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OCTOBER

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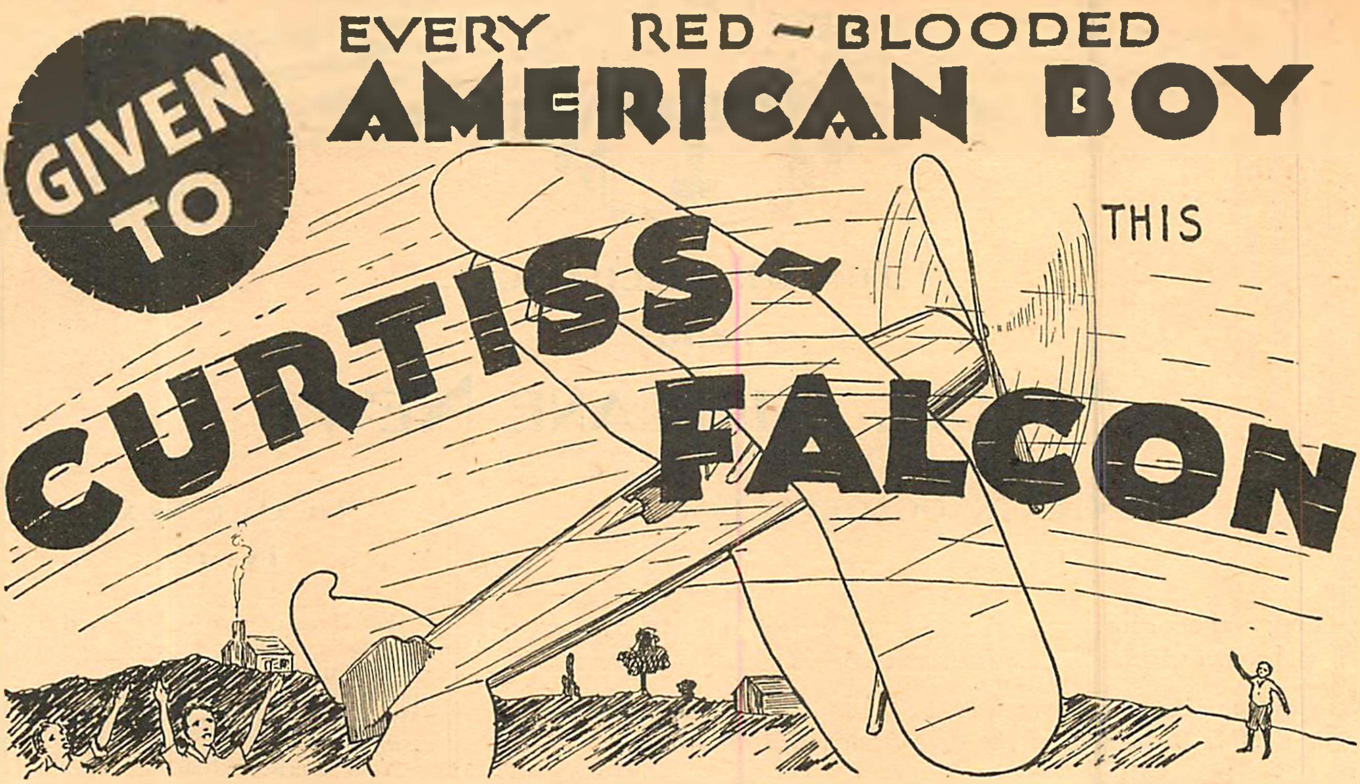

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Vol. III

No. 4

Junior Mechanics and Model Airplane News

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In Our Next Issue

For those of you who think that this issue, with its increased appeal for the junior mechanic, is above par, just wait for the next issue of Junior Mechanics and Model Airplane News!

Your surprise will only be equalled by your pleasure. For instance, in addition to the regular features embracing every phase of aviation, there are a number of constructional articles for the handy worker:

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—o—

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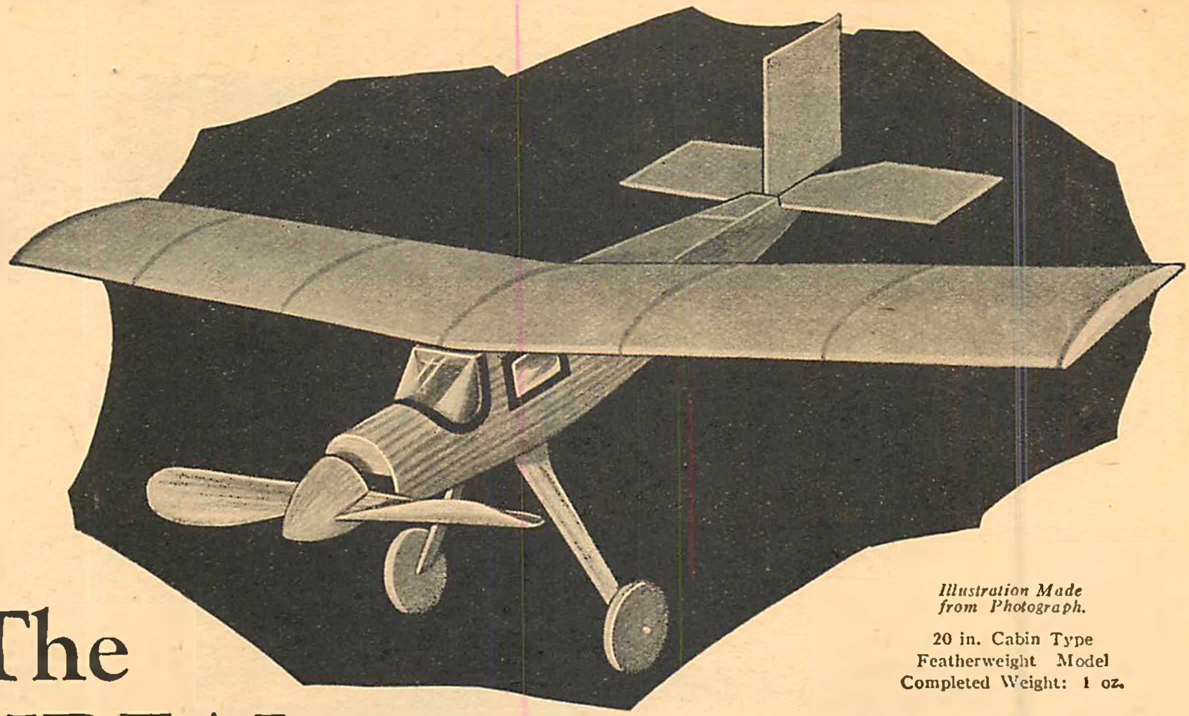

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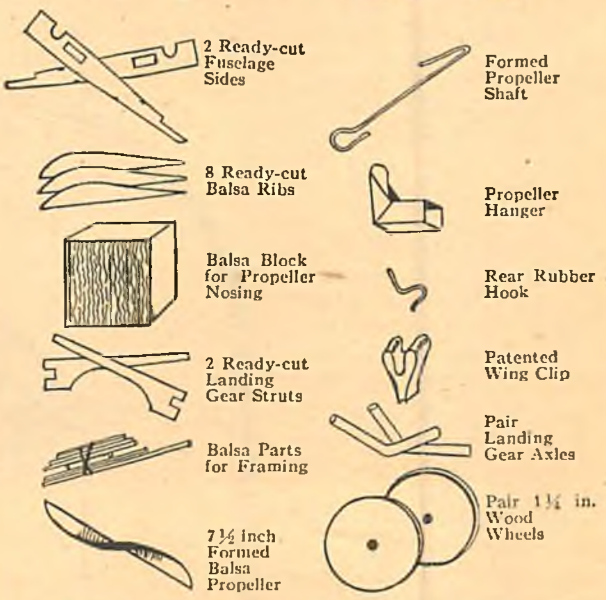

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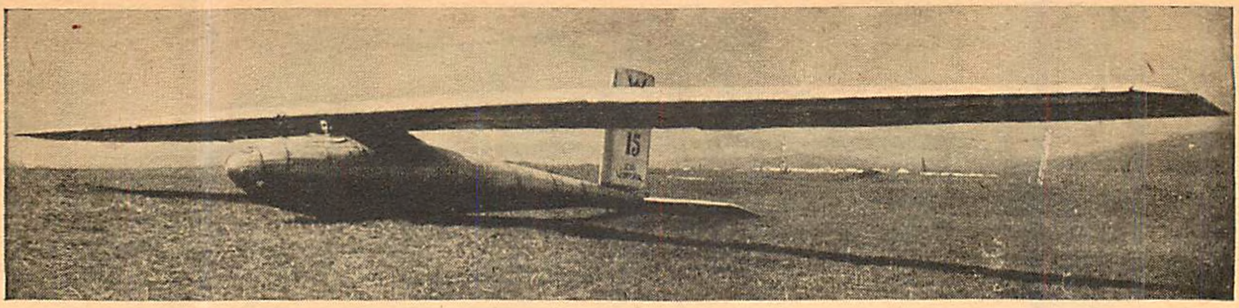
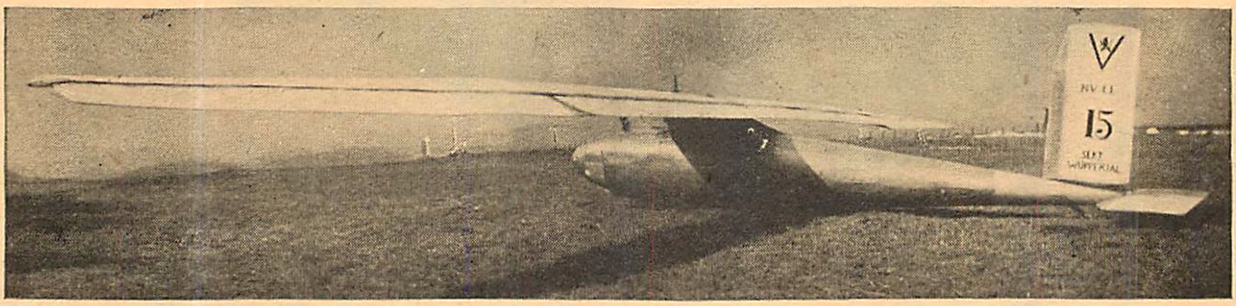


GLIDING and SOARING



A Manual of Motorless Flight

IN this issue the editor of MODEL AIRPLANE NEWS *presents the fourth 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.

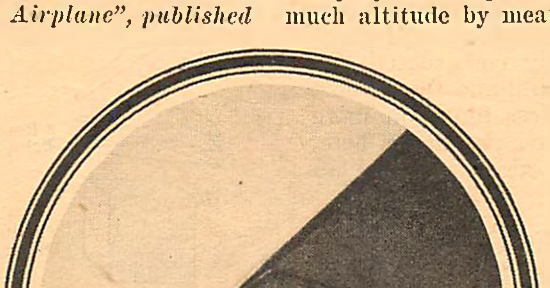
GLIDERS are far from uniform in appearance; some of them look in the air like poised birds, others like ungainly insects. Since few gliders have yet been subjected to mass production, each constructor builds his ship after his own fancy.

Therefore, a discussion of what the glider looks like must deal only with the general appearance of the more ordinary gliders.

Types of Gliders. The majority of the gliders which have been built so far may be classified in various ways: first, as gliders and soarers; second, according to methods of control; third, according to number of wing surfaces; and fourth, as to their adaptability to training purposes.

"Glider" is the generic term designating any motorless heavier-than-air craft.

"Glider" also is the specific term applied to the motorless heavier-than-air craft which maintains its speed solely by utilizing the force of gravity, without gaining much altitude by means of upward air currents.



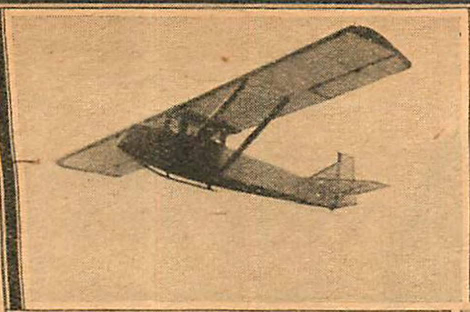
A secondary glider fitted with one wheel at the center-line of the fuselage

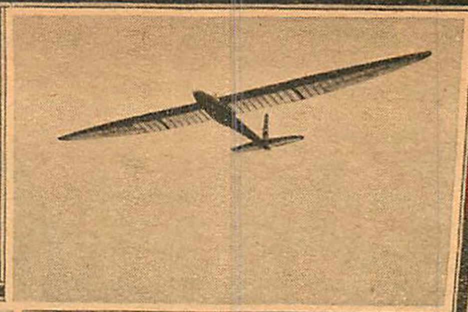
In contradistinction to "glider" in its specific sense is the term "soarer" or "sailplane", a ship which, due to higher aerodynamic perfection, is better fitted to gain altitude through the use of vertical currents of air.

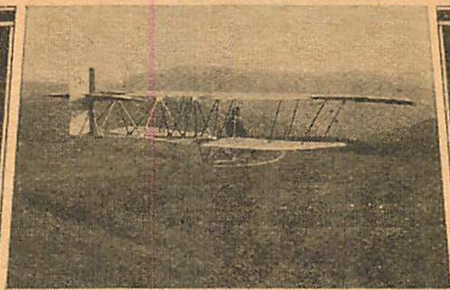
The difference in appearance between a glider and a soarer is one of degree of sensitivity: the glider is comparatively stable and heavy, with straight wings; the soarer is comparatively light, normally having wide span and tapering wings. The distinction between the two types is not a satisfactory one.

Frequently, the one type merges into the other: the simple glider sometimes soars, or the plane which has the appearance of a soarer is only capable of gliding flight. Figures 7 and 8 show types of

By PERCIVAL WHITE and MAT WHITE







Above is a secondary training glider used by the student as soon as he has made a few flights in a primary training glider. Another type of soarer is shown (top right). Note broad span and streamlining—*N. S. A.*

Biplane gliders (left) are not common. The additional wing surface does not add sufficient lift to offset the parasite resistance of the wires and struts —*Muenchener Illustrierte Zeitung*

soarers. It is necessary, therefore, to have some other means of classifying gliders.

Several different methods of control (i.e. of manoeuvering the plane when it is in the air) have so far been applied to gliders, such as:

1. Control by the swinging of the pilot's body
2. Tail control
3. Wing control
4. Special control systems

1. A glider which is controlled by the swinging of the pilot's body is called a "hang glider". In a hang glider, the pilot sits astride a strap, or hangs from the wings by his arms, so that his legs hang below the under side of the body of the plane. (See Figure 1).

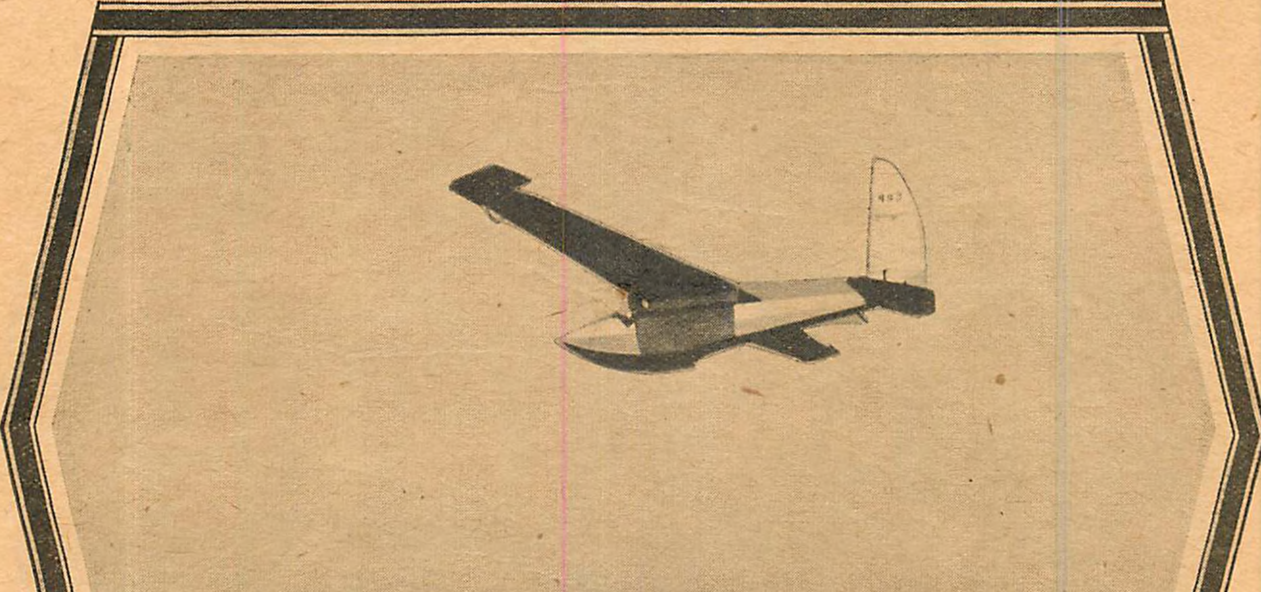
By swinging his legs backward and forward, or from side to side, he can change the center of gravity of the glider, and thus control the direction which it takes.

Hang gliders are not effective in high winds, require great skill and daring on the part of the pilot, and have little value as a means of training for motored flight, since airplanes have an entirely different method of control. The hang glider is now rarely used.

2. Gliders with tail control, supplemented by some wing control, are as yet the most efficient and widely used type. This book will deal mostly with gliders of this kind.

An objection raised to the tail-control glider is that it makes no self-adjustment to air currents, but is controlled entirely by the pilot, who is apt not to recognize the presence of a puff of wind until it has passed by.

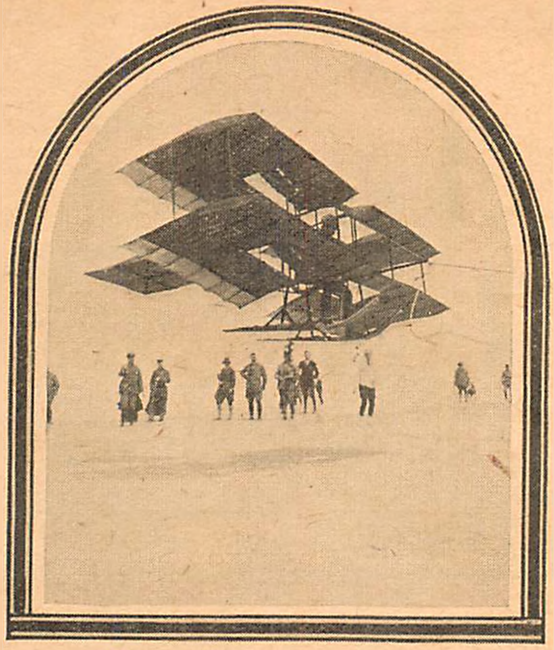
3. Two general methods of wing control have been used; either the wings are made easily warpable, so that they will of their own accord make slight adjustments to air currents; or the wings are made to rotate about their main spars, so that each wing can move as a unit. This method of control has not yet reached a high enough degree of perfection to be widely used.



A view of Hawley Bowlus in the air during his record soaring flight at San Diego, California

4. Various special control systems have been devised, such as those employed on the tailless type of glider.

Gliders with one wing surface are called monoplanes, those with two, biplanes, and those with three, triplanes. (By wing surface, the entire section of wing, extending from both sides of the body of the glider is meant.) The wing surfaces of bi- and triplanes are usually placed one above the other, although they have (rarely) been set one behind another.



Biplane glider equipped with skis

MONOPLANES are by far the most usual type. Triplanes are very rare, since for a given wing area, the additional surface detracts, rather than contributes to the efficiency of the glider.

Several types of training gliders are manufactured in this country. The best known are the primary and secondary training gliders. These are both monoplanes, supplied with tail control, supplemented by wing control; and they are gliders, not soarers. The primary training glider is usually built with an open lattice-work body and square-tipped wings.

The secondary training glider is more sensitive (it can be more easily soared), and has an enclosed body.

Some gliders are built to land on and take off from the land; others to land on and take off from the water. The former are called land gliders, the latter, water gliders. Land gliders are by far the more common.

Parts of a Glider. The most important parts of a glider or of a sailplane are:

1. The fuselage, or body
2. The lifting surfaces, or wings.
3. The controls
4. The landing gear

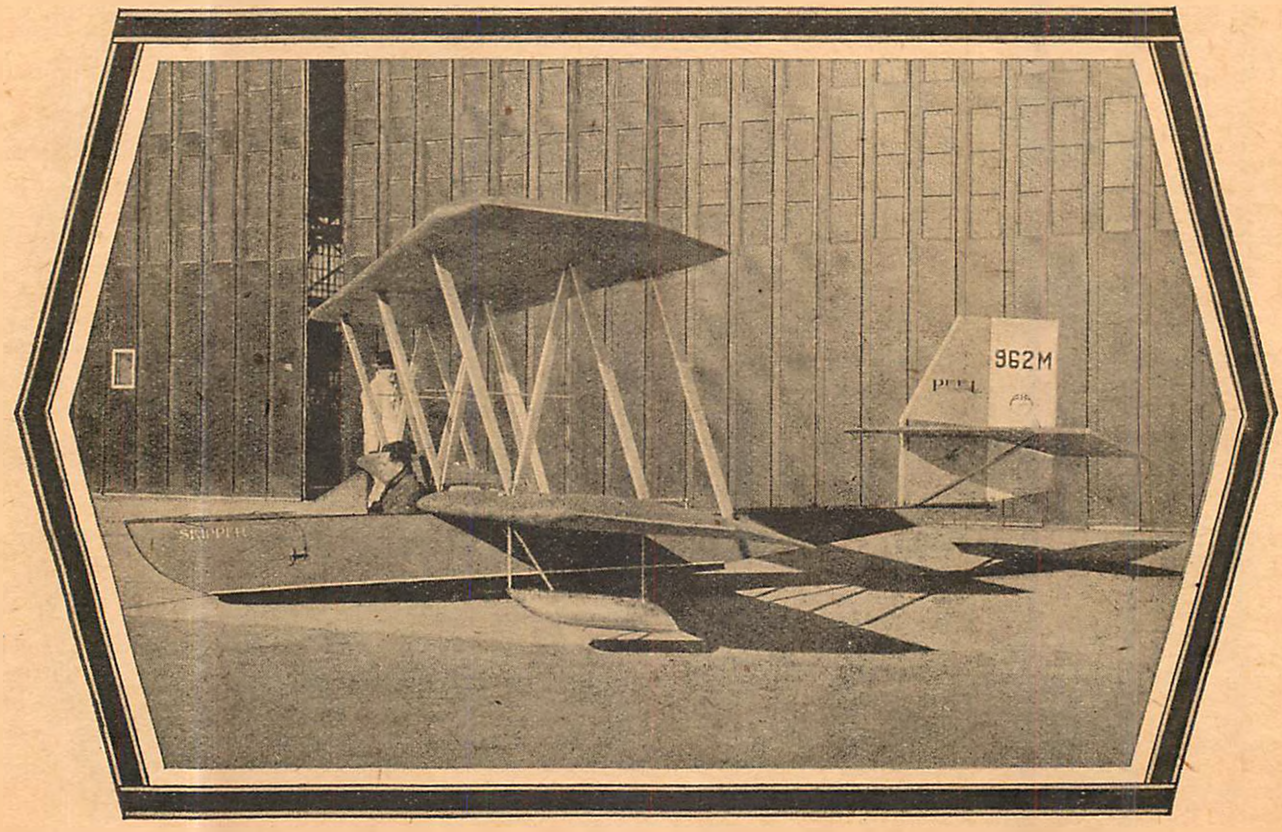
The Fuselage. The fuselage, or body of the glider, is the framework which holds the cockpit, and to which the wings and tail are attached. The frame of the fuselage is built of wood or light metal, covered usually with air-dried, knotless wood.

Cloth is frequently used as a covering. Duralumin, both for the framework and the covering of the fuselage, is stronger and as light as wood, but it is not often used since it is costly to repair and less easy to apply.

The Wings. The framework of the wings is generally built of wood, although steel or duralumin is frequently used. This is usually covered by some strong, closely woven cloth. The cloth is then treated with "dope", which permeates the fabric, pulling it taut over the framework, and making it impervious to water and air.

The Controls. The controls are the surfaces which guide the plane while it is in the air. The rudder and the elevators are two fins usually hinged to the rear end of the tail: the former is a vertical surface, and the latter a horizontal one. The ailerons are two flaps, normally hinged one at the end of each wing. Further information concerning controls is contained in another instalment.

The Landing Gear. The landing gear usually consists of a flexible skid or ski, run- (*Continued on page 48*)



A Peel water glider

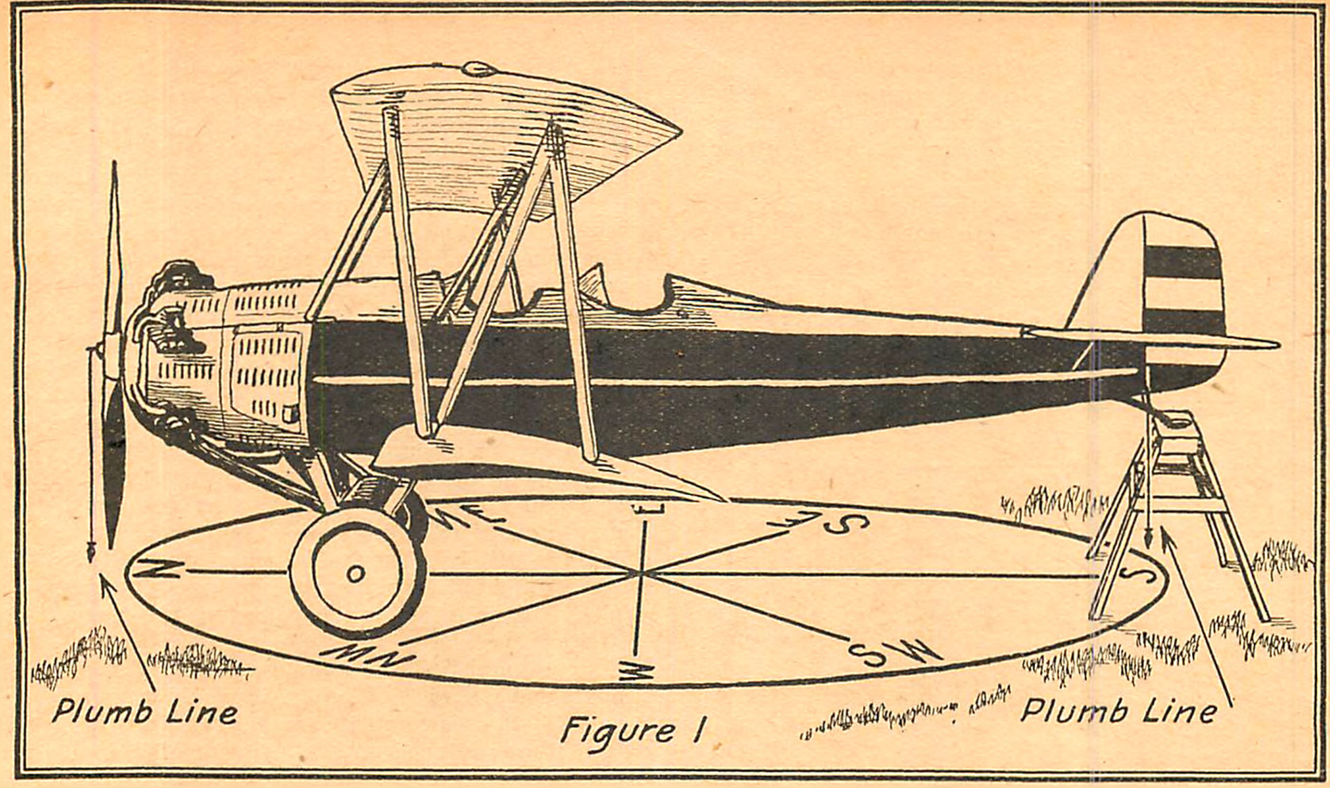


Figure 1

Special Course in Air Navigation

The Mainstay of Successful Piloting

By Captain LESLIE S. POTTER

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

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

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

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.* THE EDITOR.

HAVING dealt with the problems of deviation, magnetism and compasses and their construction, the next step to consider is how we may adjust our compass for any deviation that may exist, and the prelude to this is, of course, finding out if and what deviation does exist.

Owing to the confined space in an airplane and the large number of iron and steel parts which form its equipment—most of which are magnetic to some extent—it is impossible to avoid a certain amount of deviation with every magnetic compass.

Be careful you do not confuse this with variation. Refer to the previous articles if necessary to get this clear.

It is obvious that the amount of deviation will vary with each plane, and equally obvious that adjustments cannot be made until the compass is installed and the plane is in actual flying condition, *i. e.,* all tools, generators, batteries and radio equipment on board that would normally be carried in the plane, for we want the compass corrected under conditions which will exist in actual flight.

Adjusting, or swinging a compass, as it is called, is a job no conscientions navigator will ever delegate to anyone else, and it is a job that should be done regularly, preferably once a month but definitely not less than once a quarter.

No accurate reliance can be placed on a compass swung less frequently than this, and it is surprising how much the deviation on a compass will change owing to soft iron influences.

A compass may be swung on a swinging base or by a landing compass. A swinging base is a circle usually about forty to fifty feet in diameter, from the center of which radiating lines are drawn to all the magnetic cardinal and quadrantal points, representing a compass.

A landing compass is a compass carefully tested for accuracy, mounted on a tripod and with little sights on it through which bearings are taken on the airplane which is to be swung.

The cardinal points are north, south, east and west, and the quadrantal points are north-east, south-east, south-west and north-west.

For the purposes of this article we will consider a plane being swung on a swinging-base. The plane should be loaded as for flying, wheeled on to the base

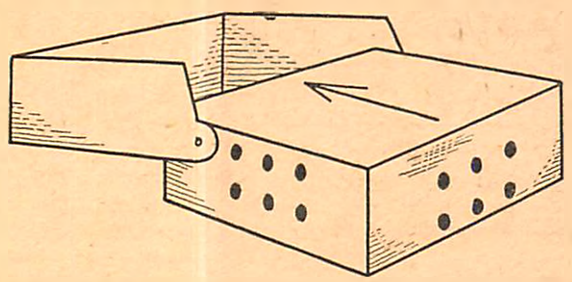


Figure 3 *Corrector Box*

and aligned on one of the cardinal points, north being generally chosen for convenience to start with.

In order to align it accurately, plumb lines are dropped from the propeller boss and the tail skid, these forming an accurate fore and aft line, and the plane placed in flying position as shown in Figure 1.

When it has been accurately aligned a compass reading should be taken and the plane placed on a fresh bearing. This process is repeated on all the cardinal and quadrantal points and sometimes, if extreme accuracy is required, readings should be taken on every 15 degrees, but this is not necessary for normal work.

NO attempt should be made to make any corrections until all the readings have been taken, as corrections are made on the readings regarded as a whole rather than as individual errors.

Before you take your first reading, place a magnet over the compass bowl and deflect the card (or the needle, as the case may be), and then see if it returns to its original reading. The bowl may be tapped slightly, if necessary, as when in flight the motor would create a similar vibration. Should the card fail to return to its original position, a state of "stickiness" would be indicated and the compass would have to be returned to the makers.

If there were similar amounts of deviation on all the compass points, you would know that the lubber-line in the compass bowl was not parallel with the fore and aft line of the plane, or else that the compass card had been incorrectly mounted on the magnet system.

The latter would be an unusual error of the makers and would have to be sent back for repair by them.

The effect of the former can be seen from Figure II. where you will see that, if the lubber-line were 10 degrees off the direct fore and aft line of the plane (an exaggerated amount), when you thought you were steering 360 degrees or north, you would really be steering 350 degrees, and so you would be steering 10 degrees less on this and all other points of the compass, equivalent to a + or easterly deviation of 10 degrees.

To correct this is comparatively simple. For a + deviation, turn the compass bowl round the necessary number of degrees (according to the amount of the deviation), reading the degrees from the compass in a clockwise direction, and for a — deviation turn the compass bowl the necessary number of degrees in an anti-clockwise direction.

The compass is usually mounted on a bracket by means of nuts and bolts through a curved slot about an inch long, which allows ample room for adjusting the position of the compass.

When the deviation differs on the various readings, the amounts of deviation revealed on the north and south readings should be considered conjointly, and similarly the amounts shown on east and west and on the quadrantal points. It is never possible to correct completely for deviations, that is to say, it is never possible to compensate a compass so that all its readings will be accurate. Such a state of bliss can never, unfortunately for the navigator, be achieved and all that can be done is to reduce the errors to as little as possible.

For example, if the compass reads 348° when it should have read 360° or 0°, it would have a deviation of +12° (E), and if it reads 186° instead of 180° when it was aligned on south, it would have a deviation of —6° (W.) The result is that to correct on these two points you would correct for the resultant of +12 less —6 divided by 2, or +9°.

Note that in algebraic subtraction the sign of deviation must always be changed when a minus sign precedes it. In this case it was +12 —6, and by algebra the —6 is changed to +6, so it becomes $\frac{12+6}{2} = +9°$, and you would try to correct on these two points for a deviation of +9°.

The same principle is followed when you adjust on east and west. Suppose on east the compass read 93° instead of 90°, a deviation of 3° (W), and on west it read 262° instead of 270°, a deviation of +8 (E), then

$$\frac{-3 \text{ Less } +8}{2} = \frac{-3-8}{2} = \frac{11}{2} = -5\tfrac{1}{2}° \text{ (W)}$$

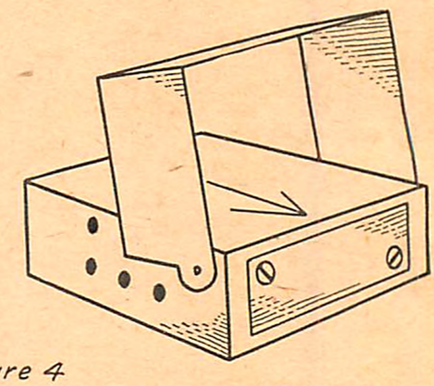


Figure 4

Corrector Box

and you would correct on either east or west until the reading changes by 5½° as near as possible. You have taken readings on the quadrantal points, N. E., S. E., etc., but these are only so that you can note them on a deviation card afterward. No facilities are given on most compasses for the correcting of any errors on these points.

How to Correct. Underneath all compasses are corrector-boxes. They vary in shape and design but the principle of them all is the same. Figures 3 and 4 give different views of a corrector-box, and into the holes shown are inserted the little corrector magnets.

To correct for a plus deviation on north or south (the result of your calculations on these deviations), insert a magnet in any of the holes running from left to right, and insert it with the red pole to the right.

To correct for a minus deviation on north and south, insert a magnet in one of the left-right holes with its blue pole to the right. Corrections must be made when the plane is heading north or south.

To correct for a plus deviation on east and west, insert a magnet in one of the fore and aft holes with its red poles forward.

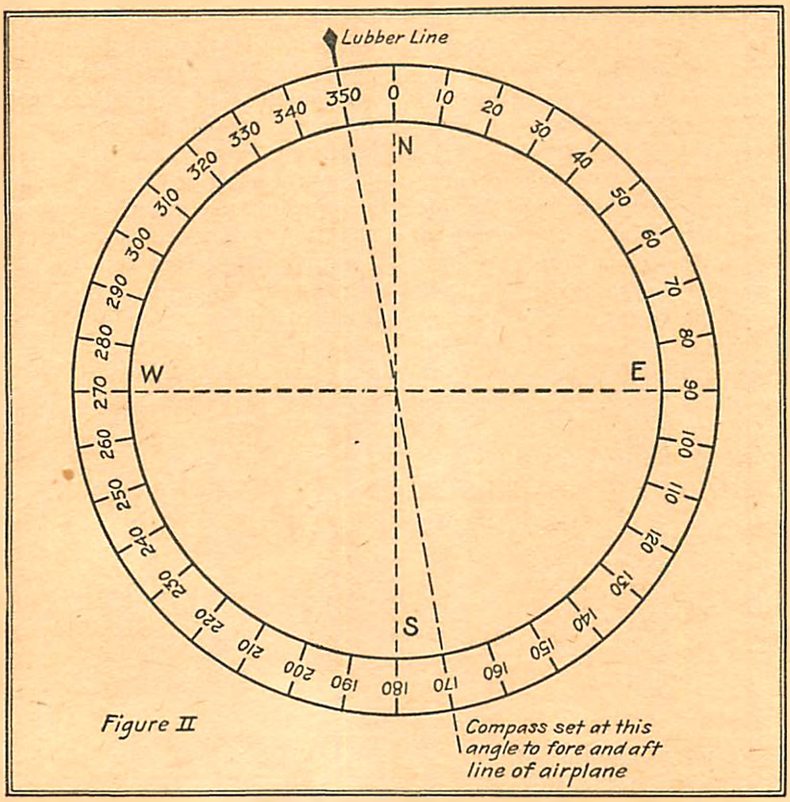


Figure II

To correct for a minus deviation on east and west, insert a magnet in one of the fore and aft holes with its blue pole forward. Corrections must be made when the plane is heading east or west.

MAGNETS are provided of various thicknesses and strengths, and the size to be used will depend on the amount of the deviation to be corrected. It may be found sometimes that when only a small amount of deviation is involved and even the smallest magnets over-correct, by putting a piece of match first in the hole in the corrector-box, the strength of the magnet will be reduced because it will not be in a central position under the compass needle.

Snipping pieces off the end of the magnet is sometimes resorted to, but this is not recommended. You may not always remember which pole to insert first, but you can always find this out for yourself by laying the magnet on the compass bowl and, observing the way the card is deflected, you know which way you want it to be deflected.

Having finished your adjusting, do not forget to see that the corrector-box covers are closed securely, that you enter up particulars of magnets used in a compass log book which accompanies each compass, and above all that you prepare a deviation card which is to be affixed near the compass. (A Specimen Deviation Card was shown with the second article of this series.)

This will show in one column the various points of the compass and, in a corresponding column, the course you would have to steer by that compass to make good such bearings. Wrap up separately any magnets you do not use. They lose their magnetism if kept together.

Swinging Bases. It may happen that on the flying field you are working from, no swinging base has been provided. In this case, you would either have to lay one out yourself or do your swinging with the aid of a landing compass.

In laying out a swinging-base there are various points to be observed. It should be in a position not too far from the hangars and where it will not be in the way of airplanes landing or taking off. It should also be free from local magnetic disturbances. These may usually be avoided provided a site is chosen at least 50 yards away from any masses of iron, such as steel structures, railway lines, etc.

You sight on all the cardinal and quadrantal points from a landing compass which you regard as the center of a circle. A helper holds a straight rod some twenty-five feet away from you and moves it on your instructions until it is on the point you wish. He then drives a peg in the ground at its foot, and the process is repeated until all the points are pegged out. From a peg in the center of the circle so formed, lines can be drawn or cords stretched to all these pegs, and your swinging base is complete.

Unless the landing compass has been tested recently, it is generally advisable to check it before using it either to swing a plane or to make a base. The best way is to get a local map of the district in which your airport is situated and, with the aid of a protractor, calculate the magnetic bearing from the airport to some easily distinguishable landmark two or three miles off. Then with your landing compass take an actual bearing on the same object. This should agree with the one obtained from the map.

Another way is to obtain another landing compass, and with the two, two hundred yards apart, take reciprocal bearings. If you use the landing compass to do your swinging with, a method which is every bit as accurate and often more convenient than the swinging base, the plane is simply placed on the various points by reference to the landing compass instead of to the base, and sighting is done from the compass on to the two plumb lines.

ANSWERS TO LAST MONTH'S QUESTIONS

1. Remove the compass bowl and place it in a position so that the filler cap is on top, then pour in a sufficient quantity of alcohol until it overflows. A fountain pen filler is often a useful adjunct to this operation.

2. Place a magnet on the compass bowl and deflect the compass card by 5 degrees. If the card returns to its original position on the removal of the magnet there can be no sticking of the needle. The bowl may be tapped lightly to assist movement.

3. (a) Never keep magnets together.
   (b) Never subject them to any intense heat.
   (c) Avoid dropping them.
   (d) Do not allow them to rust or corrode.

4. (a) Place a steel bar inside a coil through which a strong electric current is passing.
   (b) Place a bar on the end of a magnet and tap it with a hammer for a prolonged period.

(*Continued on page* 42)

FROM the Ground UP

Larry's First Flight Is Suspiciously Thrilling

By FRANK PIERCE

LARRY PRICE was an orphan who had been adopted by the Bassetts and worked on their farm. Larry had wanted a bicycle and finally had saved enough money to buy one on his eighteenth birthday.

On his way home after purchasing his bicycle, Larry's attention was attracted to a group of airplanes overhead. He watched them intently, wishing that he, too, could be a flyer. Suddenly the last of the group of planes started to sideslip and a burst of flame enveloped the cockpit as the plane drifted dangerously.

Fearing for the safety of the pilot, Larry was relieved to see a parachute descending, in which he could discern the figure of a man. Realizing that the chute was drifting perilously near the river, Larry pedalled with all his might in that direction.

When he reached the river he located the pilot with some difficulty and managed to drag him up to a place of comparative safety.

In the meantime, the other planes returned to look for the missing one and landed. The crews came to Larry's assistance and after making the injured pilot, Major Billy Riddle, more comfortable, they examined the wrecked plane. Larry discovered three bullet holes in the tank.

LARRY climbed back to the bank and joined the tall man and the mechanic. Together the three made their way back across the rocks to where the rest waited. On the way, Larry asked:

"Do you mind telling me the name of the man who got hurt?"

The pilot answered: "Not at all, son. That's Major Riddle—Billy Riddle. He was in the Ninety-Fourth Pursuit Squadron in France. Ever hear of them?"

Larry had indeed. With a thrill he realized he had met one of the greatest aces of the flying force; a man who had been one of the same body with Rickenbacker and those others who had made a glorious name for American aviation during the World War. And not only had Larry met him but had actually, the pilot said, saved his life by arriving at once on the scene.

"And what does he do at the field?" Larry found the courage to ask.

"Well, right now he's field superintendent, and he spends time making special tests with new planes," the mechanic explained. "That's why we couldn't figure what made him come down in smoke. . . . Until you found those bullet holes," he added thoughtfully.

The big man interjected: "Listen, Sam, I wouldn't say anything about that until you get a chance to talk to Billy yourself. And you, son, you better come on to the field with us now."

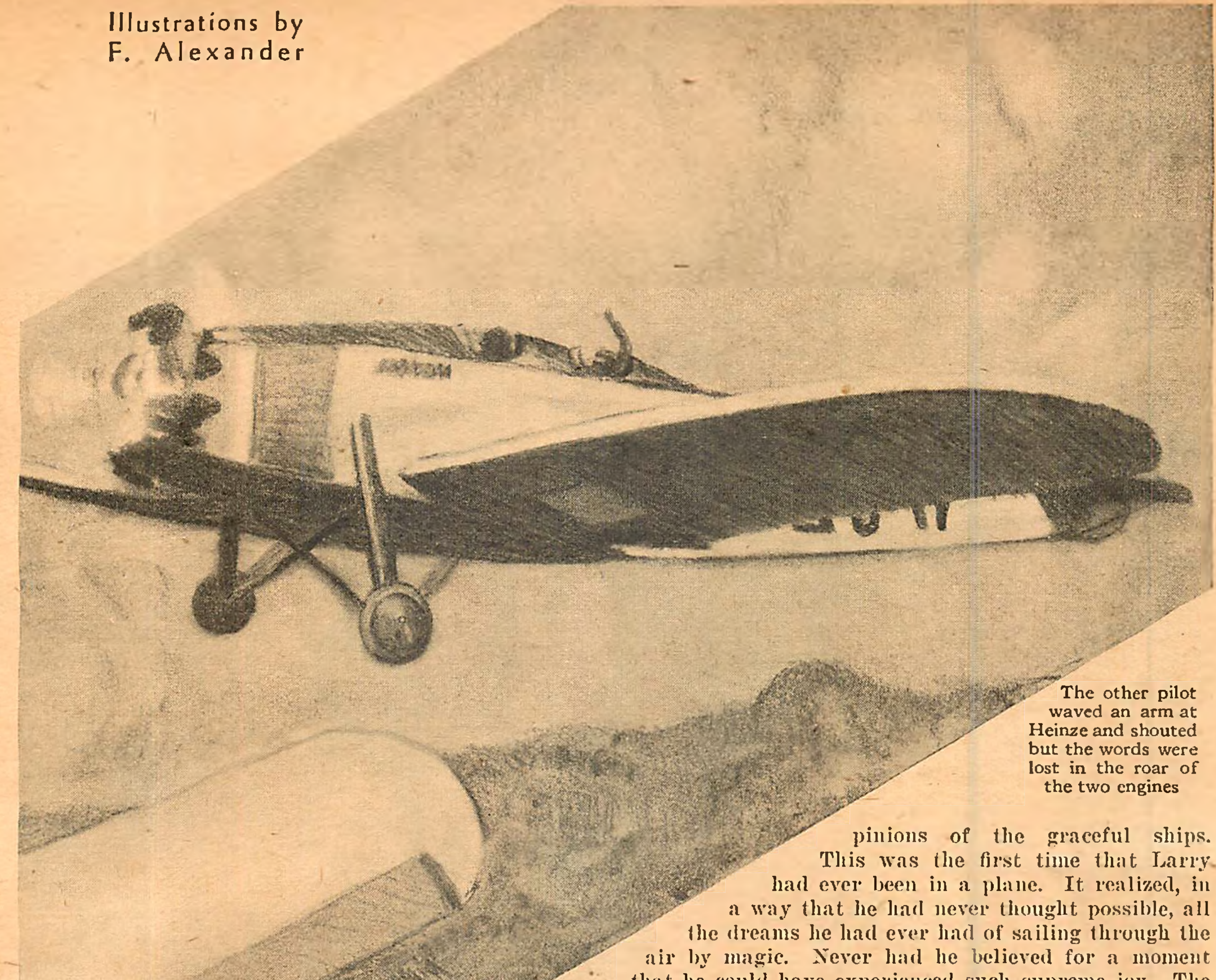
Larry accepted gladly, and when three of the men picked up the Major and carried him carefully up to the road, he went along in a joyous quiet. They had a quarter-mile of rough country to traverse, and now and then the Major jested quietly that those who carried him ought to be carpenters, not stretcher men. On such instances one of the men apologized, and quietly they went on, slowly nearing the big field where Larry knew the four other planes had landed.

As they proceeded, Larry suddenly noticed that they were one man short; Heinze had disappeared. He recalled the thin, white scar that ran down the right side of the man's face, and vividly he remembered the curious look of anger that had been directed at him when he had announced his discovery of the holes in the tank.

But he quickly forgot his apprehension on remembering the mechanic's wink, which hinted clearly that Heinze was harmlessly eccentric.

They came to the planes and the tall pilot, after a quick look around to see how many they were, arranged for the Major to go in his plane, and for Larry to go back to Plank Field with Heinze, who they found impatiently waiting, pacing nervously up and down by the fuselage of his two-seater monoplane. Larry went over to him and said apologetically:

Illustrations by
F. Alexander



The other pilot waved an arm at Heinze and shouted but the words were lost in the roar of the two engines

"I hope you don't mind, Mr. Heinze. They want me to go back to the field with you."

The man stared at him in what struck Larry as momentary astonishment. Then, without a word, he motioned Larry to the rear seat of the cockpit and climbed in himself. He busied himself at the controls, and within a few seconds the motor picked up its droning song. Larry strained to watch as Heinze eased the throttle up and revved the motor into a powerful roar.

With a sudden choking thrill, Larry felt the wheels begin to bump across the uneven surface of the field. Slowly, as increasing force pulsed through the slim gray machine, and as the prop swung into its crescendo of speed, the plane taxied across the field and imperceptibly was off the ground.

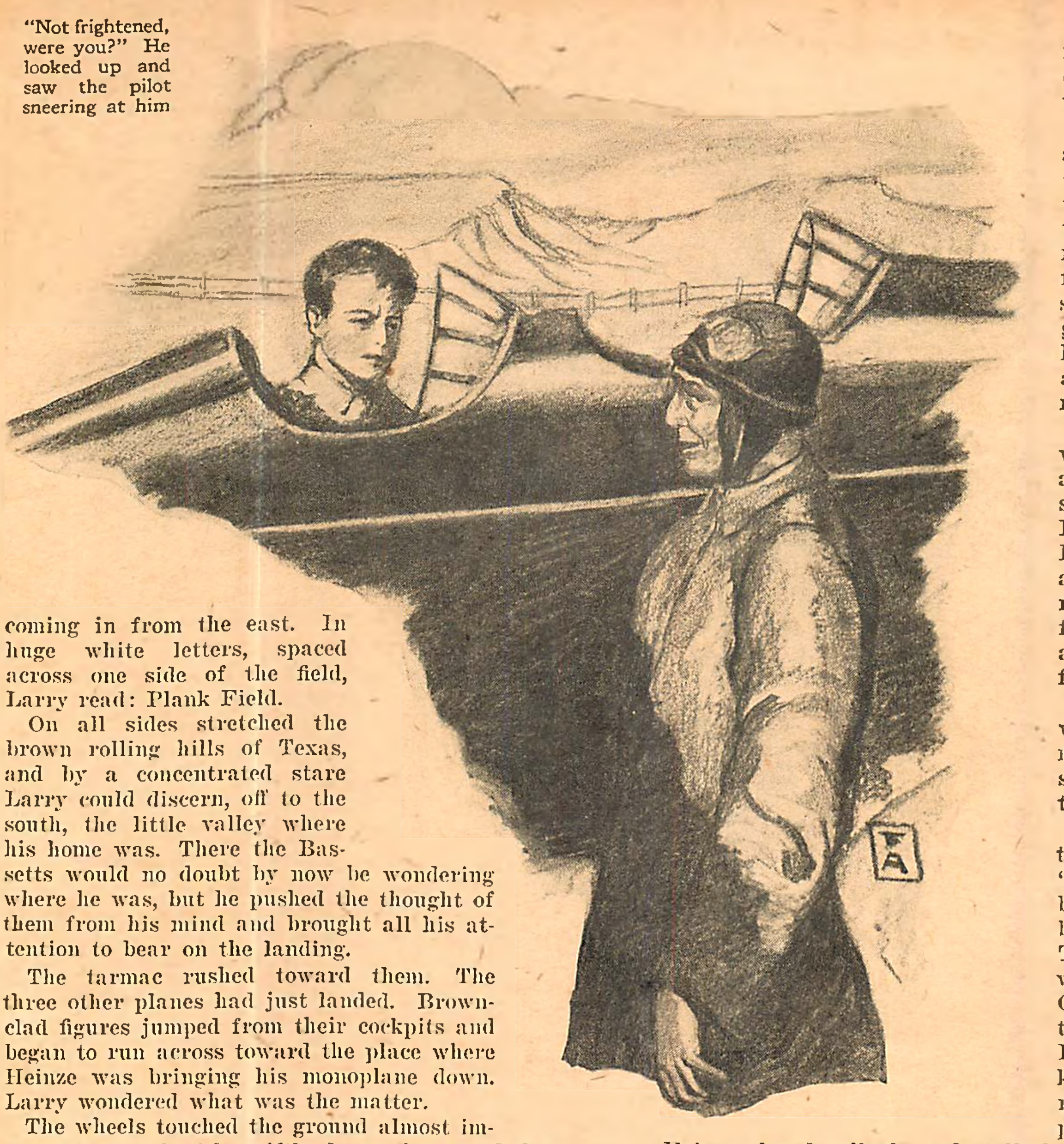
Larry looked over the side and saw the brown earth sink away beneath him. Then, on his own initiative, he buckled himself in with the straps he found on either side within the cockpit. Heinze gave her the gun and the monoplane swooped its way upward to take up the flight home toward Plank Field. Ahead of them the three other planes winged their way through the blue of early afternoon. The sun beat down on them and reflected in Larry's eager eyes the rays from the smooth pinions of the graceful ships.

This was the first time that Larry had ever been in a plane. It realized, in a way that he had never thought possible, all the dreams he had ever had of sailing through the air by magic. Never had he believed for a moment that he could have experienced such supreme joy. The cool air fanned past his face as he stared ahead past Heinze, who so far had ignored him. The roar of the motor, now settled down to a smooth cadence of power, sang a song of joy. The unhappy memories of his life fell away from him, and he knew that he had lived only for this. Miles behind him, in a clump of bushes, lay his forgotten bicycle.

Suddenly, it seemed that the world reeled. The plane tipped crazily, plunged and dived, leveled off with a sickening lurch and soared off again in wild maneuvers. In front of him Larry dazedly saw the back of Heinze's head, immovable. What was the man doing? Had he fallen prey to an attack of madness? Larry clutched the sides of the cockpit as the ship dropped in a side-slip and then circled back in the path taken by the other planes, which had now drawn ahead.

As Larry tore his tense gaze from Heinze, who seemed to have forgotten that he had an inexperienced passenger with him, he saw that one of the three planes made a wide circle and within a minute came up beside the plane containing Heinze and Larry. It shot by, and as it passed, Larry saw the pilot wave an arm at Heinze and seemed to shout something angrily, though the words were lost in the mingled roar of the two engines.

With a feeling of great relief Larry saw the field come in view, its oblong brown surface spread out to receive the knights of the sky that winged their way toward it from all sides. The gray wing-spreads of planes, silver in the sun, caught Larry's eye as they circled to come down in the wind. From another side he saw the slim racy lines of the afternoon mail plane



"Not frightened, were you?" He looked up and saw the pilot sneering at him

coming in from the east. In huge white letters, spaced across one side of the field, Larry read: Plank Field.

On all sides stretched the brown rolling hills of Texas, and by a concentrated stare Larry could discern, off to the south, the little valley where his home was. There the Bassetts would no doubt by now be wondering where he was, but he pushed the thought of them from his mind and brought all his attention to bear on the landing.

The tarmac rushed toward them. The three other planes had just landed. Brown-clad figures jumped from their cockpits and began to run across toward the place where Heinze was bringing his monoplane down. Larry wondered what was the matter.

The wheels touched the ground almost imperceptibly and with swiftly decreasing speed they taxied a little distance and came up at the right side of the huge quadrangle.

The plane stopped—its flight had ended. From a nearby hangar two mechanics issued.

As Larry began with steady hands to undo the buckle that was all that had kept him in the plane during its pilot's mad and inexplicable antics, he heard Heinze's voice:

"Not frightened, were you?"

He looked up and saw the scar-faced pilot sneering at him, his lips curled in an ill-concealed grimace of contempt.

Larry dropped the ends of the strap and replied: "No, I wasn't at all frightened. But why did you do it?"

Heinze laughed scornfully. "Just to see what you'd do."

Larry felt his cheeks burning with anger. The realization had just crossed his mind, like a flaming light, that Heinze had not looked to see whether he was strapped in before he had started his sideslips and dives. Larry felt a cold thrill steal up his back and grip his heart with the knowledge that, but for his own lucky foresight in strapping himself in, he might this moment be lying mangled in one of the brown dirt fields behind them.

He leaned forward, close to the contemptuous, mad face before him and gritted out:

"You can't frighten me as easily as all that!"

Heinze laughed again. "Bah!" he said, as he began to climb out of the plane. Larry followed and found himself surrounded by the group of men he had seen running across the field a moment before.

The tall pilot was among them, and he threw a swift glance from Larry's face to Heinze and back again. Larry made a strong effort to clear the anger from his face and said:

"Mr. Heinze was just kidding me. Tried to scare me a little, that's all."

"Oh," exclaimed the other in relief. "I figured you'd be scared to death by this time. Those stunts he was doing! Oughtn't to pull that stuff, Heinze. He's only a young kid. Probably never been in a plane before."

Heinze glared sullenly and stalked away.

The others left and with the tall man Larry walked toward the hospital building, where Major Riddle had been taken. "He's really harmless," he told Larry. "You've got plenty of guts, anyway. If he'd pulled that stuff on me the first time I was up, I'd have died."

Larry said nothing, but wondered a great deal.

THEY went at once to Major Riddle's room in the small emergency aid station and there, when they had finished dressing the Major's head-wound and strapped up his fractured arm, Larry told of what he had found in the wrecked plane.

"You're sure they were bullet-holes?" pressed the Major, lying, pale under his tan, on the clean white bed.

"Yes, sir, I am," replied Larry. "They were small and even and round. There were three of them."

The Major and the tall pilot exchanged long glances without a word. Larry's mind, stimulated to new and zestful activity by the tremendous events of this day, tried to ferret out in his own mind some reason for this seemingly inexplicable event. But he knew too little about the situation to be able to hit on anything and he took comfort in the thought that the Major and his friend seemed equally nonplused.

Then the Major spoke. "Well, Larry, I owe you a great debt. You've done me a wonderful service—more than you know. Now tell me, (*Continued on page* 48)

How to Build a Fokker D-7

A Flying Model of von Richthofen's Famous Fighter

See Plans on
Pages 14 to 19

By
WILLIAM MILLER

ONE of the most famous fighting planes in use during the World War was the Fokker D-7. Baron von Richthofen, dubbed the "Red Knight of Germany," who brought down eighty Allied planes, used a D-7 in his earlier fights.

If the instructions given here are followed carefully, a good flying model of this plane can be easily made. Jot down the materials needed for construction as you make your preliminary reading as no separate list of materials is given. Then you are ready to begin actual work on the model.

SIDES OF FUSELAGE

This part is simple but must be made with great care. Use 1/8″ sq. balsa wood, placing it over the drawing and using nails or bank pins on the inside and outside of the fuselage, so that it will stay in shape. Cut the spars of 1/8″ sq. balsa, as shown in drawing. Then pin them in between the longerons and ambroid. Make the two sides simultaneously so that both will measure alike. Set aside to dry.

TOP OF FUSELAGE

Cut 1/8″ sq. pieces of balsa the same as shown in drawing of the top fuselage. Make the spars by cutting to shape and putting together with pins and ambroid. While these are drying, make the small former as shown in drawing. Cut from a strip of 1/16″ balsa a 1/16″ sq. strip. Attach the former and the square strip of balsa so that there will be a hump on the top of fuselage. Attach with ambroid and set aside to dry.

BOTTOM OF FUSELAGE

This is a great deal like the top of the fuselage. Make the necessary spars the same size as shown in drawing. Now attach the lower spars to the fuselage, being very careful to put them in the designated places. Attach with pins and ambroid.

It is advisable to give the fuselage a coat of banana oil as this strengthens it considerably.

FUSELAGE NOSE

Draw the outline on a block of balsa 2 1/2″ x 2″ x 3 1/2″, and cut out with a knife. Sandpaper the outside and then hollow out the block. This is done with a jig saw. Be very careful in this operation as there is danger of splitting the nose.

Finish the nose by sandpapering the inside. Then give it a coat of banana oil. By this time the fuselage is dry and the nose is ready to be attached. The fuselage nose is ambroided solid to the rest of the fuselage and set aside to dry.

RUDDER

The movable part of the rudder is made of 3/32″ reed and 1/8″ sq. soft balsa. The rigid part is made of hard balsa 1/8″ sq. Cut to size all the parts of balsa and reed needed. Use balsa for bracings only. Place the parts over the drawing just as was done in the construction of the fuselage. Put together with pins and ambroid. After this is dry, give it a coat of banana oil.

TOP WINGS

Ten ribs are needed for the top wing construction. Cut these to shape as shown in drawing. Make the necessary spar cuts and also for the leading edge. Now the wing is ready for assembling.

Place the center spar, 1/16″ x 1/4″, across the working table and place the ribs the same distance apart as shown in drawing. Ambroid in place.

While this is drying, make the leading edge. This is of 1/4″ sq. soft balsa. Taper and round one side with sandpaper. By this time the ribs are dry and the leading edge may be attached. Place the leading edge in the front notches and ambroid.

Now make the trailing edges. From a strip of bamboo cut a piece 1/16″ sq., as shown in drawing. Ambroid this to the wing, leaving the center of the wing free as the circle shape must be made right over the cockpit. Shape this by holding over heat and attach with ambroid. Allow to dry.

Wing braces are made of scrap balsa. The struts of the fuselage can be ambroided to the braces, making the wing to be attached to the fuselage.

LOWER WINGS

Make ten ribs of the same size as those used in the top wing. The lower wing is smaller than the top wing and is differently spaced.

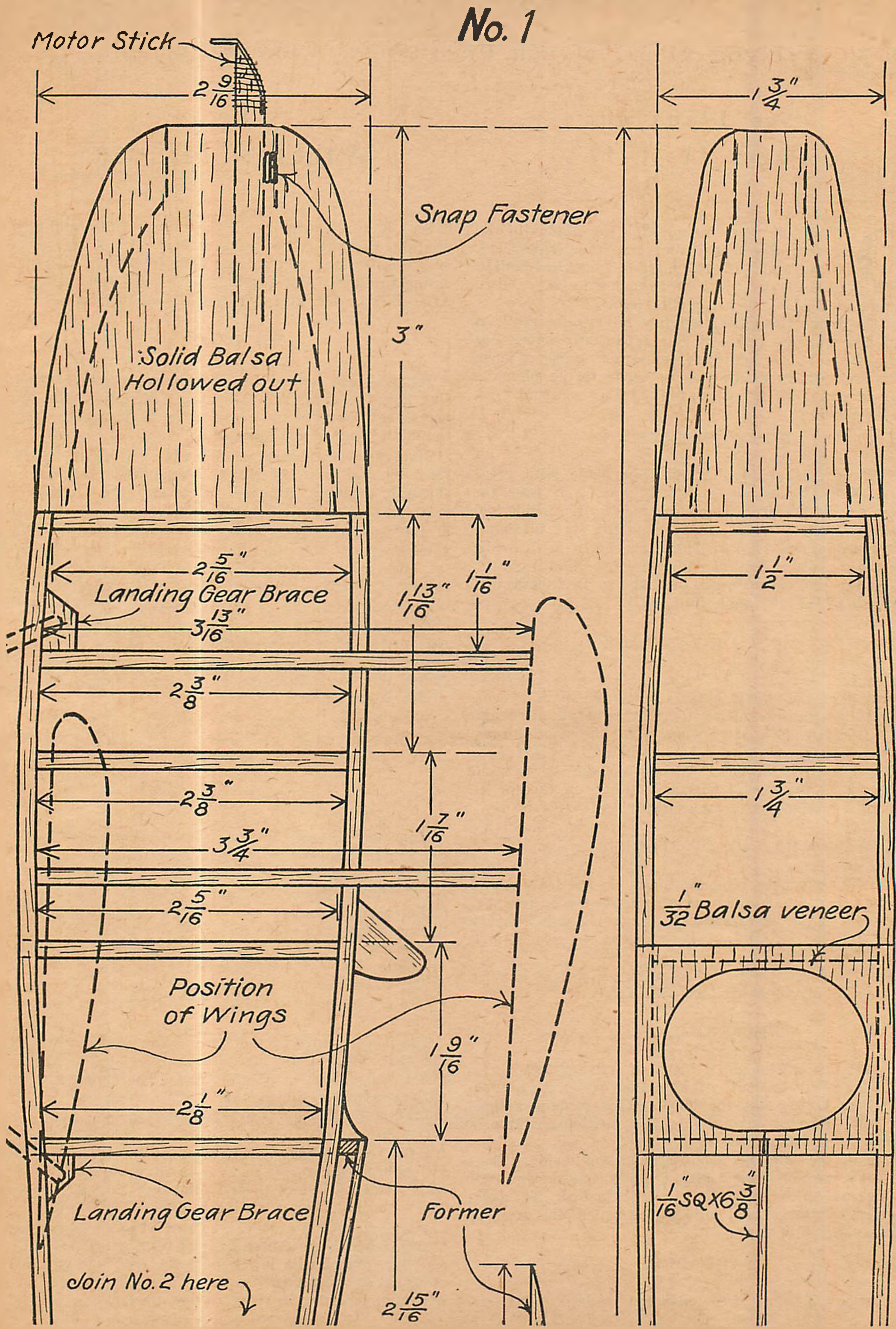
Cut the ribs from 1/16″ sheet balsa, being careful to make the right center spar cuts and also cuts for the leading edges. Then place on your working table the center spar, which is 1/16″ x 1/4″. The center spar is in two pieces because the lower wing is made in two parts. Place the ribs on the center spar in their proper places as shown in drawing. Ambroid and set aside to dry.

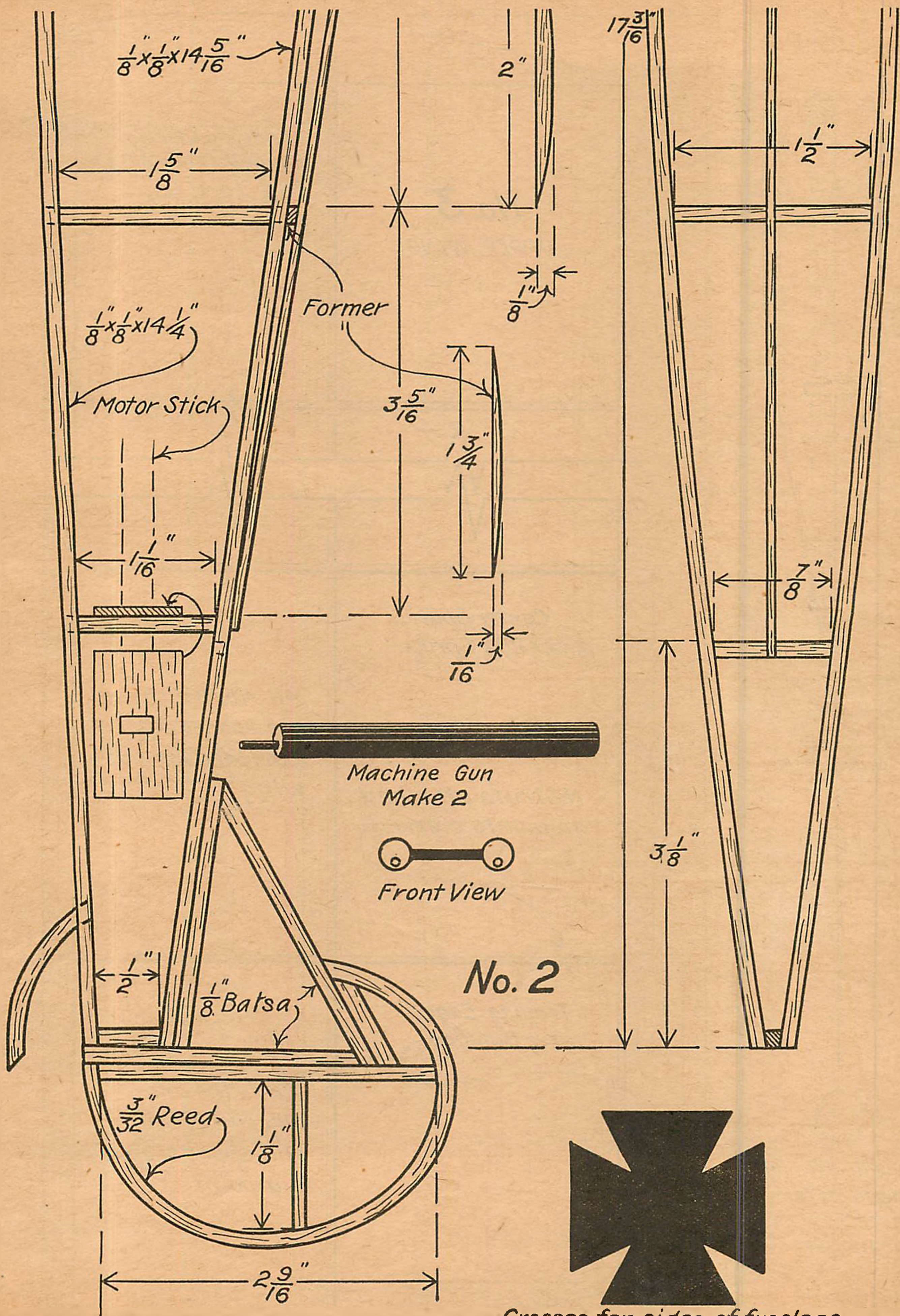
The leading edge of the lower wing is made exactly like that of the top wing. Use 1/4″ sq. balsa. Taper and round one side. After it has been smoothed down with sandpaper, place the leading edge in the rib notches and ambroid. Put away to dry.

Cut out a piece of bamboo 1/16″ sq., which is needed for the trailing edges. By this time the leading edges are ambroided securely and the trailing edges are ready to be attached. Place these at the very tips of the ribs and ambroid. Then set aside to dry.

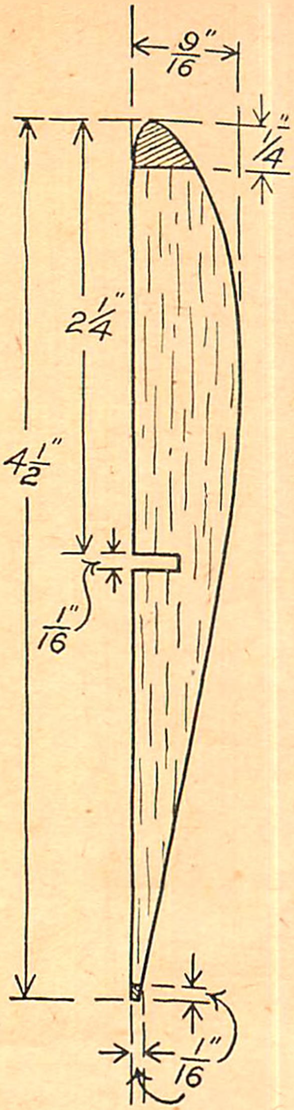
In the meantime work can be started on an aluminum sleeve in which the center spar will fit. After the wings are dry, attach the lower wing to the fuselage, and ambroid as shown in drawing. The aluminum sleeve will hold the wing in place. Allow to dry.

(*Continued on page* 40)


No. 1
Motor Stick
2 9/16
1 3/4"
Snap Fastener
3"
Solid Balsa Hollowed out
2 5/16"
Landing Gear Brace
3 13/16"
1 13/16"
1 1/16"
1 1/2"
2 3/8"
2 3/8"
3 3/4"
1 7/16"
1 3/4"
2 5/16"
1/32" Balsa veneer
Position of Wings
1 9/16"
2 1/8"
Landing Gear Brace
Former
1/16" SQ X 6 3/8"
Join No. 2 here
2 15/16"

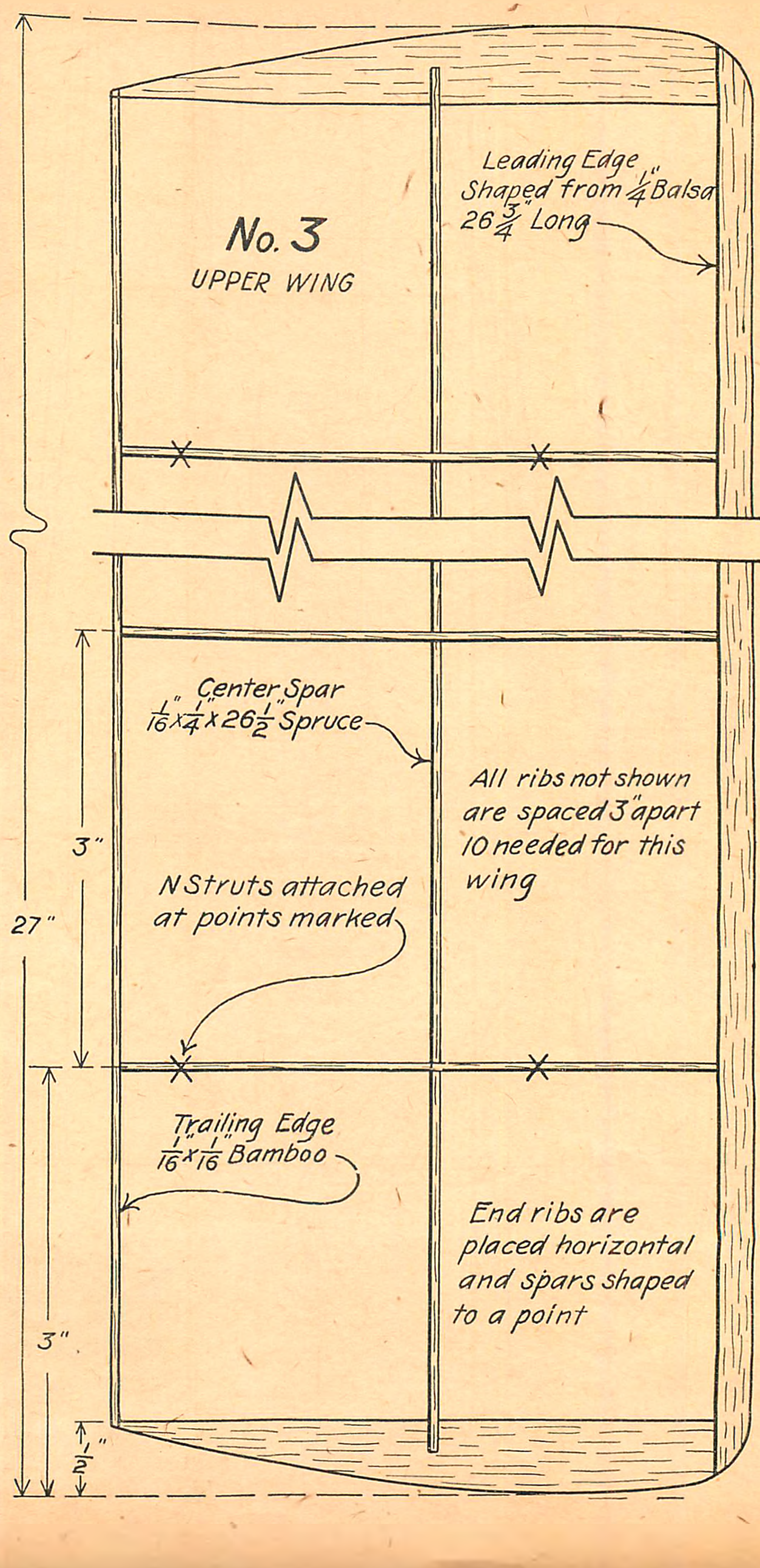


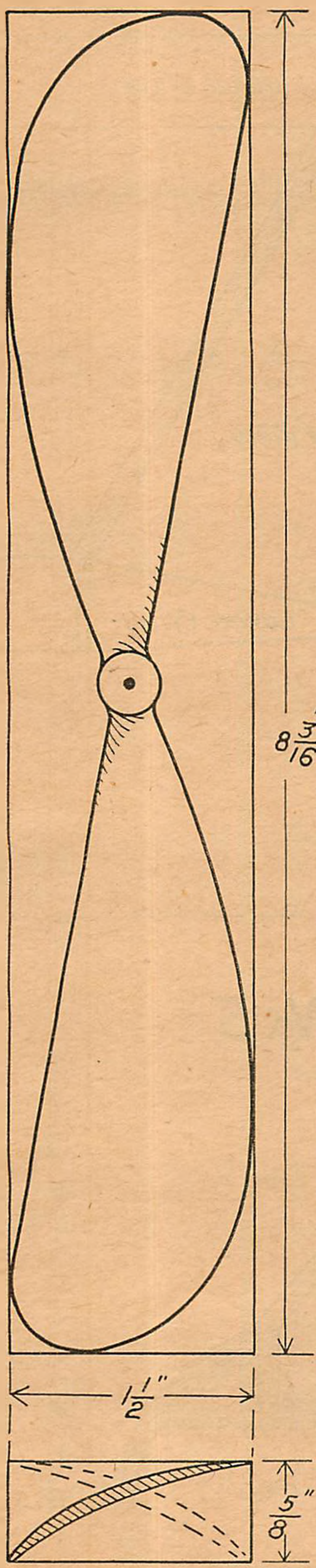
Crosses for sides of fuselage and rudder. Make 4



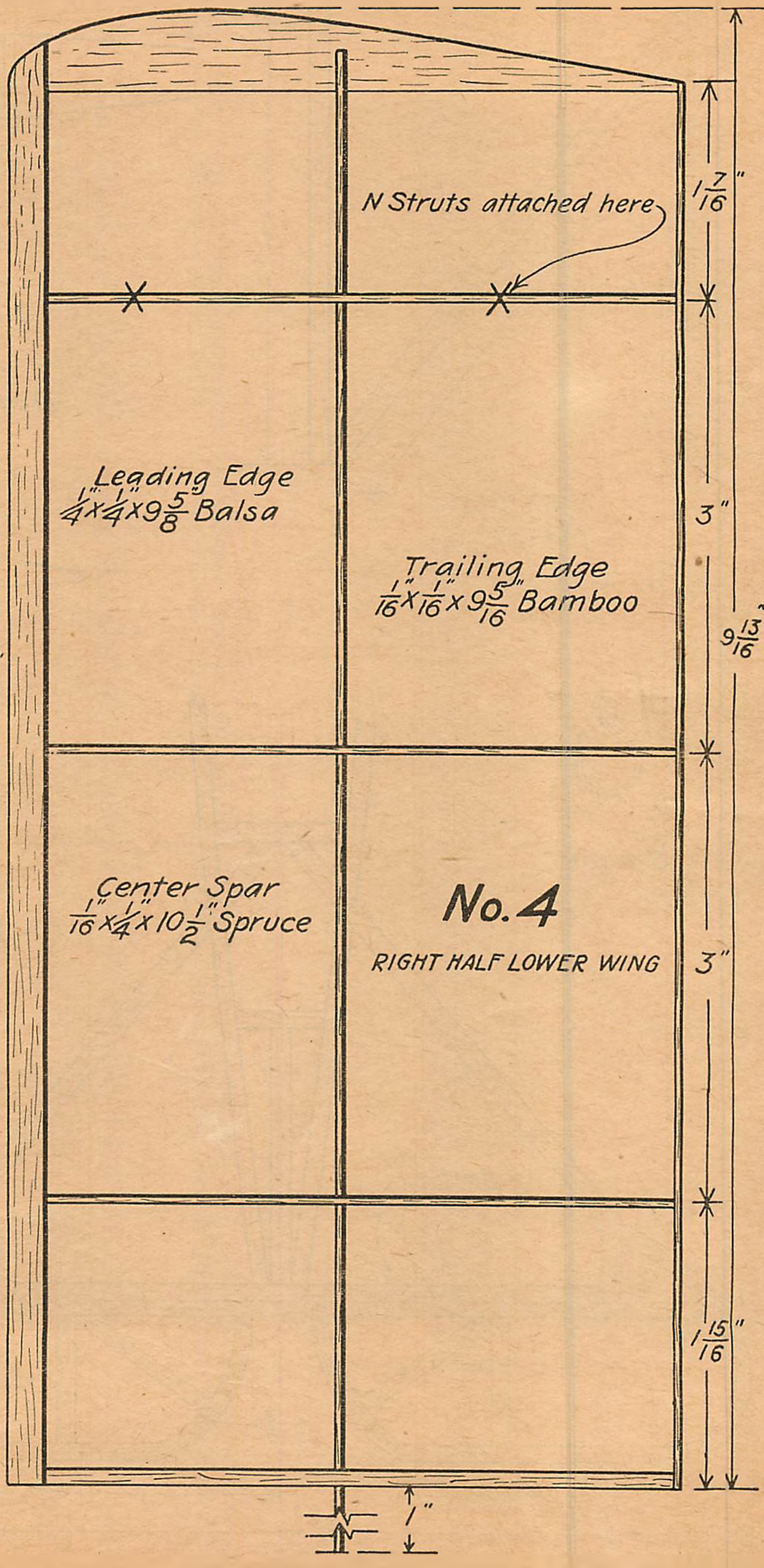
WING RIB

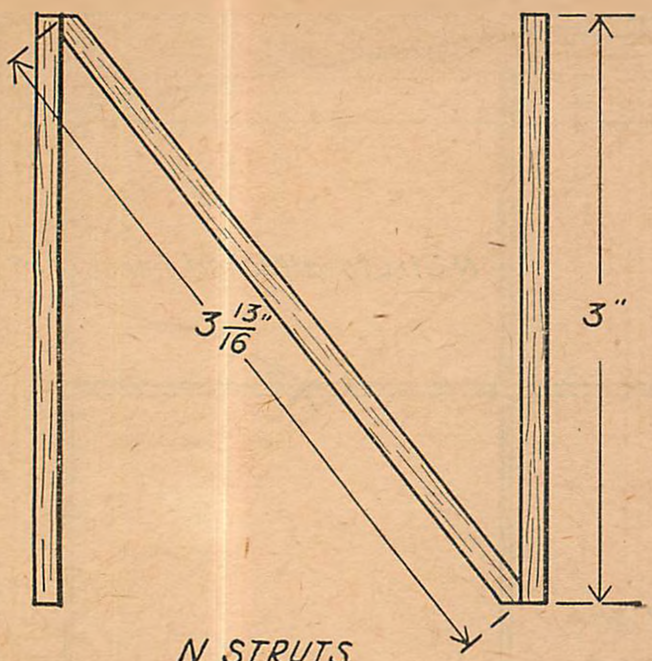
PROPELLER SHAFT
Bend after inserting in propeller



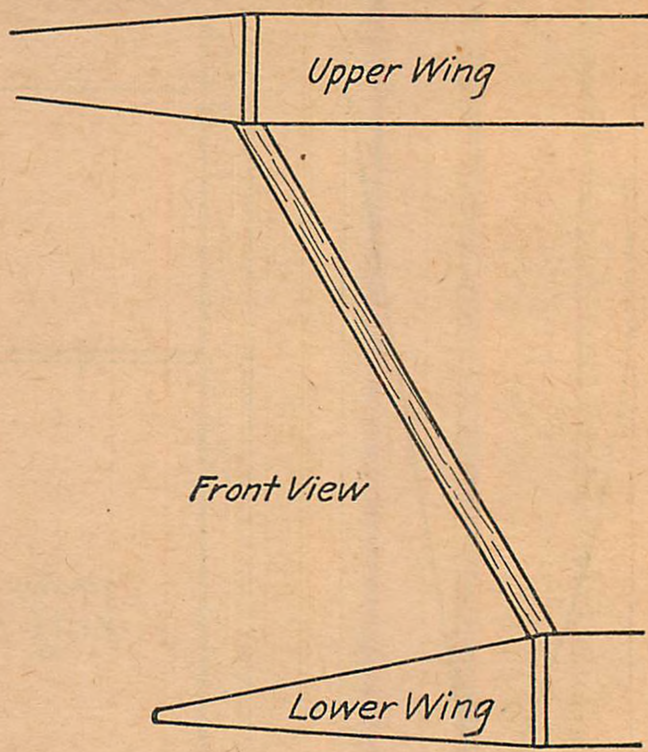


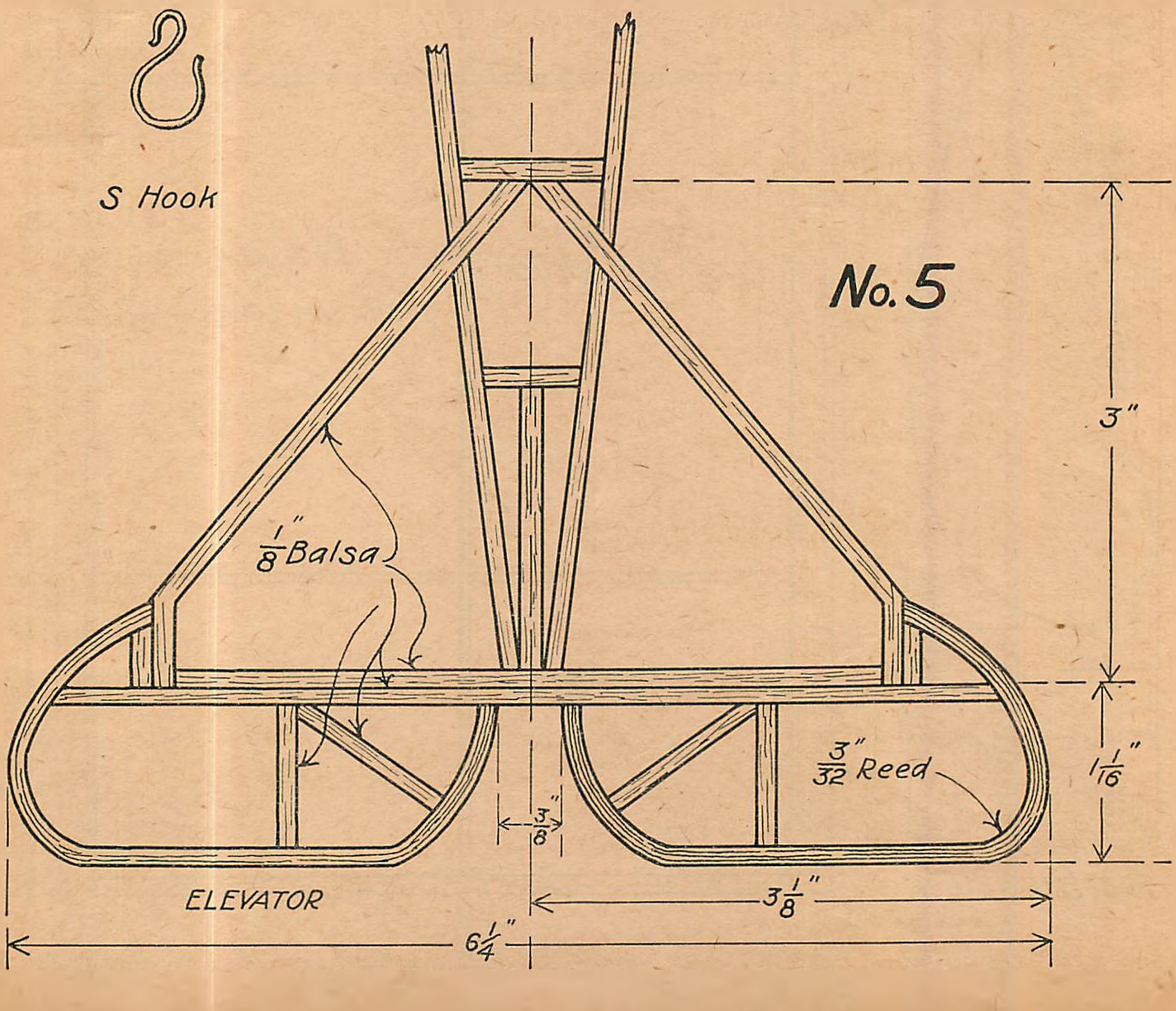
PROPELLER BLOCK

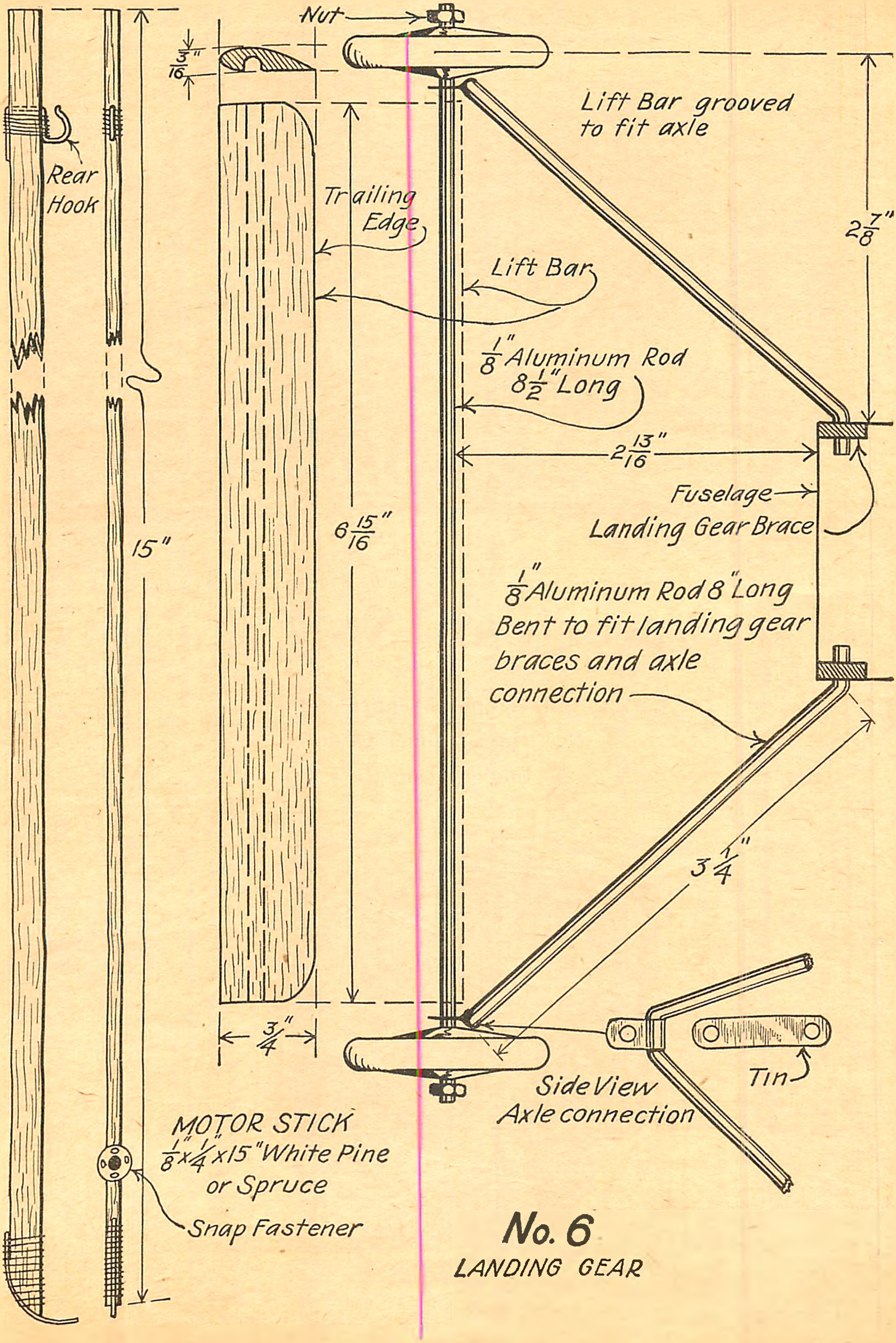




N STRUTS
Make 2

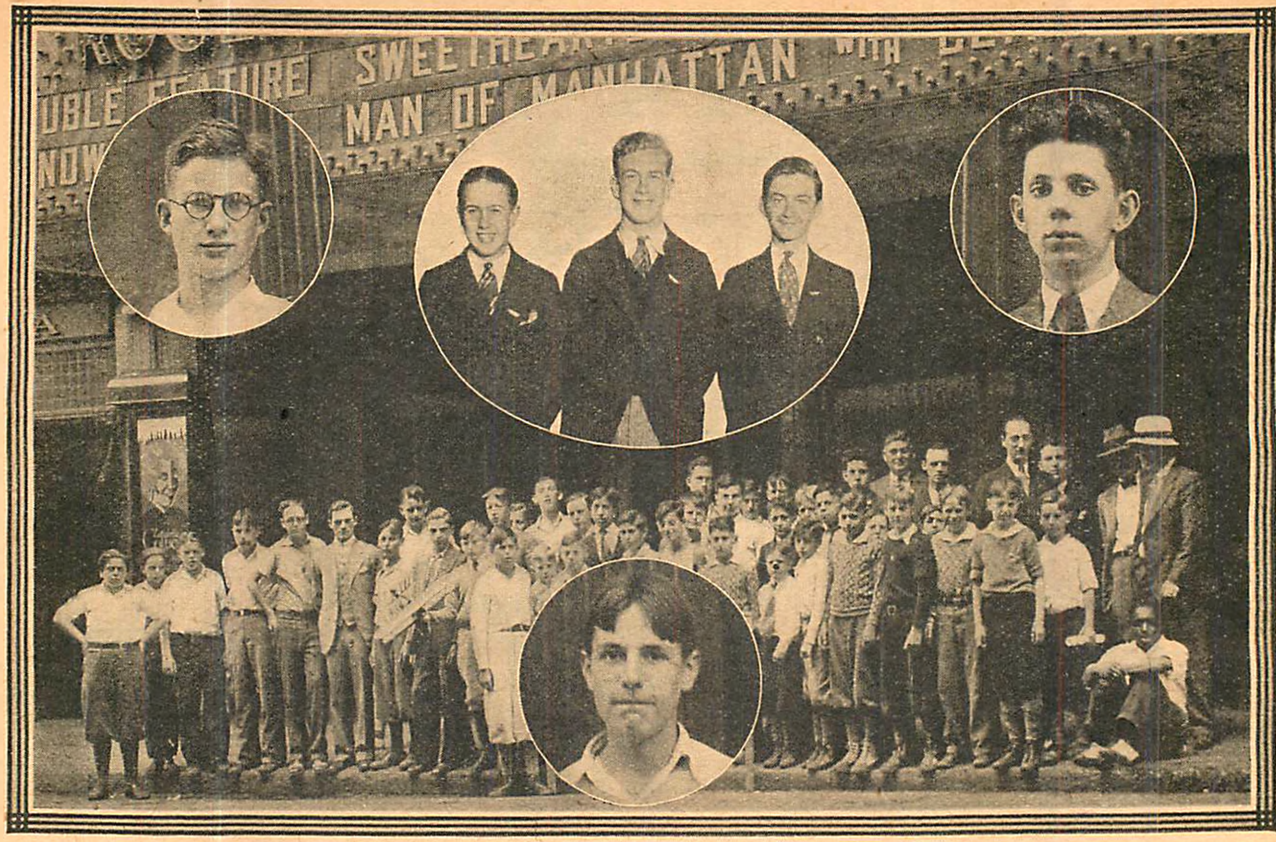






No. 6

LANDING GEAR



A general view of the *New Haven Times* division of the American Sky Cadets, showing (in oval, left to right) Harold Miller, club commander, John Warner, sergeant-at-arms, and John Cannan, secretary. In the circles are shown the three prize-winners in the *New Haven Times* model airplane contest

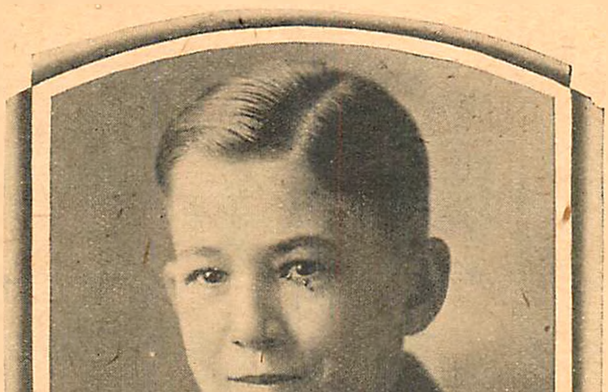
The American Sky Cadets

Stevens Trophy Winner and New Haven Times Club Inaugurations

IT can be safely said that one of the outstanding and perhaps the most unusual Contests of the Season was held in a small town in Central New York, when the Aviation Meet of the Beasley School at Fly Creek, took place at the home of Mr. A. Leo Stevens. In spite of the fact that the weather was dark and cloudy, it failed to dampen the spirits of the boys and each and every one of them was up bright and early, ready to take part in the long-talked-of event.

The boys arrived at Flyview, which is the name of Mr. Stevens' home. It has an aeronautical tang to it, hasn't it? They found that the place had been decorated in American flags and serpentine paper and it presented a gala appearance, in itself enough to put enthusiasm in any air-minded boy, but little more was needed, for everyone, large and small, turned out with the idea of making the Meet a success. What a success it was!

One of the features, and a mighty important one, too, was that a luncheon was served. And how do you think it was done? Suspended by cables from large trees, were three large famous balloon cars, the *All America* that held the World's record for many years, the *America* that has also much fame attached to it, and the *Heart of the Berkshire* that carried Mr. Waldo C. Johnston on his first aerial trip at Pittsfield in 1908. The boys were told to climb in these cars, which they did with great alacrity and hardly without being invited—and then luncheon was served. Did it taste just about a hundred per cent better from that lofty height? You can just bet your life that it did!



American Sky Cadet Philip O. Vuiliet of Seattle, Wash.

AFTER lunch the curtain went up on the business of the day. Ripley Jones was awarded the prize for the best-constructed airplane. He had built an Army and Navy plane that was a sure enough winner.

The next event took place

Cadet Wilson of Abraham & Straus' Club Presents Admiral Byrd with "Floyd Bennett" Model

on Inspiration Point and whether or not the name had anything to do with it, the fact remains, that some clever stunting of airplanes of every size and type was done. The air was filled with soaring, whirring, mechanical birds, amid shouts of the boys and the grown-ups, too, who had gathered 'round to see the fun.

Then there was a kite contest for great height, distance and construction. There were many clever designs exhibited and each and every one made a good showing.

After the judge's whistle blew and a few moments' rest, the next event was underway.

This was a sort of parachute review. The parachutes of every color and including every make from the earliest Garnerin to the modern Irving Air Chute, used by the armies both here and abroad, were shown. This ended with the Irving model having flown the greatest distance and also having held the air best.

In the glider event, many small machines made a remarkable showing and in the class for original ideas, Thomas Goodyear of Springfield Center "took the cake". This consisted of an air chute being put into a cannon that was discharged with gunpowder, which plunged the chute into space, when it came safely down again.

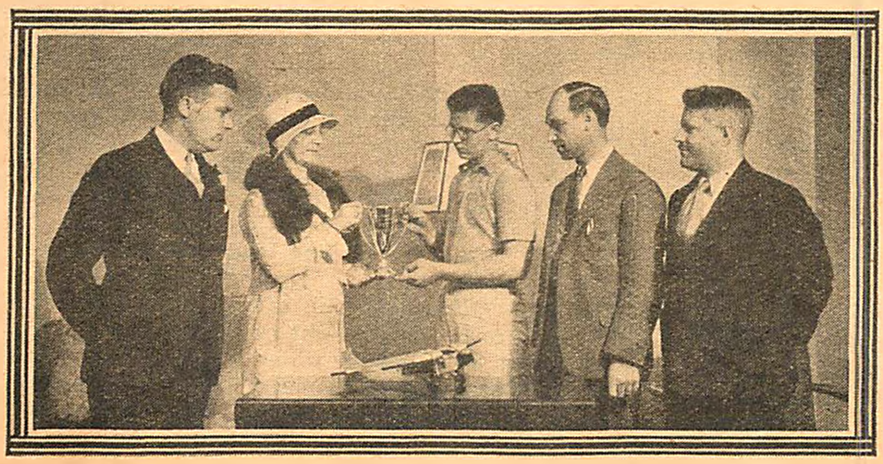
THE awarding of prizes was made under a silken parachute that had descended on many a great flight. There was much cheering as the boys received gold wings as follows: Ripley Jones, for plane, non-flying and flying contests, two prizes. Zeb Mayhew won the parachute contest, Waldo C. Johnston, kite flying, Hugh Whitehouse the glider contest, and originality went to Thomas Goodyear.

Ripley Jones is the winner of the Stevens Trophy for 1930. The trophy is a beautiful cup and each year one of the boys, who makes the best aeronautical showing will have his name added to it.

Mr. A. Leo Stevens, at whose home this wonderful day was spent, is one of the leading aeronauts and aeronautical engineers, and is the man who introduced the dirigible in America in 1901, and made many flights over New York City in 1902 and since.

The boys left Flyview voting the Beasley School Aviation Meet a huge success, and there is hardly a doubt but that a few years from now, when some of these same boys are bunched together in a hangar in some part of the world, exchanging experiences with their fellow pilots, they will still be heard to say, "That surely was a great Meet."

Three views were taken of the Beasley School Contest. In circle is Ripley Jones holding the Stevens Trophy, for 1930, which he won. The bottom photo shows Jack Wilson of Brooklyn, N. Y., who presented Admiral Byrd with a scale model of his famous *Floyd Bennett* plane. At the left of Jack is Roger Q. Williams, one of America's most famous flyers



MR. A. LEO STEVENS told a very interesting story of his first experience in a balloon, to the members of the Exchange Club in Cooperstown, N. Y. This is the story as it appeared in *The Freeman's Journal.*

"In 1889 I made my first ascension from Cleveland, Ohio. Father was interested in an amusement park. A professional aeronaut from England was engaged to make an ascension as a drawing card. At that time, Appleton had just published a reader that contained a story of two boys having ascended in a balloon that broke away. The professor described that the youngsters would descend safely since the balloon after reaching a certain elevation would expel its gas and float back to earth. This story impressed me very much. The professor who was engaged to make his ascension on the opening day of the new amusement park had promised me that he would take me up if I would help him. I carried the iron borings, acted as water boy and for three days and nights assisted him on and off while the balloon was slowly filling.

"The day announced for the flight was Sunday and those who resided in the district of the park decided that no balloon should go up on the Sabbath and an injunction was served against the park management. The professor was notified that he must not leave the earth on the Sabbath and when I inquired of the professor when we were to ascend, he replied that this would be impossible and that since I was a minor, he couldn't take me. I had fulfilled my part of the arrangement and couldn't see why I was to be left on earth after (*Continued on page 42*)

A Course in Airplane Designing

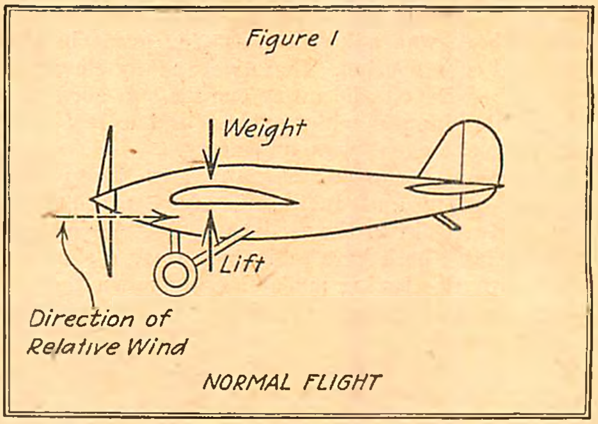
By Mastering This Valuable Course, the Model Builder of Today Lays the Cornerstone for His Career as the Aeronautical Engineer and Designer of Tomorrrow

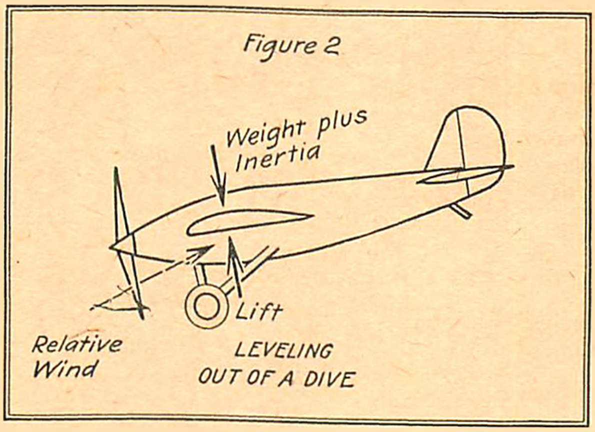
By KEN SINCLAIR

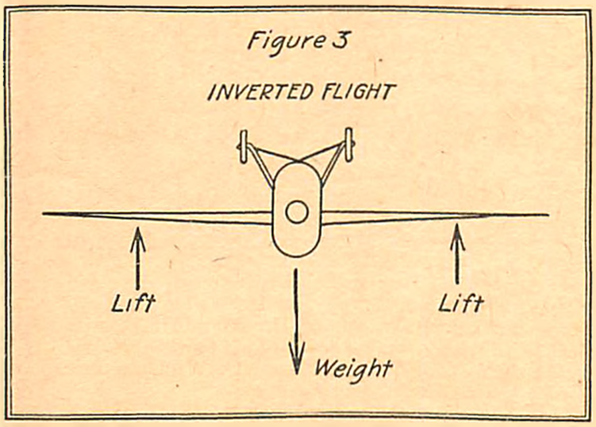
IN presenting this course, MODEL AIRPLANE NEWS wishes to stress the fact that model building is more than a mere sport. If the builder of model airplanes learns the fundamental principles underlying airplane flight and design, he prepares himself for a future career in the most profitable phase of aviation.

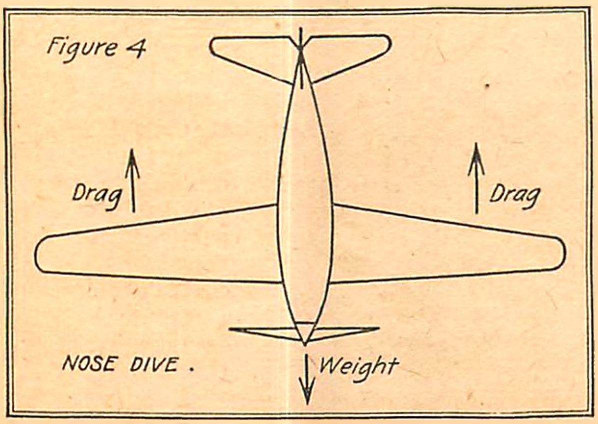
The policy of MODEL AIRPLANE NEWS is not to encourage or teach its readers to become pilots, but rather to become aeronautical engineers, designers, salesmen, manufacturers, or equip themselves for any other position which requires the training of the specialist or executive. Study this course from month 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.









THE science of airplane design may be divided, roughly, into two general divisions: aerodynamics and stress analysis. Aerodynamics deals with the air flow about an object and with the various problems of stability, while stress analysis deals with the strains that will be imposed on the members of the structure of the ship while it is in flight and in landing.

It is obviously impractical to design a ship without some knowledge of the stresses that its parts will have to withstand in all possible attitudes and conditions of flight.

For instance, if one were to design a ship with wing spars that would only support the load when the plane was flying normally, that ship would be found lacking in necessary strength for stunts and other maneuvers. Likewise, it would be impractical to design wing spars, for example, several times larger than necessary. That would be added weight and needless weight cuts down the efficiency of any airplane.

Especially in model work is this true. The model builder is usually aiming at some record. He wants his ship to fly farther than the other fellow's ship. If it is to do this, it must be a more efficient ship, both aerodynamically and structurally.

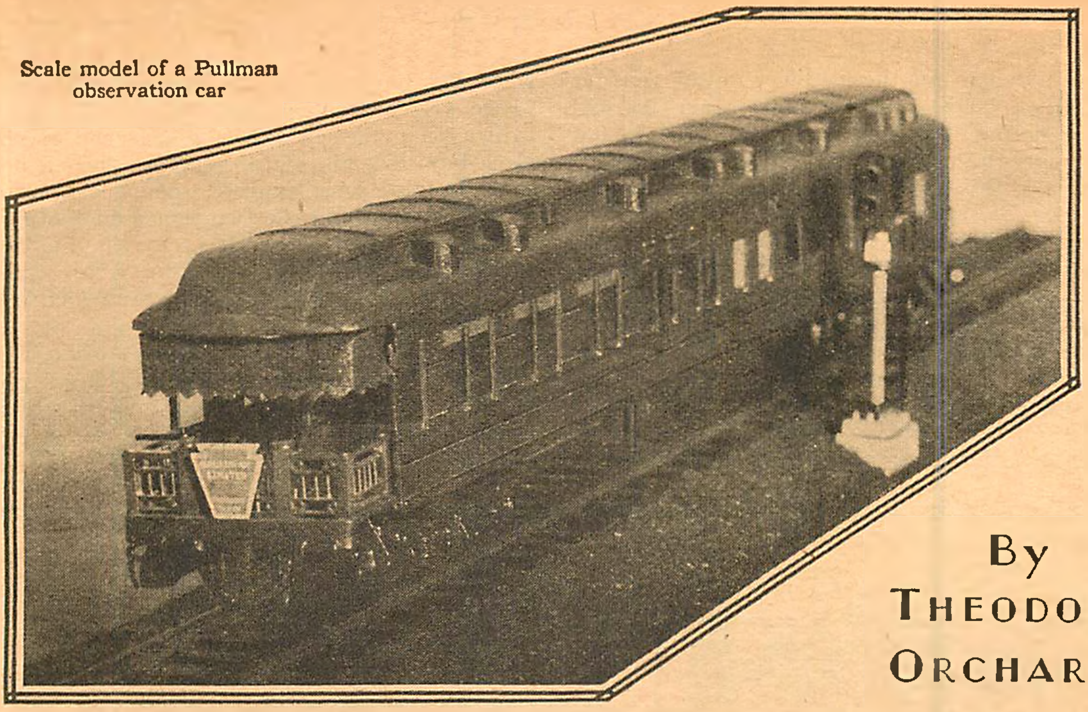
That is, it must have little resistance, it must be stable when in the air, and it must be sufficiently strong (without being unnecessarily heavy) to withstand all possible strains that may be imposed on it when in flight or in landing.

How can we analyze the stresses occurring in the various parts of the airplane? The first thing to do is to find out just what are the various positions in which the ship may be flown, and the relative strain imposed by each. We shall do this first, and then, later on, we shall see how these varying loads affect the internal structure of the ship.

Naturally, our attention is focussed on the most usual condition of flight at the beginning. That is normal flight, a condition in which the ship is flying level, right side up, neither gaining nor losing altitude appreciably.

The loads on the wing when the ship is in this position are distributed over the (*Continued on page 52*)

Scale model of a Pullman observation car



By THEODORE ORCHARDS

Real Workable Railways in Miniature

A Wonderful Hobby on which Enthusiasts Spend Years and Fortunes

SOME of you veteran model builders may think that you have reached the ultimate when your hangar is full of new-design planes and, perhaps, a three-foot zeppelin, or when you have built a model yacht and a speedboat. However, talk to one of the real enthusiasts in the model railway field, and you may get some new ideas.

Think of a model railway system, complete in your back yard! Locomotives, careful scale models of their famous prototypes, that run under their own steam or electricity, belching clouds of smoke and whistling for the curves around the Hydrangea bush! Rolling stock, passenger and freight cars with real air brakes, with doors that open just like the real trains . . . (and windows that stick). A complete trunk system, with perfect track sections, switches, crossovers, signal systems . . . and all on a gauge, or track width, of from five-eighths of an inch to two and a quarter inches!

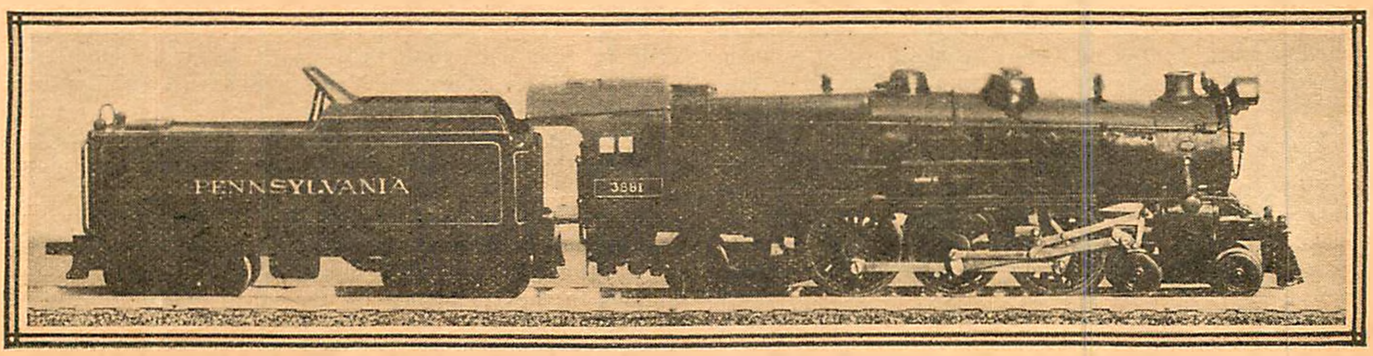
It sounds a bit complicated, doesn't it? There are, however, hundreds of such systems here in this country, some of them in cellars and attics. There is a club of "Model (Railway) Engineers" in nearly every good sized city, and in every railroad center. Of course, it takes time to complete a system.

Some enthusiasts have been working for years, and will never finish because there is always something new and fascinating to make or change. A new tunnel, a new bridge model, electrification of part of the road-bed . . . safety devices . . . there isn't any limit.

Great names have been enrolled among model railway fans . . . such men as Edsel Ford, Vincent Astor, Jim Hill of Minneapolis . . . and yet the sport is shared by everyone. Charley Cunningham of Auburn, Washington, has been a fireman on locomotives for fifteen years. During that period he has devoted all his spare time to making perfect scale models of trains and engines. His "No 2258" which won prizes all over the country last year is a perfect reproduction of the great locomotive which still pulls the North Coast Limited on the Seattle branch of the Northern Pacific.

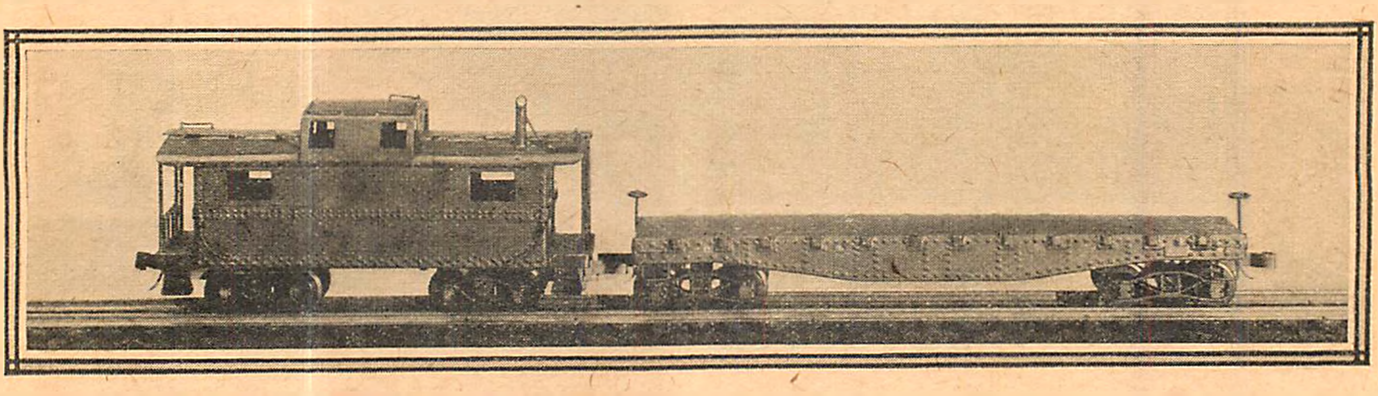
HE has made many freight and passenger trains, including such details as electric lights, plush seats, berths in the caboose, and safety devices. On his mantel-piece he keeps a model of the particular locomotive on which he is firing at the time.

The locomotives used on these model trains are of three general types. There is the clock-work engine,



A model of a Pennsylvania Railroad engine and tender complete to the most minute detail which does well enough for the beginner or the younger builder but which isn't quite the real thing. It will haul a load consisting of several cars and a caboose, but only for a few circuits of the track. Most of the ready-made outfits are of this type. Others operate on magnet motors.

Then there is the scale model which not only looks like the real thing, but is! Its boiler is full of steam, its fly-wheels whirl and its pistons plunge. Or if it is of the electric type, it operates with the real third-rail or overhead, and is the same complete power house as the full-size titan. Of these are the outfits built up laboriously and carefully by the real fans. Most of them are men, simply because it takes years to finish a project of this kind. They started, most of them, as boys who loved trains, railroading and construction.



Working scale model of a flat car and a caboose. Notice how every detail has been incorporated in this wonderful piece of workmanship

To such builders, it is nothing to spend six months or a year on the building of a model bridge to span a gulch in the back yard. Mr. B. A. Fuller, of San Diego, California, has just completed such a task . . . a perfect engineering replica of a three hundred foot span, set across a brook in his back yard. It has held a weight of five hundred pounds, and is built piece for piece after the famous C & N W bridge across the Mississippi at Clair, Nebraska.

Mr. Fuller started building a toy train for his boy years ago, and the bridge, the five tunnels, and the roundhouse full of locomotives and trains that he has today are the outgrowth of that toy beginning.

Mr. E. J. Quimby of Westchester, New York, was once upon a time an employee of an interurban system which has since become discontinued. The old line, however, is today keeping schedule in his garden, built by Mr. Quimby and his sons, assisted by every boy in the block. The system is more than a thousand feet long, and runs over an exact replica of the original country traversed by the line . . . up hill and down, across bridges, through villages . . . and just as in the main line, the model is run by third rail in the towns and overhead wires in the country!

An extraordinarily weird effect is the result of the sudden appearance of a model train, its smoke-stack puffing, from a tunnel or from the shadows of a bush. Instead of the train appearing small, everything else appears enormous, and the onlooker has the feeling of being in giant land.

In England, the model railway fans have their own magazine, and there are many informal clubs which gather once or twice a week to operate each others' models. For a large part of the fun in model railway engineering is that it affords amusement for several people.

Recently one boy living in Brighton, England, gave a garden party for his school friends. Each guest when he arrived was given a typewritten sheet telling him what his position was to be and what he must do. There were switchmen, flagmen . . . all the personnel of railway management, from dispatcher to section crew. Each boy took his place, and soon half a dozen trains, some freight, some express, some local, were hurrying on schedule around the two thousand foot system.

Now and then a wreck occurred, due to someone's carelessness, but never anything worse than a derailment, which a model wrecking crane was instantly sent to take care of.

Another party of this type was organized to dramatize a famous story of the late Sir Arthur Conan Doyle's, in which a train mysteriously disappears in broad daylight! In the original story, a track was temporarily laid, switching the ill-fated train off the main line before the train crew could stop the locomotive, and sending it down a mine shaft, which was then filled up. All track was speedily taken up, and the mine shaft filled in.

The boys on this occasion laid track in the same manner, with a switch set. The model train came speeding along, bearing a clothespin villain. Suddenly it twisted off the main line, ran a short distance along the side track, and just as it had been described in the story, disappeared down a mine shaft . . . in this case, a post-hole!

Does it sound interesting? Would you like to join the army of boys and men all over the world who are making model trains?

Ban Nagai of Japan, will compete with you for prizes in the annual contests, for this Japanese boy can make a locomotive that does everything but sand its tracks, and he may arrive at that in time. Perhaps you will have to follow the example of Carl Roberts of San Martin, Argentine Republic, who has built his rail system in the cellar because of lack of outdoor space. In a ten by twenty foot space, Roberts has built a one hundred and eighty foot track, in three tiers.

THERE are all types of model trains. Some are made by the great railroad engineers themselves, to test principles of engineering and design. These you can see on exhibition at Grand Central or at the Bush Building in New York. There are others, less difficult to build. If you have not the necessary apparatus and skill to turn out your own parts from the detailed plans available, there are firms which will supply you with most of them, ready to assemble.

After the locomotive is ready, you will find it easier to make the cars, especially if you use the regulation trucks.

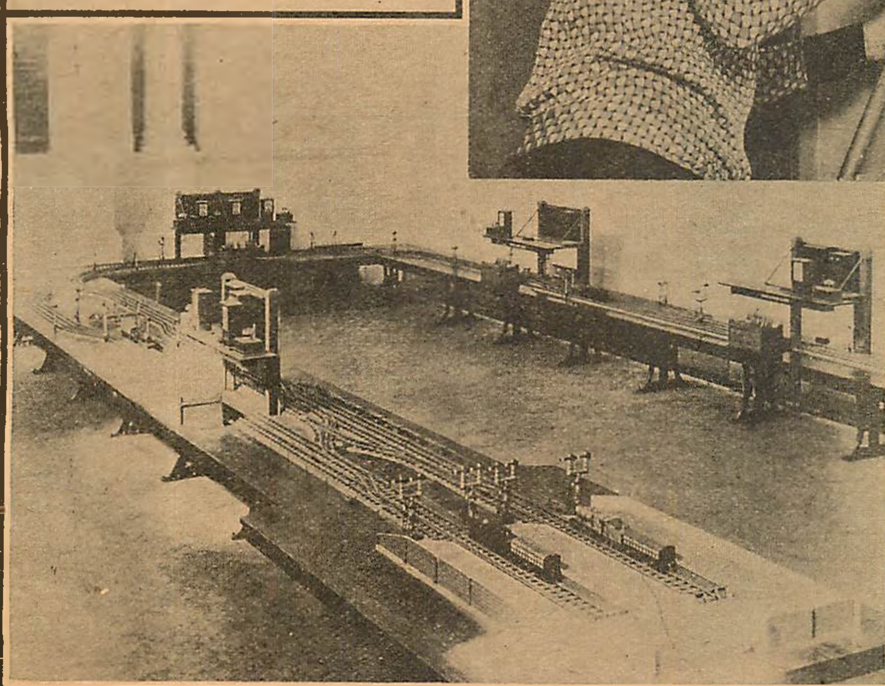
Then comes the real fun of all . . . laying out your road. Plan to have your roadbed nearly level if possible, otherwise you will find you'll have to run two engines to the train, just as the transcontinental lines do in the Rockies. Here you will see a chance for a tunnel, there a bridge. Avoid grade crossings at first, using viaducts. Later on you (*Continued on page* 55)

MISS ELINOR SMITH, noted American girl flyer, and Carl Schneider (left) examining the barograph which registered 32,000 ft. at the end of her record-breaking altitude flight over Long Island recently

P & A

HUNDREDS of labor-saving inventions are tested daily at the Institute of Patentees. At the right is shown a wall-papering machine which holds paper and paste, the paper being rolled flat as it is hung

P & A



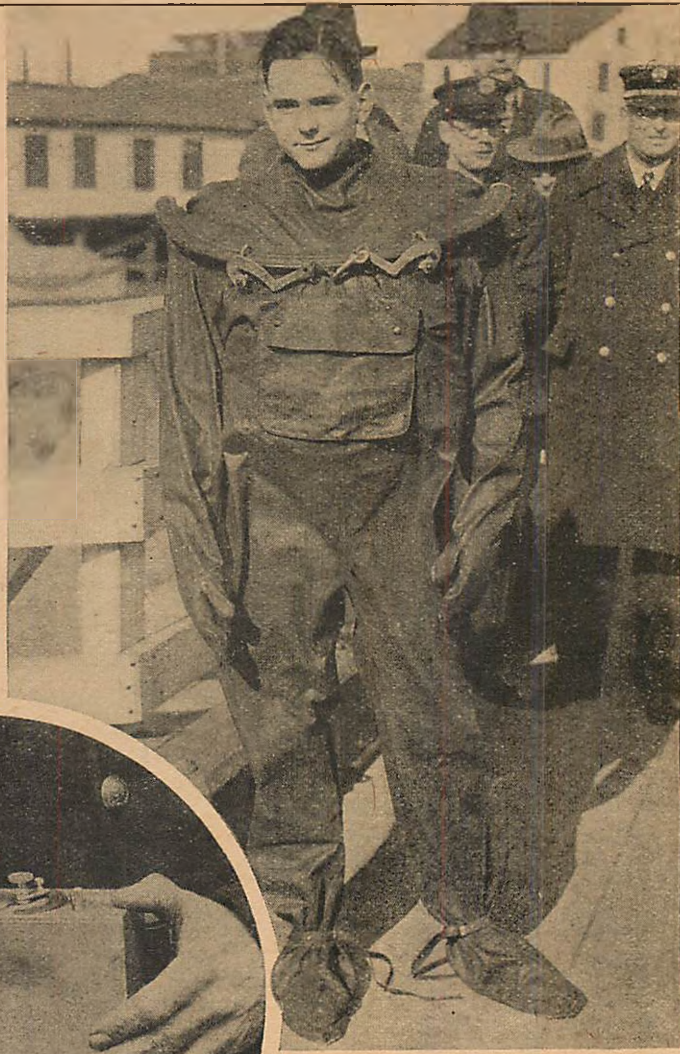
THE model room at the Railway Staff College in Dehra Dun, Bombay (at left), showing the perfect miniature railway which is used in the railway operation course. The new institution is the first of its kind in India

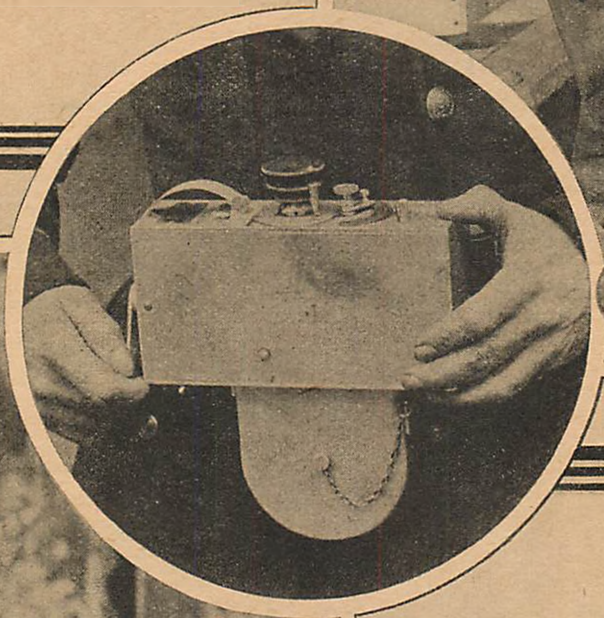
International

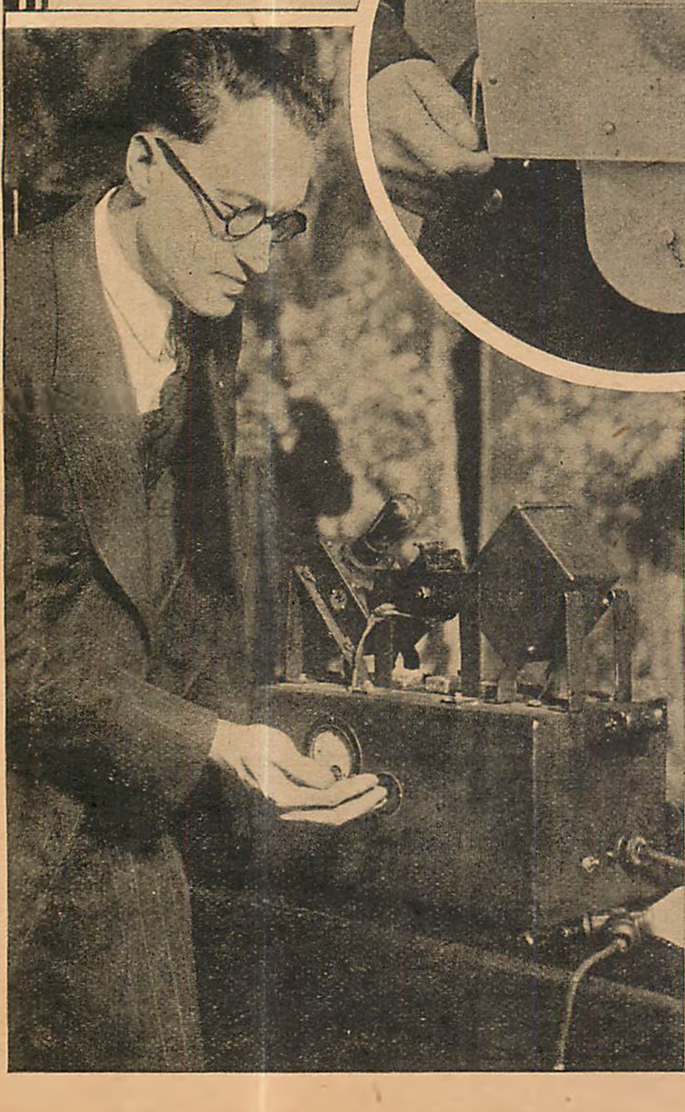
GEORGE ANDERSON (right) demonstrating an "Everwarm" life saving suit before Department of Commerce officials at the wharves in Washington, D. C. The suit is heated by means of a thermos

A NEW ticket machine now in use on London omnibuses is shown in the center. It is worked by the turning of a handle and the value of the ticket, $1\frac{3}{4}''$ x $\frac{3}{4}''$ in size, is fixed by adjustment of the knob

P & A



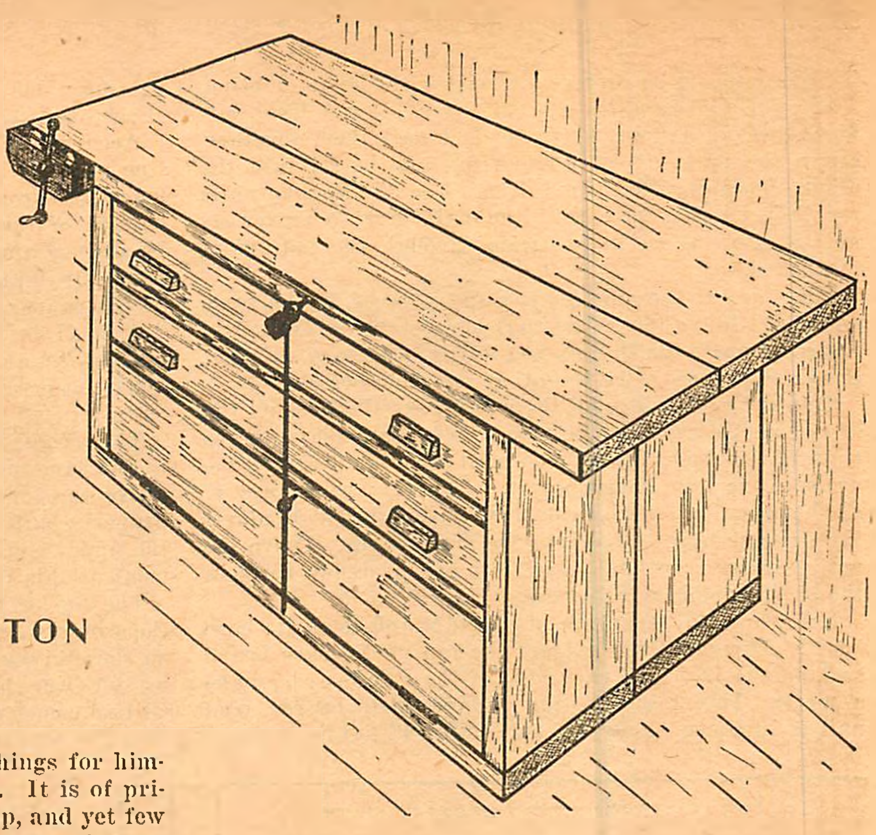




AT left is James L. McCoy of the Westinghouse Co. and the machine which he demonstrated before an engineering society in New York to produce an invisible or ultra violet ray light for the protection of valuables, or burglar alarms. These rays are invisible in both dark and lighted rooms and could be made to set off bombs of any kind

P & A

A Necessity for Every Home Mechanic



An Inexpensive and Easily Built Work Bench

By

EDWIN T. HAMILTON

EVERY one interested in building things for himself needs a first-class work bench. It is of primary importance in every workshop, and yet few boys have good ones because their cost is considerable.

The answer to such a problem is to build one yourself!

Here is a combination bench and chest, which can be easily built by the amateur at small cost, and yet will be perfect in every detail, quite as serviceable as its expensive store brother.

Two generous drawers for small tools, nails, blueprints, etc., are specified, as well as a larger cupboard for the storage of unfinished work, spare lumber, etc., all of which can be safely locked with a single padlock.

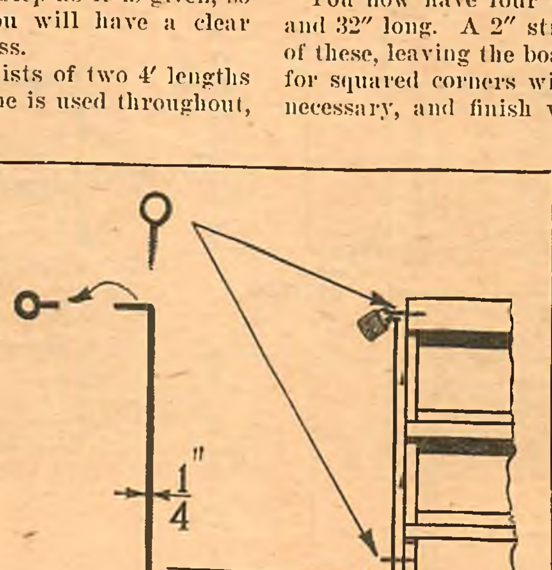
This must not be considered in the light of a toy. You will find that dad, too, will be using it, as its generous proportions make it suitable for the older folks.

Before starting actual construction, go over the plans carefully and then read these instructions thoroughly. Be sure that you understand each step as it is given, so that when you start building, you will have a clear mental picture of the entire process.

TOP: The top of the bench consists of two 4′ lengths of 2″ x 12″ yellow pine. Yellow pine is used throughout, as it is easy to work with, gives good service, is inexpensive and procurable at any lumber yard. However, if the builder prefers, other kinds of lumber may be used.

Cut the two boards 12″ wide and 4′ long, test with a try-square to see that all corners form right angles and plane smooth on both faces of each. Lay the boards aside for future use.

SIDES: The sides of the bench are also made of 2″ stock. Four boards are needed to make these and each must measure 12″ wide and 26″ long. Test for squared corners and finish by giving each a thorough sanding with a coarse sandpaper. Set aside.



Locking Device

BASE: The base of the bench is constructed from two boards, as was the top. These are also of 2″ stock, each measuring 12″ wide and 36″ long. Cut to size with a saw. Test with a try-square for squared corners, plane smooth, and give both a careful sanding for finish. Place these boards with the other finished ones until needed.

DRAWER RUNNERS: Instead of having the usual narrow strips for drawer runners, this bench is so constructed as to require full shelves, which act as drawer runners. This is done to give added strength, which is often necessary in drawer construction where heavy articles, such as tools, are kept.

These runners are made of 1″ stock, and each measures 12″ wide and 32″ long. (Note that there are two such runner shelves.) Obtain a board of 1″ stock 12″ wide and 11′ long. Cut this in four lengths, each 32″ long.

You now have four boards, each measuring 12″ wide and 32″ long. A 2″ strip is now sawed away from two of these, leaving the boards 10″ wide. Test each of these for squared corners with a try-square, plane smooth if necessary, and finish with sandpaper. These are now laid aside for future use.

ASSEMBLING BENCH: The bench is now assembled. Before proceeding with it, however, go over your finished boards, check their measurements and number. If instructions have been carefully followed, you should have the following boards:

Top: 2—2″ x 12″ x 4′ long
Sides: 4—2″ x 12″ x 26″ long
Base: 2—2″ x 12″ x 36″ long
Runners: 2—1″ x 12″ x 32″ long; 2—1″ x 10″ x 32″ long

See that you have these twelve boards, and that they coincide with the dimensions given above. When the check has been finished, and the boards found to be correct, proceed with the assembling.

Lay the two base boards side by side on a level surface, such as a floor, or table, and nail them together. Drive the nails at an angle from one board into the other. This is called toe-nailing. Use 3″ flat-head nails for this, making sure that the nails are so driven as not to allow them to protrude through the bottom of the board.

Take two of the side boards and proceed in the same manner. Join their sides together by toe-nailing. Use the same nails for this as you did for the base. Repeat the same process with the other two side boards.

Stand the two sides on their ends, lay the base on top of their ends, see that the side boards are flush with the ends of the base board, and nail together. Drive the nails about two inches apart. For this work, use 4″ flat-head nails. The nails are driven perpendicularly through the base board into the side boards. Drive the nails straight, so that they will not protrude through the sides of the side boards.

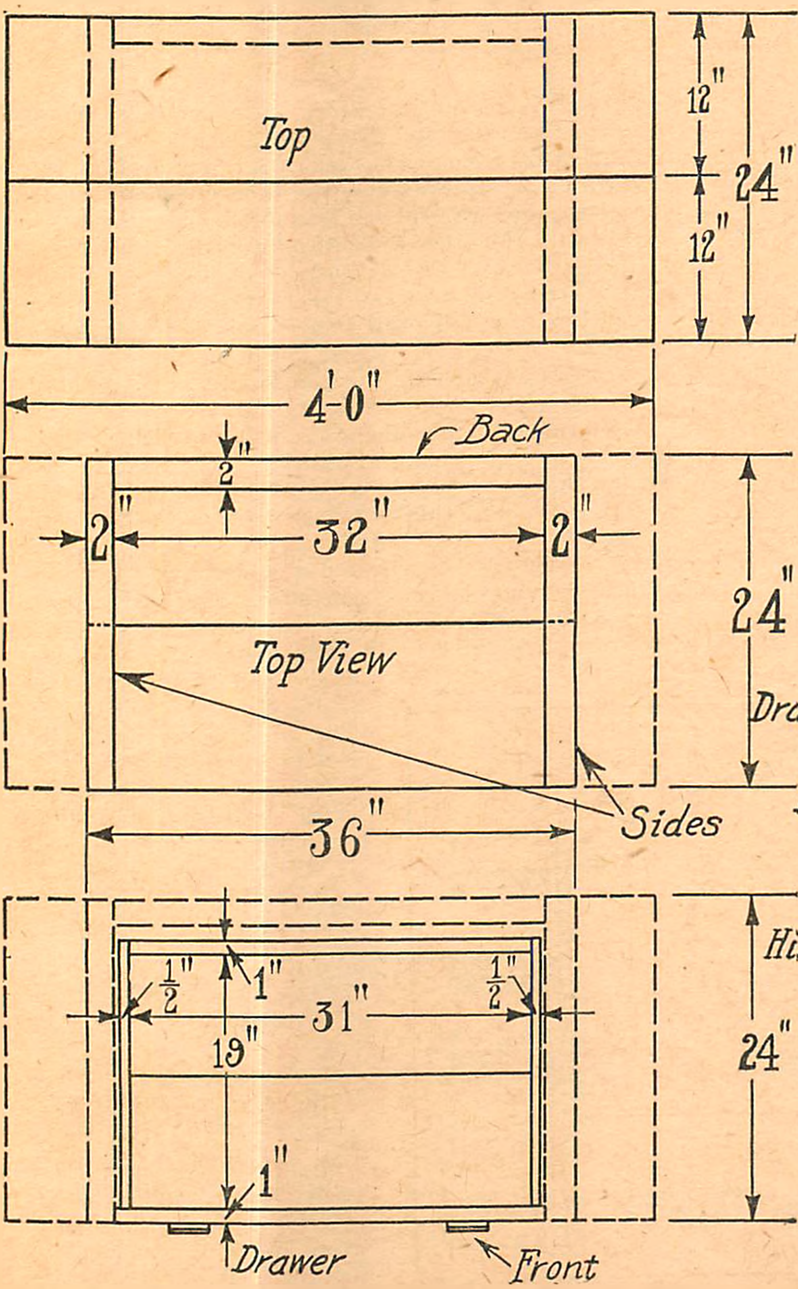
Now turn the structure over and stand it on its base board. Measure 10″ up from the top of the base board and, on the inside of each side of the side boards, make a mark. Insert one of the runner shelf boards, and nail it in place along one side. Use 4″ flat-head nails, driving them through the side boards into the end of the runner shelf board.

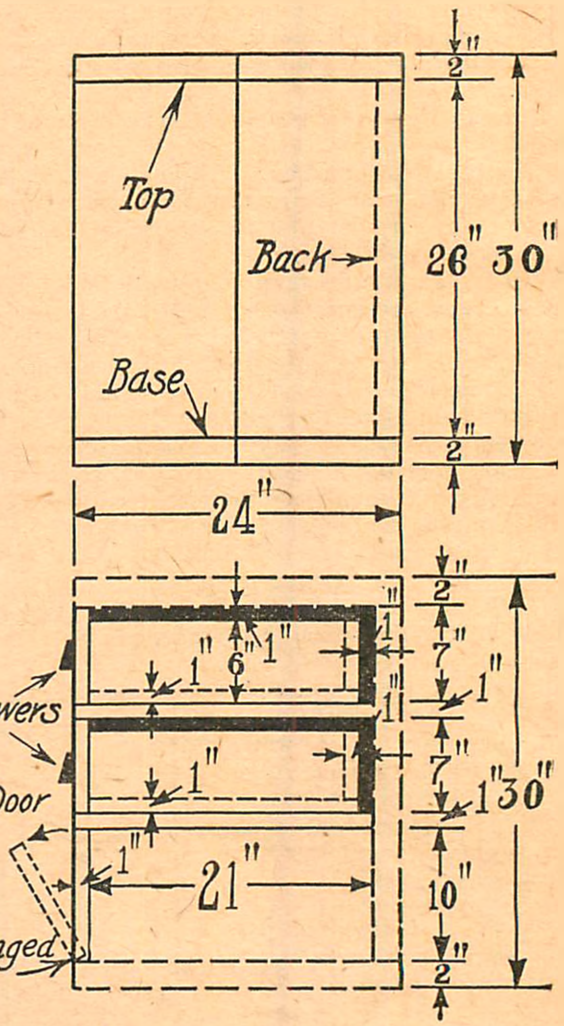
Accuracy is best gained in this work by drawing a line parallel to the end of the base board, at the point mark 10″ from the top of the base board, but on the outside of the side board. In this way, the nails can be driven along the line, which will guarantee their being straight, and entering the center of the end edge of the runner shelf board.

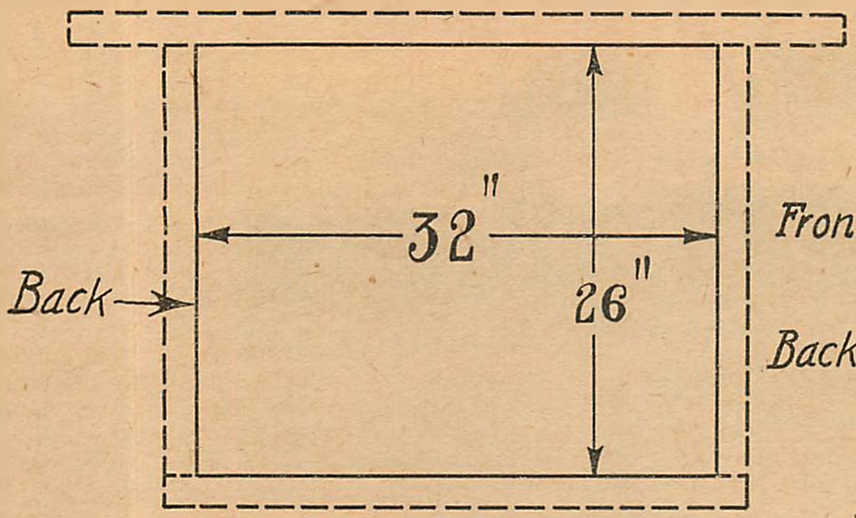
A level is now placed on the shelf board, running lengthwise, and the board adjusted until perfectly level. Drive nails through the side board into the shelf board as instructed before.

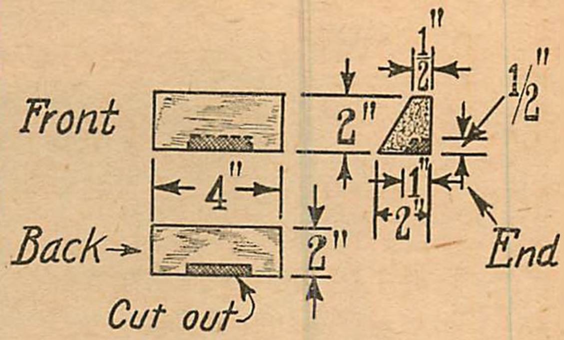
The second and top runner shelf board is now applied in the same manner as the first one. This is placed 7″ above the top face of the first runner shelf board. If properly built, this last runner board should be 7″ from the upper ends of the side boards. Check this measurement at this time.

The top of the bench is now attached. First, choose the worst sides of the two top boards, and draw a line on these sides 6″ from each end. Place the boards side by side over the ends of the side boards, so that the pencil line comes on the outer edge of each side board. See that the side edges of the top (*Continued on page 44*)

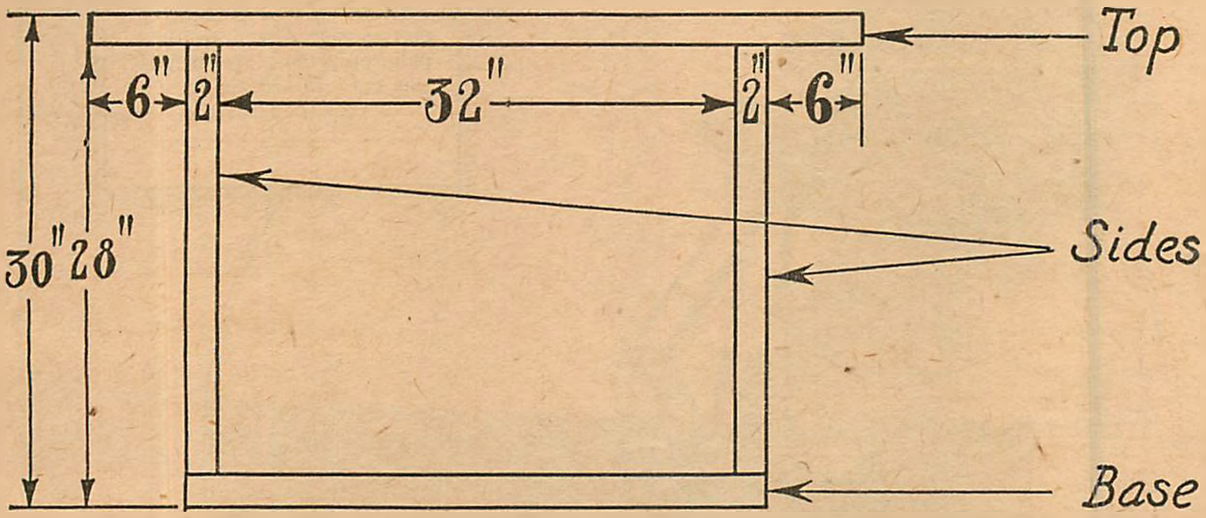


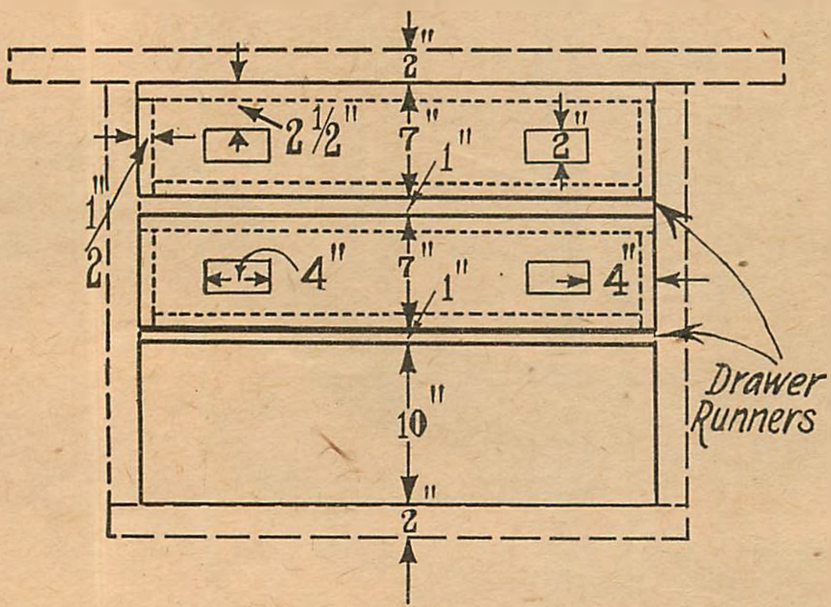


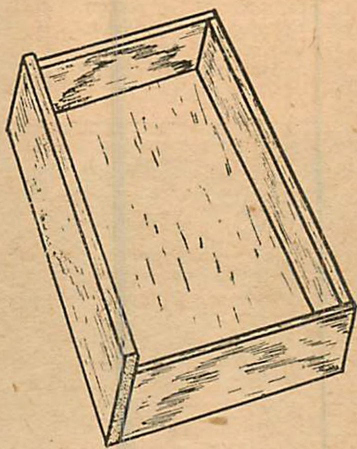




Drawer Handle

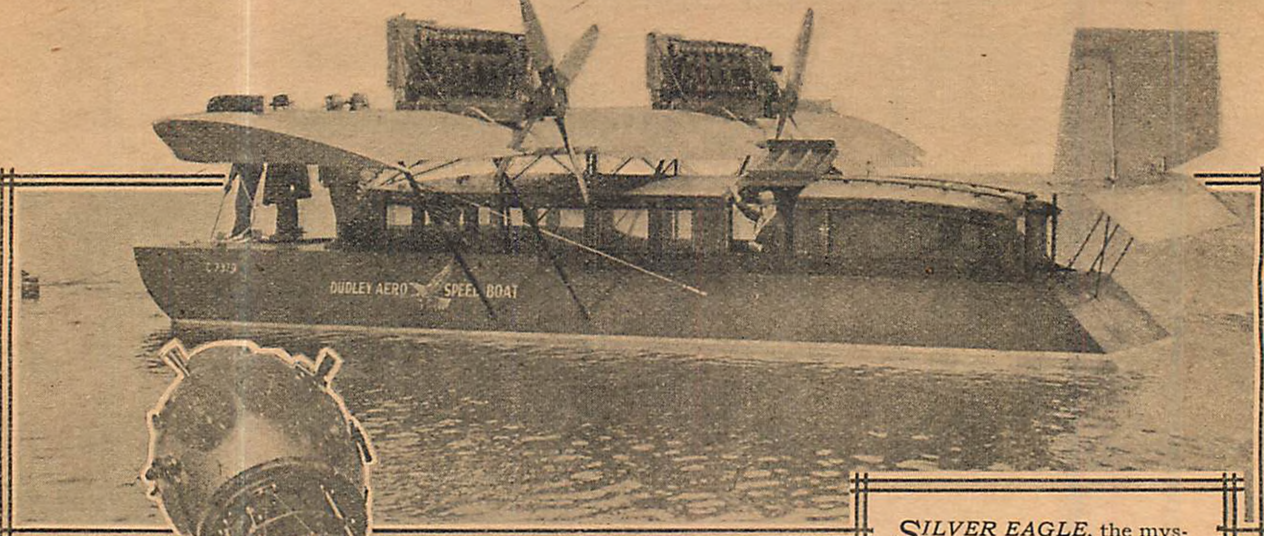






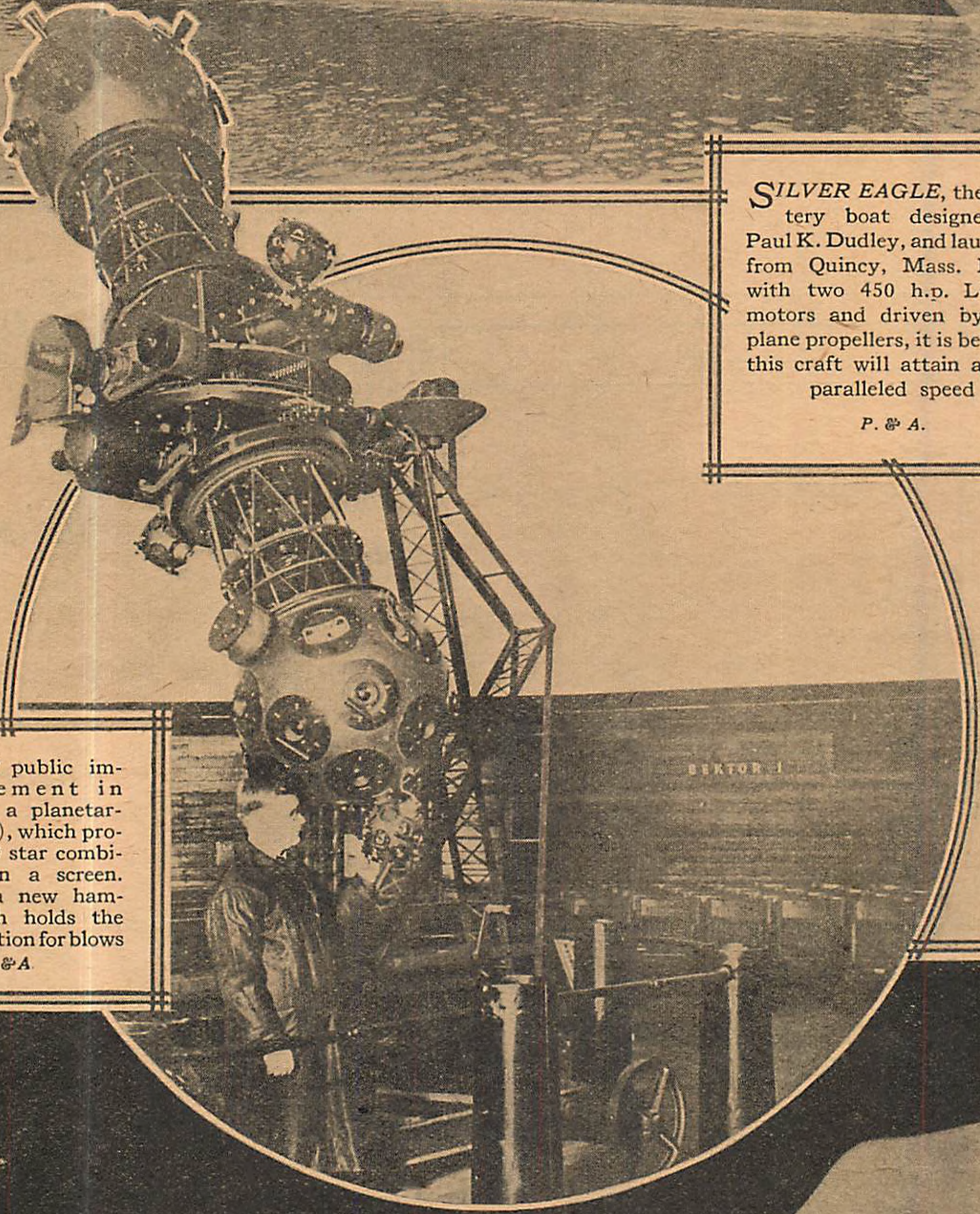
Drawer Assembly

Front Views



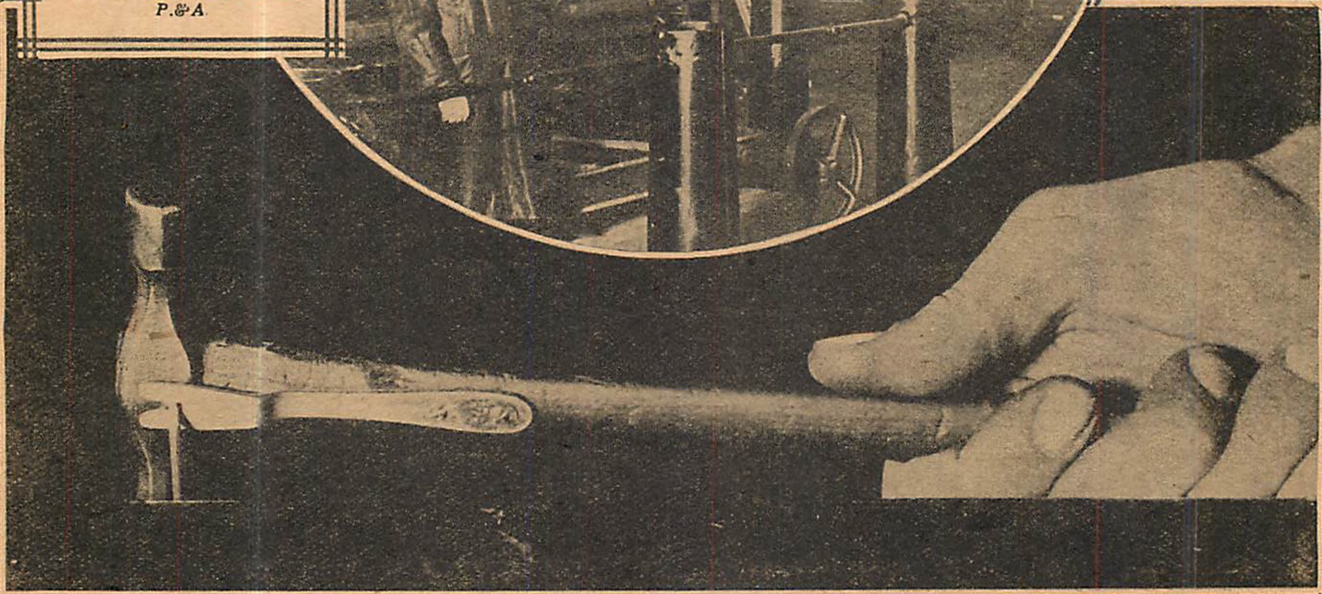
SILVER EAGLE, the mystery boat designed by Paul K. Dudley, and launched from Quincy, Mass. Fitted with two 450 h.p. Liberty motors and driven by airplane propellers, it is believed this craft will attain an unparalleled speed

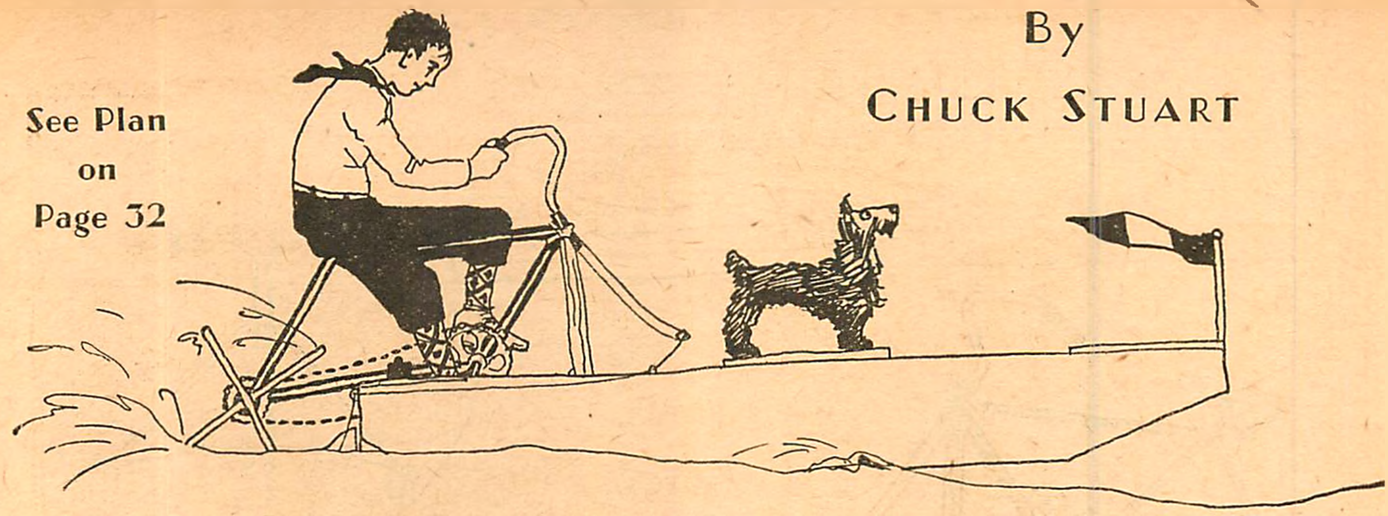
P. & A.



LATEST public improvement in Vienna is a planetarium (right), which projects 5,400 star combinations on a screen. Bottom, a new hammer which holds the nail in position for blows

P.&A.





See Plan on Page 32

By

CHUCK STUART

How to Build a Bike-Boat

An Old Bicycle, Some Wood and Nails—and An Ocean of Fun!

HERE'S a cross between a bicycle and a boat, with the best qualities of each. It will skim with ease across the water two or three times as fast as a boat with oars could hope to go. Best of all, since it is based on the pedal and paddle-wheel device, it's hardly any work to run. You can keep up a good pace on the water in your bike-boat for just as long as you could ride a bicycle on land and there aren't any hills to "pump up" on the water.

Commercial models of this bike-boat are on the market today, costing from five hundred dollars up. You can have one, as safe and as good as the expensive ones, for the cost of an old bicycle and twenty dollars' worth of lumber. And in spite of the complicated look of the thing, there is no carpentry necessary that the average boy cannot handle with the average tools.

This device could be applied to any boat, but the flat boat, or punt, is best since it is the most seaworthy boat made. Since you cannot balance yourself when on the bicycle seat, it is necessary to have a non-tippable boat. If you have or can buy an old punt, it will be less work. However, with the proper materials, you ought to be able to build the craft in a few afternoons.

Any soft wood will do. White pine is good. Cut the sides a foot and a half deep and make the length anywhere from ten to fifteen feet, depending on how many people you want to carry in your bike-boat. The less passengers, the better is the speed. When the sides are cut and tapered off at a slant of 1 in 2 for the front and 1 in 1 1/2 for the rear, nail on the ends.

Now you are ready for the real job, which is putting on the bottom. You will need to make your boat three feet wide, at least. Turn it over, bottom up, and start laying the floor-boards at the rear. Paint each heavily with white lead paint as you go, so that the joints will be water-tight. Work your way front, making sure that you have every joint tight and that every board is pressed firmly against the one in back.

When the bottom is on, fasten on the small keel. Then cut out the rudder with a saw and work it down to shape with a draw-shave. It is hung to the keel with two heavy rust-proof door hinges; the kind that swing either way. Put two staples firmly on the rudder, one on each side, about one third of the way back from the edge.

Now put on the seats of the boat, which will steady the frame. Cut away part of the rear seat and the end board, as shown in the drawing, to allow the chain of the bicycle to pass inside. Even if this slot is down near the water level, you will find that the motion of the boat and the whirl of the paddles will keep the water from splashing in.

Cut a groove with a chisel for the bicycle frame to rest in and fit a block over it. A bolt should run down through this block, through a hole drilled in the frame and through the seat. This will hold the bicycle firmly in place and allow for the push.

Now you are ready to mount the bicycle. Any old bike will do, and since its wheels will not be used, you ought to pick one up cheaply if you do not have one of your own. Take off the front wheel, leaving the fork. Strip the spokes off the rear axle if it is hollow. Otherwise, you will have to use the sprocket wheel as an axle.

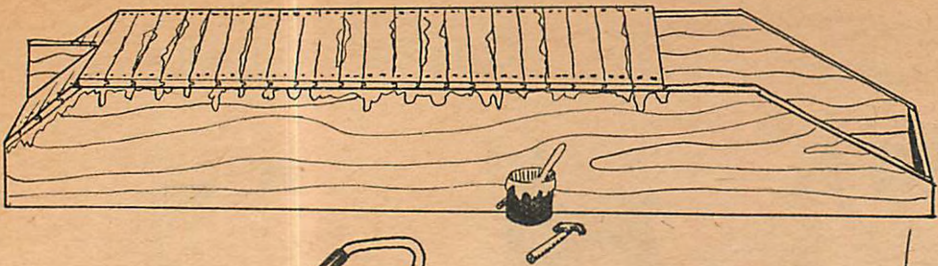
Mount the bicycle firmly in place, bolting it down to the rear seat under the block, and bracing it in the front, just under the handle-bars, with a piece of stout wood against the edge of the boat on each side. Stout wire will help hold these braces against the bike frame. Leave the fork free to turn.

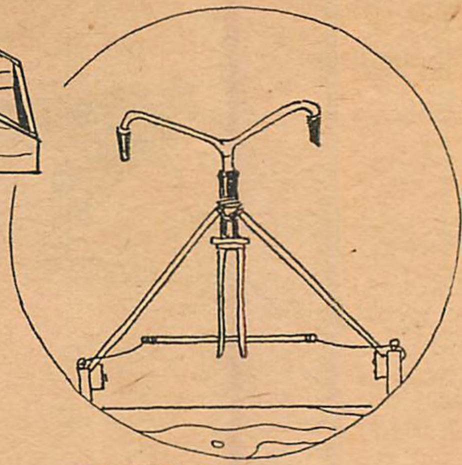
Through the holes in the bottom of the fork, run a small piece of wood about two feet in length. At each end of this fasten a small chain or cord, running it back through staples along the sides of the boat down to the rudder. You will find that this gives you as good control over the craft as the old style of rudder, meanwhile permitting you to put your weight against the handle-bars, as one does on a bicycle. If you use cord for the rudder line, be sure to wax it or dip it in tar, so that it will not rot in the water and give way when needed most.

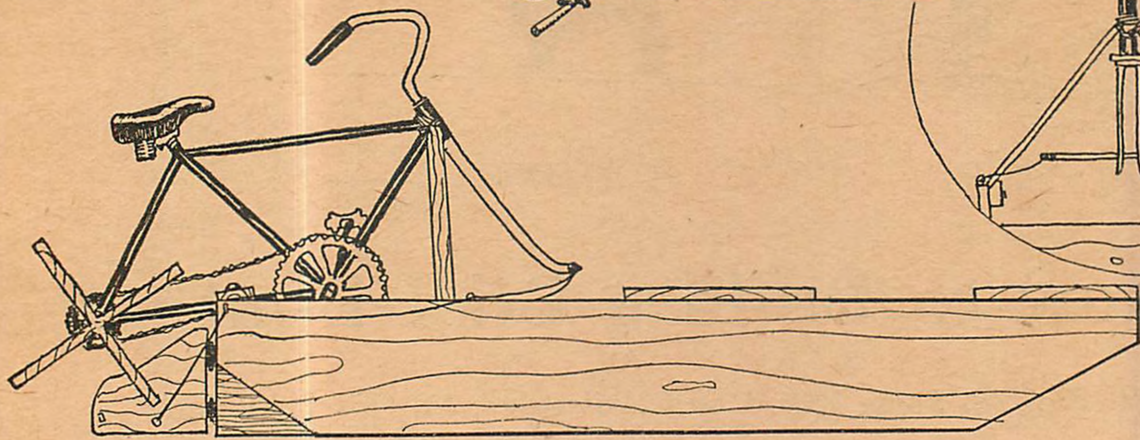
NOW that the bicycle is mounted satisfactorily, you are ready for the paddle-wheels and shaft. A metal shaft would be best, if you have tools and ability to work it, but the writer found a wooden shaft perfectly satisfactory on a bike-boat built several years ago and still in use.

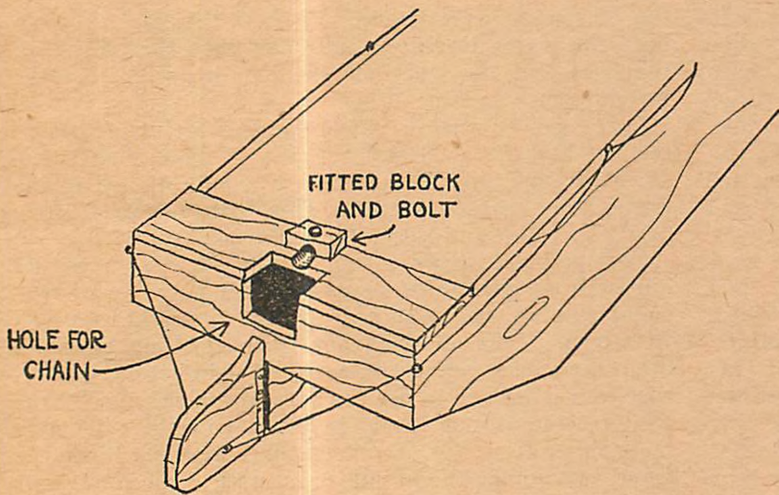
Drive your shaft through the sprocket, or the rear axle of the bicycle, so that it catches firmly. It is a good idea to drive nails in it when it is in place, so that it will be caught tight and will not slip in use, for the strain will come here.

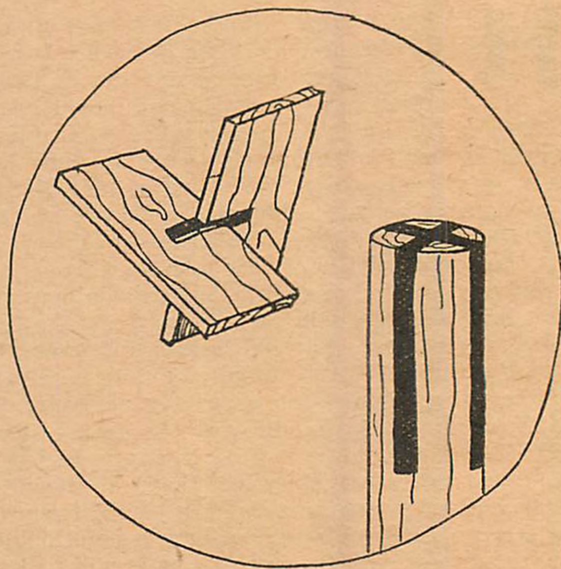
Saw an X slot at each end of this shaft, ten inches deep. Now make your paddle-wheels, as shown in the drawing, slipping them down into these X slots and forcing the wooden shaft tight (*Continued on page 54*)

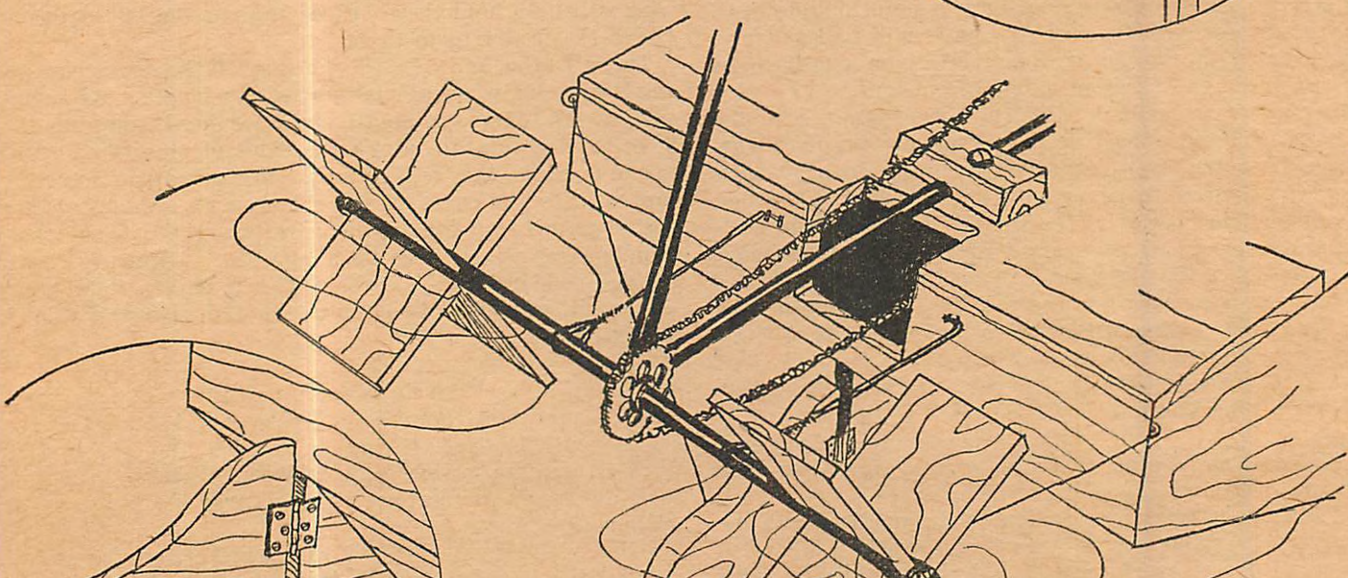







FITTED BLOCK AND BOLT
HOLE FOR CHAIN



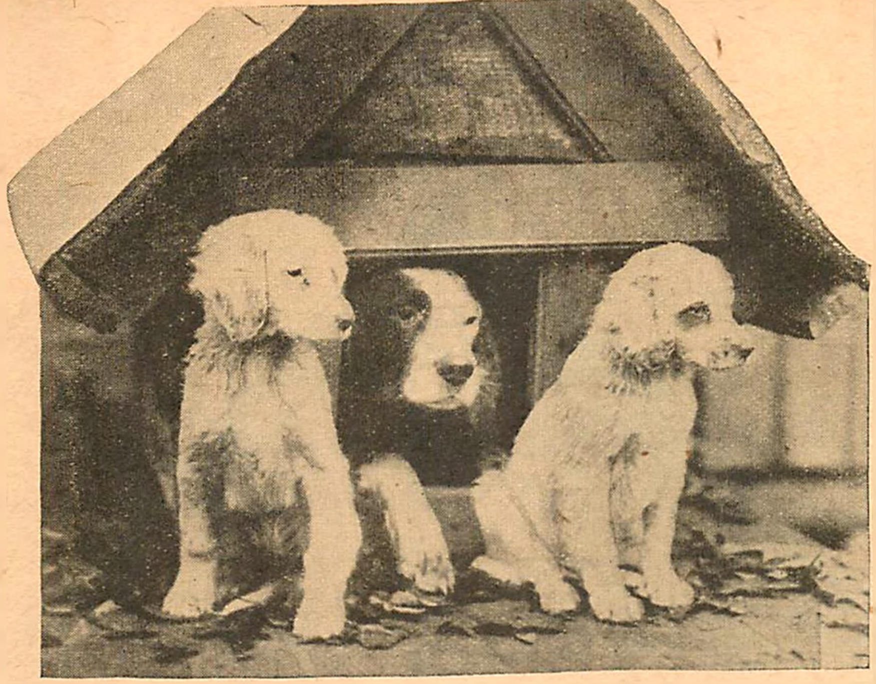


How to Build A Dog Kennel

An Inexpensive Winter Home for Your Pet

By E. P. Furth

See Plans on Pages 34 and 35



Pets like these are worth their weight in gold and deserve a comfortable kennel

THERE is one companion that every boy cherishes forever. That companion is a dog, the most faithful of all animals. The true lover of dogs is interested in his pet's welfare, especially its kennel. He wants it to be a substantial home, where the dog can sleep comfortably on cold nights. A good substantial house of this type that can be built by the average boy is given here.

Take your lumber as purchased from the lumber yard and lay out all lengths before cutting. All lengths as mentioned in the bill of stock can be procured from this lumber list if care is exercised. Be sure to cut all pieces square. Take the two 1″ x 3″ x 3′1″ and lay them down on a level surface. Place the two 1″ x 3″ x 1′6 1/2″ and lay them between the ends of the first two pieces.

Over these last two pieces lay the two 1″ x 3″ x 2′0″. Between the ends of these two pieces and over the 1″ x 3″ —2′8 1/2″ pieces. This will make a rectangle 2′0″ wide and 3′1″ long. Place a large square around the angles to see if everything is square. If so nail all pieces together. If any nails extend through the boards clinch them on the underside.

Next take the three 1″ x 10″ x 3′1″ ship lap boards and nail them to the frame just made. This makes the flooring section.

Next take three 1″ x 10″ x 3′1″ ship lap boards and two 1″ x 2″ x 1′7″ long. Take one piece of this ship lap and rip off the rabbitted edge. Look at the plan to see which is the inside bottom edge. Measure up from this edge 2 5/8″ and draw a line parallel to the bottom edge. This is the bottom of the 1″ x 2″ x 1′7″ inside corner nailing strip. Take this nailing strip and nail it to the inside of the bottom board, being sure to keep it fair with the end of the board.

Nail the other two ship lap boards to this strip. This will make one side. Duplicate these operations for the other side. Measure up from the bottom edge twenty-three inches. Rip off the top board and plane this edge to the shape indicated on the front sectional plan. Nail these two sides to the bottom on the long sides.

Take two pieces of 1″ x 10″ x 2′8″ ship lap and one piece 1″ x 10″ x 3′0″ ship lap. Place the 3′0″ piece between the 2′8″ pieces, keeping the bottom ends even with each other. Locate the center of the top side of this panel and draw a line up through the center board from bottom to top. Measure each way from this center line 12 7/8″ and draw lines parallel to the center line.

From the bottom of the center line measure up 2′9″ and from the bottom of each side line 1′ 11″. Connect up these points and you will have the shape of the ends. Saw and plane to these lines and you will have the end boards. Nail in place using the 1″ x 8″ x 1′ 10 1/2″ as a nailing tie whose bottom is 1′7″ from the floor.

On one end lay out entrance following the dimensions given on the front sectional plan. Also lay out a hole two inches in diameter at

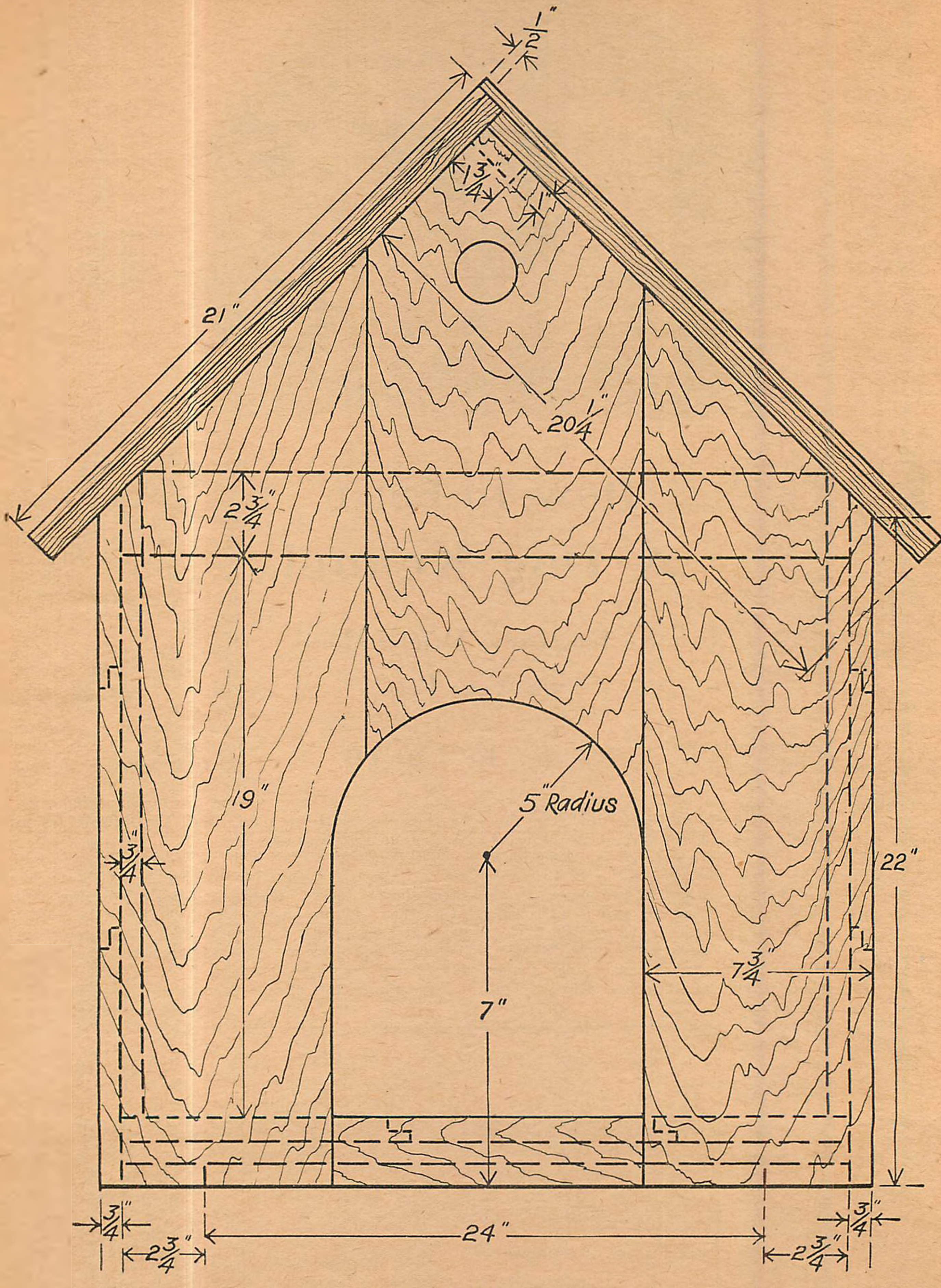
(*Continued on page 54*)

TIMBER LIST (FOR BUYING MATERIAL)

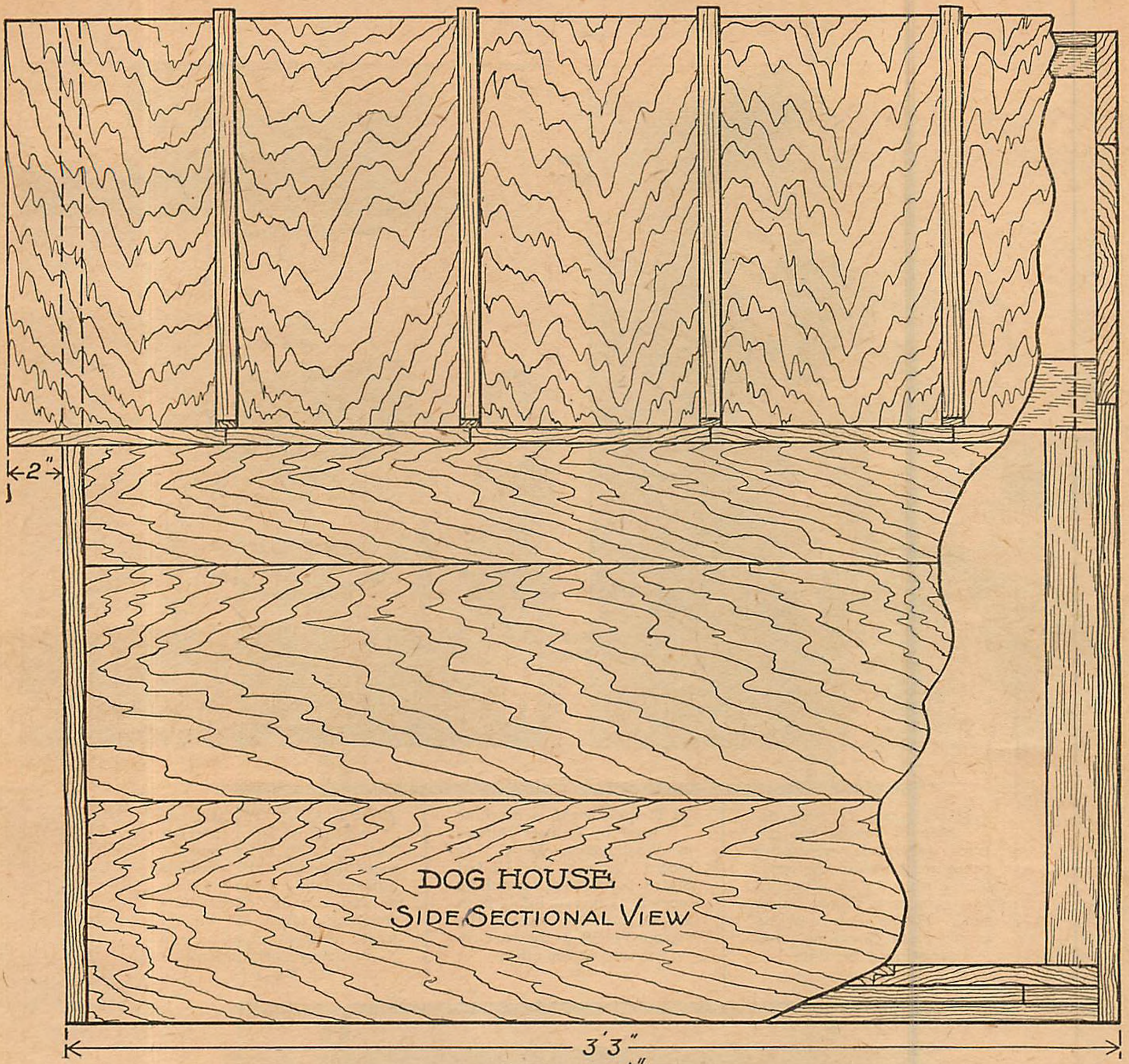
1 - 1″ x 3″ x 14′ 0″	2 - 1″ x 10″ x 12′ 0″ ship lap
1 - 1″ x 3″ x 16′ 0″	1 - 1″ x 10″ x 14′ 0″ ship lap
1 - 1/2″ x 2″ x 16′ 0″	2 - 1″ x 10″ x 16′ 0″ ship lap
1 - 1″ x 2″ x 12′ 0″	2 lbs. of 6 penny headed nails

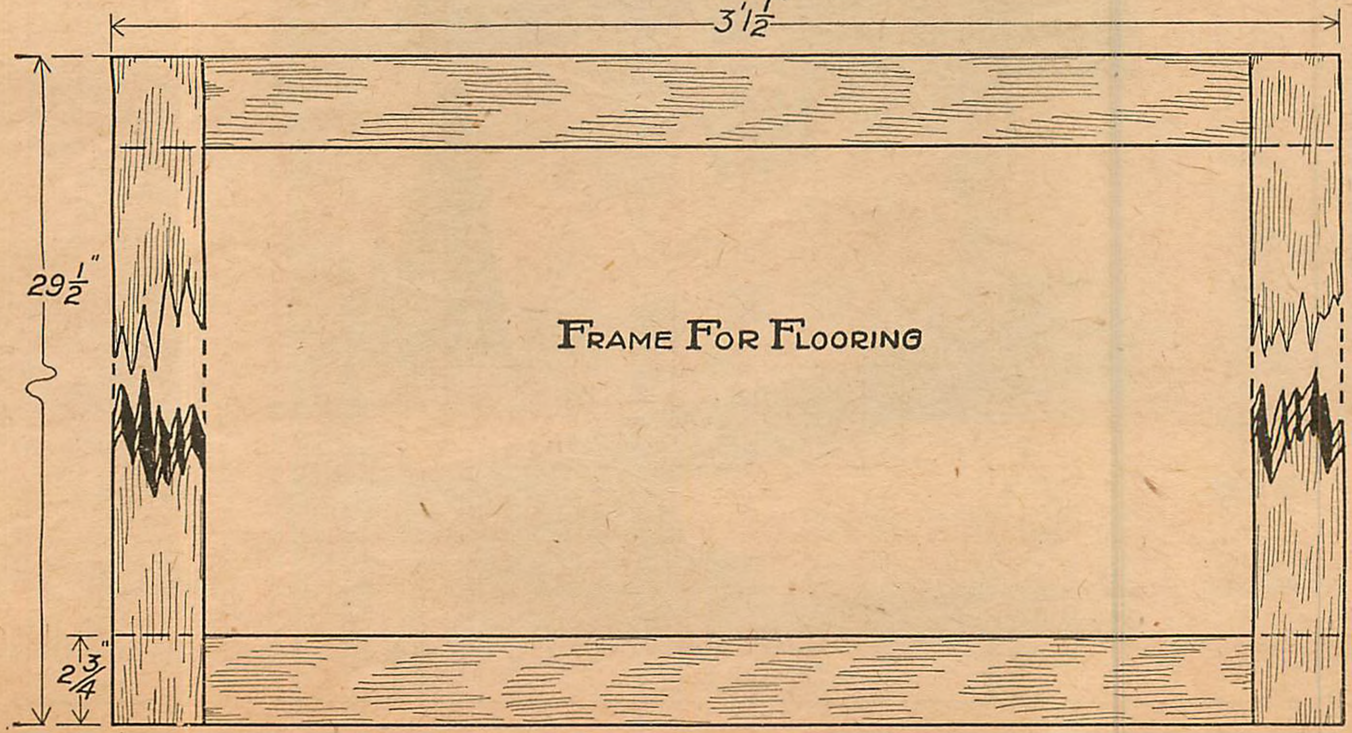
BILL OF STOCK (FINISHED DIMENSIONS)

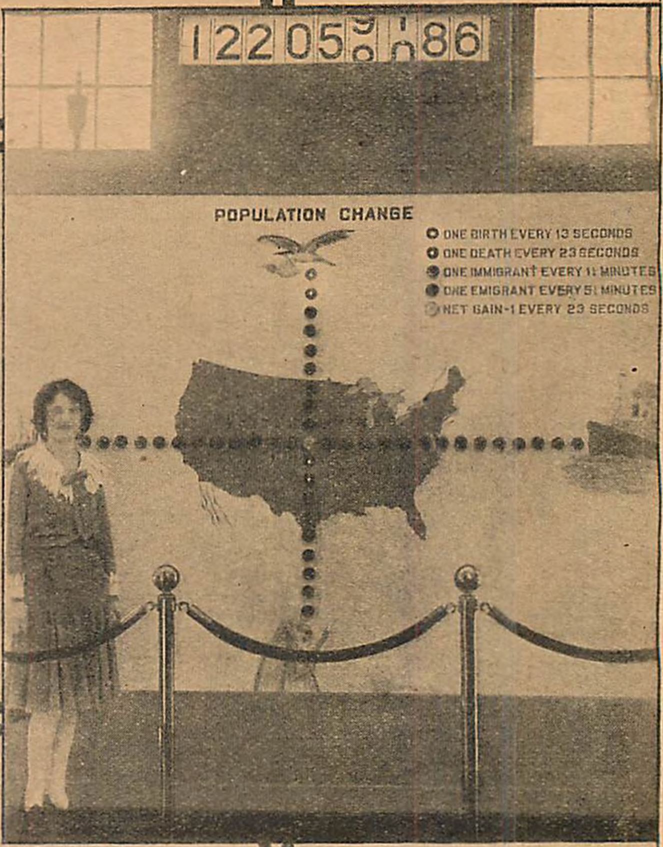
2 - 1″ x 3″ x 3′ 1″ sills	5 - 1″ x 10″ x 1′ 8 1/4″ ship lap roof
2 - 1″ x 3″ x 2′ 8 1/2″ sills	4 - 1/2″ x 2″ x 1′ 9″ roof joint strips
2 - 1″ x 3″ x 2′ 0″ sills	4 - 1/2″ x 2″ x 1′ 9 1/2″ roof joint strips
2 - 1″ x 3″ x 1′ 6 1/2″ sills	4 - 1″ x 2″ x 1′ 7″ inside corner strips
3 - 2″ x 10″ x 3′ 1″ ship lap floor	2 - 1″ x 3″ x 3′ 1″ inside strips for nailing bottom of roof boards
6 - 1″ x 10″ x 3′ 1″ ship lap sides	2 - 1″ x 3″ x 1′ 10 1/2″ inside nailing strips for ends
4 - 1″ x 10″ x 2′ 8″ ship lap ends	1 - 1″ x 2″ x 3′ 1″ nailing strip under roof peak
2 - 1″ x 10″ x 3′ 0″ ship lap ends	
5 - 1″ x 10″ x 1′ 9″ ship lap roof	



DOG HOUSE


2"
DOG HOUSE
SIDE SECTIONAL VIEW
3'3"


3' 1/2"
29 1/2"
2 3/4"
Frame For Flooring



HIGH speed camera capable of taking 400 pictures a second, twenty-five times greater than the speed of the standard motion picture camera is shown (upper left). This is used to photograph metal breaking after continued bending

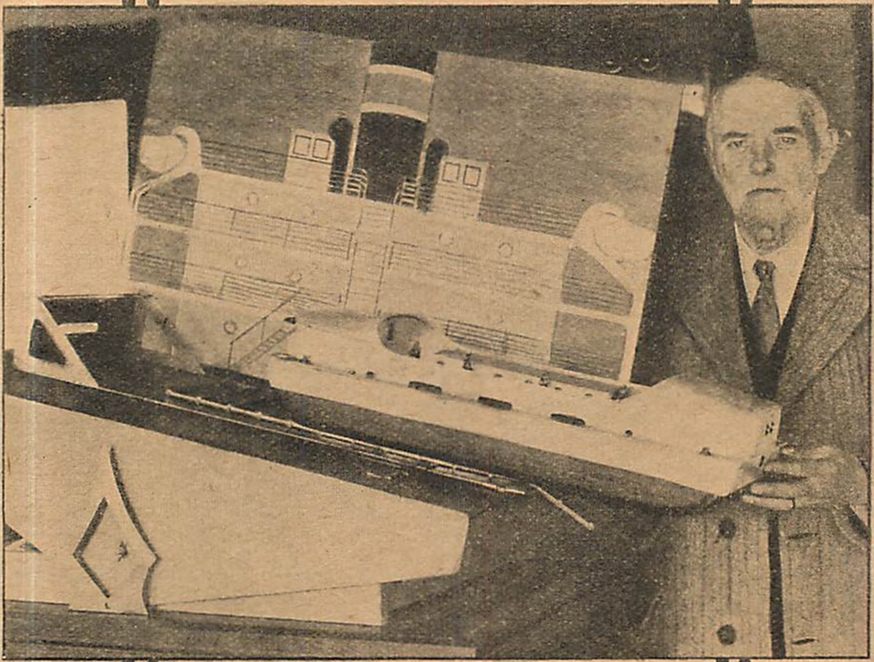
P & A

AT upper right is machine used by Census Bureau in Washington, D. C., to record growth of United States population second by second. Colored lights flash as the indicator records the various figures as they are received at the office

P & A

CAPT C. F. RODIN, inventor, of San Francisco, Cal., with his life saving device (below). It operates automatically, cannot founder and can be released by touching a lever. It will release itself automatically if the ship starts to sink

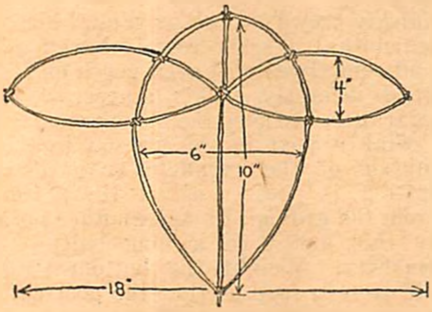
P & A



Handicraft Hints for the Junior Mechanic

Twenty-Two Useful Articles to Make

By STUART PALMER



CHINESE OWL KITE

THIS is a new type of kite which will outfly the diamond-shaped variety. Make the frame, as shown, of light reed or bamboo strips, binding them with string at all joints.

Cover the frame with stiff, light-weight paper. The paper is cupped, lapped over, and pasted. Attach it to the frame by narrow paper strips on the back side. Leave an opening in the tip of each wing, as shown, for the air to escape from the cup. The bridle string is attached at a point about three inches from the top of the upright piece, near the central joint; experiment only will show where to fasten the flying string.

It is important to note that, in cupping the wings, one starts at the lines where they join the body, then slope back until at the tip they recede about an inch. This type of kite needs no tail.

After successfully making and flying it, try another with double dimensions. Kites of this type have been made and flown with six feet wing spread!

A "SAIL-HO" WEATHER VANE

NOW for something different for the boat house or the boy who loves ships. It's a wind-vane designed from a two-masted ship at anchor, with the mainsail set and the head-sail furled.

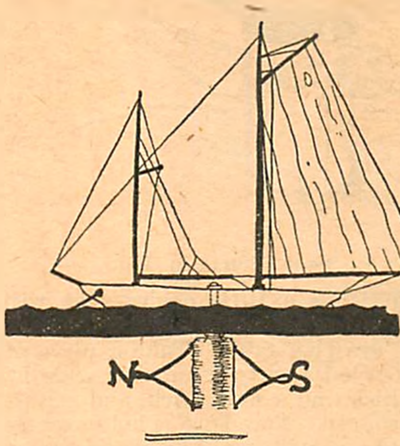
The hull, water, anchor chain and bowsprit are one piece of one-inch board. Point off the bow to a thin edge and shape the stern as much as possible. The masts are round, with a flat side on the mainmast to which the thin wooden sail is fastened with small galvanized brads. The booms are the same as the masts.

Make a shoulder on the masts about two inches from the lower end, as a sort of step, setting them in a five-eighths inch hole in the deck. The sail is of quarter inch wood and the rigging of copper wire. Both rigging and spars must be made larger than scale, so that they will show up from the ground after they become weather-worn.

Mount the vane on a piece of iron pipe for a spindle-bearing. The compass points may be cut out of tin and painted black.

The masts and spars are 7/8 inch stock, the ship itself twenty-four inches from bow to stern, and the water about thirty-six inches in width.

The ship will always sail into the wind, and if the sail is painted white and the water a blue-green, an attractive effect will be produced.

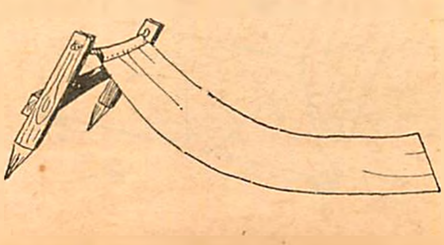


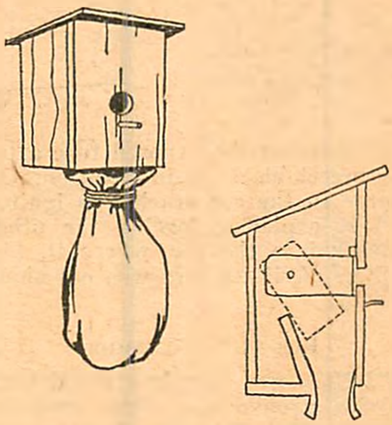
A BEACH LOUNGE

HERE we have a head and back rest which adds a great deal to lying on the sand, and which can be made in a few minutes from three hardwood strips and a piece of canvas.

The upright strips are two feet long and sharpened at the end so that they will stick in the sand easily. The cross-piece is twenty inches in length, and fastened securely with screws, not nails.

Drill holes in the tops of the uprights for the short length of rope, which runs through a hem in the six foot length of canvas, and is knotted at both ends to hold it in place. The canvas should be about sixteen inches wide. The whole affair can be rolled up easily and slipped under the seat of a car.





GET RID OF SPARROWS

ENGLISH sparrows, or, more correctly, "barn sparrows," are pests which drive away countless other desirable birds. In cases where poison is not safe on account of danger of chickens eating it, here is a device that will rid any building of sparrows in a short time, if placed near their nesting places.

A nest-box is made in the ordinary way, but with a square tin can so pivoted that when the sparrow enters looking for a nest, he will be dumped down a chute and captured in a bag. The tin can will then automatically return to its position, ready for the next bird.

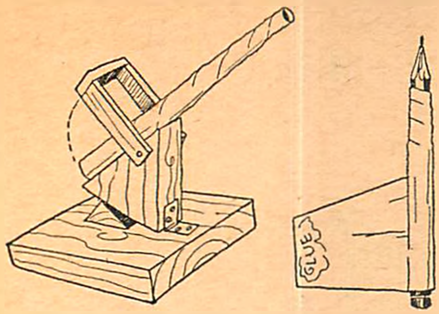
An excellent feature of this trap is that if, by chance, another species of bird should enter, it can be released without harming it when the bag is emptied. Results will be improved if the can is strewn with a few sparrow feathers to lure them on.

A FIRECRACKER CANNON

THIS harmless toy provides some real thrills. Get firecrackers the same size as an ordinary pencil. Then wind paper around a long pencil as shown, pasting the end tight. This will be the barrel of the cannon using a piece of paper seven inches by thirty-five inches.

Glue this to the top of a triangular block of wood which is hinged to a three by five inch base. Use a smaller triangle as shown to change elevation. A U-shaped breech-block is made so that it fits closely on the end of the barrel when shut, swinging on nails.

Two firecrackers are required to fire the cannon. Cut off the fuse of one short and push the cracker up in the breech, fuse to the rear. This is the "ball" of the charge. The second firecracker is cut off at the end opposite the fuse just above the plug and then shoved in the breech behind the other, allowing its fuse to protrude over breech-block to the rear.



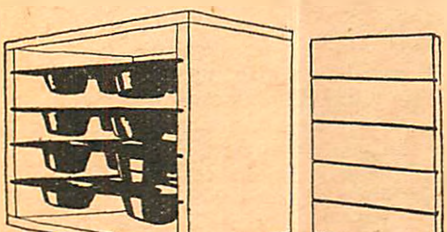
By lighting the exposed fuse after the breech-block is in position, the charge in the cut cracker is ignited and it explodes, forcing the other cracker into the air, where it, too, will go off if its fuse was cut short enough!

For the Workshop

THERE are countless small articles around the shop, such as screws, nails, brads, beads, etc., which have a way of getting lost or spilled. Here is a simple little cabinet which takes only a short time to build and which will keep all these elusive gadgets where you can reach them in an instant.

Make a stout box of wood, about seven inches wide, ten inches deep, and sixteen inches long, inside dimensions. Before you put the rear of the box in place, saw grooves as shown in the illustration; one-eighth inch wide and one-fourth inch deep, spaced about two inches apart on the sides. Now finish the back of the box.

Now get four biscuit tins, or muffin pans. As a rule these are rectangular, and seven and a quarter inches by ten and a half inches. Slide the biscuit tins in on your grooves, and they will make perfect shelves. The round depressions, three and a half inches in diameter, will hold any ordinary sized nails or brads. If you wish, it is easy to put hinges and a door on the front, completing the cabinet.



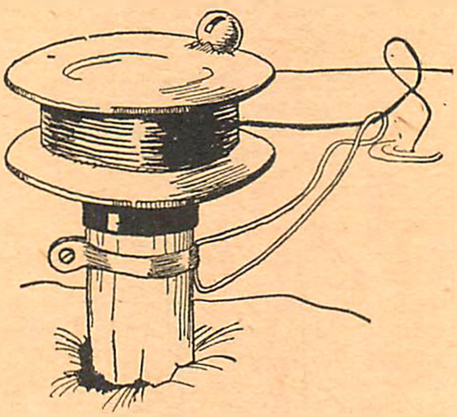
Automatic Fisherman

TAKE the roller from an old window shade, pointing one end of lid above it to form a spool. If desired, a tiny bell may be soldered to the stick so that it can be pushed in the ground. Now take two flat syrup can lids, and one baking powder top. Cut a slot in one of the syrup lids to fit the notch on the shade, and solder it in place. Now solder the baking cup top in place, and the other flat the top to give a warning of a bite.

A piece of wire twisted to make a small-eyed bracket is clamped to the roller just under the reel to serve as a guide for the line.

The end of the fish-line is tied to the reel and wound around, then pulled out until tension of the spring is strong. Now allow the catch to lock, and throw out the baited line. Give the reel one turn to the left so it can take up the shock of the first bite.

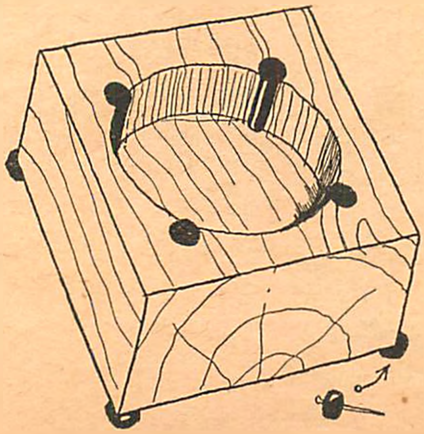
When a fish pulls, the catch is released and the line is jerked by the spring so that the hook sinks in. The reel will play the fish as long as he pulls on the end of the line, reeling in and then out.

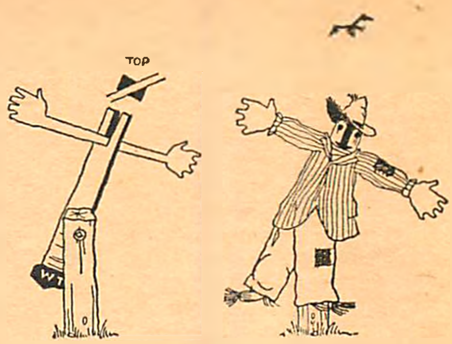


Stop Spilling Ink

HERE'S a little device that will prove its worth around the desk and drawing table. Take a piece of soft wood about four inches wide by an inch and a half thick, and saw it off square. Now bore a hole exactly in the center, making its diameter approximately that of the ink bottle you use most. Only bore the hole part way through the block, leaving about a quarter of an inch for bottom.

Now bore four one-quarter inch holes around the circles as shown in the drawing, and insert pencil erasers. These will hold the bottle fast. and allow using one of smaller size if necessary. On the bottom of the block, at the corners, nail four half-erasers, to prevent slipping or scratching the desk surface.





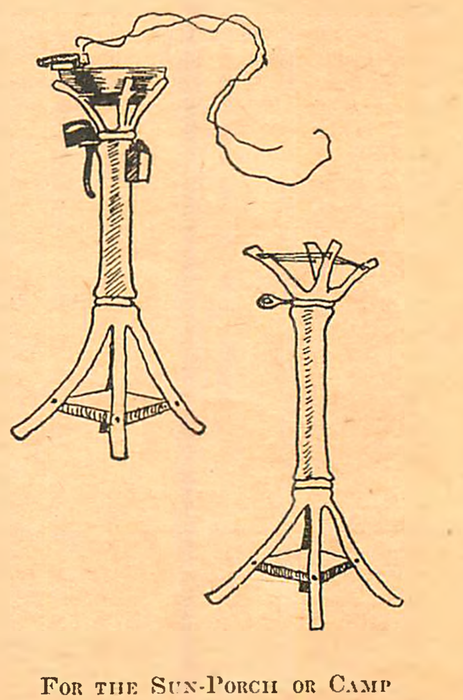
A "Live" Scarecrow

HERE'S a good kink for the farm boy. Everybody knows how quickly crows and other vandal birds learn that a scarecrow is harmless, and sometimes will even perch on its head defiantly. This scarecrow is guaranteed to keep the birds guessing.

Sink a post in the ground in the middle of the cornfield or garden, letting it project about three feet from the ground. Fasten another post to this one with a long bolt and washers. Weight the bottom with old iron or lead so that the post will swing easily, but still return each time to an upright position.

Saw a slot in the top of the second post on an angle, and insert a stick of wood with shingles on either end, carved to look like hands. Then dress up the scarecrow in the usual old clothes stuffed with straw.

The least breath of wind will make the propeller-like hands sway the entire figure, and the scarecrow will appear to be frantically shooing away the birds. Crows never get used to this, either.

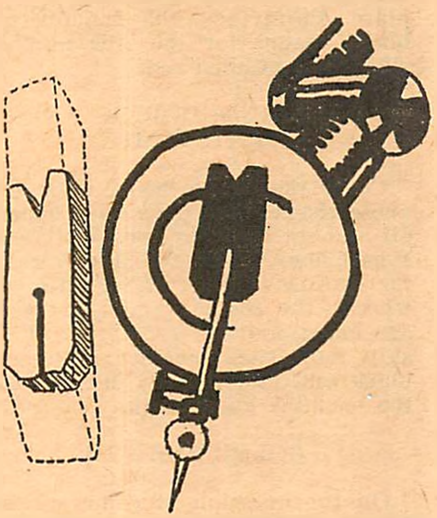


For the Sun-Porch or Camp

TAKE an ordinary piece of bamboo or cane which is at least an inch and a half in diameter, and two feet long. Saw the butt in quarters up to the first joint, spread the four legs apart, and insert a heavy block of wood. Fasten it in place with screws, and shorten legs as necessary until the thing stands erect.

Now split the upper section in the same manner, spreading the ends. Hold them in position by a heavy wire run through holes bored in their ends. A couple of screw eyes may be run into the joint to hold pipes, and a box of matches thumb tacked through the inside to the upright.

Any large ash tray will fit in place on top, and the stand is complete. If it shows signs of being easily tipped over, add weight to the bottom by placing some heavy object on the wood block.



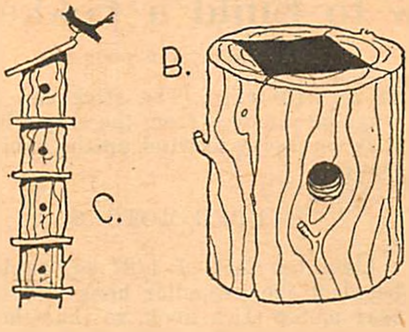
A Victrola Mute

LATE at night it is a good thing sometimes to reduce the volume of the phonograph for the sake of neighbors or other members of the family. Here is a quickly made rubber mute which does not give the boxed up effect that shutting the sound doors gives. It is cut as shown from a five cent soft pencil eraser, split halfway up on one end and notched on the other.

A Bird Apartment

HERE is a novel bird house originally planned for martins, but which will serve equally well for any other of our feathered friends. Procure a log, preferably of light wood, which is at least nine inches or more in diameter. Bore holes every twelve inches, with an inch drill for wrens, or an inch and a half or more if other birds are desired. Saw through the log between holes, as in diagram "A".

Now split the chunks, first in half, then in quarters, and then chop off the inside triangle of each quarter. Put the four pieces together, nailing them to a board at the bottom, and they will fit perfectly, with a cosy space inside. See "B."



Nail one on top of the other, and mount the edifice on top of the unused portion of the original log, or elsewhere. It is a good plan to saw the top block on an angle, so that a slanting roof will be provided.

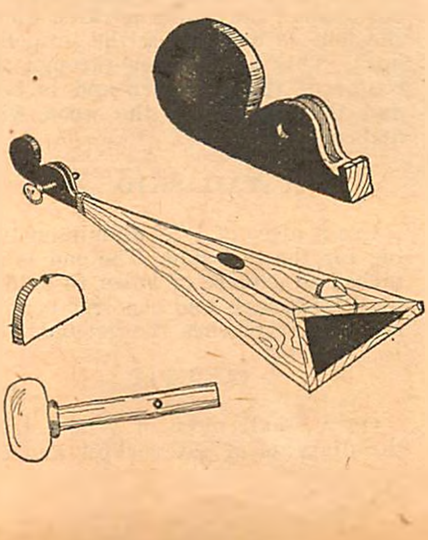
Birds have no objection to living together in this manner. They will like the apartment even more if a vine is trained around the column to make it more tree-like.

A Chinese Bugle-Violin

THIS looks harder to make than it really is. First make the three-sided sound box, gluing the pieces together. The neck should be cut to fit inside a narrow piece of wood glued in place before the top is on. The scroll is made out of a single piece of soft wood, with a slot cut for the peg-box as shown. Bore a three-eighths inch hole completely through both sides of the slot. The peg should be larger, and sand-papered down tapering so that it fits tightly. Drill the tiny hole for the string after you have found where the peg fits.

The bridge is simple to make, with a notch in the top. Use an ordinary gut 'cello string, knotting one end and making it fast to the notch in the end of the top sound board. An inch hole in this board about a third of the way toward the neck will increase the volume of tone.

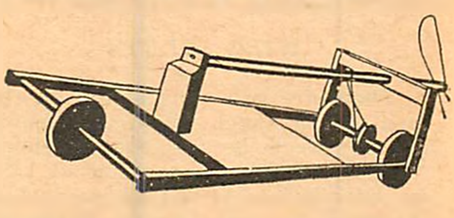
You will be surprised at the sweetness and powerful tone of this little Chinese instrument, when played with an ordinary violin bow. Practice will show you how to play the scale, and then to pick out tunes.



A Wind-Wagon

THIS novelty toy will perform astounding feats on a smooth sidewalk, because it works on an unusual principle. It requires only a few pieces of soft wood and some tin for the propeller blades.

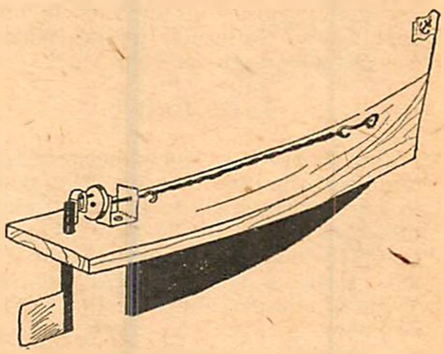
There are three wheels, about two inches in diameter, made rigid on the axle by driving them through a hole exactly in the center. The axles are held to the frame by nails driven in them through holes that serve as bearings. The propeller shaft is



mounted in the same manner in the upright at the rear, and runs through the cross-piece in front, extending about two inches or more.

The propeller may be of the two or four blade variety and is put in place, by splitting the shaft end carefully and binding the tin in shape. Twist the blades in the regular way, giving them a steep pitch. A stout cord, twisted over the propeller shaft and run around the pulley between the front wheels, transmits the power of the wind to the wheels.

On a smooth sidewalk this little wagon will drive itself directly into the wind, because the power of the windmill propeller is stronger than the pressure of the wind against the wagon!



A Boat That Sculls

THIS little "water-skate" operates on an entirely different principle, though its motor is the usual rubber-band. The hull is made as shown, with a good-sized vertical keel made of tin and fitted to the bottom.

The propeller-rudder is mounted on a wooden bearing which rises through the stern and which is fastened to a slotted tiller, which engages the crankpin made of a nail and driven through the wooden fly-wheel. The fly-wheel is mounted on an axle which extends into a hook for the rubber motor.

As the rubber unwinds, the fly-wheel spins, giving a sculling motion to the propeller and sending the boat ahead.

How to Build a Fokker-D 7

(*Continued from page* 19)

STABILIZER

This is made from 1/8″ sq. hard balsa and 3/32″ reed. Cut the necessary parts as shown in drawing. Place the parts over the drawing and put together with pins and ambroid. Wire can be used as hinges to attach the movable parts of the back section. The entire stabilizer is then attached to the fuselage with ambroid.

WING STRUTS

There are two wing struts on the end of the wings which are known as "N" struts because they resemble that letter. These are made of 1/8″ sq hard balsa. After this is attached to the wing, paint it black. There are four more struts attached from the fuselage to the top wing made of 1/8″ x 1/16″ bamboo, which are ambroided to the fuselage. When the wing is ready to be attached, they are put in the small balsa braces and ambroided in place.

LANDING GEAR

Use 1/8″ aluminum rod shaped to size as shown in drawing. Bend slightly at the ends so that when attached to the body, it will fit right in the landing gear braces. The axle of the landing gear is 7″ long. Before attaching to the landing gear, ambroid the lift bar to the axle. Then attach this to the landing gear by wire and ambroid. The landing gear is then ambroided to the landing gear braces. After this is dry install the celluloid wheel, which has already been painted black.

LIFT BAR

The lift bar is attached between the middle of the landing gear. This part is greatly responsible for the flying qualities of the model and must be carefully made. Cut out a strip 1″ x 5″ from a sheet of 1/4″ balsa. With sandpaper shape it like a rib as shown in drawing. Then make a notch across the front part of the whole lift bar so that the axle will fit in. Ambroid it to the axle and put away to dry.

MOTOR STICK

This is made from 1/8″ x 1/4″ x 15″ spruce, as shown in drawing. The propeller bearing is fastened on with thread and ambroided in place. The rear motor hook is made of number 14 piano wire as shown in drawing. This is also fastened with thread and ambroided 1″ from the back end. Dress snap fasteners are used, as shown in the same drawing, to hold the front part of the motor stick. To hold the back end of the motor stick, make from a piece of 1/16″ balsa, 1″ x 1″, a small hole 1/4″ x 1/8″ so that the back end of the motor stick can fit in with ease. The stick can always be removed from the ship when it is necessary to wind up the rubber motor.

RUBBER MOTORS

Loop ten feet of 1/8″ sq. rubber between the propeller hook and the rear motor stick hook, so that there are eight strands. Then tie a square knot in the rubber and the rubber band motor is installed. By making a small "S" hook of number 14 piano wire it will be possible to do all winding with a winder and get more power from the propeller, thus producing longer flight than with a hand-wound motor.

Trans—Atlantic Airman Praises Study of Radio

"Wonderful Field for Experiment," says Stannage of "*Southern Cross.*"

MODEL AIRPLANE NEWS is happy to present the following message to all model airplane enthusiasts and all boys whose ambition is to succeed in the field of aeronautics.

The message, an exclusive one to the magazine, is from John S. W. Stannage, radio operator with Wing-Commander Charles E. Kingsford-Smith, the famous Australian airman, on their recent successful crossing of the Atlantic Ocean from Ireland to Harbor Grace, Newfoundland.

"Tell your Sky Cadets," said Mr. Stannage to Mr. E. J. Moriarty, Assistant-Administrator of the American Sky Cadets, "that they should turn their studies to radio, as this undoubtedly will play an important part in aviation in the future.

"There is a wonderful field for experiment for the amateur in the elimination of induction from the magnetoes, without having to screen the ignition system."

Now, there is something to think about. You enthusiasts of today comprise the scientists of tomorrow, and there is no time like the present to start the ball rolling towards a successful career!

The Editor.

PROPELLER

The propeller is carved from a pine block 5/8″ x 1 1/2″ x 8 3/16″, as shown in drawing. Sandpaper down to a very fine finish, being careful not to spoil the center marking where the hole is drilled for the propeller hook. This hook comes through the center of the propeller and is bent and then placed in the wood with ambroid.

TAIL SKID

Use a piece of 1/8″ aluminum tubing for the tail skid. The end is attached to a piece of balsa to hold it to the fuselage and the rest bent to shape that reaches the ground.

COCKPIT

On a small piece of veneer trace the diagram of the cockpit and cut out the inside. Paint it black and then ambroid to the fuselage with a slight curve.

MACHINE GUNS

These are models of the Spandau machine guns and are made of 3/8″ x 2 5/8″ balsa. They are rounded on top and slightly straight on the side. After sandpapering, drill a small hole in the front so that it will admit a piece of 3/32″ round wood. Insert the round wood and ambroid in place. Paint the whole machine gun black, except for the tips in front which are painted red.

COVERING, DOPING AND PAINTING

Cover the entire model with Japanese tissue, then dope with banana oil and set aside to dry for at least a half hour. Then the ship is ready for painting. The "N" struts, the wheels, the cockpit and the crosses are black, and the remainder of the ship red. The propeller is painted black and red, the lift bar red and the machine guns black.

COLOR SCHEME

On the question of color schemes for the Fokker D-7, or any other model plane for that matter, it is often best to use your own judgment.

When von Richthofen flew in this type of machine he preferred a blood-red color for the whole plane, with the German cross in black. However, many of his "Circus" planes were camouflaged in many colors—black and white checks, red and black checks, green, brown and yellow stripes, and so on.

Whatever colors you use, however, be careful that the paint is spread on thinly in order to eliminate extra weight, which detracts from the flying qualities.

INSIGNIAS

These are made of black paper cut out to the same size as shown in drawing. Paste two on the top part of the top wings and two on the lower part of the lower wings. Paste one on either side of the fuselage and one one either side of the rudder.

FLYING

See that the model is well balanced and that the day for trial flight is not windy. Wind the rubber up to one hundred turns. Then let it take off by giving it a slight push. For the next few flights give it more turns of the rubber band, giving the model greater flight and more endurance. If the model seems nose heavy, adjust by moving the stabilizer up or down, or putting a weight in the back to balance it.

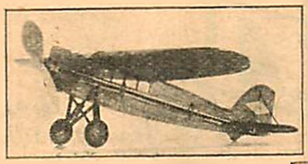
NEWPORT, KY.: "I think the Cleveland Model & Supply Co. has the best catalog and best collection of Scale Model Drawings in the country." (Name on request).

(left)
PRIMARY TRAINING GLIDER AND ADVANCED SOARER
Kit No. FL-101. Spans 13⅝'' and 18¾''. Lengths 7'' and 7½''. Colored: Red, White and Blue.

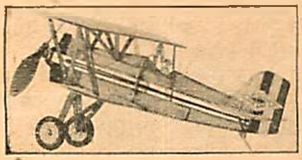
"Cleveland Blue Diamond"
Symbol of honest quality, reasonable price, and speedy 6-hour service.

(right)
GREAT LAKES TRAINER
Model FL-102. Span 10''; length 7¾''. Orange and Black. *Record of 34 Outside Loops.*

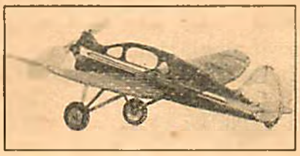
(below)
EAGLEROCK BULLET
Model FL-105. Span 14⅝''; length 8⅜''. Blue and Red. *Winner of Phila. to Cleveland Air Derby.*



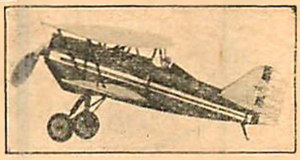
(left)
FLEETSER HIGH WING MONOPLANE
Model FL-103. Span 16⅛''; length 12⅛''. Green. *One of fastest commercial cabin planes.*



(left)
BOEING FIGHTER
Model FL-104. Span 11¼'', length 7⅝''. Silver and Blue. *Latest Army Fighter*



(right)
CURTISS HAWK
Model FL-106. Span 11¾''; length 8⅞''. Yellow and Olive Drab. *Well known Army Fighter*



The Year's Sensation in Models

New Air Line of 12 Cleveland-Designed Free Lance Kits Now Ready (*Patents Applied For*)

Here they are! The entire FL-100 Cleveland Air Line! 12 models—all balsa models—every one has perfectly proportioned outlines! These models are keen in their originality—every one designed and produced in the engineering laboratories of the Cleveland Model & Supply Co., of which Capt. Holden C. Richardson (formerly Chief of Design Section, U. S. Navy) is Chief Engineer. They may be called *Profile-Fuselage Scale Models.*

Easy to Build

As easy and simple to build as the small stick models. And fly—oh, boy—you should see them! When completed and colored, they're the prettiest little planes you've ever laid eyes on. If *you* are a *real* Cleveland Model Engineer, you cannot afford *not* to build them. After you have built two or three, you will never be satisfied till you have the balance of the line—that's the hold these clever little Free Lance Models get on you!

Entirely New Features

Each Kit contains a large, easy-to-understand drawing with everything drawn full size (as do all our model drawings) and a large photo of the model in the center—you absolutely can't go wrong. Also a separate detailed sheet of instructions, more-than-enough balsa wood, Japanese tissue, banana oil, cement, different colored dopes, Cleveland Air Line labels with other materials. Only one wire fitting needed, too, but usually three are used. And last but not least, an entirely new method

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(Modeled after Sikorsky)

This new FL-301 Kit is now going strong. Everything drawn full size, and complete detailed instructions tell how to build it. As easy to build as the Trainer. Kit complete, $3.30 postfree.

New GREAT LAKES SPORT TRAINER

kit now ready. Due to tremendous demand, our production costs have been reduced, so instead of the $6.60 advanced price, we can offer it for only $5.50 postfree. Ask the fellows who built it, or send for our catalog. Can be purchased on Cleveland Time Payment Plan—"A-Dollar-And-A-Dime each Month."

RECORD BREAKING FLIGHT

of 3,608 ft. R.O.G. for a scale model made with our Sport Trainer by Joe E. Powalski, Cleveland, Ohio. Let us know what distance your model will cover. Snapshots are welcomed, too.

of propeller making. Hubs that look like steel propeller hubs are supplied, drilled and slotted for the blades which you cut from 1/16'' flat stock and cement in place. Now you can forget your propeller worries.

A Pilot in Each Model

For the first time in commercial history, we are placing pilot's heads in flying model airplanes. The effect is startlingly real.

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Select whatever models you wish right from this page, and send only $1.25 for any one Kit, or order the entire FL-100 line for $13.25 (a saving of $1.75). The FL-100 line with a Cleveland Amphibion Kit will be shipped immediately upon receipt of $16.00 (a saving of $2.30). To avoid delay, send your order NOW.

A Suggestion

As a starter in building the FL-100 line, we recommend the FL-101 first. There is no propeller or power to contend with for practice work, and you get two models for the price of one.

Send for Notebook and Catalog

These are going like hot-cakes and the supply is limited. Send 25c (no stamps) for yours right away to avoid disappointment. (We have no free lists).

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Model Engineers

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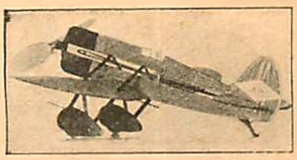
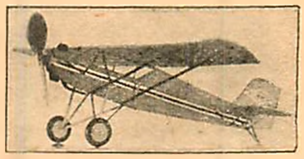


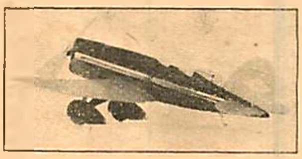
(left)
TRAVEL AIR MYSTERY SHIP
Model FL-107. Span 10⅛''; length 7¾''. Red and Black. *Capt. Hawk's Record Transcontinental Plane.*

(right)
CURTISS ROBIN
Model FL-109. Span 15⅝''; length 10''. Yellow and Orange. *Former World's Record Endurance Holder —420 hrs.*



(right)
VOUGHT CORSAIR
Model FL-110. Span 13½''; length 9⅜''. Silver and Blue. *Popular Navy and Marine Flyer.*

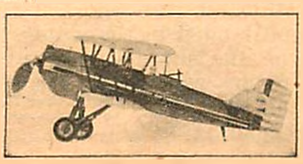
(above)
BOEING MAIL PLANE
Model FL-108. Span 16⅝''; length 12¼''. Silver and Blue. *Used on many Air Lines.*



(left)
LOCKHEED SIRIUS
Model FL-111. Span 16⅛''; length 10⅜''. Orange and Black. *Lindbergh's Famous Ship.*

"Cleveland Blue Diamond"
Symbol of honest quality, reasonable price, and speedy 6-hour service.

(right)
CURTISS FALCON
Model FL-112. Span 14¼''; length 10¼''. Yellow and Olive Drab. *Army Observation Plane.*



WENATCHEE, WASH.: "The Great Lakes Sport Trainer which I purchased from you won 'First Place' as an exhibition model in a Boy Scout Carnival." (Name on request).

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Special Course in Air Navigation

(*Continued from page* 9)

5. A magnetic compass will fail to indicate true direction during very steep turns or while the speed of the plane is being considerably altered.

THIS MONTH'S QUESTIONS

1. If your compass readings were as follows, how much adjustment would you make for north and south deviation, and how much for east and west deviation?

Magnetic	Compass
N. (0°)	350°
E. (90°)	95°
S. (180°)	184°
W. (270°)	258°

2. In question 1, which positions would you set the correcting magnets in, and with which poles forward.

3. What points would you look out for in selecting the site for a compass swinging base?

4. What conditions would be caused through a lubber line being incorrectly fixed in a plane, and how would you adjust for it?

5. Make a list of all the principal points you would observe in the care and maintenance of compasses.

The American Sky Cadets

(*Continued from page* 21)

days of toiling. When I was notified that I couldn't go my patience was exhausted, and I decided right there and then that there was one thing to do and that was to borrow the balloon without the professor's consent.

"THE swaying gas bag was to bounce from the earth at 3 o'clock at which hour forty thousand people had attended the opening of the new park only to find that three hours prior to to their arrival the balloon had started on its journey with a lone boy. Three bags of sand were suspended to the side of the car. As I stepped into the basket I cut the main rope with father's hunting knife, and in an instant I was whirled away. First, I sailed in the direction of Lake Erie. After sailing out perhaps twenty miles over the water an inward current picked me up and I started inland. An hour and fifteen minutes later, I struck the side of an old grist mill at Akron, Ohio. A bag was knocked from the side of the car and I bounced upward on my second journey. As word was sent out that a balloon had broken away at the Cleveland resort with a boy in it, a lady who was located on the scene close to where the balloon had struck stated to the press that the boy asked her where he was and she told him it was Akron. I disposed of sand and sailed away.

"The truth of the story is that I never saw or talked to this lady, I was so frightened when I struck out that I was unable to move. The sand was knocked from the side of the car and in disposing of this weight it is natural that I should have ascended again. A half hour later I descended into a large oak tree at a place called Myers Lake, Canton, Ohio. I was knocked from the car and landed in the water, fortunately on the shore line in water only up to my waist. In less time than it takes to tell the story, people were rushing to me from every point of the compass. A farmer asked me if the balloon broke away and I replied that it did. I held to this story to save myself from getting a good spanking when I arrived home."

Well, there's one bunch of youthful aviators having a roaring good time and they are the early birds who joined the *New Haven Times* Squadron of the American Sky Cadets.

Mr. Tom Wheeler is the leader of this club, and he certainly knows how to get things going.

The club has only been formed a few weeks and already there is a membership of more than 100.

The *New Haven Times* is running a daily column for the Sky Cadets entitled, "Happy Landings" and through this column the members are kept in touch with the latest developments in aviation and also are advised of the club's activities.

And what activities! No sooner is the club formed than Tom Wheeler has an outdoor showing, at his home, of War Department films dealing with aviation.

On top of that, along comes a letter to the club from the Refrigerated Paramount Theatre in New Haven, inviting the members to a showing of the famous picture "With Byrd at the South Pole" and free seats for all Cadets at that.

How interested the Cadets were in this film may be judged from the fact that they sat quiet and tense with excitement, during that part of the film showing Byrd's plane fighting its way to the Pole, and when at last the moment of success arrived, the audience of boys arose and cheered.

Next in the club's activities was the Model Plane Contest, the winners being:

INDOOR TRACTOR

First—Jerome Chichester
Second—Alex Radzay
Third—Irving Maurer

(*Continued on page* 41)

Be Original

Design Your Own Model Plane

Learn the thrill of the first successful trial flight of a plane you have designed yourself, one that from the first plans to the final check-up is all your own—not merely a plane you only put together, just like hundreds of others. You can learn to design winning model planes easily.

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HERE ARE THE FACTS you have been looking for about model aircraft building: The tools you need, and how to use them—the best materials and where to get them—how to lay out, carve, and balance propellers—how to solder a tight joint—how to make metal parts such as designers use on scientific models—the best way to put on your fabric or paper wing-covering—MONEY-SAVING, RESULT-PRODUCING facts that will enable you to build prize-winning models.

"Building and Flying Model Aircraft" is the *official book* of the Playground and Recreation Association of America—an association that carries the endorsements of Lindbergh, Wright, Byrd, Henry Ford, Adams, Guggenheim, Amelia Earhart, and many other celebrities. It tells you exactly how to build fifteen different types of model planes, gives you practical instructions on sixteen more, and prepares you to work out *your own* models. There is much valuable information on ornithopters, helicopters, etc.—facts that can start you pioneering into new fields of Aviation research. There are big, useful chapters you can't afford to miss on carrying-cases, repair kits, winders, compressed-air motors, accessories, and equipment that professionals use—refinements that often mean the difference between success and failure.

300 pages and 198 big illustrations made this one of the most valuable model books that any builder can have. The author is a member of the staff of the U. S. National Museum, the famous Smithsonian Institute, and Model Editor of the nationally known U. S. Air Services Magazine. Long and successful experience with models qualifies him to write an *authoritative* book—equal in every way to the 23 other aeronautic publications of The Ronald Press Company. These practical aviation manuals are written by the most famous experts in the world. They are standard in flying schools, airports, and factories all over the world. Designers of big transport planes rely on them for accurate information. *You* can rely on "Building and Flying Model Aircraft" for practical, result-proved facts about models.

If you are looking for success with your planes, don't cut another piece of balsa, or bend another stick of bamboo until you have this useful builder's manual right at your elbow. Send for your copy today, and see just how thorough and practical it is.

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Airplane Flight and Design What an Airplane Does, and Why

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The manual discusses the air and the airfoil, airfoils and air flow, stability and control, propeller effects, accelerated flight, the earth's atmosphere and the effects of altitude, parts of an airplane, weights and dimensions, etc., etc. It is a concise, absolutely authentic explanation of the airplane in flight—of WHAT an airplane does, and WHY.

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Our Country Club Twister Rubber Lubricant increases the number of turns from any rubber motor by 25 to 50%. One oz. 20c. Two oz. 32c.

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"Our latest discovery, a liquid which fills up the pores in balsa wood giving it a shiny appearance, strengthens the wood materially, adding but very little weight. 2 oz. 22c; 4 oz. 40c."

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Two oz. Genuine Ambroid Cement, colored or colorless, or two ounces Unitite Cement—25c.

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Rustproof Piano Wire, No. 6, No. 9, or No. 11—Two ft. per cent. No. 20—One ft. per cent.

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Aluminum Wheels with Balloon Tires 1 1/2"—13c each, 1 3/4"—15c each, 2"—17c each. Featherweight Celluloid Wheels, 1 3/8"—8c each, 1 7/8"—13c each, 3"—16c each, 3/4" hard rubber tail wheels—6c each.

CELLULOID PARTS

Featherweight celluloid single impression dummy motors—25c, double impression—35c. 3" Celluloid Cowling—25c.

PAPER

21" x 31" Japanese Tissue, either Mino Silk, or Hakone White, five sheets for 22c. 20" x 30" Wood Veneer, 17c each.

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Hard Brass Washers with .038" hole or Copper Washers with .062 hole, three dozen for 18c.

BEARINGS

Small half round steel with .025" hole or large half round steel with .035" hole, 3c each or 30c per dozen.

TUBING

1/8" Rubber tubing or 3/32" O. D. Fibre tubing, 10c per ft.

DOWELS

1/16" Dowels 24" long, 20c per dozen. These are made of a light grade of white birch, and are ideal for model work.

DOPE

We manufacture Country Club Dope under our own formula. Try it and you will never use any thing else. Four oz. 28c, one pint—16 oz. 65c. Four one oz. bottles Colored Dope, any colors you wish—60c.

BALSA WOOD

We stock only selected pieces of grade A-1 Balsa. Try a piece of 6" x 2" x 36" for $1.10. For prices on other sizes consult our catalog.

BAMBOO

1/16" x 1/4" x 12" pieces of split bamboo, 10c per dozen; 15" lengths, 14c per dozen. Shreaded bamboo strips averaging 1/32" x 1/16" x 12", 9c per dozen.

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COUNTRY CLUB AERO SUPPLY COMPANY

59th & Holmes Sts. Kansas City, Mo.

"Where your dollar has more cents"

(*Continued from page 42*)

FLYING SCALE MODELS

First—Irving Maurer
Second—Alex Radzay
Third—Arthur Reiss

GLIDERS

First—Melvin Larsen
Second—Irving Maurer
Third—Jerome Chichester

On the same day as the Contest the boys were invited by the Roger Sherman Theatre management to a free showing of the picture "Young Man of Manhattan" and the show was greatly enjoyed.

This all proves that if boys will get together and form clubs and prove their interest in aviation, there are always a number of business men and adults in general, who will also take an interest in the club and do all they can to co-operate.

At the dedication of the Floyd Bennett Airport on June 26th, a Brooklyn boy, Jack Wilson of 228 New York Avenue, had the honor of presenting Admiral Byrd with a scale model of his famous Fokker tri-motored plane, the *"Floyd Bennett"*.

The lucky boy was chosen at a contest which was held by the Brooklyn Flying Squadron in the theatre of Abraham & Straus on Saturday, June 21st, at 2:30. Mrs. Floyd Bennett, Mr. Roger Q. Williams, who made the flight from New York to Rome, and Lieut. Joseph M. Aimee, first vice-president of the Brooklyn Chapter of the National Aeronautic Association of the United States, were the judges.

IN building the model a scale of one inch to 37 inches was used. The models were judged according to their scale accuracy, workmanship, finish and detail. The Brooklyn Flying Squadron supplied authentic photographs and sketches furnished to them by the New York *Times* and the MODEL AIRPLANE NEWS. The contestants were required to get any additional information themselves, but to submit proof of their authenticity.

Mr. R. E. Blum, of Abraham & Straus, was the host of the judges at a luncheon given in the store immediately preceding the judging.

A Necessity for Every Home Mechanic

(*Continued from page 29*)

boards are flush with the side edges of the side boards. Now nail in place. Use 5" small-head nails for this work.

Drive the nails perpendicularly through the top boards into the center of the side board ends, making sure that the nails go straight, and do not come through on the sides of the side boards. These nails are now counter-sunk with a nail set. This means to drive the nails completely through the top of the top boards, so that they will not be on the surface. Sink them about 1/4" down. These holes may be filled with plastic wood later, if desired.

The bench is now assembled, except for the back, which is cut last, as an open back is often helpful while fitting the drawers.

DRAWERS: As both drawers are exact duplicates, the construction method will include that used for both and so save repetition. The front of the drawer is made of 1" stock, and is 7" wide and 32" long. Cut a board this size. Plane it smooth on both faces and test with a try-square for squared corners. Apply sandpaper over all surfaces for a satin finish. Lay aside.

The sides of the drawer are constructed of two pieces of 1/2" stock, both measuring 6" wide, or high, and 20" long. Obtain a piece of 1/2" stock, measuring 6" wide and 40" long, saw it in two 20" lengths, sandpaper to a satin finish and set aside, after testing for squareness.

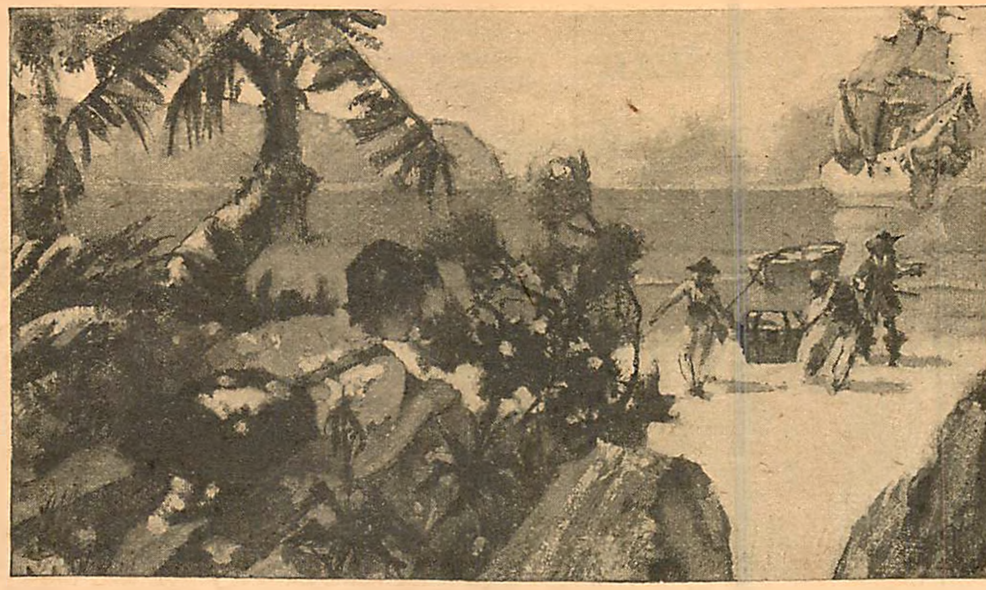
The back board of the drawer is of 1" stock, and should measure 5" wide, or high, and 31" long. Cut to this size, test for square corners with a try-square, and sandpaper for a smooth finish.

The bottom of the drawer measures 20" wide and 31" long. It is of 1" stock. It may be found difficult to obtain a piece of lumber as wide as this, and if so, it is recommended that two 10" wide pieces be used. Cut these to the above size, test for square corners, and sandpaper thoroughly for a smooth finish.

ASSEMBLING DRAWER: The drawer is now ready to assemble. Hot carpenter's glue and 2" small-head brads are used in this work. First attach one side to the front of the drawer. Coat the end of the side with glue, lay it against the front piece, and drive nails through the front piece and in the end of the side piece. (It will be found best in this work to drive the nails through the board until they just show through, before placing the other board against it. In this way, one can see exactly where the driven nails come through the board, and the difficulty of starting the nails is eliminated.) Use a nail set on all nails, which are driven through the front, sinking them about 1/8" below the surface.

Now attach the bottom board of the drawer to the structure already assembled. Hot carpenter's glue and the same nails are used in the same manner. Coat the edges of the bottom board, which come in contact with the front board and the attached side board, and drive the nails through the front and side boards into the edges of the bottom board. If two boards are used for the bot-

(*Continued on page 46*)



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HERE is an example of *teamwork* that is hard to beat.

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The Editors have already demonstrated that they can spot the one book that is heads and shoulders above any other boys' book being published. During the last few months they have picked two books that not only were big hits with boys but also became popular with the members' Dads. One of these was *Jump, Tales of the Caterpillar Club,* a book of true stories of aviators who have taken to their parachutes to save their lives. The other was *The Last Continent of Adventure,* which takes you on all the expeditions made to the South Pole.

As you gather from the titles above, the books are about different subjects. They will take you all over the world—to Africa, Alaska, the West, the Polar Regions, Wall Street, South Sea Islands. They will make you acquainted with all kinds of interesting people—pirates, big business men, explorers, statesmen, kings, scientists, college men, aviators and just other boys. All will be books you will be proud to own, books you will reread and refer to for valuable dope.

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Pioneer Model Builders Since 1909

(*Continued from page 44*)

tom, coat their connecting side edges with glue, so that when nailed to the side and front boards, the glue will effectively seal the boards together.

Now apply the opposite side board to both the front and bottom boards by using the same methods described above. See that the side boards form right angles with the front board by using a try-square. The nails that are driven from the side boards into the bottom board need not be counter-sunk unless the builder desires. However, those which are driven through the front board should be counter-sunk as they can be seen when the work is finished.

The back is now attached into its place. This board goes between the two side boards, and on top of the bottom board. When finished, the drawer should measure 5" high on the inside, 6" high on the outside, 31" on the inside and 32" on the outside for width, and 19" deep on the inside and 21" deep on the outside. The front should extend up above the sides 1", making it 7" high. Test each of these measurements carefully.

When the glue has hardened thoroughly, scrape away all excess and fill all nail set holes with plastic wood, as well as any blemishes or joints. Sandpaper to a satin finish and insert the drawer in its place in the bench. Test by moving it in and out. See that it works freely, and yet will close tightly.

Duplicate all the above instructions for the second drawer. When tested, as above, you are ready to make the handles for both the drawers.

DRAWER HANDLES: Four handles are required for the two drawers. They are cut from wood blocks, each measuring 2" x 2" x 4" long. Obtain a block 2" thick, 2" wide, and 16" long. Plane along its length one corner, until one side is 1/2" wide, while the opposite side remains 2" wide. Round all the edges of the block with sandpaper. The block can now be sawed in four lengths of 4" each. A finger grip is now gouged out of each block.

This is cut out of the side opposite to the 1/2" wide side, and extends in width from 1" from the planed, beveled face to the opposite square face. Its length extends 2" and is cut from 1" of each end.

Sandpaper the sawed edges smooth and slightly rounded, and also give the hand grip a good sanding.

The four handles are now nailed in place on the front board of each drawer, as shown in the plans. Carpenters' glue should also be used. For this work, use 2 1/2" small-head brads and use a nail set on all nails. When glue is thoroughly hard, scrape away all excess, fill nail holes with plastic wood and finish the handles carefully with sandpaper.

CUPBOARD DOOR: This consists of a single piece of 1" stock, measuring 10" wide, or high, and 32" long. Cut a board to these measurements, test with a try-square for squared corners and finish with planing, if necessary.

Two 3" hinges are used on this door. They are attached 4" from each end. It is best to cut the bottom board of the bench to which they are attached on the inside of the cupboard, so that the top of the hinges will lie level with the top of the bottom board to which they are screwed.

Also cut away on the inside of the cupboard door, where the hinges are attached, to obtain the same close fit. These hinges are held with 1" wood screws. Hinge the door in place and test to see that it opens and closes freely. Make the fit tight enough, so that when the door is closed, it will remain so.

BENCH BACK: The bench back is now cut. This consists of three pieces of 2" stock, each 32" in length. As the entire width of the back is 26", it is built of three boards, two measuring 10" wide and the third 6". The 6" board is placed between the two 10" boards. Cut the three boards to the dimensions, square up with a try-square, sand smooth, and the back is ready to assemble in place.

These three boards fit between the two side boards, and between the top board and the base board. Apply hot carpenter's glue on all four edges of each of the three boards, set them in place, and attach with 4" small-head nails. Drive the nails through the side boards into the ends of the three back boards, and through the top and base boards into the side edges of the boards of the back. Use a nail set on the nails, which are through the top board of the bench.

When the glue has become thoroughly dry, scrape away all excess glue, fill nail holes with plastic wood, and sandpaper smooth.

LOCKING DEVICE: This device is so constructed as to allow the locking of both drawers and the cupboard by using only one padlock. Two eye-screws, an iron bar of 1/4" diameter, and a padlock is all that is required.

Obtain two eye-screws, with opening of 3/8", and screw them into the bench, as shown. One is applied to the front edge of the bench top in its center, while the other goes on the cupboard door 2" from its upper edge and directly under the first eye-screw, which should be in the center of the bench. If the screw portion goes through the cupboard door, it should be carefully filed down to the level of the inner face of the door, so as to insure against any possible injury when opening or closing the door.

This eye-screw also acts as a handle for the door.

Obtain an iron rod 1/4" in diameter and 3 feet long. This will be found to be too long, but it should not be cut until later. If a fire is handy, such as a furnace fire, the rest of the work can be easily done by yourself. However, if such is impossible, request your local forge, blacksmith, tinsmith or welder to do the work for you.

Heat the bar until it is just past a cherry red, then place it in a vise and bend an eye in the end of it, as shown in the plans. This eye should not be under 3/8" on the inside diameter, nor over 1/2". Reheat the rod. Now, bend it just below the eye until at right angles to the straight rod. Allow to cool.

When cooled, thrust the straight end of the rod through the eyes of the two eye-screws, and mark a point just below the top of the bottom board of the bench, when the eye of the rod and the eye of the top eye-screw are together.

Cut with a steel saw the rod at this marked point. Now obtain a padlock with a large enough arm to reach over and through the eye of the eye-screw and the eye you made in the rod, when the two are together, as shown in the drawing under "Locking Device."

The bench is completed, except for its finish.

FINISH: The finish of a work bench is quite a problem. Many contend that due to the hard usage such an article gets, any finish is a waste of effort, time and money, but I do not agree.

It is true that the top of the bench gets plenty of hard knocks and rough treatment, and I do not recommend any finish whatever for it, but this is not the case with the entire bench.

Today, most of us keep our work bench in our basements, but it is a different basement than that of other days. Today, the basement may also house the billiard table, the recreation room, den or study, and if such is the case, a work bench must be finished in such a manner as not to clash with other furniture around it.

I would also point out that the first law of a good workman is neatness. His bench is neat, his tools are sharp, and his pride in his workshop is great. A good workman would not show his friends a dirty shop any more than he would appear in soiled clothing. So let's finish our bench, so that we may be proud of it.

For such an article, a dark finish is best, and I suggest an oak or cherry stain. Stain will be found much better and far more serviceable. Apply two coats to the entire bench, except the top. If the top is finished at all, a clear varnish, such as valspar, would be the best. Two coats will be sufficient.

Here's A Tip!

Watch JUNIOR MECHANICS AND MODEL AIRPLANE NEWS for an amazing article on "HOW TO BUILD A CURTISS-BLEECKER HELICOPTER"—a beautiful flying model.

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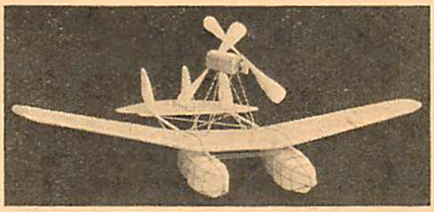

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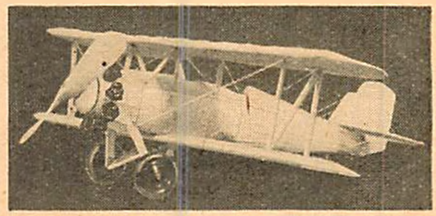

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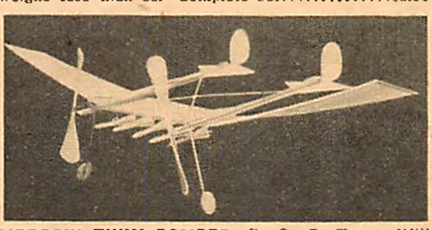

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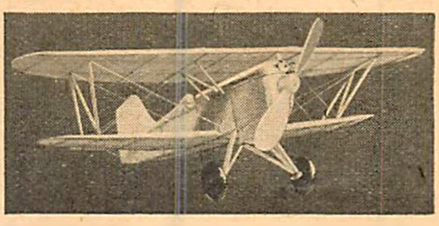

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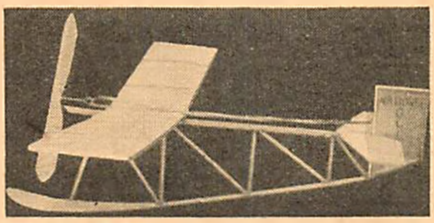

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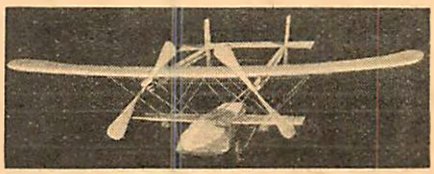

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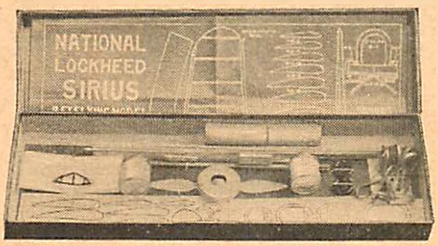

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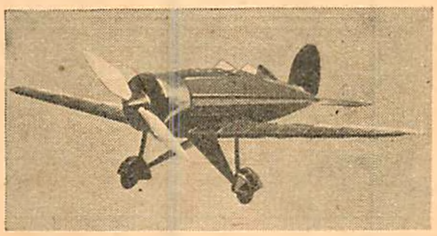

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From the Ground Up

(*Continued from page 12*)

where can I get in touch with you?"

Larry told him, and in response to further questioning by the injured young man—Larry thought he couldn't be more than thirty-five—told him a little about his life with the Bassetts, his early orphanhood, and his dreams of becoming a flyer. Major Riddle listened sympathetically; perhaps what Larry told him struck a responsive chord in his own memory and carried him back to his own hopes of flying which finally and gloriously had been fulfilled in the warfare against the enemy on the soil of France.

Embarrassed, Larry colored and stopped talking. He felt he had taken advantage of the Major's kindness. He shook hands with both men and left.

Why did Heinze want to frighten Larry? And why were the Major and his friends so secretive about it all? Strange forces seem to be moving behind the scenes. The November issue of MODEL AIRPLANE NEWS, *on sale at all news stands October 23, will thrill you. Don't miss it.*

Gliding and Soaring

(*Continued from page 6*)

ning along the under side of the fuselage. This ski absorbs the shock which the glider receives when it reaches the ground. Landing wheels are not often used on gliders because they are too heavy, and because they make control difficult on hills. (See Figure 4.)

Nevertheless, balloon tires for gliders are gaining popularity. Some gliders are provided with footballs set into the fuselage to serve as wheels. This contrivance allows the glider to roll ahead after landing until it has expended its impetus.

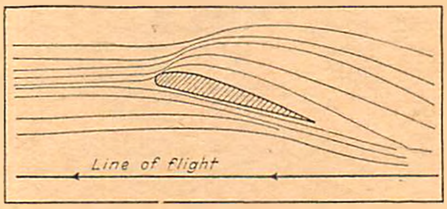

Figure 3—This shows how air is deflected upward sharply by the contour of the front part of the wing. More air is being pushed upward than is being deflected downward

Skis, in place of the runner, facilitate the use of gliders in the winter. (See Figure 5.) Water gliders land either directly on the fuselage, or on a float.

Size. In general, gliders range in size from those the same size as the smallest airplane, to those the size of six or eight passenger motored planes. The proportions of a glider, however are different from those of an airplane.

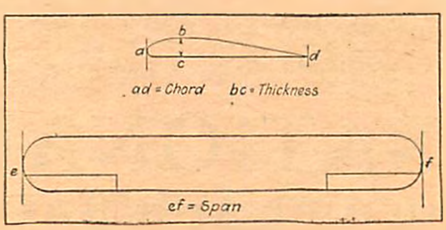

Figure 4—The relationship of the span to the chord is a matter of great importance in glider design

Whereas the wingloading (i. e., the amount of weight per square inch of wing surface) of the airplane varies, the glider always has a wide wing spread in proportion to the size of the fuselage. Thus, a soarer, with a span (i. e., spread from one wing tip to the other) greater than that of a large transport airplane, usually has a fuselage barely large enough to carry the tail group, wings, and the pilot. (See Figure 6.)

In appearance, a glider resembles an airplane, much as a moth resembles a bird. The glider has large wings in proportion to the size of its body, it is delicate of structure, and it floats about on the wind in a leisurely manner.

WHY GLIDERS STAY ALOFT

THE glider stays in the air because it has lift. Lift is the force which, working against gravity, holds the plane in the air. Lift depends upon the speed of the glider, and the

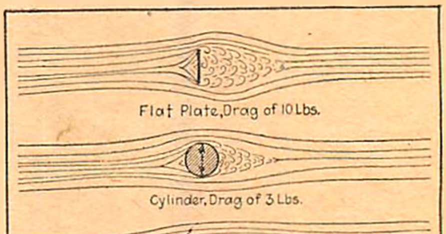

Figure 1—This shows airflow around different bodies and the approximate value of drag where they have the same diameter

size and shape of the wings, or lifting surfaces of the planes. The reasons why the glider stays in the air are dealt with by the science of aerodynamics.

Aerodynamics treat of the effects on the air of solid, moving bodies. Every pilot must have some knowledge of aerodynamic theory before he can fly his glider with maximum efficiency. Fairly complete treatments of this subject can be found in most recent books on aeronautics.

Speed. Speed is the forward movement of the glider through the air. Speed is not necessary to support a boat in the water; it can float for an indefinite period of time in the same place, without sinking.

However, a section of air becomes temporarily used up, so to speak, as soon as it has supported a body, and the airplane must pass on to fresh sections of air, to obtain continued support.

For example, a bird would drop to the ground, if he were to continue flapping his wings in the same spot of air, (unless, like the humming bird, he were especially adapted to this manoeuver). Some migratory birds and airplanes fly in V-formation, so that the leader will not render useless the air through which the followers must fly.

It is easy to see how a propeller gives speed. Two forces, used in conjunction, serve the glider in lieu of a propeller: gravity and inertia. Gravity is a well-known force. When the glider is headed downward toward the earth, it is being pulled groundward by gravity, which lends it speed. For example, it is gravity which allows the primary training glider to "slide down hill" after the plane has gained height from the take-off.

Inertia is a force as omnipresent as that of gravity, but not so commonly understood. It is the tendency of a body to remain in its state of rest, or to continue in the direction in which it is already moving. This tendency requires force to overcome it.

Thus the glider, when it has been shot off the side of a hill with a rubber cable, has inertia, i. e., it tends to continue in its forward direction, until the opposing force set up by the resistance of the air overcomes its inertia. Were it not for inertia, the glider would go with the wind instead of against it.

The Effect of the Wings on Air. Speed alone is not sufficient to hold a body in the air. A bullet, no matter how great its speed at the outset, eventually falls to earth. The factor which complements speed in holding the airplane in the air is the

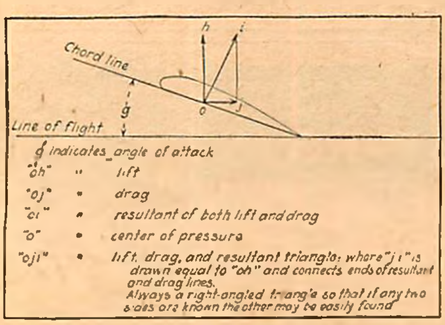

Figure 2—It is important to memorize these elementary definitions of terms relating to wings, since they are constantly used in aviation

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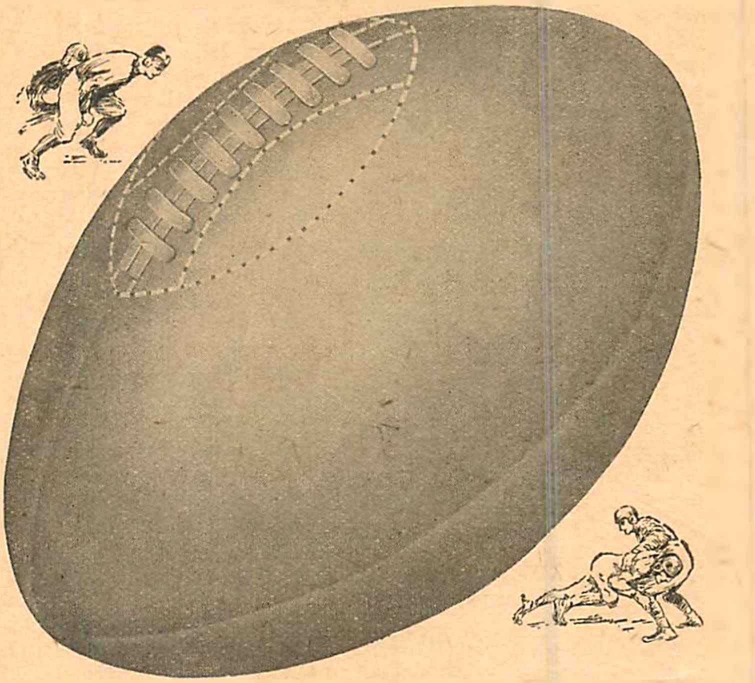

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lifting surface of the plane's wings.

A wing is a type of airfoil, that is, a solid body designed to be projected through the air in order to produce a useful reaction. If a thin airfoil is passed through the air so that its surface is exactly in line with its path of motion, little reaction will be produced. However, if the surface of the airfoil is set at a slight angle to its path of motion, so that the leading edge is higher above the ground than the trailing edge, two reactions will result: first, the air beneath and in front of the airfoil will be compressed by the moving body; second, the air above and behind will attempt to follow the foil and to fill up the space left by it; but, since the movement of the air is slow in comparison to that of the airfoil, a partial vacuum will be created.

THE compressed air, below, forces the airfoil upward and slightly backward. The partial vacuum above, pulls the airfoil upward and backward. The two forces resolve themselves into one force which acts at right angles to the surface of the airfoil. (See Figure 2).

That part of the force which pulls the foil slightly backward, thus hindering forward movement, is called "drag", while the upward component of the force is known as "lift".

The wings of a glider, in order to produce the reaction of the airfoil cited, are usually rigged so that their leading edges are slightly higher than their trailing edges. This angle of the chord of the wings to the longitudinal axis of the ship is called "angle of incidence". The angle of the chord of the wings to the ship's momentary path of motion through the air is called "angle of attack".

The Efficiency of Wings. There are several ways of increasing the efficiency of wings, both in construction and control. Wings are made not flat, but, when viewed from the end, slightly convex, with the greatest curve near the leading edge.

Thus, when the air strikes the wing, it is deflected upward, increasing the partial vacuum behind the wing. (See Figure 3.) The air escapes upward over the end of the wing, decreasing the effect of the vacuum.

This effect is lessened in the more sensitive gliders, by building them with wide span (length of the wing) in proportion to the chord (breadth). Also, to increase general efficiency wings are tapered. (See Figure 4).

The second wing of an airplane (i. e., as in a biplane) is less effective than the first wing, because one wing tends to interfere with the other. The upper one lessens the effect of the partial vacuum on the lower one.

Apart from these constructional methods of increasing wing efficiency, the pilot can make good use of the principles of lift. When the angle of attack, i. e., the angle between the path of motion and the chord of the

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The pilot's legs hang below the ship. By swinging them, he can direct the glider's course

wing, is increased somewhat, lift is also increased.

It is by increasing the angle of attack that the glider is made to climb. When this angle has been enlarged beyond a certain point, however (usually about 20 degrees), the drag becomes great, the air breaks up into eddies, reducing the effect of the vacuum, and the lift is suddenly reduced. This loss of lift is called stalling. (See Figure 5).

Streamlines. A boat, when towed through the water, presents comparatively little resistance, owing to its shape. The water flows smoothly around it and closes in at the stern, helping to force the boat ahead. Air, like water, tends to follow certain lines when it passes around objects moving through it, and when the outlines of bodies are constructed so that they coincide with these lines, the body is said to be streamlined. The more perfectly the glider, or any of its parts, is streamlined, the more easily the ship will pass through the air. (See Figure 1).

Parasite Resistance. It has been shown that the wings cause a certain amount of resistance, or drag. Likewise, other parts of the glider offer resistance. The resistance of all parts except the lifting surfaces is called parasite resistance.

It is necessary to reduce parasite resistance as much as possible, so that the progress of the plane may be little impeded.

For this purpose, the fuselage is built in a good streamline shape. For the same reason, the number of struts and wires is reduced to the minimum in glider construction.

The pilot who would become a builder of experimental gliders must have a thorough knowledge of aerodynamics. Every glider pilot, however, must be familiar with the more elementary principles of the science.

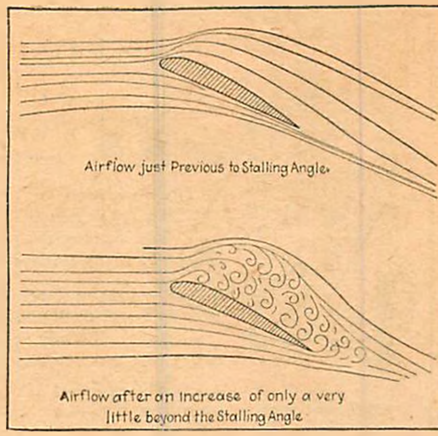

Figure 5—A slight increase in the angle of attack brings the plane from its angle of highest lift to an angle of very little lift. It is at this point that the stall occurs

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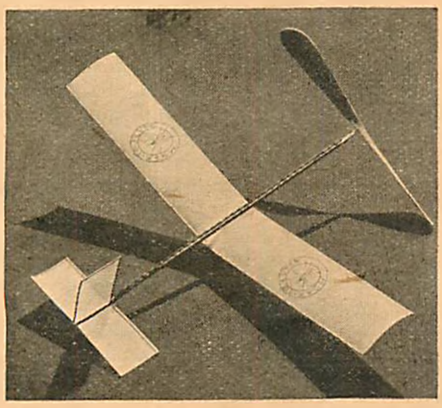

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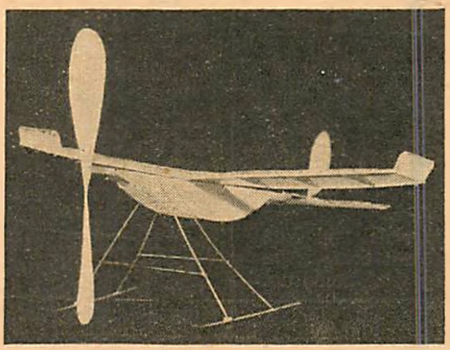

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A Course in Airplane Designing

(Continued from page 22)

surface, and the total load on the wing is equal to the weight of the ship. There is obviously no load on the landing gear when the ship is in the air, so the only stresses that we have here are those resulting from the wing loads.

IN the next article we shall take up the stresses in each of the members, but now we must confine ourselves to a general discussion of the external loads.

The second type of loading that we study is called *high incidence loading*. This type can be best explained by an illustration. If an airplane is put in a dive, allowed to speed up considerably, and then suddenly pulled level again, what will happen? The weight of the ship will try to go on in the dive, but the wings will try to bring the ship level again. Then the wings have to support not only the weight of the ship, but also the inertia force produced by the ship trying to go on in a straight line. For this reason there is a very great strain on the wings when the ship is suddenly pulled out of a dive, or when it flies through a bad bump.

Increased loading is also placed on the wings when the ship turns. Here the inertia force once more comes into account, because the ship tries to go on in a straight line while the wings are pulling it in a turn. The ship must bank over in a turn, in order to overcome the tendency of the weight to go on in a straight line. If the ship were not banked there would be no way of overcoming the force mentioned above, and the ship would skid along.

The wing lift is the only force available to counteract the inertia, and the only way to use the lift is to incline the ship toward the inside of the turn, so that a part of the lift force is acting in the opposite direction to the inertia force.

In very sharp turns an airplane must be banked nearly vertically, so that practically all of the lift may be used to overcome the inertia. In this turn there is a powerful strain on the wings, the effect being the same as that of high incidence loading.

Figure 2 shows a plane leveling out of a dive, with the lift and weight acting in the directions shown.

All airplanes, even models, must be so designed that they may be flown in safety upside down. When the ship is in this position the loads on the wings are reversed, with the lift tending to bend the wing in toward the landing gear.

For this reason, we must design our wing spars so that they will support the ship in the inverted position, as shown in Figure 3. It should be noted that the arrows indicating the lift show merely direction, and not distribution, of the lift forces. In reality, the lift is distributed along the entire wing.

The loads imposed by inverted flight may be duplicated in normal flying. That seems rather confusing, but it is nevertheless true.

FOR example, if a ship flies into a strong descending current, what happens? The ship tends to go on for a time in its original path, but the direction of the air stream as it strikes the wings has suddenly changed from horizontal to more or less vertical. This air stream then pushes the wings down, thus producing the same inverted loading as that brought about by flying the ship upside down, even though the plane is flying normally! That is merely another good reason why a ship must be designed to fly in all positions.

In man-carrying airplanes, the inverted flying loads are often imposed by the pilot suddenly putting the ship in a dive. It will be easy to see just how this comes about when we consider that the wings are forcing the ship down, while, for a few seconds, the weight tends to go on in its original direction.

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YOUR HOME Magazine is above all modern and up to the minute, but, also it is human, and its contributors are human and never forget that they are writing to human beings who are apt sometimes to make mistakes.

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The landing loads must always be considered in designing an airplane. It would be rather an anti-climax to have a ship fly well in the air and then collapse on landing, but this has actually happened!

In landing, the weight of the ship is transferred from the wings to the landing gear, which in turn transmits the strains to the members of the fuselage. At times, when the ship strikes the ground with some force, the loads in the landing gear and fuselage members are very heavy.

Most models glide right down to the ground, having no pilot to level off at the right height, and for this reason they usually strike comparatively forcibly. Therefore, we must design our landing gear members sufficiently strong to withstand quite a shock without failure. (A strut is said to fail when it collapses under a stress.) Nor must we stop here. The loads of a hard landing are not only imposed on the landing gear, but they are also carried to the fuselage.

I recall one ship that I built that had the landing gear struts fastened to the lower longerons. One day the ship made a hard landing and the landing gear literally pushed its way up into the fuselage! The longerons had been too weak at the points of attachment of the struts, and, while the struts had been strong enough, the longerons were not. After that, I made my longerons heavier at the points where the landing gear was attached. That's a tip for model builders.

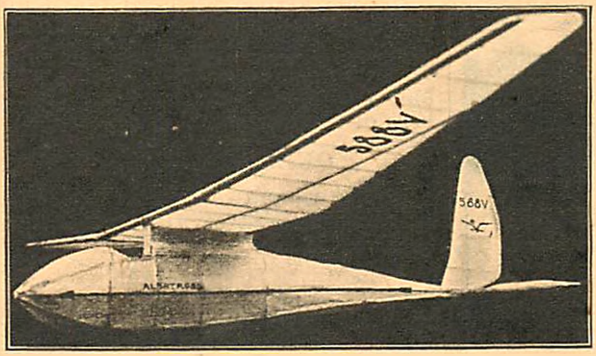
Instead of making the entire fuselage heavier for the landing loads, merely make the longerons thicker for three of four inches to each side of the landing gear struts. By doing this you will make the ship strong enough for the job, yet light enough to fly.

IT does no good to make the longerons twice as heavy as they need to be at the tail, just because they have to be that large at the nose. Make them sufficiently strong at points of stress, and shave them down toward the rear, where the loads are not very great. In this way you'll be making a light job, and that is one thing a record-breaking model must be—light.

Another loading condition that is sometimes important is the *nose dive* condition. This means, of course, that the ship is diving, nearly vertically, with great velocity. The loads here are mainly drag loads, as shown in Figure 4, tending to bend the wings backward, but there is also a *twisting strain imposed* on the wings, resulting from a down load on the front portion of the wing and an up load on the rear portion.

There are, then, the following main conditions of flight to be considered in stress analysis: normal, or low incidence flight, high incidence flight, inverted flight, landing, and the nose dive condition. Other conditions will probably occur to the reader, but

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!

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I am going to read the best page in the magazine, Page 56.

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Wing span 50", length 20". Has flown for 2½ miles. Has movable controls, detachable wing. Full size blue prints. Duration 5 min.

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8"............ .12 9"............ .14
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careful study will show that they can always be brought under one of the headings above.

In this article we have taken up the various conditions of flight. In the next article we shall see how these conditions affect the ship, and how the strains are taken by members of the structure.

QUESTIONNAIRE

1. Into what two general divisions may the science of airplane design be divided?

2. Why must the airplane designer know something about stress analysis?

3. Explain why a ship must be banked while making a turn.

4. Which would, in your opinion, impose the greater strain on the wings of an airplane: flying normally, or suddenly leveling off from a nose dive?

5. Name the various maneuvers or conditions of flight that we must consider in stress analysis.

How to Build a Dog Kennel

(*Continued from page 35*)

the top for ventilation on each end. Bore these holes with an extension bit or with a smaller bit and a compass saw. Cut out entrance hole using a rip saw and a compass saw. If this entrance hole is too large it may be laid out to suit conditions.

Take the five 1" x 10" x 1'8 1/4" ship lap. Rip off the rabbitted edge of one board. Nail these on one side, following the plan with great accuracy.

Take the five 1" x 10" x 1'9" ship lap. Repeat the above operations for the other side of the roof allowing 2" projection beyond the ends.

Cover the roof joints with the 1/2" x 2" strips.

Paint to harmonize with the surroundings or to match the other buildings nearby.

How to Build a Bike-Boat

(*Continued from page 32*)

into the angle. The paddle-wheels should be nine inches wide and each blade about twelve inches long. The extra inch at the outside allows you to wire the four pieces of the shaft together tightly to give added firmness.

The paddle-wheels should be of thin, hard wood, free from blemish. When they are mounted to your satisfaction, give the boat a coat of paint or two, emphasizing the bottom and the joints.

It is a good idea to wire the shaft wheel, as shown in the illustration, taking care not to fasten it too tightly so that it will turn hard. The wiring prevents it from swaying and working loose in the sprocket.

Before you try out the boat, put it in the lake or river for a day or two, in order that the water may soak up the seams and swell the wood. Then dump out the water which has seeped through and you will find the craft water-tight.

WHILE you won't need oarlocks, it is a good plan to take a paddle along, stowed under the seat out of the way, in case something should go wrong with the bike chain.

When fastening a chain to the bow of the boat, for purposes of fastening her to the pier, take special pains to anchor the chain to a ring-bolt which is firmly fastened into the wood, so that no one can appropriate your boat and leave you the chain and padlock.

Now you are ready to try your bike-boat. You will notice that when the rider uses the boat alone, without a passenger, the front end will tilt in the air just like a speed-boat, sliding over the water instead of cutting it as a row-boat does.

Boats of this type are handy for fishing, clam-digging, or for any jaunts on the water. They will stand staunch and sturdy through a storm that would capsize a rowboat, and even if filled with water, they will not sink. A load of three or four may be carried easily in a twelve-foot bike-boat, and a single rider can make up to five or six miles an hour if the water is calm.

Best of all, this punt-type bike-boat draws only about three inches of water with one passenger, and there is no rudder or projection to catch on stones or weeds. Everything is flush with the bottom of the boat, and the craft can be used anywhere a canoe can go.

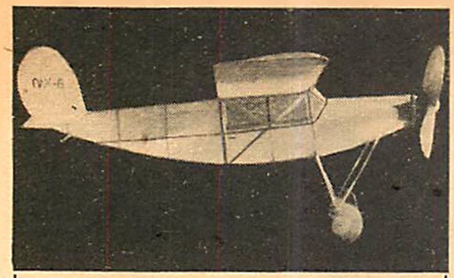
WHAT YOU NEED

Materials needed to make the bike-boat are:

- Two 1 1/2' pine boards the length of the boat. 3/4 inch stock.
- Twelve feet of pine for seats and ends, inch stock . . . inclu. rudder.
- Matched flooring for bottom, depending on length.
- Four 1/2 or 3/8 inch boards, hardwood, 24" long, for paddles.
- Stout oak pole for shaft, three feet long.
- One old bicycle minus wheels.
- One small piece of wood two feet long for steering piece.
- Four feet small chain or cord.
- One quart white lead paint for bottom and all over, if mixed.
- Wire, braces, staples, nails, etc.
- One heavy bolt.

Tools:

Hammer, saw, paint-brush, square, tape, chisel and mallet.



3 Minutes 50 Seconds

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1" x 5" x 40" selected balsa plank	1.00
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5 sheets 21" x 31" Jap Tissue	.25
No. 1 Geared Winder, double hooks	.35
Sikorsky Scale model plans	.20

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See Page 56.

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VOUGHT CORSAIR, "Eyes of the Fleet"	3.85	75c
LOCKHEED VEGA, "American Air Express"	3.85	75c
BARLING NB3, "World's Light Plane Record Holder"	4.25	75c
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Real Workable Railways in Miniature

(*Continued from page 24*)

can devise electric safety blocks which will hold up one train while the express speeds by.

Wet brown and gray paper, crumpled and then covered with thin glue to make it hold its shape and be waterproof, will make fine imitation rocks and hillsides. If your system is outdoors, like those of Edsel Ford, the Vanderbilts, Mr. Francis Eastman, and others, you will soon see the tremendous possibilities in the use of natural rocks, pebbles, and dirt. If you wish, you can build model stations, model cities and towns for terminals. From plans or photographs of the originals, you can make your own tunnels, cuts, railroad yards . . . exactly to scale.

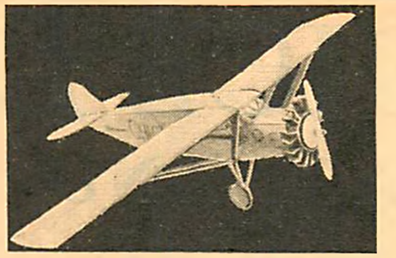
Some sets have perfect horseshoe curves, allowing the use of ten and twelve car trains or longer. Others, including the famous one of Mr. Nagai, run through miniature living greenery, made out of dwarf Japanese trees, with shrubbery, flowers, rustic bridges, and so forth to match!

ONE model builder near Los Angeles, who is also interested in flying, has launched model planes from an improvised platform raised above a moving model train! Who knows, perhaps trains of the future will have such a hook-up with aviation, transferring passengers while in motion? The same builder has also succeeded in fastening a model glider to the caboose of his model train, so that when the locomotive is at full speed the glider will take the air and be towed along.

There doesn't seem to be any limit to what the imaginative boy or man can do with a model railway system, and it is an axiom that no such system was ever "finished." The best part of it is that your time and work are not being wasted.

It has been proved that nine out of ten railway men, engineers, designers, and traffic experts who are running the world's thoroughfares of steel today got their early training on model railway systems that they made themselves. Many of them are keeping up the sets as a hobby today.

Don't tackle it unless you love tinkering, and have patience. It is a good plan to club in with several of your friends, to reduce the expense of metal parts and track. No matter how much work you put on your trains, and how long you have to save to get the lengths of track that you want . . . you'll realize that it's been worth it and more when you see a snorting replica of one of the great railroad locomotives come racing around the bank curves of your own railroad system, thunder through a tunnel . . . and draw up with its baggage cars and coaches at your station.



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the City of Chicago broke the world's endurance record, piloted by the Hunter Brothers on July 4th, 1930. You can now build a flying or scale model of this plane from our construction set which includes a Whirlwind motor, Celluloid wheels and many other finished parts. All of your friends will envy you when they see the beautiful City of Chicago —and boy will it fly! Length overall 16½". Wing spread 24". Price of construction set postpaid only $4.00.

FREE We have a surprise offer in our new catalogue. Boys, be sure to get in on this special free offer.

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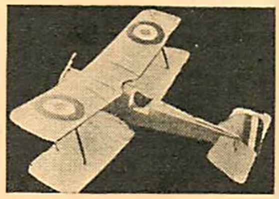

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14 2-inch rods standard diameter

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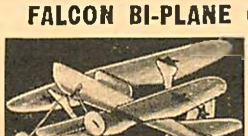

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6. Merchandise bought from us is not returnable except by our written permission, and subject to our examination before acceptance.
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1/16 x 1/16	$ .02
1/16 x 3/32	.02
1/16 x 1/8	.02
1/16 x 3/16	.02
1/16 x 1/4	.02
1/16 x 3/8	.03
1/16 x 1/2	.04
1/16 x 3/4	.05
3/32 x 3/32	.02—3 for .05
1/8 x 1/8	.02
1/8 x 3/16	.03
1/8 x 1/4	.03
1/8 x 5/16	.04
1/8 x 3/8	.04
1/8 x 1/2	.05
1/8 x 3/4	.08
5/32 x 5/32	.03
3/16 x 3/16	.03
3/16 x 1/4	.03
3/16 x 5/16	.04
3/16 x 3/8	.05
3/16 x 1/2	.05
1/4 x 1/4	.04
1/4 x 5/16	.04
1/4 x 3/8	.05
1/4 x 1/2	.05
5/16 x 5/16	.06
3/8 x 3/8	.07
3/8 x 1/2	.07
1/2 x 1/2	.08
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1/32 x 2 x 36	.12
1/32 x 3 x 36	.20
1/32 x 6 x 36	.35
1/16 x 1 x 36	.06
1/16 x 2 x 36	.12
1/16 x 3 x 36	.20
1/16 x 6 x 36	.35
1/8 x 1 x 36	.10
1/8 x 2 x 36	.15
1/8 x 3 x 36	.22
1/8 x 6 x 36	.38
3/16 x 3 x 36	.24
3/16 x 6 x 36	.43
1/4 x 3 x 36	.25
1/4 x 6 x 36	.45
5/16 x 3 x 36	.28
5/16 x 6 x 36	.51
3/8 x 3 x 36	.30
3/8 x 6 x 36	.55
1/2 x 3 x 36	.35
1/2 x 6 x 36	.60
5/8 x 3 x 36	.40
5/8 x 6 x 36	.65
3/4 x 3 x 36	.45
3/4 x 6 x 36	.70
7/8 x 3 x 36	.50
7/8 x 6 x 36	.75
1 x 3 x 36	.50
1 x 6 x 36	.75
2 x 3 x 36	.75
2 x 6 x 36	1.00
3 x 3 x 36	1.00
3 x 6 x 36	1.75
1 x 5 x 40	.75
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3/8 x 3/4 x 5"	.02—3 for .05
3/8 x 1/2 x 6"	3 for .05
1/2 x 3/4 x 6"	2 for .05
3/4 x 3/4 x 6"	.04
7/8 x 7/8 x 6"	.04
5/8 x 1 x 7"	.03
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5/8 x 3/4 x 7-1/2"	.04
1/2 x 1-1/8 x 8"	.05
1 x 1 x 8"	.06
5/8 x 1-1/4 x 8"	.07
5/8 x 1-1/4 x 10"	.08
11/16 x 1-1/4 x 10"	.08
3/4 x 1-1/4 x 10-1/2"	.08
7/8 x 1-1/4 x 10-1/2"	.08
3/4 x 1-1/4 x 11"	.08
3/4 x 1-1/2 x 11"	.08
1/2 x 1-1/4 x 12"	.09
9/16 x 1-1/4 x 12"	.09
3/4 x 1-1/4 x 12"	.09
3/4 x 1-1/2 x 12"	.10
1 x 1 x 12"	.10
1 x 1-3/8 x 12"	.10
1 x 1-1/2 x 12"	.10
1 x 3 x 12"	.20
1 x 1-1/2 x 13"	.12
5/8 x 1-3/8 x 16"	.15

Spruce and Pine

We do not stock cut sizes of Spruce or Pine. For 2c additional to listed price, per piece, we will supply you with propeller blocks and strips from 1/16" x 1/16" x 36" up as listed.

Sitka Spruce For Gliders

We specialize in Sitka Airplane Spruce for Man Carrying Gliders. Send in specifications sizes and we will quote you accordingly. Address GLIDER-CRAFT DIV.

WITH EVERY ORDER OF $2 OR OVER YOU CAN RECEIVE OUR NEW $5.50 U. S. ARMY HAWK KIT FOR ONLY . $3.50

Bamboo

Genuine "TONKIN" straight grained-no-knot bamboo strips. Size 1/16" x 1/4" x 15"—each .01

Reed

Round Reed for all type model construction. 1/16" dia.; 1/8" dia.; 3/16" dia.; 1/4" diameter. All sizes per foot .01.

Dowels (Round Wood)

Dowels are very useful for wing spars, longerons and scale model construction.

3/32" diam. x 15" long. each	.01
1/8" diam. x 36" long. each	.02
3/16" diam. x 36" long. 2 for	.05
1/4" x diam. x 36" long. each	.03

"Championship" Rubber Motor

A. A. C. "Championship" rubber motor strand is in the Championship Class by itself. Five sizes to select from for your different type models.

1/32" square	4 feet for $0.01
1/16" square	2 feet for .01
3/32" flat (36 Special)	2 feet for .01
1/8" flat	2 feet for .01
3/16" flat	per foot .01

Banana Oil

Used to stick the Japanese Tissue to wood, also for doping model covering.

1/2 oz. bottle	$0.06
1 oz. bottle	.09
2 oz. bottle	.15

Acetone

Acetone is used for thinning the heavier liquids.

1/2 oz. bottle	$0.06
1 oz. bottle	.09
2 oz. bottle	.15

Clear Dope

An A. A. C. preparation for doping wings on outdoor or flying scale models; also for fuselage covering.

1/2 oz. bottle	$0.06
1 oz. bottle	.09
2 oz. bottle	.15

Colored Dope

GENUINE *COLORED* Dope as the name implies. All others have failed to imitate our Colored Dope. Order by color: Blue, Black, Red, Green, Orange, Yellow, Olive Drab, Silver and Gold.

1/2 oz. bottle	$0.10
1 oz. bottle	.15
2 oz. bottle	.25

Ambroid

AMBROID CANNOT be equalled or imitated. It is fast drying, waterproof, flexible and durable. Comes in regular amber color and also colorless for invisible mending work. Order by color. Prices are the same.

Special Vial size	$0.05
1/2 oz. bottle	.10
1 oz. bottle	.15
2 oz. bottle	.25

A. A. C. Waterproof Pontoon Finisher

An original preparation for finishing and waterproofing R. O. W. and seaplane pontoons and hulls.

1/2 oz. bottle	.10
1 oz. bottle	.15

Davids Paste

A popular item used for sticking Japanese Tissue to Balsa wood and other woods. Leaves a clean light job.

Extra large size 6" tube .10

Wing and Fuselage Covering

Imported White Japanese Hakone—like silk. 21" x 31"....per sheet	.05
Imported Brown Japanese Hakone—like silk. 20 1/2" x 24 1/2"....per sheet	.05
Imported Red Japanese Hakone—like silk. 20 1/2" x 24 1/2"....per sheet	.05
Japanese Silk Mino Tissue. 20 1/2" x 24 1/2"....per sheet	.03
Superfine Japanese Silk Tissue—a rarely fine tissue for extra light models. Cover your Championship endurance models with this tissue. 18" x 24"....per sheet	.08
WOOD VENEER paper for scale model work. 20" x 30"....per sheet	.15

Transparent Sheet Celluloid

Genuine Transparent Celluloid. Beware of paper imitations. This cello can be used for windshields, windows & etc.

3" x 6" sheet	.10
6" x 6" sheet	.15

Celluloid Wheels

These wheels are very light and strong. Bushings sent with wheels.

3/4" diameter....per pair	.10
1-3/8" diameter....per pair	.15
1-7/8" diameter....per pair	.25
3" diameter....per pair	.50

Rubber Tired Wheels

High grade sponge rubber tired aluminum wheels. Cannot be beat for scale models.

2" diameter....per pair .50

Dummy Radial Engines

Celluloid Imitation radial engines. Has 9 cylinders and is 3" in diameter. Each .50

Music Wire

Music wire is strong, light and stiff. Used for cans, motor hooks, axles, landing gears, tail skids, bearings, propeller shafts and etc. 4—.012; 5—.014; 6—.016; 8—0197; 9—.022; 10—.0236; 12—.0283; 14—.032. Any size or gauge. 2 feet for .01.

Soft Annealed Wire

Used for guys, stays and binding joints. Per spool .05

Aluminum Tubing

For exhaust pipes and etc.:

1/8" outside diameter, per foot	$0.10
5/32" outside diameter, per foot	.12
3/16" outside diameter, per foot	14
1/4" outside diameter, per foot	.17

Model Making Pins

Small and very handy. Per pkge .05

Sheet Aluminum

For scale model work. 34 gauge sheet

6" x 12"	.15
12" x 12"	.25

Thrust Bearings (Hangers)

Large size for commercial and outdoor models. Small size for indoor endurance models. Either size, each .05

Washers

1/8" diameter for R. O. G. and similar type models. 4 for .01; 2 doz. for .05; 1/4" O. D copper washers for heavier models. 4 for .01; 2 doz. for .05. 3/8" O. D. iron washers, for making dummy motors. 2 for .01; 1 doz. for .05

Sandpaper

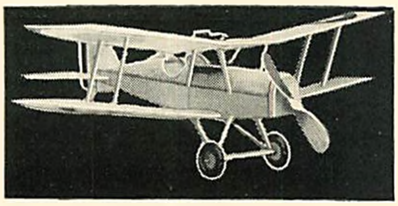
5 different grades. 000 to 1. Size 4-1/4" x 5-1/4" sheet. Pkge of 5 .05

Largest Model Airplane Supply House in the Country

A. A. C. MODEL AIRCRAFTERS, 4715-17-19 Third Avenue, New York City

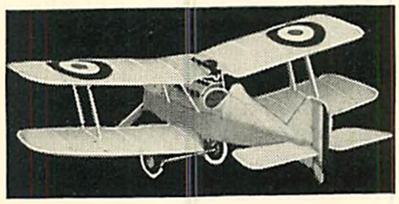
WORLD'S SCALE MODEL RECORD HOLDER

BUILD THIS 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.

BALSA!

SALE

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

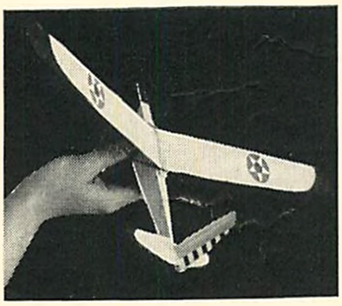
6 Blocks	5/8" x 1 1/8" x 7"	$ .24
6 Blocks	3/4" x 1 1/4" x 8"	.30
6 Blocks	1" x 1 1/4" x 10"	.45
6 Blocks	1" x 1 1/2" x 12"	.60

Postage 15c Extra

on all orders under $1.00

HAWK

Soaring Glider



This 24" glider can be assembled in 300 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.

Blue Prints!

FULL SIZE and SCALE

24" Wingspan

Curtiss Hawk P.6.	$0.40
Curtiss Hawk (Randial P.3.A.)	.40
Sea Hawk F.7.C.1.	.40
Boeing Pursuit F.4.B.1.	.40
S.E.5.A. Scout (1917)	.40
Vought Corsair	.40
Waterman O.X.5. (1921)	.40
Travel Air "Mystery Ship"	.40
Lockheed "Sirius"	.25
German B.F.W.	.25
Sikorsky (10 place)	.25
Ford Tri-Motor	.40
Stinson Detroiter	.40

NON SCALE BLUE PRINTS

Full Size

Navy Racer (wingspan 20")	$0.40
Commercial (wingspan 28")	.25
Duration Tractor	.25

SPECIAL SCALE PRINTS

(All 10" Wingspan)

Two plans on one blue print

Curtiss Hawk P.3.A. & Travel Air "Mystery Ship"	$0.25
Curtiss Hawk P.6. & Boeing Pursuit	.25
Boeing Model 80.A & Curtiss Condor	.25
Sikorsky S.38. & Boeing Model 204	.25
Fokker D.7. & S.E.5.A.	.25
Supermarine Napier & Mercury Racer	.25
Wallace Touro Plane & Inland Sport Plane	.25
Keystone Bomber & Hall Aluminum Patrol	.25

EXTRA SPECIAL SCALE PRINTS

Three plans on one blue print

"Avero Trainer," Bristol "Bulldog" Fighter and Cierva Autogiro $0.25

All blue prints sent postpaid.

Hawk Model Aeroplanes

4944 IRVING PARK BLVD., DEPT. E-1 CHICAGO, ILLINOIS, U. S. A.

ALL BALSA—AMERICA'S MOST EASILY CONSTRUCTED MODELS!

A new, all-balsa construction makes these Midland models superior to anything you have ever seen. Lighter—about two-thirds the weight of an ordinary model of the same size. Stronger—practically crash-proof. Better-looking and more realistic—smooth, sheet-balsa surfaces instead of wrinkled tissue sagging between ribs and longerons. Easier to build, because so much simpler. A job you can do in a couple of hours instead of a week. And *you* can do it. We've eliminated the question of skill.

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.

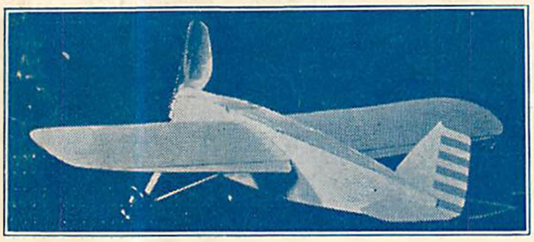
You will find these models much easier to build, and, after you have built them, much more satisfactory to fly. Fewer trial adjustments: longer, steadier flights.

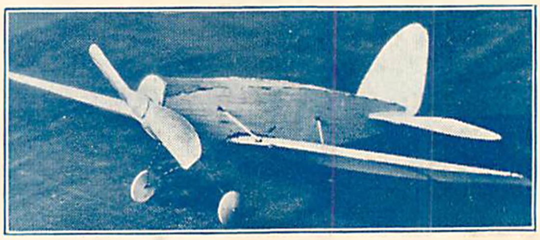
The MIDLAND MODEL WORKS
Box W, Chillicothe, Ohio

TAPER-WING COMBAT MONOPLANE—
An Unusual Value

An exceptionally graceful model of a center-wing combat monoplane, and the best distance flyer of the Midland group. Does 200 feet consistently. Can be hand launched or will rise off ground. Very easily built, and will stand hard use. Wing span 20 inches. Weight 8/10 ounce.

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.

You are doubly safe in ordering Midland sets because nothing but actual, unretouched photographs are used to advertise them. Remember that any photograph of a Midland model shows it as you will get it—not merely as you would like to have it

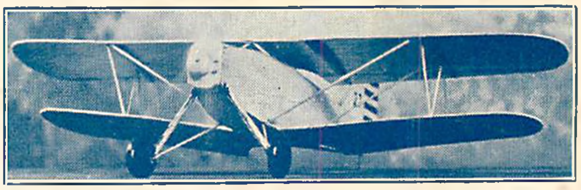
REALISTIC ARMY BIPLANE

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!

The top wing is in advance of the lower one, and at a larger angle of incidence. This results in the center of pressure of both wings being shifted *forward* when the model dives, *back* when it climbs. This is the exact opposite of the usual movement, and gives the model unequaled stability. By far the best rough-weather flyer we have seen.

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**



ORDER NOW—USE THIS COUPON

The MIDLAND MODEL WORKS, Box W, CHILLICOTHE, OHIO

Gentlemen:

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.

(Check or money order safer than cash. We cannot accept stamps or fill C O D's. No catalogue, except with set.)

Name..

Street..

City...State..................