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MODEL AIRPLANE NEWS

AND JUNIOR MECHANICS

AUGUST, 1931

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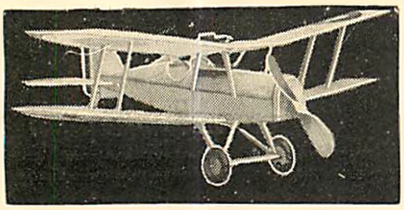

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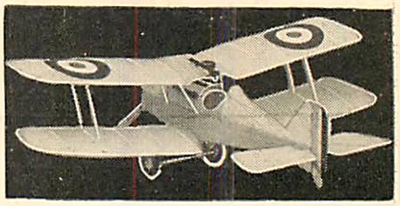

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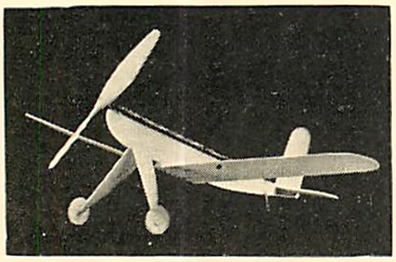

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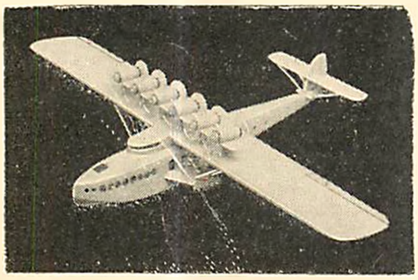

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Model Airplane News

AND JUNIOR MECHANICS

Vol. V No. 2

Published by Harold Hersey
Edited by Capt. H. J. Loftus-Price

CONTENTS

AUGUST, 1931

In Our Next Issue

Pardon us, please, if we become slightly hysterical about a great surprise we have for you in our next issue, but — —

The surprise involves our giving away something you have all dreamed about for years.

What is it? you ask.

Oh, just a 10-hours Flying Course, a complete Ground Course, and a 200 miles Cross-Country Flight with none other than the world-famous "Casey" Jones as your host-pilot!!!

Notice the nonchalance with which we endeavored to put that over?

Let's repeat it, to impress you a little:

FREE!!
A 10-hours Flying Course.
A complete Ground Course.
A 200 miles Cross-country Flight.

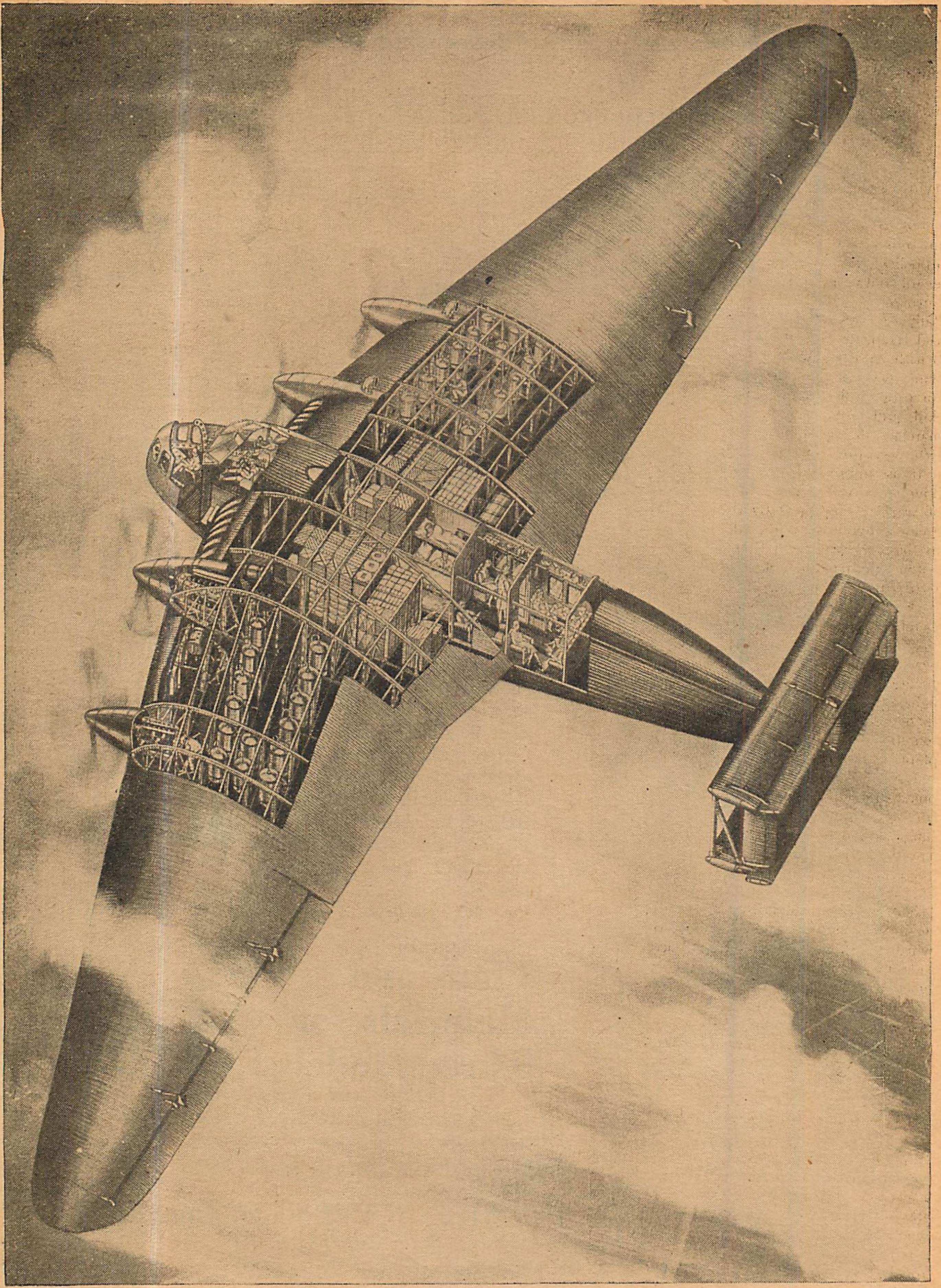
Naturally we're not going to dish those delicacies out without some help on your part. However, your end of the game consists only of a little brain-work and about five minutes time each evening for a week or so.

We'd like to give you *all* the details now, but that would spoil the fun. So take a good tip and order your September issue of MODEL AIRPLANE NEWS NOW. On all news stands August 21 next, and only 15 cents a copy. Order it now, otherwise we can't help it if you lose this great opportunity.

P. S.—Apart from this great surprise the magazine contains its usual high standard of articles, courses and plans, etc.

Published Monthly by GOOD STORY MAGAZINE COMPANY, INC., Myrick Bldg., Springfield, Mass.
Editorial and General Offices, 570 Seventh Avenue, New York City.
Harold Hersey, President Pauline Sandberg, Treasurer Frank Moran, Secretary
J. W. LeBaron, Advertising Manager. 570 Seventh Avenue, New York, N. Y.
Entered as second-class matter June 5, 1929, at the Post Office at Springfield, Mass., under the Act of March, 3, 1879.

Price 15c a copy in U. S. and in Canada. Subscription price $1.50 a year in the United States and its possessions; also Canada, Cuba, Mexico and Panama.
All other countries $2.00 per year.
Chicago Advertising Office: 333 North Michigan Ave., C. H. Shattuck, Manager.
London Agents: Atlas Publishing & Distributing Co., Ltd., 18 Bride Lane, London, E. C.



A diagramatic impression of the giant German Junkers G-38 four-engined monoplane, showing how passengers, freight, fuel, etc., are carried during flight. The G-38 is the largest landplane in the world today. The wingspan is *144 ft. 4 in.*; length *75 ft. 6 in.*; and height *21 ft. 4 in*. Speed *133* miles an hour.

Capt. Albert Ball, V. C., D. S. O., M.C.

Ball, of Great Britain

By L. ELSEN

"It was a good fight and the Huns were fine sports . . . but I do get tired of always living to kill"

A "RED SPINNER" . . . a young, short Englishman with longish black hair and eyes like a hawk . . . an impetuous manner of attack that carried all before it . . . all these spelled disaster for many a German flyer in the trying days of 1915 and 1916 during the World War.

For to come upon an S.E. 5a numbered 8898, with propeller boss painted red, meant only one thing to a German pilot—that Albert Ball, V.C., D.S.O., M.C., and recipient of many other British and foreign decorations, was roaming the skies for prey, and that one's best skill and wits were to be matched in the fierce battle that was sure to follow.

It is interesting to note how varied were the methods of warfare employed by the greatest flyers on both sides in the last war. von Richthofen, German ace of aces, resorted to an ingenious trick. Sending out several members of his "Flying Circus" as decoys, he would appear on the scene when the enemy pilot was engaged in fighting off his men, and then von Richthofen himself would quickly dispatch the plane.

Max Immelmann, his famous countryman and inventor of the turn named after him, a maneuver which allowed the pilot to reverse his direction and gain altitude at the same time, was another crafty strategist. He would set out on cloudy days, of which there were many in France, hide up in the clouds, and wait. Then when a foe appeared, he would pop out in his speedy machine and set upon the surprised pilot. Much fiery action would follow, and more times than not the enemy was routed, if not worse.

ALBERT BALL, England's premier fighting airman of his day, had a method which, curiously enough, owed its success to the fact that it really was not a method. His secret of success was his dash in attack, his absolute fearlessness, and extraordinary judgment. He would often throw himself recklessly into the midst of a compact enemy formation with great ferocity and abandon, and by his daring and the enemy's fear of collision, carry the tide of the battle.

Such description would tend to create the impression that Ball was a seasoned veteran who had learned by experience that the best way is the simple way. Hardly! Like so many flyers of that time, he was only a youngster who very likely would have been at school if the war had not broken out when it did.

When the call for volunteers came, Ball was only seventeen years of age but immediately enlisted as a private in the Sherwood Foresters. Soon after he became a non-commissioned officer in the Nottinghamshire and Derbyshire Regiment. He was destined not to fight in the trenches, however, for it was while in training as an infantryman that he took the step which led to his aerial career.

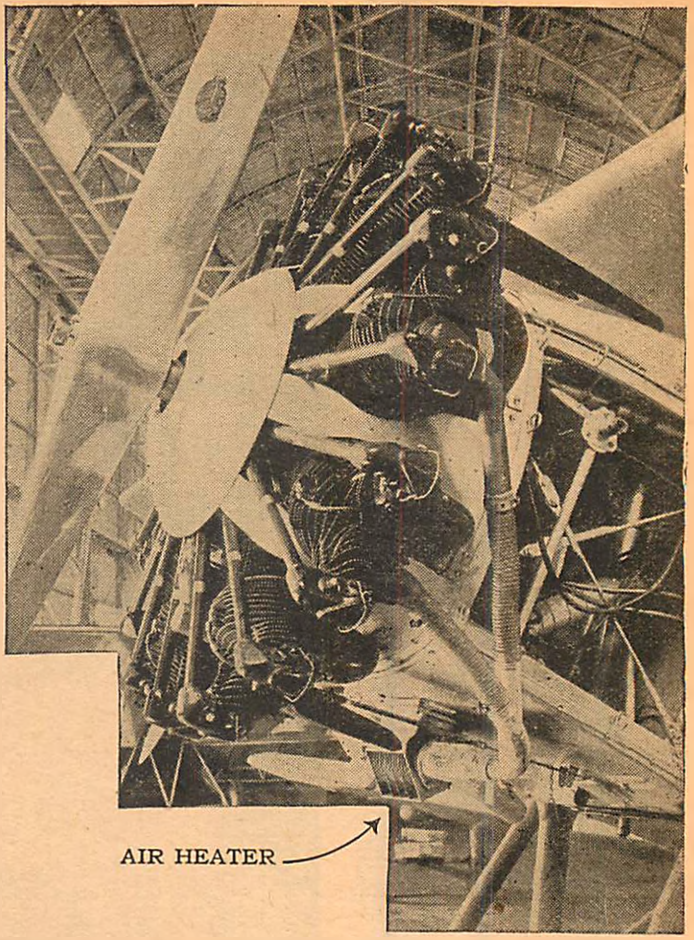
SEVERAL miles from his camp was the Hendon Airdrome, and Ball's love for mechanics drew him to it despite the distance. In order to be back at 6 a.m. for parade, he would rise at 3 a.m., make the trip to the airdrome by motorcycle and spend what time he could puttering around the hangars. It was only after a while that the desire to fly came, and he then began to take flying lessons at his own expense.

He took to flying from the first. In this he was unlike von Richthofen, who crashed on his first solo flight and only became the great flyer he was by sheer tenacity and will power. Ball's thorough knowledge of mechanics was to be of great aid, an asset which most pilots of that time did not possess.

When he was barely eighteen, he obtained his pilot's certificate on a Caudron machine at the Ruffy-Beaumann School at Hendon, and immediately applied for transfer to the Royal Flying Corps. Then he was sent to France and assigned to patrolling and spotting for the artillery. Nevertheless, he was waiting and watching for a fight at all times, despite the fact that he knew the limitations of the cumbersome and slow machine he had. From the first he became distinguished for his skillful piloting and courage.

Always the careful mechanic, he would spend all his spare moments on the ground in the hangar, verifying his instruments, his motor, and every other detail. Once in the air with a perfectly tuned machine, he threw caution to the winds but not before. He was sensible enough to know that the lives of himself and his observer depended on the condition of his machine.

At last he brought down his first machine and one victory after another followed. His fame spread. All eyes were then on the Nieuport single-seater fighter which had been produced by the Allies, and Ball petitioned for one. He longed to be alone in the (*Continued on page* 38)



This contrivance heats incoming air to carburetor and aids in vaporizing mixture

The Airplane Engine

By Lt. (jg) H. B. Miller

(*Chapter* 3)

BY FAR the most obnoxious load to be carried by an airplane is that of fuel. It is not only bulky, but it is heavy. It weighs approximately 6.5 pounds per gallon. If a plane is to operate on a long run, its fuel supply must be proportionately increased. As the fuel load expands, the amount of payload such as mail or passengers decreases.

It is for this reason that the transport planes on scheduled trips make comparatively short hops. It is more economical to carry a greater payload even though it requires the pilot to land and refuel more often.

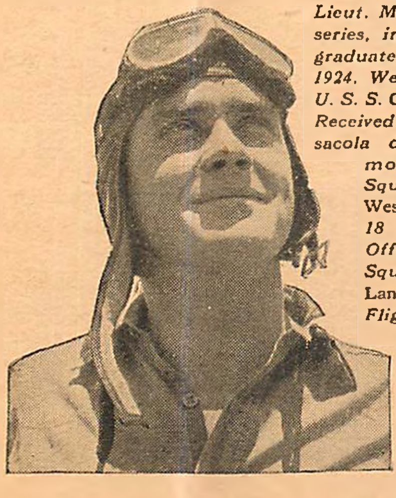
More economical engines would, of course, require a smaller supply of fuel. The aeronautical industry is making every endeavor in this direction. The greater economy of the Diesel-Packard engine has led to its adoption in many planes. Better yet, the discovery of some new, concentrated fuel would solve this problem of fuel-loads.

It is not beyond the realm of possibility that the future will produce a method for transmitting electric power by means of radio. If this could be done, the propellers of an airplane could be turned by an electric motor which received its energy from some hydro-electric plant on the ground. In this case the third of a plane's load capacity which now is occupied by fuel could be used for transporting a revenue-producing load of mail, express, or passengers.

In the meantime, however, it is necessary to design airplanes and their engines to use a liquid fuel which can be vaporized and then burned within the engine cylinders. The most simple method of constructing this system is to take advantage of the force of gravity. In this type of fuel system the gasoline tanks are placed well above the carburetor or vaporizing device. As the fuel is drawn from the carburetor and burned it is replaced by the main supply which is stored at this higher point. Thus the fuel supply is not dependent on mechanical parts which are subject to failure.

The location of the tank will depend on the dimensions of the plane. It is desirable, of course, to inclose all tanks either inside of the fuselage or within the wing in order to streamline the plane as much as possible. In the gravity fuel system the tank is generally situated inside the upper wing. The tank is of a long, flat shape and is usually enclosed in the wing before it is covered with fabric. This streamlines the planes, and, in addition, because of the greatest possible difference in level, delivers the highest fuel pressure available to the carburetor. This will insure a constant supply of gasoline to the engine.

If this system is used on a training plane, the wing tanks are often mounted just below the upper wing in order that they are readily accessible for inspection or repair. In any event it is seen that a great volume of fuel could not be carried in the wing of a plane. Consequently, this system is used only in comparatively short-range planes, such as sport or training ships.



Lieut. Miller, the author of this series, in his own words: "Was graduated U. S. Naval Academy 1924. Went to battle fleet flagship U. S. S. California *for 18 months. Received aviation training at Pensacola during 1926. Flew 18 months in Observation Squadron aboard U. S. S.* West Virginia. *Spent next 18 months as Engineering Officer of Fighting Plane Squadron Two aboard U.S.S.* Langley *and U.S.S.* Saratoga. *Flight Instructor at Pensacola during 1930. Now Chief Instructor, Power Plant Division, Ground School, U. S. Naval Air Station, Pensacola, Florida."*

The Author

The air-pressure type of fuel system was greatly used during the war and post war periods. Here the fuel tanks were mounted within the fuselage at approximately the same level as the carburetor. Consequently, it was necessary to force the gasoline to the engine. A small air pump was mounted so that it maintained an air pressure of several pounds within the tank on top of the liquid fuel. The constant air pressure naturally forced the fuel through the system.

While this type of fuel supply gave satisfactory operating results, it proved costly in event of a crash. The air pressure invariably forced raw gasoline from the system and fires frequently resulted. This type of installation is now forbidden except in very special cases.

Vacuum systems as used on automobiles are not permissible in aviation because of the possible heights at which a plane might operate. Since the density of the air decreases with altitude, it would be possible to reach a point where there was insufficient atmospheric pressure to provide the engine with fuel. In addition, since an airplane engine operates almost continuously at nearly full power, there is very little, if any, negative manifold pressure to draw fuel into the vacuum tank.

It thus becomes necessary to provide some positive method of supplying the engine with fuel. The pressure pump system is in general use today in practically every type of plane. Here the fuel may be on the same level as the engine or it may even be lower than the carburetor. The positive nature of the pressure pump permits all the fuel to be carried within the fuselage for it does not need the force of gravity.

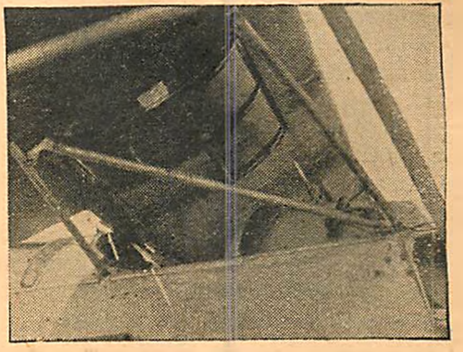
A GEAR pump is generally mounted within the accessory section of the engine. This pump draws the fuel from the lowest point of the tank and sends it to the carburetor at a pressure of approximately five pounds.

A combination of these systems is sometimes used when the fuel tanks are located at a great distance from the engine level. In this case it would be doubtful if the engine-driven fuel pumps could lift the gasoline so high. Accordingly, a separate pump which is actuated by a wind-driven propeller is provided. This pump forces the fuel to a small gravity tank in the upper wing from whence it flows direct to the engine. This system is in favor in large transport or patrol type of planes.

Regardless of the fuel system adopted, every effort is made to locate the tanks as nearly as possible to the center of gravity of the plane. Otherwise, as the fuel is consumed the plane would become unbalanced.

Nor may the fire hazard be disregarded. As instrument-flying and more reliable engines come into use, flying will become safer. The fire hazard exists, however, so long as a volatile fuel such as gasoline is used for combustion. As a protection a fire wall of metal sheeting is built to separate the engine from the fuel tank. Any piping which pierces this wall must run through a fire-tight gasket.

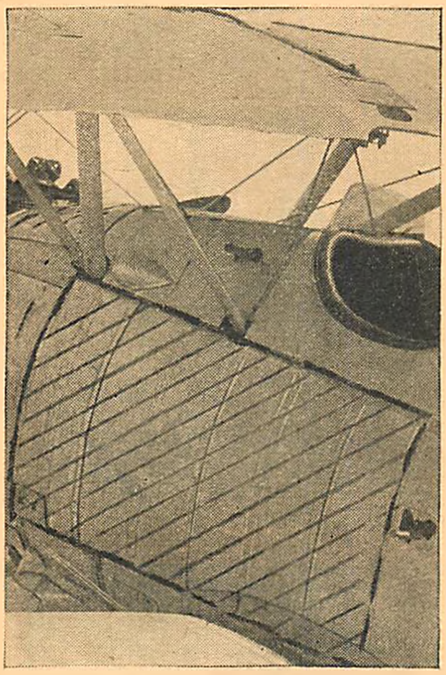
Some tanks are rubber-coated. If the tank should leak, the rubber would expand and close the opening. This scheme was first placed into use during the war in an effort to prevent leaks due to machine gun bullets.

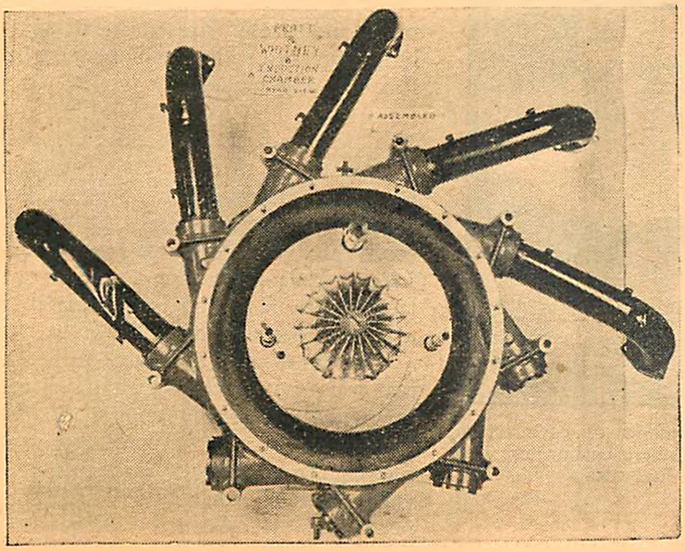


Showing the wing gravity tank

Practically all planes are now fitted with some form of a fire extinguisher. They are of the carbon tetrachloride type. The spraying is done by means of compressed air. Piping leads the extinguishing fluid to many critical points of the engine such as the carburetor. A valve operated by the pilot controls the use of this device.

Fuel tanks can be made from a number of different metals. Aluminum provides a minimum of weight but is subject to corrosion. Its alloy, duralumin, also is light of weight, but it is difficult to weld and shape. Brass, while not so light, is sturdy and can be worked by a variety of treatments. It is the material most in favor at the present time, though soldered duralumin is being used to some extent.





Above, another type of gas tank in the side of fuselage as shown by shaded area; at left is an inductor or blower, which distributes the vaporous fuel to each cylinder by means of centrifugal force

Annealed seamless copper tubing is used to convey the gasoline from the tank to the carburetor. It must be well protected from vibration, or it will harden and crack and result in an increased fire hazard. Its inside diameter must be such as to permit the passage of sufficient fuel at the engine's maximum fuel consumption.

Gauges are provided in the fuel tanks in order that the pilot shall know just how much gasoline remains. As a check, practically all pilots figure their fuel consumption according to the time the plane has been flying.

THE fuel pressure pump is of the gear type. It has many advantages over the piston-plunger pump. It is simple, reliable, and the gasoline provides sufficient lubrication to maintain it in good running order. These pumps are ordinarily driven directly from the engine, though they may be placed at a considerable distance and be driven through a flexible drive shaft.

A spring loaded valve is placed in the system to provide an outlet for the gasoline in case it is being pumped at too great a pressure. In this event the excess fuel is merely bypassed and sent back to the inlet side of the pump. Thus, the carburetor will never be flooded from that cause.

A hand operated pump is also placed in the system to provide for the time when the engine-driven pump fails. By working a lever back and forth the pilot is able to supply his engine with fuel. This also serves the purpose of supplying the engine with gasoline on starting when the main pump is not yet turning over.

Gasoline vaporizes and ignites much easier when it is heated. When starting a cold engine the worst possible vaporizing conditions exist. Consequently, in order to start an engine under such conditions, it is necessary to provide an excess supply of fuel in order that sufficient amount of the gasoline will vaporize to insure starting.

This is called priming and serves the same purpose as the choke on an automobile. A small hand pump is provided for this particular purpose. In most installations this pump forces a small amount of raw gasoline into the intake pipe of three of the cylinders. As the starter turns the engine over, the inrushing weak vapor will richen itself from this fuel. The chances of starting the engine are thus multiplied many times over.

In other types of installations the raw gasoline is injected into the induction chamber where it is vaporized by the revolving blower.

Care must be taken to prevent over-priming. In this case the raw gasoline will destroy the lubricating oil on the cylinder walls, and this will result in scored pistons and cylinders.

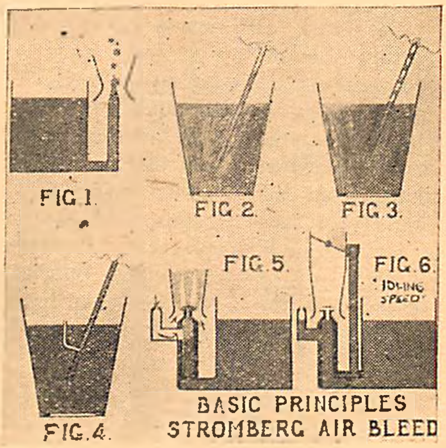
WIRE strainers are placed in the gas lines at certain points. Thus large objects that might clog the carburetor jets are stopped. A well is generally provided, also, in order that any water which may have found its way into the system may collect and be drained off before interfering with proper engine operation.

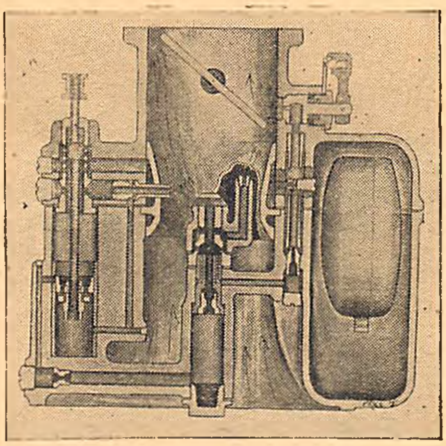
In order to use any hydrocarbon liquid as a fuel, the volatile vapors must first be mixed with the proper proportion of air. While practically any mixture of gasoline vapor and air will burn to some extent, the maximum number of heat units is released when fifteen parts of air by weight is mixed with one part of gasoline. This burning is really nothing but the chemical combination of the hydrogen and carbon of the gasoline and the oxygen of the air. It is this combination which develops the heat of the explosion.

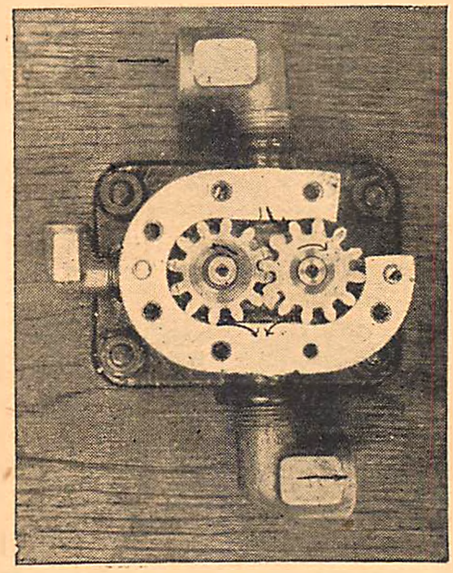
The resulting compounds, if perfect combustion has taken place, is H_2O, or plain water, and CO_2, or carbon dioxide. In other words, the exhaust from a firing cylinder is really soda water that one can buy over a soda fountain. Actually, the water is emitted as steam while the carbon dioxide is exhausted as a gas with the nitrogen which combined originally with the air.

Incidentally, it explains the principle of the water-recovery apparatus used aboard the dirigible, U. S. S. Los Angeles. As her fuel is used up and her load is thus decreased, it would become necessary to valve the valuable helium in order to maintain a predetermined level. If some way could be devised to keep the weight of the huge airship constant, the ship would have the same equilibrium. This can be done. The exhaust gases are collected and passed through a condenser. This cools the escaping steam which has been chemically manufactured and turns it back into water. It is possible to collect sufficient water to equal the weight of the fuel which is consumed.

If the vapor is lean, however, or starved for air, the combustion will lack oxygen. The resulting exhaust will consist of water (H_2O) and carbon monoxide (CO). The latter is a deadly poison and must not be breathed. It appears when an automobile engine is run in a closed garage. Since only a certain amount of oxygen is enclosed within the garage, the engine will fail to attain complete combustion. Consequently, the shortage of oxygen will result in the formation of carbon monoxide.







Top, Stromberg principle of carburetion; center, details of Stromberg carburetor; and, bottom, a C-5 type of fuel pump

No internal combustion engine should ever be operated within a closed space. The results may easily be fatal to the operator.

If the explosive charge within the cylinder lacks the correct proportion of gaseous vapor it is said to be a "lean" mixture. If it has an excessive amount of the fuel vapor it is known as a "rich" mixture. In either case maximum power will not be developed by the engine. This is because the fuel charge will burn at a slower rate and thus the maximum driving force is not applied to the downward moving piston.

Moreover, the flames act for a longer time on the cylinder walls and thus raise their temperature. This will cause trouble to the pilot attempting to operate this engine on a hot day. The problem of properly cooling the cylinder walls of an airplane engine is difficult enough without adding other complications.

One can be assured of having the proper mixture by adjusting the carburetor until the maximum number of revolutions are reached; or, if one can see the exhaust flames, as at night, the adjustment should go on until the flames are the extremely light blue color they will be just before turning whitish.

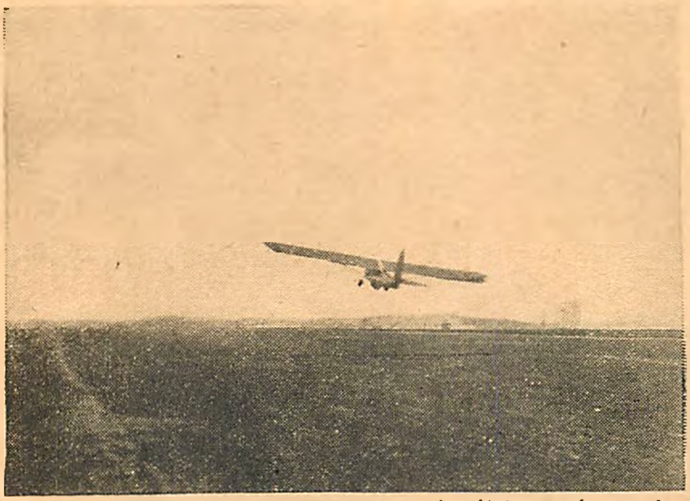
IT IS the function of the carburetor to provide the engine with a properly mixed vapor of such proportions of air and fuel that perfect combustion will result within the cylinder. It is easily seen that this is a tremendous responsibility to place on any one mechanism.

The conditions necessary to attain maximum power from the fuel charge vary with different engine speeds. With high speeds the compression of the charge is greater and this provides better combustion. The opposite (Continued on page 41)

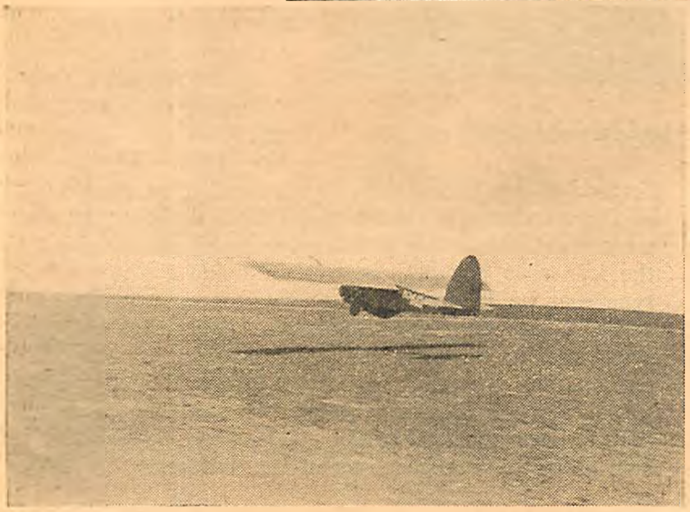
How You Learn to Glide

By
C. B. COLBY

Modern Schools Use Step-by-Step Methods



The several stages in the instruction of students. At top, being towed at 200 ft. for making "360's"; center, being towed a few feet up to practice landings (note cloud of dust from tow car at left rear); and, bottom, flying just off the ground



WITH aviation magazines advertising all kinds and shapes of gliders and sailplanes, or soaring gliders, it would seem that a few remarks on the selection of gliding methods and instruction would not be unwelcome.

At present there are several hundreds of so-called schools for the teaching of "gliding" in various parts of the country, ranging from the outfit that has a single glider to its credit and possibly one pilot that holds a U. S. Department of Commerce glider pilot's license, to the completely equipped organization. The latter school usually has the best in equipment and instructors at its command and employs the most modern methods in its instruction.

Ground classes in schools of this last type give the embryo flyer a series of classroom lectures covering all the subjects that might be needed in actual flying. This series of lectures has been prepared with great care as to simplicity and completeness and, with the help of furnished reference books and loose-leaf notebooks, covers very thoroughly such subjects as meteorology, construction, repairs, maintenance, selection of soaring terrain, and aerodynamics. When the student has completed his ground school course, he is "graduated" to actual flying, which he has been looking forward to ever since he was bitten by the bug called "aviation."

The method of flight instruction is, first, the understanding of the controls. The student must know why he moves the stick and rudder pedals, and what happens when he does. Until he does understand the function of the controls it is useless to let him leave the ground in a ship.

When the instructor is satisfied that the student will know how to move the controls to get a desired result, the glider is fastened to the back of the towing car by a long rope. A release at each end of the rope makes it possible to drop it from either the driver's seat of the tow car or from the pilot's cockpit of the glider. This prevents a panicky student from "grabbing too much altitude," as well as offering a means of release in case of trouble to car unseen by the pilot in glider above.

At first the student is towed across the field behind a car at just enough speed to enable him to feel the effect of the controls and get the sensation of the tail lifting; that is, the student is expected to notice what happens when he moves the stick and rudder pedals.

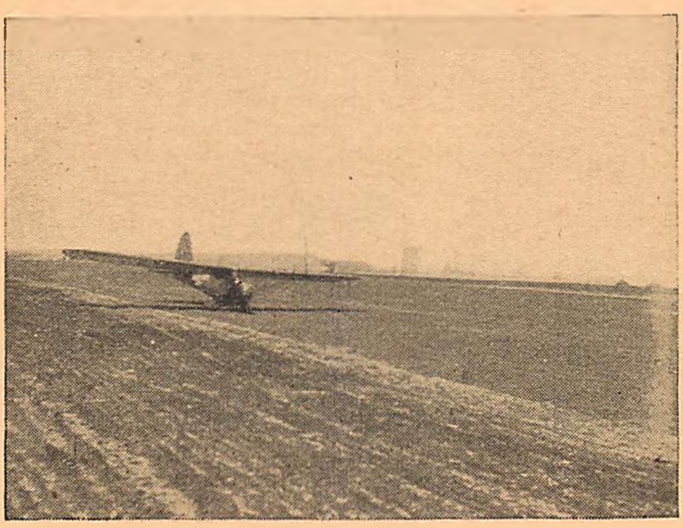
In my own case I was too busy trying to keep somewhere within sight of the tow car to even know what I was doing. My recollections of the first tow across the field are vaguely as follows:

"I'm moving!—keep behind the tow car—right—keep—your wings level—keep your wings *level*—left pedal—too much—right pedal—more—*more*—too much,—what is the car doing way over there?—left pedal—stick back—get that stick back—Great Scott, *I'm going up!*—stick forward —*forward*, you idiot—not so much—wings level—get that nose up—right rudder—we're going to hit—were goin' t' hit—wings levelnoseup stickbackwingslevelnoseupstickback *back* crummmmmp! (Short silence period during which I look cautiously about for flying parts. Seeing none, I begin to smile rather feebly. Well, I'm down again and —*alive—whoops!*)"

Believe it or not, the first tow across the field in a glider trying to follow behind a whizzing tow car is more exciting than chasing rumrunners or being a snake charmer in a circus—and I've done all three!

The only difference is that there is absolutely no danger in learning to glide in this manner. The speed of the tow car prevents the machine from attaining anything like a dangerous height and the skill of the instructor keeps the student progressing in safe, easy stages so that before he actually realizes it he is actually "solo-ing."

After the student has shown that he can buzz along after the tow car without rushing back and forth and hopping all over the runway, he is towed a bit faster and allowed to rise off the ground a matter of three or four feet; which, by the way, seems like fifty the first few times you try it. From this height the student at a signal from the instructor in the car pulls the ring beside his seat in the glider that releases the tow rope, and he is allowed to glide down to a landing from this altitude. When the student has mastered the art of a smooth easy landing without bounces and ground loops, he is towed a bit faster still and "climbed" to ten or fifteen feet and so on till he can glide down from fifty or more feet and make good landings.



A Franklin utility glider being towed behind a car

When a student has reached this stage he is allowed to make gentle banking turns to both the right and left followed by normal landings. From this the pilot learns the safe amount of banking to use for the different turns. Combining both right and left turns in one flight needs a little more air underneath the ship, but by now the student is used to being "upstairs" and so a few more added feet makes no difference.

When a student can make good turns in both directions from an altitude, he is ready for his U. S. Department of Commerce private glider pilot examination. This consists of a minimum of three flights, including moderate right and left banks. After passing this, by now, simple examination, the student before he knows it has become a duly licensed flyer. Simple, isn't it?

Oh, by the way, I forgot to mention that before a student may receive instruction in the air he must obtain a glider student pilot's permit from a Department of Commerce inspector. This merely allows him to receive instruction in duly licensed gliders from licensed glider instructors.

The school will arrange for the issuing of the permit in co-operation with the Department of Commerce inspector, and will arrange for the license examination.

After the student can execute both right and left turns well, he is allowed to make complete circles in the air, or "360's," as they are called. This means cutting loose from the tow line heading north, turning right or left, and continuing the turn until he is again heading north and then landing. The student is also taught to make "180's" which means just half a circle. This is even more tricky to most students as the glider takes off into the wind, and so naturally a "180" finds one landing with the wind on the tail, which shoves one along over the ground *plenty!* The first time I made a "180," I had visions of passing the bounds of the airport and not stopping short of New Haven, Conn.

The second time I made a "180" I was prepared; I had concealed in my flying suit the following articles: one pup tent, three eggs (hardboiled), one pair walking shoes, three tooth brushes (in case I lost one or more) and three letters to mail. The latter my wife had given me several weeks before to mail, so of course I still had them with me.

When the glider student has become adept at complete circles in the air and can set the ship down fairly near a designated spot, determined beforehand by the instructor, he is ready to take his commercial glider pilot's license test. This consists of complete circles in the air from an altitude and precision landings. The latter means landing by any mark designated by the inspector.

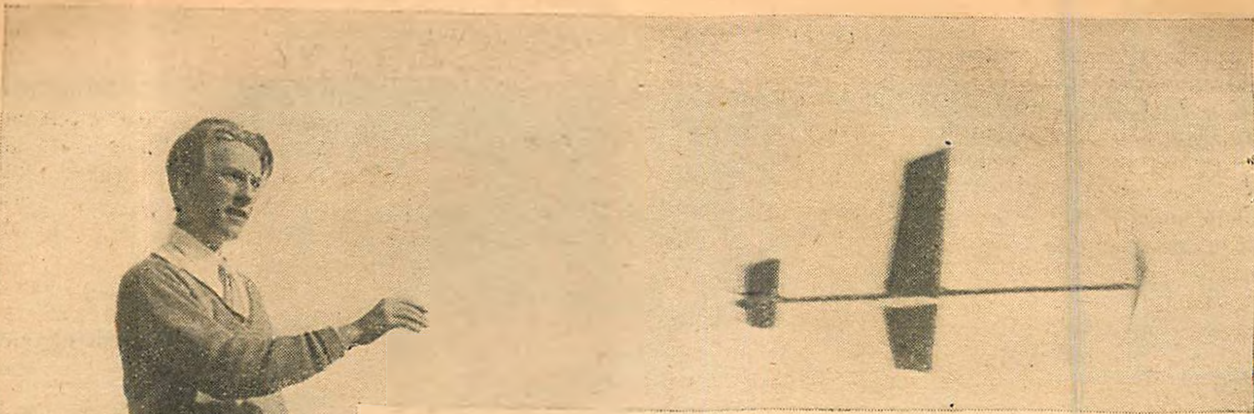
Upon receiving this license the student is entitled to give instruction for pay and can fly licensed gliders for exhibition purposes for pay. This grade of Department of Commerce glider license corresponds to a transport license for power planes. *However*—don't get the idea that just because a chap holds a license of this type that he is capable of teaching people to fly. Such ability comes only with months of experience in various ships and in all sorts of flying conditions. A physical examination the same as that required for the private power plane license is required for this license. None is required for the first glider student permit and the private glider pilot's license mentioned before.

Now that the student has progressed to this stage he is taught such other things as go to make a safe, reliable pilot; cross wind landings, stalling, side slips, etc. These are not stunts by any means, any more than being taught to park a car close to the curb is considered a stunt in auto driving.

Having been "graduated" from the gliding part of the school, the soaring instruction continues.

Flights into a valley are made so that the student may become familiar with the landing possibilities of the various fields.

These flights are made popssible by the use of shock cord launchings. A long, strong, specially-made elastic cable is attached to a hook in the nose of the glider. Several men grasp each side of the huge "V" made by the cable, and while another man or men hold the tail of the glider, walk, and then, at a signal from the pilot, run as rapidly as possible away from the glider, stretching the cable to its full length. At this (*Continued on page* 38)



She's off! Note the unusual location of the wing and the stabilizer. With the prop so far ahead, better straight-away flight can be obtained

The Quarter-Mile "What-Is-It?"

By DICK COLE

An R. O. G.-Tractor-Commercial Model

THIS little flying model can "R.O.G."; it's a "tractor" in the sense that it pulls; it's a "commercial" because the motor is enclosed. So what is it?

It is well to mention this fact at the outset, because many boys who will make this model and enter it in a contest, may have the judges scratching their heads to give it a classification. Regardless of split-hair rulings and official red tape, here is a model which performs in exceptional manner, and embodies some constructional innovations which can be applied to advantage in other models which may conform to official contest rules.

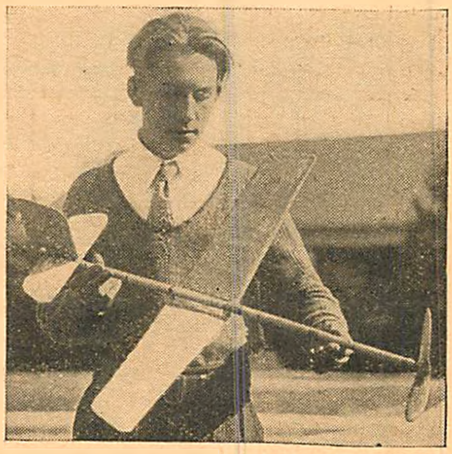
The most novel, and highly practical, feature of this model is the body and rubber band motor unit. The body consists of a hollow, balsa wood tube, ½" inside diameter. This is made by rolling a wet strip of balsa 1/32" thick around a ½" spindle, or arbor. After it has thoroughly dried out, the overlapping joint is cemented, the wood doped, and the body wrapped at intervals throughout its length with silk thread, similarly to wrapping a trout rod. Fig. 1, Plate I, shows how this body is made up.

The operation looks very simple—and is—but it is well to point out some of the snags. The first is the spindle. Be sure it is straight. Maple dowel rods can be bought at any builder's supply store, but it is nearly impossible to get one absolutely true. A ½" metal rod is better—iron, steel, brass, aluminum.

Unless some precaution is taken, it is very difficult to withdraw the spindle after the tube has been doped and wrapped. The remedy for this is first to wrap the spindle with about three layers of heavily waxed paper. Then, after the tube is finished, the whole can be heated gently over a gas flame to melt the wax, and the spindle can be withdrawn easily. Under no consideration attempt to glue the overlap with ambroid, or dope the wood, until it is thoroughly dry.

The tube can be made stronger—at the same time, slightly heavier—by wrapping it throughout its length with silk thread, and then giving it several coatings of dope. This course is advisable if more than twelve strands of ⅛" rubber are used in the motor. Fig. 2 shows the side and end elevations of the tubular body and gives the dimensions.

Fig. 3 shows all the individual parts which enter in the body and motor assembly. It will be seen that the prop shaft is held in an aluminum bush set in a balsa wood plug which fits in the front end of the body. The rear end of the motor is held to a piano wire hook, which, in turn, hooks over the sides of the body. On a later model, the writer incorporated the hook in the rear end plug, with an external hook to engage in a motor winder. The additional weight of the plug—which is only ornamental, in any case—made no appreciable difference in the performance of the model.



The designer with the finished model

Note in Fig. 5 how a suitable bush for the prop shaft can be made by rolling .005" sheet aluminum over a wire the size of the shaft. The front end plug of the tube can be made of balsa, or, better still — but heavier — of sponge rub-

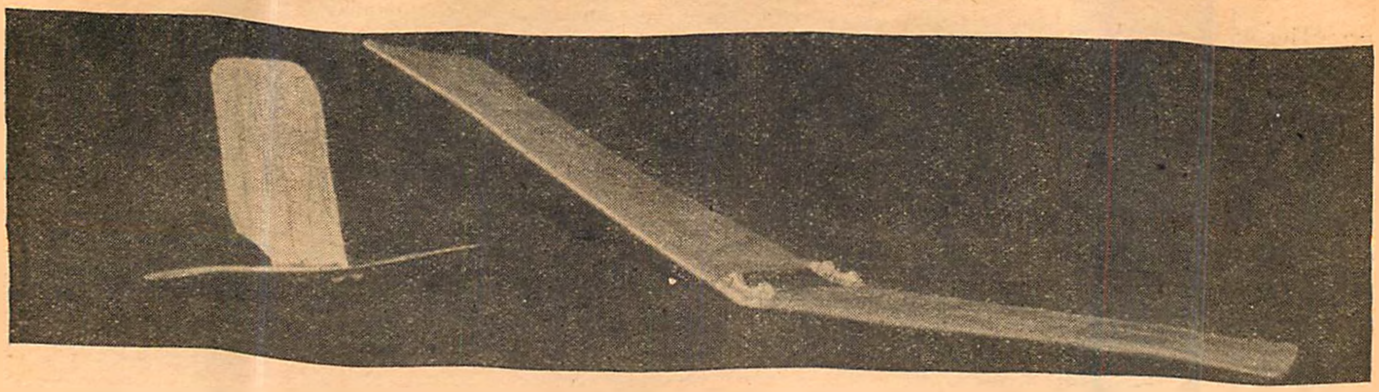
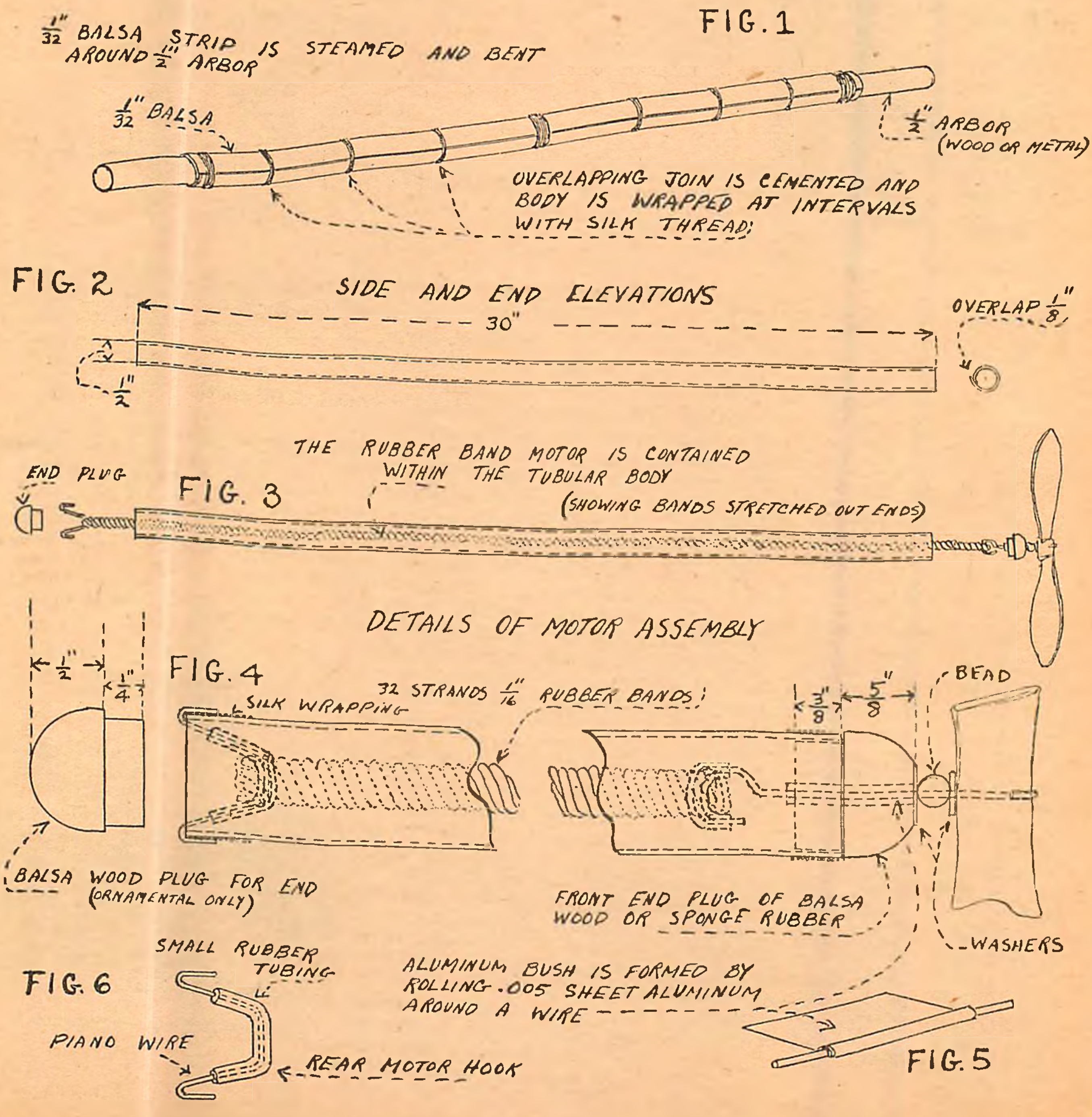


PLATE I
BODY AND MOTOR ASSEMBLY



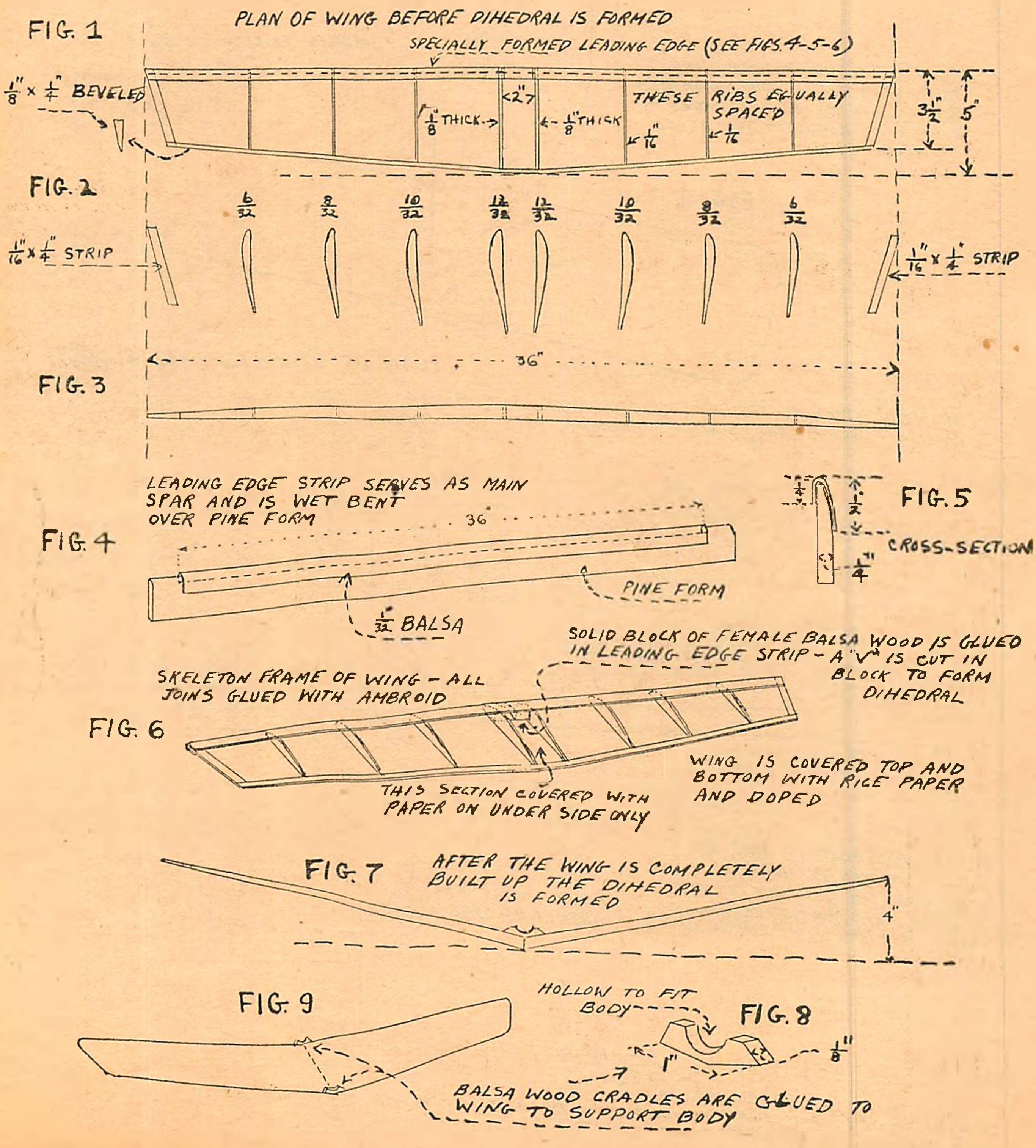
ber. This is the rubber used for "cleaning up" erasers, and can be bought for a nickel at any stationery store. The rubber plug will aid in protecting the prop and the body from damage.

We now come to the wing construction which is illustrated in detail in Plate II. Novelty and practicability is introduced here. Note that the wing has no middle spar. Instead, a rolled balsa strip forming the leading edge gives the wing the rigidity usually attained with the use of a middle spar. Not only does this provide lighter and stronger construction, but the paper can be drawn over the frame in a neater manner, and the respective air foils better preserved.

Fig. 1 (Plate II) shows the plan of the wing frame before the dihedral is formed. The wing is built up in its entirety in a flat position first and the dihedral formed after. Notations and dimensions on the drawings should make the construction clear.

Fig. 2 gives the approximate airfoils of the respective ribs. The two ribs nearest the middle are made of 1/8" balsa. The other ribs—except the tips—are made of 1/16" balsa. The wing tip pieces are (Continued on page 42)

PLATE II
WING



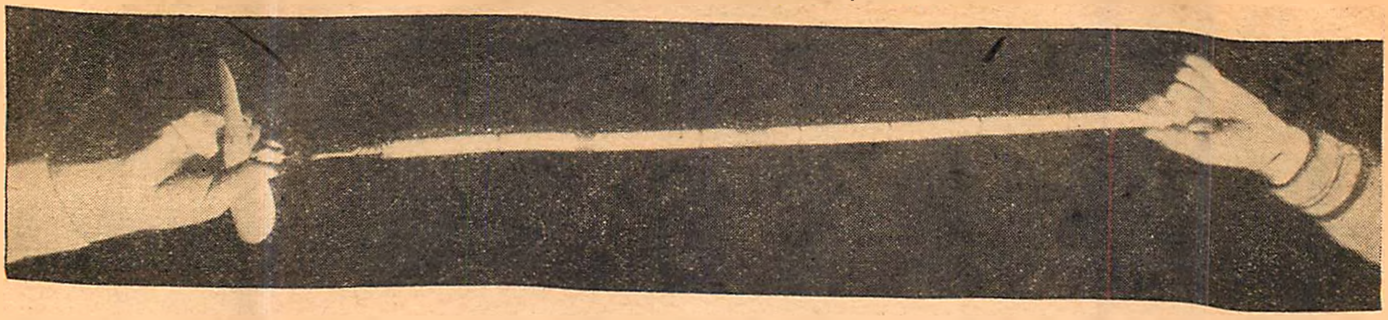


PLATE III

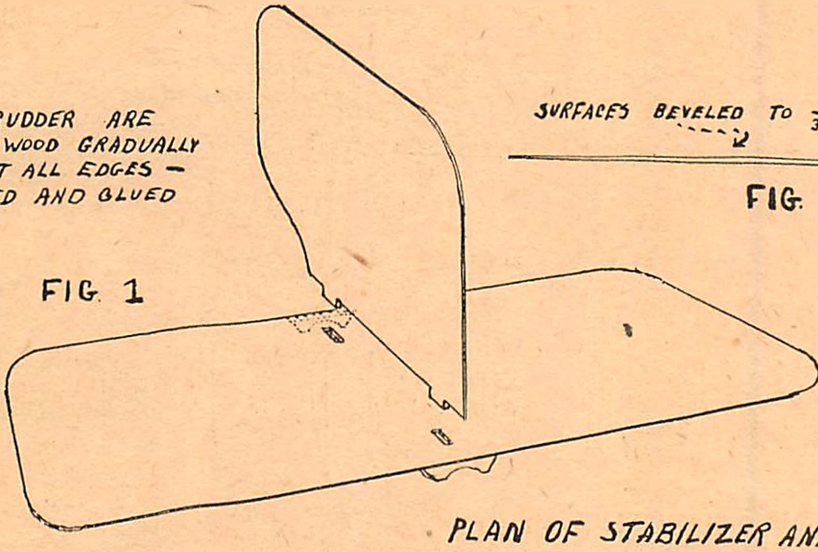
STABILIZER AND RUDDER ASSEMBLY

STABILIZER AND RUDDER ARE MADE OF 1/8" BALSA WOOD GRADUALLY BEVELED TO 1/32" AT ALL EDGES — RUDDER IS MORTISED AND GLUED TO STABILIZER

SURFACES BEVELED TO 1/32" AT ALL EDGES

FIG. 1a

FIG. 1



PLAN OF STABILIZER AND RUDDER

AS MUCH STOCK AS POSSIBLE IS CUT AWAY WITH SHARP HOLLOW PUNCHES AND SURFACES COVERED WITH RICE PAPER

FIG. 2

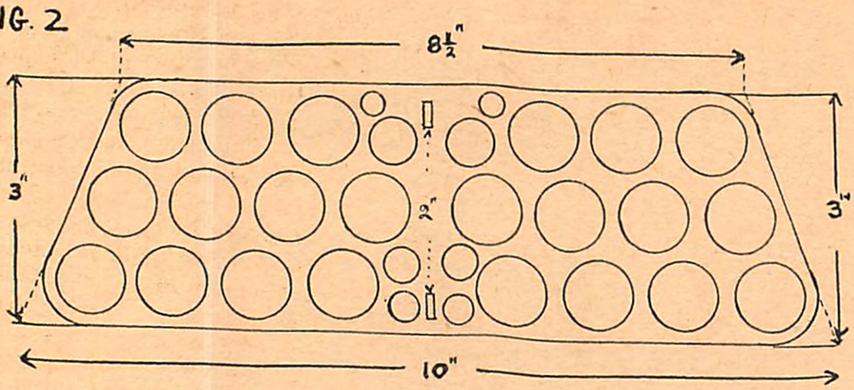
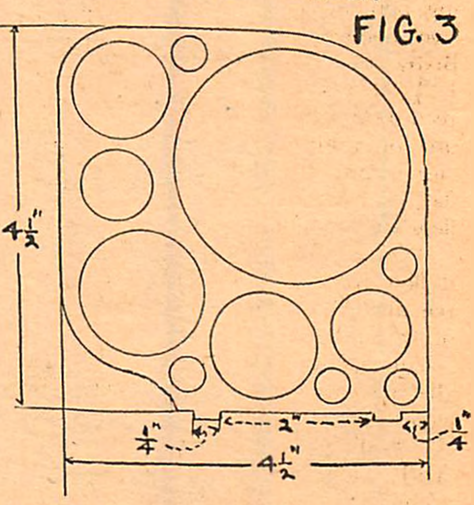


FIG. 3



AFTER ASSEMBLY IS COMPLETE THE STABILIZER IS HEATED OVER GAS AND SLIGHTLY TWISTED TO COMPENSATE FOR THE REACTIONARY TORQUE OF THE RUBBER BAND MOTOR

FIG. 5

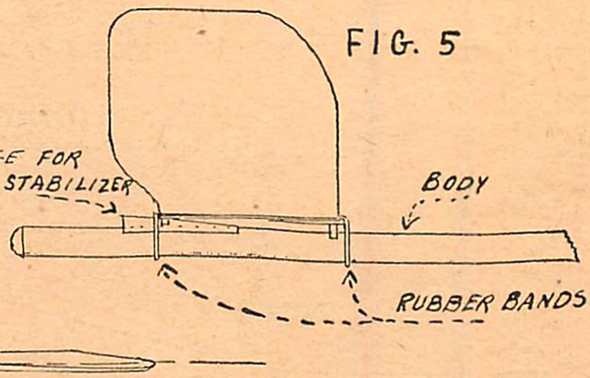


FIG. 4

NOTE TWIST IN STABILIZER — RIGHT SIDE (IN DIRECTION OF FLIGHT) IS TWISTED UP 1/8" LEFT SIDE DOWN 1/8"

CRADLES SAME AS USED ON WING

A general view of the large crowd

THE AMERICAN SKY CADETS

News Flashes from New York, Sioux City, Hamilton and Hartford Model Airplane Tournaments

MORE than 8,000 persons turned out to witness the recent New York City Model Air Derby at Central Park, New York City, and in doing so not only paid tribute to the ever-increasing popularity of this great instructive hobby, but also saw Willard Bixby, of Grand Avenue, Baldwin, L. I., create a new city championship record, and an unofficial world's record for endurance twin-pushers. The city record was timed at 10 minutes flat, as at that moment Bixby's plane flew out of sight.

Two minutes later, however, it flew back over the field and remained aloft for a total time of 14 minutes 13 seconds.

Among the most surprised of the spectators and officials was none other than the Hon. James J. Walker, Mayor of New York City, who presented the trophies at the conclusion of the meet. While, as he said himself, he had heard lots about model airplanes and had often seen boys and girls flying them, he had no idea that the present generation was so closely studying aerodynamics that they could build flying models that not only *flew* but remained aloft as any real plane might do.

The meet as a whole was one of the most successful ever held in the city, despite the fact that a variable cross-wind played havoc with the models, particularly in the speed event. Bixby's model, for instance, circled the judges platform for about two minutes at about fifty feet, and then suddenly was caught in an up-current of wind and within half a minute was flying at an altitude of about 1,500 feet!

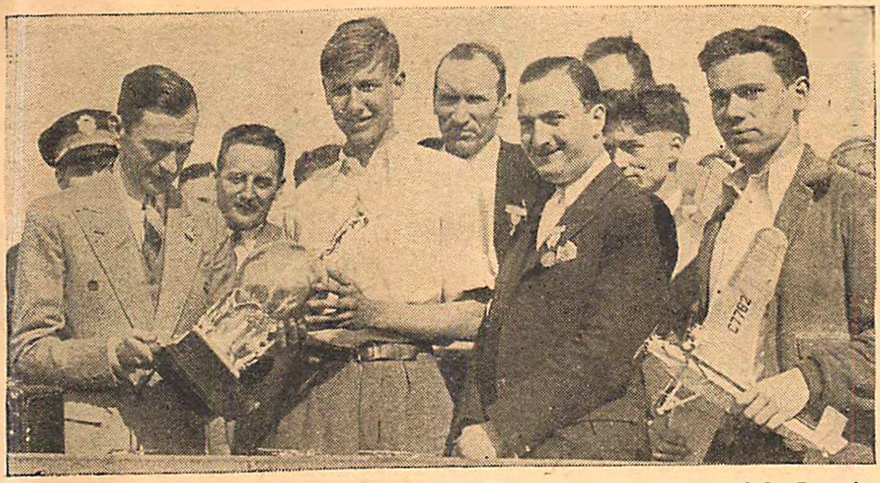
Willard Bixby launches his commercial model while Hy Kessler awaits his turn in the New York meet

The speed event, first prize winner of which averaged about 49 miles-an-hour, was replete with crack-ups because of the wind. However, it was a revelation to those who had the idea that present day model airplanes were "just pieces of paper and pasteboard pinned together."

The replica (scale model) event was another which opened the eyes of the uninitiated, particularly when on close inspection of Phillip Zechitella's scale model Stinson (Lycoming) they noticed the perfect built-up wing structure, the miniature instruments on the panel, the miniature engine, and the fact that when the door of the model was pulled open, a light in the top of the fuselage was lighted up automatically, and so forth.

EDWARD DOBRIN'S solid Tri-motor *Ford* model, too, came in for much comment. It was a replica of the real thing in every detail. A solid wood model covered with corrugated metal. The judges had a hard time deciding between his model and Zechitella's for first place, the Stinson being chosen because of its potential flying qualities and better finish.

Adrian Wallace took third prize with his solid scale model of a Travel-Air *Mystery R*. The model in itself was beautiful, but Adrian lost points on the fact that his fuselage was not tapered correctly, and because his cowling was too large.



Mayor James J. Walker, presenting the prizes. Photo shows the Mayor, left, Captain Loftus-Price, Willard Bixby receiving the city championship trophy, Mr. R. V. Mulholland, Mr. Lawrence Shaw and Edward Dobrin with his Ford Tri-motor model

Honorable mention in this event went to Pelo Desiderio, who entered a solid scale model of a Curtiss *Hawk*. Pelo lost points in trying to simulate rib markings by using wire, with the result that the trailing edge looked as if it were serrated—like war time Spads.

Altogether there were three hundred contestants present at the meet; 425 models were entered, and more than 500 flights made, ample augury of continued success for future meets.

A further point of interest in connection with this meet was that for the first time representatives of practically every model airplane organization played an active part, either as judges or timers, etc. Mr. Lawrence Shaw, leader of the N. Y. Graphic Junior Aviation Club and Honorary National Commander of the American Sky Cadets, was chairman of the meet; Captain H. J. Loftus-Price, editor of MODEL AIRPLANE NEWS and Administrator of the American Sky Cadets, was chairman of the judges.

Three of the replica models prize winners. Left, the Stinson (lycoming); center, the Travel-Air Mystery R and the Curtiss Hawk

The judges and timers included Mr. A. S. Wolfe, Eastern representative of the A. M. L. A., Mr. Gus Anderson, formerly of Gimbel's Club, Mr. T. Bulger and Mr. J. Patent, of the A. A. C., Mr. A. Selley, of the Selley Manufacturing Co., Mr. David Newmark of the Ideal Aeroplane and Supply Co., Inc., Mr. I. Sturiale, of the Crescent Model Aircraft Co., and others equally *prominent* in the model airplane field.

Thanks to Mr. R. V. Mulholland, Director of Recreation for the City of New York, the Sheep Meadow in Central Park was set aside for the meet, and through the courtesy of the New York Police Department a squad of policemen was detailed to duty at the meet.

An outstanding feature of the derby was the tendency to break away from the usual stick model for all contests. Model builders apparently are finding more instruction and more fun in testing their ability to build and fly real cabin models.

This decision is to be applauded as it will mean bigger and better model airplane tournaments in the future.

In awarding the trophies to the winners, Mayor Walker paid tribute to their industriousness, and expressed himself surprised at the performances made by the models. He was particularly impressed with the life-like resemblance of the replica models to the real planes. The mayor, incidentally, is an ardent aviation fan, and knows his planes to a "T".

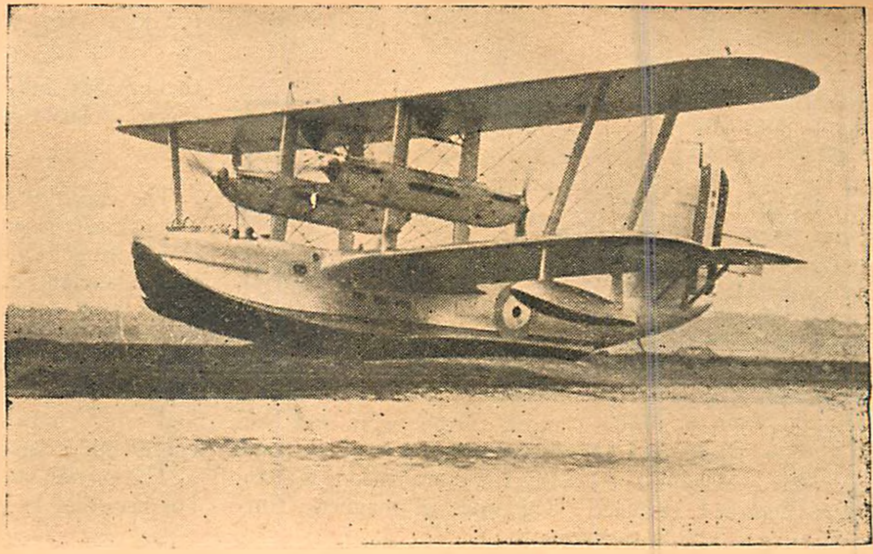
The results of the tournament were as follows:

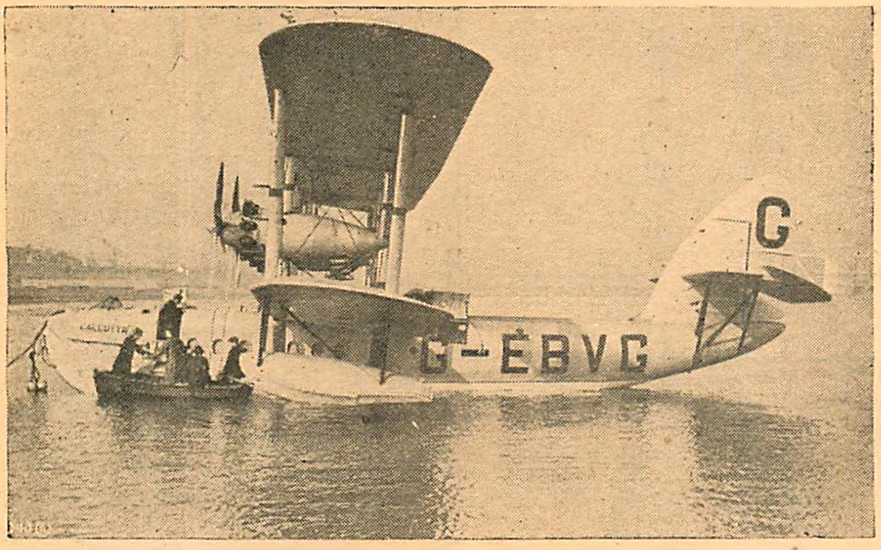
Twin-pusher event: First, Willard Bixby, 10 minutes; second, Frank Ziac, 7 minutes 10 seconds; third, Hy Kessler, 6 minutes 10 seconds; fourth, Ed Beshar, 4 minutes 27 seconds, and (*Continued on page* 39)

A group of entrants shown holding their models. Note the dirigible in the top right hand corner of the photograph

Special Course in Aerial Radio

By
Capt. Leslie S. Potter





A Short *Singapore Mk II*, above, about to alight, and, below, a Short *Calcutta* at anchor. Note comparative size of passengers

Direct Current Generator; Commutator

THE principles of the direct current generator, or dynamo, as it is sometimes named, are precisely the same as those of the alternator described in last month's MODEL AIRPLANE NEWS. In the latter we spoke of collector rings which revolved with the shaft and on which rested two brushes which conveyed current to the outer circuit in precisely the same condition as they received it. In other words, they received an alternating current and passed on an alternating current.

With the dynamo, instead of collector rings a commutator is used. A commutator consists of a ring with two or more segments which revolves with the shaft, and its duties consist of commuting the alternating current induced into the armature into a current flowing always in the same direction.

With the alternator the brushes make constant contact with the collector rings; with the dynamo, the contact is constantly being broken by the gaps between the segments. As the revolving segments pass under the surface of the carbon brushes, contact is made with the opposite terminals of the armature every second alternation, and a current is thereby passed on to the rest of the circuit flowing continuously in one direction.

Shunt Wound Generator

Sometimes a connection is made between the field poles and the brushes, and some of the current from the latter passes into the former, greatly increasing their magnetism. In this way more current is passed on through the circuit. A generator of this type is called a shunt wound generator.

Motors

Some difficulty may be experienced in appreciating the difference between a motor and generator. A generator is a machine mechanically driven, as in the case of the ordinary car generator driven by the car motor, which delivers an electric current. A motor is a machine electrically driven used for supplying motive power in such instances as driving generators and many kinds of factory equipment. Electric motors are invariably used to drive machinery in areas where the cost of electricity is cheap.

Motors, like generators, are divided into two main classes—direct current and alternating current. These are further sub-divided into other types, but they will not be dealt with at this stage. In motors it is again the close relationship between electricity and magnetism that forms the fundamental principles.

It was explained last month how like poles repel and unlike poles attract, and this will be the same whether the lines of magnetic force are coming from a charged wire or a natural magnet. *Magnetic lines of force always tend to run parallel to each other.* Two charged wires through which the current is flowing in the same direction will have the same magnetic poles, or parallel lines of force. The wires will, therefore, attract each other, and the same attraction would exist were a magnet of approximate polarity used in place of one of the wires.

In Figure 1 a loop of light wire is shown through which a current is passing. The wire is suspended so that it may turn easily. A strong bar magnet has been placed underneath, and by adjusting its position so that a maximum attractive and repelling force is inflicted on different angles of the loop, the latter will be made to revolve.

In Figure 2 the principles of the rotating coil, or armature, of the generator are

A Cardinal Point in Progressive Aviation

(*Chapter* 3)

again shown. The current generated by the armature is passed through the brushes to an external circuit. The armature must, however, be rotated by some outside means.

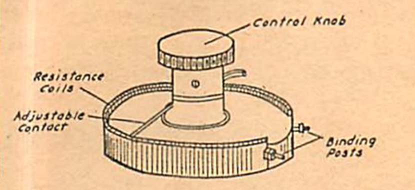


FIG 4 RHEOSTAT - EXTERIOR

If it were left motionless, and a current were sent back through the circuit to the carbon brushes it would once more rotate. Why? For exactly the same reasons that the loop in Figure 1 revolved. The lines of magnetic force are seeking to adjust themselves.

The effect of these lines which emanate from the field poles and from the charged armature, turning and twisting in their efforts to adjust themselves, produces the motive power of the motor, sometimes called its torque or turning effort. If the position of the magnets was reversed, rotation would occur in the opposite direction.

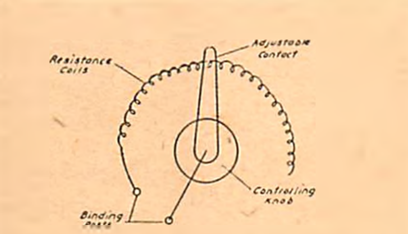


FIG 3 - RHEOSTAT - INTERIOR

Obviously it will only require a fraction of time for the lines of magnetic force to resolve themselves into approximately parallel positions, and when they have done this their efforts will cease, and also the turning of the motor. The moment this effort ceases, a reversal of the current must take place in order that the operation may be continued and continuous motion obtained. These are the fundamentals of the electrically impelled motor.

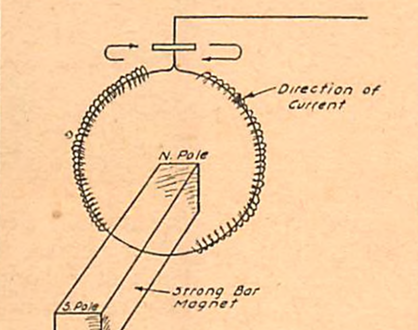


FIG 1 - REVOLVING LOOP

A PHENOMENON occurs in the rotating of the motor which results in the consumption of only sufficient current to handle the load. When the armature revolves through the magnetic field it creates an E.M.F. (electromagnetic force or electromotive force) in exactly the same manner as it did in the case of a generator; but as has already been explained, this E.M.F. is operating in a reverse direction to the E.M.F. passing into the armature, and is called the counter E.M.F.

If this equalled the applied E.M.F. obviously no current would flow, but the amount of counter E.M.F. generated depends on the speed of the armature. When the motor is running free, or with only a light load, its speed will increase, and the counter E.M.F. generated will also increase because the revolutions of the armature will be higher.

Since the current passing through the armature will be the difference between the applied E.M.F. and the counter E.M.F., the current consumed by the motor when running under light loads will be automatically reduced.

Inversely, with the motor pulling a heavy load its revolutions will drop, the counter E. M. F. will be correspondingly reduced, and the flow of current through the armature proportionately greater.

A commutator is necessary on a direct current motor as on a direct current generator, but instead of making contact between the brushes and opposite terminals of the armature every second revolution, contact is made between the brushes and opposite loops of the armature so that correct polarity and a constant rotation is maintained.

Motor Capacity

The capacity of a motor, the same as the capacity of a generator, is given to mean the work it can do without overheating. On the plate of each motor will be given the voltage and current and also the revolutions per minute it has been designed to stand. A generous safety margin is usually allowed for by the makers, but nevertheless, overloading to excess must be avoided, otherwise overheating will follow which the motor was not designed to stand, and which may cause the insulation to break down and considerable damage to follow.

The power of a motor is generally rated in horsepower but may also be given in kilowatts. A kilowatt is a thousand watts, and a watt is the unit of electrical power. One kilowatt, written K.W., equals 1.34 h.p. Twenty horsepower is, therefore, approximately 15 K.W.

Series and Shunt Motors

We mentioned earlier in the article that the two main classes of motors were further subdivided. Direct current motors fall into two main classes; series motors and shunt motors.

Going back for a moment to generators, it will be remembered that we described a shunt wound generator as a generator, the carbon brushes of which were connected to the field poles. In this way some of the current flowing from the armature was led back to the field poles and greatly increased their strength. They became, in fact, electro-magnets, and the coil of wire leading back to them from the brushes and wound around them for a certain number of turns is known as the field winding.

The shunt motor is similarly designed. The field winding is composed of many turns of wire which possess a high resistance. Since a portion of the incoming current is diverted at the brushes to the field windings, only a portion of it enters the armature. This gives the shunt motor a slower starting speed than the series motor, but the former maintains a much more constant speed under varying loads. For this reason shunt motors are mostly used to drive alternators used in radio work where constant speed-loads are essential. The series motor is the type employed on street cars.

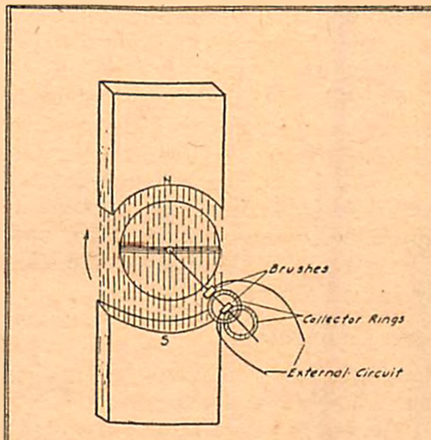


FIG. 2 - SIMPLE ALTERNATOR ARMATURE

Now let us discuss the question of how motors and generators are cared for.

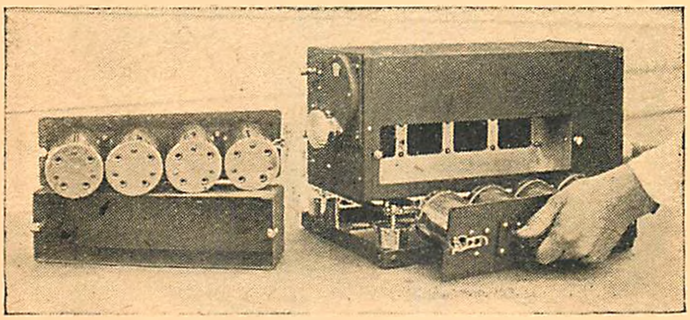
Care of Motors and Generators

All generators and motors are usually supplied with complete diagrams and maintenance instructions by the makers, and a careful study of these will usually be sufficient to ensure smooth running. Oil cups should be periodically inspected to ensure the proper level of oil is being maintained. The commutator must be kept clean and free from oil. A smear of oil will spoil a good connection; if it is too thick it will prevent a connection of any sort.

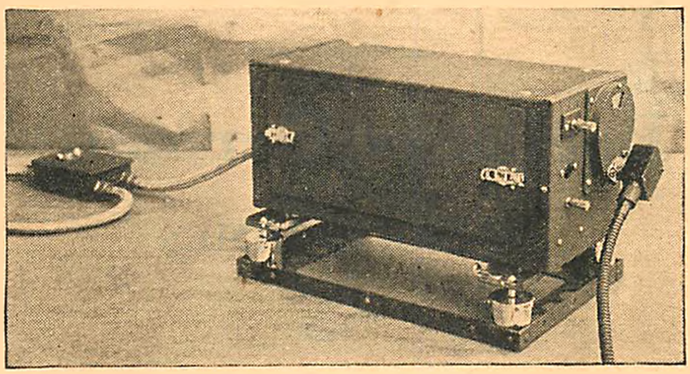
Since copper is one of the best known conductors, the segments in a commutator are usually made of this metal. They are insulated on all sides, except the side passing under the surface of the carbon brushes, with mica. If any portions of the mica become detached, presenting an uneven surface to the brushes, a severe spark will be caused on every revolution.

In time, too, the continual passage of the brushes may wear a groove in the commutator, and this will have to be smoothed down with a piece of fine sandpaper to ensure even running. Sometimes it may be necessary to take the commutator down and smooth it on a lathe, or the brushes may have worn to an uneven surface and have to be renewed.

The springs which hold the brushes firmly against the commutator occasionally become too weak to perform their functions properly. They must be replaced should this happen. The even running of a motor or generator depends, among other things, on the smooth running of the commutator.



A.R.C. Model D Receiver showing gang coil assembly being inserted



Aircraft Radio Corp. Model D set complete

Speed Regulation

The thought has probably come into the minds of those who have followed these articles thus far, "How is the speed of motors regulated? There is no throttle to be pressed down. The switch is thrown on and the motor starts; it is thrown off, the current ceases and the motor stops. There is no half-way position. How then is the motor regulated?"

Those who are familiar with the electric fan with variable speeds may possibly have some idea. It hinges on the counter E. M. F. we have already mentioned. Taking the case of a shunt d. c. motor, more current entering the armature means more counter E. M. F. and, therefore, less speed. If, then, the amount of current reaching the armature can be controlled, the speed of the motor will also be controlled.

The amount of the current may be regulated by increasing or decreasing the amount of resistance. For the benefit of those who have not followed this series of articles from the beginning, resistance is the amount of opposition offered by a conductor to the current passing along it and is measured in Ohms. Ohms are intimately connected with Volts and Amperes, and knowing the quantity of any two of these, the third may be found by the application of Ohm's law as explained in last month's issue of MODEL AIRPLANE NEWS.

In order to obtain a variable resistance, an instrument known as a Rheostat is used. Figures 3 and 4 show the interior and exterior, respectively, of a Rheostat. By turning the knob the amount of resistance is increased. This reduces the amount of current in the field winding, which in turn reduces the amount of the counter E. M. F., with the net result that the speed of the motor is increased. Briefly then, increasing resistance means increasing speed, decreasing resistance means decreasing speed.

A further method of regulating the speed of shunt motors is by changing the position of the field poles and increasing or decreasing the density of the magnetic field. This is usually done by means of a handle on the outside of the casing. Either the position of the poles themselves may be changed or the position of the armature in relation to the poles. There is also the method of raising or lowering the magnets inside the field windings and so increasing or decreasing their magnetic properties.

In these articles examples will be given as affecting shunt motors wherever possible because: this is the motor most likely to be met with in radio work, and, therefore, of most interest to future radio operators.

Motor Generators

Having dealt with motors and generators separately, we now come to the device known as the motor-generator. This is, as its name suggests, a motor and generator built as a single unit. The two are mounted on a common base and coupled to one shaft. Commercially, the motor - generator is adaptable to various uses, but in radio its principal function lies in changing direct current obtained from a power line into a direct current of higher voltage for use with vacuum tube transmitters. The principles of operation are the same as those already described separately for motors and generators.

Condensers

Condensers are sometimes described as power and receiving condensers, the first for use with transmitting sets and the second for use with receiving sets, but they are more often classified as fixed and variable condensers. A fixed condenser is invariably used with transmitting sets, but for receiving purposes the variable condenser is usually taken. Figures 5 and 6 illustrate the two types.

There are many other forms of condensers such as glass condensers, mica condensers and oil condensers, but these will not be dealt with here.

A fixed condenser may be made of alternate layers of conducting and insulating material such as tinfoil or copper and waxed paper, pressed or rolled tightly together. The essential requirement is (*Continued on page* 40)

Capt. Oswald Boelke

Boelke of Germany

By COLIN JAMES

"We went out peacefully to hunt the enemy"

THE Great War is on. Europe is seething with talk of a new fighting force that has come to the front—the airplane—and there is a great scurry among all the nations involved to assemble hurriedly groups of men, somewhat sketchily trained, to fight the enemy in the air. It is the moment to strike from the clouds—and each country looks hopefully to its fighting airmen to help the troops on land and sea.

Fonck and Guynemer are carrying the banner of the famous Cigognes ("Storks") squadron, and with it the hopes of France; America adds her celebrated Lafayette Escadrille with Raoul Lufberry at its head; England has its No. 1 Squadron, led by Capt. Fullard, with its brilliant record of two hundred enemy planes downed in six months; and the German Empire stakes its honor in the air on the noted Jagdstaffel No. 11, nicknamed by its foes the "Tango Circus."

This last group is making history. At the head is Germany's hero of the hour, Baron von Richthofen, who has formed the nucleus of his famous staffel from the remnants of another German ace's former command. He was induced to enter the air service in 1915 by that other, who was then Germany's champion air fighter, and whom von Richthofen has conceded to have been the "Master" of them all. From his predecessor he received his training in aerial strategy and he is following in his footsteps.

That man was Capt. Oswald Boelke.

HAD he lived, Boelke would surely have outstripped von Richthofen's great record by far, for when his brilliant career was ended, he had amassed a record of forty enemy planes destroyed, while his young pupil, von Richthofen, soon to come into great fame, had then only seven victories to his credit. So to Boelke must go all honors for the example he set, and the accomplishments of the men he trained and who carried on afterwards.

"We always had a wonderful feeling of security when he was with us. After all, he was the one and only." So said von Richthofen of his teacher. Boelke was worthy of such trust and admiration, for he was ever the inspiring leader, brave and charming—this despite a record of fearlessness and singleness of purpose in the air. von Richthofen worshipped Boelke and envied him the trait that he himself did not possess—a kindness of heart which drew all men to him, enemy as well as friend. He was popular as a man, too, while von Richthofen was the object of public acclaim chiefly because of his aerial achievements.

Born of Saxon parents on May 19, 1891, Oswald Boelke belied the heritage of his schoolmaster father by disliking study and longing for a military career. His love for sports, rather than the inclination to study, was a forerunner of that sporting love of combat which was to distinguish him later in his aerial achievements.

Parental objections barred him from the career he sought, but at last at the age of twenty-two he was allowed to join the Telegraphers Battalion No. 3 at Coblenz. An asthmatic affliction had prevented him from doing more strenuous work, and consent to join the Signal Corps was his parents' concession to his remarkable aptitude for mechanics and engineering.

WITH the rank of lieutenant, he worked first with the telephone division and later with the wireless division. It was in the latter service that he first came in contact with the aviation corps. This was at Darmstadt. The desire to fly was born then and he planned silently to join them, knowing full well that his family would object, but at last, in June 1914, he was transferred to the aviation school at Halberstadt. Aided greatly by his inherent understanding of mechanics, he progressed rapidly and after six weeks, emerged successfully from the final examination. This was the day before mobilization for the World War, and he was ready to add his services to the raging conflict.

Boelke's military career began inauspiciously enough but was fated not to remain so for very long. His brother Wilhelm had already joined the air corps as observer, and at Montmedy they were united. There the brothers would often fly in the same machine, Wilhelm as observer and Oswald as pilot, and the engagements of the Argonnes and the Champagne saw them fighting together.

Recognition of his ability as a flyer and a strategist came shortly after. On October 12, 1914, Boelke was awarded the Iron Cross, and ten days afterward proved conclusively that he merited such a citation by destroying one of the enemy's batteries and the next day wiping out three more in three-and-a-half hours. He had been piloting a 30 h.p. Opel machine, but in (*Continued on page 45*)

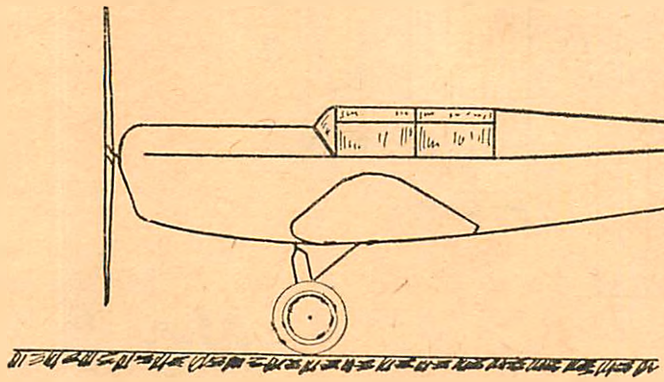
the sides and top of the fuselage can be covered with tissue. The *cockpit* is covered with cellophane.

The ribs, as shown in drawing 8, are cut from 1/16" balsa sheeting.

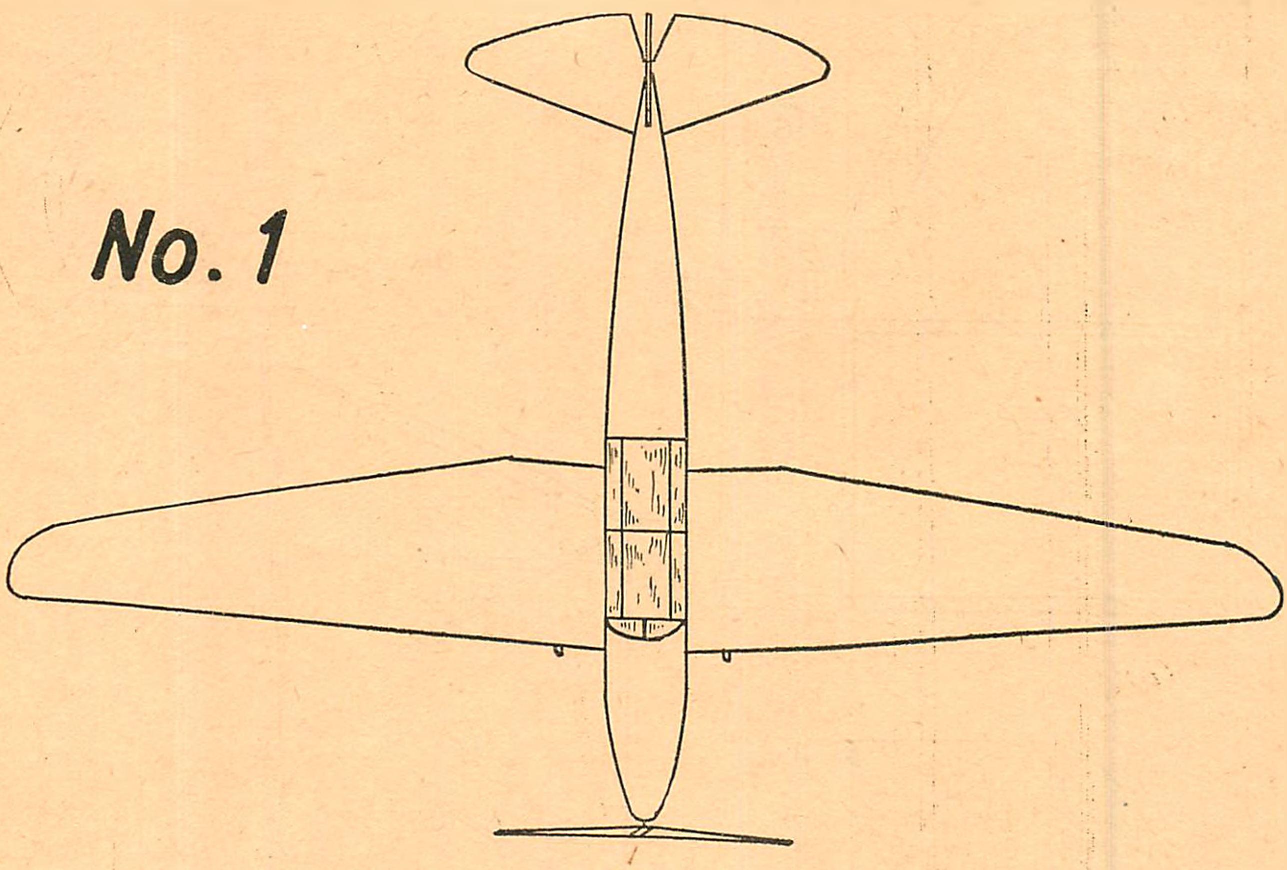
You will need two of each rib. Also from 1/16" balsa sheeting cut out the two spars marked (16). Assembly of the wing is shown in drawings 6 and 7. The leading edge (17) is of 1/16" x 1/8" balsa strip and the trailing edge (18) is of 1/32" x 3/32" balsa strip. The wingtip (19) is made from 1/16" square bamboo.

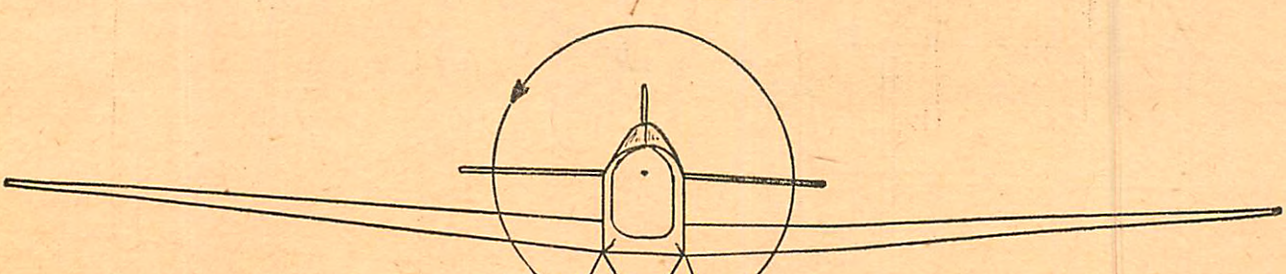
The wing is covered on both sides with Japanese tissue. The finished wings now can be placed in position.

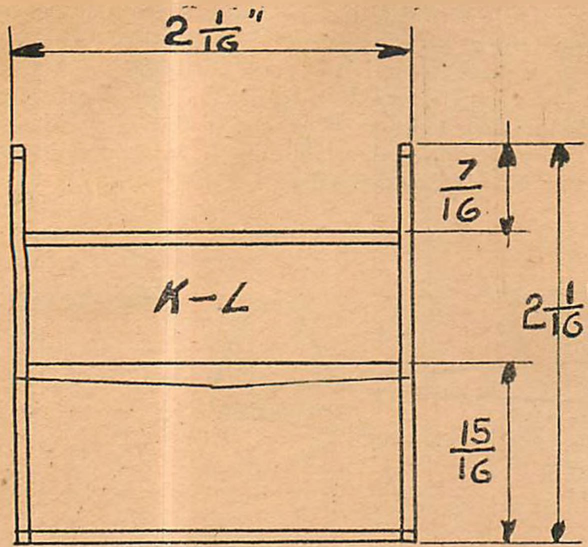
The next step is the stabilizer, shown in drawing 9, and made of 1/16" square balsa. (*Continued on page* 40)

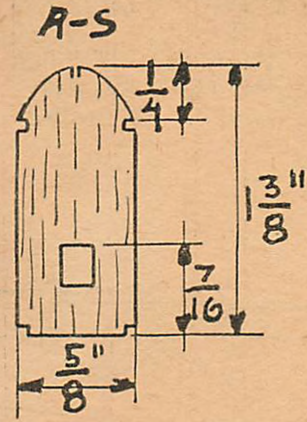


No. 1

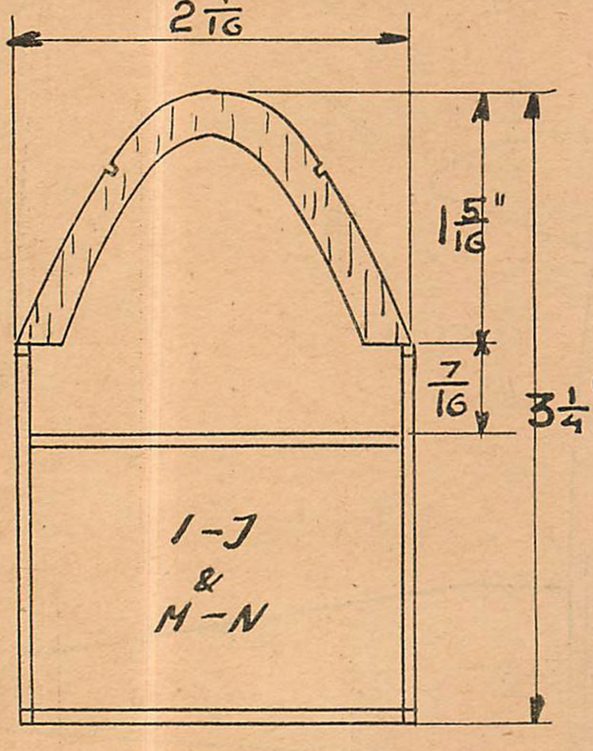


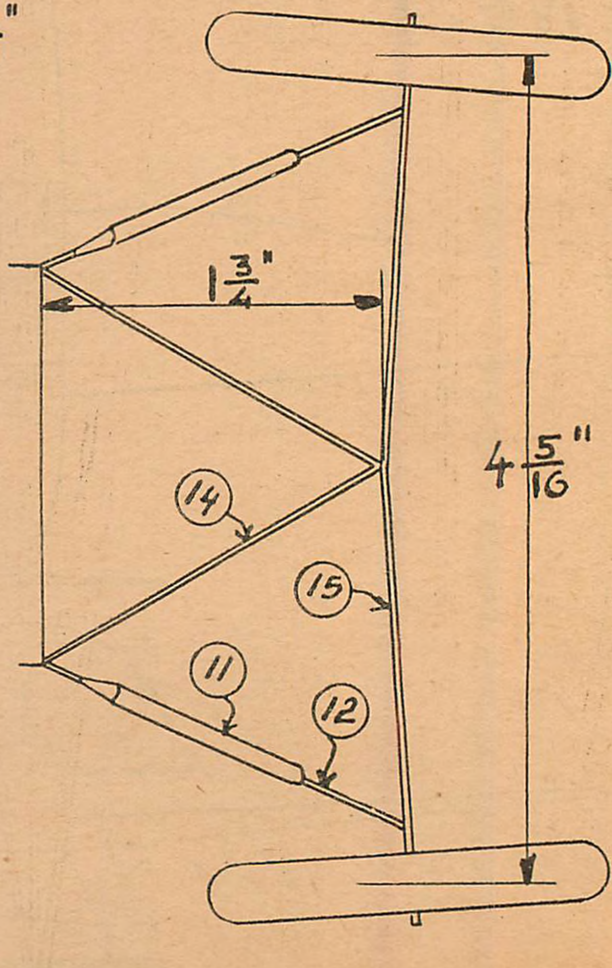


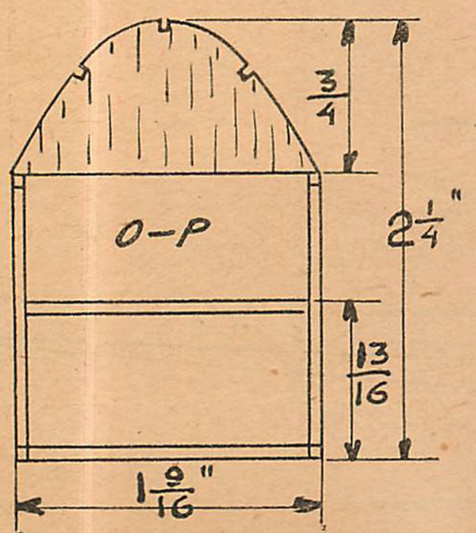

2 1/16"
7/16
2 1/16"
K-L
15/16


R-S
1/4
1 3/8"
7/16
5/8"

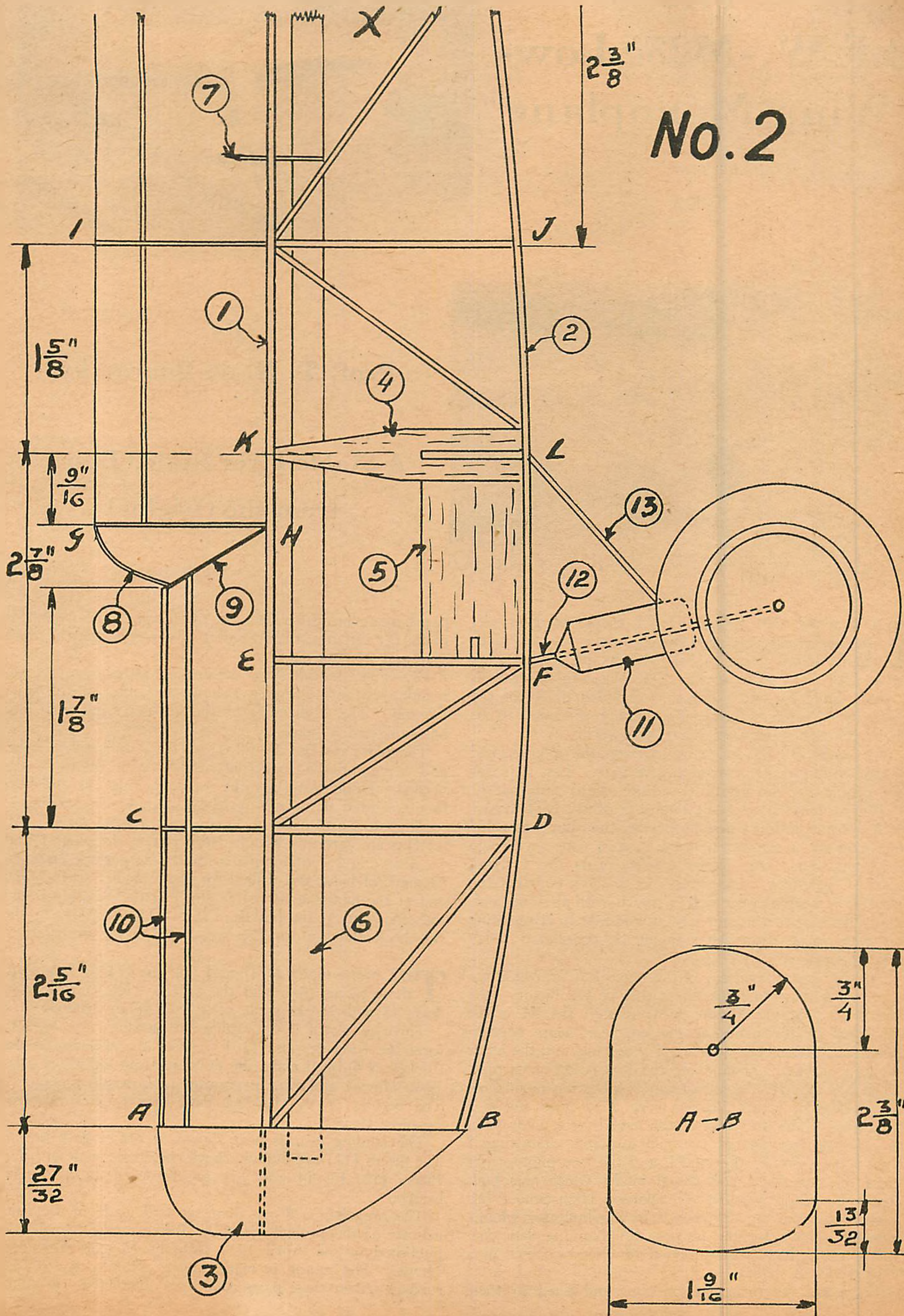
No.5


2 1/16"
1 5/16"
7/16
3 1/4"
I-J
&
M-N


1 3/4"
4 5/16"
14
15
11
12

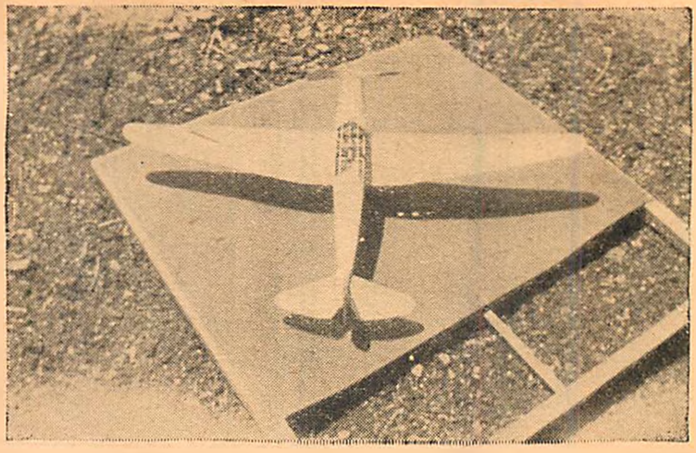

3/4
2 1/4"
O-P
13/16
1 9/16"

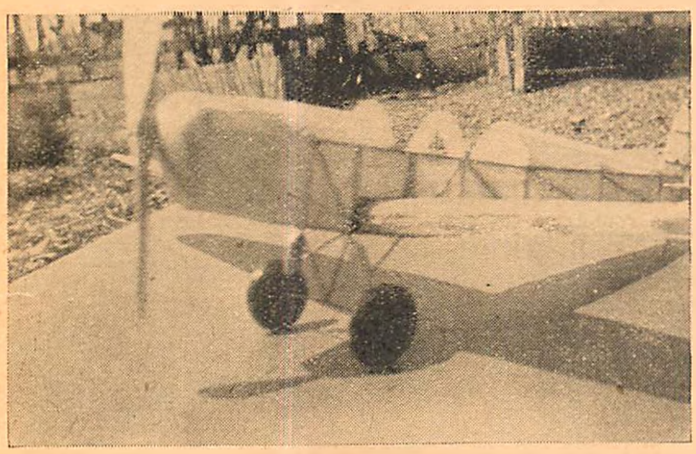
No. 2



X
2 3/8"
I
J
1 5/8"
K
L
9/16"
G
H
2 7/8"
E
F
1 7/8"
C
D
2 5/16"
A
B
27/32"
1
2
3
4
5
6
7
8
9
10
11
12
13
A-B
3/4"
3"/4
2 3/8"
13/32
1 9/16"

The B.F.W.-M23c Low-Wing Monoplane





By

Prof. T. N. de Bobrovsky

A Stable Flyer Scaled Down from the Original

IN keeping with my policy of trying to give you something different each month in the way of wind-tunnel tested flying models, this month I am taking you to Germany, so to speak. Our object in this case is to study carefully and build a good flying model of the low-wing monoplane which is generally conceded to be one of the best sport airplanes in the world.

This is the *B.F.W.-M23c* which won the international air tour of Europe for two successive years. Last year this type of plane came first and second in the tour out of fifty-seven planes entered, although the British D.H. Gypsy *Moth* actually finished first in elapsed time but was ruled out. You will remember that the August issue a year ago of MODEL AIRPLANE NEWS carried plans for a flying model of the *Moth*. I mention this to show you that the magazine is keeping you well in touch with the outstanding airplanes of the present day, in addition to acquainting you with earlier and what might be considered today freakish types.

In a way of explanation, in the name *B.F.W.-M23c* the first three letters represent the initials of the factory—the Bayerische Flugzeug Werke in Germany; the M is the first letter of the name of the engineer, Herr Messerschmidt; 23 is the type number of the plane, and the letter c indicates that this plane is the third variation of its type.

The *B.F.W.-M23c* is a two-seater, low-wing monoplane with glider-like wings. It has very good lines and is a stable flyer. The drawings of the model were made from the original drawings of the real airplane. Drawing 1 shows three views of the model, and the two photographs depict the completed and tested model which was built actually by Philip Meehan, a Dickinson High School (N. J.) student, from my drawings. It was built for MODEL AIRPLANE NEWS for the purpose of obtaining data concerning the influence of an open or closed cockpit in a flying model in flight.

This model, as in others of mine published in these pages, again brings to your attention some unconventional parts; for instance, the rear part of the fuselage, the wing spar and landing gear.

Drawings 2 and 3 show the completed fuselage skeleton in side view, and Drawing 4 shows the same skeleton from the top. The fuselage is of the built-up type and only one bulkhead is used.

The parts marked 1 and 2 are of 1/16" square balsa and represent the longerons. Two each of these are needed. Notice carefully the top longerons (1) and how they are fitted at the section M-N, as shown in drawing 3.

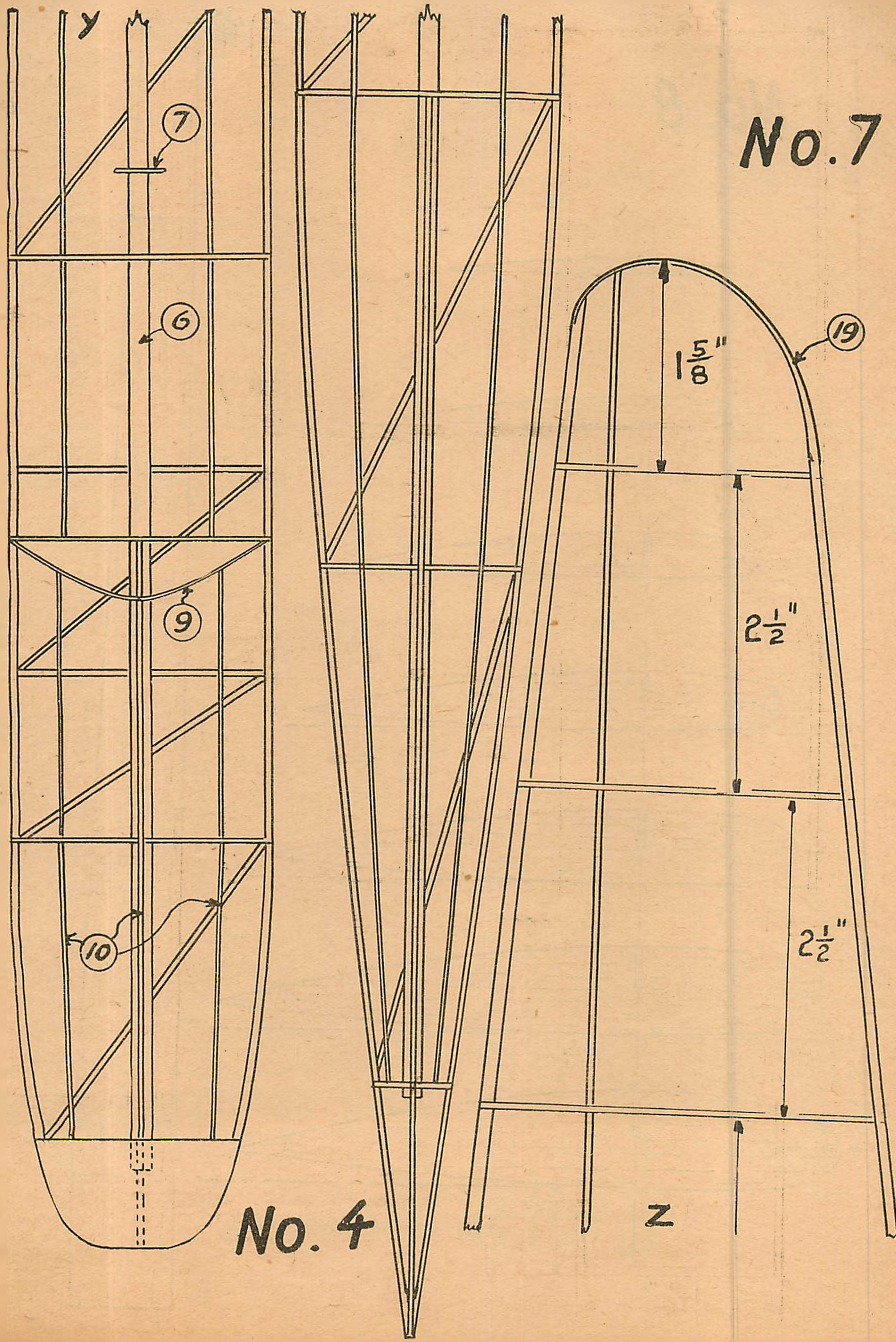
All braces are made of 1/16" square balsa strips. All sections are carefully sketched for you in drawings 3 and 5. Drawing 2 contains plans for the nose block (marked 3) made of balsa and drilled for the propeller shaft. One end of the motor stick (6) is glued in the nose block and the other end in the bulkhead R-S. The positions of the rear hook and the can (7) are shown in the drawing.

THE pieces marked (4) and (5) are 1/16" thick balsa sheet pieces that hold the wings. The cockpit windows (8 and 9) are made of 1/16" square bamboo.

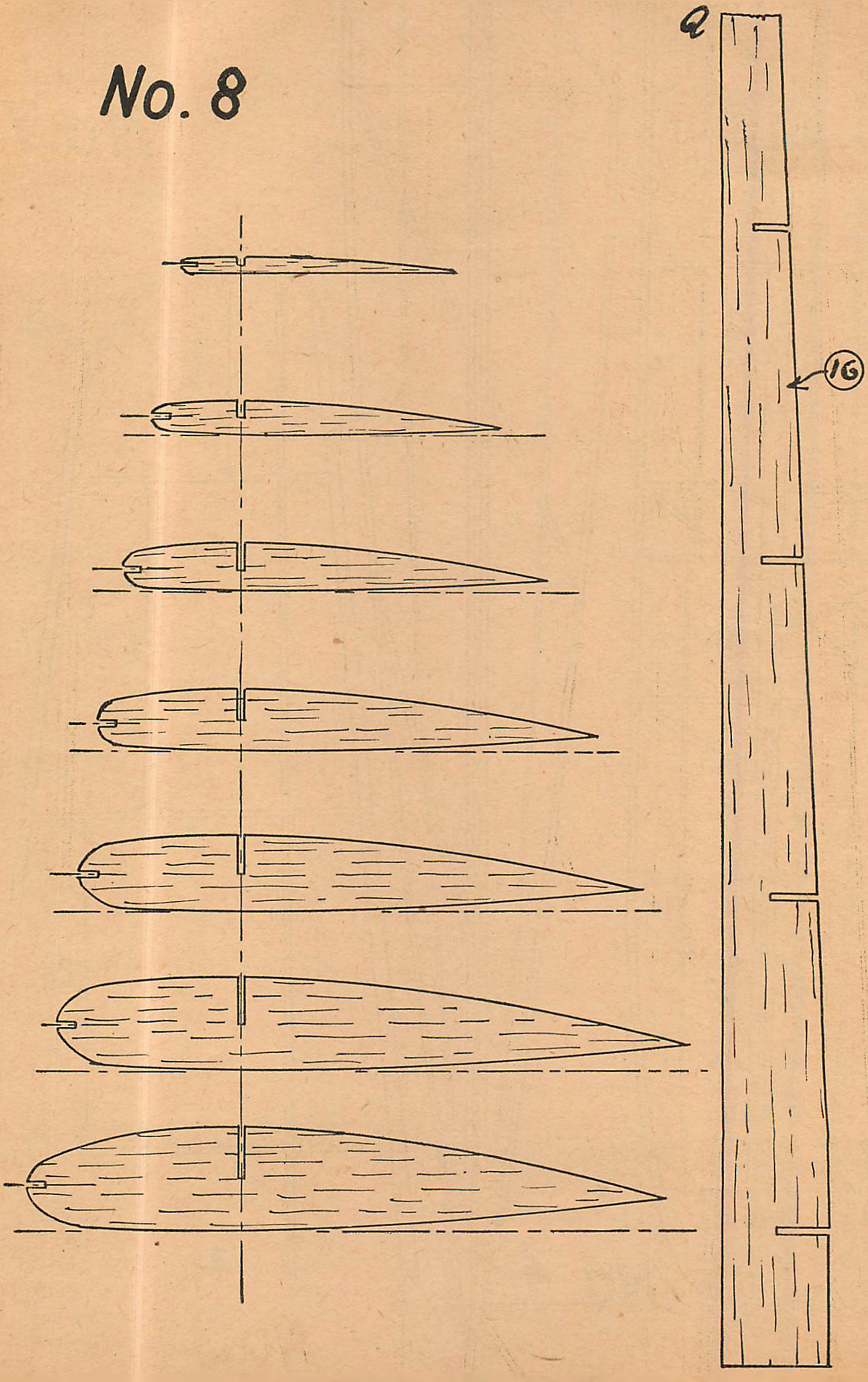
Three pieces of 1/32" square balsa strips are used to form the fuselage nose (10). After the skeleton of the fuselage is finished make the tail skid from 1/8" thick balsa (streamlined) and glue in position as shown in drawing 3. The bottom of the fuselage now can be covered with Japanese tissue.

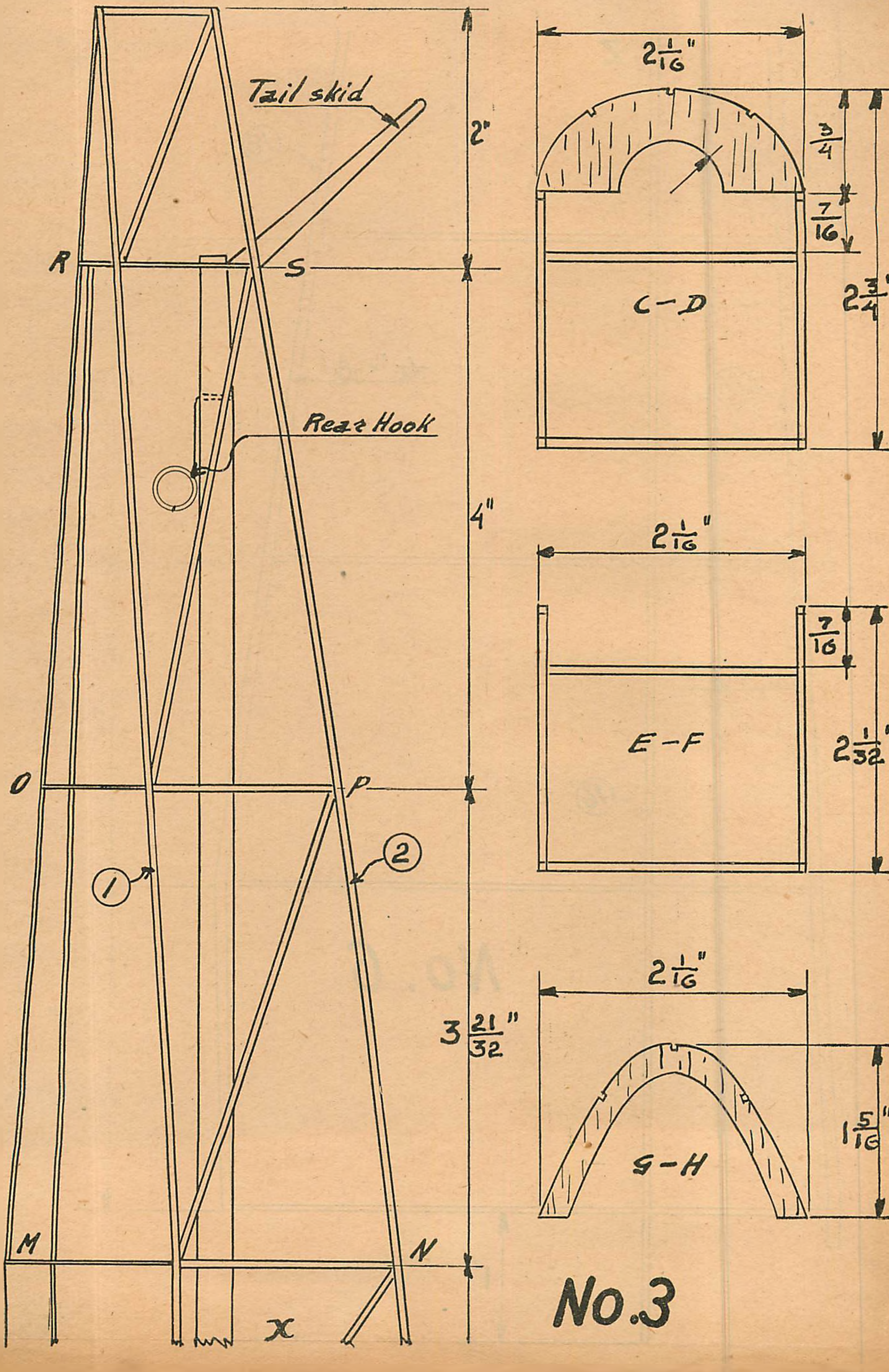
The landing gear is next shown in drawings 2 and 5. The pieces (11) are dummy shock absorbers, made of balsa. Pieces (12, 13, 14 and 15) are made of 1/32" square bamboo.

The propeller is 8" in diameter and made in the same manner as the propeller for the Rotor model, which was published in the April 1931 issue of MODEL AIRPLANE NEWS. The motor is made of six strands of 1/8" flat rubber. After these parts have been completed and fitted,

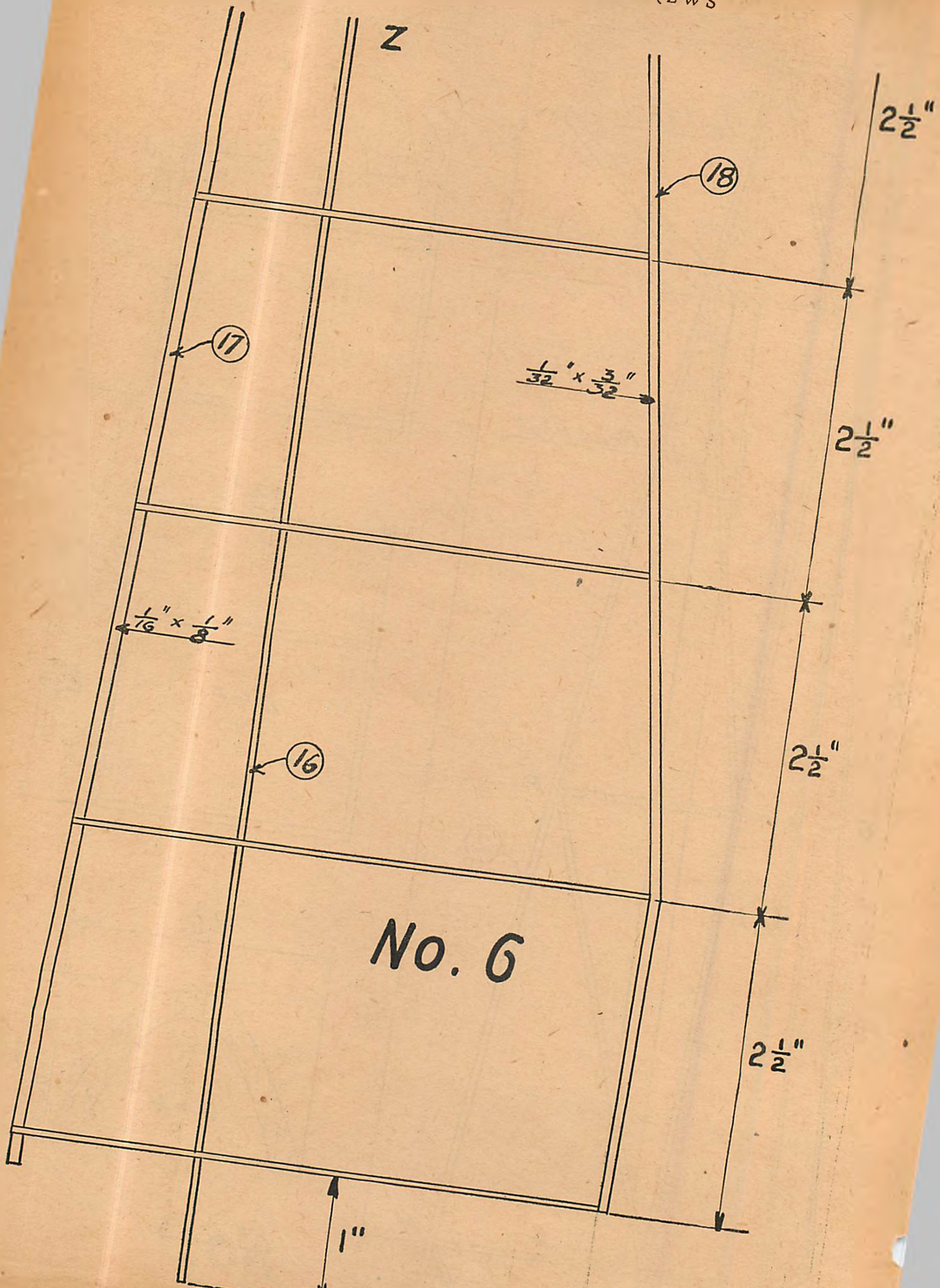

y
7
6
9
10
No. 4
No. 7
19
1 5/8"
2 1/2"
2 1/2"
z

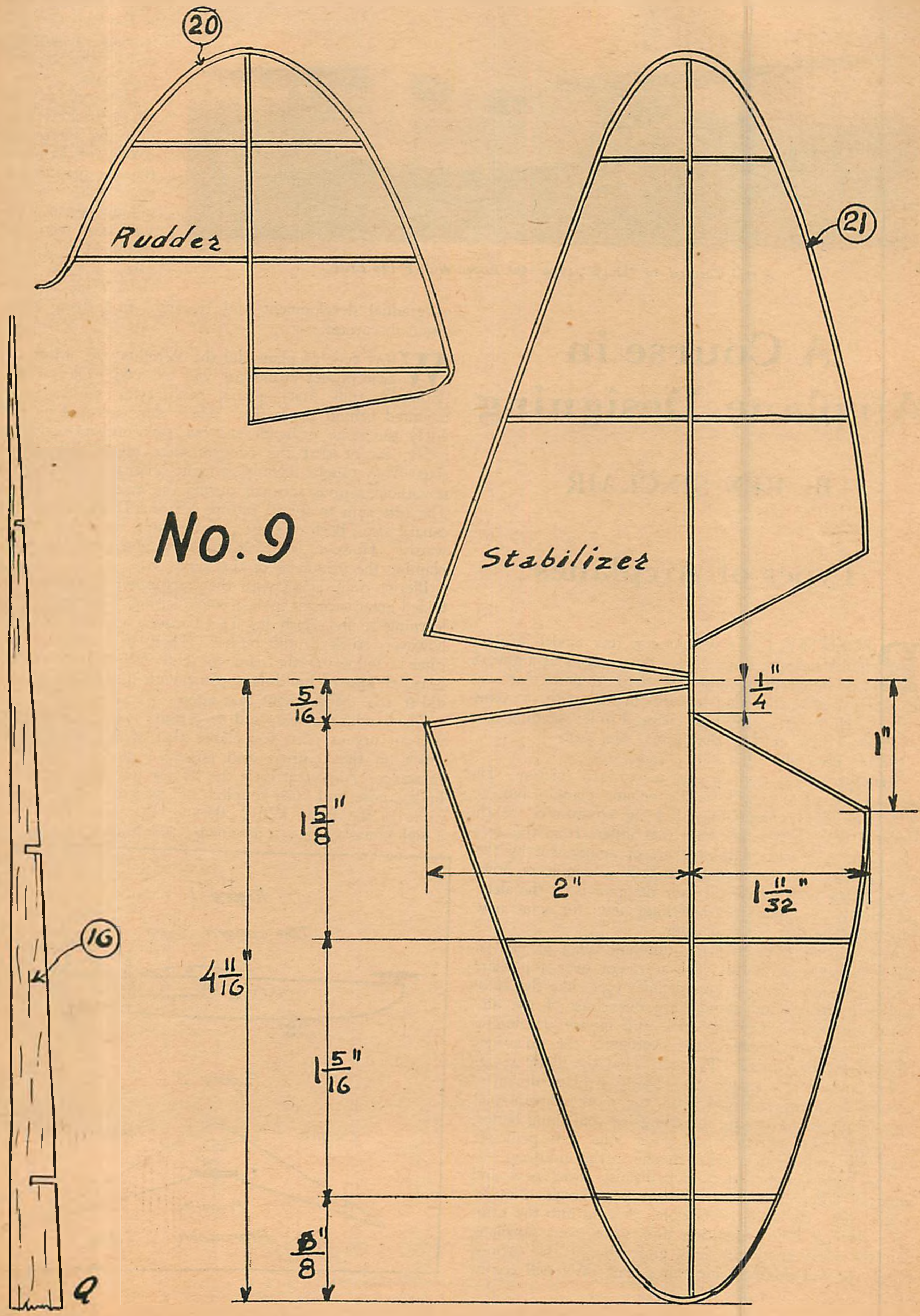
No. 8

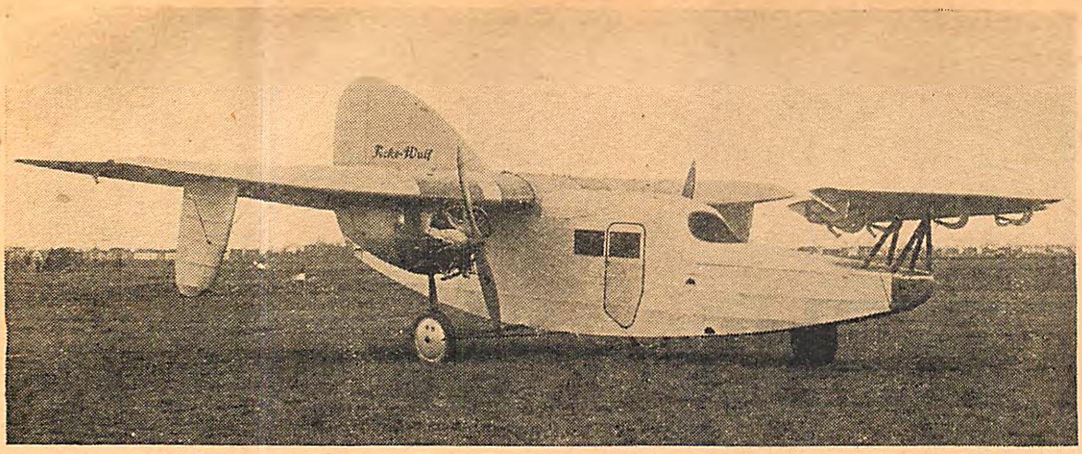



Tail skid
Rear Hook
R
S
O
P
M
N
X
1
2
2"
4"
3 21/32"
2 1/16"
3/4
7/16
2 3/4"
C—D
E—F
2 1/32"
G—H
1 5/16"

No.3


Z
18
2½"
17
1/32" × 3/32"
2½"
1/16" × 1/8"
16
2½"
No. 6
2½"
1"


20
Rudder
21
No. 9
Stabilizer
5/16
1/4"
1"
1 5/8"
2"
1 11/32"
4 11/16"
16
1 5/16"
5/8"
Q



A real *Canard*, or "Duck", type—the Focke-Wulf *F 19a Ente*

A Course in Airplane Designing

By KEN SINCLAIR

Types of Airplanes

RECENTLY I was watching a few model airplane builders flying their ships. Some excellent air work was being done, and one chap in particular was making exceptionally long, steady flights with a twin-pusher. However, a lady who chanced to be standing near me did not look at it in that way. She said:

"Why, how silly. It's flying *backwards!*"

That typifies the popular attitude toward aviation. The public has come to regard the tractor monoplane or biplane, or a ship closely resembling these in appearance, as the accepted type; and a new ship that differs from the average plane is greeted with snickers of amusement by the average man. Not so among aeronautical engineers, however. Every wide-awake airplane designer is on the alert, continually watching for something new; for some new type of plane that has real value.

Why do we have so many different types of planes? What advantages, if any, has a tractor over a pusher? Why not settle down to one definite type, like the automobile industry, and standardize our ships of the air? Why are people spending time and money developing ships like the rotor-plane, the Autogyro, the numerous helicopters, the Curtiss "Tanager," and the flying wing?

The answer is a simple one. Many airplane designers are by no means satisfied with the more conventional type of plane. They are searching for something better, something more practical and safer; some new principle that will bring about a great change in the industry.

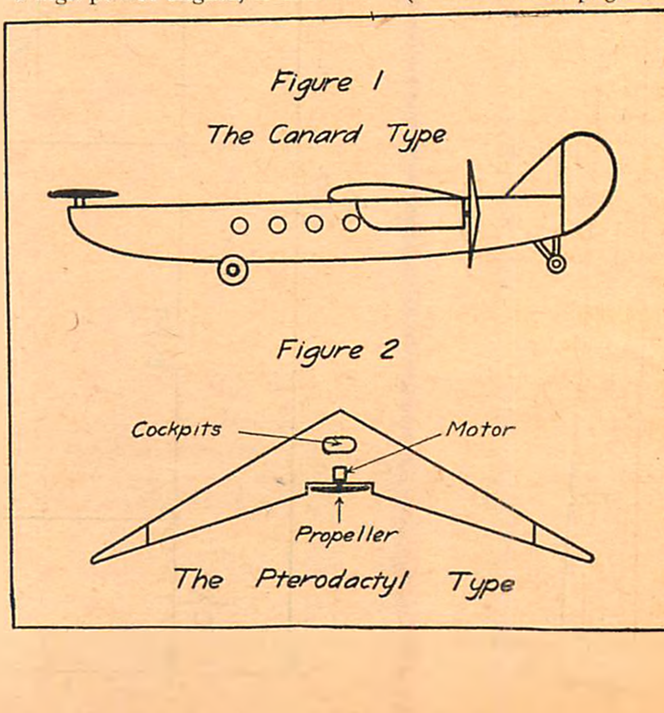
The wise designer does not dismiss these new and radically different planes with a derisive laugh. Not by a long shot. He studies every one, delving into the principles behind their operation and since every airplane designer must know the how and why of the various types, we will do the same thing here. We will try to answer the oftimes baffling question, "How does it work?" and at the same time point out a few of the important advantages and disadvantages of each type.

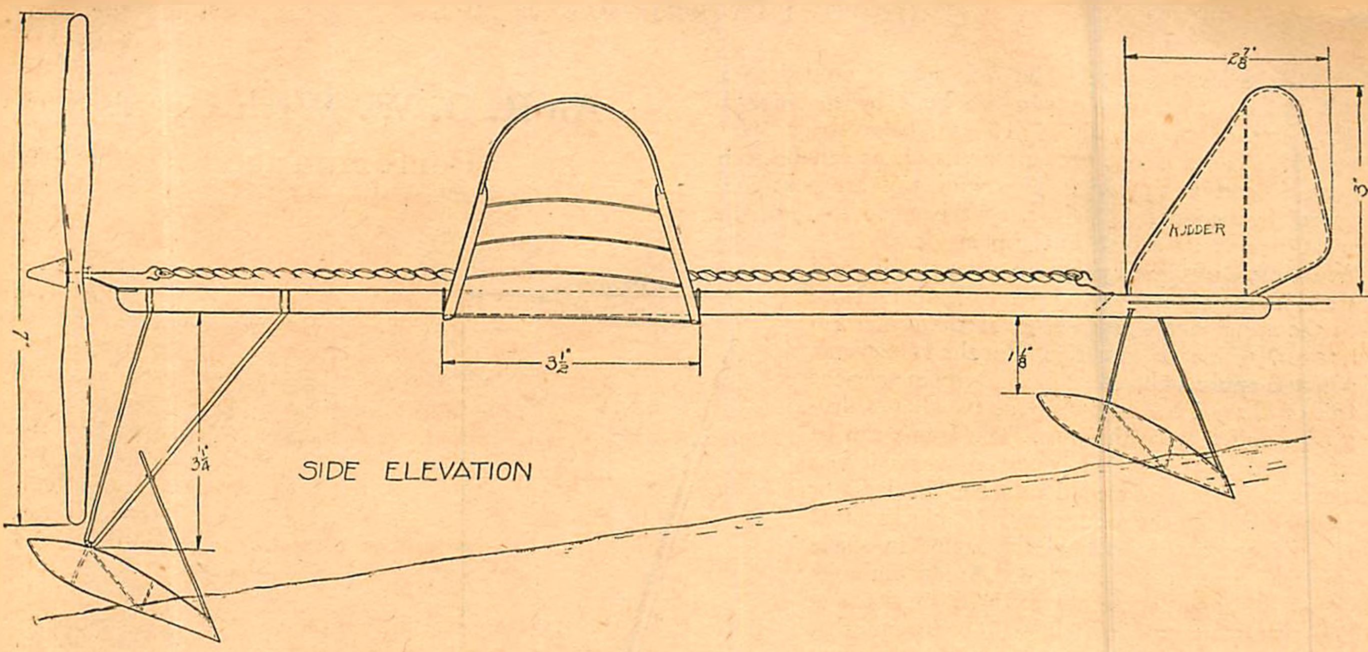
However, first of all let us look back into the interesting history of flying so that we may understand what we are talking about. We will start with the Wright brothers, because it was with them, after centuries of gradual development and research, that flying really began in earnest.

WHAT type of plane did the Wrights use? Most any twin-pusher enthusiast will tell you. They used a "canard" (tail first) plane, with twin pusher props mounted behind the wings. Their ship operated on precisely the same principles as our twin-pusher models of today, except that the rudders were placed behind the ship. They taught themselves to fly on that crate, and did it without serious accident during the process of learning. The first ship to fly in Europe (Santos-Dumont's) was a canard also. Both of these pioneer ships, then, flew "backwards!" However, we will talk more about that later, explaining the principles of this type.

Bleriot came along with the tractor monoplane and attained great success—plus a whole string of accidents while learning to fly—with it. The Farmans and the Voisons, however, stuck to the pusher. Then, in England, along came a fellow by the name of Hill with the utterly unheard-of idea of building a plane with no tail at all! He did it, too. More about that later.

Then came the war, and everything was changed. Here was an urgent need for planes that were maneuverable, quick on the controls, and possessed of very high performance. Almost at once the tractor job, with the motor in the nose and close-coupled (all weights concentrated) came to the fore. Why? Because this type, fitted with a high-power engine, is acknowl- (*Continued on page* 47)





The Ott Hydro Model

By
J. S. OTT and LIEUT. H. A. REYNOLDS

EFFICIENT, easy to build, and a reliable flyer, this little model will rise out of the water and fly above the tree tops to thrill you and your friends. It is a true R.O.W. type. Many model builders are now giving their attention to float-equipped models because almost any pond or slow-moving river makes an ideal theatre for flying operation. The plane has a clear, smooth run before it takes off and lands back on the water without the hazards of obstructions found on land.

The Ott hydro model averages sixty seconds (R.O.W.) after rising off the water on the three floats which it carries with it through the air to an elevation of seventy-five feet or more. Its center of lift and center of balance is so easily adjusted that it glides back to a three-point landing almost as if answering to the control of a pilot.

Truly for spectacular performance in the air this little hydroplane will put on a show that will attract the attention and admiration of all. Mr. Ott, with many championship and prize-winning models to his credit, considers it the most stable seaplane model he has ever built for everyday performance. A large number of experienced model builders recently witnessed trial flights at Chicago and were unanimous in their opinions that the flying ability and inherent stability of the plane were of unequalled excellence.

Many of us hesitate to start constructing a model of this type due probably to the mystery factor which usually accompanies the idea. There is no secret involved in building a good flying model! Any boy with the ability to cut sticks of balsa wood and cement them together can build the Ott hydro model. Few parts are required and it is very easy to build. The same principles are applied to a flying model that are necessary to the operation of a large man-carrying plane.

If the reader has never enjoyed the thrill of flying a model or the pleasure of building one in the home workshop, we can do no better than to present this little R.O. W. as a fitting machine with which to start. Experienced model builders will recognize its merits and to them we heartily give the construction details, knowing that they will be well repaid for their efforts.

The main wing is of very simple yet efficient design. It measures 19" from tip to tip and tapers from the middle. The fuselage consists of the motor stick to which the tail control surfaces, main wing, and landing gear are attached. It is powered with the conventional rubber-strand motor. Two strands of 1/16" x 1/32" model airplane rubber will do. More strands can be added if greater power is desired.

THIS model requires a seven-inch propeller to provide the thrust necessary to keep it flying. It will fly with almost any good grade of ready-made propeller, but to realize the maximum flight performance a true pitch propeller must be carved and balanced for this particular plane.

A ready cut blank for a 7" (low pitch) true pitch propeller can be purchased from The Model Aviator Products Co., 9 W. Illinois Street, Chicago, Ill. This blank will cost only a few cents and eliminate all mathematical calculations which might alter the accuracy of the propeller.

The true pitch blank is cut from balsa wood and has a small shaft hole drilled in its center. It measures 7" long and is 5/16" x 5/8" blocked out for carving.

To build the wings, prepare two main spars 20" long of 3/8" x 1/8" balsa. The front spar is rounded over bluntly to form the leading edge. The rear spar is sanded to a sharp trailing edge. Seven ribs are built by steaming a slight curve or camber into 1/16" sq. balsa strips 3½" long. This curve is not very pronounced, as can be seen in the rib section drawing. Two wing tips are next constructed by bending 1/16" sq. split bamboo to form the wing tip curve, as shown in the plan view.

Pin a piece of waxed paper on a flat surface and start to fit the different wing parts together. Note that the wing tapers from 3½" at the center rib down to 2½" at the spar tips. Pin the framework down and apply ambroid or model airplane cement to all of the joints. Allow about two hours drying time and remove the pins. The frame can be easily lifted from the wax paper on which it was assembled. The spars should next be "cracked" or gently broken at the center and 3" blocks fitted under the wing tips to hold the frame in shape to provide the correct dihedral. Apply ambroid or model airplane cement to these breaks and allow two hours to dry. It will be found that when the cemented spar centers are dry, they will be firmly reinforced with the cement and hold their shape indefinitely.

The motor stick is cut from ⅛" x 5/16" balsa 18" long. The rear hook for the rubber is placed 2½" from the rear end of this stick. This rear hook can be easily bent out of No. 8 music wire. A drop or two of cement will hold it securely in place. The thrust bearing or hanger for the propeller is cemented to the front end of the motor stick. This can be purchased ready shaped from a model supply store or can be made at home by bending No. 8 music wire to the proper shape. A small glass bead or two small metal washers act as a bearing between the propeller and this hanger.

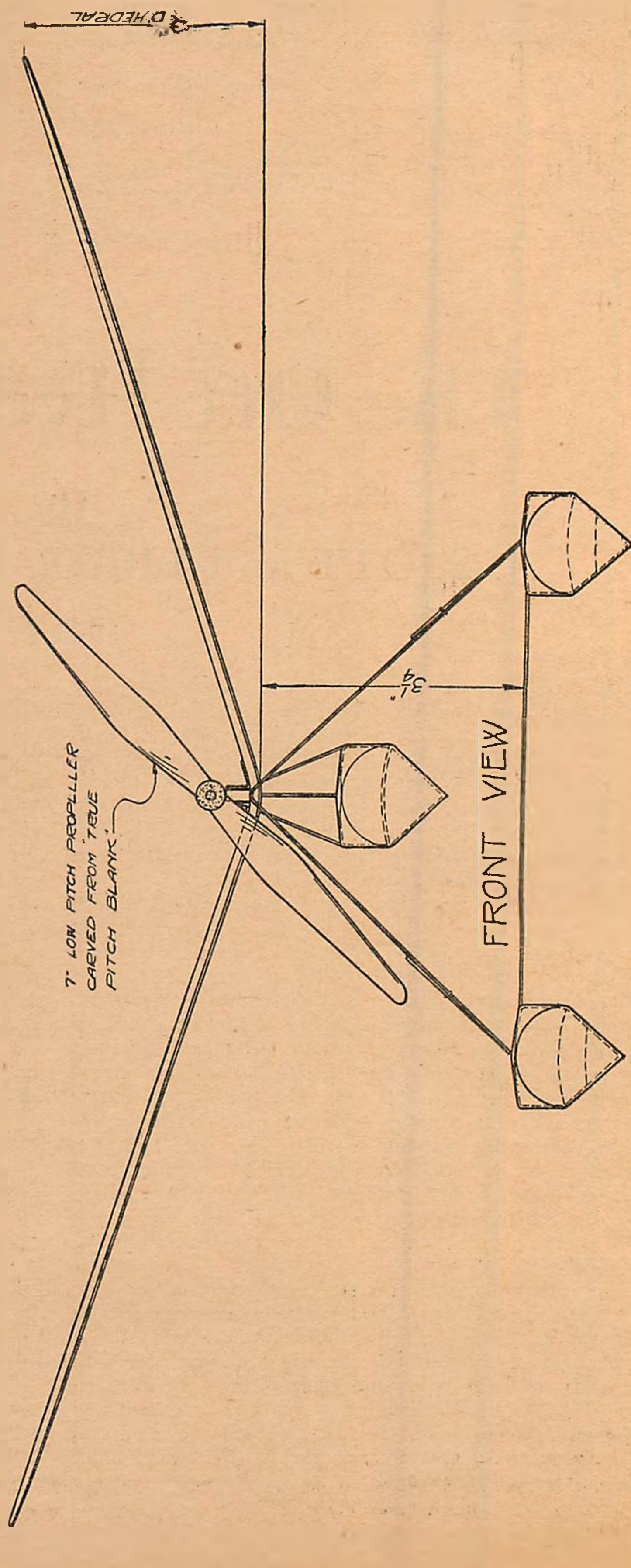
The elevator and rudder frame is made of split bamboo 1/16" square. This is bent to shape over a flame and then cemented in place on the rear of the motor stick. It is a good procedure to pin the bamboo pieces to a flat surface immediately after bending. They can then be cemented together. When they are dry the completed sections can be removed and cemented in position on the motor stick.

The model will fly very well without a landing gear. This is not advisable as it is apt to become broken in case of a hard landing. The propeller is not protected and is liable to crack if it strikes the ground with force. Wheels can be mounted on long music wire braces suspended under the plane, but as the original model was designed to take off and land on water let us consider the landing gear for this purpose.

Three floats or pontoons are required. The floats are built up around two balsa bulkheads. Strips of 1/16" square split bamboo are bent to shape to form the outline of the top and bottom of the float. The bottom outline is brought up to join the top outline at the front. The pointed rear end of the float is made by a 3½" long bamboo strip which is left protruding at the top so that it can be used as a brace in mounting later on. The split bamboo is shaped to form the supports for the floats and the whole landing assembly can be cemented to the motor stick. This assembly should be done slowly with careful attention to obtaining an even well-balanced job.

Light weight Japanese tissue is used for cover-

An R. O. W. With Great Performance



ing the wings, tail section, and pontoons. Before covering lay the part to be covered on the tissue and cut to shape, allowing a little overlap on all sides. Using a warm iron, smooth out all the wrinkles in the tissue, being careful not to scorch the tissue.

Next cement the tissue to the leading or forward edge of the part to be covered. Place a small amount of cement on the trailing edge and stretch the tissue smooth. Do not apply the tissue tight enough to warp the part out of shape.

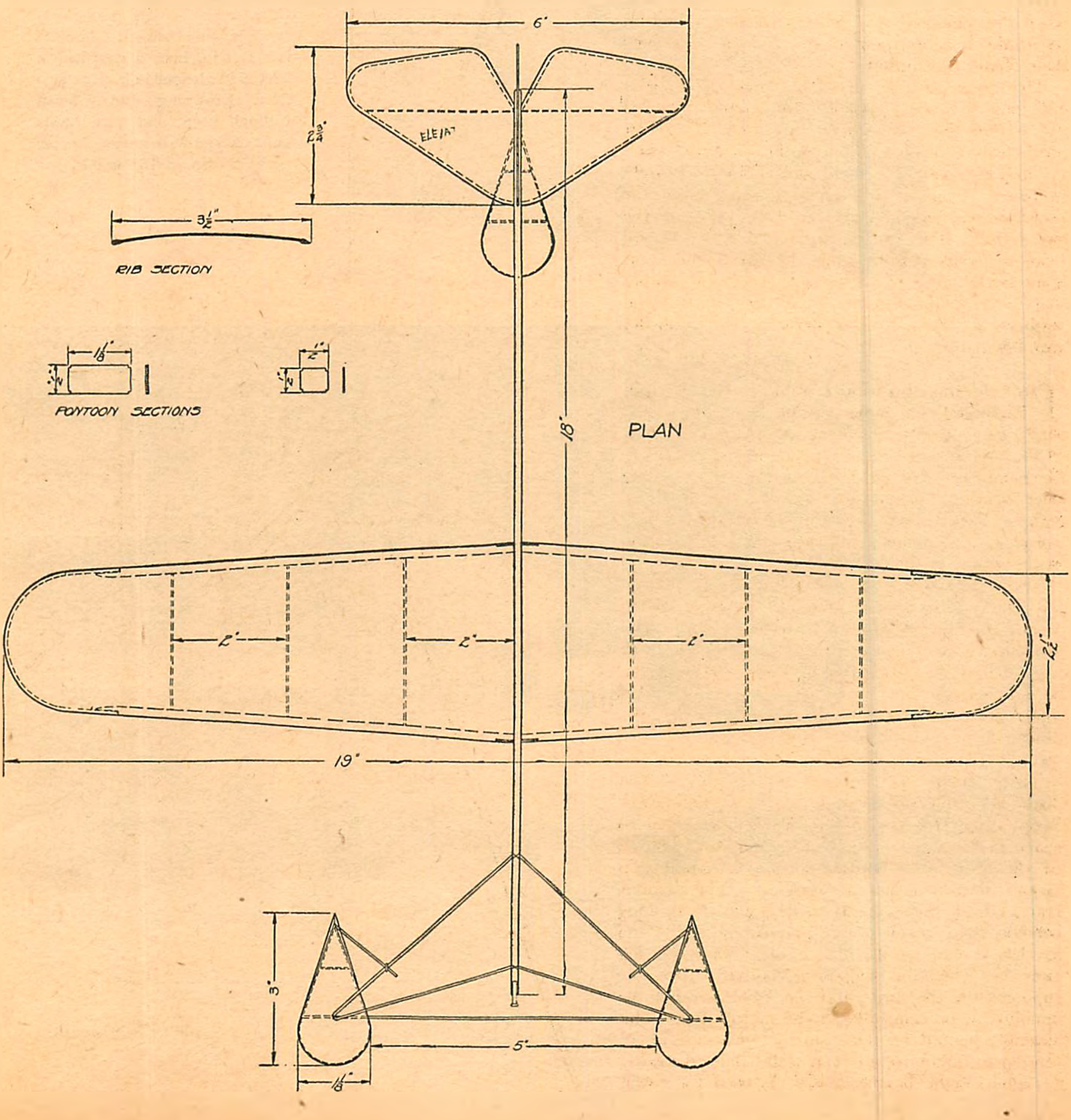
PROCURE a small quantity of good model airplane waterproof dope. The tissue should be treated by doping, as it fills the pores of the covering and makes it tight and waterproof.

Apply at least two coats of dope, allowing at least two hours drying time between coats.

To adjust the finished model for flight gently glide it first to determine the correct position for the wing. If it dives, move the wing toward the front. If it stalls and settles tail first, the wing must be moved to the rear.

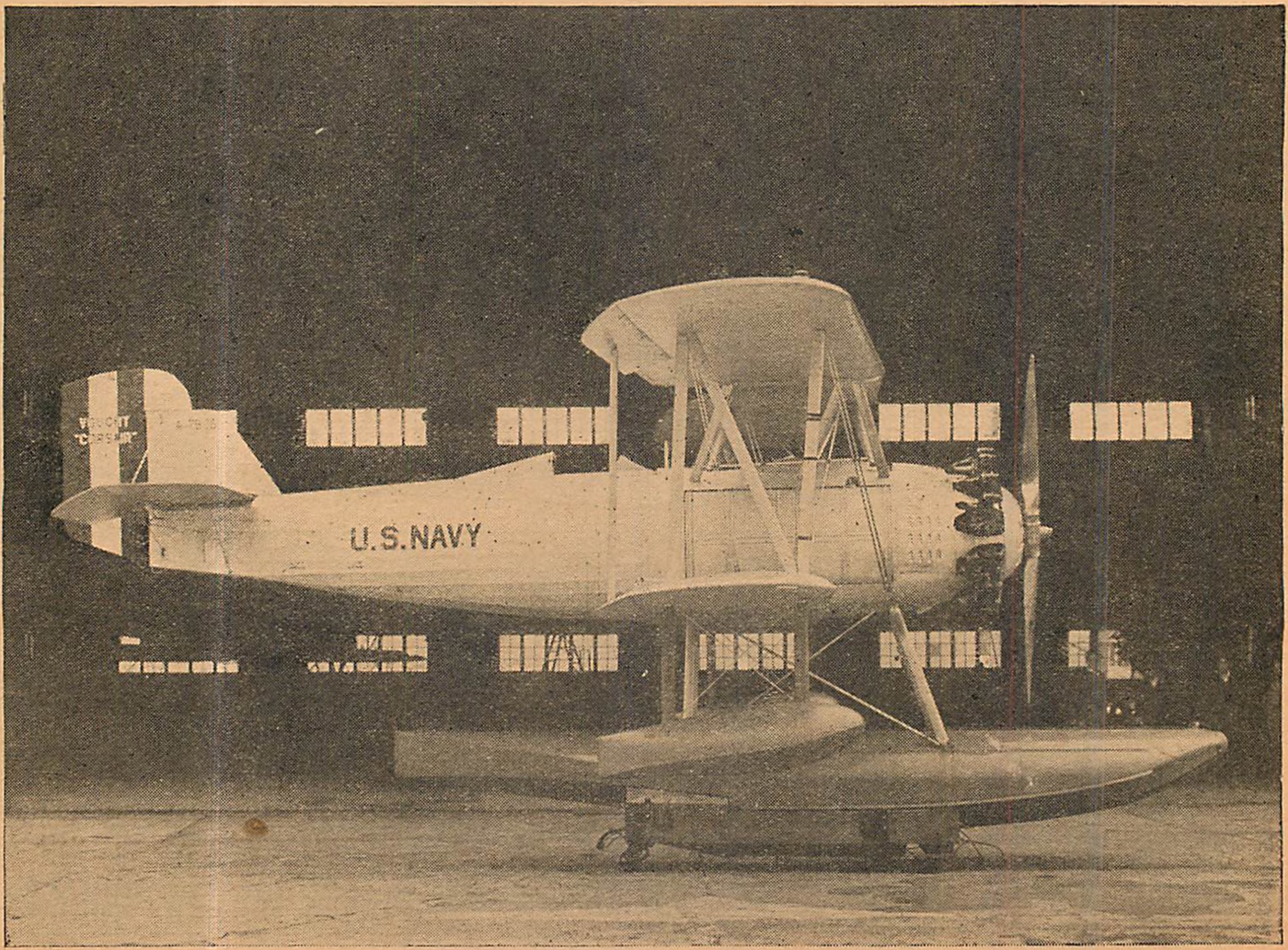
WHEN the model is adjusted in this manner so that a good glide is secured, wind the propeller about 150 turns (it will stand 200 or more for long flights) and let it go gently against a light wind for a flight under its own power. If you have been careful with your work of construction, you will have quite a run to retrieve it after it settles back to earth.

You can secure a large full-sized drawing of this model by writing to the editor of this magazine. Enclose three cents in stamps to cover the return postage and a large drawing will be promptly mailed to you. This drawing can be used as a pattern for cutting the exact parts of the model.

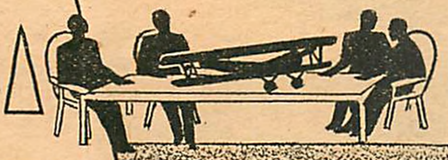


Boeing *P-12B* fighters, popular among military airmen, in formation (left). These planes have a wingspan of 30 ft. top, 26 ft. 4 in. bottom; length 20 ft. 8 in.; height 9 ft. 7 in.; and high speed of 171 m.p.h. The armament consists of two Browning guns firing through the prop

The Navy's popular Vought *Corsair* two-seater reconnaissance biplane (below). The span is 34 ft. 6 in., both wings; length 28 ft. 6 in.; height 11 ft. 5 in. Two fixed Browning guns, firing through prop, and twin Lewis guns on flexible mounting in rear cockpit. Speed 151 m.p.h.



Aviation Advisory Board



Conducted by
Capt. H. J. Loftus-Price
EX-ROYAL AIR FORCE
CHAIRMAN OF THE BOARD

EVEN as late as 1927, any of us whose endeavors were along aeronautical lines could easily identify most of the commercial airplanes then in use after no more than a casual glance, and sometimes even at a considerable distance. In fact, we could go still further and add a bit more about the name of engine, the year's model of the airplane and other qualifying statements which were generally quite accurate.

The last few years with the tremendous increase in aircraft manufacture have wrought an entirely different state of affairs. Even airport managers, accustomed as they are to seeing incoming aircraft of all makes, types and vintages, must often wait for an airplane to taxi closer until the manufacturer's trade mark is legible before they are sure of the make of airplane which has landed within their domain.

Nor are commercial types alone difficult to identify. There was a time when army airplanes, especially single and biplace models, were so different from existing commercial types that one could positively pick them out of an assemblage of their commercial airmates with no trouble at all.

Now, however, we have commercial sport types with just as "sporty" lines as any of our pursuit planes, and we even have army pursuit planes which, while capable of high speed, look much the same as the slower types. No longer are chrome-yellow wings and tail surfaces and olive-drab fuselage the distinguishing marks of a military airplane, for not a few manufacturers of commercial types have adopted this color scheme for their own products.

How, then, can we tell them apart? As we walk toward a number of parked airplanes, how can we pick out the one belonging to the Air Corps, and then, having picked it out, what do we find out about it as we come closer?

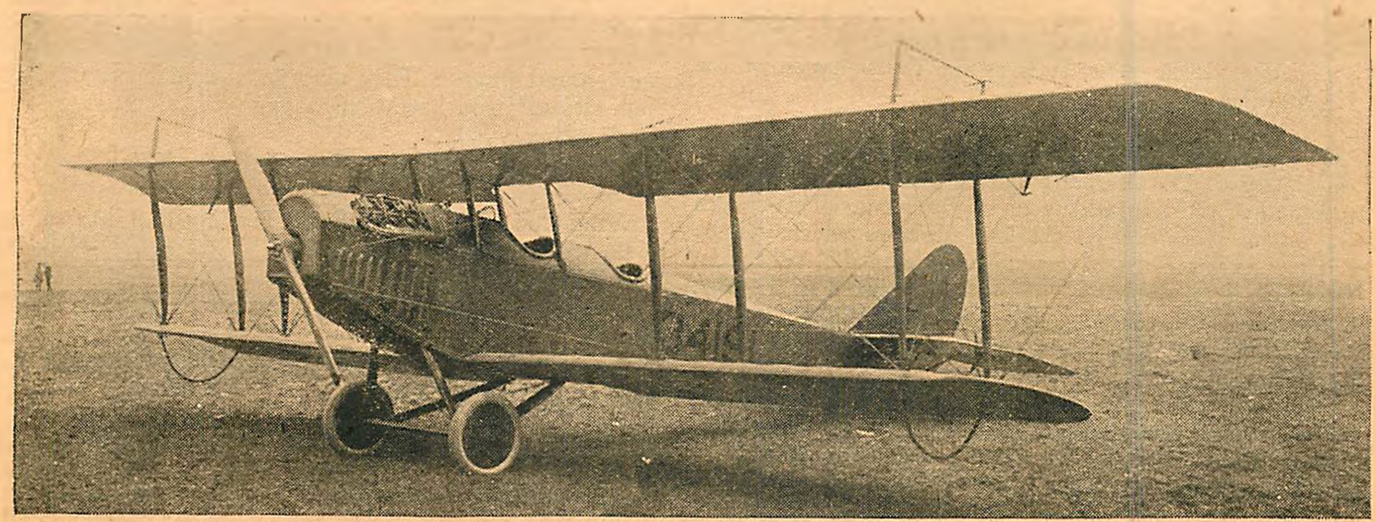
If the fuselage is olive-drab and the wings chrome-yellow in color, it *might* be an army airplane. If we approach it and see the familiar red, white and blue circle-in-a-star-in-a-circle, underneath the lower wings and on top of the upper ones; and then casting our eyes rearward observe that the rudder is marked with a vertical blue stripe next to the rudder post and thirteen alternated red and white horizontal stripes to the rear of the blue one, then we know for a certainty that this airplane belongs to Uncle Sam and has been paid for by the Army Air Corps.

TO confirm this we have only to look at the rear part of the side of the fuselage just forward of the tail group and we see the letters, "U. S. ARMY" marked thereon, with the same words in much larger lettering spread along the bottom of the lower wings.

Omitting any reference to the shape or size of the airplane in question, it might be any one of eight military models, or made at any one of the twelve aircraft factories which have Air Corps contracts. And herein comes the second line of the three which are topped by the one reading "U. S. ARMY" on the side of the fuselage.

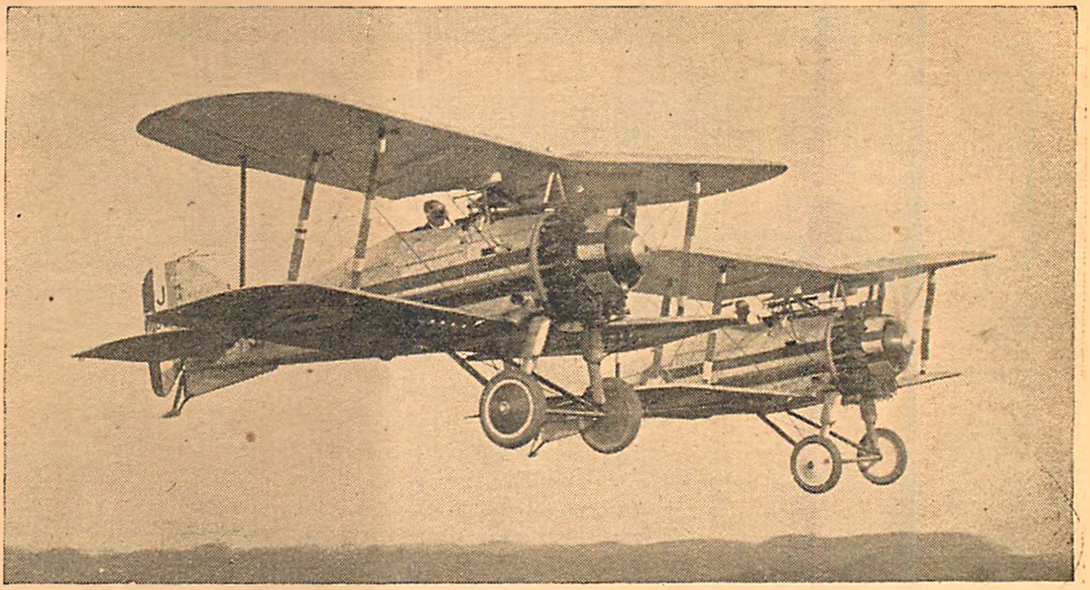
This second line tells us the name of the manufacturer, followed by the model designation of this particular airplane. The model designations are as follows:

	Model Designation
Pursuit (fighting) planes	P
Observation planes	O
Attack (ground straffing) planes	A
Transport, Cargo, Ambulance, Workshop planes	C
Bombardment planes	B
Primary Training planes	PT



A Curtiss *JN.4*—more famously and familiarly known as the "*Jenny*"—a wartime trainer

Basic Training planes, used in transition from Primary type to service type planes ....BT
Photographic planes .... F



Two Gloster *Grebe* British fighters in close formation

Airplanes of experimental and service test status are prefixed by the letters, "X" and "Y." Thus a type that is being developed either at a factory or at the Air Corps Engineering Station at Wright Field, Dayton, Ohio, would be labeled, were it a pursuit plane, "XP," followed by a number which would classify it according to its type; such as "XP6," which was the experimental stage of a pursuit plane made by the Curtiss Company somewhat on the style of the Curtiss *Hawk*.

If this experimental model proves to be of an acceptable type a small lot is then bought and put out at some active station for service test; that is, used in the service with other pursuit machines to test their serviceability and desirability. The letter "Y" would be substituted for "X" and they would then be labeled (in this case) "YP6" or "Y1P6."

Airplanes of this status, on completion of the service tests, will be reclassified as standard, substitute standard, limited standard, or obsolete, depending on the results of the service tests. When thus reclassified, the prefix letter "Y" or the symbol "Y1," as the case may be, will be dropped and the airplane identified by the remainder of the model designation which consists of a letter or letters indicating the type, and a number indicating the model. Subsequent standard airplanes procured as a result of satisfactory service test will have a letter suffix added to this model designation.

The designation of an airplane with changes and improvements incorporated as a result of tests and experience with that particular model would have an additional letter added or changed, as the Boeing Pursuit P-12-B. When a new lot was purchased, equipped with improved landing gear, ring cowling and other improvements, it was redesignated the P-12-C. A major change, such as a change in the type of engine would be designated by the next unassigned model number, such as the redesignation of the P-1A to that of P-2.

IN accordance with the policy effected under the date of January 6, 1930, aircraft will be considered absolete as to type five years from date of procurement. This creates the status of serviceable obsolete airplanes which will be retained in service until actually condemned. When declared obsolete, the letter, "Z" will be prefixed to the type designation; for example, the type P-1B airplane when declared obsolete under the policy referred to will be designated by "ZP-1B."

The model designations "LB" and "HB" formerly assigned to light bombardment and heavy bombardment airplanes respectively; and the model designation, "AT" formerly assigned to airplanes used for transformation training, have been discontinued. Airplanes of the bombardment type will hereafter be designated by the type symbol "B" combined with a number to designate the model. A new type of airplane, basic training, designated by the symbol, "BT," replaces the "AT."

Primary training, basic training, cargo and photographic airplanes as used in the Army are practically the same as those used for the same purpose in civil aviation.

Primary training planes are light, two-place planes used for primary instruction in flying. Basic training planes are used in transition instruction where the student flyer graduates from primary types and is ready to fly the larger service types. The basic training plane is much the same as an attack or observation airplane except it has dual controls.

CARGO airplanes are generally tri-motored transport monoplanes, although some single-engined cabin biplanes are also used.

Photographic planes may be observation planes used for photography, but a number of Fairchild 71, single-engined cabin monoplanes are now being used for this purpose.

PURSUIT PLANES—P-1 AND P-12

"P" stands for pursuit. Type is single-seaters, although experiments are being carried on with bi-place pursuit planes. Pursuit planes carry two machine guns mounted under the cowling, forward of the pilot; one, .30 cal. Browning and one, .50 cal. Browning. Both guns are synchronized with the engine so they can not fire while a propeller blade is in the line of fire.

The mission of pursuit aviation is to shoot down and destroy enemy aircraft and thus also protect their own air and ground forces. They must be fast, maneuverable at high altitudes and have high ceiling.

Curtiss Hawk, P-1-C:

Gross weight—2973 lbs. Span 31′ 6″. Wing Area—252 sq. ft.

Wing Curve, Clark "Y"; Wing Loading 11.8 lbs./ sq. ft.

Engine—Curtiss Water-cooled "V" 12 cyl. D-12-E, of 435 H.P. at 2300 R.P.M.

Speed, sea level—154 M.P.N.; Landing Speed, 58 M.P.N

Service ceiling 20,800 ft.; Climb 20,000 ft. in 34 mins.

Absolute ceiling 22,300 ft.

Boeing P-12-C:

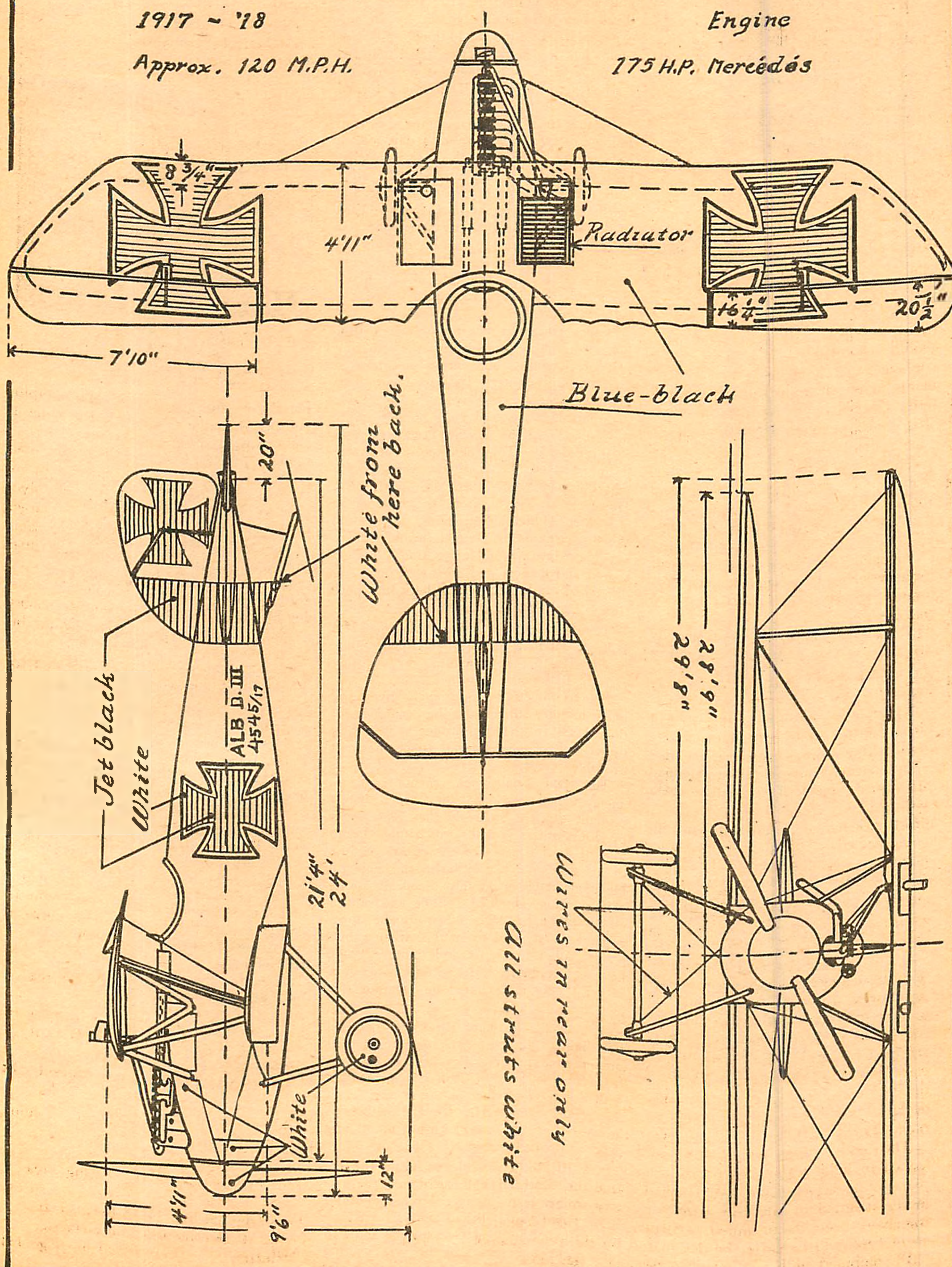
Gross weight—2597 lbs. Span—30 ft. Wing area—227.5 sq. ft.

Curve, Boeing 106; Wing loading 11.58 lbs./ sq. ft.

Wheel brakes and metal ailerons and tail surfaces.

Engine—Pratt & Whitney (*Continued on page 44*)

GERMAN ALBATROS D-III PURSUIT



Ball, of Great Britain

(*Continued from page 5*)

air and take the risks he could not take with a companion to be considered. At last this was granted. He was free and thirsting for action.

On July 26, he accomplished a daring feat which was to bring him the Military Cross. He went out after a German balloon which was known to be in the vicinity. He failed and came back. Then he volunteered to go out again. This time he succeeded in setting the balloon afire, but his engine was badly hit and he was forced to fly back at half-speed over the eight miles of German territory. To make it worse he had to travel a few feet from the ground.

By this time his total was six enemy machines and one balloon.

In August, Ball was created a full lieutenant. His particular exploit at that time was the occasion he brought down three machines in one morning, a feat equalled only by Nungesser, the French ace, whose tactics in combat so closely resembled his own.

One of his famous scraps was his fight with twelve enemy planes. They were flying in formation and Ball dived into their midst and put the nearest one out of action. The others came forward. Ball's machine was literally riddled with bullets but he succeeded in getting away unharmed. Once home he said nothing but the report of an observer identified him as the victor in the episode.

By September, 1916, he was officially credited with having destroyed twenty-three planes, and he was rapidly adding to the total. The British Government then added the Distinguished Service Order to his decorations. It is easy to believe that he had in reality many more victories than were officially credited to him, as numerous times he brought down planes so far into German territory that no official verification could be made.

Another exploit of his aroused great admiration throughout the country. Sighting a group of seven enemy machines, he singled one out at less than ten yards range and brought it down. When he was ready to take on the others, they had dashed off in confusion. He went after them. Soon he found himself in the presence of five other hostile planes. He fired at one from an eight-yard range and the enemy exploded in the air. A second came on but Ball sent him down in a crash. By this time his drum was empty and he hastened away to reload it. He flew back again. Immediately he crippled one of the three enemy planes and forced it down. By this time he was chagrined to find that his gas tank was almost empty and he was forced to return. The machine was riddled with bullets but he was unharmed.

An achievement that is worth telling took place when he was going toward Cambrai with two other machines to view a southern airdrome. A number of Albatros scouts hove into sight. Ball dived at the nearest one and fired. It broke away but he hung relentlessly on its tail, firing repeatedly. At last he managed to maneuver his position so that he was underneath at close range. The enemy went down. In the meantime the German formation had scattered. Ball and a companion made after them. They dived but were suddenly met by an unexpected sight—four additional Albatros scouts had joined the others. Ball followed his usual methods of offensive warfare and crashed one German. The others turned tail and made for home.

By this time Ball was bringing down an average of two enemy planes a day. Then he was sent home to teach other men what he knew and was decorated by the King with the Distinguished Service Order and two bars. However, he longed to get back to the front and reluctantly permission was given him to return to battle; though not before he had designed a fast flying scout machine. He was expert in airplane construction and always crying the need for better aircraft.

France saw him once more. Soon after his return he accomplished the amazing feat of downing four enemy machines in less than ten minutes. He was alone. Suddenly he was attacked by five planes. He determined to stay and flung himself at the nearest one. The enemy machines went crashing down. Then Ball, too, went down, letting his plane fall almost vertically in what airmen then called the death leap. However, ten yards from the ground he straightened out his machine, and before the three remaining Germans could maneuver back into favorable positions, he had soared above them and destroyed one. Another had crashed in getting back into position. The last one escaped.

Then came the evening of May 7, 1916. Ball set out in a single-seater triplane numbered 10046, accompanied by another plane. Ball never returned.

Many conflicting reports were given and much mystery surrounded the occurences of that day. In the circumstances, it is best to relate here what appears to be the most probable report.

The two Englishmen encountered an enemy plane which they immediately brought down. Suddenly they were beset by four others. Ball's companion found himself at the mercy of the enemy because of his unfavorable position at the moment. He immediately went into a tailspin to regain position, obtained altitude and returned to the fight. Then he brought down a plane and turned to another when a bullet fractured his wrist and another broke his steering lever. He withdrew at once in great pain and fainted on regaining his own lines.

The details of what happened after he left Ball to the three Germans remained unknown. His comrades at first had no fears for him, as he had often held his own with a greater number of the enemy. Then the report came. His triplane had been brought down by von Richthofen, and he had been killed outright!

von Richthofen, while verifying the defeat and death of Ball, attributed the victory to his own younger brother, Lothar. It is known that Ball had always been anxious to fight the great German ace and had often sent messages that he was waiting "upstairs," but the challenge had never been accepted. Who knows but that on May 7, it was taken up?

At the time of his death Albert Ball was not yet twenty-one, and held the world's record for aerial victories—forty-three airplanes and one balloon.

At heart he was always the sportsman, never the killer, and it was only his love of a good fight and the knowledge that he must do his duty that urged him on to more victories. His true feelings were revealed in a letter which he wrote home shortly before his death:

"It was a good fight and the Huns were fine sports. . . . I am indeed looked after by God, but I do get tired of always living to kill, and I am really beginning to feel like a murderer. I shall be so pleased when I have finished."

How You Learn to Glide

(*Continued from page 10*)

point the pilot cries "*Let go!*" and the tail men drop the rope attached to the tail and away and up shoots the glider as though hurled from a slingshot. This method is ideal where the space for the take-off is small and altitude is needed at once to take advantage of the air currents.

By utilizing the slope-winds or currents of air flowing up and over the sides, or slopes, of ridges and hills, the student is taught to navigate his machine back and forth along the side of the mountain, soaring high above the starting point.

Of course, great skill in soaring cannot be taught at a school. That only comes with great patience and hard work, as does anything similarly worthwhile.

Outside of the thrills and wonderful sport that are part of all soaring flights, there are various licenses to be obtained. The F. A. I., or Fédération Aeronautique Internationale, issues three classes of soaring or gliding licenses. The third-class test is to make a flight from an altitude of thirty seconds. This is usually made by a glide down a long hill. The second class license is obtained by making a one-minute flight, including right and left turns from a height. Before this test can be taken two flights of 45 seconds must be made. The first class or real soaring license can only be obtained by taking-off and remaining above the take-off point for a period of five minutes. This means that the pilot is really soaring, utilizing the slope-winds or hot upcurrents to keep him aloft, rather than the long glide down from a height.

Gliding and soaring is one of the most fascinating and thrilling sports in the world and at the same time almost the safest. Only through rank carelessness on the part of either the student or the instructor, can any serious accident mar the rapid, inexpensive, and thrilling course of instruction at any good, recognized gliding and soaring school. One does not need a "good luck" charm to see him through the so-called "dangers" of gliding. The only charm to carry is, as "Wolf" Hirth, Germany's famous soaring ace, told me not so long ago, "Confidence in yourself!"

(*Continued from page* 16)

fifth, John Valentine, 4 minutes.

Free-for-all speed event: First, Roger Desbrosses, 1 4/5 seconds, translated into mileages—about 49 miles an hour; second, Henry Orzechowski, 2 1/4 seconds; third, John Werner, 4 seconds; fourth, Phillip Zechitella, 5 seconds, and fifth, Lewis Owne, 9 seconds.

Replica models: First, Phillip Zechitella —Stinson (Lycoming); second, Edward Dobrin, tri-motored Ford; third, Adrian Wallace, Travel-Air Mystery R, and honorable mention, Pelo Desiderio, Curtiss "Hawk."

Commercial model event: First, Alton du Flan, 1 minute 15 seconds; second, Hy Kessler, 38 seconds; third, Willard Bixby, 18 seconds; fourth, Arthur Boland, 17 seconds, and fifth, John McNicholas, 13 seconds.

Willard Bixby, by his showing in the twin-pusher and commercial model events, gaining a total of 8 points, won the city championship trophy. Hy Kessler and Phillip Zechitella tied for second plane with seven points each.

—::—

ONE of our Australian enthusiasts is anxious to secure a "pen pal" in the United States with whom he can correspond on matters concerning aviation and so forth. His name is A. Nicholls, 27 Gamon Street, Fortscray, W. 11, Melbourne, Australia. Here's a chance for somebody to learn something of what's doing in aviation in Australia, so why not drop Nicholls a line!

In the same mail that brought Nicholls' letter came one which tells of a commercial model endurance flight of more than 24 minutes. Phew! That's a record, if you like. The Australian model airplane officials are now considering the question of accepting the time and promulgating it as an official record. If that is done there's a mark for American model builders to shoot at!

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American Sky Cadets

NINETY-TWO entries of model airplane enthusiasts from Sioux City and Sioux Falls entered in close competition in our first city-wide Model Airplane Circus. The Scale Model Contest was extremely interesting, Arthur Patch of Sioux City winning first prize by a score of 90.4, with a beautiful Boeing 100—Sport Model. Second place was won by Oscar Manson of Sioux Falls with a Vought *Corsair* model, score of 90.3. These models captured the interest of the public in a great way.

Especially interesting was the indoor flying at the Rickenbacker Airport Hangar. The best indoor time was gotten by James Cox of Sioux Falls with a 2 ft. 47½ in.

A strong wind prevented much of an exhibition in the outdoor flights although James Cox here again captured first place honors with his twin-pusher, staying aloft 1 ft. 8 in.

All winners were the guests of the Kiwanis Club at a banquet. At this time a most elaborate group of prizes were presented to the winners. The classes were arranged as follows: Class A—ages 18 and over; Class B—ages 14 to 18; Class C—ages 14 and under.

Stock models and novelty maneuvering events were equally well received.

It is planned that this shall be an annual event sponsored as it was this year, by the Sioux City Y. M. C. A. and the Sioux City Chapter, National Aeronautical Association.

Complete results of the Circus were as follows:

Class A—Outdoor Flying
1—Jay Hvistendahl, SF........ —57"
2—Oscar Manson, SF............ —52¼"

Class B—Outdoor Flying
1—James Cox, SF.................... 1'8"
2—Earle Johnson, SC.............. 1'6¾"
3—Bill Miller, SF..................... 1'4"

The tournament drew not only young model airplane enthusiasts, but also some of the old timers. Photo shows Captain Loftus-Price, ex-Royal Flying Corps, and Captain Fred A. Pippig, of von Richthofen's Circus, discussing the "old days"

Class C—Outdoor Flying
1—Hubert Everist, SC.............. 20½"
2—Phillip Everist, SC.............. 20"

Class A—Indoor Flying
1—Jay Hvistendahl, SF.......... 2'34½"
2—Oscar Manson, SF............ 1'45"
3—Nels Manson, SF.............. 1'4"

Class B—Indoor Flying
1—James Cox, SF.................. 2'47½"
2—Earle Johnson, SC............ 2'38½"
3—Ralph Youngberg, SF........ 1'56½"

Class C—Indoor Flying
1—Hubert Everist, SC................ 58"
2—Ted Fisher, SF...................... 41"
3—Phil Everist, SC.................... 24"

Class A—Novelty Flying
1—Oscar Manson, SF.
2—Nels Manson, SF.
3—Jay Hvistendahl, SF.

Class B—Novelty Flying
1—Earle Johnson, SC.
2—Bill Wolff, SC. .
3—James Cox, SF.

Class C—Novelty Flying
1—Phil Everist, SC.
2—Hubert Everist, SC.

Class A—Scale Models (100 pt. judging)
1—Art Patch, SC, Boeing Sport 100 .... 90.4
2—Oscar Manson, SF, Vought Corsair 90.3
3—Nels Manson, SF, Lockheed Vega 85.8

Class B—Scale Models
1—Bill Shoemaker, SC, "Spirit of St. Louis" .... 71.
2—Frank Reinhold, SC, Army Hawk 53.2
3—George Hutchins, SC, Army Hawk 50.5

Class C—Scale Models
1—Bob Shoemaker, SC, Lockheed Sirius 61.75
2—Myron Clark, SC, Stinson Detroiter 60.5

Class A—Stock Models
1—Geo. Funke, SC.
2—Dick Woodward, SC.

Class B—Stock Models
1—James Cox, SF.
2—Ralph Youngberg, SF.
3—Earle Johnson, SC.

High Point Winners.

Class A—Oscar Manson, Sioux Falls, 14 pts.
Class B—James Cox, Sioux Falls, 16 pts.
Class C—Hubert Everist, Sioux City, 13 pts.
SF indicates residence in Sioux Falls.
SC indicates residence in Sioux City.

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THE most successful meet in the history of the Hamilton branch of the Model Aircraft League of Canada was staged recently. Several new local records were established, and scores of excellent flights were made by the large number of contestants.

Gordon Chalmers showed his superiority in the Baby R.O.G. and Commercial classes by winning both events, his time being two minutes two seconds in each event. The old record for Baby R.O.G.'s was fifty-nine seconds. Ted Booth, with a new city record of four minutes nineteen seconds, won the tractor contest.

The winners, times, and prizes are as follows:

Baby R.O.G.: 1. Gordon Chalmers, 2:02, awarded the Spectator Trophy; 2. Ted Booth, 1:08, awarded $5 merchandise at T. Eaton Co.

Indoor Tractor: 1. Ted Booth, 4:19, awarded S. S. Booth Trophy; 2. John Finlay, 2:30, awarded A. V. Young Trophy.

Indoor Commercial: 1. Gordon Chalmers, 2:02, awarded Greening Rainbow Trophy; 2. Lawrence Berwick, :53, awarded J. J. MacKay Trophy.

Scale Models: 1. Lawrence Berwick, Lockheed *Vega*, Roydon Foley Trophy; 2.

Henry Sprague, Curtiss *Condor*, awarded merchandise. Honorable mention, Arthur Wilkins, Lockheed *Vega*.

WE are indebted to the Hartford *Times* for the following report of the recent model airplane tournament held under the auspices of the Hartford Y. M. C. A. The report follows:

Hartford carried off the honors in the second state model airplane meet, held in the armory when more than forty boys from six clubs competed for fourteen prizes. John Tyscewicz of the Hartford Aero Model Club won the Hiram Percy Maxim Trophy for the longest hand-launched flight made by a Hartford boy's plane; $10 in gold for the Hartford county representative winning the highest number of points; second prize in both the hand-launched duration and R. O. G. (rise off ground) commercial duration contest, and first place in the novelty contest.

The Hartford Model Club won the Savitt Cup awarded to the club scoring the highest number of points. The club scored 27 points.

The meet was sponsored by the Hartford Model Club, which is affiliated with the Hartford Y. M. C. A. Lieutenant Richard B. Bourne of the Forty-third Division Aviation, C. N. G., was director of the meet.

Herbert W. Owen, of New Britain, won two first places, the hand-launched duration and the commercial R. O. G. In the first contest his ship not only won but broke the state record by flying 520 3/5 seconds or eight minutes and 40 3/5 seconds, a remarkable flight. The world record is just a few seconds under twelve minutes. For this outstanding event he was awarded the Forty-third Division Aviation Trophy and an airplane ride. Another model of his also won first honors in the commercial R. O. G. contest. This ship flew for 295 2/5 seconds and Owen won a loving cup presented by the Forty-third Aero Club of Meriden and an airplane ride.

The prizes included four cups, two medals, a $10 gold piece, a $5 gold piece, $3, a book on model airplane construction, a radio crystal set, a twenty-minute course of flying instruction, and several airplane rides.

The armory had all the activity, suspense and competition of a regular airplane meet, but had very little noise and many more crashes. Planes flew low when they should have flown high, and spectators and officials ducked to the floor to escape being hit. Stubborn little ships, with hours of patient work in their flimsy paper wings, persisted in lodging in girders thirty or forty feet from the floor, or tail-spinning to destruction on the floor. One boy climbed the girders almost to the skylight of the armory to rescue his tiny ship, only to lose it ten minutes later when it caught on an electric light with no ladder available.

Besides the duration contests for hand-launched and commercial models, a novelty contest was held, in which many remarkable and weird-looking craft participated. There was a speed plane, built on the "flying wing" principle. It had two propellers attached on each end of a short red wing. It took off from the ground, climbed almost straight up, and then fluttered to the ground again. Another was a helicopter arrangement, that also went straight up, and landed on its tail.

The plane that won the novelty contest was made by Tyscewicz, and to begin with was a beautifully-made model of an army biplane, with a tiny machine gun mounted on the top wing. It took off from the floor and looped and dove excellently in test flights. On the first preliminary flight, however, it flew so well that it went up some twenty feet and at the bottom of a loop hit a girder and fluttered to the ground with the top wing broken. It was picked up and the owner said he would have it ready for the finals. When his turn came, he presented the plane, this time a low-wing monoplane, and in the contest it flew even better than it had with two wings, winning the prize.

Results of the contests, in order of finishing:

Hand-launched duration flight—H. W. Owen, New Britain Junior Achievement Club, 520 3/5 seconds; John Tyscewicz, Hartford Aero Model Club, 446 seconds; Edmund Morrison, Hartford, 377 seconds; H. C. Doolittle, Highhatters Model Club of Southington, 325 3/5 seconds; J. Warren, Hartford, 313 2/5 seconds; Clifford Purinton, Hartford, 310 seconds.

Commercial, rise off ground for duration —Owen, 295 2/5 seconds; Tyscewicz, 147 seconds; Doolittle, 136 2/5 seconds; J. Ricci, Hat-in-the-Ring Aero Club, Norwich, 136 1/5 seconds; J. Magna, Hartford, 133 seconds.

Novelty, Tyscewicz, Hartford, first; Edmund Morrison, Hartford, second; William Gabb, Hartford, third; Paul A. Schmidt, Hartford, fourth; Doolittle, Southington, fifth.

Finishers in the club contest for the Savitt Trophy—Hartford Aero Model Club, 27 points; Junior Achievement Aero Club, New Britain, 10 points; Highhatters of Torrington, six points; Hat-in-the-Ring Club of Norwich, two points.

Lieutenant Bourne was assisted by the following corps of officials: Albert D. Adams, Ross A. Hull, A. L. Budlong, B. E. Moore, Jr., A. H. Pepin, Warren H. Smith, O. W. Degen and C. Donald McKelvie.

The B.F.W.-M23C

(*Continued from page* 23)

The frame (21) is made of bamboo. The finished stabilizer is covered on both sides and glued to the fuselage along the line of thrust.

The rudder, shown in Figure 9, is also made of 1/16" square balsa and the frame (20) of bamboo. After covering the rudder on both sides, glue it to the end of the fuselage as shown in the drawing. The model is now finished.

If you desire to color your model, paint the sides and bottom of the fuselage brown and the propeller and fuselage, up to section C-D, silver. The top of the fuselage and fin take a coat of natural dope. The rudder is brown, the shock absorbers silver and the rest of the landing gear and the tail skid are black. The wings and elevator are yellow.

Aerial Radio

(*Continued from page* 19)

that the insulating material must be strong enough to prevent leakage or puncturing at the voltage for which it is designed.

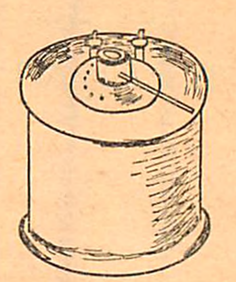


FIG. 7- VARIABLE CONDENSER COMPLETE

Condenser capacity is measured in farads, which, for convenience sake, are divided into millionth parts called microfarads, written mfd. The peculiarity of these condensers is that they permit the flow of an alternating current while preventing the flow of a direct current.

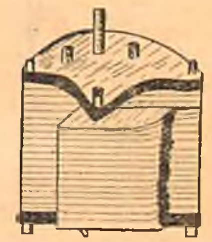


FIG 6- VARIABLE CONDENSER

The variable condenser consists of two sets of plates which are mounted on supports insulated from each other. One of the sets is movable, and, by moving a knob can be rotated so as to interleave the fixed

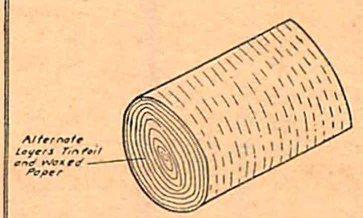


FIG. 5 - ILLUSTRATING CONSTRUCTION OF FIXED CONDENSER

set. The rotating of the movable plates varies the capacity of the condenser, and this in turn varies the capacity of the current to which it is connected. By this means the set can be adjusted to the capacity of incoming waves and a sharper or clearer reception is possible.

The Airplane Engine

(*Continued from page 8*)

condition is true at idling speed. Here the compression of the fuel charge is at a minimum and a richer charge must be supplied to insure ready ignition. All of these cases are satisfactorily met by the present-day carburetor.

Basically, the carburetor consists of a vertical, hollow jet in which is maintained a constant supply of liquid gasoline. This jet is fed from a bowl in which is a float that governs the height of the liquid in both the bowl and the jet. As the air is led around the jet at a high rate of speed, it draws the liquid fuel out into the passageway as bubbles. Drawn into the swift stream of air, the fuel is further vaporized and is led off to the various cylinders where it is ignited.

The velocity of the air flowing past the carburetor jet is created by the suction of the downward moving pistons within the cylinders. The intake valve opens as the pistons start downward and this suction reaches through the manifold and on to the carburetor. This velocity is increased by passing the incoming air through a venturi or a choked throat in the center of which is located the jet. To provide for varying conditions, both the venturi and the fuel jets can be changed and different sized ones substituted.

The speed of the airplane engine is controlled by the opening or closing of a butterfly valve in the throat of the venturi. If the valve obstructs the passageway, naturally less vapor will be able to find its way to the cylinders, and hence less power will be developed. Consequently, the engine speed will drop.

Since the butterfly valve is placed above the main jet, little suction will be acting on the jet when the engine is throttled down. Accordingly, a very weak mixture will go to the cylinders and the engine will not operate smoothly. An idling jet is placed in the side wall at a point where sufficient suction exists to draw out the necessary amount of fuel. This secondary jet provides for engine speeds from the lowest idling speeds, about 250 revolutions, to about 800 revolutions. At this point the fuel is drawn from the main jet.

A quick build-up of engine speeds from idling to full throttle would exhaust the fuel from the main jet before the inertia would permit a renewal of the supply. As a result, the engine would cut out any time the throttle was opened quickly. To prevent this an enlarged space is built in the base of the main jet. This well fills up under normal operation.

As the throttle is opened quickly the well provides a supply of fuel that can be used until it can be renewed from the bowl. It thus prevents any lag between the throttle opening and the acceleration of the engine. This device is called the accelerating well.

As a plane climbs above its normal levels the air becomes less dense. In effect, the air becomes thin. Consequently, the fuel mixture going to the cylinders would become overly rich and lose power. Hence, the ceiling of the plane would be quite limited. It is essential to provide the pilot with means for thinning out the mixture in order that it will always be properly proportioned for the best efficiency.

An air line is run from the carburetor air passage to the top of the bowl. In this line is placed a valve which is controlled from the cockpit. Depending on the position of the valve, a suction can be placed on the carburetor bowl and, hence, less fuel will be permitted to be drawn out from the jets. The mixture is thus leaned down.

Practically all airplane engines are given a rich carburetor setting to insure good combustion on the takeoff. This is, however, inefficient and uneconomical. Hence, when once in the air and starting off on a run, all cross-country flyers lean down their mixtures to a more efficient point. It is possible to save four or five gallons of gasoline an hour by this method. Care must be taken not to run too lean for then the engine will heat up excessively.

The carburetor is designed to operate in any normal condition. However, in combat maneuvers or in stunting, success frequently depends on the continuous operation of the engine. As long as the pilot continues to have his weight carried on his seat, the carburetor will function normally. That is, gravity governs the action of the float which operates the position of the needle valve. The speed at which most such maneuvers are done is ordinarily so great that they are completed before the carburetor has run dry.

Most of us have seen some of our great pilots fly for considerable lengths of time with their planes in an inverted position. In this case, the carburetor float does not cut off the supply of fuel. On the contrary, the needle valve is kept open, thus allowing the pressure from the engine-driven fuel pump to act directly on the main jets. The result is, of course, a flooded engine which will cut out.

Thus, for inverted flying, a small "restriction jet" is placed in the fuel line to allow only a certain amount of gasoline to get through. This amount will be sufficient for the full-engine speed, but not enough to flood the carburetor. The engine will operate properly on its back for long periods with this set-up. Of course, a special arrangement must be made for the oil circulation, otherwise the engine would get no lubrication during inverted flight.

When operating in cold weather it has been discovered that the cold air rushing through the passageway will not properly atomize the particles of gasoline it draws from the jets. When these small globules of liquid reach the cylinder they will not entirely burn because the flames cannot reach into the drops. Heavy smoke, carbon deposits, and low power result. This condition is certainly not desirable and it might even be dangerous on a takeoff. Moreover, the evaporation of the fuel will lower the temperature in that vicinity and ice might form which will render the carburetor inoperative.

A heater is generally used to combat this difficulty. Sometimes it is placed to heat the incoming air, but more often it heats the mixture after the air has passed through the carburetor. The exhaust from two cylinders are led through the manifold in which the vapor is passing on its way to the cylinders. Naturally, the vapor is heated and is atomized even further.

Of course, it must be remembered that the volume of the vapor will expand. Consequently, less of the charge can be drawn into the cylinder and a slight loss in volumetric efficiency will result. Most operators are more than willing to sacrifice this, however, for the benefits of safety to be gained.

One last unit remains in the carburetion system of air-cooled engines. On water-cooled engines the gaseous vapor is led directly to the individual cylinders by the intake manifold. Some of the cylinders get a full charge while others may be starved.

The shape of the radial engine permits the use of an inductor or blower. It is nothing but a fan or turbine geared directly to the crankshaft. The vapor is led into the center of this blower and thrown tangentially outward at a high rate of speed and pressure. Around the periphery are intake pipes which conduct this vapor to the cylinders. It is to be seen that the vapor has been thoroughly mixed and evenly distributed to all cylinders. Moreover, it serves in the nature of a supercharger. Naturally, more of the charge can be forced into the cylinder under pressure, thus increasing the volumetric efficiency many per cent.

The carburetion system is a delicate part of the airplane engine and can cause much trouble. Once correctly set up, however, it should continue to operate entirely satisfactorily.

The fourth article of this series will be a complete discussion of the ignition system of the airplane engine. This will include an explanation of the magneto. This should be especially interesting for it will explain much about the high tension ignition similar to that used on automobiles.

"The What Is It"?

(Continued from page 13)

flat strips of 1/16" balsa. The trailing edge is a strip of balsa ⅛" x ¼" beveled down to 1/16" at its extreme edge. A solid block of balsa is set into the leading edge strip between the two middle ribs. Later a "V" is cut in this block to form the dihedral. Fig. 3 shows the side elevation with the wing flat.

The first operation in making up the wing is to form the leading edge strip. A wooden form is made of ¼" wood with the edge rounded off to the approximate airfoil of the wing. This shape does not have to be extremely accurate as the ribs will shape the wing to its true contour.

Now a strip of balsa 1/16" x 1" is sanded down to 1/32", soaked in hot water for a few minutes, and then carefully bent around the form. It can be held in place with thumb-tacks or with rubber bands until dried out. While it is drying out, the builder can make the ribs and trailing edge strip. After the leading edge strip is dry, the wing is assembled as shown in Fig. 6.

When the ambroid has set firmly so that the wing-frame can be handled, it is covered with rice or bamboo paper. The paper should be glued to the trailing edge first, then brought around the leading edge and back to the trailing edge and glued. In other words, it is glued to the trailing edge only for the time being.

Now give the paper a coat of dope. After this has thoroughly dried, glue the paper to the wing-tip strips. Do not do this before doping the paper. Distortion of the wing is likely to result. This is a tip which can be applied to advantage on any wing construction.

After the wing has been covered top and bottom with the paper, the paper is cut away from the top section between the two middle ribs. A "V" is then cut in the leading edge strip and the small wooden block, and the dihedral is formed as shown in Fig. 7.

To hold the dihedral, and at the same time provide a cradle for the tubular body, two balsa blocks are shaped as shown in Fig. 8, and these are glued to the upper side of the wing as in Fig. 9. The wing is held to the body with rubber bands.

Now for the stabilizer and rudder assembly. Again novelty of construction prevails. Fig. 1 (Plate III) shows how this assembly is made up. The rudder and the stabilizer are both made of a solid piece of balsa 1/8" thick, which has been beveled off to all edges to 1/32". This can be done with sandpaper.

Note how the rudder is mortised into the stabilizer. However, before doing this, let us lighten the units by cutting holes as shown in Figs. 2 and 3. Very sharp, hollow punches should be used for this job. These can be made with thin, steel tubing. The cutting edge should be made by filing the inside of the tubing with a half-round file, and then bringing it to a keen edge with an oil-stone applied to the outer edge.

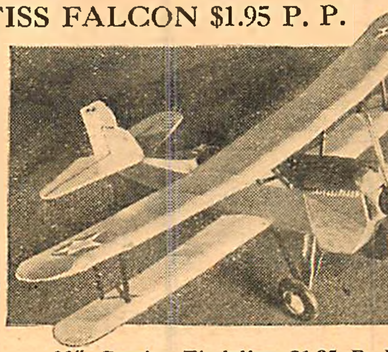
After as much stock as is practical has been cut away, the wood is doped and covered on both sides with paper. The result is a stabilizer assembly which is truly formed and which is nearly as light as by following the usual flimsy construction.

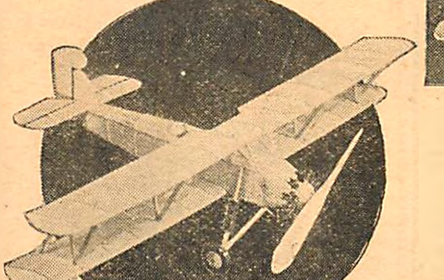
This assembly is secured to the body with the use of balsa cradles and rubber bands as in the case of the wing. A convex-concave wedge is used under the assembly for adjustment as shown in Fig. 5.

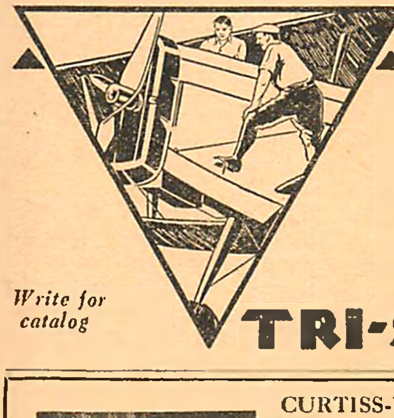
Fig. 4 illustrates a feature of this model which is different from the usual model. Note the slight twist in the stabilizer. This, in a way, serves the purpose of an aileron in that it compensates for the reactionary torque of the rubber band motor.

Obviously, the body of a single-motored model tends to turn in the opposite direction to the movement of the prop. The slight twist in the stabilizer overcomes this torque, and at the same time offers very little additional drag. The twist can be formed with the hands by holding the stabilizer over the kitchen gas range.

Of course, a wide range of props can be used with this model with varying results, but the best performance seems to be had with an 8" balsa wood prop with a heavy pitch, hooked up with a 12-1/8" strand motor. With a winder, the motor can be wound up about 500 turns, and, given fair conditions, the model will make a quarter-mile, straight-away flight. So I call it The Quarter-Mile "What-Is-It?"







Aviation Advisory Board

(*Continued from page 36*)

Wasp, SR 1340 C, radial air-cooled, of 525 H.P. at 2200 R.P.M.—has supercharger and Townsend ring about motor.

High speed at 8,000 ft. alt.—192 M.P.H.; Landing Speed, 60 M.P.H.

Service Ceiling, 29,900 ft.; Climbs to 25,000 ft. in 19.47 mins.

Absolute Ceiling, 31,000 ft.; Speed, Sea Level—167.8 M.P.H.

NOTE: As the engine has a supercharger it can not be run at full throttle at sea level and should not be run until at about 8,000 feet altitude.

ATTACK PLANES—A-3B

The "A" stands for "attack." Type used to attack ground forces, (ground straffing). Attack planes carry at least six .30 cal. machine guns; two mounted forward of the pilot, two on the lower wings (one on each side) and two mounted on a flexible mount which swings about the rear cockpit. The pilot operates the first four, the aerial gunner in the rear seat operates the last two.

Attack planes also carry ten 25 lb. fragmentation bombs on racks under the wings.

They must be fast and maneuverable at low altitudes and must have good visibility for the pilot ahead and below. They need not have high ceiling as they are seldom called on to fly higher than 500 feet on a tactical mission.

Curtiss Falcon A-3-B:

Gross Weight—4458 lbs. Span—38 ft. Wing Area—353 sq. ft.

Curve, Clark "Y"; Wing loading—12.63 lbs./sq. ft.

Engine—Curtiss V type water-cooled 12 cyl. V-1150 E. of 435 H.P. at 2300 R.P.M.

Speed, Sea Level, 139 M.P.H.; Landing speed—60 M.P.H.

B3A

Bombardment Planes—LB-7 (Light Bombardment) and B-2 (Heavy Bombardment): Bombers—Keystone (LB-7) and Curtiss Condor B-2:

The "LB" stands for "Light Bombardment." A bombing plane must be able to carry a great weight of bombs, be able to get good ceiling with this load and have large enough fuel tanks to give it a good cruising radius and provide space for a pilot, co-pilot or navigator, gunner and bomber, radio operator and at least one other gunner. These gunners operate in defense in case of attack by hostile aircraft.

B3A or LB-7—Keystone Light Bombardment:

Bomber in nose of fuselage. Pilot and co-pilot seated side by side. Aerial gunner and radio operator in rear of fuselage. Bomber also acts as aerial gunner. The LB-7 designation is now obsolete, the new B3A being the standard type. It is much the same as the LB-7 except for single rudder.

Gross weight—6½ tons including 2,000 lb. bomb load.

Span—75 ft.; Wing area—1148 sq. ft.

Wing curve—Gottingen 398; Wing loading—12 lbs./sq. ft.

Two engines—Pratt & Whitney "Hornets," R-1690, radial air-cooled engines of 530 H.P. each, at 1,930 R.P.M.

Speed, Sea Level, 114 M.P.H.; Landing Speed, 55 M.P.H.

Service Ceiling, 13,325 ft.; Climbs to 15,000 ft. in 53 mins.

Absolute Ceiling, 15,700 ft.

B-2—Curtiss Condor Heavy Bomber:

Has crew of six. Gunners' cockpits at rear of each engine nacelle. Bomber in nose of fuselage (also acts as gunner when necessary). Pilot and co-pilot (navigator) seated side by side. Radio operator in rear fuselage. Carries 4,000 lbs. of bombs.

Gross weight (with bombs) 8½ tons; Span—90 ft.; Wing Area—1,498.6 sq. ft. Curve—C-72; Wing Loading—11.2 lbs./sq. ft.

Two engines—Curtiss V type water-cooled 12 cyl. engines, type GV-1570 of 600 H.P. each at 2400 R.P.M.

Propellers geared to operate at ½ engine speed.

Speed, Sea Level, 130 M.P.H.; Landing Speed, 57 M.P.H.

Service Ceiling, 16,500 ft.; Climbs to 15,000 ft. in 33½ mins.

Absolute Ceiling, 18,600 ft.

OBSERVATION PLANES—O-1-E: O-25 AND O-19:

Observation aviation is known as "the eyes of the army," taking photographs and gathering useful information for its own forces.

Observation planes have a pilot, seated in front, and an observer seated in the rear. The observer's cockpit contains a radio receiver and transmitter, a signalling pistol and ammunition, and, sometimes, an aerial camera. Around the cockpit is a gun mount with two .30 calibre machine guns. The pilot has one .30 cal. machine gun synchronized to shoot through the propeller.

O-1-E—Curtiss Falcon Observation.

Practically the same in appearance and performance as the Curtiss Falcon Attack (A-3-B) plane except for less armament and different arrangement of the rear (observer's) cockpit.

O-25—Douglas Observation:

Gross Weight—4,573 lbs. Span—40 ft. Wing Area—364.1 sq. ft.

Curve—Gottingen 398. Wing Loading—12.55 lbs./sq. ft.

Engine—Curtiss water-cooled V-type, 12 cyl. engine G1V 1570 of 600 h. p. at 2,450 R.P.M. Propeller geared to engine. Prestone-cooled engine.

Speed—Sea Level, 158.4 M.P.H.; Landing Speed, 60 M. P. H.

Service Ceiling, 22,375 ft.; climbs to 20,000 ft. in 29 mins. Absolute Ceiling, 24,000 ft.

Thomas-Morse O-19:

Metal fuselage, tail group and ailerons. (Wings are fabric covered.)

Gross weight, 3,994 lbs.

Span—39 ft. 9 ins.

Wing area—346.2 sq. ft.

Wing curve—Clark "Y".

Wing loading—11.5 lbs./sq. ft.

Engine—Pratt & Whitney radial air-cooled Wasp; with 10.1 geared supercharger. 508 h.p. at 1,900 R.P.M.

Speed—Sea Level, 146.5 M.P.H. Landing Speed, 58 M.P.H.

Service Ceiling, 21,425 ft. Climbs to 20,000 ft. in 33 mins. Absolute Ceiling, 23,000 ft.

In addition to the above a long-distance reconnaissance (observation) airplane is undergoing service test. This is a three-place dual-engined Fokker monoplane—with 2,600 h.p. Curtiss motors placed in the wings, and retractable landing gear.

Crew consists of (1) observer (or photographer) in nose; (2) pilot; (3) radio operator in rear cockpit back of wings. Observer and radio man both serve as aerial gunners.

The following are a few examples of Army airplanes, at present, or lately, in service, together with their particular model designations.

P1A—Curtiss Hawk Pursuit Plane with Curtiss D-12C, 430 h.p. engine.

P1B—Improved P1A and improved motor (Curtiss D-12-D); larger landing wheels.

P1C—Same as P1B, except motor has new type of gun synchronizer and wheels have brakes.

P6—Same as P1B, except for 600 h.p. Curtiss motor, guns moved forward, instrument board revised, oleo landing gear and different brake pedals.

P12—Boeing No. 89 Pursuit plane, Pratt-Whitney Wasp engine.

P12B—Modified P-12 with improved landing gear, and tail surfaces, Frize ailerons, metal constructed.

COA-1—Corps Observation Amphibian; Loening Amphibian plane equipped for military observation purposes.

O1B—Curtiss Falcon Observation plane with Curtiss D-12, 420 h.p. engine, wheel brakes and dumpable main fuel tank, and droppable auxiliary fuel tank.

O1E—Same as O1B except for Frize ailerons, oleo landing gear, new gun synchronizer.

O2—Douglas Observation plane, Liberty engine.

O2A—O2 equipped for night flying.

O2C—Improved O2A, improved gunner's cockpit.

O2H—Improved O2C, tanks in fuselage instead of in wings, new tail surfaces.

O11—Curtiss Falcon Observation plane with Liberty engine.

O19—Thomas-Morse Observation plane, all-metal except for wings, elevators and fin covering; Pratt-Whitney Wasp engine.

O25—Same as Douglas O2H, except for replacement of Liberty engine with geared Curtiss 600 h.p. engine.

A3—Curtiss Falcon Attack plane, a modified O1 for attack purposes. Gun and bomb racks inside lower wings.

A3B—Modified A3 with Frize ailerons, oleo landing gear, new gun synchronizer and simplified gun installation.

C-1—Douglas Cargo (Transport) plane, one direct-drive Liberty engine.

C-3—Ford Tri-motor Transport plane, Wright Whirlwind engine.

C-6—Sikorsky Model S-38A Amphibian plane.

C-7—Fokker Tri-motored Transport with J-6 engines.

C-9—Improved C-3 with Wright J-6 (300 h.p.) engines.

B-2—Curtiss Condor bomber, two geared 600 h.p. Curtiss engines, 4,000 lb. bomb capacity.

LB-7—Keystone Light Bomber, two Pratt-Whitney Hornet (525 h.p.) engines, 2,000 lb. bomb capacity.

PT-1—Consolidated Primary Training plane, 180 h.p. Wright V-type Model E engine.

PT-3—Same as PT-1 except for wing modification and Wright Whirlwind engine.

BT-1—Douglas Basic Training plane, O2-H with dual controls and no military equipment.

BT-2—Similar to BT-1 but with Pratt-Whitney Wasp engines.

YF-1—Fairchild 71 Model, photographic plane put out for service test.

B3A—The new LB-7—new designation—single rudder.

To return to the lower line of the three on the side of the fuselage, we find the letters "A.C.", for Air Corps, and the year of the contract under which the airplane was made, together with the Air Corps annual serial number for that airplane.

Boelke, of Germany

(Continued from page 20)

December of that year the machine he had been seeking was given him, a Fokker which definitely placed him in a far superior position to his foes because of its greater speed, stability and ease of control.

Now he had two machines, further indication of the esteem in which he was held by the German officials—the small Fokker monoplane with a 150 h.p. rotary engine in front, which he used for range-finding, and a large biplane for long flights.

He must have had a thrilling and breathtaking existence. By this time the French were doing their utmost to squelch aerial tactics by sending out fighters in German territory, and Boelke and others were assigned to protect observers while on patrol. His plane had been equipped with a wireless, by means of which he also directed artillery fire.

Boelke went merrily on his way until June 1915, adding to his growing list of achievements, having earned by this time the citation of the Iron Cross of the First Class. Then he was transferred to a single-seater fighting squadron and took under his wing a raw recruit, Max Immelmann, who under his tuition later became one of Germany's outstanding aerial fighters. At this time von Richthofen was also learning his method of warfare in the skies.

Amid all the horror and bloodshed of those days, Boelke still had time to be human. Already he was noted for his bravery and chivalry, frequently visiting the hospitals which were caring for his wound-

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ed English and French adversaries to bring them gifts of cigarettes and other trifles. Once, back of the German lines, he risked his life to save a French boy from drowning.

Boelke had the acumen to first seek a favorable position in the air before attacking an enemy. He waited for the opportunity to attack from behind, not directly in back but at an angle, since to be immediately behind the enemy was to allow the other's motor to act as protection. A peculiarity of his, and a fortunate one for him, was that he generally set his opponent's aircraft on fire within a short time after the first attack, sometimes with only a few shots. In jest his own men used to say that all Boelke needed to do was to molest an enemy and the plane would immediately catch fire or at least lose a wing.

By the end of August, 1915, Boelke was an officer. His machine was now a newer and more powerful one. Lieut. Immelmann was accompanying him each evening to the front lines to search for French planes. Boelke's own field reports of that period mention blandly, "We went out peacefully to hunt the enemy," and find them they did. More victories came in increasing numbers.

On September 23, Boelke was transferred to another squadron, and as his own plane had not yet arrived, the Commander lent him his own Fokker. Orders were to go up at 9 o'clock that morning with several others to protect the Kaiser, who was breakfasting in a castle nearby. However, Boelke went up alone before then in order to get the feel of the strange machine. Only three or four minutes had elapsed before bombs began bursting and he spied several enemy planes flying toward his division's locale.

By the time Boelke had brought his machine up to their altitude, the enemy had dispatched all their bombs on his company's quarters. However, nothing was hit and they turned to go. Boelke was now in range of the lowest of the group, but in order not to attract their attention too soon did not fire until within three hundred feet. The plane tried to escape but Boelke hung on its tail, shooting continually. At last the Frenchman was hit. He tried to glide to earth and land behind his own lines, but lost control of his machine and fell behind the German barbed wire entanglements. The pilot was captured by the artillery detachment and the plane destroyed by their fire.

In Boelke's own opinion, the hardest fight he ever was in took place about two weeks later. He was up about an hour between Lille and Arras when the smoke of bombs nearby announced the enemy. He flew toward it and the Englishman who was responsible started for him without a moment's hesitation. A great scrap ensued. Each tried repeatedly to attack the other from behind. Round and round they circled each other like two hawks stalking their prey, waiting for an opening.

Keeping in mind an earlier experience when he had used up all his ammunition at a critical moment, Boelke was sparing of his fire and would shoot only when he could get his sights on the enemy. Often not a shot was fired for several minutes, and the grim, unceasing circling went on.

The advantage was Boelke's, however, for they were over the German lines, and he knew that sooner or later the enemy would give up and make a dash for home. At last his opponent gave himself away. Boelke noticed that while circling he began to edge over toward his own lines, which were not far distant. The German waited his chance and climbed into favorable position.

Using the enemy's engine as a target, Boelke fired several bursts into it, putting it out of commission. Thinking that his adversary might be able to make his own lines in safety, despite the useless engine, Boelke continued the attack, and nearly let himself in for trouble. Firing at close range he failed to see that he was virtually over No Man's Land. With very little fuel left, Boelke was forced into doing the obvious—landing behind his own lines—and proving that oftimes "Discretion is the better part of valor."

On landing, Boelke learned that the British machine had landed near the English lines, and that one occupant had escaped by dashing through German shell fire to the shelter of the trenches. The other occupant of the machine, if not killed during the aerial fight, was killed when German shells blew the machine to bits, and set it on fire.

So Boelke continued the ruthless game of war, accepting it because it was his duty but never forgetting that his enemy was human like himself.

He did not spare himself, facing any and all danger with fatalistic calm. The German High Command began to fear for him, and as his services as an instructor were equally as valuable as a fighter, they ordered him to the Balkans to teach others his masterful aerial tactics. This was in July, 1916. However, hero-worship and honors meant nothing to him as compared with the zest of battling in the air, and three months later he was back on the Western Front, where victory followed victory, until Boelke's name was a household word in Germany. By this time he had brought down 40 Allied machines.

Then the inevitable happened. It was October 28, 1916. Boelke and his Jagdstaffel had been hard put since the preceding July trying to overcome the British superiority on the Somme front. The German infantry had been forced back, and with it the German air corps had suffered, the Allies having attained strategic mastery in the air.

"Looking for trouble" of some kind or other, Boelke was leading two of his flights on patrol near Pozieres when they came across two British de Haviland planes, apparently doing contact patrol work.

Though outnumbered, the British flyers took up the fight. The seven German planes swooped down on the two de Havilands. Boelke singled one out and dived at it. von Richthofen followed Boelke and joined in pouring bullets into the enemy machine. However, one of his companions flew between Boelke and von Richthofen, forcing the Baron to swerve away and leave Boelke alone.

Another of the German machines, an Albatross piloted by Lieut. Boehme, dived to the assistance of Boelke, but in doing so wrote "finis" to the career of Germany's then greatest air fighter. Boehme's dive was so steep and fast that the machine did not respond to the controls quickly enough, and one wing-tip grazed the wing-tip of Boelke's machine. The impact apparently was very slight, yet Boelke's plane began to flutter downwards, the wing falling off a few seconds later. He was doomed. The plane fell like a plummet, was smashed to bits, and Boelke was killed.

Such was the end of a valiant enemy and a master aerial fighter. No better tribute to his courage and chivalry could have been paid than that of the British Royal Flying Corps. Flying over the German lines—a white pennant fluttering from a strut to signify his peaceful intent—a British airman dropped a laurel wreath on Boelke's airdrome. The inscription on the wreath was simple, but sincere. It read:

"To the memory of Captain Boelke, our brave and chivalrous foe. From the British Royal Flying Corps."

Airplane Designing Course

(*Continued from page* 30)

edged the most rapidly maneuverable type in existence.

Well, the war did not last forever, fortunately, but it lasted long enough to wipe out the old reliable pushers and the flying wings (the pterodactyl) and substituted the quick-moving, fast-climbing tractor ship of high power—in other words, the ship that we see in general use today.

However, these designers who are not satisfied with our present planes for civilian and commercial purposes ask, "Does a good fighting plane, with its qualities of high performance, necessarily make a good safe ship for the private owner? Can a person teach himself to fly—safely—on one of our modern planes? Can a ship with a fifty-mile-an-hour landing speed and a run of six hundred feet on smooth ground be called safe for the unskilled pilot who flies for sport?"

Those are a few of the questions that every airplane designer must face. The modern pioneers who are searching for and developing new principles of flight say this:

That the modern, conventional plane requires too much skill in operation for the inexperienced private owner who flies only for pleasure and, perhaps, for business trips. That the tendency toward more and more power and even greater speed is raising the cost of the airplane far beyond the capacity of the average man to pay. That, what with the ever-present danger of the stall and the spin, the present type of airplane is fundamentally unsound in design.

Sounds pretty bad, doesn't it? Well, I do quite a bit of flying in the conventional type of plane, and manage to get around safely; but it is not our purpose here to take sides in the controversy. The thing to do is to look at the thing sanely, not blinded by prejudice, and see what we can learn of the various types and how they work.

First we will discuss the "canard," the old familiar twin-pusher type. The canard, or tail-first type, was the first successful airplane to carry a man. The Wrights taught themselves to fly on one. That indomitable Brazilian, Santos Dumont, made the first flight in Europe on one. Furthermore, both the Wrights and Santos Dumont taught themselves to fly on these lumbering crates—and did it safely, crude as their ships were at that time. This would seem to speak volumes for the safety of the canard type.

Just how does this "tail first" airplane operate? What features make it safer—if it is safer—than the ordinary plane?

To answer that first question let us take a twin-pusher model in hand and get down to business. A twin-pusher model of the usual A-frame type is, as all model builders know, about the simplest and most efficient of the real long-distance model ships. It consists merely of a vee-shaped fuselage of two sticks which take the strain of the motors, a small elevator out in front, the main wing at the rear, and, behind the wing, the propellers. This is the true canard type.

Now take a look at Figure 1. Here we see sketched a full-size ship of the canard type, with the elevator out in front and the motors slung under the wings, driving pusher props. We should mention, perhaps, that the plane shown in the sketch is not offered as a practical design. It is merely an example of this type of ship.

It is quite easy to see just how this tail-first airplane works. The main wing provides the lift that sustains the weight of the ship in the air. The elevator is, of course, used only for control. So far, then, we haven't seen anything very remarkable. But wait. Suppose we try to stall a well-designed canard plane. First, we'll increase the angle of attack of the elevator in order to put the ship into a climb. The ship responds and noses up. Since we are deliberately trying to stall, however, we keep that elevator control well back. The plane noses higher and still higher. Presently it begins to lose most of its speed, just like any other plane that is nosed into a climb too steep for the motors. Right here things are changed!

That elevator is small in comparison to the main wing; and, since the control is kept well back, the elevator is operating at an angle of attack greater than that of the wing. Well and good. Now, *before* the ship stalls—that is, before the main wing reaches its stalling angle of attack—the elevator is stalled. That is simply because the elevator had a greater angle of attack in the first place.

The elevator, having reached and passed its stalling angle, loses lift very rapidly, and is no longer able to exert the force that keeps the whole plane nosed up in the steep climb. What happens? Simply this—the plane noses down of its own accord, *before that main wing reaches its stalling angle*, and comes out with only a few feet of altitude lost in the process.

There can be no falling off on one wing, no disastrous spin; all for the simple reason that the spin depends on the main wing being fully stalled. No airplane can spin

unless the angle of attack of the wing has passed the burble point. We learned that in the articles on the tail spin in this course.

There you have one of the greatest points in favor of the canard type. It can't be stalled, in the sense that we use the word, if it is well-designed. It can't be spun, either.

This type has other advantages, too. For one thing, the motors are behind the passengers, slung beneath the wings in the type sketched, where they are well away from the cabin. This cuts down the noise in the passengers' compartments. It does away with objectionable motor fumes and reduces the fire hazard. It is cleaner. Furthermore, the propeller slipstreams do not mess up the air for any control surfaces; nor do they eddy and swirl around any parts of the ship to produce excess drag.

Then, too, the pilot of this type of plane can stop his ship quickly when landing. As every builder of flying scale models knows, the conventional type of airplane has an exasperating tendency to nose over when landing, especially when some slight obstruction is encountered by the wheels.

In full-size work, pilots never apply their wheel brakes with too much force. They would nose over if they did so, and a nose-over in a full-size, heavy ship that is coming in at some forty miles an hour is no joke. It means a good prop gone west, a strained motor mounting, perhaps a strained fuselage structure, a bad shock for the passengers, and a jolt for the whole machine.

Now, suppose the pilot of a canard plane was forced to shoot a landing in a very small field. He knows that the normal landing run of the plane, probably, is quite a bit longer than the available space. Yet he comes in with confidence, because he knows that he can apply the brakes with full force as soon as the wheels touch, and do it with no danger of a nose-over. At worst, the plane would only nose down and skid along on the fore part of the fuselage. With the conventional plane in the same fix the pilot would have his choice of three things: he could ram whatever obstructions happened to be in the way—meaning a nice crash, or, at the very best, a perfectly good set of wings ruined; or he could apply the brakes full-force and half wreck his plane in the consequent nose-over; or he could pull a ground loop as soon as he landed. This last would mean a strained landing gear, probably a lower wing torn off or smashed, and other damage.

These are some of the advantages of the canard type of airplane. It has some disadvantages, too. The present types are sluggish on the controls. They are, admittedly, not as maneuverable as the tractor types; but the sponsors of the canard type point out that ships for passenger carrying and private flying need not be built for stunting.

In Germany, the Focke-Wulf concern has been experimenting with the tail-first type for quite some time. It was Herr Focke, I believe, who decided that a canard job would be a worthwhile experiment. After lengthy scientific investigations and wind tunnel work, Herr Focke decided that he wanted more practical experiments before he undertook the building of the full-size ship. What did he do?

Yea, brothers! He built, and flew, literally dozens of model airplanes, even as you and I; and he watched the performance of each, noting various characteristics and effects of changes in the design. He carried on this work for some time. Then he was ready to build the full-size ship. He did. The plane was a success.

Then he built another, applying what he had learned with the first one. The second was even more successful than the first; and, from all reports, the Focke-Wulf concern intends to go on building these canards.

The canard type is an interesting idea, and its development will be watched by all airplane designers; but there are other types equally deserving of attention. One of these is the flying wing, or, to be more accurate, the vee-wing or pterodactyl type. That tongue-twister, "pterodactyl," is the name of a prehistoric flying reptile that had swept-back wings and no tail to speak of. It controlled its movements in the air by moving the tips of its wings—or so the archeologists say. We'll have to take their word for it.

Like the canard, this type of airplane is an old one. About the first successful one, as far as I know, was built in England. This ship had a pronounced sweepback in the wings, and, of course, no tail at all. It flew quite successfully until the war came along and the urge for speed and power and maneuverability backed everything else off the map.

Now for the principles of the pterodactyl type. As shown in Figure 2, the wings are swept back at an angle of about thirty degrees. In monoplane jobs the wings are usually tapered a great deal, although the biplanes of this type, as a rule, use wings without taper.

The methods of control are varied. On some ships the whole tip of the wing is adjustable, being used both for aileron and elevator. This combination of control is a little hard to explain. We should remember that the tips operate as ailerons by being moved *with respect to each other* (one up, the other down) and that, even while acting as ailerons, they may be moved together to act as elevators. The thing can easily be reasoned out.

As for rudders, they are usually strange in size, variety and placement. Sometimes none are used at all. In these cases the designer depends upon the ailerons for turning, knowing that, once the ship is banked over, the natural stability will cause it to turn of its own volition. When rudders are used, sometimes they are placed above the wing, sometimes below. Usually, however, two rudders—one on each side of the fuselage—are used.

Now for the advantages of this type. There are many, but one of the most important of these deals with the stall. The pterodactyl type is easy to control at angles far beyond the burble point. To those who have studied the earlier articles in this course that means a lot, because they will know that the average airplane goes into a tailspin only because the pilot loses aileron control when the plane is stalled.

Thus we find the pterodactyl type to be safe from the dread specter of the tailspin. Then, too, it has remarkable stability. It almost flies itself.

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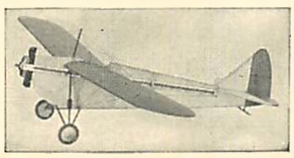

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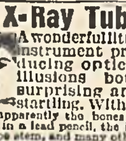

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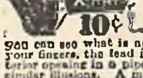

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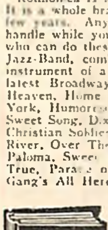

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