know exactly how a ship acts in a spin.

First, what makes a ship spin? To answer this question, let's forget all about the fuselage, the landing gear and the control surfaces, and consider only the wing. It is the wing that causes the spin, and, although the tail surfaces help us to stop a spin, they are not essentional for our study of causes.

We place a wing in a wind tunnel, fasten it to an axis as shown in Figure 1, and blow a curent of air past the wing. The wing is at a high angle of attack, beyond the burble point, and is free to revolve about the axis, which is placed in the center of the span.

For a moment the wing remains stationary, but when it is moved slightly it suddenly begins to revolve! Then the wing speeds up until it reaches a certain velocity, and continues to revolve at that rate as long as the air stream is blown past it. There is nothing in the shape of the wing to make it do this, since both sides are exactly alike.

LET'S see if we can't find some logical explanation of this strange behavior. The explanation lies in three words, *angle of attack*. As we learned in the last article, the angle of attack is a purely relative matter, and depends only on the *direction of motion*. We then applied this to the wing as a whole.

Now let us apply it to parts of this wing that we have set up in the wind tunnel, and which is revolving without any apparent reason. The wing may be revolving either way, but we will say that when it starts, the left tip, looking from the rear, goes down. As it continues to revolve this left tip goes up again, on the other side, of course, but we shall refer to it as going down, with respect to the air stream, as long as the wing turns. The right tip is then doing the opposite, or going up, in relation to the air stream. This must be remembered.

Now, instead of thinking of the entire wing, let's divide it up, and think of two sections of it, one at the left tip, the other at the right tip. *In relation to the air stream*, we have the left tip going down, while the other tip is going upward. Figure 2 shows these sections and the directions in which they are moving. Study the sketch carefully.

We see that the left tip has a certain apparent angle of attack, which is the same as that of the right tip. However, the left tip is at the same time moving downward, considering the air stream, and we can easily see that this fact will change the angle of attack, which depends only on the direction of relative motion. Our angle of attack, on the left wing tip, is then *increased*.

ON the other hand, the right wing tip is moving upward. This fact *decreases* its angle of attack.

We can see that, when the wing is revolving quite rapidly, these changes in angle of attack may be quite great. Will they not, then, make some difference in the lift of the various sections of the wing? They do.

Considering again our complete wing, we have it already at a very high angle of attack, beyond the burble point, but as soon as it begins to rotate, we find that the angle of attack on the side that is "going down" is increased still further, while that of the other side is decreased.

However, the lift of a wing falls off rapidly beyond the burble point. Then the left side, which is already going down with respect to the air, has less lift than ever, and the opposite side actually gains lift, since its angle of attack is decreased, until it is back in the range of maximum lift!

The whole thing depends on the decrease of lift beyond the burble point. The wing speeds up in its rotation until the side going "up" finds its lift descreasing because of too much decrease in angle of attack, and then an equilibrium results. The wing continues to rotate at that speed.

It is imperative that these facts be grasped, for they explain the whole matter of the tail spin. The wing that begins to go up finds its angle of attack decreasing with increase in speed of rotation, and soon the angle of attack is back in the range of full lift, giving this half of the wing more lift; lift that tends to *speed up* the rotation. It's like a puppy chasing its tail. The faster he goes, the faster his tail goes, and he never catches up with it.

This rotation, caused by the change in angle of attack and the loss of lift beyond the burble point, is called *autorotation*. The word means that it is rotation, or turning, caused without any outside force or motor to make it go. The thing to be remembered, however, is that autorotation can *never occur until the wing is stalled.*

Remembering what we have learned about autorotation, it is easy to see just what causes the tail spin. A spin is nothing more than autorotation. The airplane is stalled, the wing's angle of attack goes beyond the burble point, and the ship falls off on one wing. The wing that goes down, (just as with the wing in the wind tunnel), is already at a very high angle of attack, and as the ship rotates, this increases. The angle of attack of the other wing is decreased until it is back in the range of high lift, and its lift is thereby increased.

In Figure 3 we see a side view of a plane in a tail spin. Note the very high angle of attack. The whole ship is descending, while at the same time it is whirling around the axis, and is fully stalled at all times during the spin. Pulling the stick back still further merely serves to stall the ship more than ever, if that is possible, and does no good whatever if one wants to get out of the spin.

How can a ship be brought out of a tail spin? We have seen that a ship cannot spin unless it is first stalled, and that, although the nose is down, the ship is actually stalled during the spin. The thing to do, then, is first to get the ship out of that stalled condition.

We do this by pushing the stick *forward*, a little beyond neutral, and at the same time we kick rudder opposite to the spin to stop the rotation. The ship comes out in a straight dive.

Having found out something of the facts underlying the tail spin, we naturally wish to know how to design our ships so that they will come out of spins readily. We don't want ships that will go into spins and refuse to come out. That would be disastrous.

An airplane descends prettty rapidly in a tail spin, and if the ground gets in the way before the pilot can bring it out, it's a safe bet that the ship will be chalked up as a total loss. We must find a way to design our ships so that they may be kept out of spins easily, and so that they will come out of spins instantly when the controls are handled correctly.

How can a ship be kept out of a spin? Assuredly, by not stalling it in the first place. But to be safe we must design our planes with spins in mind, because sometime every ship is stalled, intentionally or not.

Models stall often, but, unless they are poorly designed, they rarely spin, unless the controls are set to make them spin purposely. The object in full size plane building is to make the ship controllable on the verge of a spin, after it has been stalled. We want to keep that wing from dropping lower than the other one.

If the pilot can keep the wings level in a stall it is practically certain that the ship will be easy to keep out of a tail spin. Slots and flaps, since they retard the burble point, help and floating ailerons are very efficient in keeping the wings level when the plane is stalled.

It should be mentioned here that the controls of the airplane "go out" in a stall. The ailerons are usually the first to go. The controls feel soft, "mushy", and are very ineffective. The rudder, however, is usually the last to go out, and exerts a powerful effect on keeping the ship out of a spin. For this reason it is good policy to give a ship a powerful and well-designed rudder.

The ailerons, too, are very important. I recall one small biplane, made a few years ago, in which the pilot had absolutely no aileron control when the ship was near a stall. If a wing began to drop, beginning a spin, the pilot was helpless. This is evidently a bad condition. If a pilot accidentally stalls near the ground, it is imperative that he have as much control as possible so that he may keep out of a spin.

Effective ailerons and a powerful rudder are the best assurance against spins. The distribution of weight in the ship has a great deal to do with the matter of spinning, as we shall learn in the next article, when we take up also the "flat" spin. More will be said about methods of preventing and controlling spins at that time.

How to Build a Nail Cabinet

(Continued from page 38)

on these, as they fit together in the assembling, and their corners must coincide. Set aside for future use, marking in pencil each piece, such as "Side," "Front Side," "Back Side," etc.

The three partition boards, which extend from side-to-side when in place in the finished box, are of 3/8" stock, each measuring 1 3/4" wide, or high, and 15 1/4" long. Cut these to size, plane each on both faces and finish smooth with sandpaper.

The partition boards, which fit between those running from side-to-side, can be made of cigar box wood, if some is obtainable. If not, use 1/4" stock. There are 12 of these boards, all duplicates, and measuring 1 3/4" wide, or high, and 3 9/32" long. Cut these to their proper width, but cut their length 3 1/2" each.

As the cover extends over the entire box, it must be the exact size of the box overall. It is constructed of 3/8" stock and measures 15" wide and 16" long. Cut a single board this size, plane on both its faces and finish smooth with sandpaper.

Some will find difficulty in obtaining a board of this required size, and if so, it is recommended that two 8" wide boards be used. If this is done, make the boards only 13" long. Carefully glue the two boards together, along their 13" sides, using hot carpenter's glue. You would now have a piece measuring 13" wide and 16" long, but as the finished size must be 15" x 16", the board is 2" short.

A board of this width (2") is now added, and is glued across the front of the two 8" wide boards, which have been glued together.

The box is assembled by use of hot carpenter's glue and 1/2" small-head brads. Before starting this work, carefully check each piece you have prepared to see that it is to exact size. If these instructions have been properly followed, you should have the following pieces:

Bottom—1 pc.—14 1/2" x 15 1/2" or,
2 pc.— 7 1/2" x 15 1/2"
Sides—2 pcs.—2" x 16"
2 pcs.—2" x 14 1/4"
Partitions—3 pcs.—1 3/4" x 15 1/4"
12 pcs.—1 3/4" x 3 1/2"

The first step in assembling the box is to join together the bottom boards, if it was necessary to construct this in two parts. Apply hot carpenter's glue along the two 15 1/4" edges to be joined. Place them together, seeing that both ends match perfectly, and place in a carpenter's wood clamp. If one is not available, tie them together in position. Set aside to dry.

First, assemble the four sides together with hot carpenter's glue and the nails, or brads. After the structure is thoroughly dry, glue and nail the long partition boards in place. The top edges of these boards must be flush with the tops of the side pieces, which will leave 1/4" free on the bottom for the bottom of the box to fit into.

When the whole structure is perfectly set, and the glue is hard, the bottom is attached. First, draw lines in pencil along the under face of the bottom board at the exact lines where the sides and the long partition boards will come, when in place. Drive nails along these lines about 2" apart, until they just show through the wood.

Drive the brads into place. Now use a nail set on all the nails, driving them in about 1/16" below the surface of the wood.

The short partition boards are now applied. Cut each of these until they give a wedge fit between the long partition boards. Hot glue alone holds these in place, so it is important that they fit into their respective places tightly.

Proceed in the above manner with the cover, apply two 3" hinges, as shown in the drawing.

The Mystery of the Silver Dart

(Continued from page 35)

"Unload every round of live ammunition from the plane and fix me up a belt containing about one hundred rounds of blank cartridges—I'm going duck-hunting!"

He then left for his quarters to prepare for the flight and also to pick up two revolvers and some extra ammunition for Ian and Ruddy.

"Duck-hunting is right," mumbled the sergeant as he went to a trim-looking Vought *Corsair* seaplane, its silver-grey body and wings glistening in the sunlight that filled the hangar. "Duck-hunting with *blank* cartridges! Hmmph! Somebody's crazy, and I know I'm not. . . ."

The sergeant, you see, was taking advantage of the prerogative of all old soldiers to grumble like blazes at all times, but you should have seen the smile of pleasure that lit up the commander's face when he saw what an extraordinarily good job the sergeant had done to his plane. Real soldiers are like that.

* * *

MEANWHILE, the three destroyers and the *Saratoga* were plowing their way through the Caribbean with every ounce of steam their boilers could stand.

They were not having an easy time, as the Caribbean was running high under an overcast sky following in the wake of the storm that had ravaged parts of Cuba and Haiti.

The lowerings clouds, too, bespoke the possibility of poor visibility and consequent little chance of good observation from the planes. It is hard enough at all times to spot a submarine, and more or less impossible if the skies are grey and a heavy sea is running.

However, the warships deployed in "V" scouting formation; one destroyer ahead and one on either side of the *Saratoga*, and, until the weather should clear and allow observation by plane, extra lookouts were posted on all ships.

In this manner they headed for Jamaica under full steam and at a uniform speed of 33 knots an hour.

* * *

In the meantime, let us see what's been happening to Ian and Ruddy and their Fokker.

It was not long after the storm cleared that the wind died down in their vicinity, and the light of day began to creep over the horizon to the east. Ruddy plotted their position and the course of the plane was altered to make good their proper course.

About 4:30 in the morning they sighted a few of the small atols, of the Bahamas group, and breathed a deep sigh of relief at the knowledge that they were at least within call of human aid, if necessary.

Not long after this they came in sight of Long Island, and in the distance could make out South Point lighthouse, for which they were headed and at which point they would have to set their course for Guantanamo Bay.

Ian, as the plane crossed the shore line of the island, noticed that his course was 235 degrees. According to the chart they had plotted before taking off, their true course from South Point lighthouse to Guantanamo Bay was 185 degrees. Therefore, Ian swung the nose of the plane round to port 50 degrees, at which point his compass read 185 degrees.

The lull following the storm was such that there was virtually no wind, and consequently no drift, so that it was with more than a grin of contentment that Ian passed back a note to Ruddy on which he had written:

"Cheer up! Only about three more hours—and then for a good bath. What d'you say?"

Ruddy nodded and grinned, and to show that he wasn't very much worried, clambered on to the gas tank and peered at the clock on Ian's instrument board.

They flew in this manner for about an hour, when Ian turned in his seat and beckoned Ruddy to bend forward so that he could shout in his ear.

"Thought the Guantanamo crowd were going to send out a flight of *Corsairs* to meet us," he said.

"How about giving them a call on the W/T (wireless telegraph)?" suggested Ian.

"Nothing doing," ejaculated Ruddy. "My last signals were very weak, one tube is burning very shakily, and I'm conserving all the juice I can in case of real need now. They must know we're on our way because South Point lighthouse keepers must have signalled our passing."

IAN shrugged his shoulders as much as to say, "Oh, well," and turned his attention to the plane.

Things went along quietly for the next hour or so, and then Ian and Ruddy literally nearly dived overboard from sheer amazement. Ruddy dozing on top of the gas tank and Ian gazing intently ahead and keeping the plane on its course had not noticed a tiny speck in the sky creep up on them from ahead and pass them.

Suddenly there was a "whirrrrrrr" . . . !

What trick is Fate playing now? Has the enemy won the first move in this battle of wits? What does that menacing sound portend? Don't fail to get your March Model Airplane News. *On all news stands, and only 15 cents!*

"?" Model Plans

(*Continued from page 9*)

tip ribs, which are made of the 1/16" sheet balsa. Make the necessary spar cuts. The leading edge is sandpapered to the proper shape from a piece of 3/16" x 3/16" x 23-5/8" balsa. The trailing edge and wing tip are of 1/32" square bamboo. The tip is carefully bent around a candle flame. The spar is of 1/8" x 1/4" x 24-1/4" balsa.

The lower wing consists of two sections, each 71-1/16" long. Be sure to make two opposite wings, i.e., one right and one left. They are made in the same manner as the upper wing.

The center section "N" struts are made of streamlined balsa as shown in the drawing, as are also the outer bay struts.

The wheels of the model are streamlined by means of "pants". Carefully carve and sandpaper them from the 5/8 x 1" x 2" blocks. The two covers are made from the 3/16 x 1" x 2-1/2" piece of balsa. The wheels are placed into the slots and the cover plate is ambroided on.

INSERT a plain pin through the streamline and through the hole in the wheel. Do not clip off the point of the pin. The spreader bar is of streamline 1" x 1/8" x 3-1/2" balsa. The landing gear struts are of 1/16" bamboo covered with tissue.

The propeller is carved from a white pine or spruce block, 9/16" x 8" x 1-3/16". After it is perfectly balanced, insert the shaft which is made of No. 14 music wire.

The motor stick is 1/8" x 1/4" x 12-1/2" spruce with the fittings attached in the usual manner.

The motor consists of ten strands of 1/8" flat rubber of the best grade.

Cover the fuselage and wing surfaces with Japanese tissue.

First glue the stabilizer between formers F-8 and F-9, making sure it is level. Then attach the rudder to formers F-9 and F-8. The landing gear is attached next. The "V's" are glued to formers F-3 and F-4 directly under the projection to which the lower wings are fastened. The "pants" are then glued to the struts. The spreader bar is glued to the pins which project from the pants. With the nose block complete with propeller snapped to the first former, the plane is balanced.

The upper wing is attached with its leading edge one third ahead of the balancing point, by means of the center section struts to the strut carrier. The lower wings are then fastened to the projections on formers F-3, F-4 and F-5. There is no stagger and the lower wing is fastened with a slight angle of incidence. The struts are fastened to points marked on the wings.

The entire plane is first doped with banana oil, then colored red except for the part forward of former F-3, which is silver; or colored as shown in the drawing.

The American Sky Cadets

(*Continued from page 16*)

Nyborg, of Evanston, Ill., with a flight of 3 minutes and 21 3/5 seconds, and the final scoring position went to Guy Darst, of Knoxville, Tenn., whose ship flew 2 minutes and 25 4/5 seconds.

In the senior division of this R.O.W. event, the previous record also was smashed with the model belonging to Ferris Thomas, of Knoxville, Tenn., which remained in the air for 5 minutes and 23 3/5 seconds, bettering the new junior mark by 43 seconds.

The next event, which was the R.O.G. fuselage models, proved to be a most interesting one.

The judges awarded first place in the junior class to Robert Bonner, of San Francisco, whose model flew for 3 minutes, 31 1/5 seconds. Second place was captured by Julius Martini, of Providence, R. I., with 2 minutes, 57 3/5 seconds. John Sullivan, of Washington, was third with 2 minutes, 40 4/5 seconds; Harry McGinniss, of Washington, with 2 minutes and 15 seconds was fourth, and fifth place went to Frank Salisbury, with 1 minute, 59 2/5 seconds.

For seniors in this event, Bernard Collins, of Providence, R. I., was first with 3 minutes, 7 4/5 seconds; Eugene Lincourt, Providence, was second with 2 minutes and 51 seconds; Joseph Ioanrilli, of Boston, third, with 2 minutes and 45 seconds; Edward Harms, of Evanston, Ill., fourth, 2 minutes and 44 1/5 seconds, and Glen Hainer, of San Francisco, fifth, with 2 minutes and 44 seconds.

The winners were announced as follows: The National Junior Champion was Robert Bonner, of San Francisco, who scored 20 points. Second place was captured by Guy Darst, of Knoxville, Tenn., who averaged 14 points.

The senior division was won by Bernard Collins, of Providence, who had 14 points to his credit. A deadlock for second place existed as the result of a triple tie between Robert Loper, of Topeka, Kans., Ferris Thomas, of Knoxville, Tenn., and Paul Paulson, of Providence, each scoring 11 points.

DETROIT DAILY ACTIVITIES

MORE than a little stimulus in growth and interest in the *Detroit Daily* Junior Aviation club of the American Sky Cadets has been shown during the past month as a result of an interesting re-organization and increased activities.

Detroit's metropolitan district was divided geographically into six wings, each named after famous pilots. They are Admiral Richard E. Byrd (1); Al Williams (2); Col. Eddie Rickenbacker (3); Lieut. Frank Luke (4); Col. Charles Lindbergh (5); and Capt. Frank Hawks (6). All of these were selected by vote of the members concerned.

Two general club meetings are held each month, one at some central school auditorium and the other alternately in each wing.

A club orchestra is being organized and a minstrel show is planned. Among the other activities planned for this winter are: an "older members'" club for aviation instruction next summer: prize essays and debates by members on junior aviation topics; skating, swimming and other sports' meets; trips to airports and factories; and inter-wing model contests.

Keen rivalry has been built up between the various wings and squadrons. Among the most enthusiastic and helpful of the members have been Wing Commanders Eddie Bania, Wing Commander Frank Zagaiski, Wing Commander Henry Rainey (national junior model champion), Wing Commander Julius Simon, Wing Lieutenant Helen Lucas and Squadron Lieutenants Emily Vuici and Angeline Zambroska.

Aviation Advisory Board

(*Continued from page 29*)

plane. That of the 2nd Bombardment Group was significant. It assumes as its chief motif the recent activities of the Group over the battlefields of France.

Along the head of the shield are five scalloped palets, each one representing one of the five major offensives in which the Group participated—Cantigny, Aisne-Marne, St. Mihiel, Chateau-Thierry, and Meuse-Argonne. The center palet bears a white fleur-de-lys, symbolizing France. The shield itself is gold, with four blue aerial bombs in its center. Blue and gold are the Air Corps colors and the four bombs are the four combatant squadrons which comprised the Group.

Beneath the shield is the motto: "Mors Et Destruction" (Death and Destruction), an appropriate one for a bombardment outfit.

Without doubt the squadron insignia of the outfits in this Second Bombardment Group stand out most clearly in one's memory. The 20th Squadron has a pirate hurling a hand grenade. As he dashes to the attack he treads a horizontal aerial bomb with two bands and eleven crosses. The two bands stand for the major offensives in which this squadron played a leading part, bringing down eleven enemy planes while defending themselves on their bombing raids over the enemy lines in the late war.

Autogyro Model Plans

(*Continued from page 17*)

models. On the top of the fuselage is a structure which carries the four-bladed variable pitch type of propeller and in that way differs from ordinary models.

All the necessary parts can be seen in Fig. 1 and Fig. 2. First, cut out the two sides of the fuselage from 1/16" thick medium balsa, or, if desired, 1/32" hard balsa. The drawing shows all the necessary dimensions and where all the bulkheads are to be ambroided.

From bulkhead No. 3 left and right, drill two 5/32" diameter holes in the sides of the fuselage, as shown in Fig. 2. Later the aluminum tubes shown in Fig. 7 which carry the wings will be inserted in these openings.

The next step is to cut the five bulkheads shown in Fig. 1 and Fig. 2. Use 1/16" thick medium balsa and after cutting all the necessary pieces, cover both sides with colorless dope.

Now we can start to construct the control mechanism of the vertical propeller. These pieces are to be made one by one.

Fig. 3 and 4 show the whole structure. A piece of hard balsa 15 1/2" x 3/16" x 5/16" is needed. See that the grain in each piece runs parallel. If possible, always buy hard balsa wood cut to correct size for the motor stick, if you do not have the necessary requisites for cutting them yourself. All the pieces on the drawing are numbered.

The first thing is to make a bracket which is fitted with a drum. No. 1 is a 1/16" diameter steel axle which is threaded 3/4" long at one end. In addition, two or three small nuts and two washers are neded.

Form No. 2 bracket from 3/64" thick brass or copper. Between the two flanges solder the copper tube, No. 3, which is 1/8" in diameter. On the No. 1 axle fasten No. 5 wooden drum, which consists of pieces of 5A and 5B. The best material for flange 5A is three-ply birch veneer. For 5B use a 3/8" diameter x 3/8" long hard wood piece.

Glue the three pieces together and drill a 1/16" diameter hole for the axle. Now you are ready with the 5_1 drum, which should be held in place in the No. 1 axle with the two nuts. Insert a washer between the drum and the bracket.

Cut two No. 6 pieces of three-ply birch veneer. Ambroid these on the motorstick and after drying, wind to the No. 2 bracket with fine thread.

The drawing shows the dimensions for the No. 7 pulley and for the No. 8 axle. Use hard wood for No. 7 and steel for No. 8. Insert the No. 7 pulley between the two No. 6 hangers and stick through the No. 8 axle. It is very important that nothing stop the rotation of the No. 7 pulley and that friction should be cut down to a minimum. The rear part of the motorstick is now ready.

For making No. 10, file a piece of copper sheet to the shape of a parallelogram (a four-sided plane figure whose opposite sides are parallel).

In the middle solder a copper tube of 1/16" diameter (inside measurement), as shown in Fig. 3. Attach No. 10 with thread and ambroid in its place to the motor stick, 6 1/2" apart from the nose. This will be the lower bearing for the lifting propeller. It is best to make two square pieces 1 1/2" x 5/32" x 5/32" for No. 15 of hard balsa.

Glue pieces No. 15 in the two cutouts on the motor stick. Then two pieces for No. 12 of 1/32" thick three-ply birch veneer. Use 1/8" thick three-ply birch veneer for No. 13. Now ambroid the "V" struts as shown in drawing to the end of the square pieces No. 15. Ambroid on the top the square No. 13 piece, which carries the upper bearing of the lifting propeller.

The upper bearing No. 14 is made of 1/16" inside diameter copper tubing. In Fig. 3 are shown the No. 17 and No. 18 cross braces which are made of 1/16" thick three-ply birch veneer. Ambroid these pieces between the No. 12 "V" struts. These pieces prevent the axle of the lifting propeller from bending. In their center drill 1/16" diameter holes and there ambroid a couple of washers.

No 11, the axle of the lifting propeller is of 1/16" diameter steel. Cut a thread on both ends. Place the No. 5_2 pulley on the lower end of the axle and hold it in place with three nuts. Fasten the propeller on the upper end with four nuts. Stick the axle in from the top through the No. 14 bearing, then through the two No. 16 washers and ending in the No. 10 bearing. Do the same thing with No. 5_2 as with No. 5_1

Use 1/4" long copper tube as spacer, slide it over the No. 11 axle and place it under the lowest washer, No. 16. (This small spacer tube is not illustrated in order to make the drawings clear.) Now tighten the two nuts and then slide them over the No. 5_2 drum. Tighten the third nut and in the same way place the end of the axle in the bearing No. 10. The middle part of the motor stick is now ready.

Now for the regulator. Cut two pieces of 1/16" hard balsa for No. 23 and drill 1/16" diameter holes accordingly. Cut 1/32" thick three-ply birch veneer for No. 21 and drill three holes of 1/16" diameter for axles No. 8 and No. 22. Ambroid the two No. 23 pieces on the motorstick. See drawing No. 4. Push No. 8 axle through the holes, place the "L" shaped No. 21 on the outer ends, and ambroid to make a rigid connection.

With regard to No. 20a and No. 20b, make pulley No. 20 the same as was done with No. 5 pulley. Insert No. 20 in its place and use one No. 8 as axle so that the pulley has enough clearance to turn freely. The outer ends should be ambroided to No. 21. Push No. 22, made of 5/16″ x 1/16″ diameter hard wood, through the holes of No. 21 and ambroid it in place. After drying, fasten No. 22 to the motor stick, using the No. 24 elastic band which will be connected between the crank and the motor stick.

Make two more hangers, No. 28 and No. 30, using copper or brass. Fasten in place with ambroid and wind thread, as shown in drawing No. 3. Over the No. 29 axle slide the No. 31, made of 5/16″ diameter pearl. It is possible, to use a washer of the same diameter instead, and then later fasten the 8″ diameter high pitch propeller on the axle. The propeller can be made of hard balsa.

Slide the 1/16″ diameter axle marked No. 26 on Fig. 3 in the No. 28 bracket. At the end of this axle solder the small copper tube, No. 27, exactly as shown. Now ambroid carefully the motorstick between the bulkheads of the fuselage. Every bulkhead has a slot for the motor stick and it is in this respect that these differ from normal ones. The illustration will show the slots.

Fig. 2 shows the reedwood tail skid and the place where it is located is shown in Fig. 1. Make two pieces each of pieces a, b, c and d. Use 1/16″ thick hard balsa. Ambroid these struts in their correct places, as shown in Fig. 5, which will make it a very rigid structure. Ambroid the conventional type of shock absorbers, made of wire, on the end of the landing gear struts. The celluloid wheels are 2″ in diameter.

Next come the tail surfaces, which are shown in Fig. 6. The ribs are made of 1/16″ soft balsa. Use medium balsa for spars.

The two wings are pictured in Fig. 7 and 8. The ribs are made of hard balsa, the spars of hard or medium balsa. The "O" triangle-shaped pieces stiffen the rear corners of the wings. After drying, cover the tail and the wings with Japanese Hackone tissue. There are two aluminum tubes to hold the wings to the fuselage. Use 5/32″ outside diameter tubes for this purpose. Bend the tubes as shown in Fig. 7 and ambroid just one end in the holes mentioned in the description of the fuselage sides.

Let us begin to prepare the lifting propeller, some parts of which are shown in Fig. 6. Cut out the "g" cylinder of 11/16″ thick hard balsa. Of 1/16″ thick three-ply birch veneer cut two flanges for "h" and glue these in their places, as shown in drawing. Bore an exact hole for the axle with a 1/16″ diameter drill. Then drill twice through the sides, using 5/32″ diameter drill, in such a way that the two holes are 90° to each other. Insert in the holes two 2″ long aluminum tubes (marked "i" on Fig. 6) and be sure that they fit right. Drill these tubes with 1/16″ diameter drill.

Now if you put this cylinder on the No. 11 axle it is impossible to move the tubes. Pull out the tubes from the cylinder and, as drawing shows, drill holes of 3/32″ diameter, afterward filing them out to a square shape. The magnified picture shows this. In these cutouts, later place a 3/32″ diameter nut, which serves to fasten, and to change the pitch of the propeller blades.

Replace the tubes in their places and tighten the two nuts on the No. 11 axle. Then slide over the "g-h" cylinder and secure it in its place with two nuts.

Use hard wood to make four "l" pieces, as shown in Fig. 6. Sandpaper the outside diameter so that it fits into the "i" tubes, making sure that the fit is not too tight.

Fig. 5 shows the shape of the blades. Make four of these of 1/16″ thick hard balsa, streamlining them and sandpapering the leading and trailing edges and the tips. The drawing and photograph shows where the "l" fork ends should be ambroided to the blades. Put in all the "i" tubes in the "l" pieces. Set the propeller blades at zero angle of attack. Through the holes of the "i" tube, drill a hole in "l" and drive into it a 3/32″ diameter bolt.

Thin but strong thread, fishing line or strong special threads used for sewing airplane fabrics can be used for this. To one end of the line "9" fasten and ambroid the No. 5_1 pulley. Put the other end through the No. 7 pulley and fasten and ambroid to the No. 5_2 pulley. The length of the thread should be twice as long as the distance between the two pulleys.

When it is dry, wind all the rest of the thread on pulley No. 5_2. The second thread, No. 19, should be fastened and ambroided to the axle No. 11, as shown in Fig. 4. The length of the thread should be about four times the distance between axle No. 11 and pulley No. 20.

Fasten and ambroid the other end of the thread to pulley No. 20, and after drying, wind up the rest. At the outer end of axle No. 8 fasten a thread using the same length as shown on the picture. Fasten the other end to hook No. 25. Drop some oil on all axles and be sure that these parts move freely.

Set the blades of the lifting propeller with the aid of the setting screws to exactly five degrees and tighten the screws afterward. Use sixteen strands of 1/8″ flat rubber.

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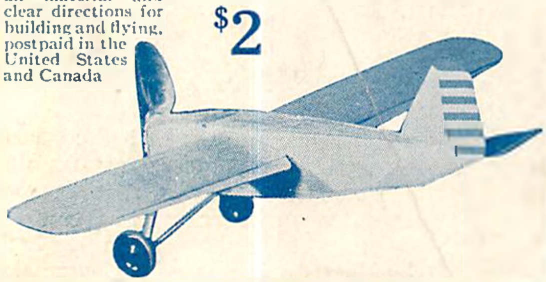

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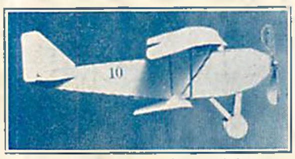

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