# GLIDERS

## CHAPTER 17

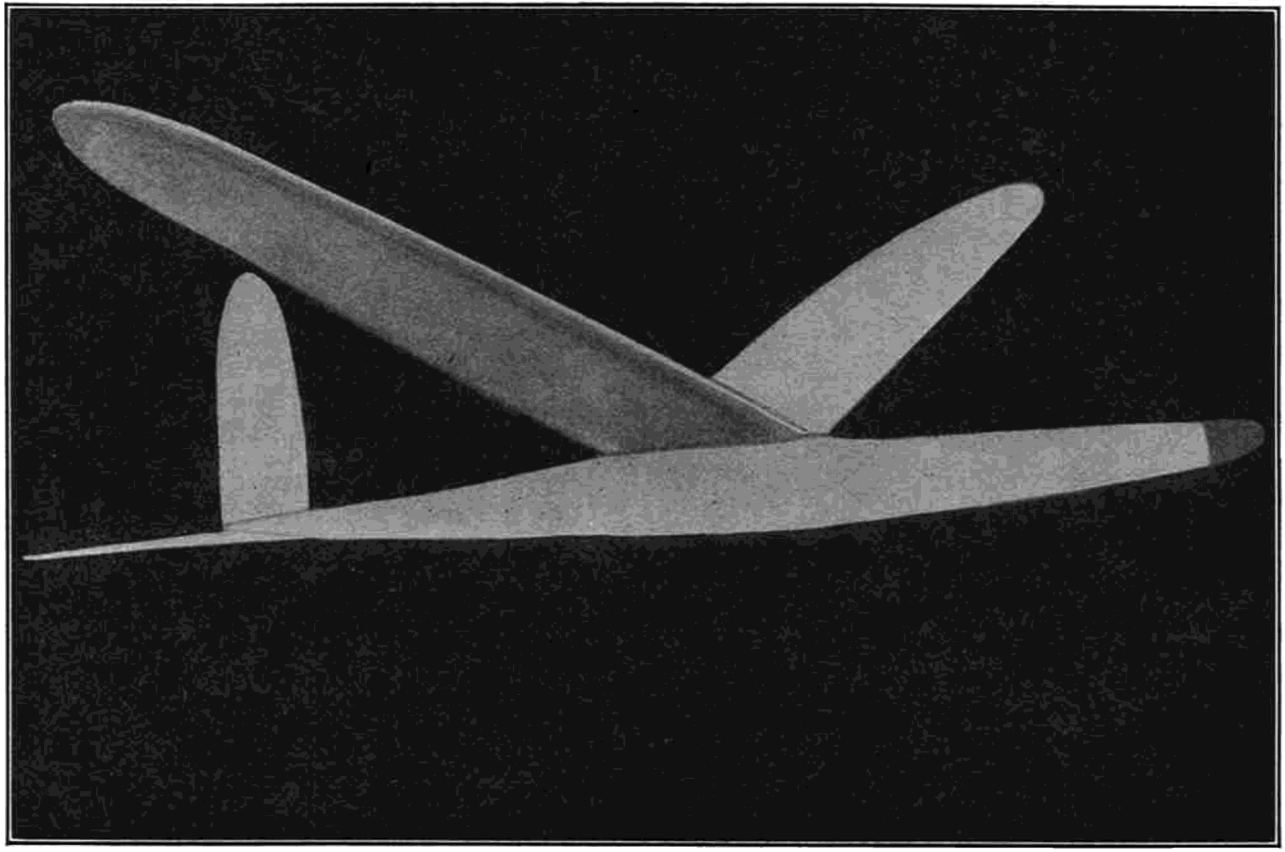
## CHAMPIONSHIP SOLID BALSA GLIDER

IF records mean anything, here's the champion of champions in the all-balsa glider class. Designed and built by Louis Milowitz, it has made official and unofficial records surpassing anything of which the author has yet heard. The best performance it has been known to give took place in the Bronx, New York, where it was timed in the air for thirty minutes before flying over the Harlem River and out of sight. Official records show that it was clocked four minutes out of sight to win the 1935 Junior Birdmen Novice Contest, and that in a high wind under adverse conditions it flew for forty-seven seconds to win the New York City Park Department Contest. Later in the same contest it flew three minutes out of sight and was later found on the roof of one of New York's skyscraper hotels. Here is a glider you can't afford to miss, so get busy, build it, and when the next glider contest comes along you'll go home with the prize!

MATERIAL LIST

1 pc.—1/4" x 3/4" x 18" long—Sheet Balsa (Fuselage)
1 pc.—1/16" x 2" x 12" long—Sheet Balsa (Tail unit)
1 pc.—1/8" x 3" x 18" long—Sheet Balsa (Wing)
Banana oil
Colorless cement
Sandpaper

FUSELAGE. The fuselage is carved to shape from a single sheet of balsa 1/4" x 3/4" x 18" long. Study the accompanying plan. In the side view shown at the bottom of the plan are three cross-sectional views of the fuselage. These are "A-A," "B-B" and "C-C." It will be noted that at "B-B" the full width of the fuselage is kept, while it tapers off toward both ends. Square up the sheet balsa to 1/4" x 3/4" x 17 1/2" long. Make a full-size drawing of its outline on paper. The part that is kept 3/4" wide is the wing location. This begins 5 1/2" back from the nose and continues for 3". Start at this point, which is 8 1/2" back from the nose, to work out your drawing. Draw the slight dip just behind this point, as shown in the plan. Measure



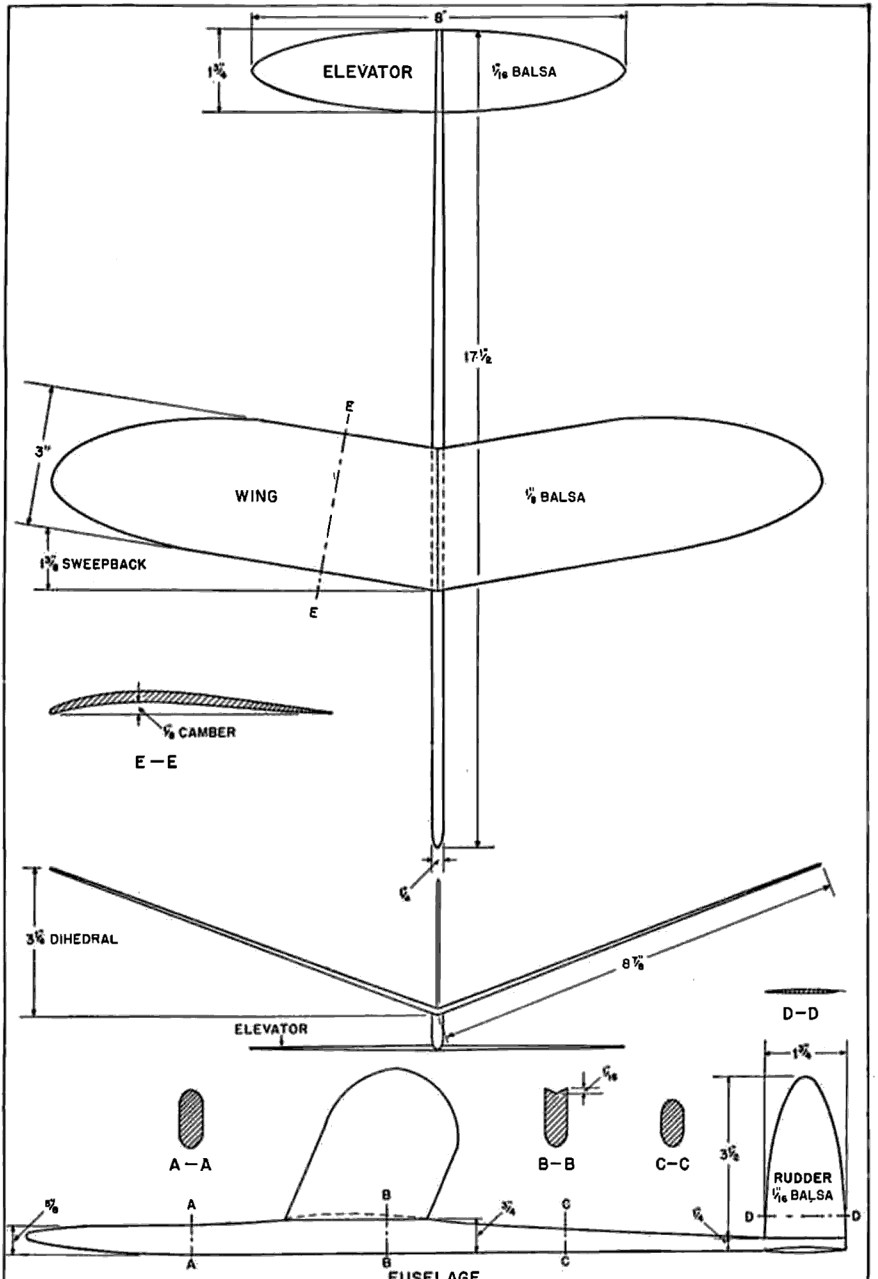
CHAMPIONSHIP SOLID BALSA GLIDER

1¾" in from the end of the fuselage. Draw a line ¼" above and parallel with the bottom edge of the layout board. This is the width of the fuselage along this distance. Join the front end of this line with the rear point of the dip just drawn by a straight line. The bottom edge of the board remains straight until within 3" of its front end, where it curves up ⅜" to form a blunt nose. Draw a slight dip from the front of the wing location on the upper edge of the drawing to the nose, which completes it. This is then traced on the ¼" sheet balsa and cut out. Note that the fuselage is cut out under the rudder location to accommodate half the thickness of the elevator. The cross-section "B-B" shows the "V" cut along the 3" of the wing location to accommodate it, and the top view of the plan shows how the fuselage tapers slightly in thickness toward the tail. When this taper and the other cuts have been made, bring the fuselage to a satin smoothness with fine sandpaper. Apply three coats of banana oil sanding between each coat.

WING. The wing is shaped from a ⅛" sheet of balsa 3" wide and 17¾" long. The tips are shaped first. The tip curves on both ends start at a point 3¼" in from the ends of the wing board along the leading edge. They start 4½" in from the ends along the trailing edge. Shape these tips and then give the entire length of the wing a natural camber. Note that the thickness of the wing tapers from its full thickness at the center to a knife edge at both tips. This taper must be given when the camber is being obtained. The camber forming an under-chamber is not given the wing at this time. Note this at "E-E." Cut the wing in half. Obtain the 1⅜" sweepback at each tip by tapering the inner end of each wing half ½" on its trailing edge. Bevel the inner ends and then obtain the necessary dihedral. Lay the wing halves in position flat on the bench. Hold their inner ends together and lift one tip 6½" off the bench. Cement the halves together and hold in this position until dry. Apply three coats of banana oil and sand between each coat for proper finish. Cement the wing in the "V" cut for it on top of the fuselage at zero degrees.

ELEVATOR. The elevator is shaped from 1/16" sheet balsa cut 1¾" wide and 8" long. Give it proper camber, as shown in the plan, and finish smooth with sandpaper. Apply three coats of banana oil and sand lightly between each coat. Cement it in place on the upper side of the fuselage at zero degrees. Test to see that it is perfectly level and at right angles to the fuselage.

RUDDER. The rudder is cut from 1/16" sheet balsa 1¾" wide and 3½" high. It is given the same form as one end of the elevator and then streamlined, as shown in the cross-sectional view "D-D." When finally sanded




CHAMPIONSHIP SOLID BALSA GLIDER PLAN

smooth, apply three coats of banana oil and sand between each coat with fine paper. Cement the rudder to the top-center of the fuselage just above the location of the elevator. Test to see that it is at right angles to the elevator.

ADJUSTING. The tips of the wing should be given a 1/8" under-chamber, as shown in the plan at "E-E." In adjusting the glider, clay is used on the nose to produce proper weight. The amount required to gain this longitudinal stability is determined by gliding it from the hand. For a right hand adjustment the glider should be made to turn to the left in a circle about thirty-five feet in diameter. This can be done by warping the trailing edge of the rudder to the left. When launching the model, it should be given an almost vertical thrust upward into the air with a slight right bank. The glider has a very slow glide which allows it to take full advantage of upward currents. Here's to hours of fun for future glider experts!

GLIDING. The secret of proper gliding is to have the weight of the model located just in front of the center of pressure. Then if the model stalls, this forward weight will pull the nose of the glider down and allow it to continue its glide. If the nose of the glider were not heavier than its tail, and the model should stall, it might drop into a tail slip which would carry it to the ground.

To prevent this a piece of sheet lead, or any other appropriate weight, is added to the nose of the model, and the builder must determine the exact amount of this weight necessary to give the best results. This is not difficult, but requires careful tests of the gliding ability of the model. If the model stalls, the weight must be increased, and if it dives, too much weight has been applied.

The builder will find that the sheet of lead called for in the material list is larger than necessary for such a model, but this has been done purposely. Adding weight to a model is far more difficult than removing it. This is true because a single piece of lead is easier to attach to the upper edge of a fuselage than two or more small pieces. So we start our trial glides with too much weight, and then slowly cut away the excess material until a single piece of the correct weight remains, which is then cemented in place.

Bend the sheet of lead so that it will fit over the top edge of the fuselage, as shown. When launching the model, do not thrust it from you with force, but allow it to leave the hand lightly. When the model dives, cut a small amount of the lead away, replace it in position on the fuselage, and relaunch. Continue these tests until the model continues in a straight path with its nose pointing slightly down in a rather fast glide.

When a long, smooth glide of this type has been obtained, give the model more force by swinging the arm forward and releasing it. If it stalls, you have cut off too much weight, which must be corrected by additional lead. If, however, the model tends to sail up, stall slightly, drop its nose into a dive, and then straighten into another glide, its action is correct, and long glides should result. When such flights have been obtained, the lead should be cemented in place.

If the glide is not straight, the builder must examine his rudder, as this is usually the cause of any turning in flight. Make sure it is perfectly straight up and down. If this does not correct the fault, the wing should be removed and given the balance test. (See Chapter 7, "Wing Assembly.")

The builder wishing a larger glider can easily build one by doubling all dimensions given in the plan, and following building instructions given in the text.

## CHAPTER 18

## PRIMARY GLIDER

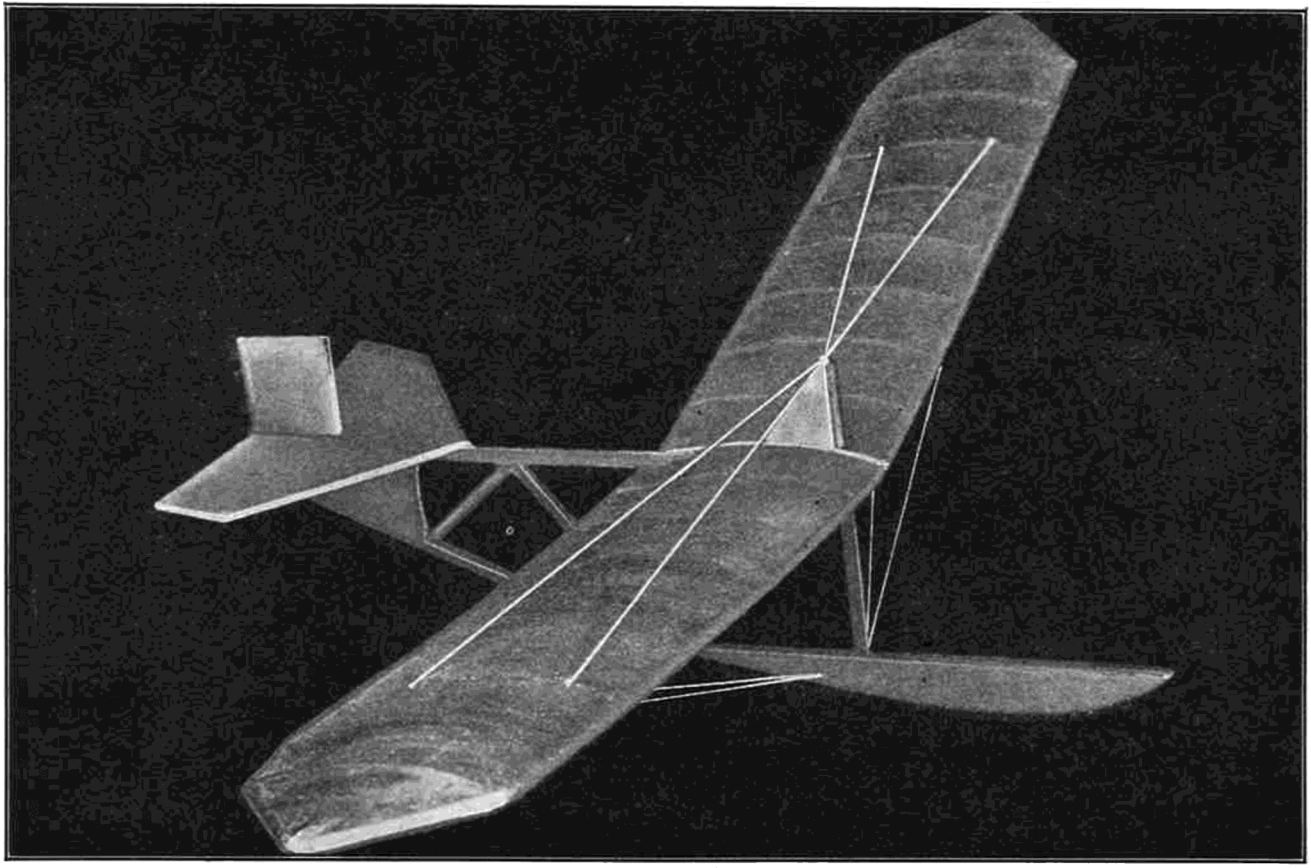
PRIMARY gliders obtain their name through the fact that they are the first on which new students learn the fundamentals behind soaring, or motorless, flight. From these, they graduate to secondary gliders and then to soaring gliders. This model is a true design of the best known primary glider. It adapts itself to the necessary small dimensions in a remarkable way, and its builder will find it a splendid performer in the air.

MATERIAL LIST

| | |
|---|---|
| 1 pc. —1/16" x 3" x 36" | —Sheet balsa for wing ribs and gusset plates |
| 2 pcs.—1/4" x 1/4" x 18" | —Balsa for inner wing spar |
| 2 pcs.—1/4" x 1/4" x 18" | —Balsa for leading edge spar |
| 2 pcs.—1/8" x 1/8" x 18" | —Balsa for trailing edge spar |
| 1 pc. —3/8" x 1 1/8" x 10 1/8" | —Balsa wood for skid of fuselage |
| 1 pc. —1/4" x 1/4" x 36" | —Balsa for fuselage, wing tips, and fin |
| 1 pc. —1/8" x 1/8" x 30" | —Balsa for rudder and elevator |
| 1 1/2 sheets | —Japanese tissue paper for covering |
| 1/2 oz. | —Colorless cement |
| 1/2 oz. | —Dope |
| 1 yard | —White cotton thread |
| Sheet lead weight | |

FUSELAGE. On this type of model, the fuselage can be divided into two parts, the skid and the frame. On the 3/8" x 1 1/8" x 10 1/8" piece of balsa, trace with pencil the shape of the skid, as shown in Plan 1. This consists of the solid piece located along the bottom of the fuselage. When the shape has been traced, the piece is cut out and its edges sandpapered smooth. An edge view of the fuselage skid is shown in Plan 2. It is 3/8" thick at the front end and tapers to 1/4" thick at the end. This is also shown in the edge view, and is called for in Plan 1. Sandpaper both faces of this balsa piece until it tapers from its original thickness at the nose to 1/4" thickness at its rear end.

The frame of the fuselage is built up on the skid with 1/4" square balsa lengths. Cut your 1/4" x 1/4" x 36" length of balsa wood into the required nine pieces, which will leave enough wood to make the necessary wing tips.



PRIMARY GLIDER

Assemble these pieces to the skid, and cement each in place. Cement the four uprights to the skid, follow with the long cross piece, and then cut and cement in the diagonal cross braces. The gusset plates are added to strengthen the frame. The plates A are cut first. Draw a 1½" diameter circle in pencil on the 1/16" sheet balsa. This circle is cut out, and split into two halves. Along the straight edge of each half circle, the form of the fuselage is cut, so that it will fit perfectly in place, as shown in the plan. One of these gusset plates is cemented on each side of skid and frame upright.

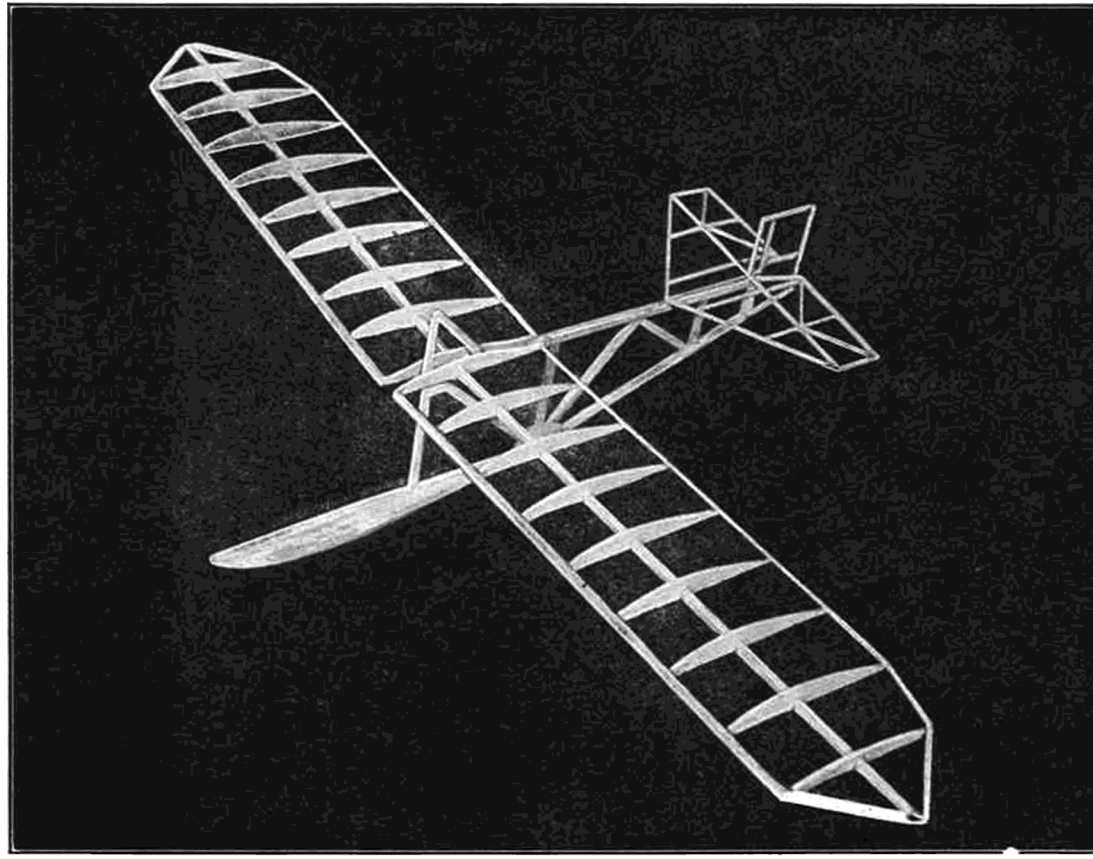
The smaller plates B are also cut from the 1/16" sheet balsa. These are ¾" wide and 1" long. Cut them out and cement one on each side of the front upright and the long top member of the frame. The assembly should dry for an hour, after which it is lightly sandpapered to remove all traces of cement.

RUDDER. As the rudder is built on the fuselage and is therefore a part of it, this should be cut and assembled at this time. It requires seven pieces of 1/8" x 1/8" balsa. Cut these pieces and assemble them in position to the end of the fuselage, as shown. Each should be carefully cemented in place, and when dry, given a light sandpapering for a smooth finish and to remove excess cement.

When assembled and sandpapered, the rudder is covered on both sides. At the same time, the frame section next to the rudder is also covered on both sides. This can be seen in the photograph of the finished model. Cut the Japanese tissue to proper shape, coat all parts the paper will cover with dope, or clear banana oil, and press the tissue in place on them. When dry, water-spray the paper, and give it a coat of dope. (See Chapter 7, "Wing Covering.")

ELEVATOR. The elevator is constructed of 1/8" square balsa lengths. As it is fully assembled before being attached to the fuselage, the builder should make a full-size working drawing of the elevator. (See Plan 2.)

Cut one balsa length 8", which forms the longest member of its frame. This is the inner spar. Place it in position on your drawing. Cut two leading edge spars long enough to extend from the ends of the inner spar to a point 3" in front of it, where the ends of the leading edge spars meet. Cement these three pieces together. A center rib 3" long is cemented in place from the center of the inner spar to the point where the leading edge spars meet. Two more ribs are cemented between the leading edge spars and the inner spar ½" on each side of this center rib. The remaining two ribs, which complete the front of the elevator, are cemented between the lead-



PRIMARY GLIDER SKELETON

ing edge spars and the inner spar. These are located 1¾″ out from the last attached ribs, and complete the front section of the elevator.

The trailing edge spars are both 3½″ long and are located 1½″ behind the inner spar. Note that each of the 1½″ ribs used on this part of the elevator are so placed as to look like continuations of the forward ribs, but that they are further strengthened by diagonally placed spars. Lay each piece in its proper position on the plan, and when complete, cement each in place.

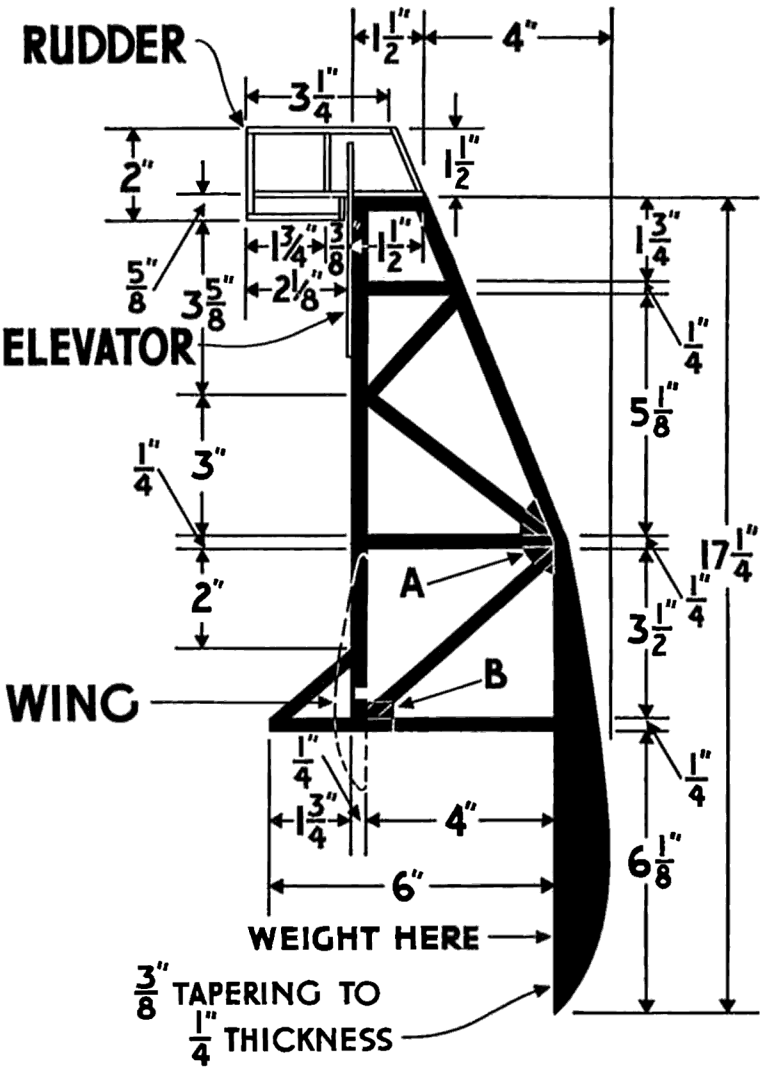
When the construction of the elevator has been completed, cover its upper side with Japanese tissue. (See Chapter 7, "Wing Covering.") Give the surface a water-spraying and then a thin coat of dope. The elevator is now attached to the fuselage. Note its position in Plan 1 and Plan 2. The inner spar fits under the rudder between it and the edge of the fuselage frame. It should be located directly over the end strut of the frame, with its covered surface facing up.

WING. The wing is made in two parts. As both are exact duplicates, these instructions cover the building of only one. From the 1/16″ x 3″ x 36″ sheet of balsa wood, cut eight A ribs, as shown in the plan. To do this, a template should be cut to the full size of these ribs. Draw ½″ squares on a sheet of paper. The outline of the rib is drawn full size on this ruled paper. Follow the outline as shown in the plan under "Wing Ribs—A," making sure that each part of the line passes through each square in exactly the same location it takes through the squares of the plan.

When completed, trace the outline of the rib on the balsa sheet, by cutting out the drawing and using it as a template. After one rib has been cut out, sandpaper its edges smooth, and test to see that its shape is an exact copy of the one in the plan. When completed, all other ribs can be cut from this master one by tracing its outline on the sheet balsa.

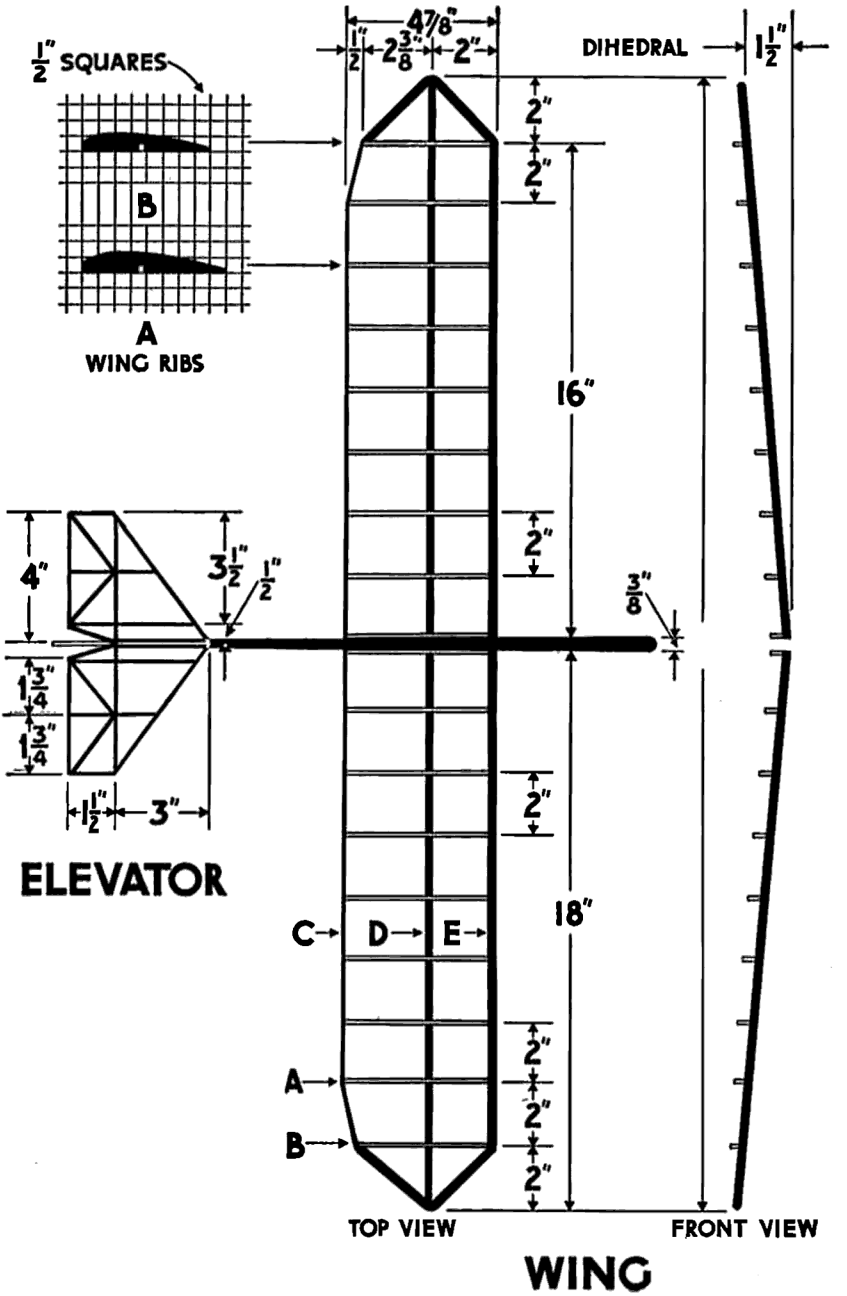
The same process should be used for cutting the end rib B. For each half wing, eight A ribs and one B rib will be required. When these are completed, the leading edge, trailing edge, and inner spars should be cut. The leading edge spar, shown in the plan by E, is ¼″ x ¼″ x 16″ long. It should be rounded on one side to carry out the front curve of the wing ribs. The inner wing spar D is ¼″ x ¼″ x 18″ long. It is left square, as can be seen from the side view of the ribs under "Wing Ribs." Each rib is notched on its straight under edge to accommodate this spar.

The trailing edge spar is cut from a balsa piece ⅛″ x ⅛″ x 16″ long. It is shown in the plan by C. Cement the eight ribs 2″ apart along the inner wing spar D. Cement the leading edge spar E to the front ends of each of these ribs. The short rib B is cemented 2″ from the last A rib on the inner




# FUSELAGE

PRIMARY GLIDER PLAN 1




PRIMARY GLIDER PLAN 2

spar. The trailing edge spar is attached with cement to the ends of the eight A ribs. Note that it will require bending to be cemented to the end of the short B rib. Crack it slightly at this point, fill the crack with cement, and cement its end to the trailing end of B rib, at the same time cementing the other end of B rib to the end of E spar.

The wing tip is formed of two lengths of 1/4" x 1/4" balsa. These are cut and cemented in place. The wing is covered on both sides with Japanese tissue. (See Chapter 7, "Wing Covering.") Give the tissue a water-spraying and then finish with a thin coat of dope. This completes one half of the wing. The second half is constructed in the same manner.

The wing is now assembled on the model. Each half is fitted to each side of the fuselage frame, as shown in Plan 1. Note that the wing has a 1½" dihedral angle. To obtain this, each half of the wing must be attached to the fuselage with its tip 1½" higher than the point of attachment at the fuselage. When doing this work, hold the wing in place on the side of the fuselage frame with model pins until the exact dihedral is obtained. When in proper position, fill the crack between the inner rib and the fuselage side with cement and allow to dry for one hour. The model pins can then be removed.

To complete the model, the small forward fin just above the wing is covered on both sides with Japanese tissue, as shown in the photograph of the finished model, and then water-sprayed and given a thin coat of dope.

The landing and flying wires are added, as shown in the photograph. These are of white cotton thread. For determining the proper amount of weight, its location, and the flying of glider models, see Chapter 17. If you wish a larger model than the one given here, all measurements should be increased in the same proportions.