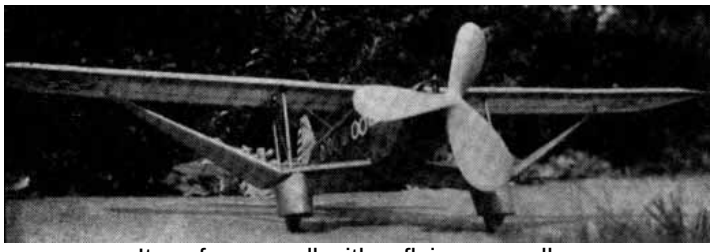


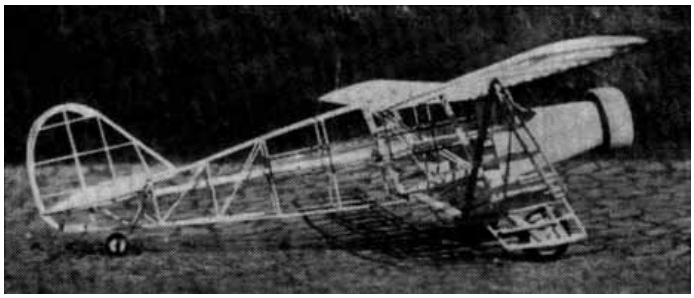
It performs well with a flying propeller

The finished model with scale propeller

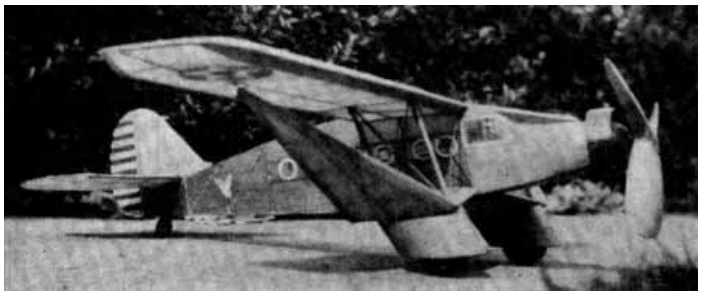
A Flying Belanca Aircruiser

How You Can Build a Flying Scale Model of a Famous Cargo Plane That Includes Many Fine Details of Construction

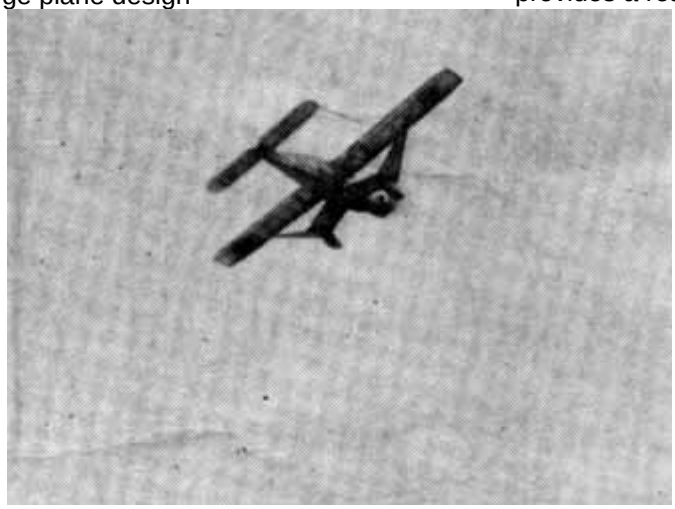
By JOSEPH KOVEL



The completed uncovered framework indicates close adherence to the large plane design



Embodying many realistic details of the full scale plane, it provides a real thrill when is flight



An actual photograph of the model in full light

THE Bellanca Aircruiser Cargo Landplane, to give it its full title, was designed and built for transport work. Modern transport needs require ships that are fast, economical, yet capable of carrying high pay loads. The Bellanca Aircruiser meets these requirements very nicely. Its single engine and cruising range of 1000 miles assure economy. The high speed of the ship at 7000 ft. is 165 miles per hour, while the cruising speed is 155 miles per hour. (Imagine a freight train cruising at that speed!) The ship weighs 6115 pounds when empty and is capable of carrying a pay load of 4021 pounds. This high weight pay load ratio may be attributed to the unusual design of the ship. Note that the wing struts serve not only to brace the wing structure, but also contribute to the lift of the ship. This two purpose design of the strut results in a considerable saving in weight, which is

reflected in the weight-lifting ability of the ship.

This ship is well adapted for model work. The long nose moment allows the model to be built with a natural balance - that is - the finished model will not require any additional weight in the nose to balance it (providing of course, that you use the proper grade of materials.) This eliminates dead weight, which detracts from the efficiency of the ship.

This model is very stable due to the large dihedral angle formed by each lower wing stub and the lifting strut. Two other important factors that contribute to the stability of the ship are that the center of lateral area is almost exactly on the thrust line, while the center of gravity is slightly below the thrust line. The cathedral angle, formed by the lower wing stubs and the bottom of the fuselage, permits easy landings, due to the cushioning effect of this arrangement. Not only is the model a good flyer, but it also looks good, as you may judge from the accompanying photographs.

Following is the suggested procedure for building the model:

General Instructions

Study the drawings and read the instructions before starting actual work on the ship. Strive for accuracy and neatness of workmanship. When building the ship, be sure to use the grade of materials specified as this has a great deal to do with the balance of the finished model.

Sand each piece of wood that goes into the model. This will remove the "whiskers" which have no structural strength, yet burden the ship with useless weight.

Fuselage

In order to build the fuselage, you'll have to round up a soft board (about 8" x 24"), some drawing paper, pins and some wax paper, or better yet, a wax candle. Tack the drawing paper to the board and lay out the fuselage side. You do this by drawing the base line of the fuselage about one inch from the long edge of the board, then dropping a perpendicular from that line about 2" from the left side of the board. This perpendicular to the base line will determine the position of Station 1. Drop the perpendiculars from the base line that will determine the positions of the other 10 Stations (Plate 1-Side View).

From the base line, measure down on each perpendicular the distance indicated on the plan, and make a dot there. When you have done this to all eleven perpendiculars, connect the dots, using the same curve as shown on plan. Thus you have the top outline of the fuselage side. To obtain the bottom outline, measure down on each perpendicular the distance indicated on the side view of the plan, plus 3/16" and make a dot there. (The dimensions given between the top and bottom longerons are for the vertical struts only). In order to get the bottom outline of the fuselage, we must add the top and bottom longeron thicknesses, 3/32" + 3/32", to the vertical strut dimensions. Hence the "plus 3/16"! When this has been done to all eleven stations, connect the dots, using the same curve as shown on plan. Now that you have the top and bottom outlines of the fuselage side, draw the various vertical and diagonal struts into place and you are ready to start work on the model. (Note! The portholes are put into place after the two sides have been assembled.) Either lay a sheet of wax paper over the drawing, or else rub the drawing with the wax candle previously mentioned. This will prevent the "work" from sticking to the drawing as you cement each joint. Make a pin jig for the fuselage side by pushing pins on each side of each longeron at strategic positions. As you cut either a longeron or strut to size for the right side of the fuselage, make an exact duplicate of that part for the left side and lay it aside until you have finished the first side and taken it out of the jig. All you have to do to make the second side is to assemble the parts you have made previously. This process makes it possible to get the two fuselage sides exactly alike. The longerons and struts are made of 3/32" sq. medium hard balsa, sanded smooth. The struts at Station 1 are 3/32" x 1/4" medium hard balsa. Set the longerons into the pin jig, then fit and glue into place all of the vertical and diagonal struts except those at Stations 4 and 5. Make a metal or hardwood wing rib template and another template for the bottom wing-stub rib. Using these templates, make 2 ribs of each kind, using medium soft 3/32" thick balsa. Shape these ribs to fit against the fuselage longerons as shown in Side View, Plate 1, then glue them into position. You can now cement the struts for Stations 4 and 5 into place. Make an elevator rib template and using it as a pattern, shape the 3/32" x 1/4" medium balsa strip that is used for the elevator cradle, then cement it into place.

When you have the two fuselage sides done, assemble them as shown in Top View, Plate 1, taking care to square the job up right. Note Station 4, 5, 10 and 11 details. The fuselage formers are made of medium soft balsa. After you have shaped them and cemented them into place, the stringers 1-B, made of 1/16" sq. medium balsa, are assembled into position. Make the porthole frames 1-F, using 1/32" sheet balsa, medium grade. The windows should be made of a light grade of celluloid, cut just 1/16" larger in radius than the openings for the portholes (see drawing), then cemented to the side of the porthole frame which is to face the interior of the fuselage. Glue the completed porthole frames into place. The windows for the pilot's compartment may be covered with either light celluloid or cellophane.

The next step is to make the motorstick (Plate 6). First make a "square" which is to fit into the nose of the ship (1/16" x 1/4" medium balsa). Select a light piece of balsa for the nose block (1-3/8" sq. x 1/2") and cement it firmly to the "square." When this is dry, fit the "square" into the nose of the fuselage, carve and sand the block to the correct shape. (If you intend making a scale prop for your model, make two of these nose-plug units, one for the flying prop and one for the scale prop.) The motorstick is made of 3/16" x 1/4" x 17-5/8" hard balsa. Sand this stick, then give it a couple of coats of dope, which will serve to strengthen it. Cut a small section out of the "square" and make a hole through the nose block as shown on plan, then push the motor-stick into place and cement it there. The prop bearing consists of an eyelet glued to the front of the nose block and a washer at the rear of the block. The rear hook is made of .032 music wire. Should your motor-stick bend excessively when the rubber motor is

tightly wound, make a wire can (.028 music wire) and cement it to the center of the motor-stick. Now that you have the motor-stick finished, you can cover the nose of the fuselage with 1/64" medium soft balsa. The top of the fuselage is covered as far as Station 3, while the bottom and sides are covered as far as Station 4.

The tail-wheel is made of 1/8" medium balsa (Two 1/16" sheets glued together cross-grained) and has a washer cemented to each side of the hub. The wire fitting (Plate 2) is made of .018 music wire. Cement the unit to the fuselage as shown in the perspective detail on Plate 1. Check the glue joints of the fuselage and reinforce all those that may need it with another coat of cement.

Tail Frames

Using the rib template you made for shaping the elevator cradle for the fuselage, make 10 elevator ribs, using medium balsa 1/ 20" thick. Notch the ribs as shown (Plate 3), then make the leading edge (medium balsa), the spars (hard balsa) and the trailing edge (hard balsa). Mark the position of the ribs on the leading edge and the trailing edge, then make 1/32" notches in the trailing edge to receive the ribs. Start assembling the frame by cementing the ribs to the leading and trailing edge. (Note - the trailing edge is kept in one piece until the entire frame is finished - after which the center section is cut away for the rudder clearance.) Cement the spars into place. The tips are made by bending a 3/64" x 1/4" strip of bamboo to shape over a candle or other flame, then splitting off a couple of 3/64" strips and rounding them. After the tips are glued into place, cut away the center section of the trailing edge as mentioned above, then cover the leading section of the elevator with 1/64" med. soft sheet balsa. The rudder (Plate 2) is made using the same procedure as for the elevator. The controlling flap is fastened into place by means of a piece of aluminum or copper wire 1/32" dia., which is glued into place as shown on plan.

Main Wings (Plate 2)

The main wing is made in the same manner as the elevator. The leading edge, spars, tip and 1/20" thick ribs are all made of medium balsa, while the 1/16" end rib and the trailing edge are made of hard balsa. After the main wing frames are done, cover the leading sections with 1/64" thick medium soft balsa, then glue wire fittings 2-G and the flying strut attachment hook into place.

Top and Bottom Wing Stubs (Plate 4)

The top and bottom wing stubs are also made in the same manner as the elevator except that the bottom stubs have a false spar just over the rear spar at the end section adjoining the flying strut. There is a filler block between the false top and the bottom spars which serves to transmit the landing shock to struts 1-K, and so up to the main wing. (See Front View, Plate 2). To make the stub fillets, cement the blocks to the ends of the wing stubs first, then shape them as shown on plan. Glue the 1 /16" aluminum tubes to the spars, then check their position by sliding the main wing into place and seeing that it lines up all right.

Flying Struts (Plate 5)

The flying struts are also similar in construction to the elevator. Note that the end rib is set at an angle. Cement wire fitting, 5-E into place. (Fitting 5-F is cemented into place as the ship is assembled.

Landing Gear (Plate 3)

Make pant ribs 1, 2 and 3 using a medium grade of balsa. Assemble each pant as shown in Side View, making one left and one right. Note that the top rib is set at an angle so as to conform with the wing stub angle (see Front View - - Plate 2). Make the landing struts 3-J. Glue the front and rear struts together, forming a "V" as shown in the Side View. Cement a washer to each side of the front strut, then glue each "V" into the pant frame as shown in the perspective view. Cement the cross-brace into place. Note that the tops of the "V" struts are flush with the top of the rib. The wheels are made of 3-ply balsa (three 1/8" sheets of medium balsa glued together cross-grained). Cement a washer to each side of the wheel hub, then paint the "tire" black and the center orange (or any other color you may prefer). After the wheels have been painted, put them into position between the "V" struts of the landing gear, pass a pin thru the struts and wheel, then cement the pin into place.

Covering

Cover the fuselage with blue tissue, then spray it with water. After it has dried, give it two coats of clear dope. Using some light writing paper, cut out 12 circular rims, having an O.D. of 9/16" and an I.D. of 5/8 ", and cement one to each porthole. (See accompanying photographs). Using the same type of paper, cut some strips 1/16" wide and cement them around the front windows.

The elevator, main wings, top and bottom wing stubs and the flying struts are covered with yellow tissue, and treated the same way (water sprayed, then two coats clear dope). The rudder may be entirely covered with yellow tissue, or if you wish to have army rudder bars on it, cover the part forward of the main spar with yellow tissue, and the part rear of the main spar with white tissue. Cut some 1/4" wide strips of red tissue and dope them to the white tissue of the rudder at 1/4" intervals, parallel to the ribs, then dope a strip of blue tissue about 3/8" wide just over the main spar.

Assembly

Cement the elevator into its cradle at the rear of the fuselage, then glue the rudder into place. Take care to line them up properly. Join the main wing and the upper wing stub as shown in Front View, Plate 2, using a drop of cement at the leading and trailing edge of the joint. Now, using a table or any other cleared surface, we'll make an assembly jig. This is done by laying the fuselage on the table and propping up the rear end so that it is in flying position. Put a small weight on top of the fuselage to prevent its moving around.

Cement each wing half to the corresponding fuselage side, putting books or something else under each wing tip to keep it in position until the glue has hardened. Check the dihedral angle, the angle of incidence of each wing half (making sure that both halves have the same amount of incidence)

and the alignment of the wing to the fuselage. Take the ship out of the jig, cement the lower wing stubs to the fuselage, then glue the struts 1-K into place. Join the flying struts to the lower wing stubs and note the position to which the wire hooks 5-F should be cemented to the flying struts in order to preserve the proper alignment of the surfaces. When you have determined the proper positions for these hooks, disjoin the flying struts from the lower wing stubs and cement the hooks into place. When the glue has hardened, engage the hooks at the ends of the flying struts with the hooks in the wing, then once more join the flying struts with the lower wing stubs, putting a drop of cement at the leading and trailing edges of the joints.

Cement each pant unit to its corresponding lower wing stub so that the front struts of the "V" braces anchor to the front spar of the lower wing stub and the rear struts of the "V" braces anchor to the rear spars of the wing stub. Now cover each pant frame with 1/64" thick medium light balsa, then cover the unit with blue tissue. Cement the bamboo struts 1-L into place, after having painted them silver.

The cylinders are made of 1/4" balsa dowel with black thread wrapped and cemented around it to simulate the cooling fins. Cut these cylinders to size and cement them to the nose of the ship as shown on Plate 2. The anti-drag ring (Plate 5) is made of either balsa or a light grade of cardboard. The cardboard is preferred in this case as it will bend easily and symmetrically without cracking, as the balsa would tend to do. After you have bent the ring to shape and cemented the joint, put it around the cylinders and see that it fits right. After you've checked the fit, dope some orange tissue to the inside and outside of the ring. This will both strengthen and decorate it. Fit the ring over the cylinders and cement it into place.

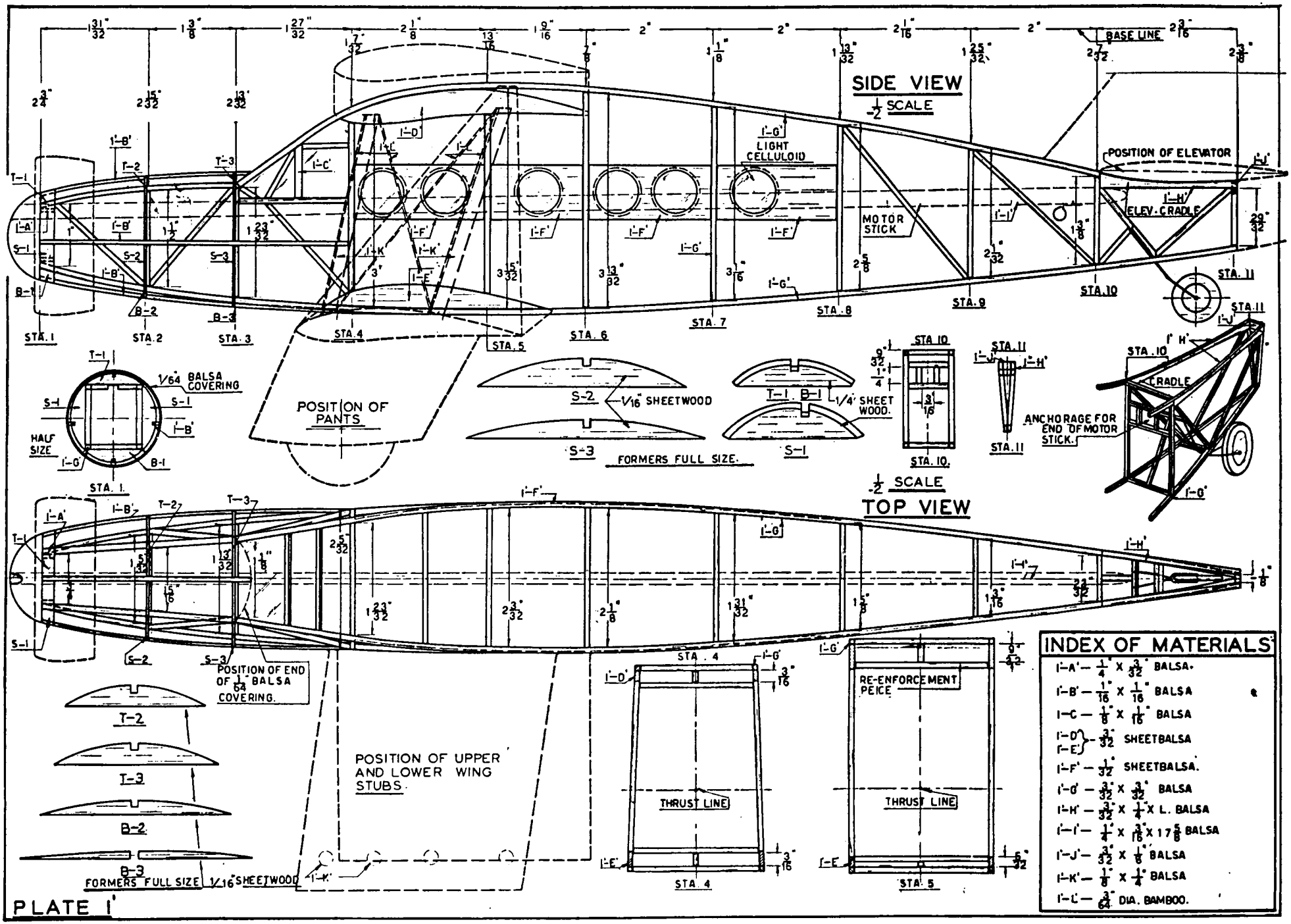
Propellers (Plate 6)

The flying prop is made of medium balsa. Join the blades as shown on drawing, then when the glue joint has hardened, carve the concave face of the blades. When this has been done, shape the blades as shown, then carve the convex face of the blades. The next job is to balance the prop. Push a pin through the hub of the prop, then, holding the protruding end of the pin with one hand, spin the prop over with the other hand. If it turns over evenly and comes to rest smoothly, the prop is balanced, but if it turns over jerkily and one of the blades causes a pendulum-like action just before coming to a rest pointing towards the ground, you'll have to sand that heavy blade and repeat the tests until the prop balances perfectly. Give it two coats of clear dope and two coats of silver dope. Sand lightly between coats. The last coat is not sanded, but left natural. Push the prop shaft through the rear of the nose plug, slip a few washers on the shaft, put the prop on the shaft, bend the end of the shaft to a "U" shape, and pull the shaft back so that the "U" sinks into the prop hub. Cement it firmly into place. (While making the flying prop, it is advisable to make the scale prop. You will note how much more realistic the ship looks with the scale prop than with the flying prop. When you're not fling the ship, you can take out the motor-stick with the flying prop and put the nose-plug with the scale prop on it and you have an attractive exhibition model.)

Slip 4 strands of 3/16" flat rubber on the rear-hook and prop shaft, put the motor-stick unit into the fuselage, and anchor it into place by pushing a pin through the anti-drag ring, top cylinder, and into the motor-stick (see Nosepiece Detail, Plate 2). The ship is now ready for the test hop.

Balance the ship by holding the wing with your index fingers about 1/3 back of the leading edge. The model should balance on an even keel. If it is tail heavy, add a bit of weight to the nose. If it is nose heavy, add weight to the tail. When the ship has been balanced, wind the prop about 75 turns by hand, raise the nose of the ship slightly and launch the ship. If the model has been built properly, it will make a fairly long gliding flight to the ground for a graceful landing. If the ship stalls, raise the leading edge of the elevator slightly. If the ship dives, raise the trailing edge of the elevator slightly. If it banks excessively, wash-in the low banking wing, wash-out the high banking wing, and give the ship some opposite rudder if necessary.

When the ship has been adjusted properly, remove the motor-stick from the fuselage, lubricate the rubber motor, attach an "S" hook to the rear of the rubber motor, hook the "S" hook to a mechanical winder, stretch the motor to about 4 times its normal length, and then give it as many winds as it will safely hold. Put the motor-stick back into the fuselage, pin it into place, then launch the ship on its maiden flight to the heavens. You'll get a big kick out of watching the smooth and graceful flight action of the ship, and the dignified attitude with which it comes in for a landing.
A free-wheeling device on the prop will tend to flatten the glide of the ship.



INDEX OF MATERIALS

- 1'-A' — 1/4" X 3/32" BALSA.
- 1'-B' — 1/16" X 1/16" BALSA
- 1'-C — 1/8" X 1/16" BALSA
- 1'-D, 1'-E — 3/32" SHEETBALSA
- 1'-F' — 1/32" SHEETBALSA.
- 1'-G' — 3/32" X 3/32" BALSA
- 1'-H' — 3/32" X 1/4" X L. BALSA
- 1'-I' — 1/4" X 3/16" X 17 5/8 BALSA
- 1'-J' — 3/32" X 1/8" BALSA
- 1'-K' — 1/8" X 1/4" BALSA
- 1'-L' — 3/64" DIA. BAMBOO.

PLATE 1

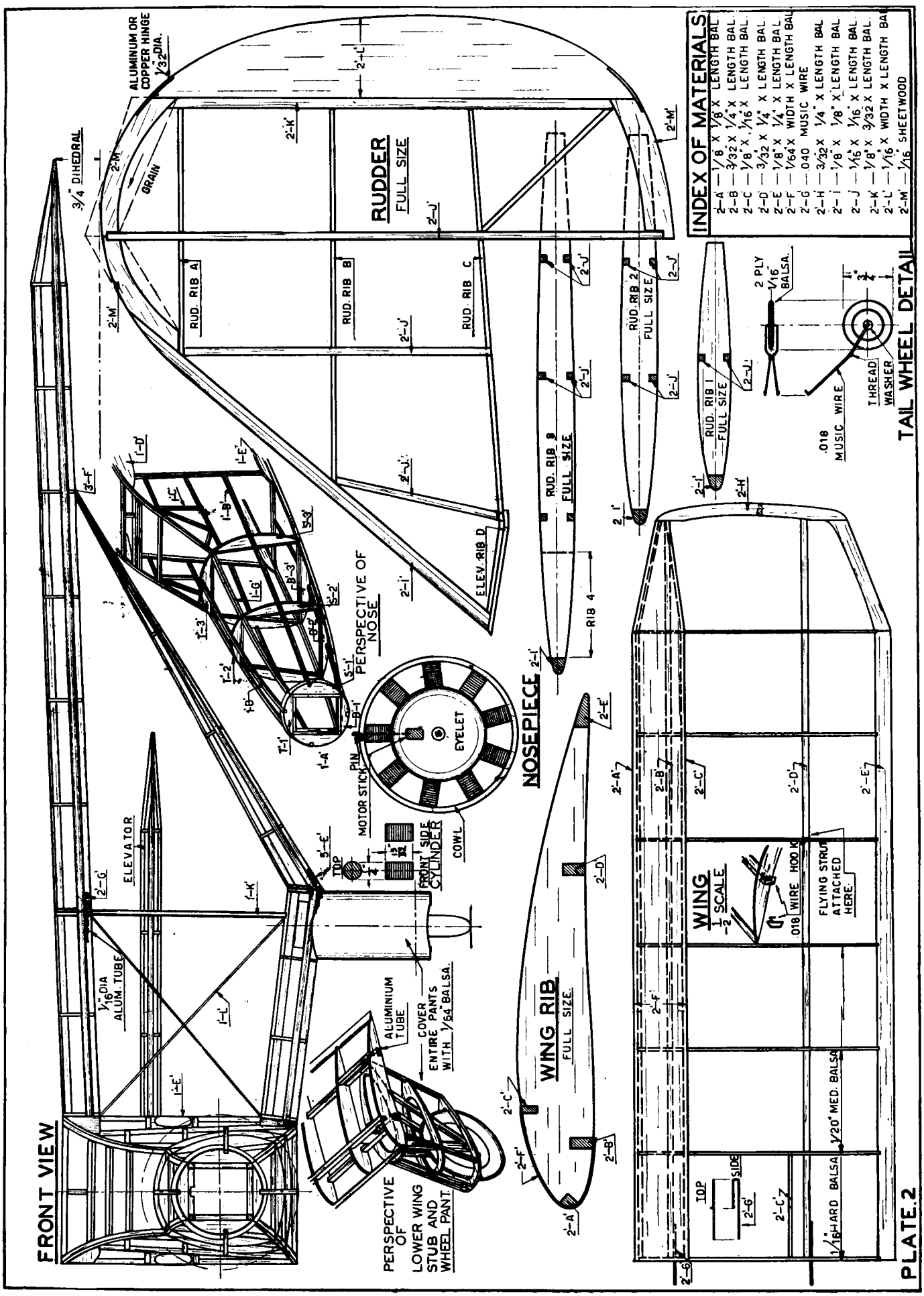
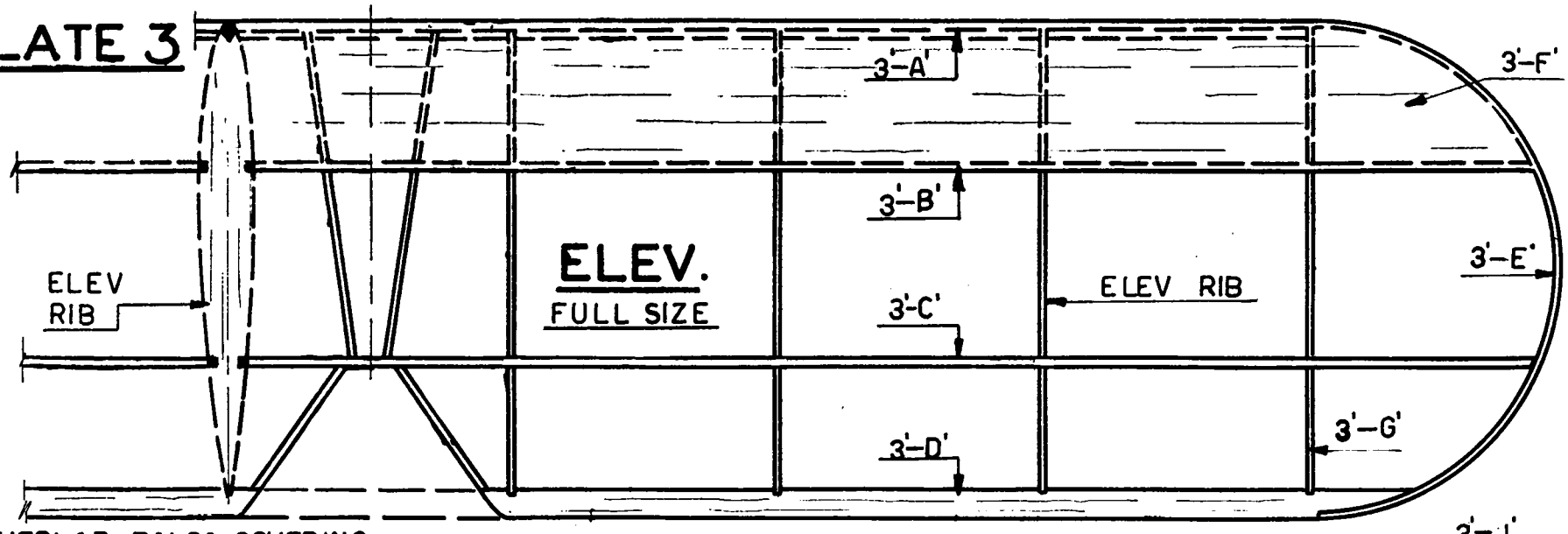
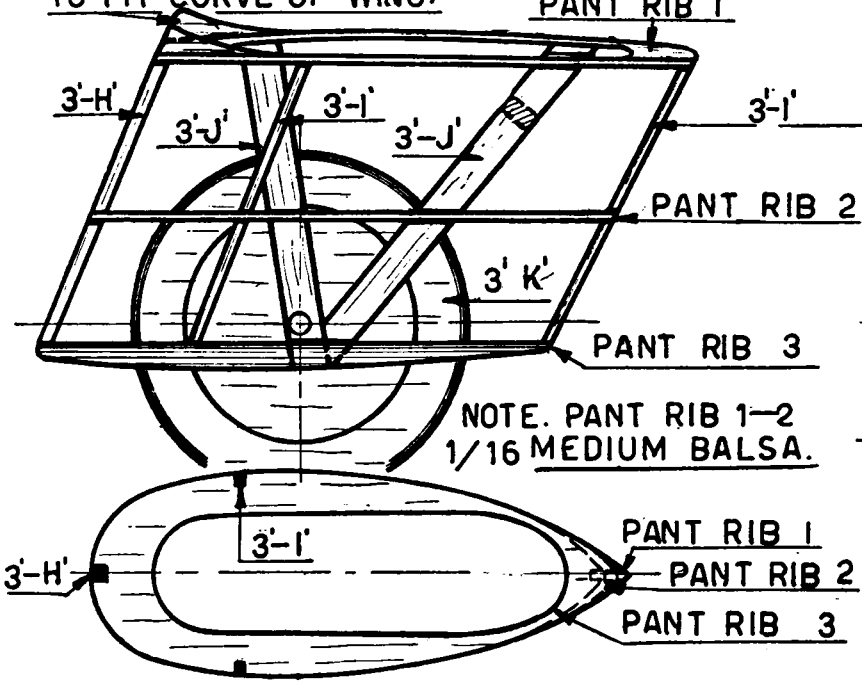
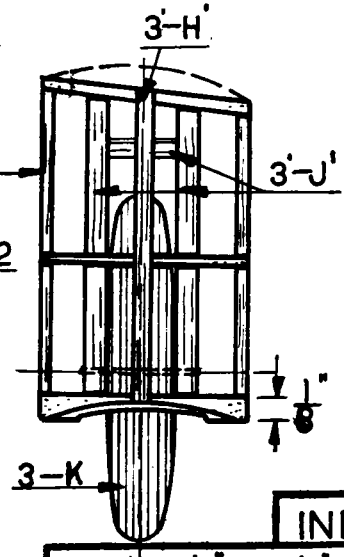
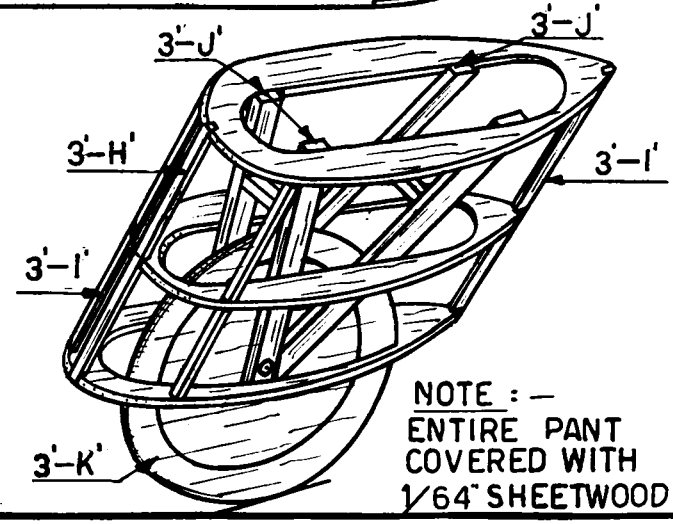

INDEX OF MATERIALS
2-A — 1/8" X 1/8" X LENGTH BAL.
2-B — 3/32" X 1/4" X LENGTH BAL.
2-C — 1/8" X 1/16" X LENGTH BAL.
2-D — 3/32" X 1/4" X LENGTH BAL.
2-E — 1/8" X 1/4" X LENGTH BAL.
2-F — 1/64" X WIDTH X LENGTH BAL.
2-G — .040 MUSIC WIRE
2-H — 3/32" X 1/4" X LENGTH BAL.
2-I — 1/8" X 1/8" X LENGTH BAL.
2-J — 1/16" X 1/16" X LENGTH BAL.
2-K — 1/8" X 3/32" X LENGTH BAL.
2-L — 1/16" X WIDTH X LENGTH BAL.
2-M — 1/16" SHEETWOOD
RUDDER
FULL SIZE
RUD. RIB A
RUD. RIB B
RUD. RIB C
RUD. RIB 2
FULL SIZE
RUD. RIB 3
FULL SIZE
RUD. RIB 1
FULL SIZE
ELEV. RIB D
ALUMINUM OR COPPER HINGE 1/32" DIA.
3/4" DIHEDRAL
GRAIN
2 PLY 1/16" BALSA
.018 MUSIC WIRE
THREAD
WASHER
TAIL WHEEL DETAIL
PERSPECTIVE OF NOSE
EYELET
MOTOR STICK PIN
NOSEPIECE
COWL
TOP
SIDE
FRONT
CYLINDER
ELEVATOR
1/16" DIA ALUM. TUBE
ALUMINIUM TUBE
COVER ENTIRE PANTS WITH 1/64" BALSA.
PERSPECTIVE OF LOWER WING STUB AND WHEEL PANT.
FRONT VIEW
WING RIB
FULL SIZE.
RIB 4
WING
1/2 SCALE
.018 WIRE HOOK
FLYING STRUT ATTACHED HERE
1/16" HARD BALSA
1/20" MED. BALSA
PLATE.2

PLATE 3









INDEX OF MATERIALS

3—A'	1/8" X 1/8" X LENGTH BAL.	3—G'	1/20" SHEET WOOD
3—B'	1/16" X 1/16" " "	3'—H'	3/32" X 3/32" X LEN.
3—C'	1/16" X 1/16" " "	3'—I'	1/16" X 1/16" X LENGTH
3—D'	3/16" X 1/16" " "	3'—J'	3/16" X 1/8" X LENGTH
3—E'	3/64" DIA. BAMBOO	3'—K'	3/8 X 1 3/4" DIA. BAL.
3—F'	1/64" BALSA COVERING		

PLATE 4

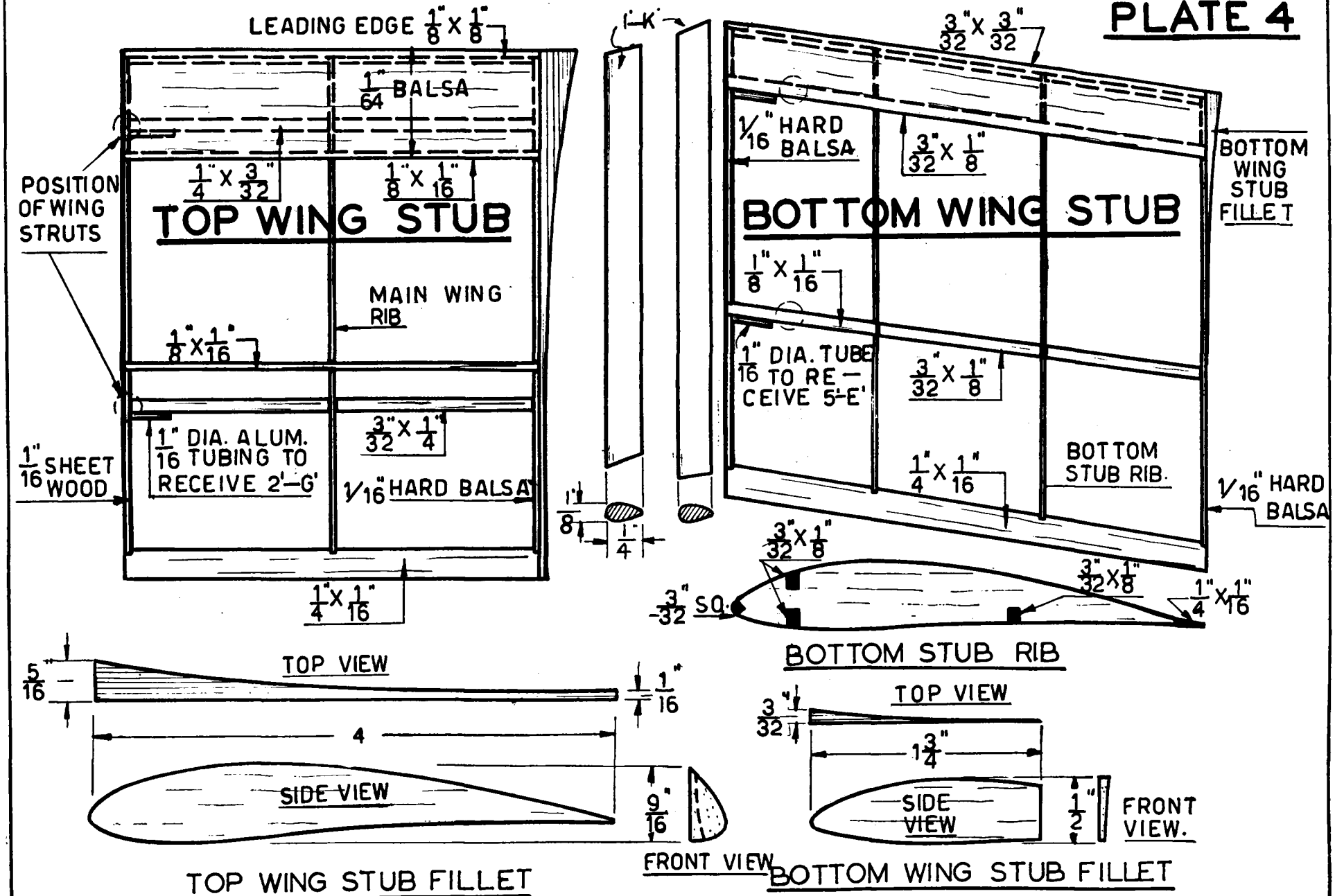
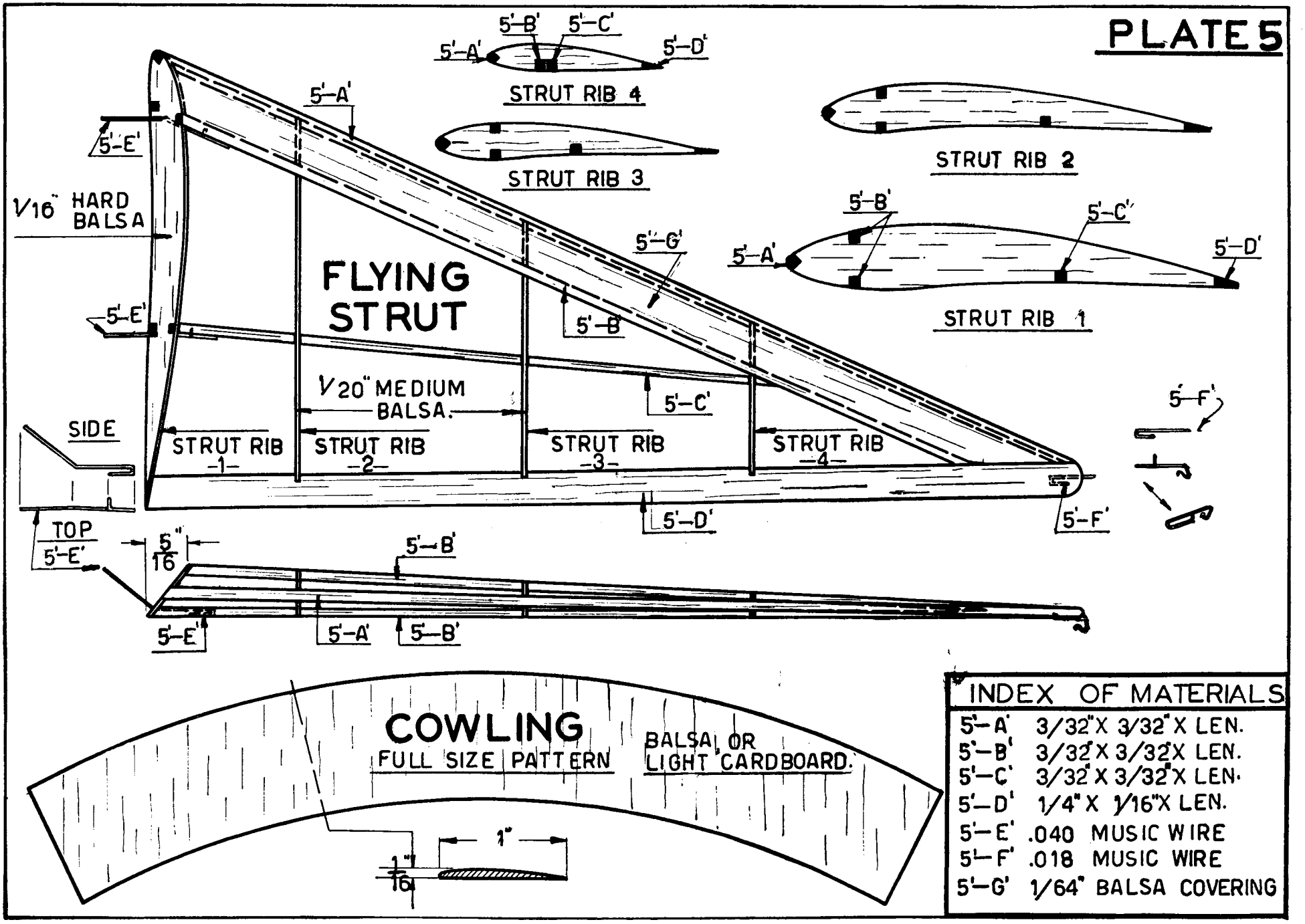
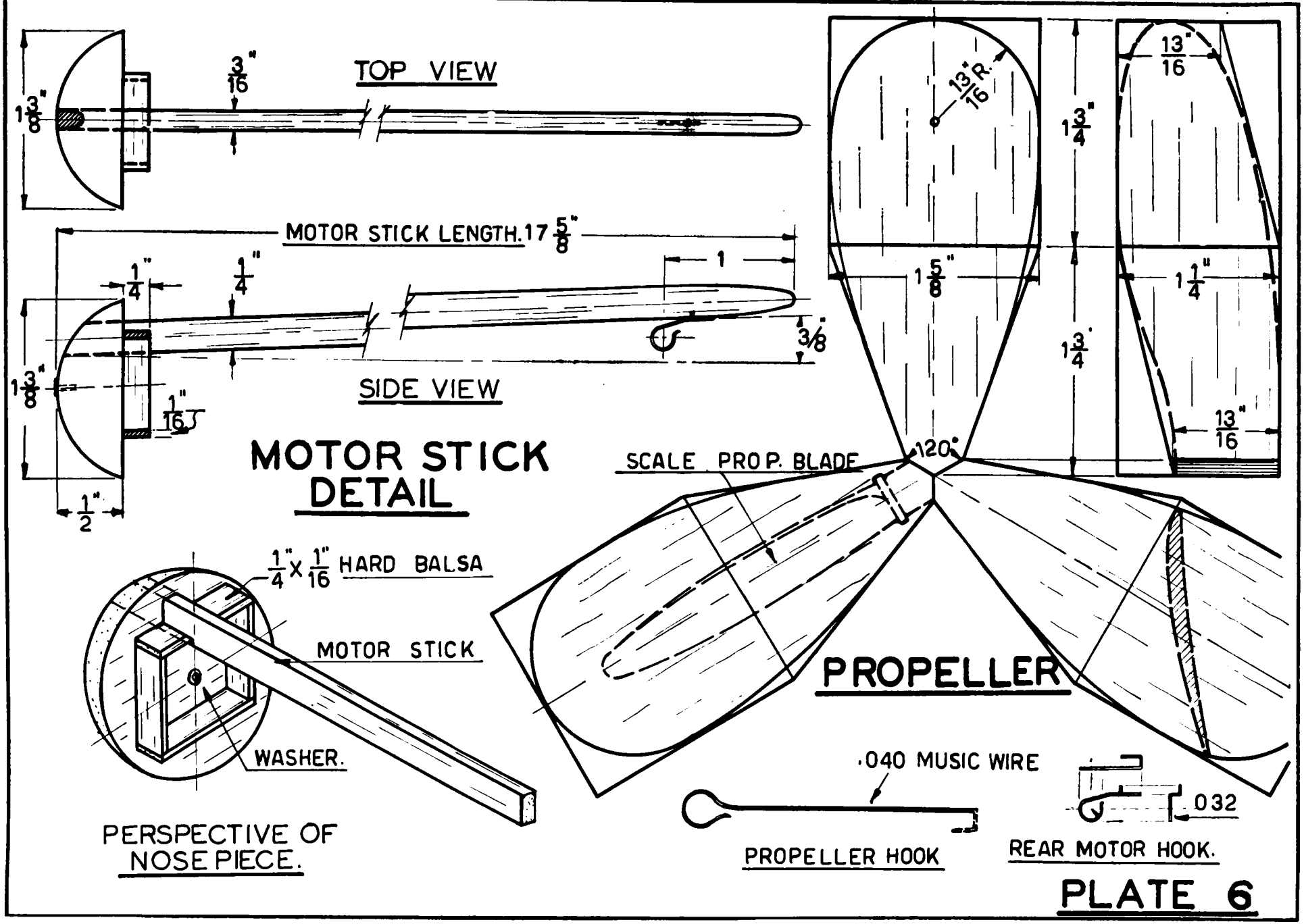

LEADING EDGE 1/8" X 1/8"
1/64" BALSA
POSITION OF WING STRUTS
1/4" X 3/32"
1/8" X 1/16"
TOP WING STUB
MAIN WING RIB
1/8" X 1/16"
1/16" SHEET WOOD
1/16" DIA. ALUM. TUBING TO RECEIVE 2'-G'
3/32" X 1/4"
1/16" HARD BALSA
1/4" X 1/16"
1'-K'
1/8"
1/4"
3/32" X 3/32"
1/16" HARD BALSA
3/32" X 1/8"
BOTTOM WING STUB
BOTTOM WING STUB FILLET
1/8" X 1/16"
1/16" DIA. TUBE TO RECEIVE 5'-E'
3/32" X 1/8"
1/4" X 1/16"
BOTTOM STUB RIB.
1/16" HARD BALSA
3/32" X 1/8"
3/32" SQ.
3/32" X 1/8"
1/4" X 1/16"
BOTTOM STUB RIB
5/16"
TOP VIEW
1/16"
4
SIDE VIEW
9/16"
FRONT VIEW
TOP WING STUB FILLET
3/32"
TOP VIEW
1 3/4"
SIDE VIEW
1/2"
FRONT VIEW.
BOTTOM WING STUB FILLET

PLATE 5



INDEX OF MATERIALS

5'-A'	3/32" X 3/32" X LEN.
5'-B'	3/32" X 3/32" X LEN.
5'-C'	3/32" X 3/32" X LEN.
5'-D'	1/4" X 1/16" X LEN.
5'-E'	.040 MUSIC WIRE
5'-F'	.018 MUSIC WIRE
5'-G'	1/64" BALSA COVERING


TOP VIEW
3/16"
1 3/8"
MOTOR STICK LENGTH. 17 5/8"
1"
1/4"
1/4"
1
3/8"
SIDE VIEW
1 3/8"
1/16"
1/2"
MOTOR STICK DETAIL
13/16" R.
1 3/4"
1 5/8"
1 3/4"
13/16"
1 1/4"
13/16"
120°
SCALE PROP. BLADE
PROPELLER
1/4" X 1/16" HARD BALSA
MOTOR STICK
WASHER.
PERSPECTIVE OF NOSE PIECE.
.040 MUSIC WIRE
PROPELLER HOOK
.032
REAR MOTOR HOOK.
PLATE 6