JUNIOR MECHANICS

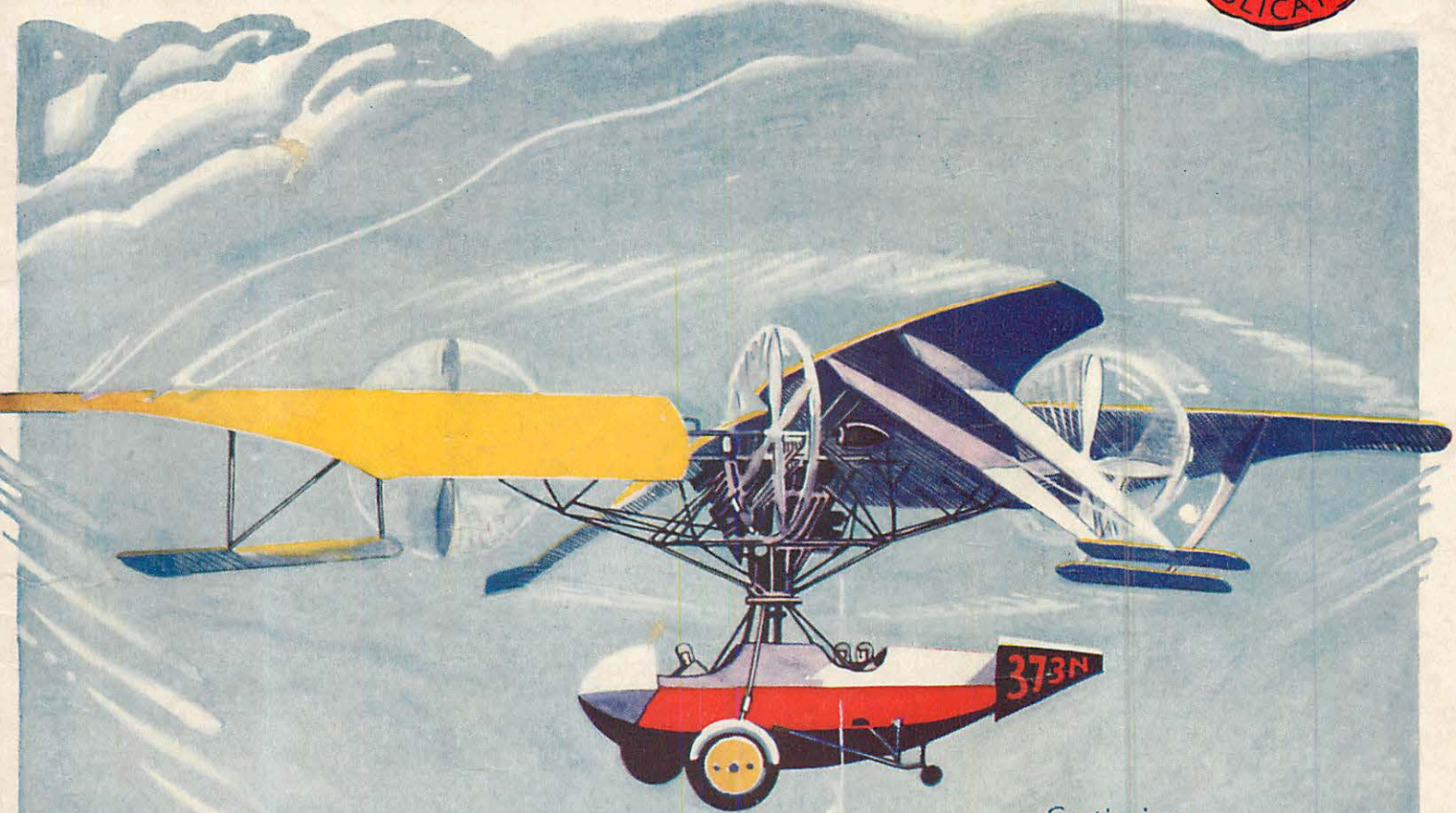
AND

MODEL AIRPLANE NEWS

NOVEMBER

A MACFADDEN PUBLICATION

PRICE 15 CENTS



Continuing
GLIDING and SOARING
AIR NAVIGATION

FULL SIZE PLANS
U.S. ARMY CURTISS "CONDOR" MODEL

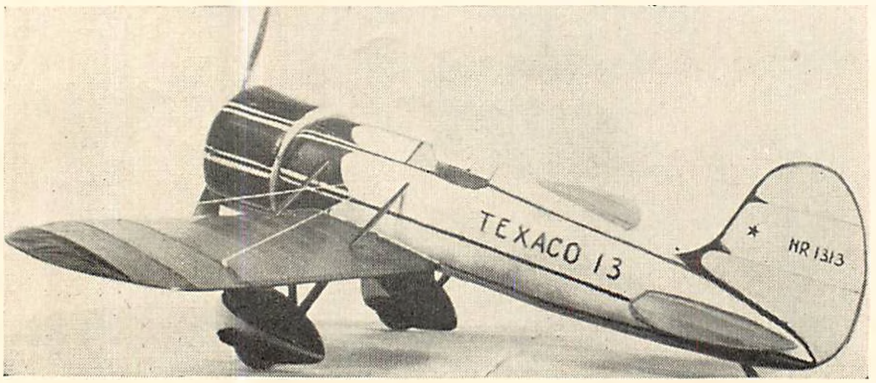
For the Junior Mechanic

How to Make a
CEILING FIXTURE
TOOL PANEL
CABIN BOAT
WHITTLING and
HANDICRAFT HINTS

Norman E Jennett 1930

THE CURTISS-BLEECKER HELICOPTER

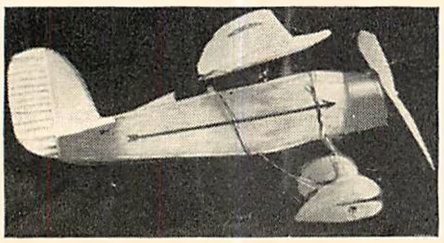
SUNRISE MODEL AIRPLANES AND SUPPLIES!



Travel Air Mystery Plane

The model shown here of the Travel Air Mystery sure is a wow! Just look at that streamlined fuselage, shiny wing, dummy cowling, streamlined pants, colorful schemes, and insignia. Don't you wish you owned this model? Yes, you can, simply send for our complete construction set, which contains all the wood parts, streamline pants, adjustable propeller, stamped ribs, celluloid wheels, full-sized plans, detail instructions, tissue, glue, dope, and etc. It has a wing span of 30" and has flown as far as 400 feet and that is darn good for a scale-model. Be the first to have this model! Rush! Construction set. **$3.50**

The Sunrise Parasol Model



This model is copied after the famous parasol type of aircraft. This model has a wing span of 30" and weighs less that 1 oz. It has a dummy N. A. C. cowling, and streamlined celluloid pants with wheels attached. This model is very powerful, and has obtained a duration of 2 mins. outdoors. Our kit contains, full-sized plans, glue, dope, insignia, dummy celluloid cowling and pants, side panels cut and everything! Construction set..... **$2.00**

New Model Airplane Supplies

Below are listed several of our famous supplies of guaranteed quality complete satisfaction or money back. Add 15c for postage. Send Money Orders, and checks only. Prompt Service!

PLANS (Plans are Prepaid)

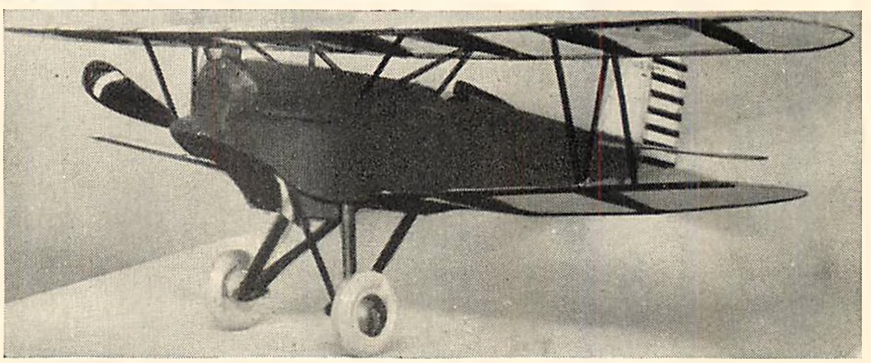
Travel Mystery	$0.50
Midget Curtiss Hawk	.35
Model Parasol	.35
Boeing Pursuit	.50
Bowlus Glider	.50

BALSA WOOD

2" x 6" x 36"	$1.00
1/8" x 6" x 36"	.50
1/16" x 6" x 36"	.35
1/32" x 6" x 36"	.35
1/8" x sq. x 3'	.03
1/8" x 1/2" x 3'	.07
3/16" x 1/2" x 3'	.07
3/8" sq. x 3'	.07
1/8" x 1/4" x 3'	.04
3/16" sq. x 3'	.05
1/4" x 1/4" x 3'	.07
3/8" x 1/2" x 3'	.09
Colorless Ambroid, 2 oz	.28
Banana Oil, 1 oz. 15c, 2 oz	.20
Dope, any color, 1 oz. 15c, 2 oz	.30
Japanese Silk tissue, 5c per sht., 25 shts	1.00
Bamboo strips, 12" 1c, 15" 2c, 19"	.03
Reed, any size per ft	.01
Miniature Dummy motor	.75
Dummy cowling	.35
Celluloid Streamlined Pants—with wheels attached	.50
Army insignia, per set	.15
Adjustable aluminum propeller	75
Rubber Strands, any size, per ft. 1c, 3/16" flat. 1-1/2c	

Midget Curtiss Army Hawk

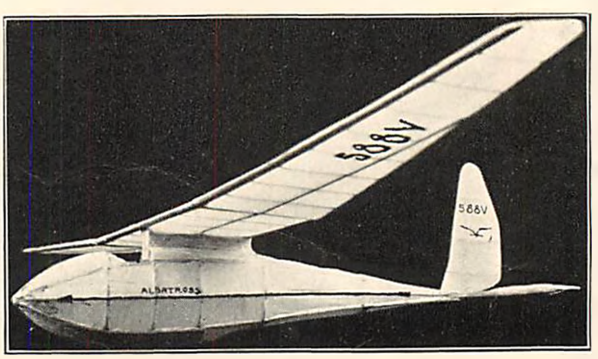
Here's that model of the Curtiss Army Hawk you have been looking for. This model is of 18" wing span and is just the size you want, and just the price you want to pay. This Hawk is very easy to build, yet it looks like the real ship. Our construction set contains all the necessary materials, and everything that you need. Satisfaction guaranteed! Construction set. **$1.15**



Boeing Pursuit Ship!

A model of this type won the scale-model contest, held at Detroit this year, and here is your chance to have that model in your model airport. This model is capable of staying in the air for 30 secs. or more and what's more, 300 or 400 feet with ease! Our set contains the materials necessary to build, with dummy motor, adjustable prop., insignia, wood parts, glue, dope, tissue & etc. The best buy in town for its price. Construction set..... **$4.00**

A Model of That Bowlus Albatross Soarer!



Here's that Bowlus Soarer, that you have been looking for. This model Glider is capable of staying up in the air for more than 2 mins. It has a wing spread of 48" and an overall length of 18". Just imagine taking this 4-ft. Model Glider out into the open, for the first time, and few minutes later, seeing its long and tapered wing and shining silver fuselage tacking and turning and flowing with and against the wind, 400 or 500 and even 600 feet above the earth. Yes sir! Just imagine! Our kit contains all the parts, such as instruction sheets, full size plans, glue, dope, paper, wood cut to sizes, and launching equipment. Satisfaction guaranteed! Construction Set—(Postpaid in U. S.) (Canada, $2.50) **$2.00**

Sends 10c now for our coming illustrated catalog, now going to press! New models, new supplies, etc.

SUNRISE MODEL AIRPLANE SUPPLY CO. Dept. A-11, Cedarhurst, N.Y.

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Here you are young fellow. This is the plane you will want to build. This Curtiss Falcon Model Mail Plane has established more records and won more contests than any other model plane. We are reserving a complete construction kit of this famous plane for you—that is if you act quickly. It is easy to build and guaranteed to fly. Working drawings and complete instructions accompany each kit and you may have it FREE

Model Aircraft Department

Thos. L. Bulger, acknowledged to be the country's foremost authority on designing and building model aircraft conducts a practical department on

Model Building

in the National Glider.

Each month will appear the latest designs and constructional drawings, with accurate scale plans of indoor and outdoor model airplanes from all parts of the world. Listed below are some of the model types that will be featured in future issues of this fascinating and instructive magazine:

Curtiss Robin	"Baby" Junkers
Stinson	Travel Air
D. O. X.	Commandaire
Spad	Davis Monoplane
Condor	Hawk
Bird Biplane	Bowlus Glider

Questions and Answers

This valuable department is conducted for the benefit of our readers as an added additional feature.

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Gliding, the newest popular and fascinating sport, is conceded to be the most economical and the safest method of flight-training. National Glider, the Magazine of Practical Aviation edited by Lieut. E. Stieri, is published primarily for the advancement of authentic knowledge of this popular and safe sport. Every issue contains not only the latest news profusely illustrated, showing the progress and rapid development being made both by gliders and powered craft, but also articles of interest written by aviation's outstanding authorities.

Outstanding Authorities Contribute

Major W. L. Purcell, a recognized authority on aviation, formerly Director of the Roosevelt Aviation School, is conducting in this magazine a complete "Home Study Course in Aviation." This course should be read by every person interested in aviation. Fascinating and instructive articles by men famous for their air exploits such as Hawley Bowlus, Capt. Frank M. Hawks, Roger Q. Williams, Anthony Fokker, Major Victor W. Pagé and others equally renowned appear in every issue.

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Vol. III No. 5

JUNIOR MECHANICS and MODEL AIRPLANE NEWS

CONTENTS, NOVEMBER, 1930

In Our Next Issue

December is holiday time, bringing the resultant empty pockets when gift-giving is over. Why not make some gifts yourself? Ever stop to think how inexpensive it would be and how much greater the appreciation of such a gift, let alone the actual enjoyment for yourself in making them?

Next month's issue contains complete instructions for making wonderful gifts for the various members of the family.

In the meantime, you model airplane enthusiasts need not think you're being shoved off the map. You're very much among those present in December's issue.

In it you will find plans for making something decidedly original in model airplanes along scientific lines —a pusher biplane. This was designed especially for MODEL AIRPLANE NEWS by the man you all know, Prof. T. N. de Bobrovsky of the Aeronautical Research Laboratory at Secaucus, N. J.

The *Gliding and Soaring* series is still going strong, as well as the courses in *Air Navigation* and in *Airplane Designing.*

Then comes the thrill of a lifetime in the way of stirring fiction! *The Mystery of the Silver Dart*, a fast-moving story of intrigue and adventure against the vibrant background of the secret service, will start in the next issue.

It's your own fault if you miss the rare treat in store for you in the December issue of JUNIOR MECHANICS AND MODEL AIRPLANE NEWS. On all news stands November 23 next, and only 15c a copy.

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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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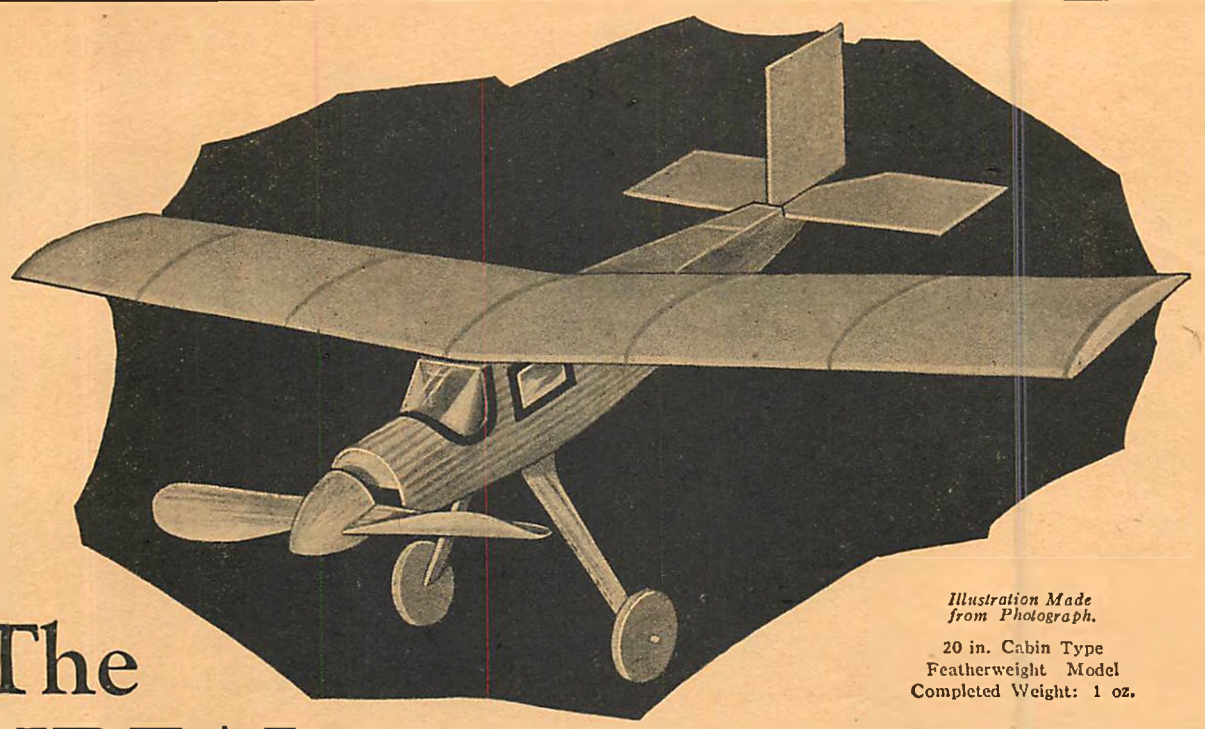

Illustration Made from Photograph.

20 in. Cabin Type Featherweight Model Completed Weight: 1 oz.

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A Triumph of Beauty Simplicity and Action!

THE most remarkable little ship you ever saw; a real reproduction of present-day commercial Airplanes! Nothing like it ever offered before. A complete, 20 in. wing span Model made entirely of balsawood (not cardboard) and guaranteed to fly when correctly constructed, for only 50 cents!! You can build and fly a whole squadron. Has many features found in more expensive Models, and parts, as shown here, come ready to use in Construction Set with Plan and Directions.

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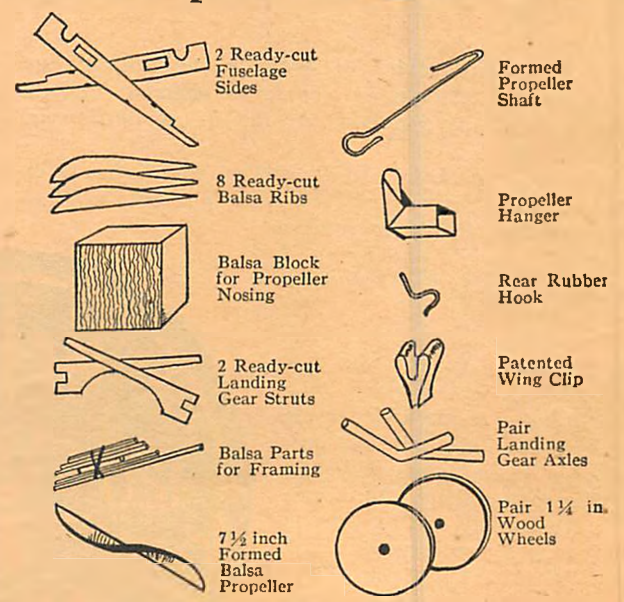
Special Circular, just out, illustrating the newest ideas in Flying Models; also the big 48-page IDEAL Catalog of Models, Parts, Supplies and Fittings—all for 5c.

Construction Set Contains these parts: 50c.



Rubber Motor—Japan-tissue Covering Paper—Cellophane for Windows—Propeller Shaft Washers and Eyelet—Instruction Sheet containing Plans and Diagrams

All parts, fittings and materials needed to construct the complete model are included in this Set; the builder need supply only glue and such coloring material as may be desired to dress the model in the color scheme wanted.

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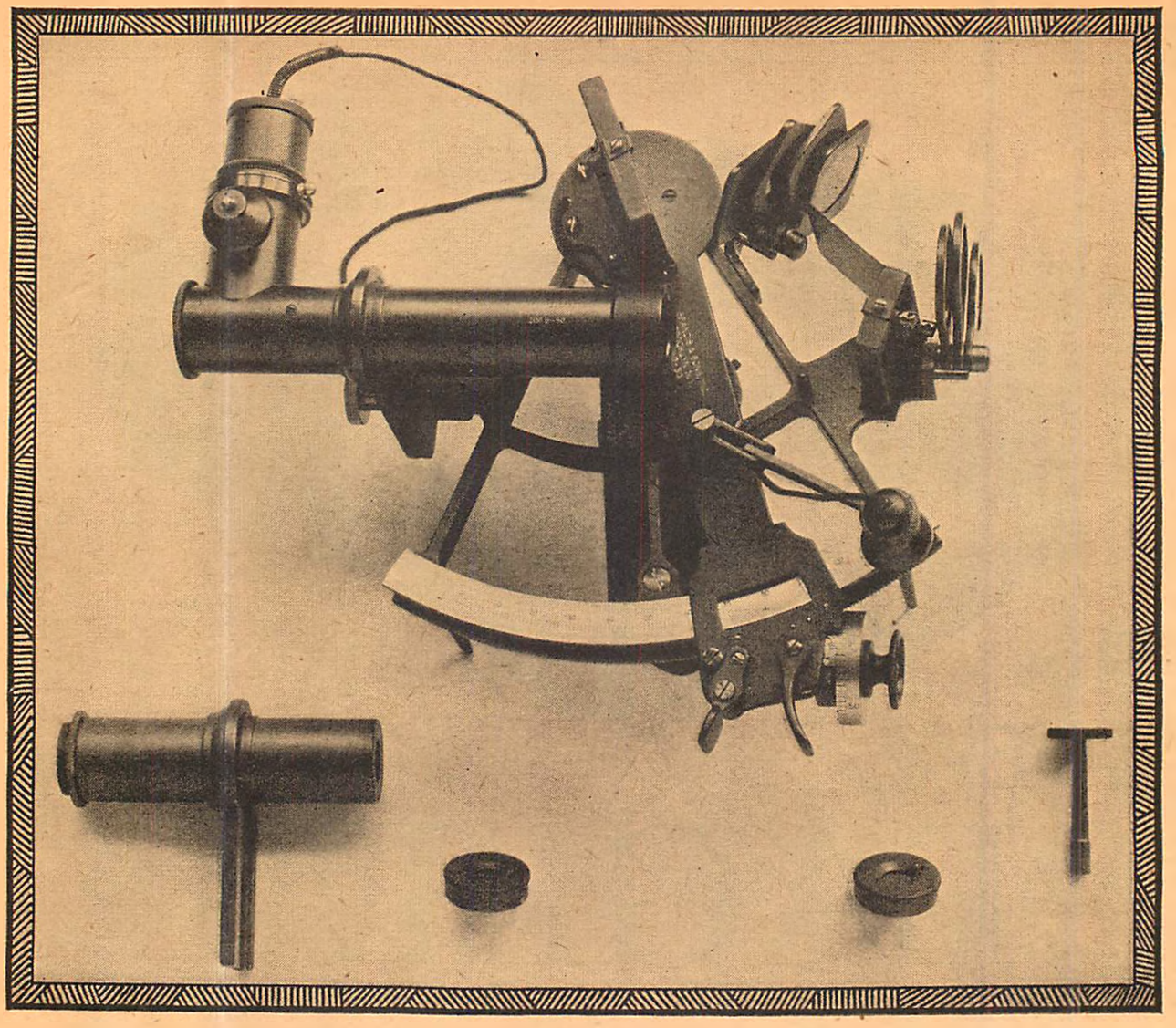


A Pioneer Octant

Special Course in Air Navigation

IN the following 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.

Air navigation is not *a complicated subject, an intense knowledge of mathematics and trigonometry is* not *necessary, merely the average person's powers of common-sense reasoning. The whys and wherefores of all the facts will only be given where they are necessary to understand the facts, as it is considered that in a short course too many of these would be confusing and apt to mislead the reader.*

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.

Keep all your copies of Model Airplane News *for future reference, you will probably need them to refer to as you go on.*

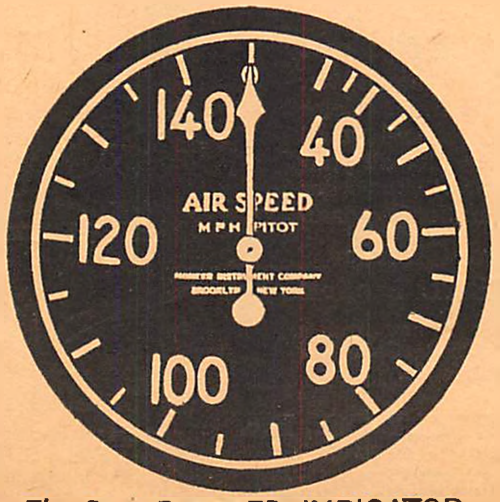


Fig. 2 AIR SPEED INDICATOR

The Editor.

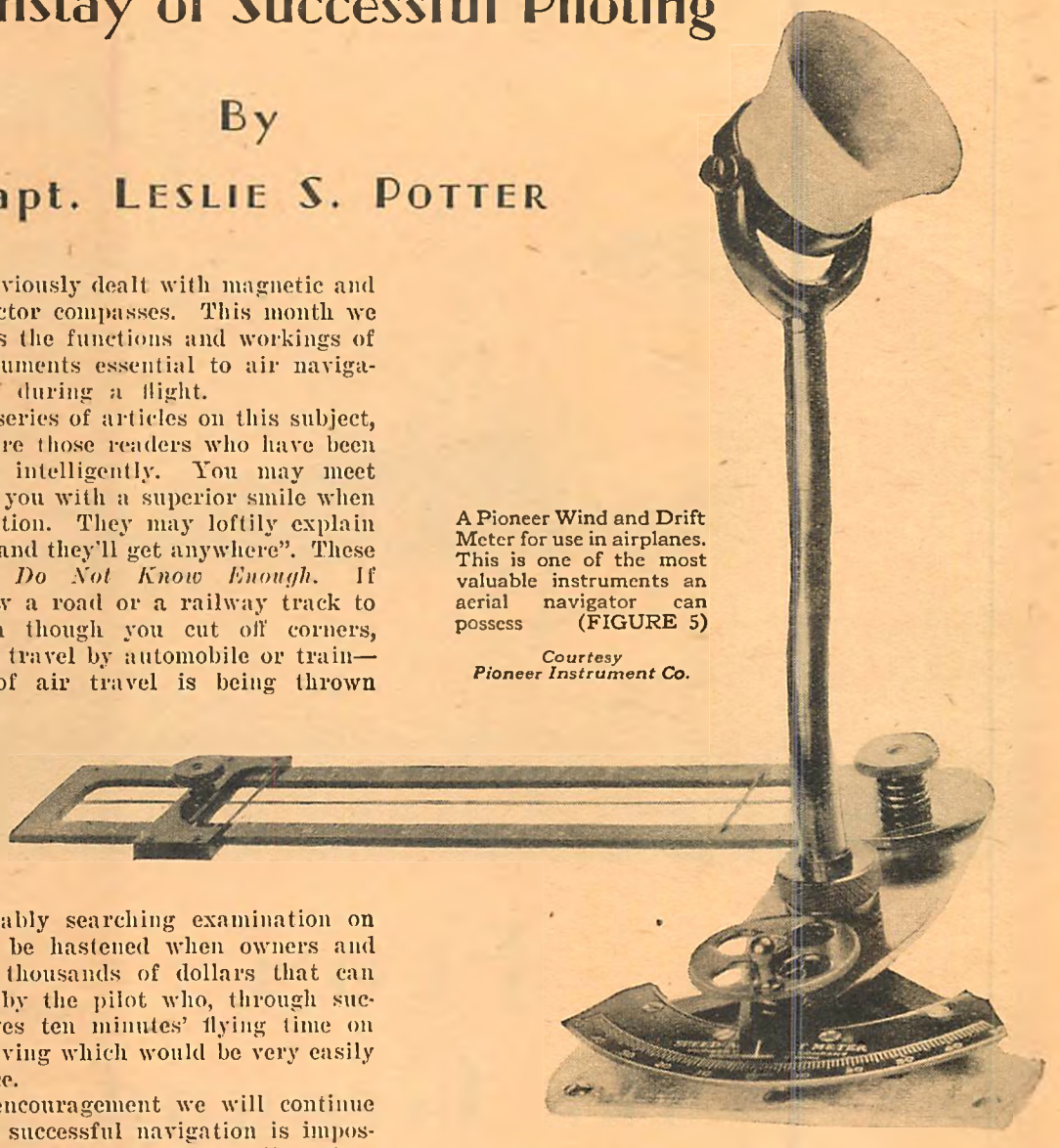
The Mainstay of Successful Piloting

By

Capt. LESLIE S. POTTER

WE have previously dealt with magnetic and earth inductor compasses. This month we will discuss the functions and workings of other instruments essential to air navigation to insure success during a flight.

At this point in the series of articles on this subject, I should like to reassure those readers who have been following the articles intelligently. You may meet pilots who will look at you with a superior smile when you talk of air navigation. They may loftily explain that "give them a map and they'll get anywhere". These are the pilots *Who Do Not Know Enough.* If you are going to follow a road or a railway track to your destination, even though you cut off corners, you might just as well travel by automobile or train—the chief advantage of air travel is being thrown away.



A Pioneer Wind and Drift Meter for use in airplanes. This is one of the most valuable instruments an aerial navigator can possess (FIGURE 5)

Courtesy Pioneer Instrument Co.

A day is going to come not so far ahead in this country—it has already arrived in Europe, when all transport pilots will be compelled to pass a tolerably searching examination on navigation. This will be hastened when owners and companies realize the thousands of dollars that can be saved them yearly by the pilot who, through successful navigation, saves ten minutes' flying time on a run of 200 miles, a saving which would be very easily effected on this distance.

With this word of encouragement we will continue by reminding you that successful navigation is impossible with inaccurate instruments and that all navigators should be familiar with the principles of the various instruments used. The calibration, that is to say, the adjustment and correction of his instruments is also the responsibility of the navigator; but since in very few places will the necessary facilities, instruments, etc., exist for the calibration of instruments, it is not proposed to deal with this here.

Air Speed Indicator. This consists of a pressure head connected by metal tubes with the instrument proper. The pressure head is made up of two tubes about one sixth of an inch in diameter (the diameter varies, of course, with different instruments), which are clamped together, one above the other, on an outer strut of the airplane. One, the pressure tube, is open to admit the airflow, and the other, the static tube, is closed but for small perforations along the side which ensure that the air pressure inside the tube is the same as that outside it.

The tubes have to be fixed when the plane is in flying position and have to be clear of any propeller slipstream. The flow of air coming down the tube passes into the back of the indicator where it distends a diaphragm or chamber to an extent depending on the amount of the airflow, or, in other words, the amount of the speed. A mechanism connects the movements of the diaphragm or chamber with a pointer on the dial, which then records the airspeed. See Figs. 1 and 2.

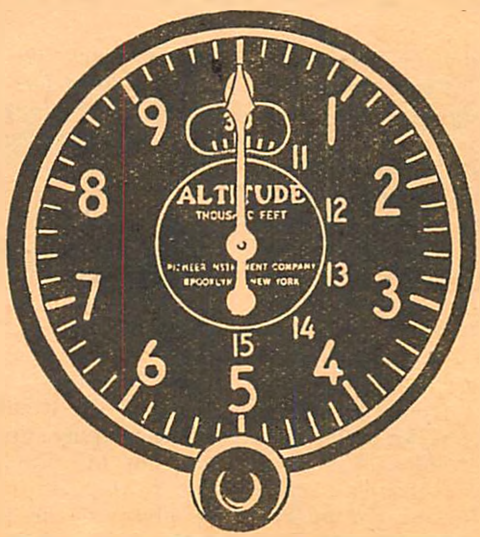
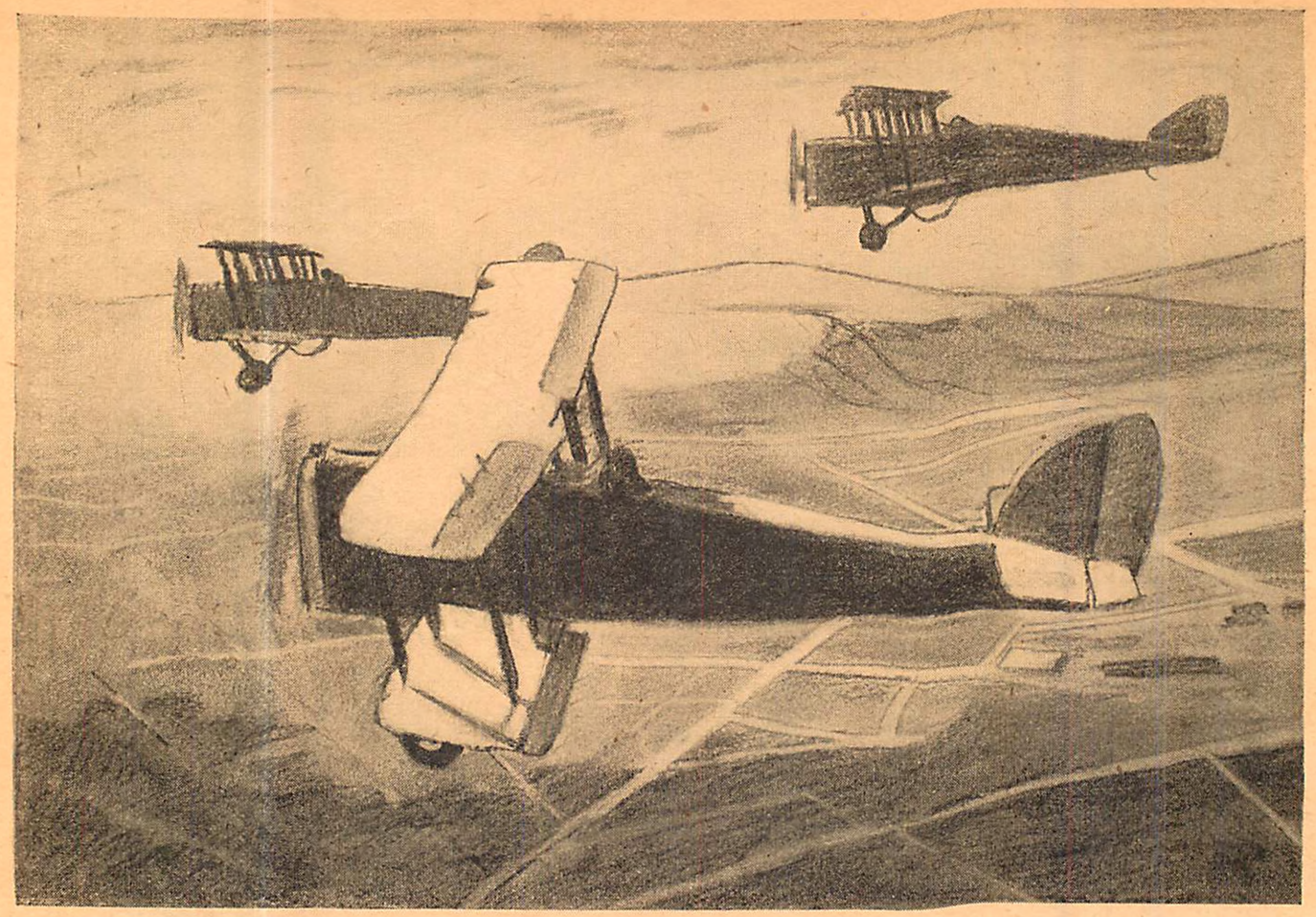


Fig. 4. ANEROID ALTIMETER

Both of these tubes must be kept clean and free from obstructions, pieces of dirt, etc., the holes in the static tube kept clear, rubber joints watched for signs of perishing and no dents allowed in the metal tubing. Any of these will cause a false reading.

It must also be remembered that owing to the varying densities of air at various heights, an allowance has to be made for this, and you must add 1 3/4% to the air speed shown in the dial for every 1,000 feet of height. If your dial showed you a speed of 100 m.p.h. and you were at a height of 1,000 feet, your true speed would be 101 3/4 m.p.h.; and if you were at 10,000 feet it would be 117.5 m.p.h. (*Continued on page* 38)



From the Ground Up

By Frank Pierce

LARRY PRICE had been adopted in his early childhood by the Bassetts, and although he was unhappy with them, had worked on their farm ever since.

On his eighteenth birthday he was bicycling along the road home from town, when his attention was attracted to a group of airplanes overhead. Larry was greatly interested in aviation, and wished to be a flyer himself.

Suddenly he noticed that the last of the group of planes started to sideslip and that flames enveloped its cockpit. When he realized that the pilot was descending in his parachute, drifting dangerously near the river, Larry, too, sped in that direction.

With difficulty he located the pilot, whom he found injured, and dragged him to a safe place. By that time the other pilots landed to look for their missing comrade.

Larry helped make the famous ace, and now superintendent of Plank Field, Major Billy Riddle, more comfortable and assisted in examining the wrecked plane. He discovered three bullet holes in the tank.

It was arranged that Larry go to Plank Field with them, and he was assigned to go along with Heinze, who had kept himself eccentrically apart from the others. Larry remembered the strange look on the man's face when he saw Larry discover the bullet holes.

Once in the air, Heinze put his plane through a series of wild maneuvers, until another pilot passed by and shouted angrily at him. Larry recalled, too, that Heinze knew this was his first flight, and that he did not know that Larry had strapped himself in. When they landed, Larry tried to save Heinze from reproof by saying that Heinze was just trying to scare him a little.

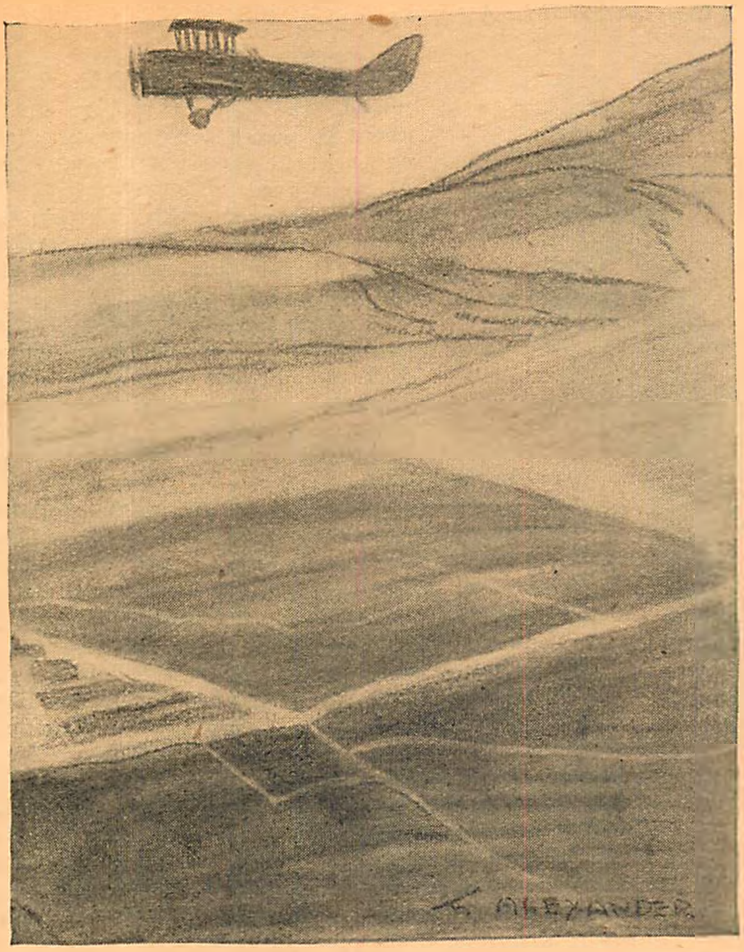
At the aid station Major Riddle questioned Larry concerning his discovery of the bullet holes, and later concerning his personal life and his desire to become a flyer.

As they talked, Major Riddle felt a genuine liking and sympathy for this lad who had saved his life, and whose hopes and ambitions were so much like those of his own youth.

He thanked Larry and asked him how he could get in touch with him. They then shook hands and Larry, exhilarated, went back to his humdrum existence on the farm.

A FAR from cordial welcome awaited him at home. Mr. Bassett growled at him for staying away all day, though Mrs. Bassett had hinted that morning that they would let Larry off some of the usual work, since it was his birthday. But now they resented his absence, and when they heard his story they remained silent, seeming to Larry to resent the wonderful adventure he had had.

The next morning he took up the usual round of his life, but his mind was not on it. He wanted to run over to the field to see how the Major was. In his mind he pictured the planes coming and going, like eager active birds, on Plank Field. In burning, vivid detail he recalled his thoughts and sensations as he had flown



Suddenly Quick Thinking and Quicker Action Is Called For and Up Among the Clouds Larry Takes a Long Chance—

Illustrations by
F. Alexander

Flying in perfect military formation, on came the entire fleet of Plank Field

from Las Vegas River to Plank Field with the curiously eccentric Heinze. Again his cheeks burned in anger at the sneers and contemptuous laughter of the pilot with the scarred face, who had just wanted to see if he could be easily frightened.

Larry remembered the deep-throated roar of the engine, the swoop of pinioned wings that bore them through the blue sky, the rainbow arc of the propeller blades that forged their way through the cool, rushing air. With sinking heart he realized that he would never again feel those sensations that had lifted him from the bog of his joyless, drudging life.

SILENTLY he did the chores demanded of him in ever-increasing frequency by Mr. Bassett. The woman, too, kept up a continual nagging at the boy.

Larry tried to tell himself, night after night, as he lay awake on his narrow bed in the uppermost room in the house, that these people had treated him very kindly, that there had been no call upon them to support him thus far in his life. But he knew, also, that Bassett needed an extra hand on the miserly farm, and certainly found that Larry was more willing and cheaper than any hired man would have been.

So, little by little, with a heart secretly aching with all the misery of a lonely life, Larry toiled and tried to forget the tanned faces of the flyers at Plank Field that kept presenting themselves in his imagination. A week passed. One evening Larry went to retrieve his new bicycle from the bushes where he had let it fall, and without explanation to his foster-parents, put it in the barn. It was completely forgotten after that.

Then one morning, ten days after his birthday and its attendant adventures, he heard the roar of a plane overhead. With suddenly leaping heart, he turned his gaze aloft. From the direction of Plank Field a brand new monoplane was winging its swift way. Larry stood motionless, rapt in burning attention at the beautiful mechanical bird that approached him. It came nearer and nearer. His heart beat quickened as it headed directly for the Bassett farm.

Then it passed over and Larry's heart dropped. But suddenly it circled back, coming lower and lower. Now it was but little more than a hundred feet up. The roar of its engine rose to a swift and booming crescendo of power as it swooped down. Then it passed, and as it passed a gleaming object fell from its pilot's hand not far from where Larry stoood.

The boy ran over and picked up a small aluminum cylinder. With trembling hands he opened it and took out a piece of white paper. His hands shook with excitement as he rolled it out flat.

On it was written:

This is the first time I could fly since the crack-up. This note is to ask if you want to be my assistant at the field. I'll teach you to fly, with a salary, of course. I want to repay you for having saved my life and I think this is the best way to do it. I know you want to fly. Come over to the field this afternoon.

W. Riddle.

That afternoon, after a stormy parting from the Bassetts, Larry presented himself before Major Riddle at Plank Field, suitcase in hand. The flyer, his right arm bound close to his body and his face still showing a trace of pallor, shook him heartily by the hand.

"Larry," he said, "you're going to be a first-rate flyer. You've got the spirit!"

Larry could only shake the Major's hand more fervently and hope that what Major Riddle said was true.

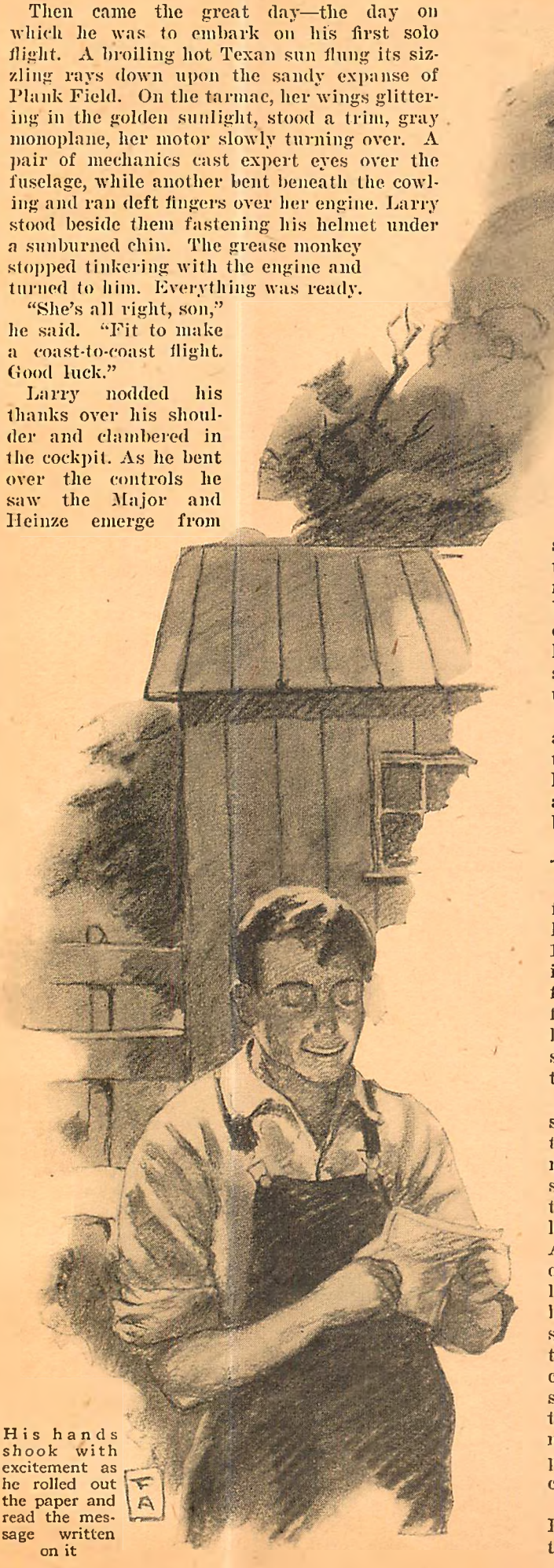
LARRY took to his new life as a duck takes to water. He was, as the Major had assured him, born to the controls. He got the feel of a ship almost at once. The low drone of a pounding motor in his ears was sweet music to his soul. It seemed as if something that had been missing from his life for eighteen motherless years had at last been given to him. He had attained a happiness that had been denied him in his playless, hard-working youth.

During the day, he remained on the tarmac, avidly gleaning information from the mechanics, and at night he pored studiously over thick, dusty books on theory that he had borrowed from the Major's office.

Then came the great day—the day on which he was to embark on his first solo flight. A broiling hot Texan sun flung its sizzling rays down upon the sandy expanse of Plank Field. On the tarmac, her wings glittering in the golden sunlight, stood a trim, gray monoplane, her motor slowly turning over. A pair of mechanics cast expert eyes over the fuselage, while another bent beneath the cowling and ran deft fingers over her engine. Larry stood beside them fastening his helmet under a sunburned chin. The grease monkey stopped tinkering with the engine and turned to him. Everything was ready.

"She's all right, son," he said. "Fit to make a coast-to-coast flight. Good luck."

Larry nodded his thanks over his shoulder and clambered in the cockpit. As he bent over the controls he saw the Major and Heinze emerge from the office and cross the field. They joined the spectators gathered about to watch the youngest pilot on the field earn his wings. The Major waved encouragingly, and Larry gestured with his gloved hand in response. Then he turned away, all thoughts concentrated on the business before him.



His hands shook with excitement as he rolled out the paper and read the message written on it

Slowly he gave her the gun. The engine's song rose suddenly from a dull, monotonous drone to a crescendo roar of power, drowning all else with its tremendous vibrations. Larry felt a thrill come over him as the ship trembled beneath him, as though she, too, were eager to be off—a captive bird longing for the freedom of the heavens. Above him a clear, blue sky roofed the world. Larry eased her down slowly, and removing his hand from the throttle he gestured to the waiting mechanics.

"Contact!" he roared, his voice clashing with the pounding of the eager engine.

Brawny hands pulled the chocks away, and like a race horse beating the barrier, the monoplane shot ahead. For a moment she taxied unevenly across the field, gaining speed with each turn of her prop. The motor purred evenly. Slowly he brought back the stick. Up went her nose as she zoomed. The spinning wheels of the landing gear left the ground. Again Larry gave her the gun, and jerked the stick back all the way. Up she went, for a fleeting moment almost perpendicular, until it seemed as if she must fall into a whip stall.

But Larry knew his ship. He levelled her out slightly, and then zoomed again. Through the still summer air the monoplane roared her way, her motor singing a happy song of freedom; her wings gliding through the air like some gigantic eagle of the sky and her prop blades invisible whirring arcs in the center of the sun.

THE slipstream flung a veritable gale behind him, and the rushing air blew its freshness full in his face. It seemed as if the very elements were reflecting his own happiness. The hand on the altimeter was at 1500 when he flattened her out, and swinging his ailerons into play, banked prettily some two miles south of the field. He knew that a score of eyes were watching him from below, and he felt proud that he was acquitting himself well. As he approached the field again from the south side, he thrust the stick forward to dip in a salute to his friends below.

Her nose went down, and the air howled through the struts as gravity and the racing engine conspired to give the plane a terrific speed. For a moment he killed the motor, and, pulling back the stick, coasted gracefully a scant three hundred feet above the upturned faces on the tarmac. As he zoomed into the heavens once more he noted that the field below was lined with planes. Again he shot into the sky, over the trees at the far end of the field. And in less than two minutes the gallant little monoplane was a mile-and-a-half to the north. As he banked and headed again for the hangars, he saw a score of shimmering white birds coming toward him in the distance. Flying in perfect military formation, on came the entire fleet of Plank Field. At the apex of the speeding wedge which bore down on him, he recognized the gaily painted ship of the Major. For a fleeting moment he was puzzled; then, as he realized their purpose, his heart gave a great bound of pride. They were coming to escort him in!

Slowly, he brought the plane around to meet them. He brought the stick back slightly, in order to fly over them as they turned to go back (*Continued on page 52*)

GLIDING and SOARING

In the photograph above is shown a "Wien" type sailplane in which Robert Kronfeld in July, 1929, flew 93 miles, reaching 7,080 feet above the starting point, and in which he also flew 101 miles recently. The shock-cord is shown (right) just as it has left the nose of the secondary type glider used by Lieut. Barnaby, U.S.N.

By PERCIVAL WHITE and MAT WHITE

A Manual of Motorless Flight

IN this issue the editor of MODEL AIRPLANE NEWS *presents the fifth instalment of the long-heralded series on Gliders and Gliding.*

The authors have obtained the material for these articles from all the most authoritative and up-to-date sources.

Percival White is well known as a writer. He has brought out many books on technical and semi-technical subjects, (such as "How to Fly an Airplane", published by Harper and Brothers), Mat White, the co-author, has collaborated with Percival White in the writing of some of his previous works on aerial subjects.

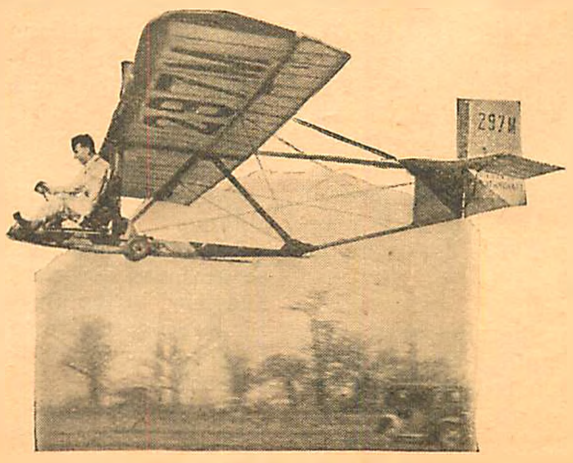
THE controls are the surfaces which govern the speed, direction of flight, and in general, the attitude of the glider. There are three sets of controls; the elevators, the rudder, and the ailerons. Before you start to fly, you must learn how to use these controls, since a glider without controls would be like a kite without a string.

The Axes of a Glider. A glider has three axes about which it turns. From Figure 1, you can see that the ship turns up or down on axis Z, to the left or right on axis Y, and rolls sideways to the left or right on axis X. The movement on axis Z is called the longitudinal movement of the glider; that on axis Y, the directional movement; and that on axis X, the lateral movement. These three movements are known, respectively, as pitch, yaw, and roll.

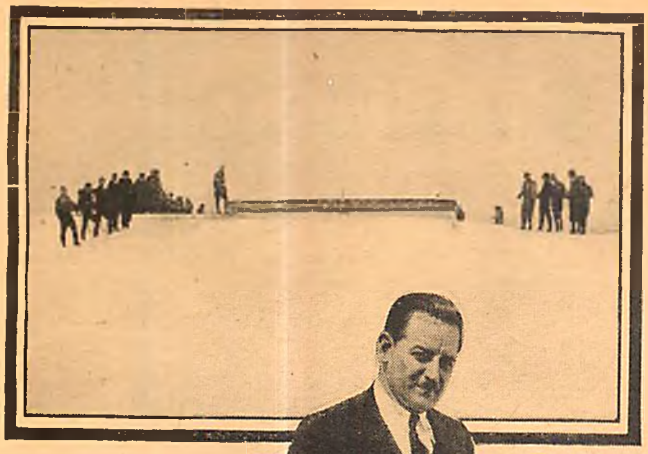
The Elevators. The elevators usually consist of two flaps, often hinged to a stationary fin, called the stabilizer, which projects from either side of the rear end of the fuselage. The elevators lie normally in a horizontal plane, but can be moved up or down on their hinges. The two elevators act as a single unit, both moving upward or downward at the same time. (See Figure A.)

When they are raised, the supporting surface is reduced causing the tail of the glider to go down, and the nose to go up in consequence. (See Figure B.) When they are lowered, the air forces the tail up and the nose down. (See Figure B.) Thus the plane can be made to climb or dive, or can be held level by the movement of the elevators.

The Ailerons. The ailerons are two horizontal flaps, hinged usually to the trailing edge of each wing. Although they in rare cases run the whole length of the wing, they usually oc-



A remarkable view of a primary glider at the moment of release



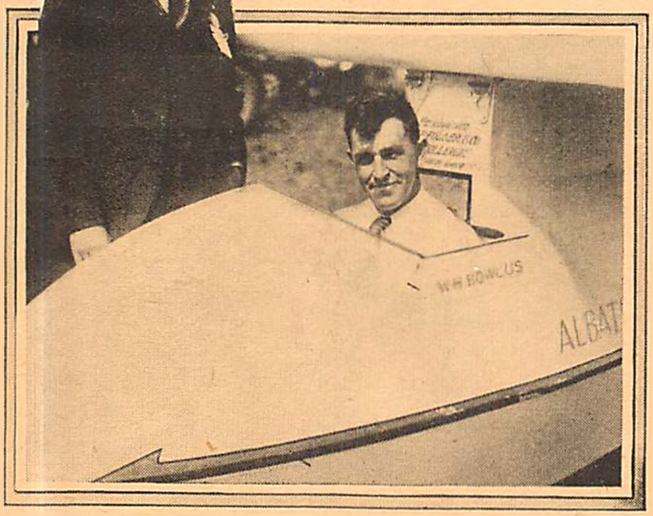
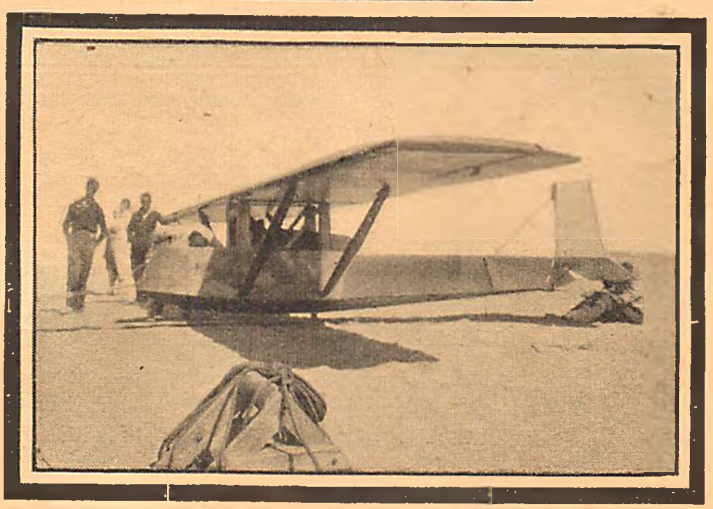


Photo above shows handlers ready to pull forward on the shock cord. Center (left to right) are shown Capt. H. J. Loftus-Price, editor of MODEL AIRPLANE NEWS, and Hawley Bowlus, American glider champ, at the recent New York glider Meet at Bayside, L. I. A side view of the glider in position for the take-off is depicted below.



cupy from one-third to one-half of the total length of the wing. (See Figure A.)

Figure A shows a wing tip aileron of a still different type. Ailerons move up and down on their hinges in the same way that the elevators do, except that they are connected in such a way that whenever one goes up, the other goes down. When the aileron on one wing moves upward, the lift on that side is reduced, and that wing drops. Meanwhile, the aileron on the other wing has been depressed, the lift is increased, and therefore that wing is raised. (See Fig. B.)

The Rudder. The rudder is a vertical flap, usually hinged to a stationary fin at the end of the fuselage, and movable from side to side. (See Figure A.) The rudder and the elevators form the tail group, or empennage. The rudder acts in the same manner as the rudder on a boat; when it is moved to the left, the force of the air pushes the tail to the right, and there is a resulting turn of the nose to the left. The action of the rudder is shown in Figure B.

THE STICK. It is obvious that the pilot must have some convenient means of controlling the elevators, the rudder, and the ailerons from the cockpit. The stick controls the elevators and the ailerons. The stick projects from the floor of the cockpit between the pilot's knees. It is universally mounted, so that it can be pushed backward and forward and to the right and left. The pilot usually grasps it with his right hand. It is connected by wires with the ailerons and the elevators.

A forward movement of the stick depresses, and a backward movement raises, the nose; while a movement of the stick to the left depresses the left and raises the right wing, and vice versa. (See Figure B.)

The Rudder-Bar. The rudder is controlled from the cockpit by the rudder-bar, just as the ailerons and elevators are controlled by the stick. The rudder-bar lies in a horizontal plane, and is pivoted at the center, so that either end of it may be pushed forward. The pilot moves it with his feet, which rest on either end of the bar.

The rudder-bar is connected by wires to the rudder itself, so that when the left end of the rudder-bar is pushed forward, the rudder, and consequently the plane, turn left; and vice versa. (These control movements are the exact opposite of those of the handle bars on a bicycle: e. g. when you push on the right end of the handle bar, it turns the machine to the left.)

SENSITIVITY of the Controls. The sensitivity of the controls depends, not only on the size of the control surfaces, but also on the speed with which the glider is travelling. If the wind is high, or if the ship is diving at a steep angle, the force of the air on the ailerons, the elevators, and rudder, will be great, and the plane will respond readily to control movements.

This responsiveness is in direct proportion to the air speed. When the speed is high the pilot must handle the stick and the rudder-bar gently, and his movements of them must be slight. On the other hand if the speed of the glider is low, the sensitivity of the controls will be decreased, and wide and sweeping movements of the stick and rudder-bar will become necessary. The controls are then said to be "mushy."

Due to the relatively slow speed of a glider, all control surfaces must be much larger than in a powered airplane.

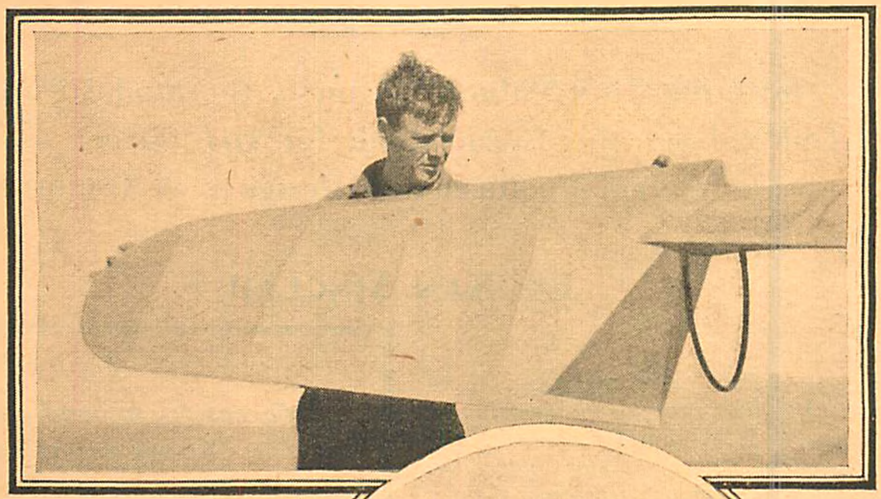
Conclusion. The use of the controls is the basis of gliding.

The movements of the stick and rudder-bar must be reviewed in the mind, practiced on the ground, and tried in the air by the student pilot, until they become so instinctive to him that he can guide the action of the glider as involuntarily as he does his own arms and legs.

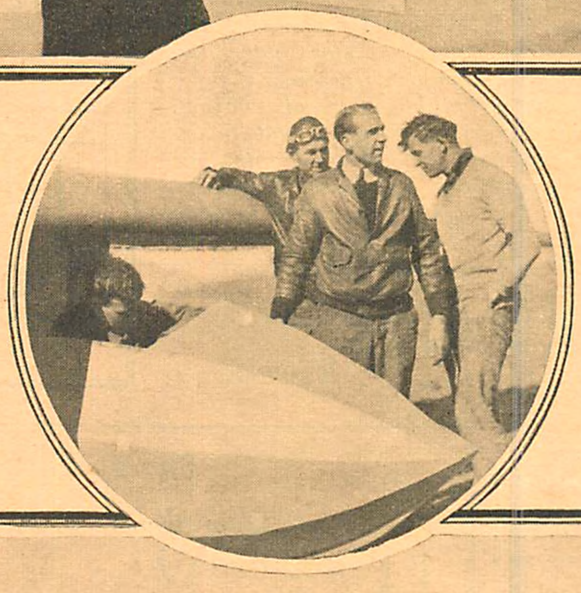
A take-off is the act of manoeuvering the glider from the ground into the air. In order to take off, the glider must gain speed sufficient to give it lift and control. As the primary glider must, when in the air,

rely largely upon the force of gravity for propulsion; so, when on the ground, the glider must gain speed from some exterior source. A ball will not go through the air until set in motion by the thrower's arm.

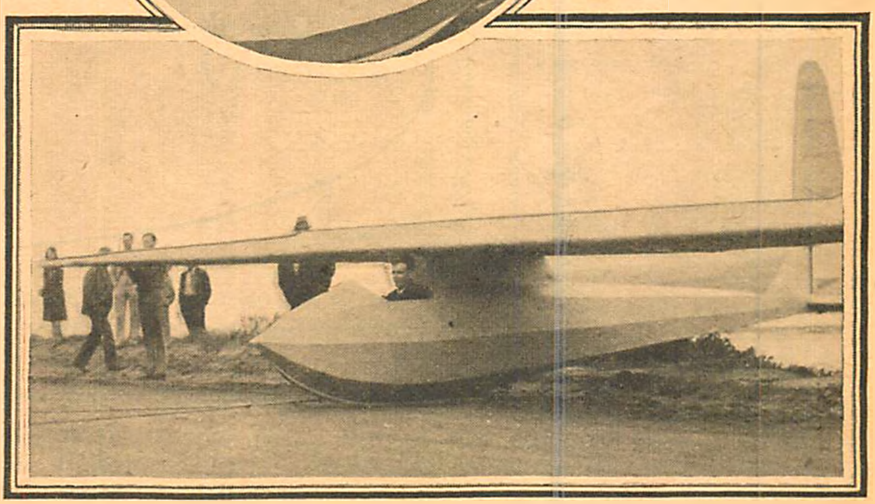
Choosing the Position for the Take-Off. The glider must be dragged to the part of the field from which the take-off is to be made. For this purpose the glider is usually set on small wheels. The following things must be considered when choosing the spot for the take-off: first, the direction of the wind; second, the steepness of the slope down which you intend to glide; and third, the freedom of the desired path from obstacles.



Col. Charles A. Lindbergh (left) placing a wing tip aileron on a Bowlus sailplane. Col. Lindbergh (circle) is shown checking over the controls before a flight at Lebec, Calif. This is necessary as sometimes the control wires become crossed in the rigging. Hawley Bowlus, the plane's builder, is standing at the ship's nose



The famous "Lone Eagle" is seen (below) a moment before he was catapulted off Point Loma on his first flight, which lasted thirty-one minutes and won him his first-class glider license —*Wm. Van Dusen*



IT is important, although not absolutely necessary, that you take off directly into the wind. The reason for this is that when you take off into the wind, your wings obtain maximum lifting power sooner. If you should take off with the wind, you would be apt to be blown almost immediately to the ground. If you took off cross wind, the ship would be in danger of tilting sharply to one side, and your take-off would be poor. If, however, you take off directly into the wind, your air speed will be greater than your ground speed by an amount equal to the velocity of the wind. (See Figure 1a.)

For example, having taken off into the wind, a glider may appear from the ground not to be moving at all; while actually it is holding its own against the wind which rushes past it. The distinction between air and ground speed will become clearer if you consider the analogy of the swimmer who swims as hard as he can against the current, and yet cannot progress beyond the point on the bank where he started; his water speed is considerable, although his ground speed is zero.

In order that the take-off may be into the wind, gliding fields are usually chosen which face into the prevailing wind of the region, or which provide slopes in all directions.

Beginners should make their early flights over level ground or along gentle slopes. Steep slopes may cause such violent upward currents that they make smooth gliding impossible. The path of the beginner's flight should be so near the ground all the way that the landing will be an easy one. (See Figure 2.)

Moreover, if the hill is a long one, do not take off from the top until you have become proficient enough to make comparatively long flights; it is easier to land on the level ground at the foot of the hill than on the slope.

It is imperative that your path of flight be free from obstacles. Trees, fences, boulders, electric wires and other high obstructions are difficult to avoid after the flight has commenced; consequently, you must plan your course before taking off. Never assume that you will go only a short distance—you may stay in the air longer than you expect, and encounter obstacles which you had ignored when planning your course.

Even when you have become an able glider pilot, be sure to allow yourself a wide path; no matter how exactly you are headed into the wind, there is apt to be a certain amount of drift.

INSPECTION of the Glider. Before taking off, make sure that the glider is ready for flight. The pilot who flew before you may have caused some injury to the ship which he did not repair. Inspect all nuts, wires, turn buckles, etc. Move the stick and rudder-bar to make sure that they effect the proper control movements; the wires connecting the stick and rudder-bar with the control surfaces sometimes get (*Continued on page* 18)

A Course in Airplane Designing

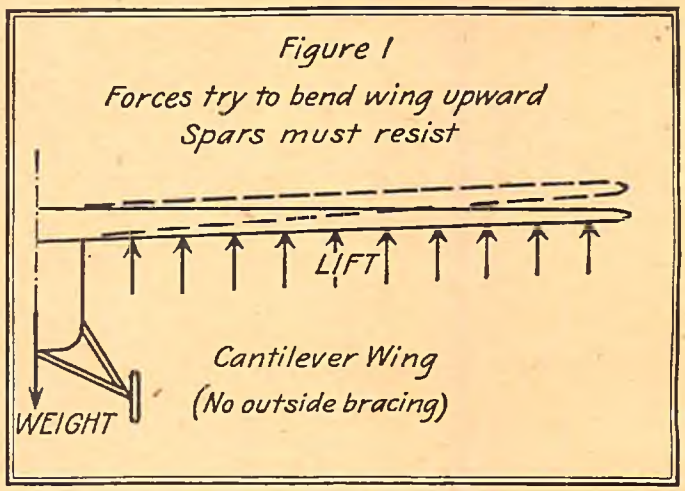
By Mastering This Valuable Course, the Model Builder of Today Lays the Cornerstone for His Career as the Aeronautical Engineer and Designer of Tomorrow

By KEN SINCLAIR

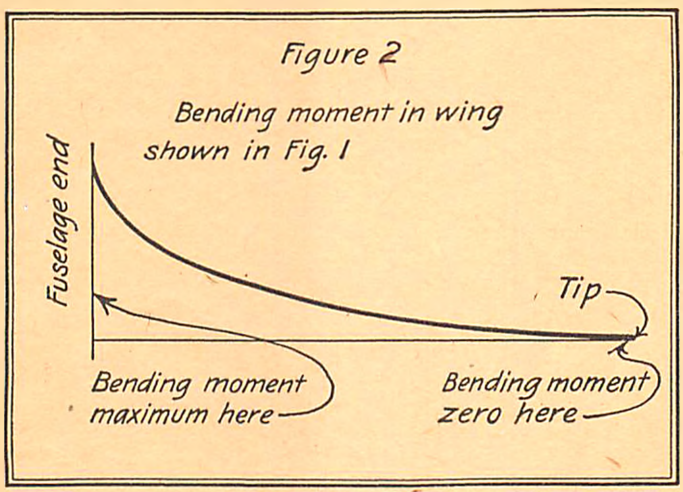
IN presenting this course, MODEL AIRPLANE NEWS *wishes to stress the fact that model building is more than a mere sport. If the builder of model airplanes learns the fundamental principles underlying airplane flight and designing, he prepares himself for a future career in the most profitable phase of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



AS we learned in the last article, every condition of flight imposes a different set of stresses on the structure of the model airplane. Our task now is to see just how these stresses affect the internal members of that structure, and to try to formulate some method of determining the sizes that will be needed for the various members.



To begin with, we must admit that it is rather beyond the average model builder to analyze *all* of the stresses in a model airplane. In addition to the inherent difficulty of the task, there is a lack of data on the subjects of strength and weight of material in very small sizes, as used in the model.

I have, however, gone through a complete stress analysis for a flying scale model, and later experimental work proved that the results were surprisingly accurate! However, that requires quite a bit of experience. Most model builders, though unable to go through the complicated process of a complete stress analysis, can, however, get a general idea of the subject, and be able to estimate the sizes of struts, longerons, etc., with reasonable accuracy.

It is obviously useless to build a ship with every member but one twice as large as needed, and with that one member too weak. The ship would be needlessly heavy, and that one weak member would probably cause it to collapse in the air! There are the two extremes to watch out for. First, the ship must not be too heavy; second, it must not be too weak to withstand the loads of flight and landing.

However, how can we tell just how strong a certain part must be? Since there is usually a different load in each member, how can we tell just what each load will be? That is rather complicated, but let us begin with a simple case, a wing spar, and see what we can learn about the stresses imposed on it.

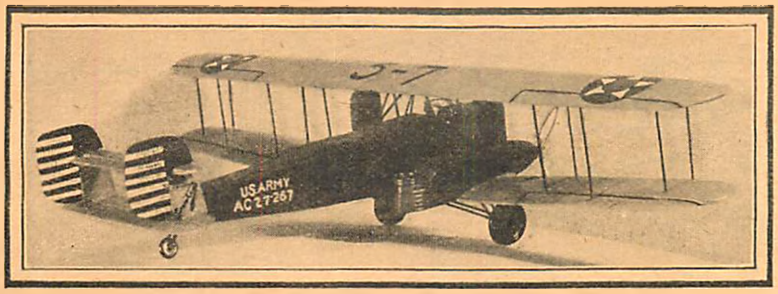
As we have learned in the earlier articles of this course, there is always a lift, distributed over the wing or wings, that holds the ship in the air. Opposing the lift, we have the weight, trying to bring the ship back down to the ground again. The lift is distributed over the entire wing span, while the weight is mainly in the fuselage, and this leaves us with the forces tending to bend the tips of the wings upward, as shown in Figure 1. Then the wing spar must resist this bending tendency, or else the wing will break. As the wing spar resists, it is in bending stress; which means that the forces applied to it tend to bend it.

AS an example; hold a ruler on the edge of a table with one hand, leaving all but about two or three inches of the ruler extending beyond the edge. Now push down the outer tip with the other hand. The ruler will bend a little and, if the force applied is large enough, or if the ruler is weak, it will break. (It really is not necessary to break the ruler.)

The ruler was in bending stress, just as is our wing spar when the ship is in the air. The only difference is that, in place of the single force at the outside end of the ruler, there is a continuous load, or distributed load, on the wing spar. For our purposes the effects are the same in either case.

Now let us turn that ruler on edge and repeat the experiment. Very hard to (*Continued on page 54*)

See Plans on Pages 14 to 19



By JESSE DAVIDSON

HOW TO BUILD
A Solid Scale Model of a Curtiss "Condor"

Excellent Data for Making a Replica of the U. S. Army Bomber

THE Pacific Coast only a few months ago was the scene of the most extensive mimic war ever staged by the Air Corps. Pursuit, attack, bombardment, and observation planes were recruited from seven army flying fields. Commanding officers agreed that maneuvers further showed the importance of air forces in defense and attack. The engagements also developed several practical points. One of them was that there should be two types of bombing planes; a light one for day service and a heavier one that could carry bombs weighing up to 4,000 lbs. for night attacks. The Curtiss *Condor* was decided the ideal bomber for night attacks.

The plans drawn here in the magazine are scaled to 20". The *Condor* makes a peach of a model when painted the regular air corps colors.

In making this model the builder can use either white pine or balsa, which can be bought at practically the same price. Be sure to read over the directions before going to work.

You will notice in looking over the plans that the plane itself is slim and has narrow chord wings and fine features. Let us start to make this model beginning with the wings.

WINGS

The top wing is made in one piece. After attaining the correct wing section, smooth with sandpaper and mark out the ailerons in dark pencil lines. The lower wing is made in four sections. The two large halves have the same airfoil section as on the top wing. The center wings, which extend from the sides of the fuselage to the motors, taper down from the higher point near the fuselage to the same section of the lower wing near the side motors. Be careful on this point.

Finish off the wing like the top wing and mark out the ailerons.

TAIL SURFACES

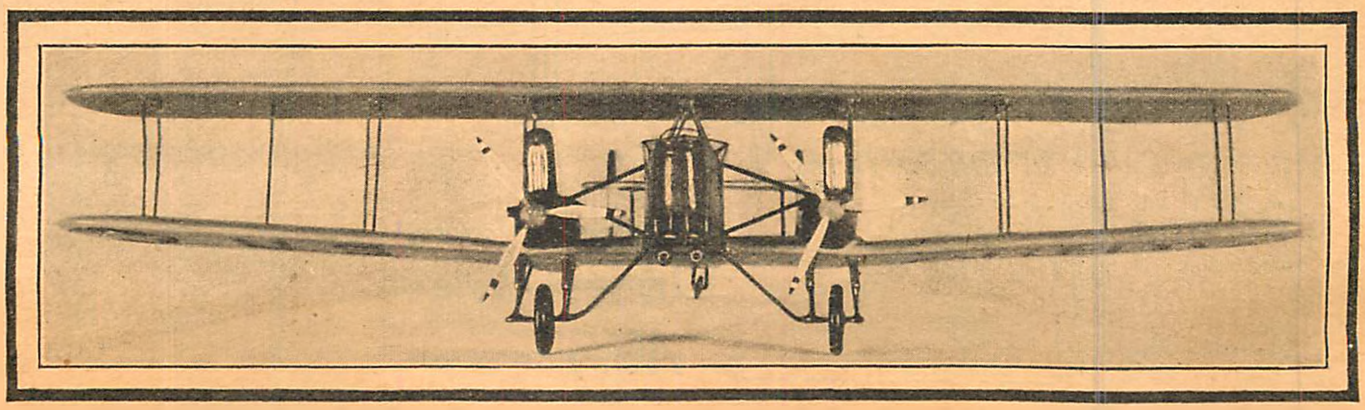
The rudders can be made movable if the builder wishes to do so. Trace out from plans, shape and stream line as shown in the drawing. There are two elevators and two stabilizers. These also can be made movable if desired. Tail surfaces are streamlined carefully, as shown in the plans.

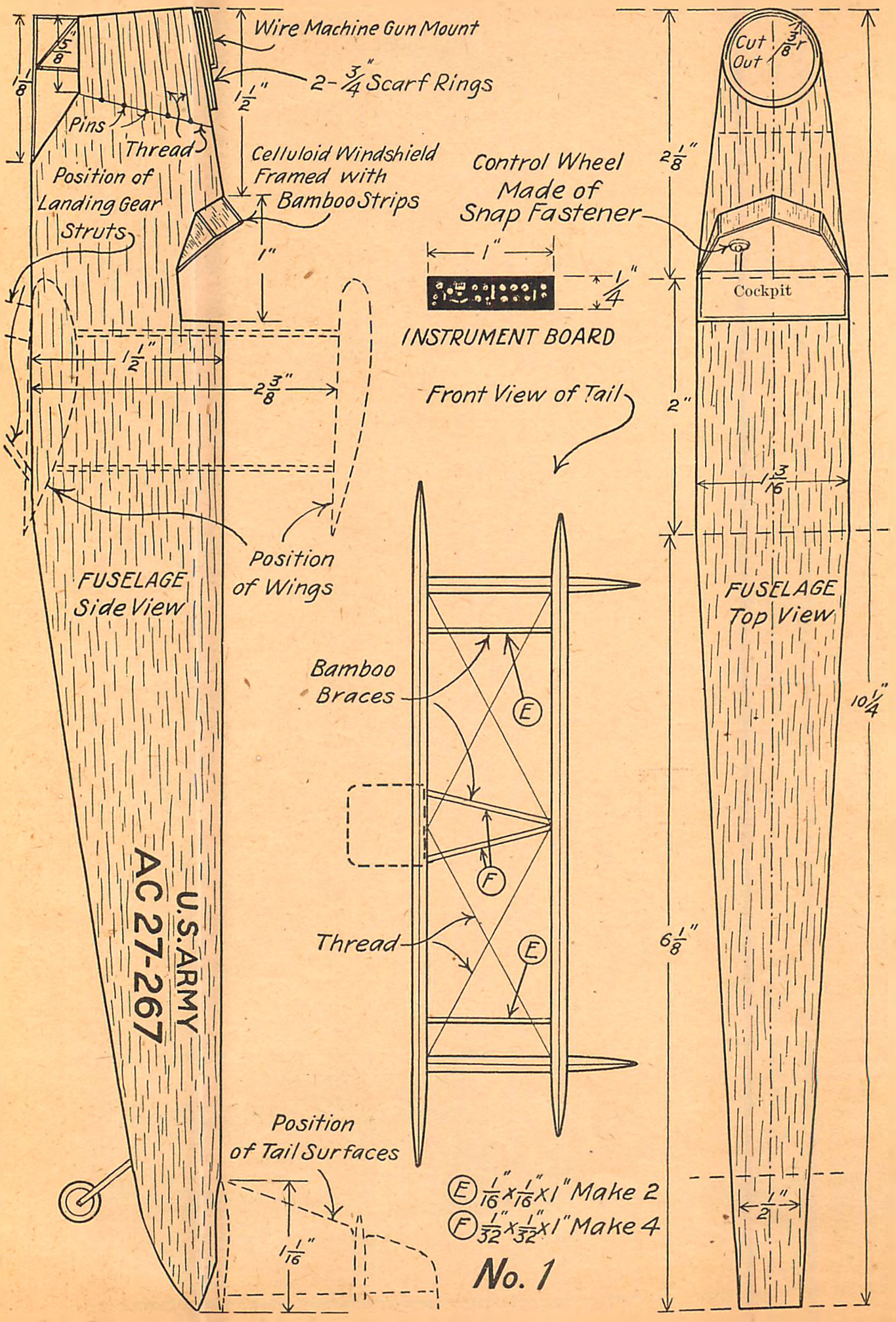
FUSELAGE

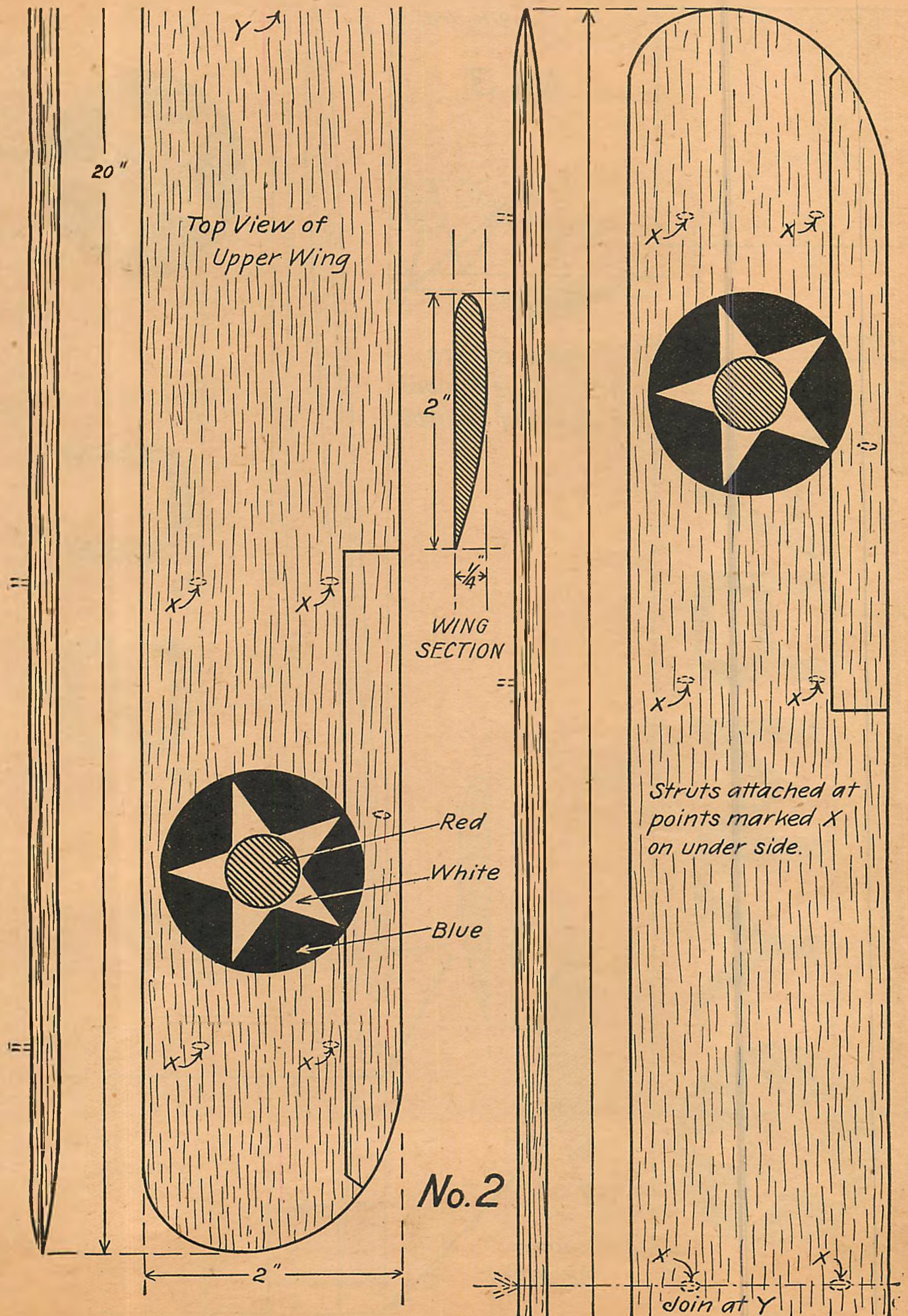
The fuselage is comparatively small and narrow. It is all square-sided and tapers down at the tail point. The cockpit is carefully carved and cleaned out with sandpaper. Place in the little seats as shown in the drawing, a miniature control which can be made from a stick of wood with a washer or wheel glued to the top, as shown in the drawing. The windshield and instrument board are also made from the plans. The gunners' cockpit should be drilled out before the fuselage is cut to shape. The scarf rings shown around the cockpits and on the side motors can be made of heavy wire or can be bought in any five and ten cent store. You will find them just the right size. There are needed six rings in all, two around each cockpit. They are assembled as shown in the drawings.

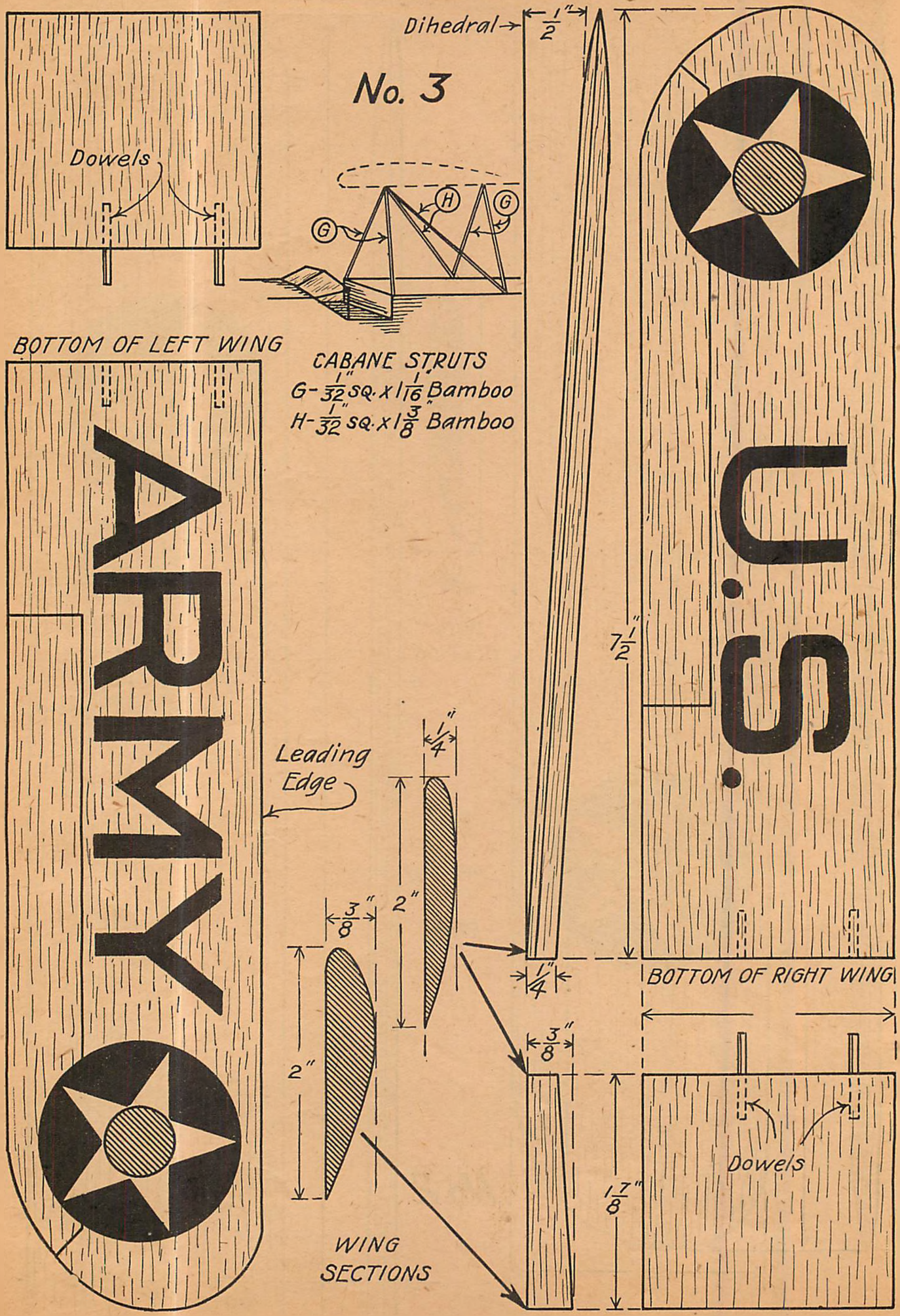
SIDE MOTORS

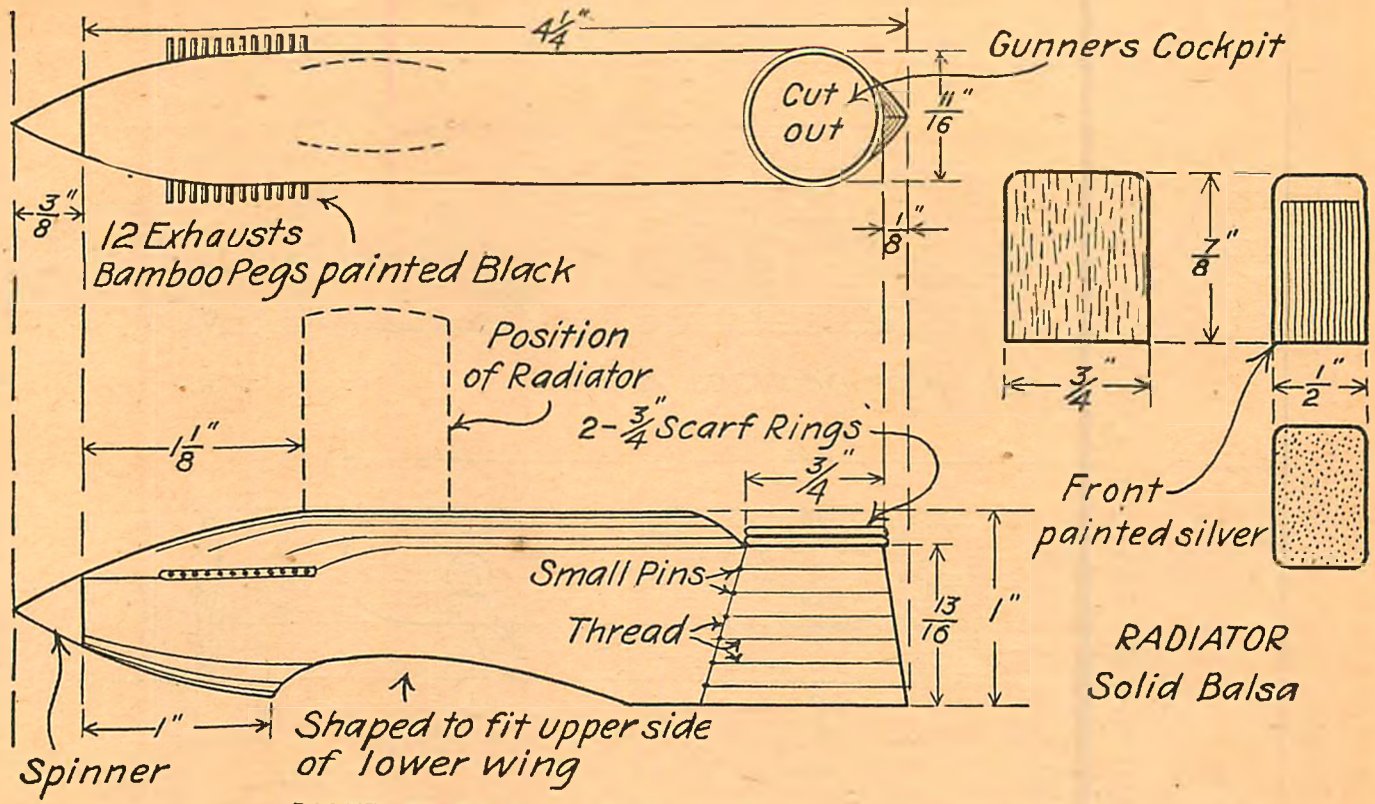
The two motors are made from blocks of wood cut down to the proper dimensions. (*Continued on page* 51)

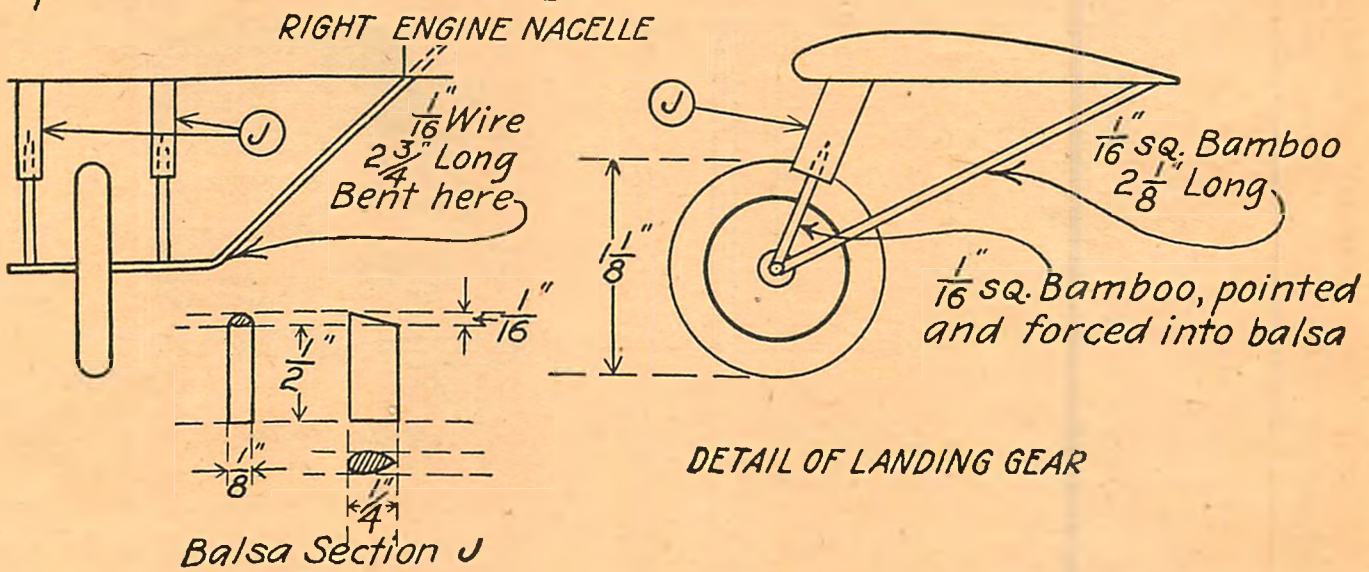


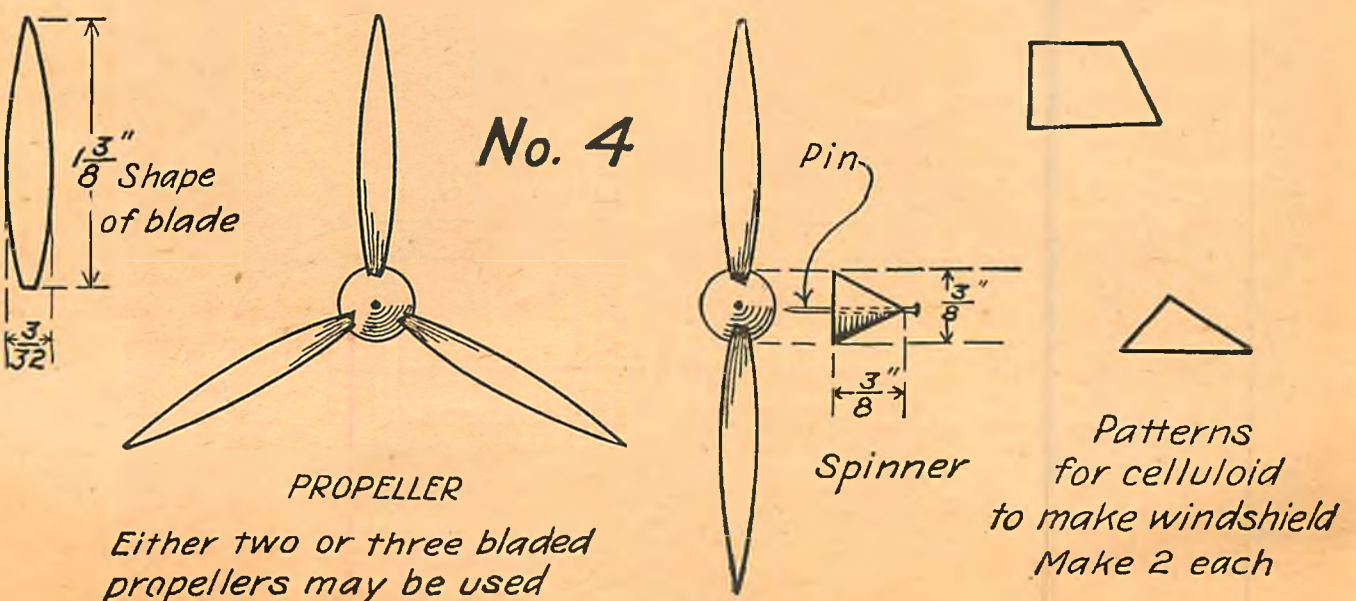

Wire Machine Gun Mount
2-¾" Scarf Rings
Celluloid Windshield Framed with Bamboo Strips
Pins
Thread
Position of Landing Gear Struts
Control Wheel Made of Snap Fastener
INSTRUMENT BOARD
Front View of Tail
Position of Wings
FUSELAGE Side View
Bamboo Braces
Thread
Position of Tail Surfaces
U.S. ARMY AC 27-267
Cut Out
Cockpit
FUSELAGE Top View
E ¹/₁₆" x ¹/₁₆" x 1" Make 2
F ¹/₃₂" x ¹/₃₂" x 1" Make 4
No. 1

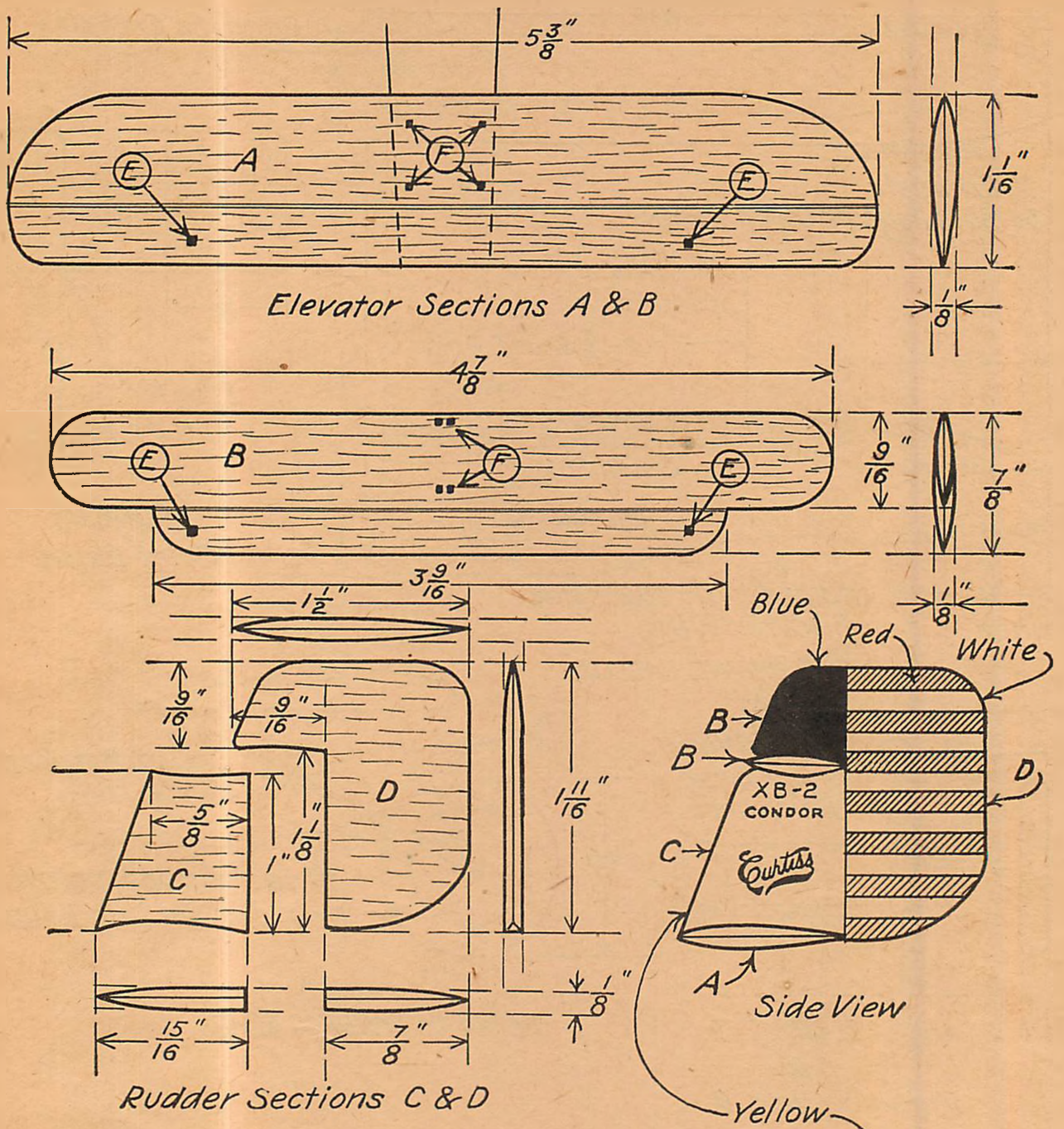

Y
20"
Top View of
Upper Wing
X
X
2"
1/4"
WING
SECTION
Red
White
Blue
2"
No.2
X
X
Struts attached at
points marked X
on under side.
X
X
Join at Y


No. 3
Dihedral
1/2"
Dowels
H
G
G
BOTTOM OF LEFT WING
CABANE STRUTS
G-1/32" SQ. x 1 1/16" Bamboo
H-1/32" SQ. x 1 3/8" Bamboo
ARMY
U.S.
7 1/2"
Leading Edge
1/4"
2"
3/8"
2"
1/4"
BOTTOM OF RIGHT WING
3/8"
Dowels
1 7/8"
WING SECTIONS


4 1/4"
Gunners Cockpit
Cut out
11/16"
3/8"
1/8"
12 Exhausts
Bamboo Pegs painted Black
Position of Radiator
2-3/4" Scarf Rings
1 1/8"
3/4"
7/8"
3/4"
1/2"
Front painted silver
Small Pins
Thread
13/16
1"
RADIATOR
Solid Balsa
1"
Spinner
Shaped to fit upper side of lower wing

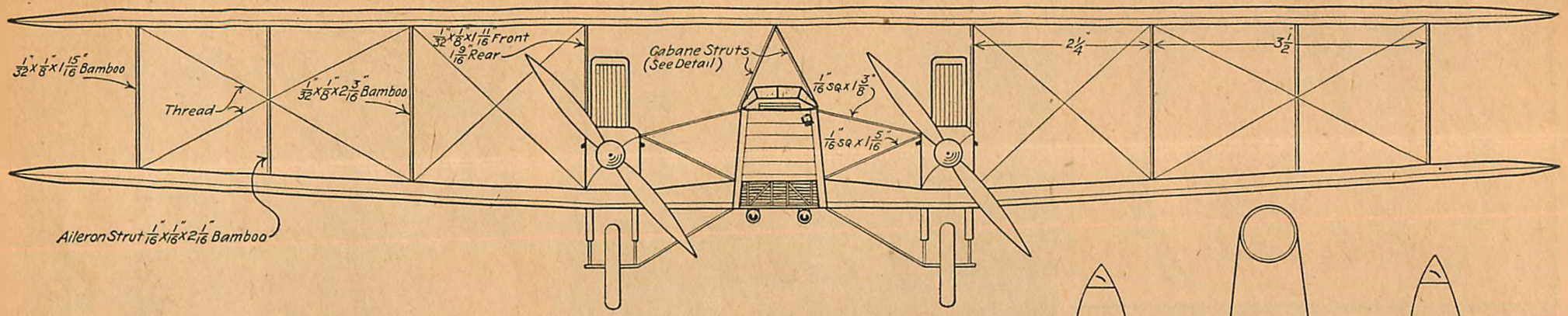

RIGHT ENGINE NACELLE
J
1/16" Wire
2 3/4" Long
Bent here
1/16"
1/2"
1/8"
1/4"
Balsa Section J
J
1/16" sq. Bamboo
2 1/8" Long
1 1/8"
1/16" sq. Bamboo, pointed
and forced into balsa
DETAIL OF LANDING GEAR


1 3/8" Shape of blade
3/32
No. 4
PROPELLER
Either two or three bladed
propellers may be used
Pin
3/8"
3/8"
Spinner
Patterns
for celluloid
to make windshield
Make 2 each

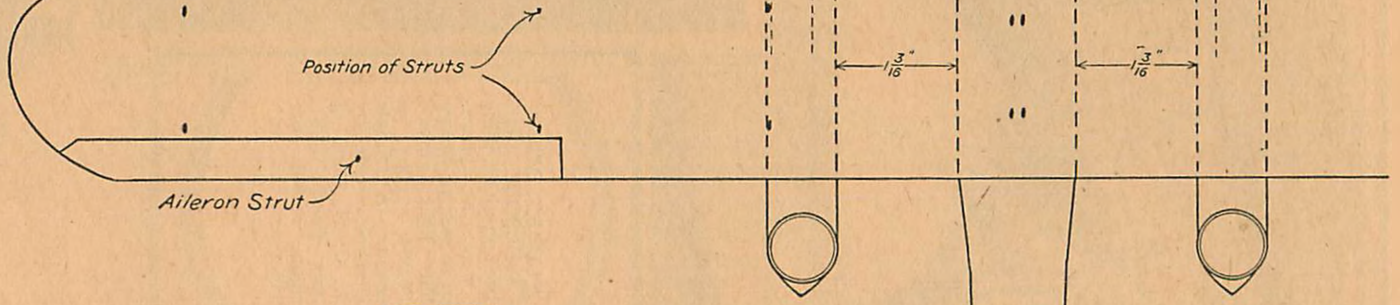


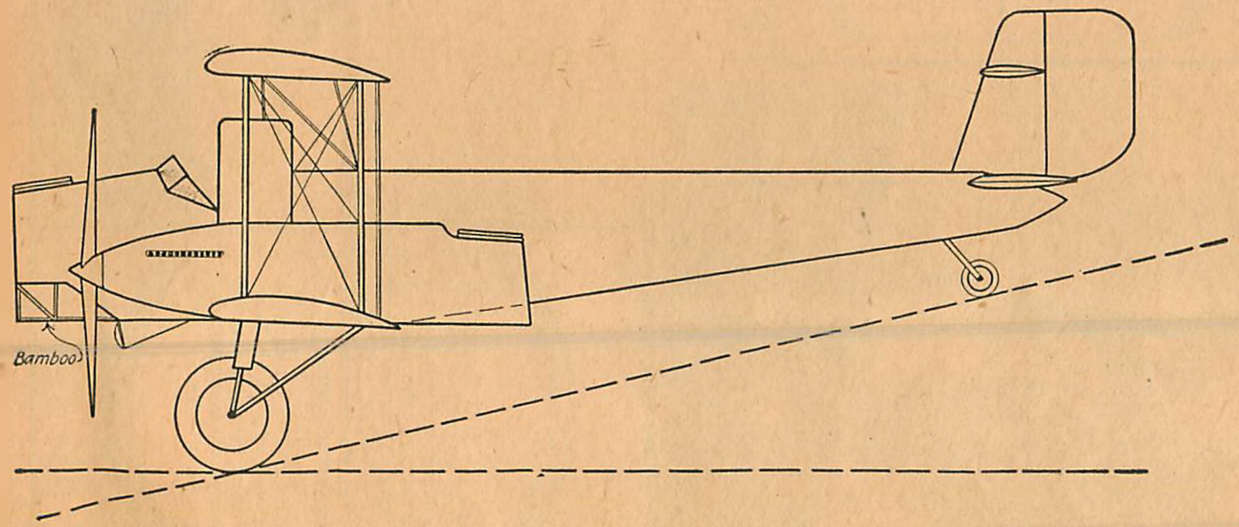
No. 5

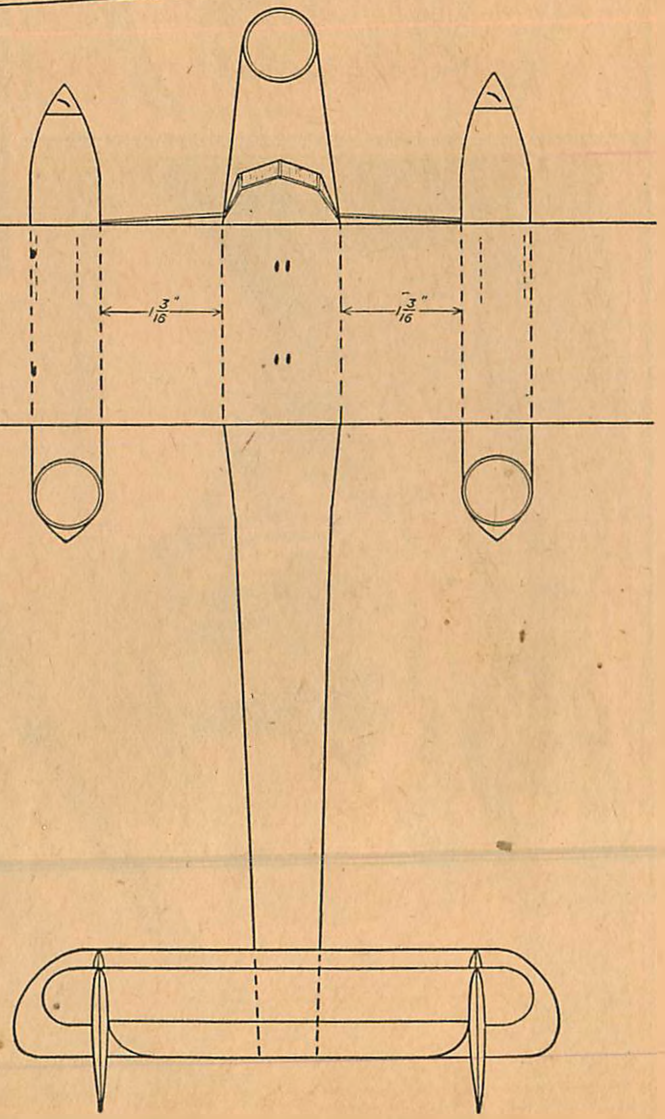
TAIL SURFACES

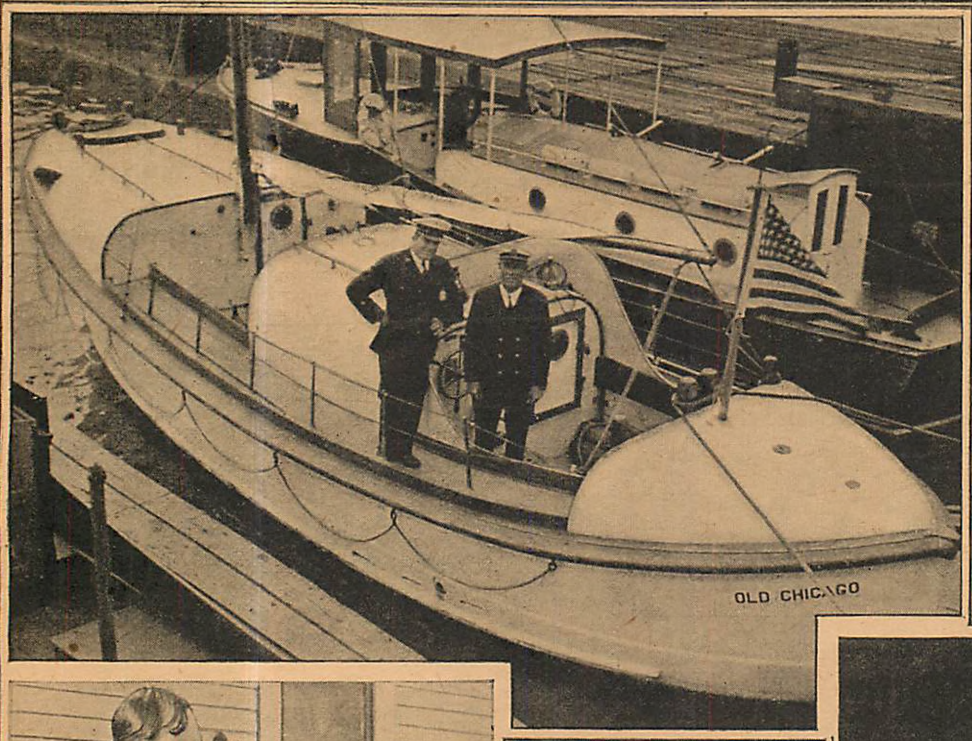

1" x 1/8" x 1 15/16" Bamboo
Thread
1" x 1/8" x 2 3/16" Bamboo
1" x 1/8" x 1 11/16" Front
1 9/16" Rear
Cabane Struts (See Detail)
1/16" SQ x 1 3/8"
1/16" SQ x 1 5/16"
2 1/4"
3 1/2"
Aileron Strut 1/16" x 1/16" x 2 1/16" Bamboo

No. 6


Position of Struts
Aileron Strut
1 3/16"
1 3/16"

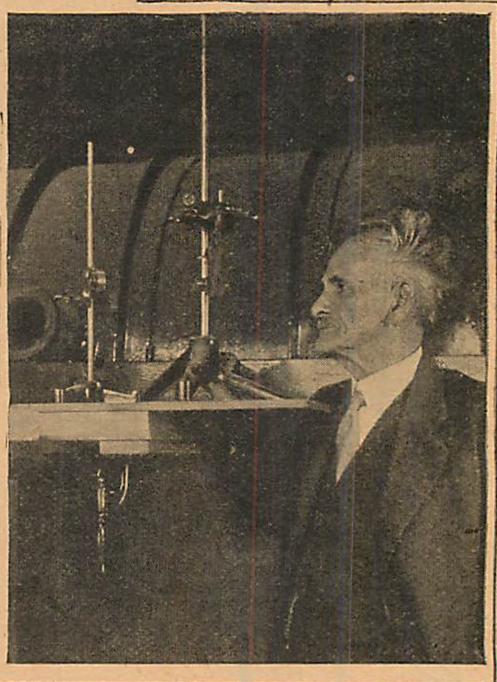

Bamboo



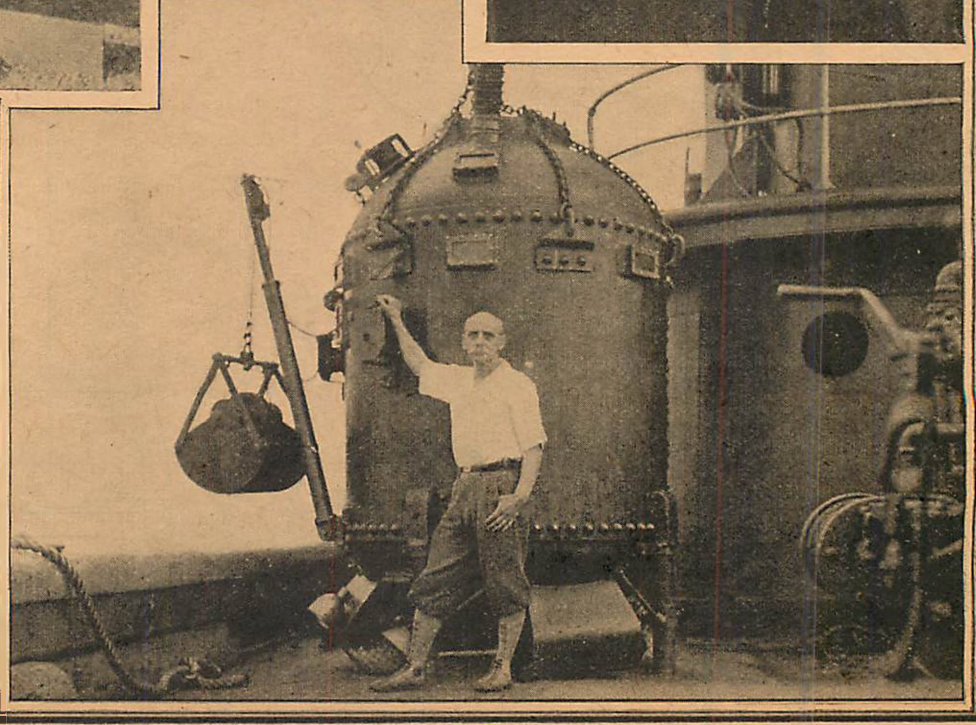


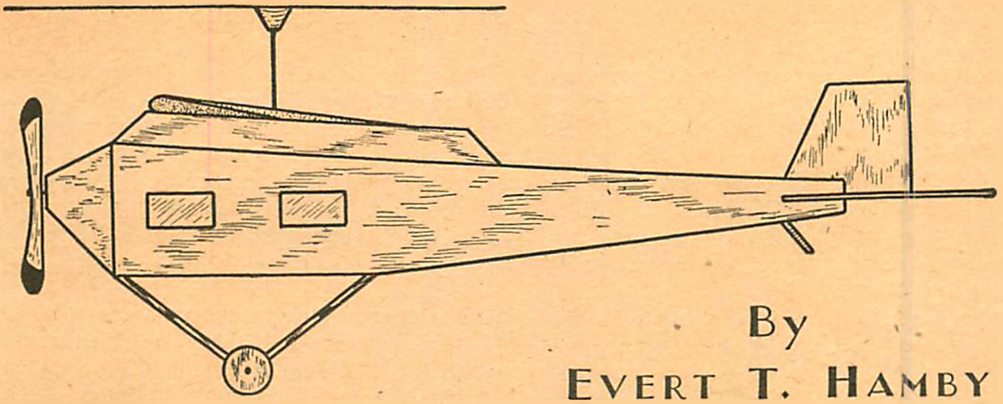
NONSINKABLE and can't overturn! Dennis Owens, machinist's mate, (left) and Capt. J. O. Anderson of the Central Coast Guard on board the *Old Chicago* on its arrival in that city after a 2,000 mile trip from the Coast Guard shipyard at Curtiss Bay, Md., under its own power (at left) —*P & A*

ALBERT MICHELSON, (left) noted physicist, using a measuring apparatus to test his theory that light travels 186,284 miles a second. A simple telescope, made by Dr. C. N. Lord, of Long Beach, Calif., (right) reveals the planets and this earth —*P & A*



A HUGE diving bell (at right) for use in salvage work was demonstrated off the shore of Long Island by Harry L. Bowdoin of New York, the inventor. The bell was lowered to a depth of 135 feet, where it successfully located a diver who had been lowered a short distance away from its diving point —*P & A*





By
EVERT T. HAMBY

Here's a Novel Light to Make Yourself!

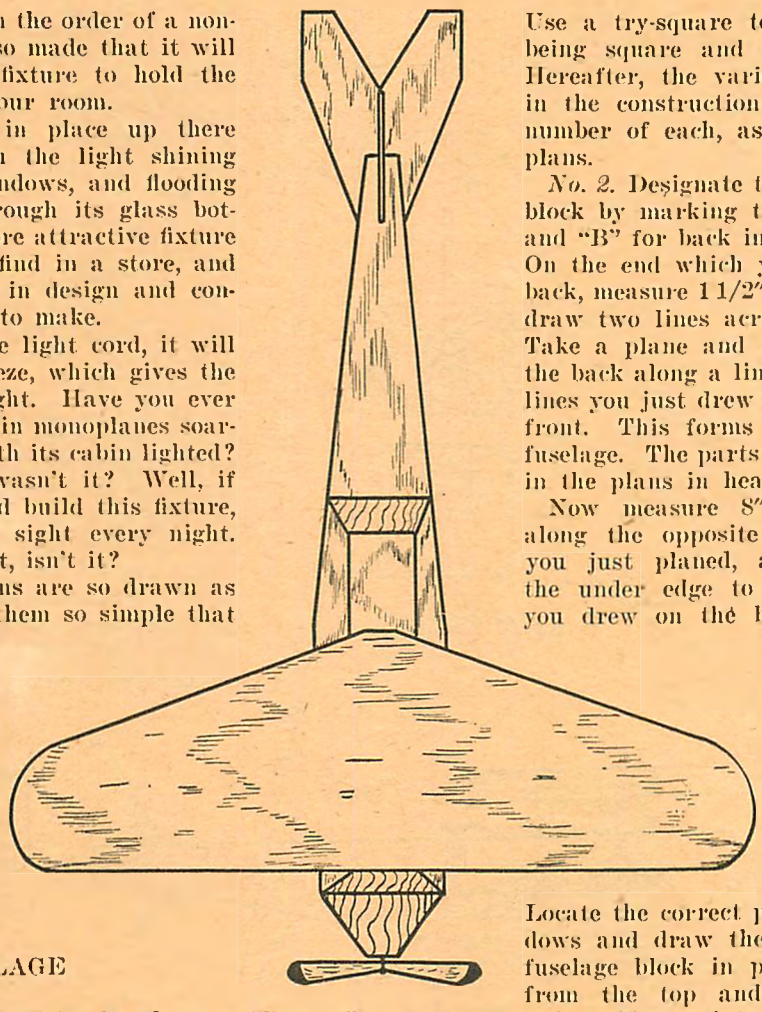
Full Construction Data for an Inexpensive Fixture

HERE is a new one! An airplane of the speedy monoplane type, built much on the order of a non-flying, scale model, but so made that it will serve as a fascinating fixture to hold the center ceiling light in your room.

Can you imagine it in place up there against the ceiling with the light shining out of its two cabin windows, and flooding the room with light through its glass bottom? It will prove a more attractive fixture than any you will ever find in a store, and yet it is simple enough in design and construction for the novice to make.

Hanging loosely by the light cord, it will sway in the lightest breeze, which gives the appearance of actual flight. Have you ever seen one of our great cabin monoplanes soaring through the night with its cabin lighted? It was a pretty sight, wasn't it? Well, if you get to work now and build this fixture, you will see that same sight every night. Something to think about, isn't it?

The accompanying plans are so drawn as to make the reading of them so simple that any boy who has never seen a set of blueprints can read them as he might a book. Each step in the work is shown and is designated by number. Let's get busy and be the first in our town to build and own an airplane light fixture.



FUSELAGE

The fuselage is designated in the plans as "Part A". Turn to this, study it well, and make sure that you understand it before you start actual work. The fuselage is built in five operations. Original block is *No. 1.*

It is recommended that white pine be used for the fuselage, though other woods can be used. The builder, in choosing his stock, should keep in mind the fact that the finished fixture hangs on an electric light cord and, therefore, weight should be kept at a minimum. Do not use balsa, as heat affects it.

Obtain a piece of white pine, measuring 4 1/4" x 4 1/4" x 23". Plane the four sides and ends to the desired size of 4" square and 22 1/2" long, as shown under *No. 1* in the plans. Use a try-square to assure all dimensions being square and finish by sandpapering. Hereafter, the various operations or steps in the construction will appear under the number of each, as they are shown in the plans.

No. 2. Designate the front and back of the block by marking the letters "F" for front and "B" for back in pencil on the two ends. On the end which you have chosen for the back, measure 1 1/2" from opposite sides and draw two lines across the face of the end. Take a plane and plane from the front to the back along a line drawn from one of the lines you just drew to the upper edge at the front. This forms the top contour of the fuselage. The parts to be removed are shown in the plans in heavy shading lines.

Now measure 8" from the front end, along the opposite face from that which you just planed, and draw a line from the under edge to the unused line which you drew on the back face. Plane along this line until you have removed all the stock, as shown. Finish with sandpaper.

A slot is now cut in the rear end, as shown, which is 1/8" wide and 2" long, extending completely through the block from side to side. Locate the correct position for the side windows and draw these on both sides of the fuselage block in pencil. These are 1 1/2" from the top and bottom of the block, measured at its widest point, which is at the extreme front end.

There are four windows in all, two on each side. As this part of the fuselage is later cut out so that its walls are only 1/4" thick, these windows need not be cut deeper than 1/4". A common pen knife will be found best for this work. Run the point of the knife around the four sides of each window. Press it carefully in the wood until the blade is about 1/4" deep or deeper. Still using the point of the knife, slowly pry the wood up until the holes are at least 1/4" deep. Care must be exercised in this work, or the wood will

split past the knife cuts. The sides of the fuselage are now finished.

No. 3. Measure 8″ from the front end of the block, and draw a line around all four sides of the block. With a plane, remove the wood shown in heavy shading in the plans. At the rear end of the block, two lines 1 1/2″ from each edge are drawn, as was done in operation *No. 2.* Plane from the front line you have already drawn to these two new lines.

This will give the desired form to the top and bottom of the fuselage. If the work has been done properly, the back end of the block will now be 1″ square, as shown in the end view. Finish by sandpapering smooth.

No. 4. The outline form of the fuselage is now finished. The top and bottom of the fuselage should now be so marked in pencil. As they are both duplicates, the builder may choose which side the bottom will be, but must keep in mind that the bottom side should be the best, as this shows the most when the fixture is hung in place.

All work from now on is done on the top and bottom sides of the fuselage. Take a fine tooth coping saw for the following work. Place the block in the vise, using several folds of paper to protect the block when in the vise, in such a position as to leave the block free from the vise 9″ from the front end. Place it in so that the front end is up.

Now saw two cuts down the length of the block, so that two 3/4″ walls are left on each side. Make these cuts exactly 8″ long. Remove the block from the vise, and, using a chisel, remove the waste center block. To insure against splitting the block, work the chisel from the center of the block at the 8″ line toward the front end. When the rough cutting is finished, smooth with sandpaper.

PLACE the block in the vise again in the same manner as before, and taking a brace and expansive bit, bore a 1 1/2″ diameter hole 3 1/2″ in the exact center of the block. Do not attempt to judge the depth of this hole without frequently removing the bit and dropping a rule in the hole. Remove the block from the vise and with a 1/2″ auger bit, bore a hole from the top of the block in the 1 1/2″ hole you have just finished. This second hole is located 11 1/4″ from the front end of the block and in the center of the top. If done correctly, the second hole will connect with the first one at the end of it.

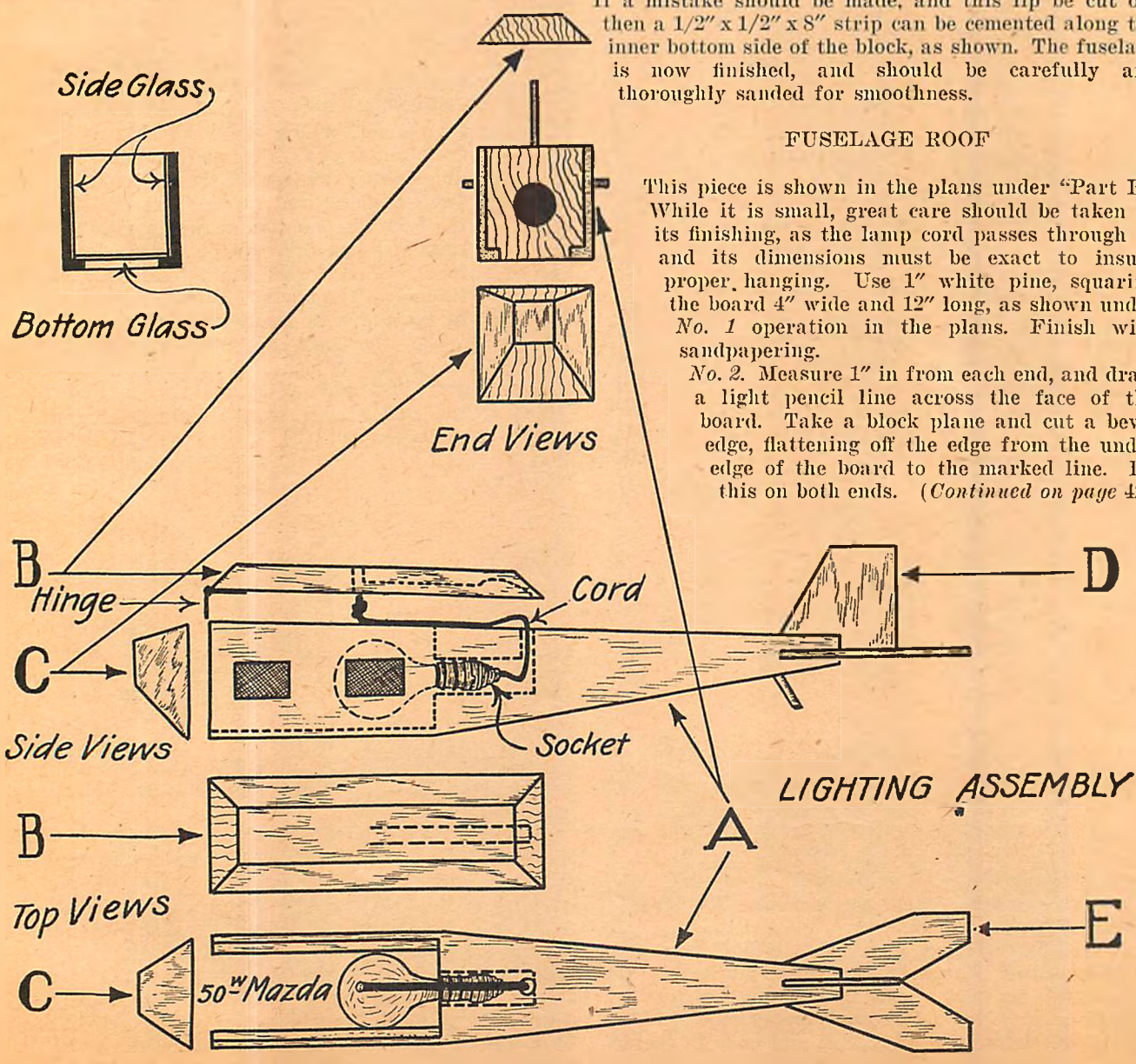
No. 5. The block is now finished except for cutting the small 1/2″ steps, which hold the interior glass. The sides of the front 8″ of the block have been cut 3/4″ thick. They are now cut down to 1/4″ thickness, leaving the original thickness of 3/4″ at the bottom side of the block, which extends up 1/2″. A pen knife and small chisel are used for this work.

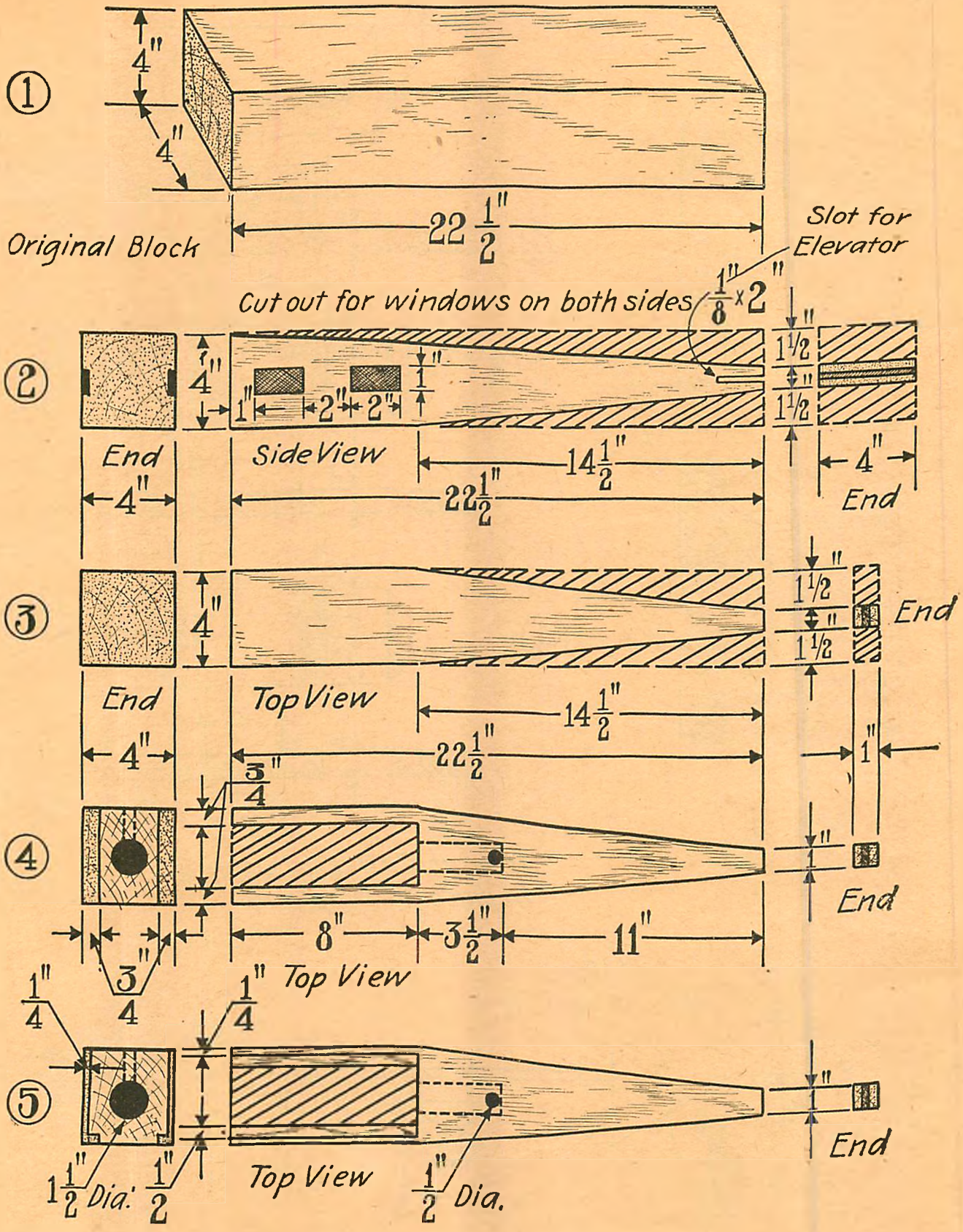
If a mistake should be made, and this lip be cut off, then a 1/2″ x 1/2″ x 8″ strip can be cemented along the inner bottom side of the block, as shown. The fuselage is now finished, and should be carefully and thoroughly sanded for smoothness.

FUSELAGE ROOF

This piece is shown in the plans under "Part B". While it is small, great care should be taken in its finishing, as the lamp cord passes through it, and its dimensions must be exact to insure proper hanging. Use 1″ white pine, squaring the board 4″ wide and 12″ long, as shown under *No. 1* operation in the plans. Finish with sandpapering.

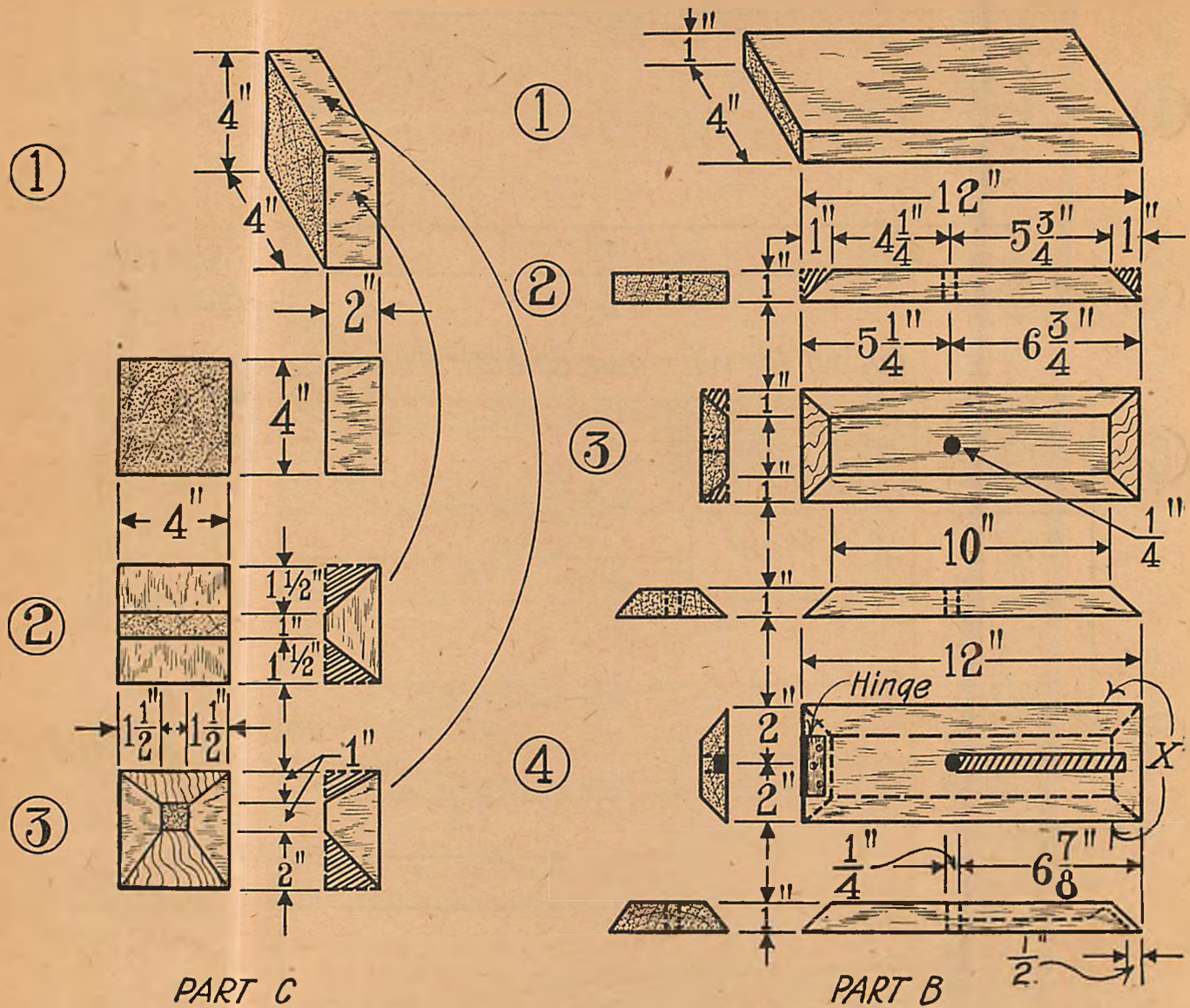
No. 2. Measure 1″ in from each end, and draw a light pencil line across the face of the board. Take a block plane and cut a bevel edge, flattening off the edge from the under edge of the board to the marked line. Do this on both ends. (*Continued on page 42*)





PART A

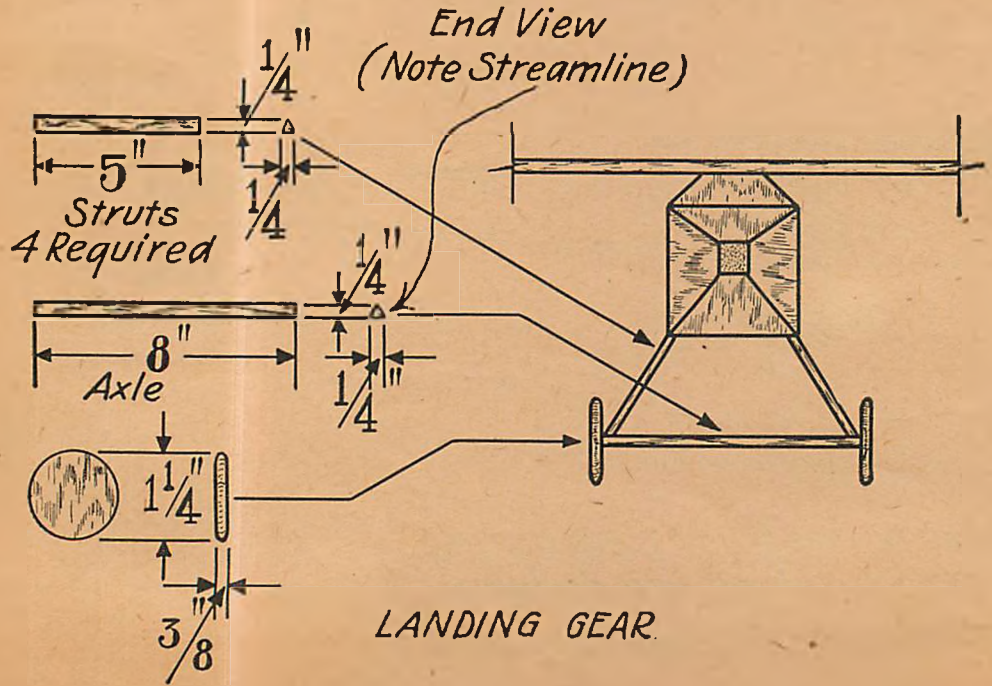
The steps necessary in constructing parts of the fuselage are designated. (Cut away all shaded parts.)



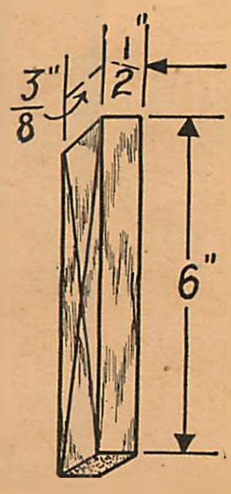
PART C

PART B

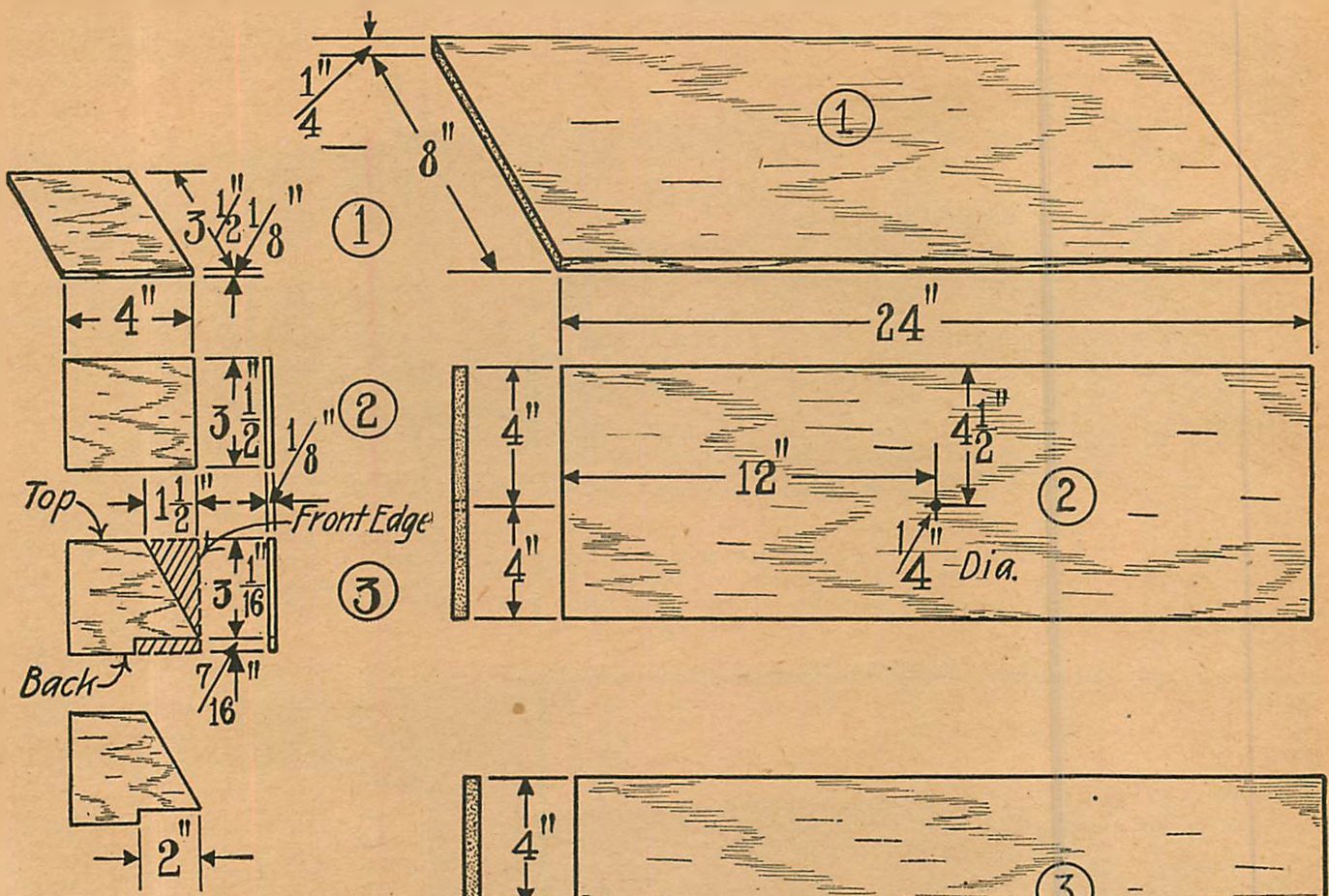
Trim at X after attaching in place on fuselage



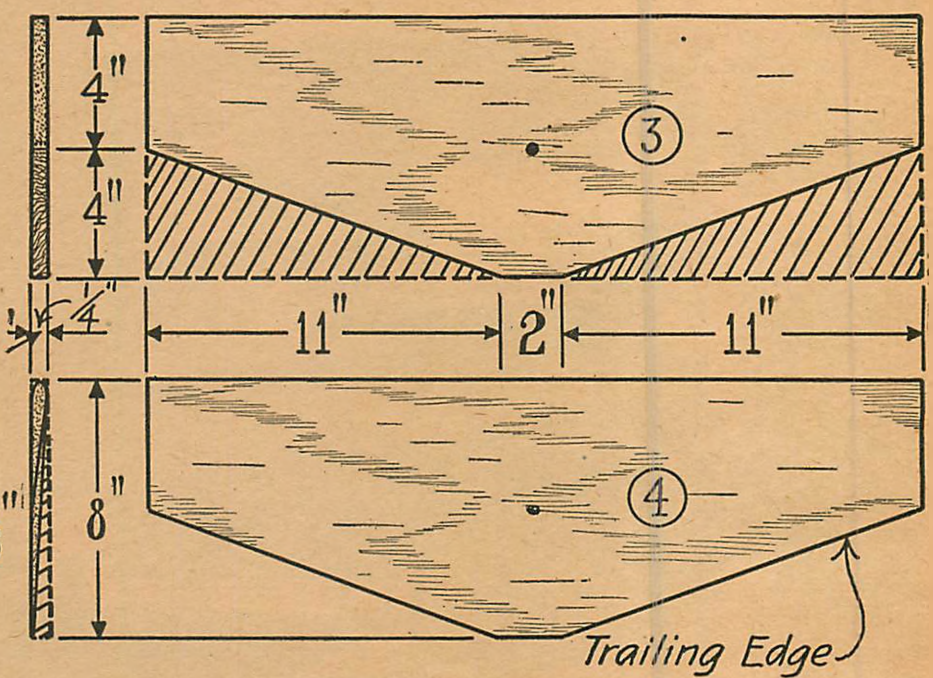
LANDING GEAR

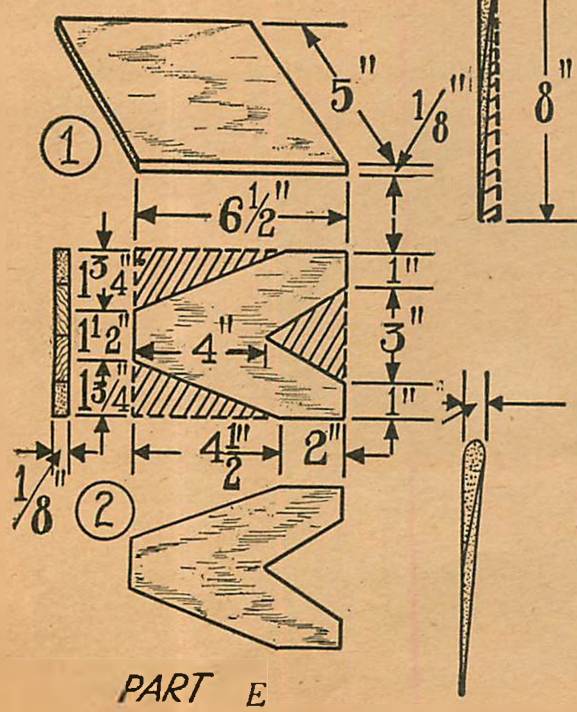


PROPELLER

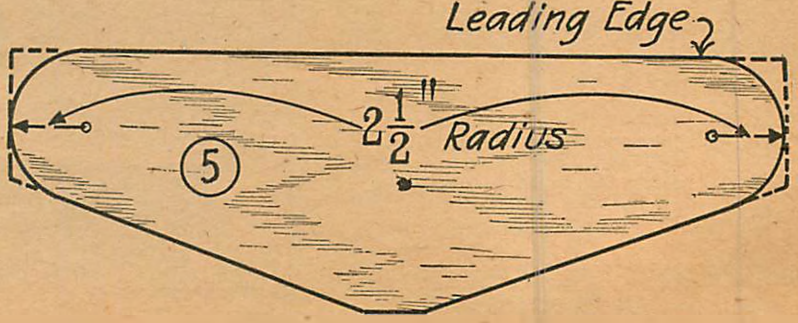


PART D

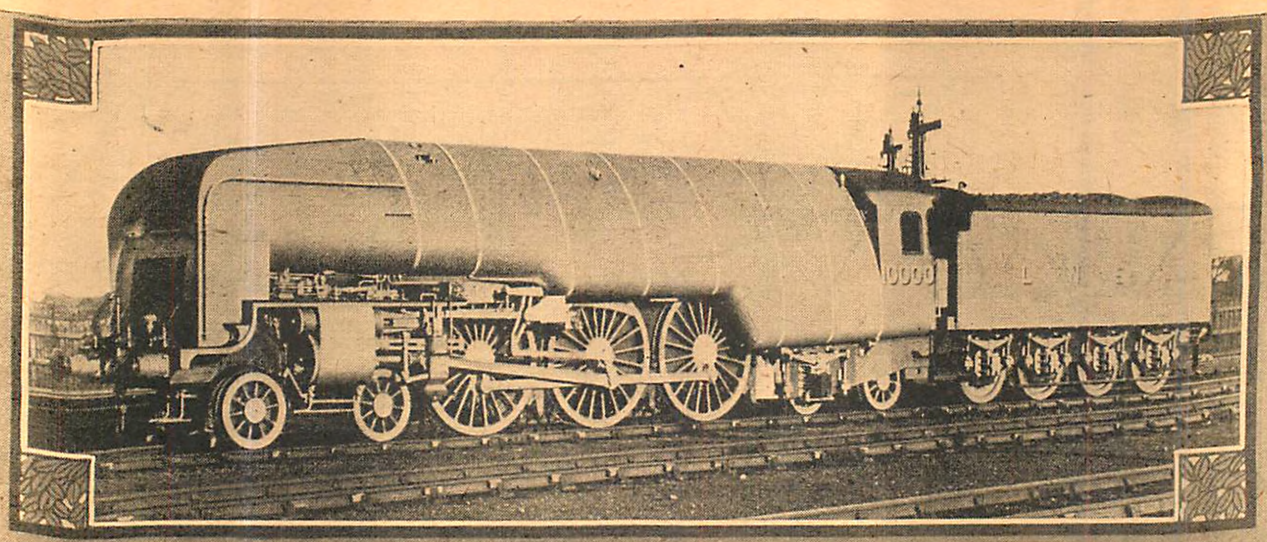




PART E

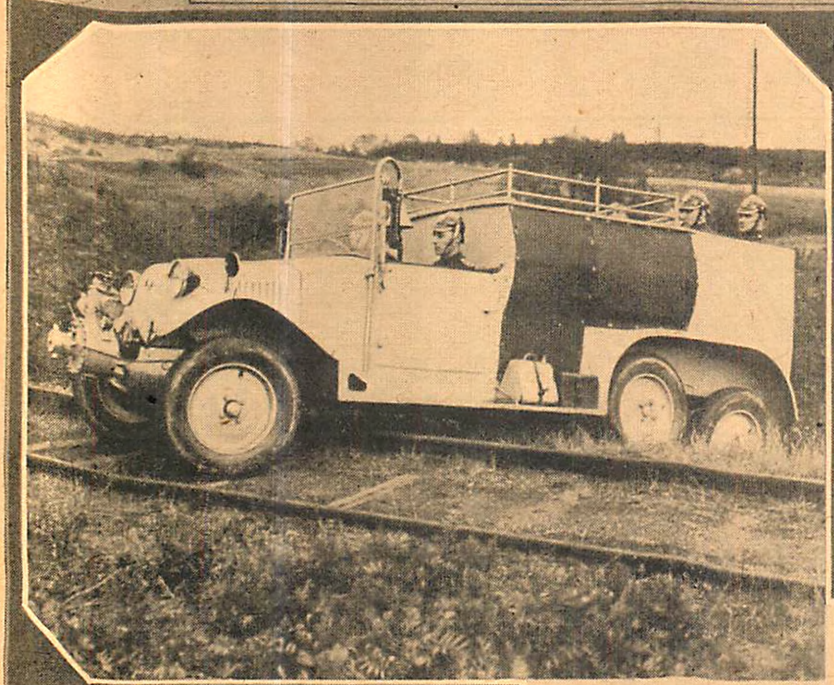


WING



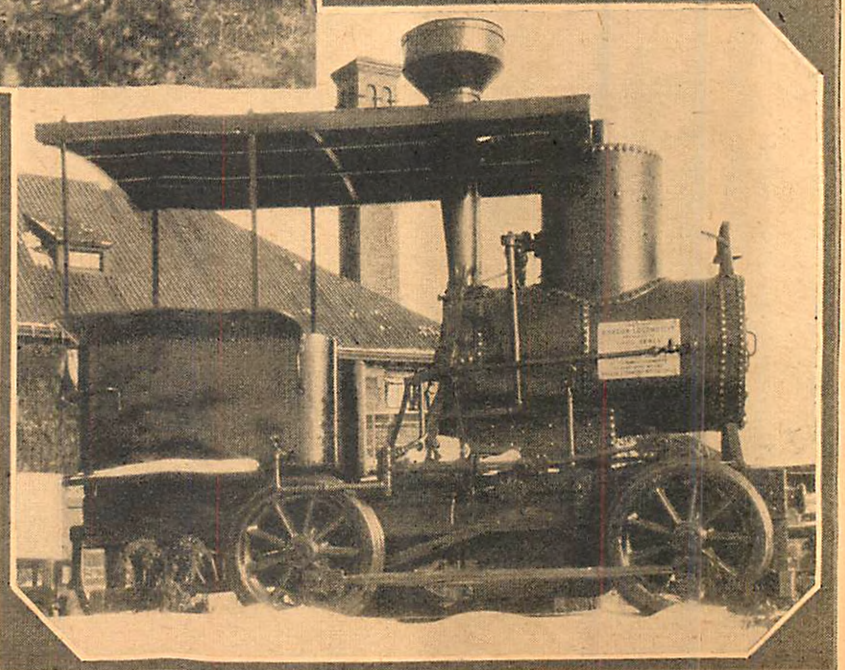
THE Darlington Shops in England, in producing this giant locomotive (above), have introduced principles of boiler construction new to British railways. It was designed for high speed traffic on the east coast route. Because of the secrecy in its construction, the new locomotive was given the sobriquet of the "hush hush" engine by the workmen

P & A



GERMANY has come forth with something radically different in the cross-country fire truck (left), designed for use in rural districts. Its initial workout included plunging up and down hill, as well as over railroad tracks, and it is claimed that it can be driven over creeks and plowed fields equally well

International



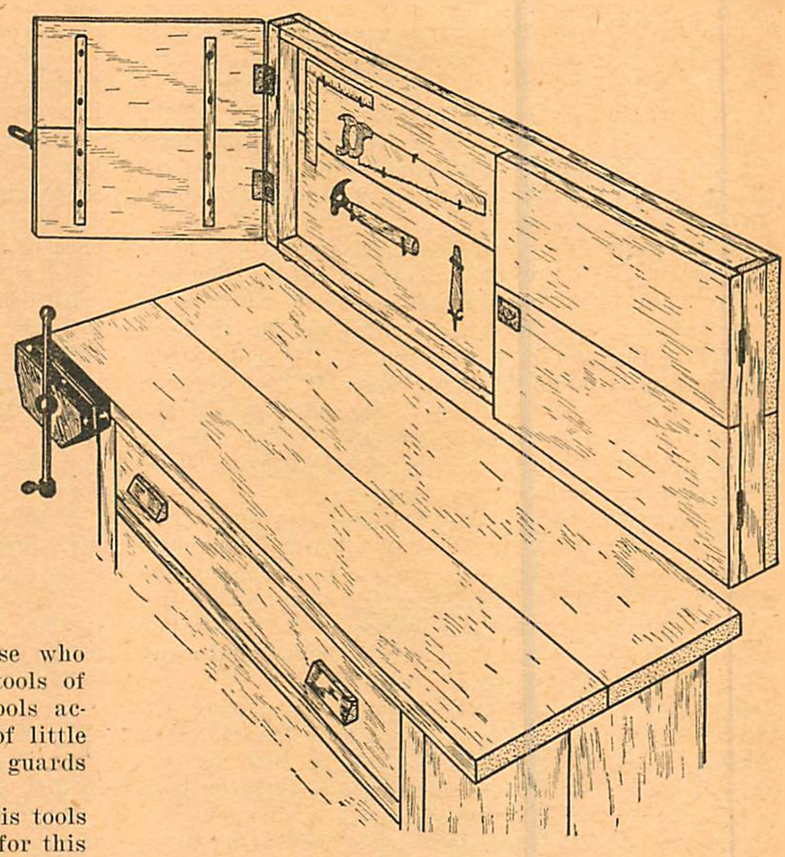
IN great contrast to the modern machines pictured above is the famous "Oregon pony" (right), the first locomotive to penetrate the Pacific Northwest in pioneer days. This old veteran has witnessed many hostile attacks made by the redskins as it carried passengers and freight in 1862 and 1863 in its trips along the southern bank of the Columbia River

International

A Safe and Handy Tool Panel

You Can Build This Easily and Cheaply!

By
EDWIN T. HAMILTON



EVERY good carpenter, as well as those who wish to be, considers the care of his tools of primary importance. Whether those tools actually earn a living for their user is of little matter, as every real craftsman instinctively guards the things with which he works.

No matter how skilled a worker may be, if his tools are dull, his work is bound to be dull, too. So for this reason, great care should be exercised to see that tools are kept sharp. Keeping them in proper condition is merely a question of keeping them in the proper place.

Many use regular tool boxes for this purpose, but such boxes are often moved from place to place, at which time tools are sometimes thrown together. When tools are loose in this manner and allowed to shift around, they often become dulled or nicked, especially in the case of fine, highly-tempered steel tools. Another drawback to the box is that considerable time is lost in hunting for desired tools, which have a way of being on the bottom of the pile.

Drawers also present the same difficulties, as the pulling out and pushing in of a drawer causes the tools to shift, until they become an untidy and jumbled mass.

The answer to all of these objections is the tool panel, where every tool is easily seen, can be removed or replaced in a second, and where each individual tool has its own particular place. It will be found to be quite as handy to return the used tool to its particular spot, as to lay it on the bench where it may be lost or misplaced.

This tool panel fits just above the work bench, is fastened to the wall, and has a swinging door, equipped with a hasp and padlock, so that your tools may be safely locked away when not in use.

Follow these instructions carefully, and build your own tool panel. It is the best insurance you can obtain on your tools.

BACK: The back of the panel is constructed of 1″ yellow pine. Two boards, measuring 12″ wide and 4′ 0″ long, are used. Obtain a board 12″ x 8′ 0″ long, and saw it into two four-foot lengths. Use a try-square to check corners, making sure that these form right angles. One face of each of these boards must be planed and sandpapered until perfectly smooth, as they form the panel when placed together. As the opposite face of each rests against the wall, it is not necessary to finish it smooth.

Heat some carpenter's glue, and when the boards have been placed side by side, with the finished faces up, apply generously along the edges to be joined. Hold them together with a carpenter's clamp, or if one is not available, tie the two boards together. If the latter method is used, make sure that the corresponding sides and ends of the two boards are perfectly flush. Set aside to dry thoroughly.

SIDES: The sides consist of two duplicate boards, each measuring 2″ wide and 3′ 10″ long. Material is of 1″ stock. These two boards may be cut from a piece 7′ 8″ long. Saw the board in half, making sure that all corners form right angles. Finish both of the boards by planing and sandpapering thoroughly. Set aside for future use.

ENDS: The ends are made of 1″ stock, also, and may be cut from a single board measuring 2″ wide and 4′ 0″ long. Saw the board into two equal lengths of 24″. Test with a try-square in the usual manner. These must also be finished on both sides by planing, if necessary, and sandpapering for desired smoothness. Set aside.

ASSEMBLING: The panel is now ready to assemble. If instructions have been followed, you should have the following boards:

For back: 2 pcs.—12″ x 4′-0″ (glued together)
For sides: 2 pcs.—2″ x 3′ 10″
For ends: 2 pcs.—2″ x 24″

CHECK each of these boards, making sure that they are exactly to size, and have been finished as instructed above. Before proceeding, see that the back boards are glued tightly together and that the glue is hard. If not, do not start the assembly until it has become so.

Hot carpenter's glue and 2″ small-head brads are used for this work. First attach the two end pieces. Apply the glue along the edge which is to be attached to the back board. Drive the nails through the back board from the back, until their points just show through the wood at the front.

These nails should be driven 1/2" from the end of the back board, and in a line with its edge. Drawing such a line in pencil will greatly help in this work. Be sure that the nails are driven perpendicularly, so that when their points show through the board, they will also be in line. (Note drawing of this step.)

Now place the back board on the side edge of the end board, see that the ends of both pieces and their sides are perfectly flush with each other and drive the nails home. Space the nails about 2" apart, as shown.

ATTACH the other end board in exactly the same manner. We are now ready to attach the side boards. Glue is applied to the long edge, which is to go against the back board, and also on the two end edges. Slip the side board between the two end boards, and drive nails from the outer faces of both the end boards, through them and into the end edges of the side board. Next, drive nails from the back face of the back board, through it, and into the side board. These should also be spaced about 2" apart.

At this point in the assembling, take a try-square and test all points, making sure that they form right angles with each other. When correct in this step, lay the entire structure aside until thoroughly dry. This can be determined by testing the excess glue, which has oozed from the joints. If it is hard enough to cut away with a knife, the structure has dried.

DOOR: Obtain a piece of 1" stock measuring 12" wide and 8' 0" long. Saw this into four lengths, each 24" long, which will give you four pieces, each measuring 12" wide and 24" long. Plane all of these on both sides, if rough, and finish smooth with sandpaper.

There are two duplicate doors, each measuring 24" x 24". To obtain these, the four pieces you have just finished must be joined together in pairs. This is done by small braces, which are made of 1/4" stock, each measuring 1" wide and 21" long.

They must not extend across the entire width of the door, otherwise the doors would not close tightly as the braces would hit against the edges of the sides of the panel. A space of 1 1/2" on each end is left clear to overcome this. Cut four pieces, each 1/4" x 1" x 21" long. Sandpaper to satin finish.

Note in the drawing which shows these strips that they are held in place with wood screws, which are countersunk. Take a countersink and bore these out. Four screws are used in each, and they should be evenly spaced.

Two of the door boards are now glued together, as was the back, and in the same manner, using hot carpenter's glue and a wood clamp or by tying the boards together until dry.

Now glue the remaining two door boards together. When thoroughly dry, attach the four braces you have prepared, two to a door, with glue and the wood screws. The screws should be 1 1/4" long. The braces are placed on the inside of the doors. See that the screws are screwed all the way in, so that their heads are flush with the face of the door, as shown in the drawing. Set the doors aside to dry.

FINISHING: Scrape away all excess glue from the joints with a knife. Finish the panel by giving it a thorough sanding, filling all holes with plastic wood, and then applying two coats of stain. Do not stain the back of the panel on which the tools hang, but leave in its natural color until later.

Now finish the two doors by attaching two 3" hinges to each, as shown. The places on the doors and the ends of the panel to which they are attached should be hollowed out to receive them, so that when in place they will tie perfectly flush with the top of the face. Use 3/4" wood screws. Center the hinges, as shown, and place on the inside of the doors, so that when the doors are closed, the hinges will not show.

A hasp is now attached to hold the padlock for locking. Remove all excess glue with a knife, fill all holes with plastic wood, and finish with sandpaper. Test to see that the doors swing freely, and will yet close tightly. Now finish by applying two coats of stain completely over both the doors, on the inside as well as the outside.

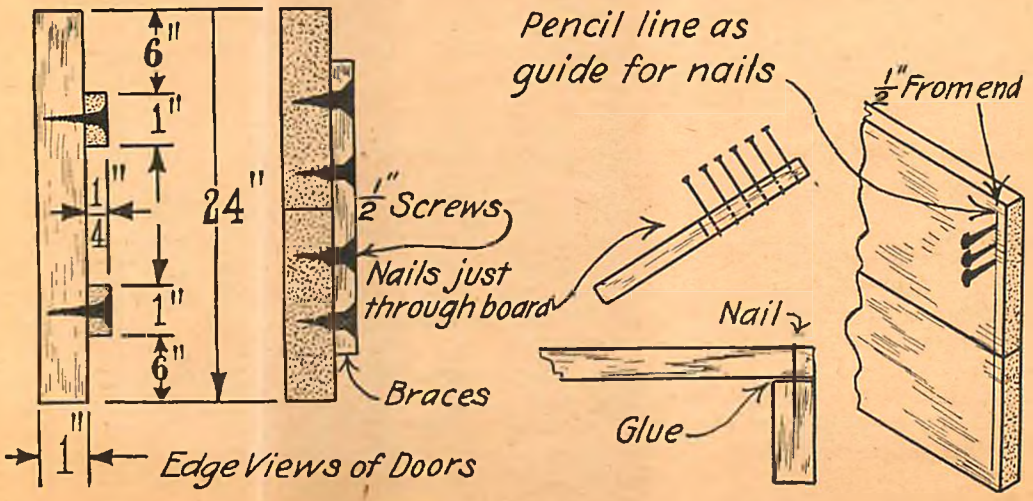
TOOLS are kept in place on the panel by either bent nails or bent screws. If the former is used, proceed in this manner:

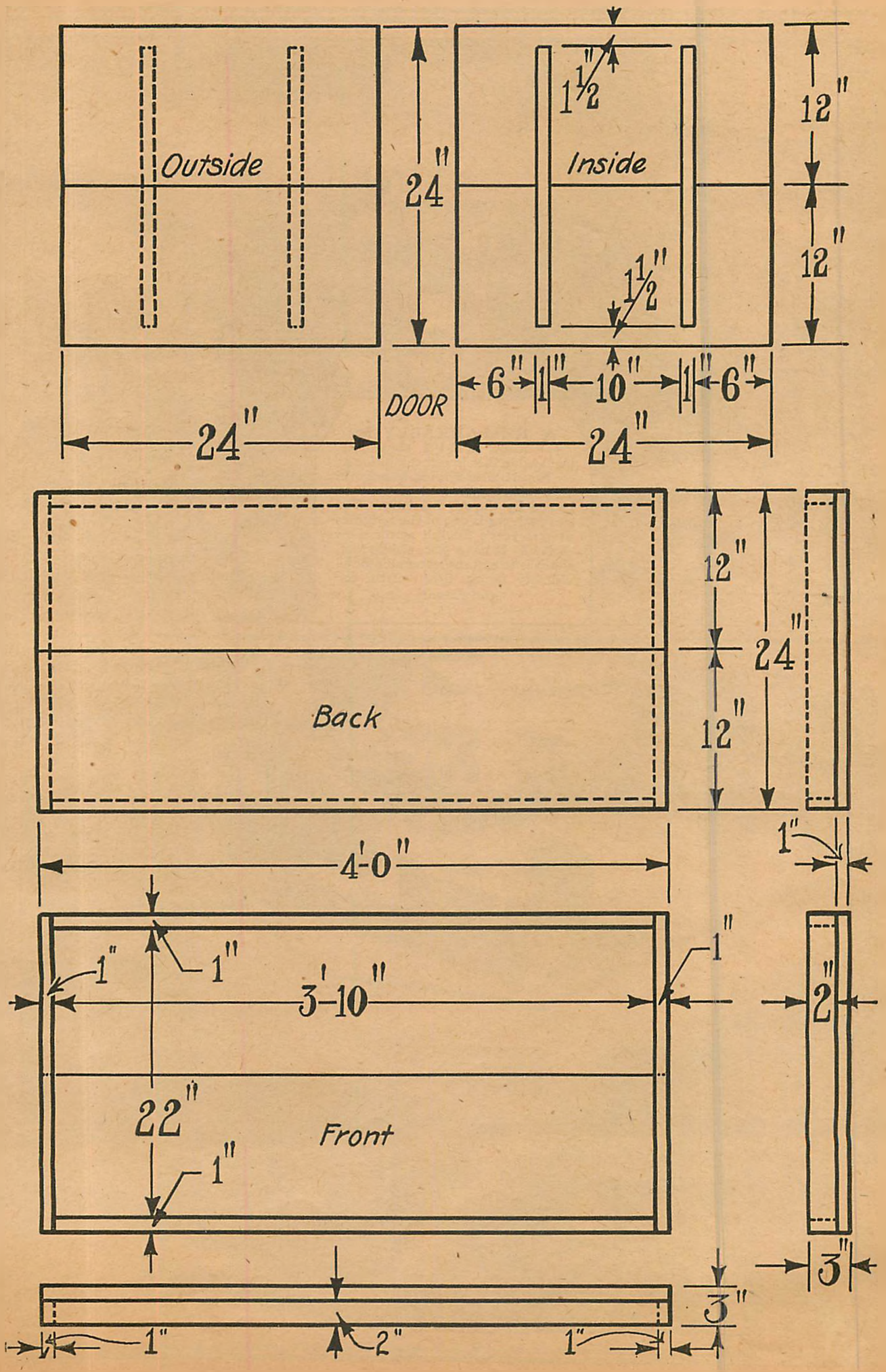
Determine the exact location on the panel for each of your tools, so planning the distribution as to allow spare space on the panel for new tools. Lay the tool in its chosen place against the panel, draw an outline of it in pencil on the panel, and fill this in with black paint. Do this with each of your tools, so that, when finished, the location of each tool can easily be seen. In this way, when the tool is removed for use, its location on the panel can easily be recognized when ready to replace the tool.

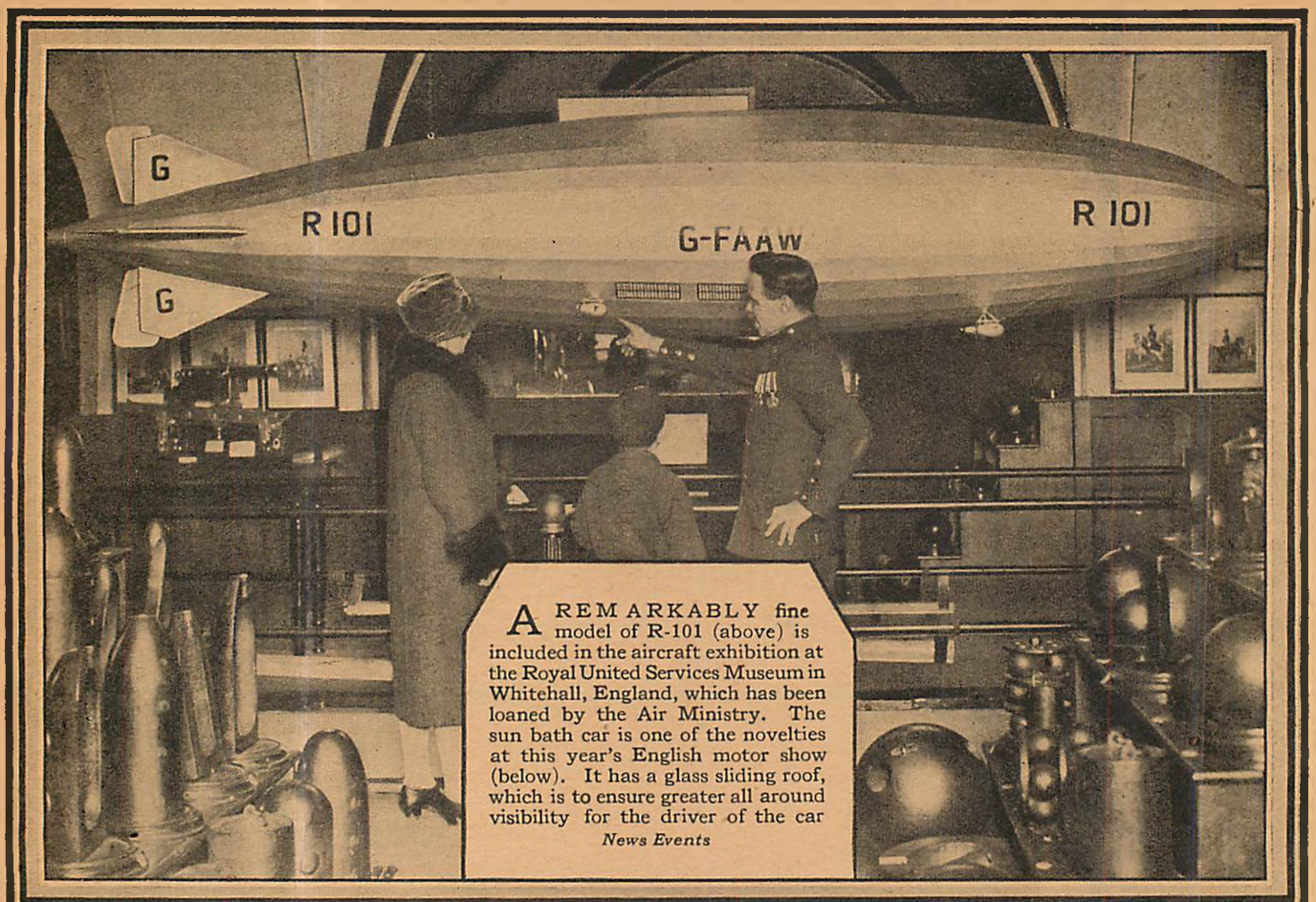
Now lay the panel flat on the floor, figure where best to place the supports to keep the tools from falling and in place, and drive 4" large-head nails into these places. Drive the nails 1" into the back, but try to keep them from going through the back. Obtain a 1" pipe of short length, lay it against the nail, and then hammer the nail tightly around it, until it is parallel to the back board. When finished, place the tool in its proper place and test to see that the nails hold perfectly. The nails can be swung around to admit or release the tool, as desired.

Follow the above directions if using the bent screws, which are so often used for curtains, and can be bought at any hardware store at small cost. The panel is now complete and is ready for hanging.

Place the panel 2" above the top of your work bench, so that when the doors are opened, they will clear any low objects you may have on your bench. The tool panel is now completed. Place your tools in it, and don't forget to lock it when finished working.

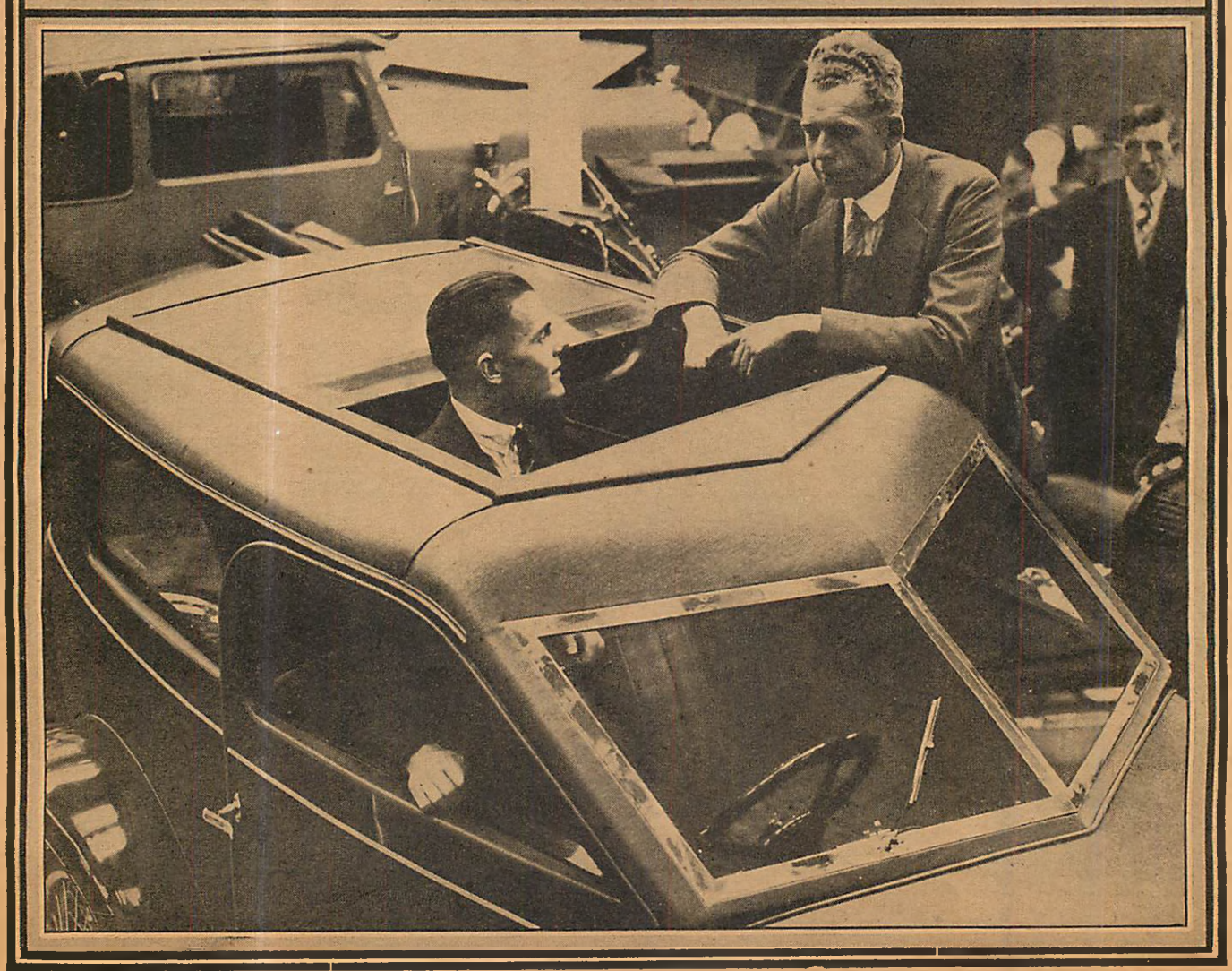



Outside
24"
Inside
1½"
1½"
12"
12"
24"
DOOR
6"
1"
10"
1"
6"
24"
Back
12"
24"
12"
1"
4'-0"
1"
1"
3'-10"
1"
2"
22"
Front
1"
3"
1"
2"
1"



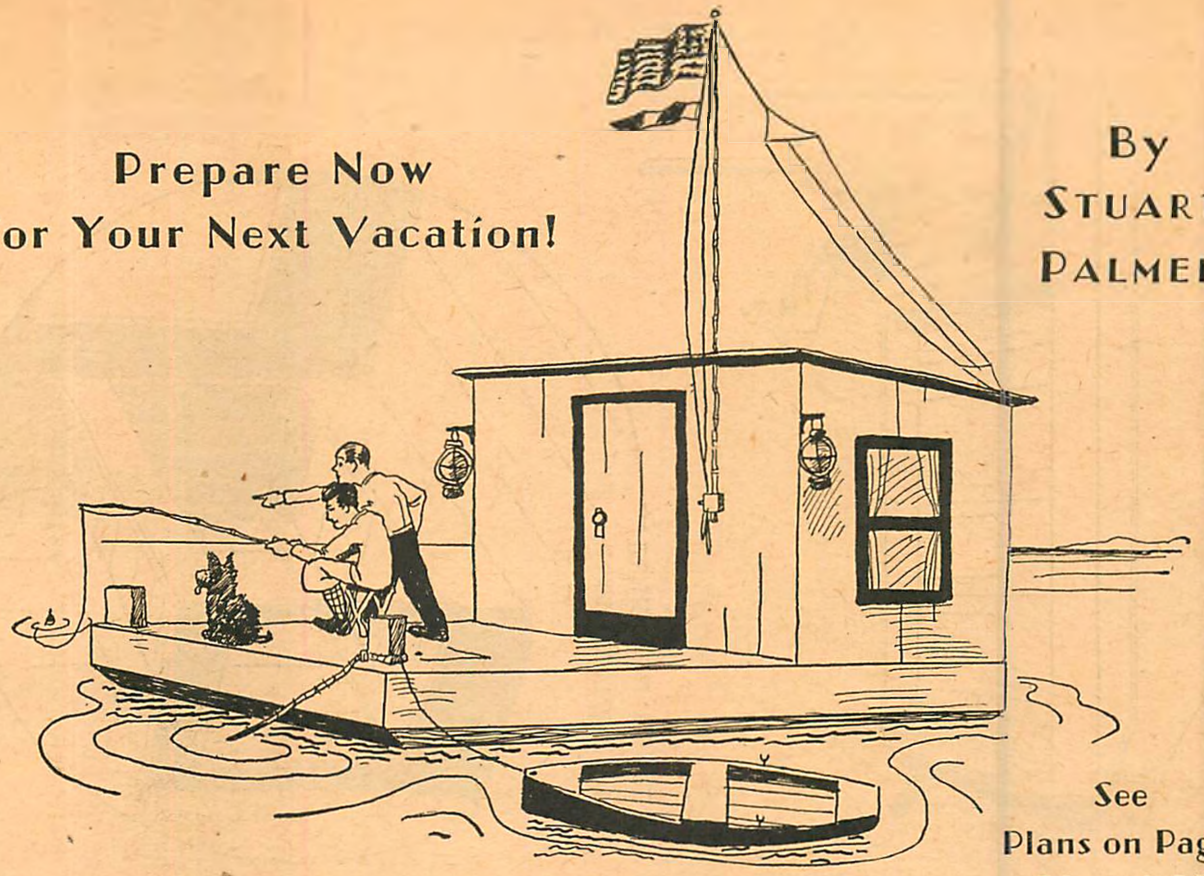
A REMARKABLY fine model of R-101 (above) is included in the aircraft exhibition at the Royal United Services Museum in Whitehall, England, which has been loaned by the Air Ministry. The sun bath car is one of the novelties at this year's English motor show (below). It has a glass sliding roof, which is to ensure greater all around visibility for the driver of the car

News Events



Prepare Now
for Your Next Vacation!

By
STUART
PALMER



See
Plans on Pages
32 and 33

How to Build A Cabin-Boat

HAVEN'T you ever wanted a real houseboat of your own? Well, here's a convenient type of one called the "cabin-boat." Anchored on a lake or river, it will give you all the thrills of camping out, plus the excitement of being captain and crew of your own ship.

The cabin-boat is absolutely safe. It can't be tipped over and it can't sink. It offers the most wonderful vacation any boy could have. Anchor it out in the middle of the lake and you will find absolute freedom from mosquitoes and flies, for they do not cross water very far.

If you tire of your anchorage and have no motorboat to tow you, just wait until the wind is right and take up your anchor. The sides of the cabin offer enough sail surface to carry you slowly but surely to the desired destination; and when you want to return, wait till the wind has changed.

Best of all, there isn't a thing in the making of this cabin-boat that is beyond the skill of the average boy who is handy with tools. Two or three boys working together could finish it in a few weeks, and have it ready for the vacation season.

Everything in the building of this house-boat is simple. There are no fussy details to bother you. Old lumber is just as good as new and it won't cost you a tenth as much. The carpentry is of a rough and ready type and even the making of the cabin will give you few difficulties.

First, pick your location. It is necessary to build this craft right by the side of the water, because of its weight. Remember what happened to Robinson Crusoe, who built a big canoe and then found it was half a mile from shore, and he couldn't carry it. Pick a good place right on the shore, preferably on a sloping beach.

Then get your lumber together, new or old. If you use new lumber you will have to interest your father in the project, but ten to one when he realizes what a great health and happiness builder this cabin-boat will be, not only for you but for all the family next summer, he'll willingly help you with the finances.

Decide on your dimensions. Much must depend on the money at your disposal, on the number of people you want to use the boat after it is built and on your age and size. I should suggest sixteen by eight as a good size for the boat, to be used by two boys. Keep the proportions about the same if you change the size.

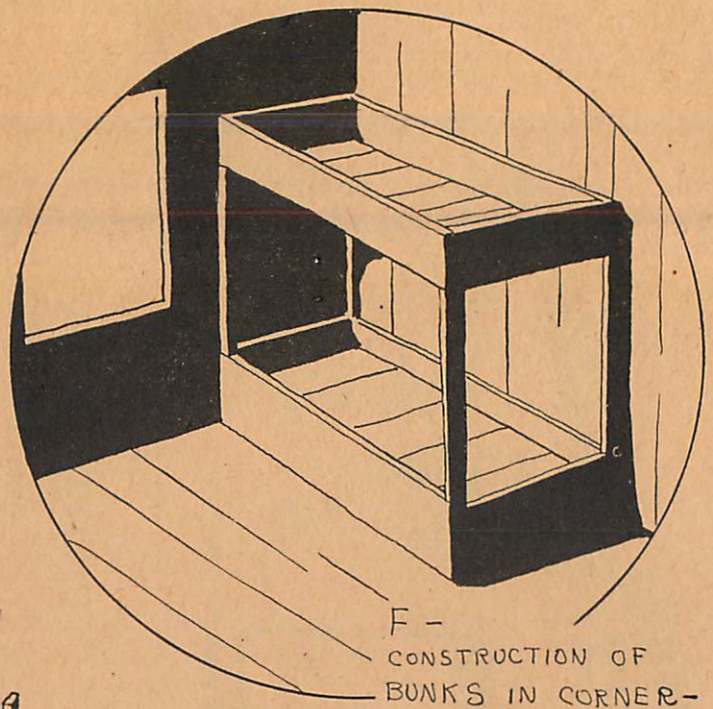
First build the boat, the so-called "barge" on which the superstructure rests. This is easily knocked together, as shown in plate A. First the side boards are nailed to the two-by-four blocks, then end-boards and the bracing two-by-fours. Last, put on the bottom boards. These need only be one-inch lumber or less, the sides, however, should be one inch and a quarter.

THE two short projections at the end corners are mooring posts and the corresponding long ones are uprights, which will build into the cabin and make the whole thing steady as a rock. The mooring posts should project above the sideboards at least a foot and the uprights should project at least six feet.

Be careful in picking your lumber for all parts which will be beneath water level when the boat is done, so that there may be no flaws in the wood and no knot holes to plug. Make all joints reasonably tight and smear the boards with white lead paint as you put them together. This will save a lot of caulking later.

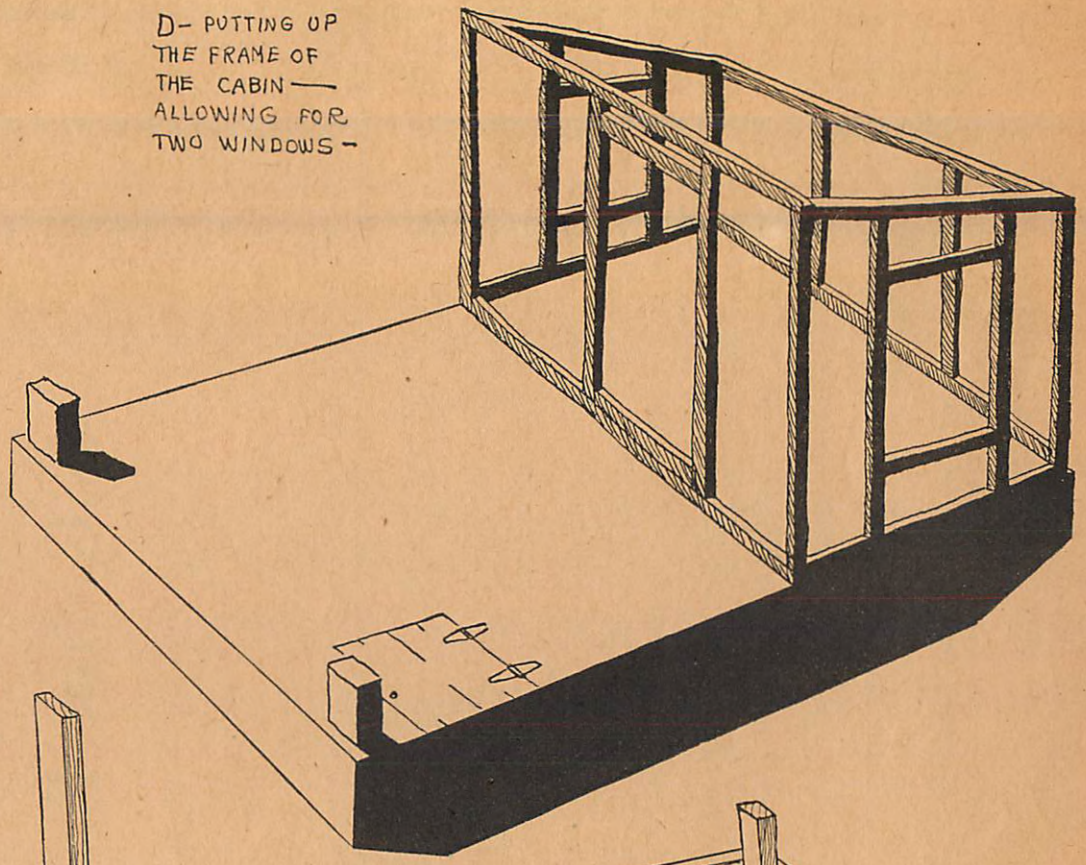
Next comes the deck of the boat. Pick even boards, free from splinters, and lay them carefully, starting at the tall uprights. Fit the boards around the uprights by sawing out whatever is necessary.

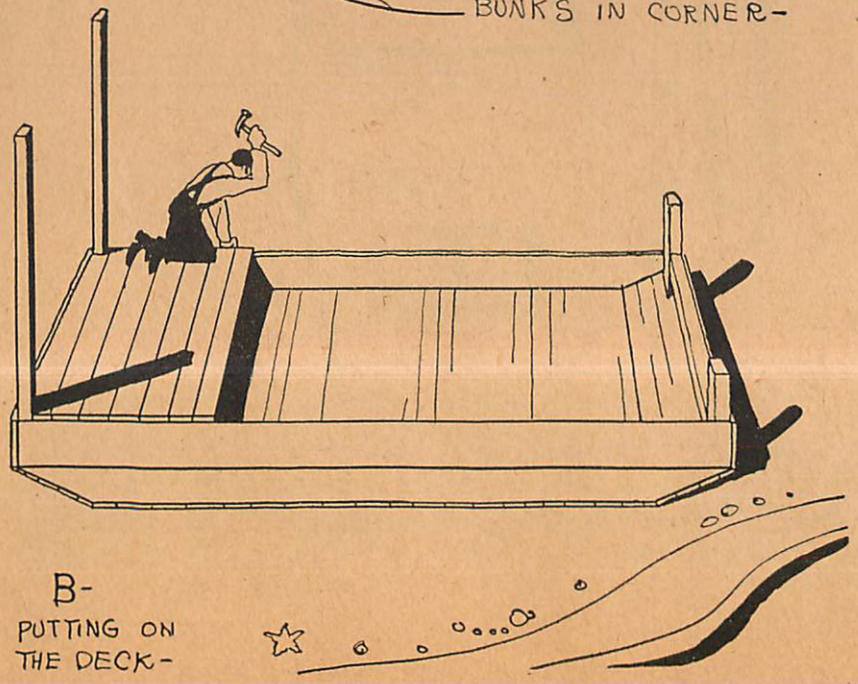
When you have laid the deck to your satisfaction, cut out a two-foot hatchway in one corner as shown in drawing C. Cleat the (*Continued on page* 40)



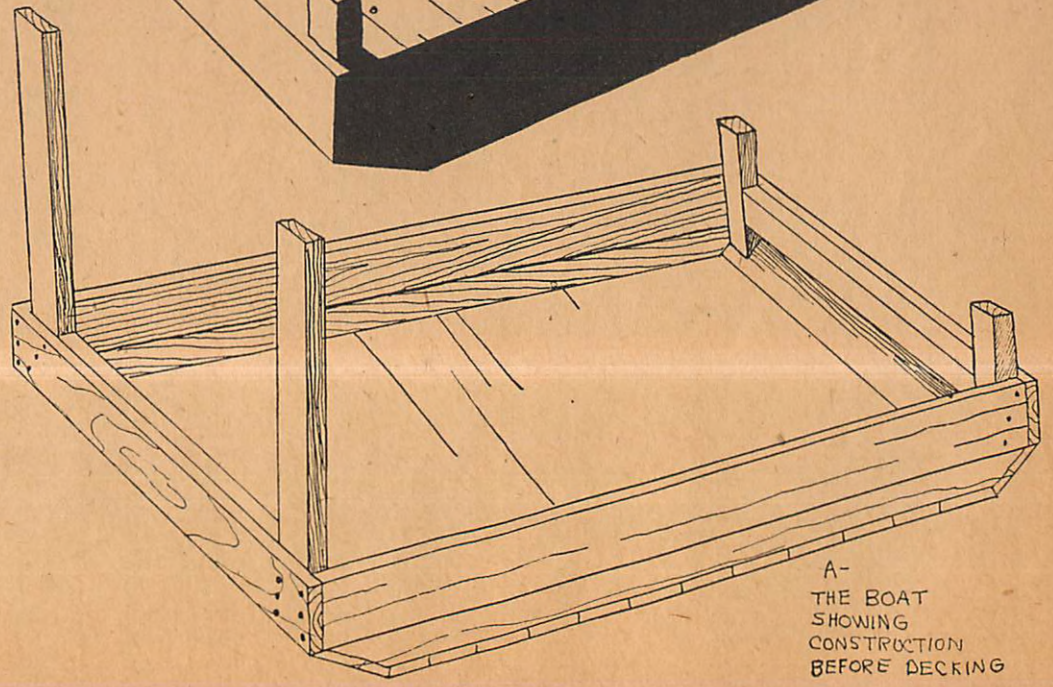
F-
CONSTRUCTION OF
BUNKS IN CORNER-

D- PUTTING UP
THE FRAME OF
THE CABIN —
ALLOWING FOR
TWO WINDOWS -

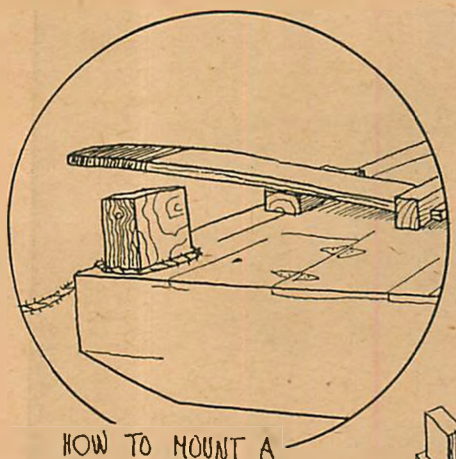




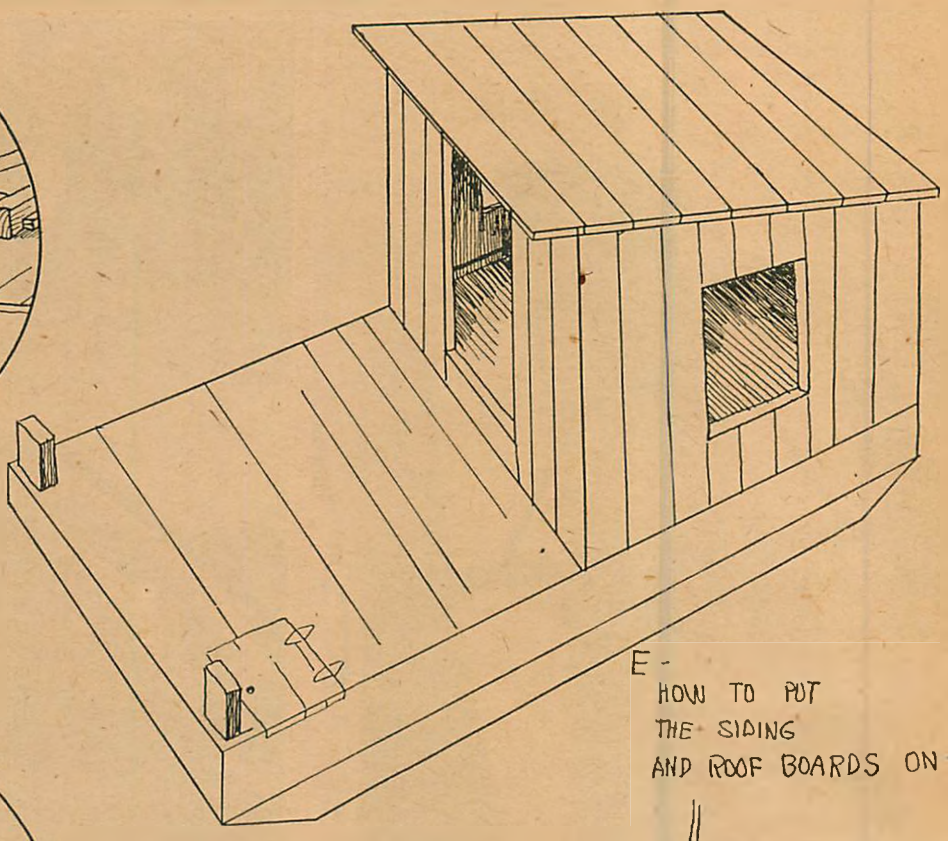
B-
PUTTING ON
THE DECK-



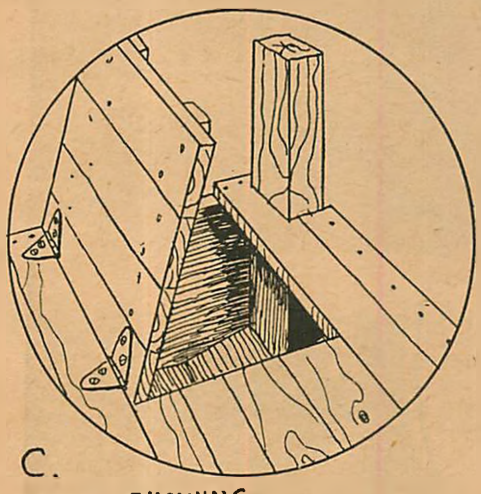
A-
THE BOAT
SHOWING
CONSTRUCTION
BEFORE DECKING



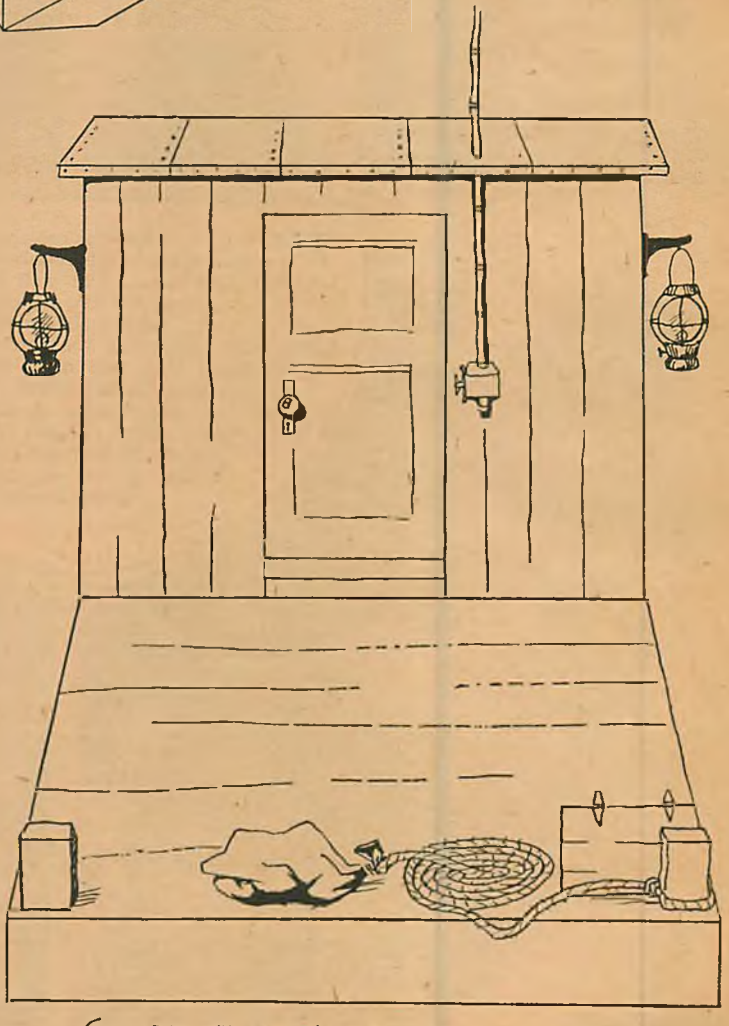
HOW TO MOUNT A DIVING BOARD ON THE CABIN-BOAT



E-
HOW TO PUT THE SIDING AND ROOF BOARDS ON—

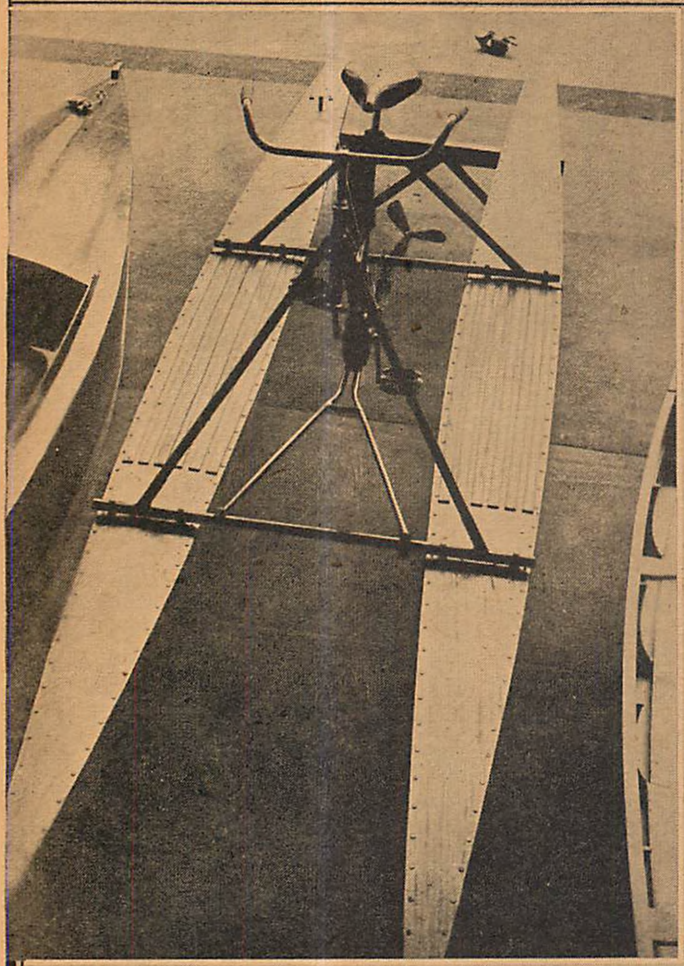


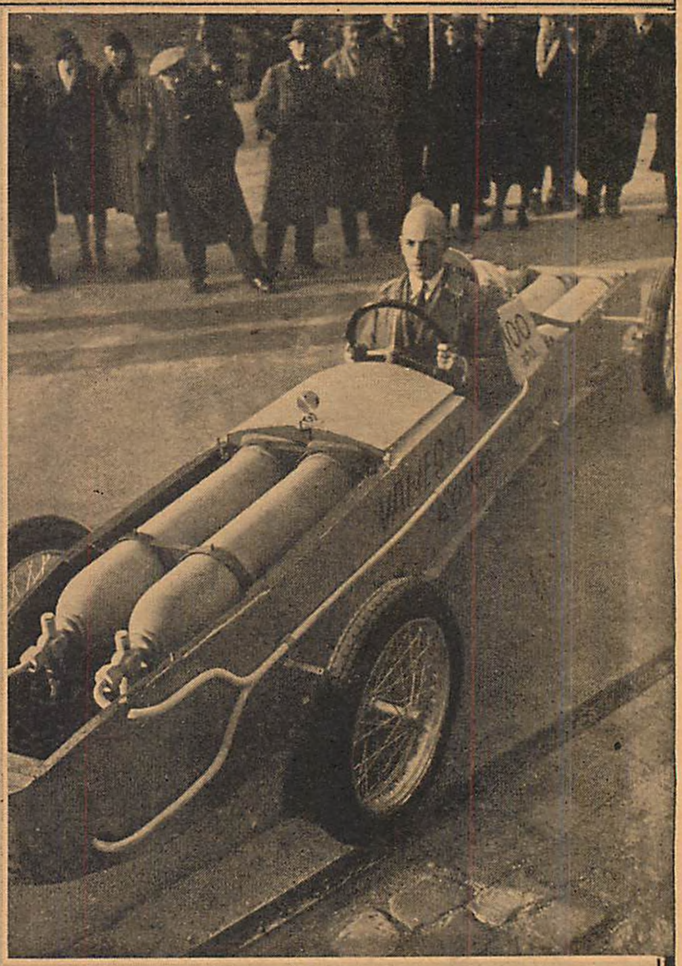
C.
DETAIL SHOWING HATCH FOR BAILING ETC—



G- FRONT VIEW OF CABIN-BOAT— SHOWING METHOD OF ANCHORING FLAG POLE, LANTERNS AND ANCHOR.

HOW TO LAUNCH THE CABIN-BOAT





THE newest in vehicles are shown above. At left is a gliding boat with pedals which was exhibited in Paris this year. The well known astronomer, Max Valier, drove his new rocket auto on the Avus in Berlin (right). A valuable antique in the Bavarian Library in Munich is the famous Codes Aureous (bottom, left), the most beautiful evangelistic book in the world. It is studded with valuable jewels. A new invention is the warm closet radiator (bottom, right) which will keep both foods and dishes warm at all times

News Events

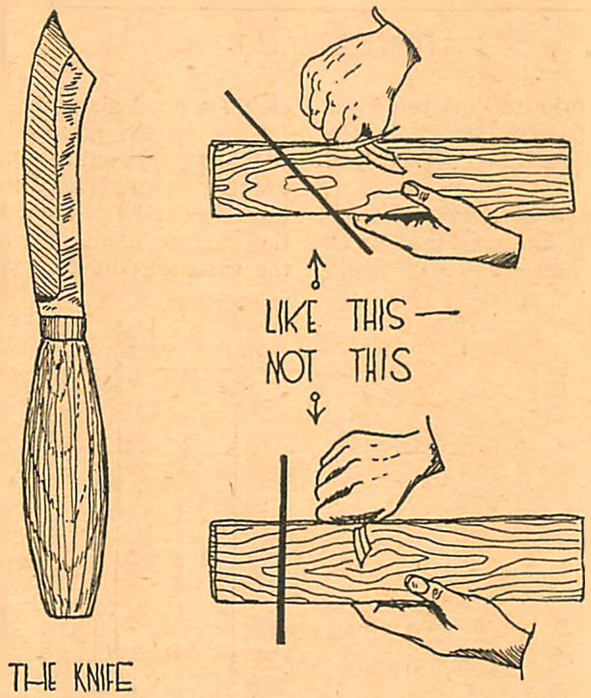
Whittling for Fun

Wood + Knife = Several Natty Articles

By
THEODORE ORCHARDS

EVERY boy has hacked away at a piece of soft wood with his folding pen-knife and called it whittling. However, the real art of wood-working with a knife is something else again. In New England, the old time Yankees used to carve the most complicated designs with a single blade. Some of them made full rigged ship models inside bottles, lengths of wooden-linked chain, and other seemingly impossible things.

Any boy can learn to whittle and you will be amazed at the things you can make when you have learned the fundamentals. Whittling can be done at odd moments and in places where a complete set of tools is out of the question. Besides, it offers the best foundation of training for the young wood-worker. It is useless to start in trying to make furniture and complicated lathe-turned objects before you know how to use a blade . . . to whittle.



1 THE KNIFE HOW AND HOW NOT TO USE IT

First of all, provide yourself with a real knife. The folding pen-knife, or jacknife, is of little use in whittling because it has a tendency to close up on the fingers. In addition, it is not likely to be made of a good steel which will hold the necessary edge, and you don't want to be sharpening the knife every few minutes. Get a knife of the type known as "Swedish whittling," with a curved wooden handle and a rigid blade of good Swedish steel, from which the best ship-bottoms are made today.

Make sure that your knife has a good edge and keep it so. Grinding will not be necessary often but learn to use an oil stone, with a circular motion and the knife blade flat against the stone. This keeps it in fine shape and cuts the work in two.

White pine is the best wood to work with because it is usually straight in grain and free from sappiness, as well as soft and easily cut. First practice until you can cut a piece of pine into an exact oblong six inches by one inch square. There is no use in trying anything further advanced until you learn to cut exactly to dimensions and no farther. When one side is straight and proven true with the try-square, mark a small X on it with pencil so that you won't cut into that side again.

The correct way to hold the knife is shown in the sketch labelled 1. It should be on a slant, an oblique angle, with the wood and not at right angles as is the invariable way of the amateur. This gives the necessary paring edge and is easier as well as better to do.

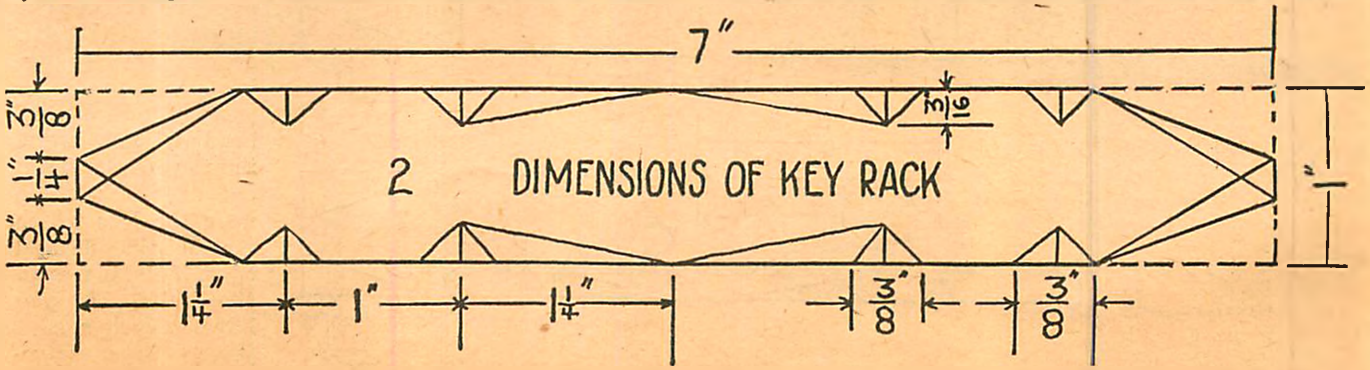
As soon as you find that you can cut where you want to, without wasting wood, try making this key rack for the home. Most houses haven't any place for keys, and they are always getting lost, strayed or stolen. Many times the key loses its usefulness because it is not tagged and labelled.

First choose your wood. Since the key rack is to be used for the household, gum wood might be chosen instead of pine, since it is just as easy to work with and has a better grain.

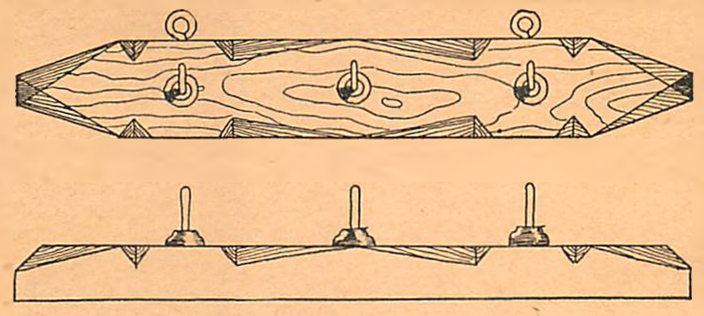
Choose a piece free from knots or defects, with a straight and attractive grain. It should be about eight inches long and an inch and a half square when cut out of the rough, with either saw or hatchet. Now whittle it carefully down to the outside dimensions shown in drawing number 2, which are seven inches long by one inch square.

PLATE 3 shows the three steps in the cutting of the key rack. A shows the block ready for cutting the details. B shows the shaping lines of the end and the cutting of them. C shows how all the notches are laid out, marked with a 4H pencil and then carefully cut. The ends are bevelled by whittling to the lines and then cutting back to the middle of each edge, as shown in C.

Now the knife work is finished, as soon as all rough spots and details are taken care of. Place three brass screw-hooks in the exact centers of the large blank



spaces and two small screw-eyes to match in the upper edge, so that the key rack can be hung from the wall. Plate 4 shows two views of the finished key rack.

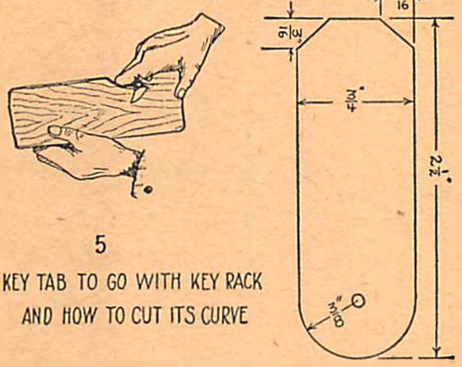


4- FINISHED KEY RACK

For practice in whittling curves, try making a dozen or so of the key tabs shown in Plate 5. Get as thin stock for these as you can, for it will save cutting. Remember in cutting curves with the knife that you must keep your thumb out of the way, as is shown in the drawing. If you hold the wood in this manner, you cannot cut yourself.

Remember that a true craftsman cuts toward himself as much as possible, in the Indian fashion, as it allows greater accuracy and less chance of spoiling the thing you are making by a wild stroke.

Make the little holes in the tabs with a brad-awl and wire them to the keys with small pieces of copper wire. Print the name of the key on its tab with black Indian ink, which is waterproof. If the key tabs get lots of use and tend to become dirty, you can sandpaper them off, reletter the name, and then apply one light coat of varnish, which will protect them.



5

KEY TAB TO GO WITH KEY RACK AND HOW TO CUT ITS CURVE

A whittling project of somewhat greater difficulty is the fishing-line winder shown in Plate 6. Make this half an inch thick, one inch wide in the middle and two inches at the ends, and six inches in length. Practice will enable you to make true curves on the ends, following the guiding lines drawn with a compass before you start.

It is permissible to use sand-paper to finish the curved surfaces, although the skillful whittler avoids it on all flat or angular work, since it covers up mistakes. Also when once it has worked its fine grit in the wood, no tool may be used there again without being dulled.

When you have whittled the above pieces successfully, you are ready to undertake something several steps advanced in the art of knife-work. A picture frame with bevelled edges and an oval or elliptical opening will make a charming Christmas present for someone, or serve as a decoration for your own room.

Get a piece of maple wood, which has a most attractive grain. Its size will depend on the picture you wish to frame, and in any case, it should not be smaller than three by four inches, nor larger than ten by fifteen. The thickness should be half-inch, or even quarter-inch if the smaller size dimensions are used. For the sake of convenience, all dimensions are here given as for the larger size of six inches by eight; a good size for the small picture.

True up the piece of wood with your knife, testing with the try-square and the rule, until you have it exactly squared in the chosen dimensions. Now with the 4H pencil and the square or rule, mark a line around the surface a quarter of an inch from the edge. Do the same on the ends and sides.

This outlines your bevel, which must be cut away with great care. Work slowly, starting at one upper corner and going right around.

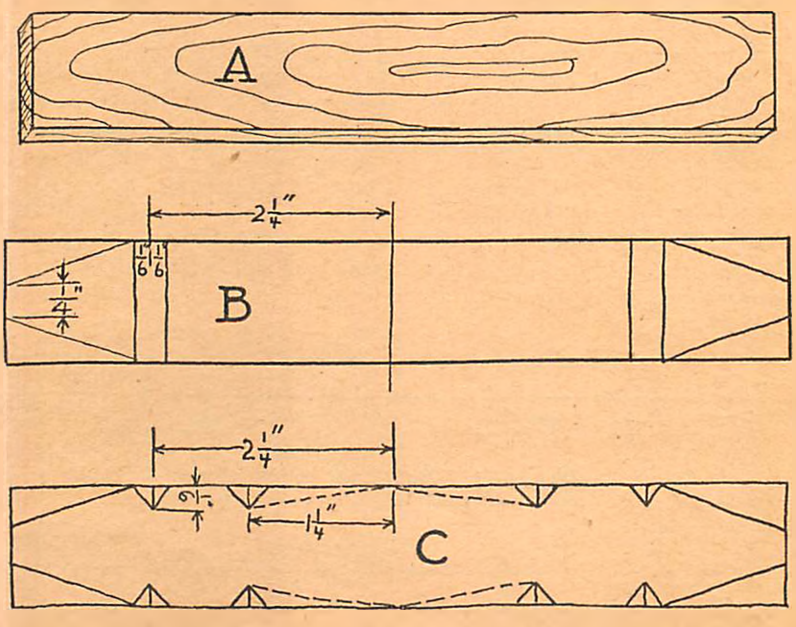
When the edge is finished, you are ready to mark out the oval in the center, which must be cut away. The simplest and best way of marking out the oval, avoiding all drawing of angles and circles, is to use the carpenter's "string rule".

First draw a line vertically down the center of the piece of wood, lengthwise. Then measure and draw a line horizontally, also in the middle. All this must be done accurately.

Now measure up one inch from the cross-line on the vertical line and make a dot. Measure down the same distance and make another dot. Drive a heavy pin or a light finishing nail at each of these dots.

Now take a piece of ordinary string about nine inches long and tie its ends together. Lay this over the two pins. Place the point of a pencil inside this string circle, and pressing outward and around, you will transcribe a perfect ellipse, much more quickly and successfully than instruments could do it. If the ellipse is too large or small, shorten or lengthen the string and draw another.

Now take out the pins and cut out the inside of the oval. If you have a coping-saw, use it by passing it through a brad-awl hole bored in the oval. Then cut around not too near the line which marks the desired edge, finishing with the knife. If you haven't such a saw, just drill a (*Continued on page 53*)

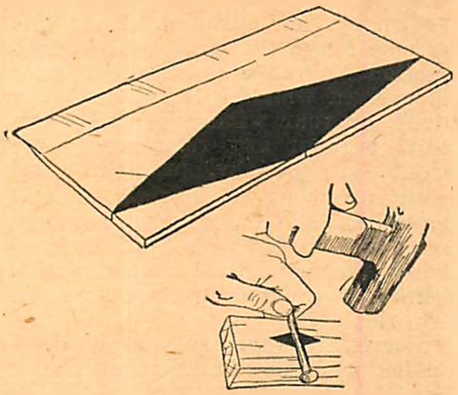


3- THREE STEPS IN CUTTING OUT THE KEY RACK

Handicraft Hints for the Junior Mechanic

Several Useful Articles to Make

By Chuck Stewart



Here's the Only Home-Made Compass!

TAKE an ordinary safety razor blade and grind it down on an emery wheel or hand stone until a diamond shaped piece similar to the black part of diagram one is the result. Keep the blade wet while grinding so that its temper will remain. After the shape is formed, take the temper out of the middle with gas or alcohol flame and bend by pounding with a nail, as shown in the second illustration, using a soft wood block as the base.

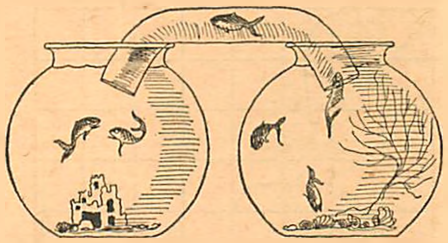
Mount this needle on a brass pin. Almost any club or campaign button is built on one, and it can be easily removed. The brass must have a very fine point.

Put the needle on the pin, with the point in the groove you have pounded. Grind down the needle until there is perfect balance. Magnetize by rubbing the needle from the middle toward one end with one pole of a horseshoe magnet, and then from the middle toward the other end with the other end of the magnet.

The needle will show a decided dip now. Regrind it until there is perfect balance again. Now polish the needle carefully, all but a small triangle on the north tip, which will serve to distinguish it.

You now have a compass which will compare favorably with any. Don't be confused by the fact that the magnetic north and the true north are several points apart, and also remember that the north star is not exactly in the true scientific north.

Hunters have carried a straight brass pin instead of the curved one; needle and pin wrapped in waxed paper and carried in the pocket for safety. There may always come a cloudy day when the compass means home instead of wandering lost and alone.



A Goldfish Bridge

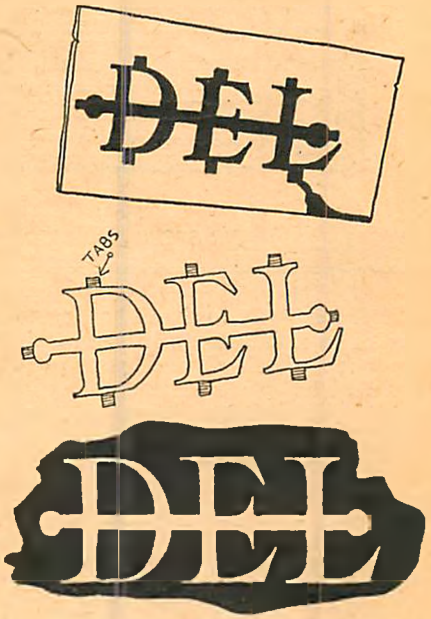
THIS looks like parlor magic but it works. Take any two bowls of goldfish and make sure that the levels of the water are the same in each. Now bend a large-sized glass tube to the shape of a wide, long U, using an alcohol flame or a Bunsen burner. Make sure the tube is big enough for your fish.

Fill the tube with water and quickly insert its ends in the water of the goldfish bowls. It will remain filled and you will soon see the fish exploring their new promenade.

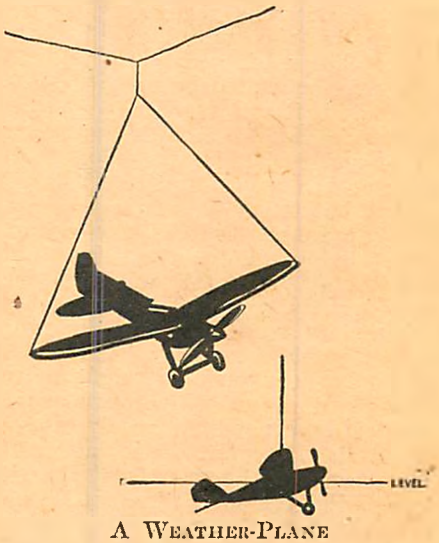
Give Your Car Class

A MONOGRAM lends smartness to any car, whether it be a limousine or a flivver. Aluminum lasts the longest, is the easiest to work with, and polishes the best.

Cut out the two or three letters you want from a magazine or newspaper in the style you think best suited, and paste them to the piece of aluminum you intend to use. It is a good plan to leave a bar of aluminum connecting or binding in the letters to hold the design together as shown in the drawing. Getting a design is the hardest part of the job but a little practice will make you able to tell what balances and what does not.



Now cut around the pattern with shears, working extra carefully. A pocket knife and an ordinary three-cornered file are handy for smoothing off rough edges. Leave little tabs, or ears, at the top and bottom. When the design is finished, these are inserted in slots cut in the door of the car and bent over. If the panel has a wood backing, drill holes in the monogram and fasten it up with small nails. File their heads off afterward and polish the monogram until it sparkles.



A Weather-Plane

HERE'S a new stunt for you model-builders; one that will catch the public eye and let the world know you are sky-minded. Take one of your old scale-model planes, making sure that it is well weather-proofed. Balance it carefully by a cord from each wing-tip until it hangs with the tail just a little below the fuselage. (*Cont'd on page* 55)

Special Course in Air Navigation

(*Continued from page 5*)

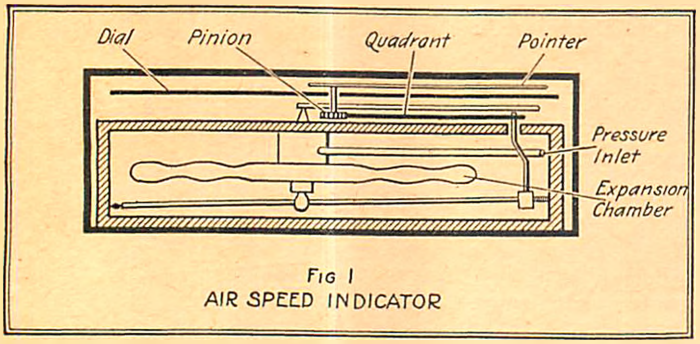


FIG 1
AIR SPEED INDICATOR

The easiest way to avoid having to make these calculations in the air is to prepare a little scale of your own, showing what your true speed will be at various heights, based on your normal cruising speed.

Altimeter. The altimeter is an instrument for recording your height and is really the least exact instrument of any used in the air today. If you know the principles of the ordinary aneroid barometer, you have at once the principles of the aneroid altimeter — the two are intimately connected. With the barometer, changes in air pressure express changes in weather; with the altimeter, changes in air pressure express changes in height.

IF you left your altimeter at night set at zero and it was reading lower in the morning, other things being equal, fine weather would be indicated; if it was reading higher, bad weather. This is, of course, not the function of the aneroid altimeter, but it can be seen how approximate it is, for if you were flying along at a constant height and the weather was changing considerably, your altimeter would change its reading, although your height would be the same. Also it will only show you your height above the place from which you have started and not necessarily above sea-level. However, it is sufficient for most normal purposes, though it is essential you should know its limitations.

The altimeter consists of a vacuum chamber and a delicate mechanism which communicates the movement of the vacuum chamber to a graduated dial. From Figure 3 you will see that the vacuum chamber is a little, thin corrugated chamber, one side of which is fastened to the base of the instrument. Normally the air-pressure from outside (since there is none inside to counteract it) would contract the chamber; but this is prevented by a spring which is attached to the other side holding it in a normal position.

When you rise the air-pressure decreases and the force of the spring acts on the chamber. When you return to land, the air-pressure has increased again and acts against the force of the spring on the vacuum chamber. These movements are communicated to a dial. On the face of the dial is a little screw which may be turned to set the dial at zero before you start, after which all the heights shown will be relative to your starting place.

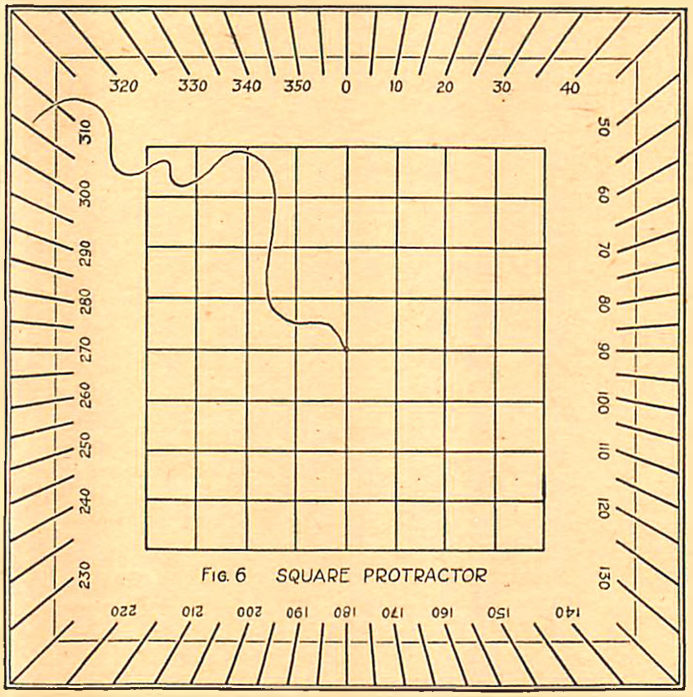


FIG. 6 SQUARE PROTRACTOR

This must be remembered in flying over hilly country and maps must be consulted to find out the heights above sea-level of the regions over which you are flying—your altimeter will not tell you this. Subject to these limitations an altimeter will generally give accurate service for long periods. If any faults develop, the instrument must be returned to the makers.

Drift Indicator. This is one of the most important instruments in air navigation and tells you your drift, or the angle your actual track over the ground makes with the course you are steering as shown by your compass. From this can be found the windspeed and direction. As soon as any instrument is evolved which will tell you your drift, or your windspeed and direction, without any reference to the earth, sea or sky, practically all your problems of navigation will have been solved for you. You will see later on how essential it is to know the windspeed and direction before an exact compass course can be calculated.

There are various types of drift indicators in use, but Figure 5 shows a well known type made by the Pioneer Instrument Company, which is accurate and easy to use. It is essential that the instrument be so mounted that when the pointer indicates zero, the drift wire is parallel with the fore and aft line of the plane. If this is not so, all the angles obtained will be wrong.

You fly on a constant course and, looking through the eyepiece on to the drift-wire, you observe objects on the ground passing along underneath. By turning a small handle you turn the frame holding the drift-wire until the objects on the ground appear to be passing right along the wire. A glance at the indicator on the side of the instrument will show you your drift angle. From your drift angle, in conjunction with your airspeed as shown on the indicator, can be worked out your windspeed from the table given on page 40.

At certain of these windspeeds you would obviously not be in the air at all, but the table has been made as comprehensive as possible. On bumpy days when the ship is on an unsteady keel, it is very difficult, if not impossible, to get accurate results with a drift indicator.

Having found your angle of drift

(*Continued on page 40*)

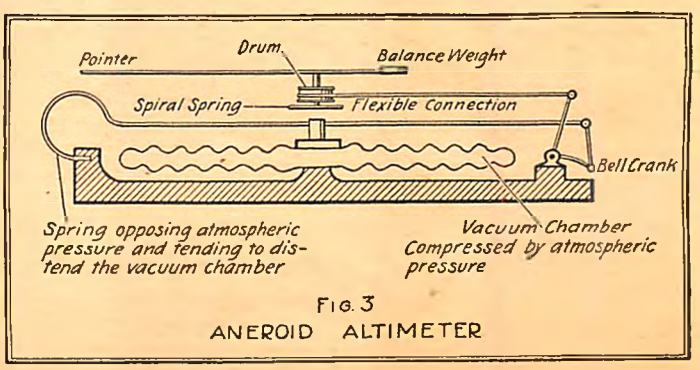


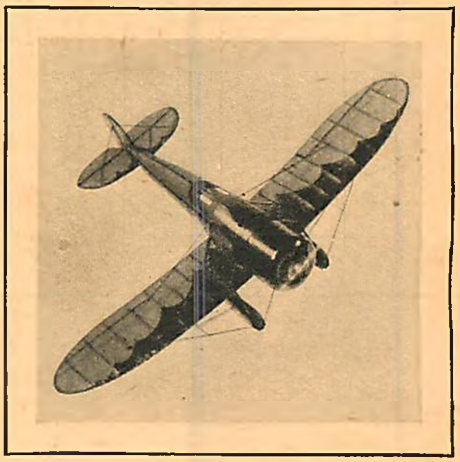
FIG. 3
ANEROID ALTIMETER

Time after time others have tried it, then

They all began saying "IT CAN'T BE DONE"

—but they reckoned without Cleveland engineers, for

HERE IT IS!



The Travel Air Mystery Ship! The most talked about plane in America today. The ship that ran away with the show at the National Air Races in Cleveland. The plane that crossed America in half a day. Every boy has been thrilled with its amazing performance, its swift, spirited lines. *And now here it is in Kit form for you to build!* We knew you wanted it—and though it's just about the hardest plane of all to model, so much so that no other concern has attempted to produce it commercially—we've literally turned heaven and earth in our determination to give it to you. And with just a trivial modification (which might even be missed by an expert) it's an exact scale model of Capt. Hawk's record-making transcontinental plane. *You'll be wild about it!*

You Never Saw So Many FEATURES *In One Model Before*

1. Kit contains an extra large drawing—everything full size—and crammed with photographs and super-detailed instructions.
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3. All possible details reproduced.
4. Perfectly turned and finished balsa N. A. C. A. Cowl and Ring.
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6. Very efficient wing section employed.
7. Only two important wire parts to make.
8. New Cleveland-Designed nose bearing.
9. It is a flying or exhibition model (change only propellers).
10. Simplified construction throughout (simple even for beginners).
11. New simple method of Cleveland-Designed propeller making (indestructable propellers).
12. Colored like its prototype, a brilliant red beautifully scalloped batlike in black, with the use of patterns cut from our pattern sheet.
13. Adjustable control surfaces and removable parts. Flight adjustment simple.
14. Very well stressed. It will even power dive into the ground from a 50-foot altitude without crashing (Flattening out often comes into play due to "ground effect," in which case the model makes a beautiful 3-point landing.)
15. Wings do not slide for balancing. It always looks like the real Mystery Ship.
16. Wheel shoes easily made.
17. Perfectly proportioned to ¾" scale, the standard set by Cleveland Model Engineers.
18. Many other advanced Cleveland-Designed features which you will discover yourself when you get your kit.

The Sensational Cleveland-Designed TRAVEL AIR MYSTERY SHIP

The most-wanted model plane in America—and here's the still bigger surprise: *It's even easier to construct than our famous Great Lakes Sport Trainer Model.* Like the big plane itself, it flies at a very high rate of speed, climbs with breath-taking rapidity—and has astonished experienced model engineers with its distance. Don't miss getting it—but you must hurry. We have many, many advanced orders on hand, and can only guarantee delivery in the order of acceptance. So to avoid long delays and disappointment SEND YOUR ORDER RIGHT AWAY. The complete kit with its super-detailed drawings, easy-to-follow instructions and all materials costs only $6.60, postfree to any part of the world. You can also buy it on the Cleveland Dollar-and-Dime-a-Month Plan.

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New CLEVELAND AMPHIBION

Modeled after Sikorsky. Known as FL-301 Kit. Everything drawn full size, with complete detailed instructions. Be sure to get it. Easy as the Trainer to build. Colors—Yellow and Blue. Kit complete, $3.30 postfree.

New GREAT LAKES SPORT TRAINER

The great popularity of this epoch-making kit has enabled us to reduce our proposed advanced price from $6.60 to $5.50 postfree. This as well as the Kit above may be purchased on the Dollar-and-Dime-a-Month plan. This is the plane that one Cleveland man made a record flight of 3,608 ft. R.O.G. with.

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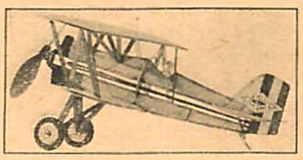
Kit No. FL-101. Spans 13⅜" and 18-¾". Lengths 7" and 7½". Colored: Red, White and Blue.



Boeing Fighter

Model FL-104. Span 11⅛" length 7⅝" Silver and Blue. *Latest Fighter in U. S. Air Forces.*

Lockheed Sirius

Model FL-111. Span 16½"; length 10¾". Orange and Black. *Lindbergh's Famous Ship.*

BOYS, MEET CAPT. RICHARDSON

Officially he's known as Captain Holden C. Richardson, Chief Engineer of the Cleveland Model and Supply Co. Formerly he was Chief of Design Section, Bureau of Aeronautics, United States Navy.

Send for New Notebook and Catalog

The new Fall-Winter Notebook and Catalog gives complete details on all Cleveland-Designed Air Line Models and 15c Outline Drawings. If you haven't already got one (those who have will regularly receive new fillers to keep theirs up-to-date) send 25c NOW while the supply still lasts. It will bring you many happy hours, and beats anything else for passing long winter evenings. Rush your 25c TODAY (stamps not accepted).

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(List rest of your order on separate sheet and pin to this).

Name.....

Address.....

Model Experience.....yrs. Age....yrs.

CLEVELAND MODEL & SUPPLY CO.,
Model Engineers, 1866N West 57th St., Cleveland, Ohio, U.S.A.

(*Continued from page* 38)

Angle of Drift	AIRSPEED Miles per Hour						
	60	70	80	90	100	110	120
5°	5	6	7	8	9	10	11
7°	7	9	10	12	13	15	16
9°	10	11	13	15	17	19	20
11°	12	13	16	18	20	22	23
13°	14	16	18	21	24	26	28
15°	16	19	21	24	27	29	30
17°	19	22	24	27	31	34	37
19°	21	25	28	31	35	39	42
21°	23	27	31	35	39	43	47
23°	26	30	34	38	43	47	52
25°	28	33	38	42	47	52	57

To the nearest mile per hour

it may be advisable to also find the direction *from which* the wind is blowing. This ensures greater accuracy in working out a course. To do this you have the drift indicator at zero and turn the ship round into the wind until looking through the eyepiece on to the drift-wire, the objects below seem to be passing directly along the wire. Now glance quickly at your compass and this will tell you the bearing from which the wind is blowing.

What you do with your windspeed, drift-angles and wind directions will be dealt with in a later article. At the moment we are only concerned with the instruments.

How to Build a Cabin-Boat

(*Continued from page* 31)

boards, cut a hole for a finger-grip in lifting and fasten back in place with two good strong hinges. Brass will be best and look best, too. This hatch will offer you a way of getting in the hold to make repairs and to bail out any water that may leak in before the seams have swelled up tight. It also offers a good place to hide things or to store foodstuffs, etc., that have to be kept cool and out of the sunlight.

MANY cabin-boats of this type have diving-boards built on them, and if you plan to do much swimming one will add a good deal to the sport. Choose a board that is of hardwood, stout and strong. It should be about eight feet long. Mount it securely under a heavy oak block as shown in the picture, resting its middle teeter-totter style on another block. About six feet of the board should project over the water.

Tape or bind the end securely so that your feet will not slip when you take the hop-off. This board may be removed easily by slipping it out from under the oak block and stowed away in the hold until needed again. If it is left in place, you are apt to crack it by ramming a pier or the shore.

The next step is the superstructure; the cabin itself. The boat may, of course, be launched now, but you will find it easier to get around it and do the work of carpentry if it is secure on the sand until the cabin is in shape. The weight of the cabin will not add much to the difficulty of launching.

Drawing D shows how to put up the frame of the cabin, using the two uprights as rear corners. Two-by-fours are best for this frame, and pine will do better than hard wood. One-by-twos may also be used if light construction is wanted, but they will not be as secure and strong. Frame the windows and the door as shown. It is a good idea to hunt around until you find some old windows which you can pick up cheaply and use, instead of buying them new or trying to make them yourself. The door could be got the same way.

Be sure and leave a six or eight inch lintel, or bottom crosspiece, in the doorway. This is necessary on all ships, so that when water sloshes across the deck it cannot trickle in the door and wet the interior. And even on this cabin-boat, there may be rainy and windy days when the waves break over her bows.

In the illustration, the frame of the roof has been left out to show more of the uprights. One or two pieces of two-by-four should extend on the slant between the top of the door and the rear, to support the roof boards.

When the frame is up to your satisfaction and securely nailed with spikes, it is time to put on the siding and roof. Start at one corner and go right around the building. Cut out space for the windows.

If you have made the cabin-boat in the dimensions suggested, sixteen by eight, then the cabin should be about eight by six and needs but one window. If the arrangement of the interior permits, however, a second window will be a great help in getting air and light. It is best to make the place for it in the frame, and then leave the boards in place until you decide whether or not you need it.

The roof boards may be put on of any scraps of lumber, since they will have to be shingled or covered with tar roofing if you want the building to be waterproof. I should suggest, by the way, that the roof slant on a good angle, to secure swift drainage of rain water. Have the front of the cabin seven feet high, which will make a foot drop.

Next decide what you are going to do about the roof. Shingles are good but expensive. Enough to cover this building would cost about twelve dollars and if you can get part of a roll of tar paper, you will find it just as good and much cheaper, besides taking less skill and time to put on when the roof is ready for it.

However, if you want to cut down on expenses even more, you can do what one boy did successfully . . . gather old newspapers, fold them in triangles and lay them like shingles on the roof, and on the sides, too, if you want to make the building wind and weather proof. Shingles made of newspaper will last for several years; they insulate against heat or cold and they give an unusual effect. Best of all, they don't cost anything but some trouble in gathering.

When you have finished the roof, you are ready to launch the cabin-boat. Get a bunch of the fellows together and borrow a couple of auto-jacks from your dad's car. You will need three or four long poles, or if these aren't to be had, round blocks of wood will do.

Jack up the cabin-boat until you can get one of the blocks or rollers under, and the same with the other end. Work in this manner until you have the entire boat up in the air, resting on the rollers. Now put your shoulders against it and push. The boat will slide easily down toward the water. Go slowly, so that you'll have time to insert the rollers in front of the boat as it rolls off them behind.

IF you wish, have somebody break a bottle of pop on the bows as the boat slides in the water, christening her whatever name you have chosen. Remember to have a rope fast to one mooring post when the boat slides in the water, or else you'll see it drift out and have a time getting her back.

Also one boy should jump on board as she floats, for it is considered bad luck among mariners to let a vessel go down the ways without a crew on her. You'll have a lot of fun planning the details of the launching and christening according to maritime tradition.

The next step is fitting up the cabin. You ought to have a couple of built-in berths, as they are easier

to sleep in than cots and take up less room if they are double-decked. Make them as shown in drawing F, flush against one corner. They should be six feet long and two feet wide, supported at the corners by two-by-twos of hardwood.

Your imagination will suggest many things to do to the inside of the cabin and it can be a mighty comfortable little place. Get old furniture that your mother doesn't want to give house-room any more, build tables and benches that fit against the wall and put down old carpets on the floor. The bunks can be fitted up with mattresses or with home-made ticks full of straw. An oil stove can go at one end of the room, under a window, for cooking.

It will add to the appearance of the boat if you give it a couple of coats of white paint outside. White paint is cheaper than any other and gives a true nautical effect. Remember to paint the bottom, below the door, black so that you will see it and not stumble every time you go through the door.

FIND out what the laws are regarding house-boats in your state. It may be necessary to display lights at night. At any rate you will want a couple of old lanterns, ship's lanterns if you can get them, to hang for port and starboard lights. Hang them from iron or wooden brackets, so that they project cornerwise and are visible fore and aft, as well as from the sides.

An anchor is absolutely necessary, for sometimes you will want to get out away from the shore and stay in deep water. Get rope enough to reach the deepest part of the body of water in which your boat floats, and tar it thoroughly to prevent its rotting. Take a canvas sack, not a gunny sack, and fill it with old iron or sand. Wire the rope to the sack and fasten the other end to one of the mooring posts. This will be anchor enough to hold the cabin-boat in a gale.

For a mast, take an ordinary good stout fishpole of the cane variety, mount it in a block and set through a hole in the projecting part of the roof, as shown. There should be a tiny pulley at the top of the mast for the flag-rope to run through, and some means of fastening the rope at the block.

A real nautical effect, as well as pleasant entertainment for the evenings can be attained by hanging a ship's type aerial from the tip of the mast to the corner of the cabin, connecting with a radio inside.

You will need a small boat to use as a tender for the times when your house-boat is out in the middle of the lake and can't be reached by wading.

The nautical effect may be carried out by having all your hardware of brass, such as the door-knob, lanterns, brackets and the fastener for the flag-rope. This must be kept sparkling and bright by polishing

but it will last forever and will not rust. The windows may be outlined in black or any color you choose.

If you have followed directions carefully, you will have by this time a permanent vacation playground ... a safe, useful, comfortable camp on the water. Nothing beats a house-boat for swimming, fishing or any of the out-of-door water sports. Such boats as this one have gone down the Mississippi, and one only a little larger crossed the Gulf of Mexico, went down the coast past the Canal and anchored in the mouth of the Amazon!

The materials necessary for making this cabin-boat, in the eight by sixteen size suggested, are approximately as follows. However, if you use second-hand lumber, you can substitute what you have for most anything listed.

Lumber: One hundred feet of one inch soft wood, fifty feet of one inch and a quarter, fifty feet of one inch and a quarter hard wood, two hundred feet of two-by-fours, fifty feet of matched flooring for bottom.

Hardware: Two pairs of hinges, door fittings, lanterns, brackets, galvanized (rust-proof) nails and spikes. Also gallon of white lead for bottom.

Fittings: Sack of old iron, springboard, stout fish-pole for mast, wire for aerial, one door, two windows, one hundred feet of inch rope for moorings, fifty feet of inch rope or larger for anchor, half roll of tar roofing and tacks.

Tools: The only tools required for this cabin-boat are the very simplest hammer, saws, square, tape measure, etc., plus the auto jacks necessary for launching, and the rollers.

Here's a Novel Light to Make Yourself!

(*Continued from page* 22)

Finish with a light sandpapering.

Mark one of these beveled ends "Front", and measure from it a distance of 5 1/4", or 4 1/4" from the top edge of the cut. Make a mark at this point exactly in the center of the board. Take a brace and auger bit, and bore a 1/4" diameter hole through the board. Bore from the top side to the under side. Sandpaper is used around the hole on both sides to remove excess.

No. 3. On the top face of the board, draw two lines along the sides, each 1" from the side edges. Plane bevels along these sides, as you did on the ends. Finish with sandpaper. See that the end bevels match the side bevels at the points where they meet.

No. 4. We now turn the board over and work on its under side. Attach a 2" hinge at the front end of the board. See to it that the screws do not penetrate through the board. As no great stress is placed on the hinge, short screws can be safely used.

A 1/4" groove is now cut on the under side of the board. This is the same side of the board on which the hinge has been attached. It extends from the bored 1/4" hole to within 1/2" of the rear edge, and is 1/4" deep. Scoop this out with a 1/4" chisel after laying out in pencil. Work from the rear toward the bored hole so that if the chisel slips, it will go in the hole and not split the wood. At the rear end of the groove, cut it 1/2" deep, as shown, so that the light cord can be easily bent. Finish with sandpaper.

NOSE BLOCK

Shown in the plans as "Part C", this block fits over the front end of the fuselage block and is hinged to the piece you have just completed. It acts as a door through which the light bulb can be changed, etc. The propeller is also attached to this piece.

No. 1. Obtain a piece of white pine measuring 4" x 4" x 2" thick. Use a try-square to insure squared corners, and sandpaper smooth.

No. 2. Measure 1 1/2" in from two opposite sides of the block, and draw parallel lines along the face of the block. Take your block plane and flatten off the edge, so as to obtain a bevel, as shown under operation *No. 2.* When so planing, work from the edges in toward the center, which will prevent splitting of the wood.

No. 3. On one of the two sides which have not been beveled, draw a line 1" from the edge of the side and parallel to it. On the opposite side, draw another line 2" from its side edge and parallel to the first line.

Cut a bevel edge, as you did before, on these two sides. If properly done, the point of the nose block will be 1" square. Sandpaper to a smooth finish.

RUDDER

This is designated as "Part D" in the plans. Square up a piece of white pine of 1/8" stock 3 1/2" wide and 4" long. Use a try-square to insure square corners. Sandpaper should be used on both faces and on all four edges. Note operations *No. 1* and *No. 2.*

No. 3. The back edge of the board is not changed in any way, and all cuts are made on the front edge, and the under and top edges. Measure along the top edge 1 1/2" from the front edge and draw a line across the edge.

Measure along the front edge 7/16" from the bottom edge and mark. Draw a line across the face of the board from one to the other of these two lines. Saw along this line and finish the cut smooth with a plane. Measure along the bottom edge 2" and mark. From the bottom edge

at the point of this mark, measure up the face of the board 7/16". Remove this piece with a coping saw, and finish smooth with sandpaper.

All parts which are to be cut away, are shown in the plans in heavy shading lines. The rudder is now finished.

ELEVATOR

This is shown as "Part E" in the plans. A piece of 1/8" stock is used, which must measure 5" wide and 6 1/2" long. Use a try-square to square up the board to these dimensions, as is shown under operation *No. 1.*

No. 2. Locate the center between the two sides of the board, and draw a center line its full length. Along one end edge of the board, measure 1" from each side and mark. From this same edge, measure 2" along each side and mark. Measure 3/4" on each side of the center line at the front and opposite end from that on which the other measurements were made.

Draw two lines from the two marks just made to the marks on the side edges of the board 2" from the rear end. Saw along these marks. Finish smooth with a plane and sandpaper. These cuts should leave the front of the board 1 1/2" wide. Measure from the rear end of the board along the center line 2 1/2" and mark. Draw lines from this center mark to the marks first made, which are 1" from each side along the rear edge. This will form a small triangle. Remove it by sawing along the two lines just drawn. Finish with sandpaper. The elevator is now finished.

WING

The wing is shown in the plans in five building steps.

No. 1. Obtain a piece of 1/4" white pine stock, measuring 8 1/4" wide and 24 1/4" long. Plane the board's edges down until it measures the desired size of 8" x 24", using a try-square to insure the sides and ends being at right angles to each other. Sandpaper the edges smooth.

No. 2. Measure 4 1/2" from either edge and mark. Hereafter, the edge just chosen becomes the leading edge of the wing and should be so marked. Measure 12" from either end of the board and mark at point where the first mark came. Take a brace and bit and bore a 1/4" hole completely through the board, working from the top to the bottom of the board. Mark this side of the board "Top". Make sure that the hole is bored at exactly the point indicated.

No. 3. Measure 4" from the edge marked as the leading edge, and draw a line across the top face the full length of the board, parallel to the leading edge. Draw a line at right angles to this line from the center of the bored hole to the trailing edge. Measure 1" on each side of this last drawn line at the trailing edge and mark. Draw two lines from these last two marks to the points marked on the side edges 4" from the leading edge. Saw along these two lines, thus removing the shaded portions, as shown in the plans. Plane these edges, and finish with sandpaper.

No. 4. In this operation the wing is streamlined. The leading edge retains its original width of 1/4", though it is slightly rounded along its full length. This can be easily

AMERICAN SKY CADETS

It is deeply regretted that owing to lack of space we have been compelled to omit from this issue the usual reports concerning American Sky Cadets activities from different parts of the world.

However, this and other interesting reports will appear in the next issue of JUNIOR MECHANICS AND MODEL AIRPLANE NEWS

The Editor.

done with a small block plane. It is then finished with sandpaper.

Note that the bottom of the wing is not changed, all the streamlining being done from the top face of the wood. A smooth plane will be found best for this work, but if one is not available, the block plane will do the work. Plane along the length of the board with the grain, and never against it.

Do not plane the trailing edge to a knife-like edge, but leave about 1/32" thickness there. While removing this surplus surface wood, use your try-square frequently to see that the face on which you are cutting retains its smooth flat surface.

When the wing looks about finished, lay aside your plane, and finish the work with sandpaper. Flat surfaces, such as this, should be finished with the sandpaper wrapped around a square block of wood, so that it will leave a flat surface. The two ends of the wing can be slightly tapered to a rounded edge, if desired.

No. 5. The wing is now completely finished, except for the rounding of the wing tips. This operation is optional with the builder, as some prefer the squared tip. If so, do not complete this operation. Those wishing to finish the wing tips, as shown in the plans, should first lay out the work with a compass. Locate the center of the square wing tips, as they are now, and draw a line across the top of the wing parallel to the leading edge. Measure 2 1/2" in from each end of the wing along this line. Set your compass to draw a circle with a diameter of 5". This is done by spacing the needle point and the pencil 2 1/2" apart.

Lay the needle point of the compass on the point you have marked 2 1/2" from the end, and draw a half circle from the leading edge through the end edge of the wing to the trailing edge. Do this on both ends. Round the ends to these circle lines with a block plane, starting from the leading edge around to the center of the end edge. Then turn the board around and plane from the trailing edge to the center of the end. This will prevent splitting.

The wing is now completely finished, and should be given a thorough sanding with a light sandpaper for a satin finish.

LANDING GEAR

The landing gear is constructed of seven parts: four struts, one axle and two wheels. The four struts are made from white pine, each 1/4" x 1/4" x 5" long. Cut these five pieces to the correct size. They are streamlined, as is shown in the end view in the plans, which can best be done with an ordinary pen knife.

Note that both faces of the struts are streamlined, instead of only one face, as in the case of the wing. Finish these with sandpapering. Take special pains in finishing these small parts as they are the pieces which will be closest to the observer when the fixture is hung.

The axle is made of the same material and is 1/4" x 1/4" x 8" long. It is also streamlined, the work being accomplished in the same manner. Finish to a satin finish with sanding.

The two wheels must, of course, be exact duplicates. Obtain a piece of white pine measuring 1 1/4" wide and 2 1/2" long. The stock should be 3/8" thick. Take your pencil compass, set it to make a 1 1/4" diameter circle by spreading the needle point and the pencil 5/8" apart, and draw a line along its length through the center of the board. Then place the pencil on one end, press the needle point into the center line, and draw a circle.

Repeat this process on the other end of the board. Saw the board apart at the point where the two circles meet, and cut out the circles with your knife. Do not cut past the pencilled circle, but be sure to cut exactly up to it at all points. Round the edges of each wheel, as a tire is rounded, and sandpaper smooth. The parts for the landing gear are now completed. Model airplane wheels may be substituted if desired by the builder.

TAIL SKID

A 1/4" diameter, round dowel stick is used for the tail skid. It is 2" long and should be beveled at the two ends, so that it will fit snugly against the bottom of the fuselage and will also look as if it were ready for use on the ground end.

PROPELLER

The propeller may be carved from a 1/2" x 3/8" x 6" balsa propeller blank or block, but it will be much better looking if made of mahogany. If the builder is carving his own, the usual standard method is used. Mahogany propellers may be purchased at any model supply store, and are apt to give better satisfaction than if the builder makes his own.

All parts for the construction of the fixture are now finished, each of which should be carefully checked as to measurements before the work is continued.

ASSEMBLY

Before starting actual assembling, read these instructions through carefully, handling each part as it is referred to, and making sure that each step is thoroughly understood before proceeding to the next. It would be disappointing to spoil all the work so far accomplished by blundering in the assembling, so that careful attention is necessary.

The first step in the assembling is the hardest, inasmuch as the lighting attachments are now assembled. Decide at this time about how low you wish the fixture to hang from your ceiling, and then add 10" to

this length. Obtain a heavy duty electric light cord of the desired length. Let us say, for example, that you wish the fixture to hang 12″ below the ceiling. The length of the cord you would then buy would be 12″ plus 10″, or 22″ long.

Take the cord and thrust it through the hole in the top of the fuselage. Push it down until it can be seen through the larger hole of the fuselage. Take a small pair of pliers, grasp the end of the cord and carefully work it through the big hole. Pull it through until the extra 10″ are outside of the large hole.

OBTAIN an electric light socket from any Five and Ten Cent store, or an electrical shop, and connect the wire to the socket. If you have never done this, ask the store keeper to explain the process. The diameter of the average brass socket is about 1 3/8″, so it can be easily slipped in the 1 1/2″ hole through which you have worked the cord. If the cord you have is silk covered on the outside, wrap it tightly in mechanic's adhesive tape.

When so wrapped, start working the cord back through the large and small holes, until the socket has entered the large hole, as shown in the plans under "Lighting Assembly". Do not allow the socket to enter the hole too deeply, as you would then have trouble screwing in the bulb.

When in place, cut some small wood wedges, a little larger in width than the average common match stick, and wedge these in between the socket and the sides of the large hole, so that the socket will be held tightly in place. Lay the cord along the top of the fuselage, as is shown in the plans, and tie a knot in it just at the point where it bends upward to go through the hole bored in the fuselage roof.

Before proceeding with the lighting arrangement, attach the nose piece to the fuselage roof piece by means of the hinge which was screwed to the fuselage roof. The hinge is attached to the flat side of the nose piece, shown as "Part C", and at the upper edge of it.

Be sure that the screws do not protrude through the wood. The wing is now attached to the fuselage roof piece. The straight edge of the wing (leading edge) goes toward the front of the fuselage roof piece, which is the end to which the nose piece is attached. The leading edge of the wing should coincide with the top edge of the fuselage roof, so that only the beveled edge shows beyond the wing's edge.

The wing should be perfectly centered on the roof piece, so that the leading edge of the wing and the side edges of the fuselage roof piece form perfect right angles. Test this with your try-square. The hole of the wing should be directly above and in line with the hole of the roof.

Attach these two parts with ambroid or any good wood cement. When attaching, it will be best to

thrust a 1/4" dowel stick through the two holes of the pieces to insure that these are perfectly lined up.

The elevator is now thrust in the 1/8" slot cut in the tail of the fuselage piece and firmly cemented into place. See that it is in line with the fuselage when cementing. The rudder is attached to the fuselage just above the elevator with its straight edge toward the back. (See "Assembly" in the plans).

When attaching it, make sure that it is in line with the fuselage. Use ambroid or any good wood cement for this purpose. The dowel tail skid is now attached. A 1/4" diameter hole is bored in the bottom of the fuselage piece 2 1/2" from the rear end and in the exact center. Apply cement to the dowel stick, thrust in the hole 1/4" and allow to dry. See that when the hole is bored, it is slanting toward the front of the fuselage, so that when the tail skid is placed in it, the tail skid will slant toward the rear.

SMALL-HEAD brads 1/2" long hold the wheels of the landing gear on the axle. These should be carefully driven through the center of each wheel and in the ends of the axle. (Note "Landing Gear Assembly" in the plans).

The four 5" struts hold the axle and its two wheels to the fuselage. Two of these extend from the front of the fuselage piece, at its bottom, to the axle, while the other two extend from the rear end of the level 8" long part of the fuselage to the axle. Ambroid or any good wood cement is used for this purpose. (Note these positions under "Assembly".)

A small head brad, or a common pin is used as a propeller hook, except that it is not made into a hook, as would be done in the case of rubber-driven model. Drive it through the center of the hub of the propeller and in the center of the 1" square part of the nose block.

If the propeller is bought, and already has a hole in its hub, a large head nail is used. Care must be exercised not to split the nose block when applying the nail to it.

We are now ready to finish the interior of the "cabin". Three pieces of common window glass are used for this purpose. The side pieces, which are attached in place first, are duplicates in size, both being 3" high and 7 1/2" long. The bottom piece, which alone forms the bottom of the cabin, is 3" wide and 8" long. If you do not understand glass cutting, ask your nearest hardware dealer to supply these three pieces of glass.

The two side pieces fit in the cabin, rest on the two 1/2" bottom projecting shelves, and are held in place by your wood cement. Apply it to the wood of the fuselage, as well as to the glass, for the best results. The bottom piece of glass is not cemented to the cabin, for it must be removable so that any necessary electrical work, such as changing bulbs, etc., may be accomplished with ease. It rests on the same two projections, which hold the side pieces, and in between them.

It may be found that the glass you have obtained is so thin that this bottom piece will be too narrow for the width of the bottom, and if so, a wider piece should be obtained. This will allow the glass to be easily slipped in or out, and will yet hold it from slipping from side to side. To make sure of this measurement, cut a piece of heavy paper until it is the desired width and then measure it for width.

The electric cord, which comes from the fuselage, is now thrust through the fuselage roof piece and the wing. As you have already so attached these two pieces that their two holes are in line with each other, the cord should pass through them easily. Thrust it through the bottom of the roof piece and out of the top of the wing.

Pull the cord through until the knot you have tied in it stops its progress. Apply ambroid to the top of the fuselage piece where the fuselage roof comes in contact with it, and press the roof piece and wing in place. When doing this, test for correct position by being sure that the nose piece, which you have hinged to the roof piece, fits tightly against the front of the fuselage piece, and that the top, bottom and sides of both match each other. Two 2" nails are now driven through the roof piece in the fuselage piece, at the point where the roof and the fuselage meet at the rear, without the wing.

Necessary Materials

(*Note*: Where "wood" is indicated, use white pine or balsa)

2 pieces	1/2" x 2 1/2" x 20"	wood	wings
1 piece	1/4" x 3" x 12"	wood	tail surfaces
1 piece	1 1/2" x 1 3/4" x 12"	wood	fuselage
2 blocks	1 1/8" x 1 1/8" x 5"	wood	motors
3 strips		bamboo	struts, etc.
1 pair	1/8" diameter wheels to fit 1/16" diameter axle		
1 piece	1/8" x 1/4" x 6"	wood	shock absorber
1 piece		celluloid	windshield
2 pieces	1/2" x 1" x 1"	wood	radiator
1 piece	1/16" x 1" x 6"	wood	propeller blades
1/2 oz can		ambroid	
1 package		model making pins	
1 spool		white cotton	
5 dozen		bank pins	exhaust stacks

Paints: yellow, olive drab. Small quantity of red, white, blue and black

Care must be taken not to drive the nails in the cord, so it is best to lay out in pencil on the top of the roof the position of the groove holding the cord. Drive the two nails on each side of this groove. Small-head brads should be used, and a nail set applied.

The electric lamp space in the fuselage is large enough to hold a fifty or seventy-five watt bulb. Use a frosted Mazda lamp, as the glass at the bottom of the fixture is clear, and a frosted lamp greatly adds to the appearance.

When the ambroid or wood cement has hardened, remove all excess with a knife, fill the nail holes and cracks with plastic wood, and finish by sandpapering the whole structure lightly. At this time, the rear of the fuselage roof piece must be slightly trimmed, so that it will match the form of the fuselage, where it narrows toward the tail. (See Part B—*No. 4*).

FINISH

The inside of the cabin should be silvered with silver paint. Apply this to all parts of the interior cabin, except the glass. This acts as a reflector and greatly adds to the lighting effect of the fixture.

If a mahogany propeller has been used, polish it with any good furniture polish. If other wood has been used, stain it mahogany.

Paint the nose piece, landing gear, and tail skid jet black. The rudder should be finished in red, white and blue; dividing the width in three equal strips, and applying one of the three above colors to each.

Paint the wing on both sides silver, which will also assist to deflect the light. The body, or fuselage, the elevator and the wheels should be of one color. This is left to the builder's opinion. Red makes a splendid combination with the other colors.

If manufactured wheels have been applied, leave them as they are, but if you have made your own, paint the rims white to give the effect of rubber tires.

HANGING

Open the nose door, remove the bottom glass and polish the side glasses. Then place a Mazda frosted lamp in the socket, clean the bottom glass, place in position and close down the nose door. If the hinge is not tight enough to hold the door tightly against the front of the fuselage, a pin may be thrust through the bottom corner of the nose piece in the 1/2" square shelf on one side.

However, the weight of the propeller usually holds this in place. If you thoroughly understand electrical work, you may make your own ceiling connection, but if not, have an electrician do this.

Be sure to shut off the main current before working on the ceiling connection. You will find, possibly, that the cord is too long, in which case, it can be easily cut to desired length.

Gliding and Soaring

(*Continued from page 11*)

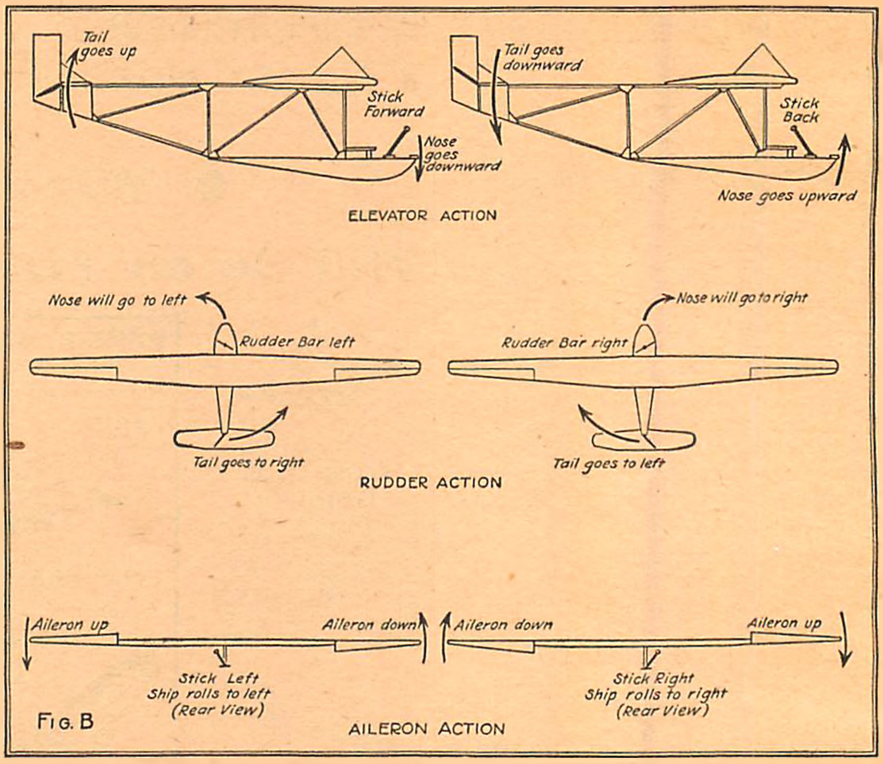

FIG. B

mixed while the ship is being rigged, so that, for example, a forward movement of the stick moves the elevators up, instead of down.

Getting Ready for the Take-Off. When you get into the seat, fasten the safety belt around you. The safety belt is a strap, buckling around your waist, which holds you to the glider. You may be grateful for this belt if you hit an air "bump", or make a poor landing.

Feel for a rope which should be attached to the under-wing surface above you. (American ships are not always equipped with this rope, but most German ships have it). Hold on to this rope with your left hand (the right hand grasps the stick) while taking off. In this way, your body will assume a position perpendicular to the ground, and you will be instantly aware whenever one wing dips down.

BEFORE taking off, choose some object on the horizon right in front of you. By keeping your eye fixed on this object, you will be able to maintain flight in the course which you have planned.

When you are ready to start, hold both rudder bar and stick in neutral. When you have had some experience you may find it practicable to pull the stick back a very little. This will raise the elevators slightly, ready for the climb. Much depends on the individual glider which you are flying.

Methods of Taking Off. There are at least four different ways in which a glider can take off:

The oldest method is by running down hill. All hang gliders were taken off in this manner; the pilot, whose legs were, of course, free, held the glider with his arms, and ran until flying speed was reached, and the glider rose from the ground of its own accord. Frequently, even now, gliders are taken off by a crew of men who pull the glider down hill by means of a hemp rope.

This method is, however, a comparatively unsatisfactory one, since the glider is apt to be damaged by being dragged along the ground for too long a period. It not only is a strain on the glider to pull it along the ground too far, but also the pilot has difficulty in handling the plane before it gets into the air.

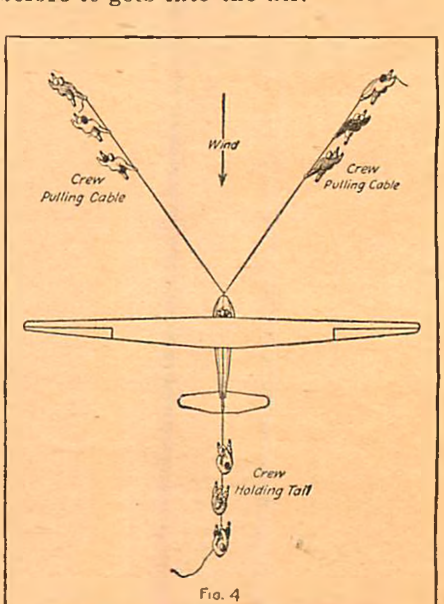

FIG. 4

THE CATAPULT METHOD OF TAKE-OFF

The crews stretch the elastic cable by running forward with it, while one or two others hold the tail to prevent a premature take off. When the cables are sufficiently tight a signal is given and the tail crew lets go with the result that the glider shoots into the air.

A second method of taking off, and one which is being used more and more extensively for training, is that of towing the glider behind an automobile or motor boat. The glider is attached to the towing machine by a rope with a length of perhaps two hundred feet. As the pilot becomes more experienced, the rope may be lengthened to five hundred feet or more. The automobile, or motor boat, gathers speed rapidly in order to get

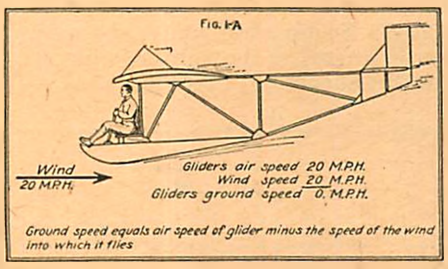

Fig. 4A
Ground speed equals air speed of glider minus the speed of the wind into which it flies

the glider off the ground as soon as possible. As soon as the glider gains sufficient forward speed, (evidenced by tendency of the glider to rise by itself) the pilot pulls the stick back gently. This brings the plane into the air. When it has taken off, the towing machine should continue to travel fast, in order to continue the glider's "thrust" as long as possible.

If the glider is going so slowly that it is forced to remain very near the ground for some time, the tow rope will drag and flight will be very uneven. When sufficient altitude has been reached, the tow-rope is released by a manual control and the pilot flies independently. *This method of take-off should be attempted by the student pilot only under the direction of a competent instructor.*

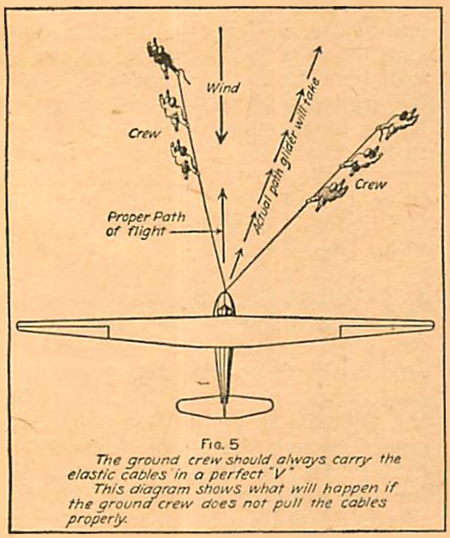

Fig. 5
The ground crew should always carry the elastic cables in a perfect "V" This diagram shows what will happen if the ground crew does not pull the cables properly.

Experiments have recently been made in which gliders have been towed behind airplanes. The procedure here is, in general, the same as when the automobile does the towing, but it is far more intricate. The airplane's speed is of necessity very high, so that it is an unusually difficult task to pilot the glider. This,

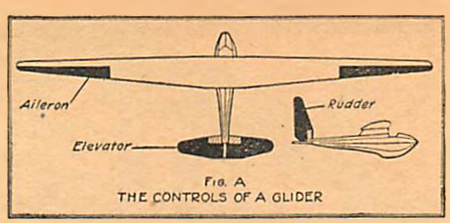

Fig. A
THE CONTROLS OF A GLIDER

of course, should be attempted by only the most experienced pilots.

The Shock Cord Method of Taking Off. The usual, and in most cases, the most practicable method of take-off is one in which the glider is catapulted into the air by means of an elastic cable. This works in exactly the same manner as a sling-shot, where a rubber cord is stretched backward, then released, shooting a missile into the air.

The elastic cable consists of numerous strands of rubber held together by a braided covering. It should be from eighty to two hundred feet long. At the center of it a metal ring is attached. This ring slips over an inverted hook on the nose of the glider, so that unless the cord is taut the ring falls off the hook. (See Figure 3.) Each end of the cable is held by a crew of from two to six men. These men walk out ahead of the glider, carrying the cable forward so that it forms a V, with the point of the V at the ship's nose. (See Figure 4.) The glider is usually held stationary by one man who sits on the ground and holds the tail, or by several men who hold a rope attached to the tail.

THE instructor holds one wing of the plane to preserve lateral balance, and, at the same time, gives instructions to the ground crew. At the command "Walk!", the crew on the rubber cable takes about ten steps ahead. Then, at the command, "Run!", the crew runs ahead another ten paces. Next, the instructor shouts, "Turn loose!" and the men at the tail go, allowing the glider to be shot into the air. The elastic cord becomes slack, the ring falls to the

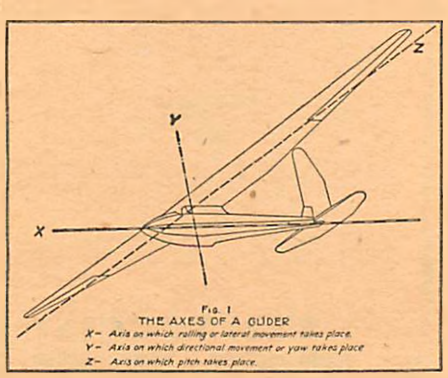

Fig. 1
THE AXES OF A GLIDER
X- Axis on which rolling or lateral movement takes place.
Y- Axis on which directional movement or yaw takes place.
Z- Axis on which pitch takes place.

ground, and the starting crew stops running.

In a low wind, this method of take-off will launch the glider at a speed of about fifteen miles an hour. When the pilot becomes more expert the ground crew may be enlarged and may run ahead farther and at a greater speed, thus increasing the glider's speed. The crew may start to run when the cable is stretched to about 150 percent of its length and turn loose when it is stretched to its capacity, (about 200 percent of its original length).

Sometimes the man, or men, at the tail are not used. The glider's own weight will hold it still until the shock cord has been stretched considerably.

Several precautions must be taken when this method of taking off is used: In the first place, the ground crew carrying the rubber cable must walk ahead so that the cord will

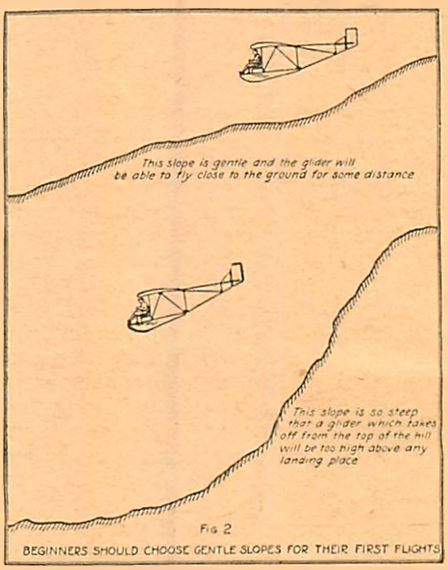

Fig. 2
BEGINNERS SHOULD CHOOSE GENTLE SLOPES FOR THEIR FIRST FLIGHTS

form a perfect V, i. e., so that the bisector of the angle of the V will be directly in line with the fuselage and the glider's path of flight. If one end of the rubber cable is carried too far to one side, the tail of the glider will be swung about during the take-off, and the ship will not start out along its intended path of flight. In order that the ground crew may stretch the cord to form a perfect V, it is a good idea to mark places on the ground toward which they must run. (See Figure 5).

MOREOVER, after the command, "Turn loose!", has been given, the men carrying the cable should duck away from the glider's path, so that the plane will not hit the men if the take-off is poor. Sometimes the ring does not fall off the hook immediately. In this event it is necessary for the pilot to push the stick forward, dropping the nose for a moment, and then to pull the stick back again. The ring usually drops off without further difficulty. An experienced pilot can tell when the hook drops off from the action of the ship.

Some automatic launching devices have been experimented with, but they are still experimental.

Conclusion. A take-off is not a difficult feat, but the success of the entire flight depends to a great extent upon its proper execution. The student should have a well-trained

ground crew, and should himself be thoroughly acquainted with the principles of the take-off, before he attempts his first glide.

Four Things to Remember about the Take-Off:

1. Take off into the wind.
2. Be sure your course is free from obstacles.
3. Keep the stick in neutral during the take-off.
4. The first flight is never so startling as you expect. Keep cool!

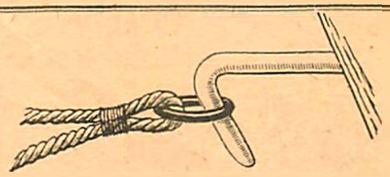

FIG. 3

The ring and hook which connect the elastic cable to the nose of the glider.

As long as the cable is taut the ring stays on the hook

A Scale Model of a Curtiss "Condor"

(*Continued from page* 13)

Cut to shape and finish off as shown in the drawings. There are twelve exhaust pipes on each side of a motor. These can be imitated with small pins. The cockpits for the gunners are drilled out carefully and rings glued around them as shown in the drawings.

Be careful to note that the radiator on the right engine is off-center to the right; and the left radiator off-center to the left.

The radiators are shaped from small blocks of wood, streamlined and grooved according to the plans.

The two small wings are glued to the fuselage first and given plenty of time to dry. The two side motors are glued on next. After being permanently set, the other two lower halves are attached. Refer to the drawings when doing this. The top wing is glued on next and is held on securely by the cabane struts which are of bamboo sticks. Push the top wing in the sticks to get a firm hold. Now glue it and see that the wing is perfectly level. The radiators are glued in just above the motors. Bamboo sticks cut to the proper length are used for struts. Mark off their proper place and glue securely.

TAIL ASSEMBLY

The tail group should be assembled next. Rig up the tail assembly as shown in the drawings. Bamboo is used for the elevator struts, glued, and set perfectly straight.

The landing gear is the next step. A pair of 1 1/8" wheels will be needed. Balsa or white pine is used for the shock-absorbers. Bamboo is used for the struts. The wheels are situated directly under the side motors. The tail wheel assembly is made as shown in the drawing. A small wheel taken from a toy automobile will be just the right size.

PROPS

The props are made with either two or three blades, as preferred. Shape out two bullet heads or spinners. Drill the amount of holes for the blade and insert. Twist the blade so that the props will turn clockwise, as on the *Conqueror* engine as used on the *Condor*. Now insert a pin through the spinner and make the hole larger, so that the props will spin more easily.

PAINTING

For your color use lacquer as this is quick drying and gives a very good appearance. You will need medium yellow, olive drab and a small amount of red, white, blue, black and silver. The wings are painted yellow. Give two coats if necessary. The tail, elevator, stabilizer and vertical fins are painted yellow. The fuselage is olive drab; so are the motors, radiators, struts and landing gear.

The grooves in the radiators are painted silver as shown in the drawings, propeller blades are silver and the spinners olive drab. The rudder is marked and painted red and white. There are seven red stripes and six white stripes on this. Blue is painted on the balanced portion of the rudder. The centers of the wheels are olive drab, the tires black. The landing lights made from the plans are painted olive drab with white and black rings in front. The stars can be bought and pasted on or painted. "U. S. ARMY" is painted in black, 1/4" width letters, under the lower wings. This completes the model.

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From the Ground Up

(Continued from page 8)

to the field. On and on they came, each ship keeping its place as though held there by invisible strings. Like a covey of thundering hawks they flew by him, the whole formation dipping in salute as they passed. Larry dropped his plane's nose in answer. A flaming red rocket leaped to a scarlet light, as the Major fired from a Very pistol the signal to return.

The Major, at the apex of the V, executed a swift Immelmann turn, which left him flying in the opposite direction at higher altitude. The remainder of the escort banked at top speed and dangerous angles, and a moment later the entire fleet was returning to the tarmac in formation. Above them and slightly behind the Major's biplane flew Larry, his hands steady and firm on the controls and a proud smile playing on his lips.

THE familiar, ugly bulk of the hangars hove suddenly into view. The Major's ship detached herself from the formation, and shooting downward, achieved a graceful landing. One by one the other planes followed suit. Larry idly flew in circles, giving the others time to land. As his eyes swept the sky he suddenly realized that there was only one other ship in the air in addition to his own. That ship he recognized immediately as Heinze's. To his surprise the latter made no indication of following the other ships down.

Larry swung his rudder over and passed close to the other plane, which was flying aimlessly back and forth over the field. He shot a questioning look at the saturnine face of Heinze as they passed. The latter pointed downward meaningly. Larry nodded, taking it as a signal for him to land.

Down went the ship, closer and closer to the sandy soil below. Then, when it seemed as if a nose dive was inevitable, he jerked back on the controls. She flattened out perfectly, and came out of it almost parallel to the ground. For a second she skimmed along, her wheels almost touching the ground. He settled back and waited for the moment when his landing gear would scrape the earth. Then it happened.

There was a sudden roaring behind him. He turned quickly to see the ship of Heinze, descending like some predatory hawk in search of prey. He was landing, his speed greater than Larry's, and as his ship tore along the ground behind Larry, it was inevitable that their wings would tangle unless the monoplane was thrown off her course.

Larry wasted no time in trying to determine this madman's motive. No matter what, it was the Major's paramount ruling that a life must never be endangered. If a plane must crack—well, it could be replaced, but a human life cannot be reclaimed.

With this in mind, Larry did not hesitate. With all the strength in his young body, he jammed down on the rudder bar, and at the same time flung the stick hard over. The monoplane groaned protestingly. For a moment she seemed to hesitate. Then she swung over. She skidded badly, then thrust her nose toward the hangar. Her tail came suddenly up, and her spinning prop fouled a rope that had been lying on the tarmac.

The rope twined about the prop blades like a twining snake lying in ambush. Her nose burrowed deep into the earth. There was a sickening splintering of wood, as the undercarriage cracked beneath the strain that was put on her. Larry was conscious of a terrific blow in his chest, as he was thrown up against the controls. The grating shriek of ripped fabric came to his ears. Then came a dull cracking thud, and the stricken ship stopped dead on the tarmac it had left in intact condition less than an hour ago.

A moment later Larry emerged from the wreck. Blood streamed down his face, and he was aware of a sharp, paralyzing pain in his knee. As he reeled across the field, he saw Heinze spring from the cockpit and regard the wrecked mono with a sardonic expression.

"You're a swell flyer," he said, and his voice held a mocking note. "I wouldn't have come within a yard of you. Well, if a pilot's yellow, it comes out in a landing."

LARRY suddenly saw red. With a cry of rage, he flung himself upon the other. Heinze's little yellow eyes flamed with hate as he advanced to meet Larry's onslaught. For a moment they grappled, two pair of hands seeking a hold. Then Larry heard the Major's crisp tones.

"Take those men apart."

Strong hands separated them, and Larry looked up into the angry eyes of Riddle.

"Larry, go to the first aid room, and get yourself fixed up. Heinze, you're grounded until further orders. Furthermore I'll see you in my office in half an hour."

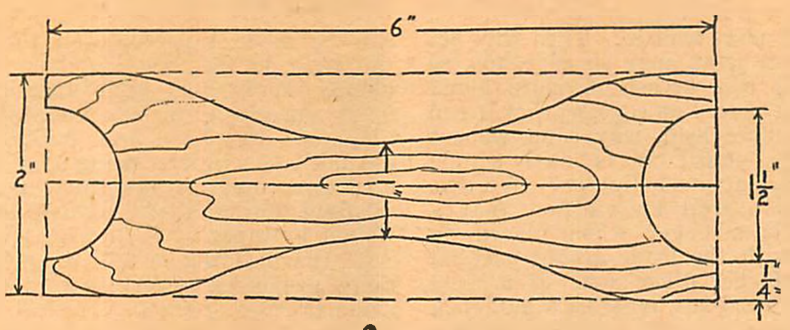
Heinze glared at him, his eyes twin pools of distended hate. He opened his mouth as though to speak, but evidently thought better of it. He turned on his heel, and strode off across the field. Dully, Larry made his way to the small room at the back of the office, where a makeshift field hospital had been installed for use in cases of emergency.

The strings behind the curtain manipulate the figures in this strange drama more blindly than ever, and to what purpose? Is Heinze the guiding hand or is he but a tool in more sinister hands?

The tempo increases and the conclusion draws near. Follow it to the thrilling end in the December issue. On sale at all news stands November 23, and only 15 cents a copy.

Whittling for Fun

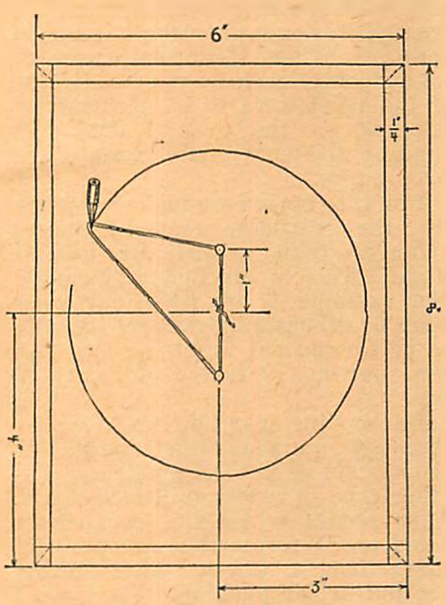
(Continued from page 36)



6

hole so that you can get the knife-blade through and cut the frame down to shape. Take pains not to run over the edge of the line you drew, for mistakes here cannot be rectified or hidden.

Drawing 7 shows you both the dimensions of the frame and how to draw the ellipse. When the whittling is done smoothly, mount a piece of thin plate glass of about seven and a half inches by five and a half inches on the back, against which rests a piece of cardboard, on which is pasted the picture you want to use in the frame, as shown in plate 8. Bent brads or small nails will hold the glass and cardboard in place, since they do not show from the front, or you may use bent bits of triangular metal such as are put in window frames to hold the glass firm.



7- PLAN OF PICTURE FRAME AND HOW TO MARK OVAL

You will add to the appearance of the picture frame if you stain it with a light antique stain, and then shellac and wax it. This finish goes with the style of hand-carving.

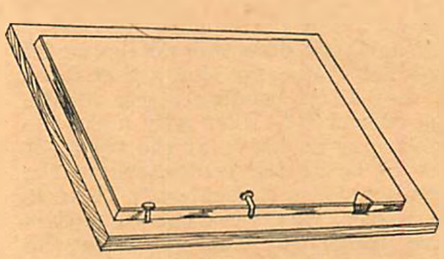
By the time you have finished the picture-frame, a hundred other objects for the home, the work-shop, and the desk will suggest themselves. Remember to lay out a design or drawing of any object you make, so that all dimensions check up and are clearly before you when you start to whittle.

Keep your knife sharp and your dimensions true, and before long you may successfully turn out a foot-long wooden chain or a ball within a cube to astonish your friends. Best of all, the accuracy of hand and eye gained in whittling will be of the greatest value to you in any other handicraft work you may take up in the future.

WHAT YOU NEED

Tools and materials necessary to make the objects mentioned in this article are as follows:

Scraps of pine, gum, and maple lumber of varying thicknesses; one or more good Swedish steel whittling knives, try-square, brad-awl or drill, screw-eyes and hooks, nails and brads, string, pencil, etc.; piece of thin glass and cardboard.



8 - HOW TO FASTEN GLASS AND CARDBOARD TO FRAME

Christmas Gift Suggestions to Junior Mechanics

For mother—a **sewing basket**, handy for thread, needles, and the usual odds and ends—a **shoes and stockings box** to keep shoes and stockings in their proper shape in their proper places.

For father—a **smoking stand**, trim-looking. There are never too many of them in the home—**alarm clock cover**, a clever stand to house an alarm clock. The article, **Christmas gifts from the Home Workshop**, in the December issue of JUNIOR MECHANICS AND MODEL AIRPLANE NEWS tells you how.

On all news stands November 23, and only 15 cents a copy!

A Course in Airplane Designing

(*Continued from page* 12)

bend it now, isn't it? Then why not turn our wing spar on edge, too, so that it can withstand more load? With it placed on edge, so that it can stand more load, why can't we cut it down until it is still strong enough, but much lighter? We can.

It is a well known fact that a beam is stronger when placed on edge, with the loads acting parallel to its longer dimension. If a wing spar, placed flat, must be a half inch wide by a quarter thick to stand a certain load, we can place it on edge, cut it down quite a bit, and it will still be strong enough to stand that load! Within practical limits, we can save a lot of weight in our model airplanes by doing just this thing.

How can we tell what size to make our wing spar? That is something that the model builder will have to learn by experience. There is a method of doing this, but it is too involved for use here. The best thing to do is to copy spar sizes from other ships, successful ones, and then make refinements as one learns.

Going back to that wing spar, in Figure 1, we can easily see that the greatest bending stress is going to come at a point near the fuselage, because at that point the spar must resist the loads on the whole half of the wing, while at points further out the load decreases. Figure 2 shows the bending stress for one half of a monoplane wing without outside struts. The distances from the base line to the curve are the values of the bending stress.

FOR example: At the tip of the wing, at the right, there is very little stress, so the curve comes down to the base line; meaning that at the very tip of the wing, there is no bending stress. As we go in toward the fuselage, the curve shoots up rapidly, indicating that there is much more bending stress as we go toward the center of the wing.

What good does this do the model builder? The curve shows that there is very little bending stress at the tip, doesn't it? Then why make the wing spar as heavy at the tip as it has to be at the center, where the bending stress is greatest? There is no reason why we can't in models save weight by cutting down the spars near the tips of the wings. It does not save very much weight, true, but sometimes a very little weight can make a lot of difference in the length of a flight, especially in contest work.

Try making your spars tapering, thickest at the center, smallest at the tips, and note the saving in weight without loss of too much strength. But also watch out for overdoing the thing. Don't make the spars unreasonably small.

To make a wing spar tapered, it is not necessary to make the wing tapered. It is obvious that the spar can be made tapered, even though the wing is the same thickness all along. It is also quite true that many successful models and larger airplanes, too, have been built that did not use a tapered wing spar construction, but, all the same, model airplane builders *can* save a little weight by tapering their wing spars.

In the building of full size ships there are often other matters that make tapered spars impractical, unless the wings themselves are to be tapered. It is interesting to note the present tendency toward the tapered wing, which of course includes the tapered wing spar.

AN important matter in connection with stress analysis is the factor of safety. Suppose we built a ship with the wing spars just strong enough for normal flight and no stronger. Then, if the ship were to be suddenly leveled out of a dive or if the wing were to be accidentally scraped on the ground during a landing, the wing would perhaps fail or collapse.

For this reason we make all parts of the airplane several times stronger than needed for normal flight. This is the factor of safety. For example, if we make our wing spar five times as strong as it needs to be for normal flight, we say that the spar has a factor of safety of five.

In the wing spar that we have just discussed, we found the material of the spar to be in bending stress. Another type of stress is direct stress. This occurs when the member is acted on by forces that are parallel to its length, whether these forces are pulling or pushing.

Take a ruler, holding it with one hand at each end and push, each hand toward the other. The ruler is now in direct stress. The particular kind of direct stress is in this case compression, since the forces applied tend to compress the material of the ruler. If we pull on each end of the ruler it is in tension because the forces applied tend to stretch the ruler.

In the next article we shall look into the stresses in the other parts of the airplane, so make sure that you understand the various kinds of stresses that we have described here.

QUESTIONNAIRE

1. In a wing spar to be used in a monoplane without external wing bracing, where will the greatest bending stress come—near the tip or near the center of the wing?

2. If one had a wing spar, a half inch wide and an eighth of an inch thick, how should it be placed in the wing—laid flat or on edge? Why?

3. What is the advantage of the tapered wing spar for a model airplane?

Handicraft Hints for the Junior Mechanic

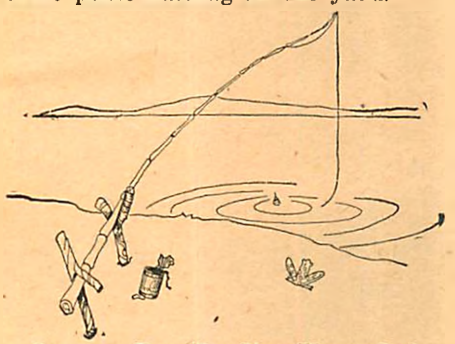
(Continued from page 37)

The drawing shows the correct angle. You may find it necessary to load the cockpit with any convenient material to get just the right balance.

Now make sure that the cords attached to your wing-tips are securely fixed. Tie them together and fasten the model to a third cord which runs between two buildings or trees at the highest elevation you can get. Use cord of low visibility, gray is best, and at a short distance your plane will appear to be in flight.

Best of all, if the angle is right, your plane will bank and turn in the breeze and sometimes do a perfect loop. If the cords are attached in the manner shown, the plane will not tangle itself, no matter what evolution it performs.

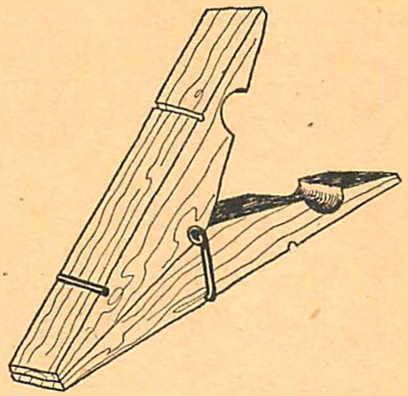
A model "weather-plane-vane" of this type set up near Seattle, Washington, soared for over a year until the string rotted through . . . and the plane came down, making a perfect three point landing in the yard.



SIMPLE—BUT DID YOU KNOW IT?

IT doesn't take any longer to cut these two sticks and set them in the ground than it does to ram the end of a cane pole far enough in so that it will stand by itself. Moreover, the great advantage is that the end of the pole stays clean. Besides, the jerk of a good-sized "cat" won't pull your pole down in the water if you use this kink.

Under and over . . . that's all. If you try it the next time you go "lazy-man fishing" you'll become a convert. It's quicker, too, to lift and pull in when that hoped-for yank does come at the end of the line.

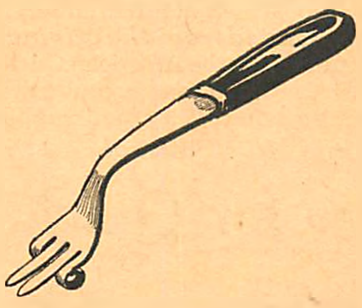


A QUICK PICK-UP

HERE'S a handy pair of pliers or tweezers that will prove useful around the home or the workbench, and that can be made in five minutes. Simply remove the spring from a snap clothespin and reverse it, so that its ends bear against opposite ends of the clothespin and hold them together. Cut small notches in the wood to furnish a good seat for the spring.

A TACK-PULLER

AN old, worn-out fork will make one of the handiest tack-pullers you ever saw. It must be of the four-tined variety. Cut off the tines to about three-quarters of an inch. The outside tines are bent back to make a fulcrum, and the two middle ones are filed away on the bottom so that they will slip in under the tack head easily.

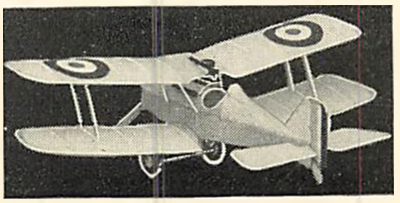


RECORD HOLDING SCALE MODEL

Famous World War Plane

THE S. E. 5 "A"

24" Wingspan



The construction set for this plane contains all the necessary parts and material: ribs cut, formers made, celluloid wheels, full size layout exact scale blue prints and instructions. All wood parts are of feather weight BALSA. The S. E. 5 "A" is easy to construct and is by far the best flying scale model that can be built, holding the present record of 48 seconds. The S. E. 5 "A" has a gliding angle of 12 to 1, a ceiling of 60 feet—nothing like it has yet been produced in kit sets.

The S. E. 5 "A" is the plane that won for the Royal Flying Corps the supremacy of the air in the World War.

PRICE FOR KIT $3.00, postpaid.

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1st grade featherweight

10 sheets	1/16" x 2" x 36"	$1.00
5 sheets	1/16" x 2" x 36"	.50
6 sheets	1/8" x 2" x 36"	1.00
3 sheets	1/8" x 2" x 36"	.60
5 sheets	1/16" x 6" x 18"	1.00
3 sheets	1/16" x 6" x 24"	.90
10 sheets	1/16" x 1" x 20"	.40
20 sheets	1/16" x 2" x 12"	.50
25 sticks	1/4" x 1/4" x 36"	1.10
25 sticks	1/8" x 1/4" x 36"	1.00
12 sticks	1/8" x 1/4" x 36"	.50
25 sticks	1/8" x 1/8" x 36"	.60
25 sticks	1/8" x 1/8" x 20"	.45
50 sticks	1/16" x 1/16" x 20"	.50

PROP. BLOCKS

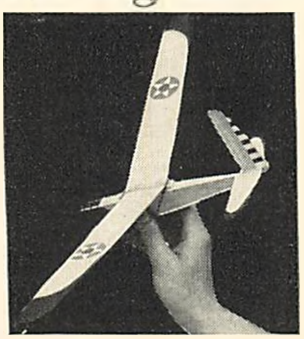
6 Blocks	5/8" x 1 1/8" x 7"	$ .24
6 Blocks	3/4" x 1 1/4" x 8"	.30
6 Blocks	1" x 1 1/4" x 10"	.45
6 Blocks	1" x 1 1/2" x 12"	.60

Postage 15c Extra

on all orders under $1.00

HAWK

Soaring Glider



This 24" glider can be assembled in 30 seconds. All parts cut to size and shape. Cement and insignias and instructions are furnished. Has recorded flight of one minute. PRICE FOR KIT $0.75, postpaid.

5c

Brings you a complete illustrated booklet containing all models shown above and other latest model airplanes, and model airplane supplies. Full description of materials and equipment needed for each model. Every model is designed to fly when made according to our simplified plans of construction. Don't fail to send for it.

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Hawk Model Aeroplanes

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Midland's all-balsa construction makes use of sheet balsa 1/32 of an inch thick for the wings and the sides of the fuselage. Balsa—almost as light as the paper it replaces, and infinitely stronger! The only paper is that used to cover the top and bottom of the fuselage and the tail.

No fragile, tedious built-up framework. Nothing to draw. Nothing to measure off. No nails to drive, no holes to drill. A ready-made, die-stamped aluminum propeller to save you the work of carving one and to prevent the failures due to poorly-made propellers. Struts of spruce and bamboo. Celluloid wheels, light and good-looking. A shock-absorbing landing gear. Colorless, quick-drying model cement—the fastest-drying known. Rubber 10% more powerful. Landing wheels well forward to protect the propeller. Wings at a high angle of incidence for fast climb and minimum center of pressure travel. Tips "washed out" to reduce losses. Scores of other aerodynamic refinements seldom found in models.

You will find these models much easier to build, and, after you have built them, much more satisfactory to fly. Fewer trial adjustments: longer, steadier flights.

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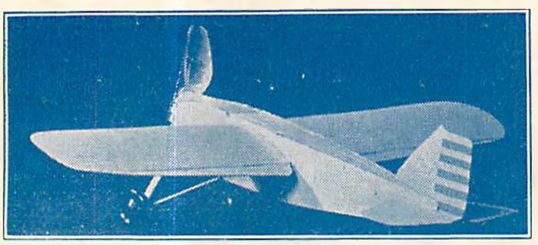
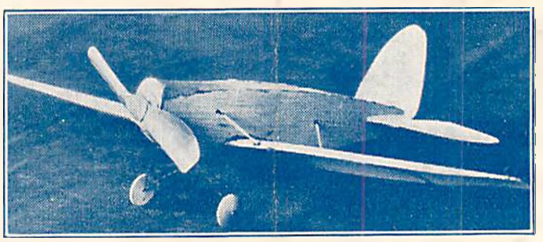
Complete set, with all material and full building and flying directions, postpaid in the United States and Canada..... **$2.00**





MIDLAND BABY BULLET

Wing span 15 inches. Weight 3/8 ounce. Flight range 140 feet or more.

A simple, easily-constructed r. o. g. model of a one-place low-wing sport plane. The propeller is only one-fourth as long as the wings, and much closer to true scale than in ordinary models. Propeller blades deeply curved for slow revolution and unusual duration.

Complete set, with all material and full building and flying directions, postpaid in the United States and Canada, only..... **$1.00**

Midland Army Biplane in Flight

Unretouched photograph

1 OUT of 10

Probably not one model airplane in ten ever gives its purchaser a satisfactory flight. Some failures are due to careless construction. Some are due to careless *design*—a carelessness sometimes so great that the model can not be made to fly under any conditions. But the majority of failures are due to the tremendous difficulty encountered in building many models.

The average model would be entirely satisfactory if it could be constructed with less skill, but it may be a sad disappointment to the ordinary model builder, who often finds that he has wasted both his money and his time on a set which only an expert can put together.

A simple and easy construction is the key-note of Midland design. We do not pretend that Midland models are *exact scale* reproductions, for such models are hard to build, unsatisfactory to fly. We do not claim that these models will break records, for record-breaking models are too delicate to build, too fragile to last. All that we say is that these models are pleasingly realistic, that they will fly well time after time, and that the average boy can build them. Why risk disappointment by purchasing a model advertised with extravagant claims of exact scale design and almost unbelievable flying ability? Buy a Midland model and get what you expect, and what you are entitled to have.

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This fast biplane fighter is a tremendously impressive model. Its trim fuselage and tapered, close-set wings give an impression of speed, and in the air it looks so much like a real ship that flight photographs of the model are usually mistaken for pictures of a full-sized airplane.

The wing spread is 20 inches, the weight exactly 1 ounce. The flight distance is close to 200 feet. Because of its greater wing area the Army Biplane gains a great deal of altitude. The average limit is about 50 feet, but we have photographed it when almost three times that high!

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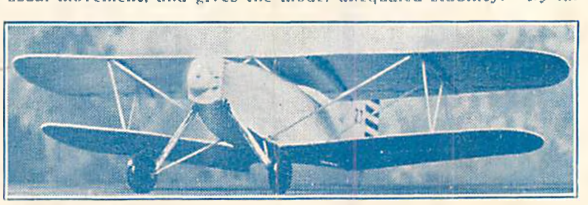
Harder to build than the monoplanes, but still much easier than any conventional built-up model. Complete set, with all material and full building and flying directions, postpaid in the United States and Canada ... **$2.50**



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Enclosed find $..... for which send me your construction set for ( ) BABY BULLET ( ) COMBAT MONOPLANE ( ) ARMY BIPLANE. I understand that these sets will be sent postpaid in the United States and Canada, and that you will refund the purchase price of any model which fails to satisfy me after I have constructed it.

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