THE SECOND BOYS' BOOK OF MODEL AEROPLANES

CHAPTER I

MODEL AEROPLANES OF 1911

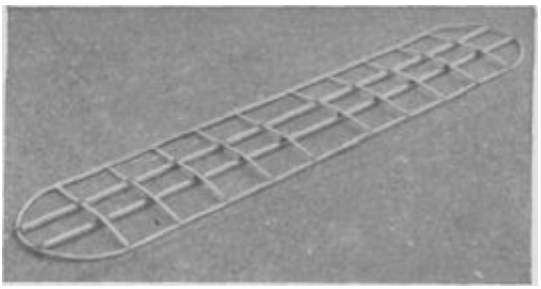
FOR the average boy there is no more stirring music than the brisk, whirring note of his model aeroplane. Let the propellers spin steadily for ten glorious seconds, and the journey spans a couple hundred feet or more. Double the time and the flight becomes a triumph. Out of the ingenuity of thousands of boy aviators, the world over, has come a surprising development of the model aeroplane. The experimental stage is passed. Any bright boy may now build a model aeroplane which is certain to give results. The distance qualities of your model may even rival your endurance as a runner in keeping pace with it.

Working along different lines, the builders of model aeroplanes, widely scattered, seem to be gradually developing much the same type of air craft. The tendency is toward the construction of much lighter and more logical models than last year. In place of

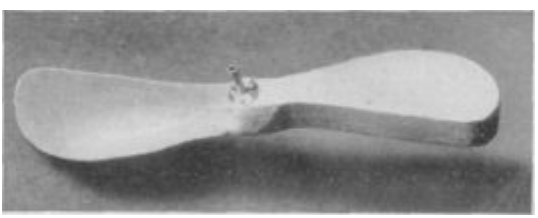
the complicated models supported by several broad planes, we find the most successful amateur aviators expending all their ingenuity upon simple monoplane forms. The biplane forms are being abandoned by model builders, as well as the biplane form of elevating planes. In place of the models made from fifty or more members, we now find excellent models, capable of much longer flights, formed of but a dozen pieces. The builders of model aeroplanes are keeping pace with the development of the man-carrying machines, if they are not passing them, in developing the flying machine of the future.

Improvement in the distance qualities of the model aeroplanes, in the past few months, has been remarkable. At one of the first model aeroplane tournaments, held in New York, less than two years since, the longest flight was under sixty feet. In less than one year, flights of more than 200 feet had become common. To-day the improved racing model aeroplanes have flown more than 2,500 feet. As a result of the labors of the boy aviators, it is much easier to build a successful model flying machine to-day than it was a year ago.

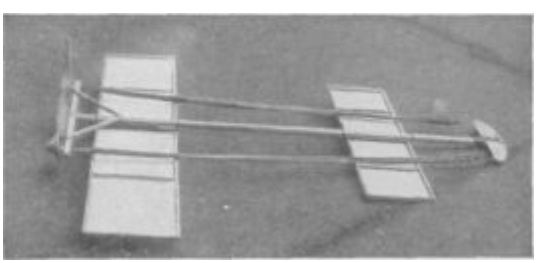
What may be called the 1911 type of model aeroplane looks every inch a racer. Every unnecessary stick and string has been cut away. When skids are used they are of the lightest possible material and the simplest construction. The miniature rubber-tired wheels, with ball bearings, which made many of last year's models so attractive, are rarely used. The



A good specimen of plane-building



"Finish one end of the blade before cutting away the opposite end"



Model aeroplane. Designed by Cecil Peoli

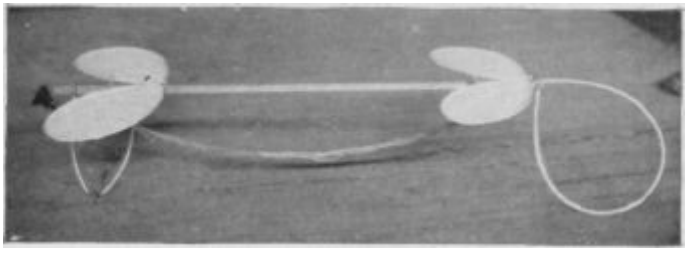
CHAPTER II

MODEL AEROPLANE TOURNAMENTS

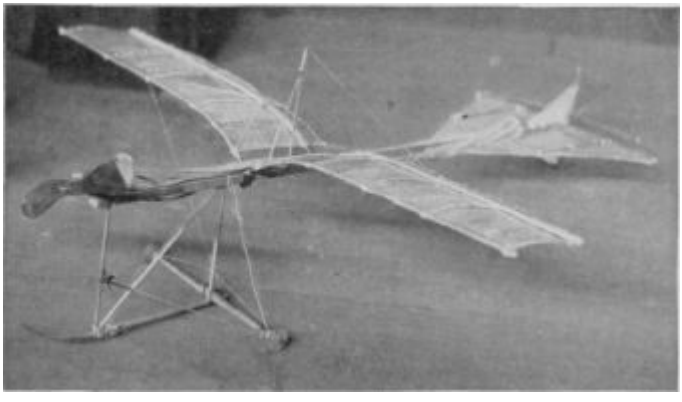
WITHIN the year, exhibitions and contests of model aeroplane flights have become an established form of entertainment. The attractions of the flights of man-carrying machines are borrowed in a large measure by the model aeroplanes. The building of models has progressed so rapidly, bringing the little air-craft under such control, that a definite program of flights may now be carried out. The programs may be considerably varied to include distance flights, weight-lifting contests, and spectacular flights in which the models loop the loop and perform other amazing feats.

The first formal exhibition or professional appearance of the model aeroplane in public as an entertainment was made in connection with the first aviation meet held at Asbury Park, New Jersey. Two of the most successful model builders, Percy Pierce and Frank Schoeber, of the New York Model Aero Club, were engaged to give exhibition flights for one hour a day in the intervals between the flights of Arch Hoxey, Johnston and other aviators of the Wright Brothers staff.

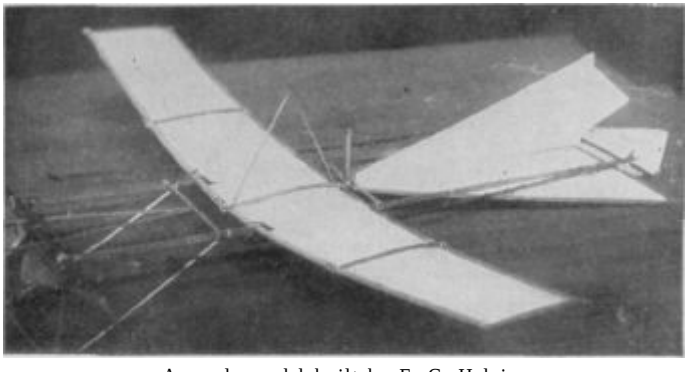
The models were flown for more than 200 feet



An original design built by Harry McAllister



An interesting experiment in stability



An early model built by E. G. Halpine

plane. The accompanying picture will show how simple this all is.

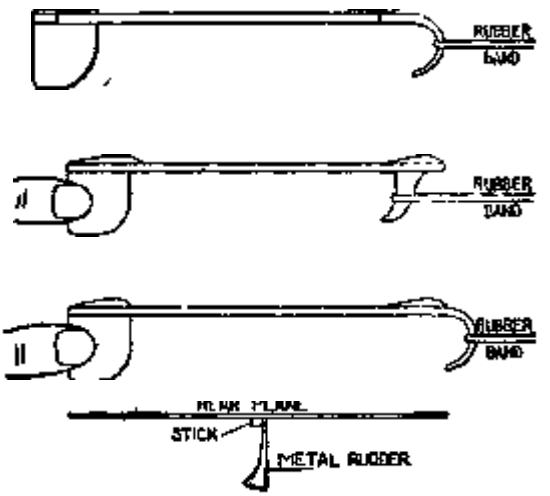
The biplanes as a rule require no weighing. To launch them, hold them high in the air and merely let go. They fly best with their smaller planes forward. By varying the angle of the front plane, you can soon bring it to an even keel. A vertical rudder placed three inches behind the main plane will increase the model's directional stability.

An amazingly clever little glider may be made of a piece of reed or cane, say five inches in length, and a sheet of writing paper. With a pair of scissors cut two planes, one three by one inch and the second two by half an inch. You will also need a vertical rudder one inch square. Round off the corners slightly and glue the planes at either end of the stick and exactly on a level. Now fasten the rudder at right angles to the planes beneath the larger plane. If it dips, the front plane is too far back, while if it rises too quickly and settles back, the front plane must be brought back.

The paper gliders form an excellent kindergarten preparation to the study of aviation, leading up to the construction of large model gliders. You will thus gain a skill in adjusting the planes and fixing the centers of gravity and of pressure, which will prove valuable later on. The possibilities of glider-building come as a surprise to the laymen in such matters.

THE SLING-SHOT GLIDER.

A fascinating field of experiment is opened by combining the sling-shot principle with the ordinary glider. The speed with which one can launch a glider from the hand is, of course, limited. Now use a small strand of rubber to launch the planes,



DESIGNS FOR SLING-SHOT GLIDERS.

and the increased speed will not only lengthen the flight surprisingly but make possible a really remarkable spectacular flight. A small glider may be made to return to the starting point or even loop the loop two or three times before touching the ground. By a simple adjustment of the planes, these curves may be varied indefinitely.

CHAPTER V

THEORY AND PRACTICE OF PLANE CONSTRUCTION

THE planes of your model aeroplane need no longer be a blind experiment whose merits or defects may only be learned by actual test. The science of wing-building is much better understood to-day than a year ago. Without going into the complicated equations dealing with aspect ratio, pressure, and gravity, it is important that one bear in mind a few definite rules in designing even the simplest planes. A great many useless experiments may be avoided.

In a previous volume, it was pointed out that a narrow plane, or. one with a high aspect ratio, driven with its broader side forward, would yield greater support than a square surface of the same area. (The aspect ratio, it may be well to repeat, is the relation between the width and depth of the plane. A wing, for instance, whose width is five times its depth, is said to have an aspect ratio of five.)

It has been found that on small planes the center of pressure is situated about one-third the distance back from its front or entering edge. The center of pressure in flexed planes occupies about the same position.

As long as a plane remains horizontal, or nearly so, a very narrow surface,— one, that is, with a high aspect ratio,— will exert greater lifting power than a deeper plane of the same area. An examination of the successful model aeroplanes of 1911 will show that the depth of the planes has been cut away. Planes are used with an aspect ratio as high as ten. The speed at which such a plane travels is a very important factor. As the speed increases, the efficiency of the plane surface increases, so that a model aeroplane driven rapidly may be sustained by less wing area than in the case of one which flies slowly.

As the front edge of a plane is raised, the center of pressure travels backward. By the time the plane has reached an angle of about fifteen degrees, its lifting power has diminished about one-half. A very narrow plane, or one with a high aspect ratio, should, therefore, be set near the horizontal. The model should, moreover, rest upon skids at as low an angle as possible.

In starting off, the planes will thus exert their maximum lift, or nearly so. If the narrow planes be elevated too much, the center of pressure will come nearer the rear than the front edge, and tend to force the aeroplane downward, or, as the phrase is, make it "sit on its tail." As long as a plane is traveling horizontally, or at low angles, its rear portion exerts very little sustaining power and may be cut away.

A plane with a high aspect ratio is much more stable in flight than a surface of greater depth. The

smoothly, pressing the air backward without splashing. It is only when an aeroplane is held fast that its propellers kick up such a fuss and blow your hat off. The aeroplane propeller's work is much the same as that of a steamship, although the air through which it travels has many tricks not yet understood. The density of the air compares to that of water as one to eight hundred, but the friction encountered by the air propellers is much greater than 1-8ooth that of water. It may be laid down as a general rule, however, that the driving force of an aeroplane propeller varies as the square of the number of revolutions per minute.

There is at present no standard form of propeller for the man-carrying or model aeroplane. One school of designers favors a small blade revolved at high speed, while others claim that a larger propeller driven more slowly is more efficient. As a general rule it may be laid down that a model with a span of thirty inches should be driven by twin propellers eight inches in length or diameter. They should have a speed of about 1,200 revolutions per minute, or at the rate of some 200 turns every ten seconds. To test the strength of your motor, give the propeller 200 or 400 turns, and watch in hand, find how long it takes to run down.

There is much difference of opinion as to the proper modeling of the propeller. It has been worked out by elaborate equations that the blade should be concave and yet in actual tests it has been found that some machines are driven faster by a flat blade pro-

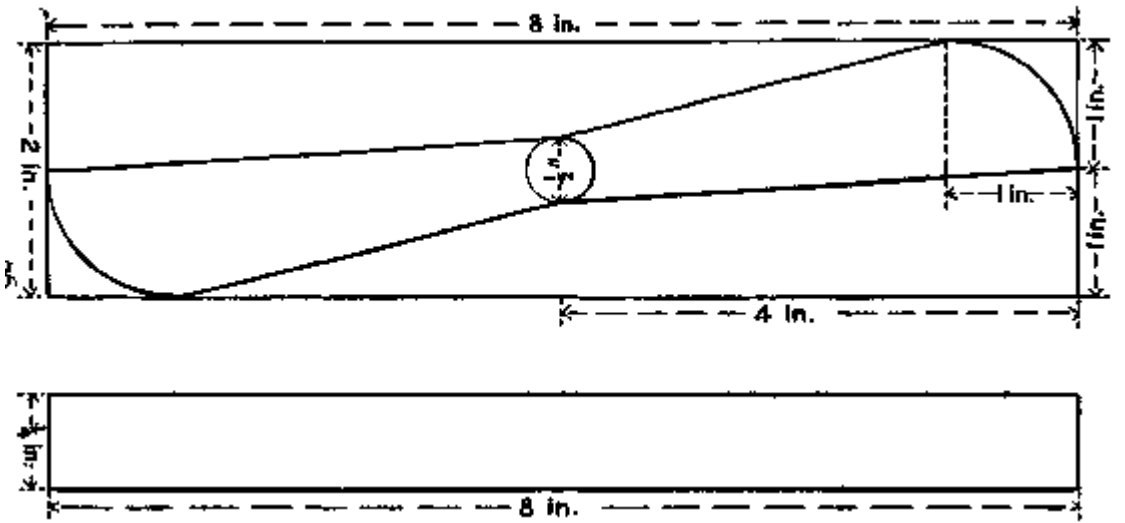


DIAGRAM SHOWING HOW TO MAKE A PROPELLER FROM A WOODEN "BLANK."

DICTIONARY OF AERONAUTICAL TERMS

A

AERODROME. A tract of land selected for flying purposes.

AERODYNAMICS. The science of aviation, literally the study of the influence of air in motion.

AEROFOIL. A flat or flexed plane which lends support to an aeroplane.

AERONAUT. One engaged in navigating the air.

AERONAUTICS. The science of navigating the air.

AEROPLANE. A heavier than air machine supported by one or more fixed planes.

AEROSTATICS. The science of aerostation, or of buoyancy caused by displacement, ballooning.

AEROSTATION. The science of lighter than air or gas-born machines.

AILERON. The outer edge or tip of a plane, usually adjustable, used to balance or stabilize.

AIRSHIP. Commonly used to denote both heavier and lighter than air machines; correctly a dirigible balloon.

ANGLE OF INCIDENCE. The angle of the plane with the line of travel.

AREA. In the case of planes, the extent of surface measured on both the upper and lower sides. An area of one square foot comprises the actual surface of two square feet.

ASPECT RATIO. The relation of a surface crossing the