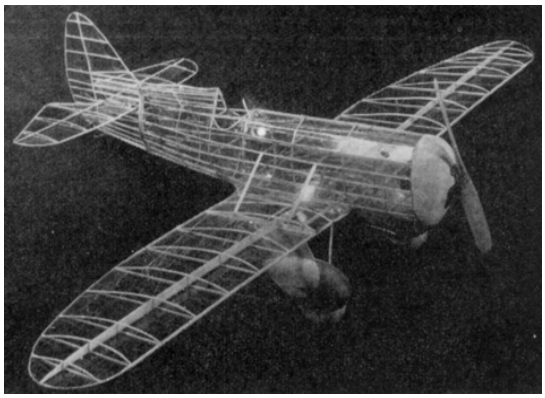
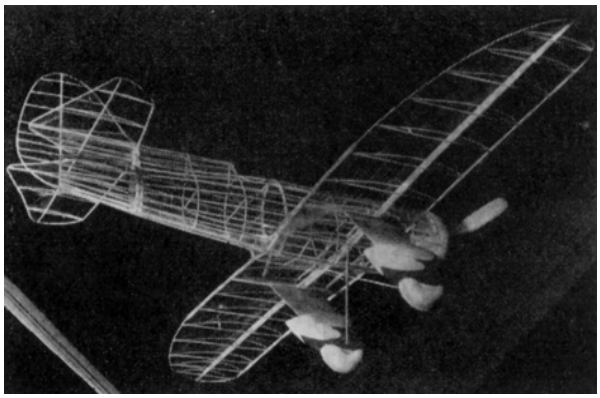
A FEATHER WEIGHT GEE BEE '"FLYING SCALE"

Presenting for the First Time A Unique Prize Winning Indoor Flying Scale Model That Is Completely Covered With Microfilm

By WILLIAM GOUGH, Jr.



The phenomenal plane in startling detail



Its performance cannot be over-estimated

MOST model builders will remember the popular racing airplane, the Granville "Gee Bee," winner of many famous National Air Races. It was then better known as the "Flying Milk Bottle." Now here is the sister ship of this plane, the "Gee Bee Sportster D," which is an accurate reproduction of the original ship.

The model in this article conforms to the rule that it must be accurately built to the outline dimensions of its big brother in relation to scale, of course. That is, the propeller size or chord, elevator area, etc., have not been altered in any way to suit the model's flying ability. It is impracticable to construct a flying scale model with its complete inner details for indoor competition since the added weight involved is too great a handicap when exceptional endurance is desired.

The following rules and regulations were conceived by members of the Illinois Model Aero Club. These rules have been governing their indoor flying scale contest for many years with great success and interest. The ship presented in this article was built in accordance with them. The first "Gee Bee Sportster D" built by Donald Lockwood about five years ago won the club trophy three years in succession. Don's ship was covered with tissue which is a heavier than microfilm in weight. Since film has less resistance and it is much lighter it has proved to be very successful in regards to its use on indoor scale ships.

"Flying Scale Model Rules of the Illinois Model Aero Club."

(A) The design of the ship entered must not be more than ten years old. This is to eliminate the desire of members to build old-type ships. This rule compels the entrant to experiment with the modern type of airplane and also to build more models.

(B) Points are awarded as follows: 50 points for flying; the longest flight declared winner of flying points. 25 points for accuracy. 25 points for neatness, workmanship and detail.

(C) Any model more than ten per cent "off" in accuracy in regards to any part of the model measured is disqualified from the meet.

(D) The propeller blade width or chord must not be more than one-twelfth of the prop overall diameter.

Ten or fifteen measurements are taken and since the builder does not know what they may be he is forced to build his ship very accurately to scale in regards to the original plane it is modeled after.

Before beginning construction on this ship, obtain the lightest indoor balsa wood possible. The lighter this job is built the better it will be for flying, provided the strength of the materials used are placed correctly on the model. If in doubt, build the ship a bit heavier at first and as the work proceeds lighten it as desired. To preserve this magazine for future reference, it is best to make a full size drawing of the model. This can be done by using carbon paper or tracing paper to copy from the pages of this magazine.

To begin, the fuselage or body is built in halves. Select a medium sheet of balsa and cut out the three main longerons. The size of the top main longeron is 3/32" x 1/16" x 8". The rear top longeron is 1/16" square, sanded round. A slightly harder grade of wood should be used for this piece. The bottom main

longeron is the heavier of the three and measures 1/16" x 1/8" x 18". Sand these pieces slightly to remove the rough edges. Pin these longerons in their proper places as indicated on the drawings.

Next, cut the formers out of 1/20" sheet balsa. Formers A and B are the same shape. Make four halves; two for each side at the nose and cockpit. The formers between A and B are pieced in by later cementing small pieces of wood between the stringers. Then make formers C and D. The formers are about 1/8" wide all around from the top to the bottom of the fuselage. Cement formers A, B, C and D in their places to the longerons. It is not necessary to cut notches in these formers for the stringers since the stringers are cemented on top of the formers. There are eight stringers to each side of the fuselage and are of medium wood 1/20" square. Cement them to the formers in their respective places, using a thin cement for lightness.

After placing evenly and cementing the stringers in place proceed to cut several long strips of light balsa 1/20" square. Cut these strips into small pieces to fit in between the fuselage stringers. These small pieces when cemented and lined up correctly between the stringers make the formers between A, B, C and D. Notice on the photographs the placing and the neatness of these built-up formers. Notice that former D has a double wall of 1/20" sheet balsa; that is, two formers in one. This is not necessary if the builder does not wish to have the tail removable from the ship.

If the tail is removable for easier winding make former D of two separate pieces. When the ship is finished just cut the sections apart. The best policy is to leave the tail section on the plane and wind the model from the nose instead. It not only helps to make the model look neater, but it is lighter and stronger that way. Make the rear hook of .014 steel or piano wire and cement this hook to former D as indicated on the drawing. The drawings do not indicate the thread windings. However, using a fine grade of silk thread, start at the nose and cement the tip of the thread to it. After this is dry, wind the thread around the fuselage, cementing it to the top and bottom of each former. Continue this all the way back to the tail. Next wind one in the opposite direction. Three or four windings will do depending on the strength of the body. If it is generally weak, use four windings of thread. If fairly strong, use only two windings. Lay the fuselage aside in a safe place where no one will lay a book on it or something.

Next comes the nose block. Select two very light pieces of balsa for the nose block, as shown on the drawings. Trace the side view or outline of the nose block on a sheet of paper and cement it lightly to the block. (Cement the two block halves together lightly around the edges.) Use very little glue as they will be broken later to be hollowed out. Then shape this block to the edge of the side view outline allowing about 1/32" for sanding. Copy the front view outline of the block and glue it to the block. Then cut and sand to the correct shape as shown on the photographs and drawing. Complete by sanding the block with a fine sandpaper. Apply a thin coat of banana oil and sand again. Now cut the two halves of the nose block apart with a razor blade at the center. A small gouge was used to hollow out the block. If the wood is soft, a knife or razor blade will do the trick. Cement the two halves together "for good" now and sand the walls to about one sixteenth of an inch. Glue the finished product to the fuselage and put both aside to be covered with film later.

The construction of the pants and wheels is identical to that of the nose block. Choose a light grade of balsa good for cutting. Hollow the pants and wheels to a wall-thinness of one-hundredth of an inch at least, to make them very light. Use a light type of wire for the axles and set the wheels in the pants accurately. Make the landing gear struts of 3/32" soft sheet balsa. Sand smooth to a streamlined section shape. Check the above various parts carefully and if there is no scale available use your judgment and build them as light as possible, leaving just enough strength in them to hold up the model, of course.

Wing

Start the wing by making a balsa or cardboard template of the wing rib. Cut sixteen top ribs out of 1/20" thick sheet balsa. Then four top and twenty bottom ribs out of 1/16" thick sheet balsa. Put these ribs aside and start on the wing spars.

Cut and sand the two leading edge spars to the dimensions of 1/8" round at the center, to 1/16" round at the tips. These two spars are 13" long. Trailing edge spars are 3/32" x 1/8" oval in section and taper to 3/32" round at X on the drawing. These pieces are 9-1/8" long. The tip pieces taper from 3/32" round at X to 3/64" at their tips. Use a curling iron or anything that can be used to bend these tip spars to the shape on the drawing. Next, pin the completed spars to the full-size wing layout you have drawn. Cement all the top ribs in place with a thin glue, triming the trailing edge of these ribs off to the right size as they are glued in place. When this frame work has fully dried cut it from the drawing and glue in the bottom ribs. Slice out two pieces out of light wood, which will make up the main spar. They should each measure 15-3/16" in length. Finish to dimensions on the drawing. Then cement these two main wing spars into the wing, but do not cement them together at the center yet.

Now take the fuselage and cement the wing in its place, cutting the trailing edge at the center and cementing it flush to the bottom of the fuselage lower longeron. Do the same with the leading edge and the middle main spar, at the same time making sure that the wing tips have four degrees of dihedral in them. The dihedral should be 1-1/8" at each wing tip. Next, cement in the few extra pieces of light balsa between the wing ribs and the fuselage, as shown in the photos. Glue two pieces of balsa 1/8" x 1/16" x 5 and 3/8" long at the landing gear rib.

Elevator

The elevator is constructed the same way as the wing. Follow the dimensions on the drawing. Take a piece of fine silk thread and split it three ways. Split several yards of this thread in this way and cement the thread lines running along the wing, rudder and elevator. Pull these lines fairly tight, watching carefully that the various surfaces are not warped in tightening and cementing. These lines with the right tension help to prevent the film surfaces from sticking together on the ship. The wing has four of the lines running along the top ribs and three along the lower ribs; the elevator has two on the top and two on the bottom surface.

Propeller

The scale block measures 8-1/8" x 3/8" x 5/8". If using a higher pitched propeller remember that it will turn slower than a lower pitched propeller on the same power. The finished prop blades should taper from 3/32" at the hub to 1/32" at the tip. The blades may be made a little thinner by cutting them out of a harder grade of wood.

Wing and Landing Gear Struts

These struts are cut out of 1/16" sheet wood. All are 1/4" wide. The front wing struts are 2-1/8" long. Rear ones are 2-1/4" in length. The two landing gear struts are 4-1/16" long. Sand all struts with fine sandpaper. The front wing struts are glued later about one inch from the leading edge of the wing on the rib that the landing gear is glued to. The rear ones are 1-1/4" from the trailing edge of the wing. Examine photographs for details in placing.

Microfilm Covering

At first glance it would seem that it is difficult to cover this ship with film. It's not, though, once one is used to handling microfilm. Take the body with the wing attached to it and prepare to cover the body first. Lest we forget, have plenty of film sheets on hand. Lay a sheet of film out horizontally suspended between two chair backs.. Use a soft wide brush to apply a coating of water to the first side of the body. Brush this water or saliva from the nose to the tip of the rudder. Don't spare the water for it will evaporate later. Cut a small hole in the sheet of film slightly larger than the wing section. Being careful, slide the uncovered wing half down through this opening and lay the body on the film. Using a red-hot wire, slice out the top section of the film and while cutting around the body side roll the body towards the uncut film and make sure it has stuck to the body all the way around. At least one-half of the body can be covered in this way.

Repeat the procedure to cover the other body side. If a few openings or holes are present they may be covered with film patches. The secret of covering a round or oval fuselage with film is in rolling the wet body over the film slowly and at the same time, while cutting the edges with the iron, noting that the tension is not too great in stretching the film. For if it is, the film sheet will split and then it would be better to start over again if a very neat ship is desired. All in all, it's a case of knowing how to control the "shake in one's nerves" to go with the film operation.

When the body and the rudder is completely covered start the wing. Cover the bottom of the wing using a sheet slightly longer than the wing span and wider than the width or chord. Moisten the bottom of the wing and place it on this film sheet. Cut out with a hot wire as was done on the fuselage. Cover the top section of the wing in halves, one-half at a time, placing the film as close to the body as possible. Next cement the two elevator halves to the fuselage. Cover the top and bottom of both with film.

Then cement the landing gear, all struts in place and the wing wires which are thread. And there is a beauty of a model ready for flying. Go to it!

Flying the Model

This ship should weigh close to three tenths of an ounce minus the rubber motor. With the motor, which is four strands of 3/32" flat brown rubber, about four-tenths of an ounce. Test the ship with a short, lighter motor first. When it takes off it will tend to turn in a sharp circle with the prop torque; that is, toward the left. Straighten out the circle a bit by warping the trailing edge of the left wing down and turning the rudder about one-eighth of an inch toward the right. If the model tends to be tail heavy add a small amount of clay in the nose block until it is balanced correctly. The center of gravity on the model should come about three inches back of the leading edge of the wing close to the bottom of the fuselage. Glide the ship about six inches from the floor and if the glide is correct wind the motor about three hundred turns for a test flight. The writer's model consistently turned in flights from one to two minutes. A high time of two

minutes and six seconds proved to be the best to date. Handle the model with the utmost care in testing and it will prove to be the best indoor flying scale model in your town. For a good climb use about 1/8" down thrust in the prop.

Flying Scale Designs

In choosing a good scale model design keep the following thoughts in mind for they will prove to be ample in flying the ship: Pick a plane with a fairly large elevator, at least twenty per cent of the wing area. A large propeller, long nose and plenty of dihedral are always a boon in flying a ship of this type. Of course the trouble is that probably not one ship in many designs to choose from will have all of the mentioned qualities. This writer has built quite a number of flying scale jobs; high-wings, mid-wings and low-wings. Among them all, he has found that the low-wing designs have been the best for flying as most low-wing planes have the qualities mentioned as best for flying scale models. However, perhaps that is just a matter of opinion, since many have had success with high-wing designs. On low-wings a small elevator and long tapered wing combination wasn't very successful from the standpoint of a reliable and consistent flyer for indoor endurance work.

The wing section is responsible for success in a big way. Pick a scale ship for flying with a thin high lift section. The tendency in a streamlined section is more towards speed which may prove to be uncontrollable, depending on the individual builder's skill in flying a model with such a wing section. There are exceptions to every rule in flying a ship of this type, depending on the balance and natural stable qualities of the design involved. In constructing an indoor flying scale model select and place the heaviest and lightest materials in the right spots on the model. For example, it would be foolish to spend a great deal of time on a model only to discover in tests that the center section of the fuselage is weak and unable to take the strain of the motor when fully wound or that any part of the ship will not support itself in flight.

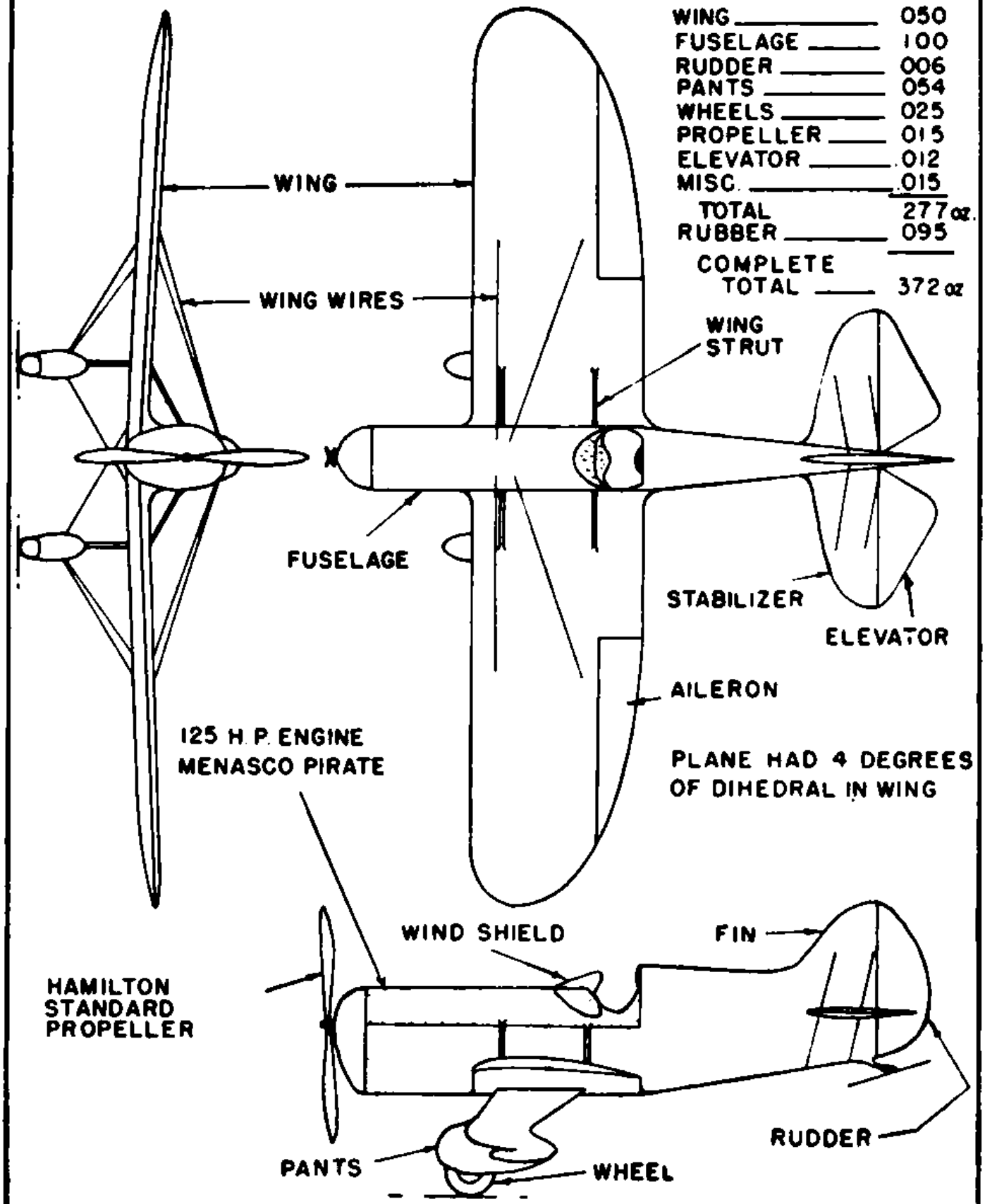
In conclusion, it is possible while the model is under construction, to place all materials, hard and light, at the best points on the model which will stand up under power and in flight regardless of how light the complete ship may be. The rule for this might be called, "getting the feel of the materials that one is working with," in many lines this is true regardless whether it be a hobby or a position in the world.

Since a singer must study many years to get the feel of his voice, a musician his instrument, so with a model builder (though in a hobby way), being an artist also, through patience and very careful workmanship must feel his way into the secrets of successful model building.

GRANVILLE GEE BEE SPORTSTER "D"

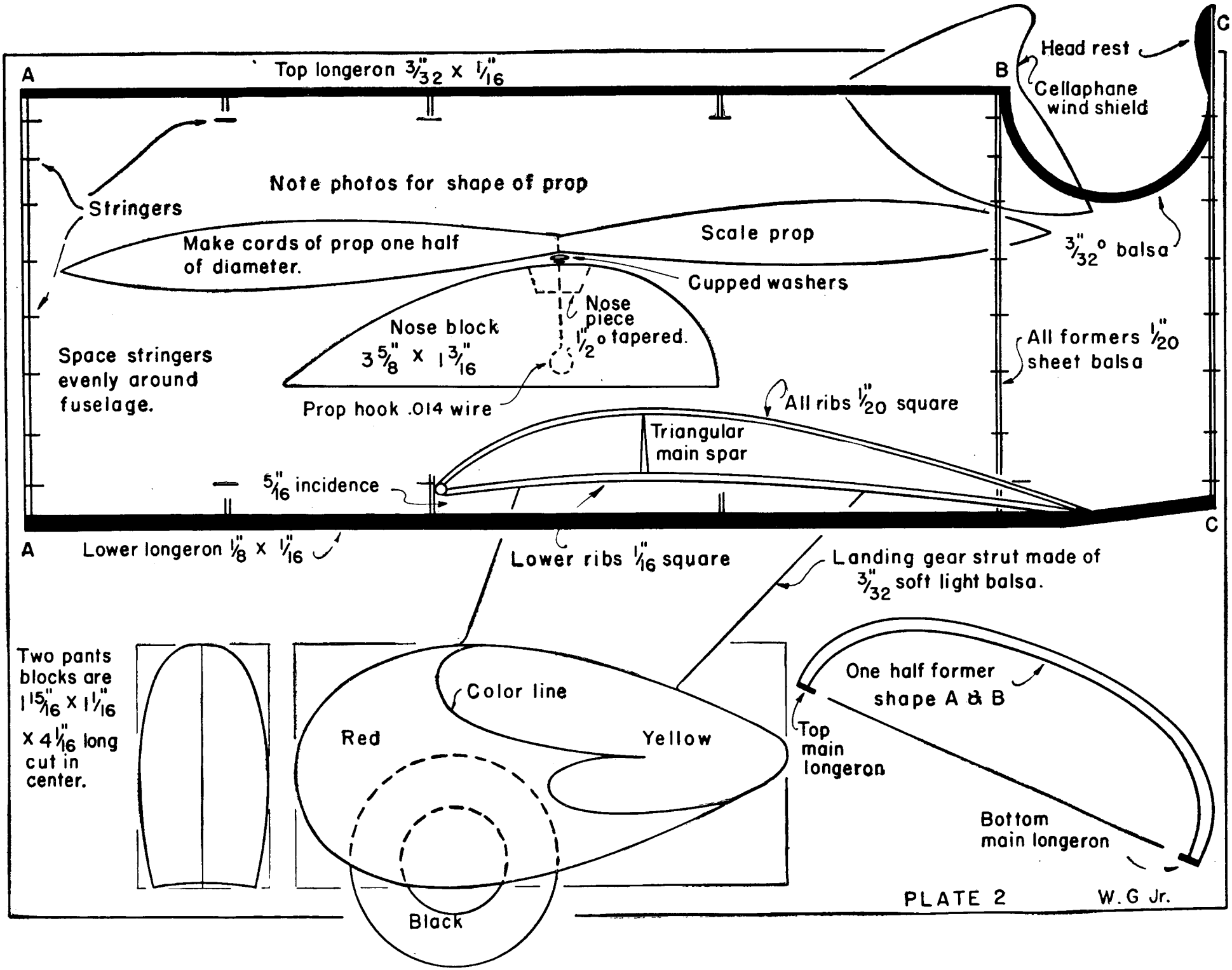
MODEL WEIGHTS IN OZ

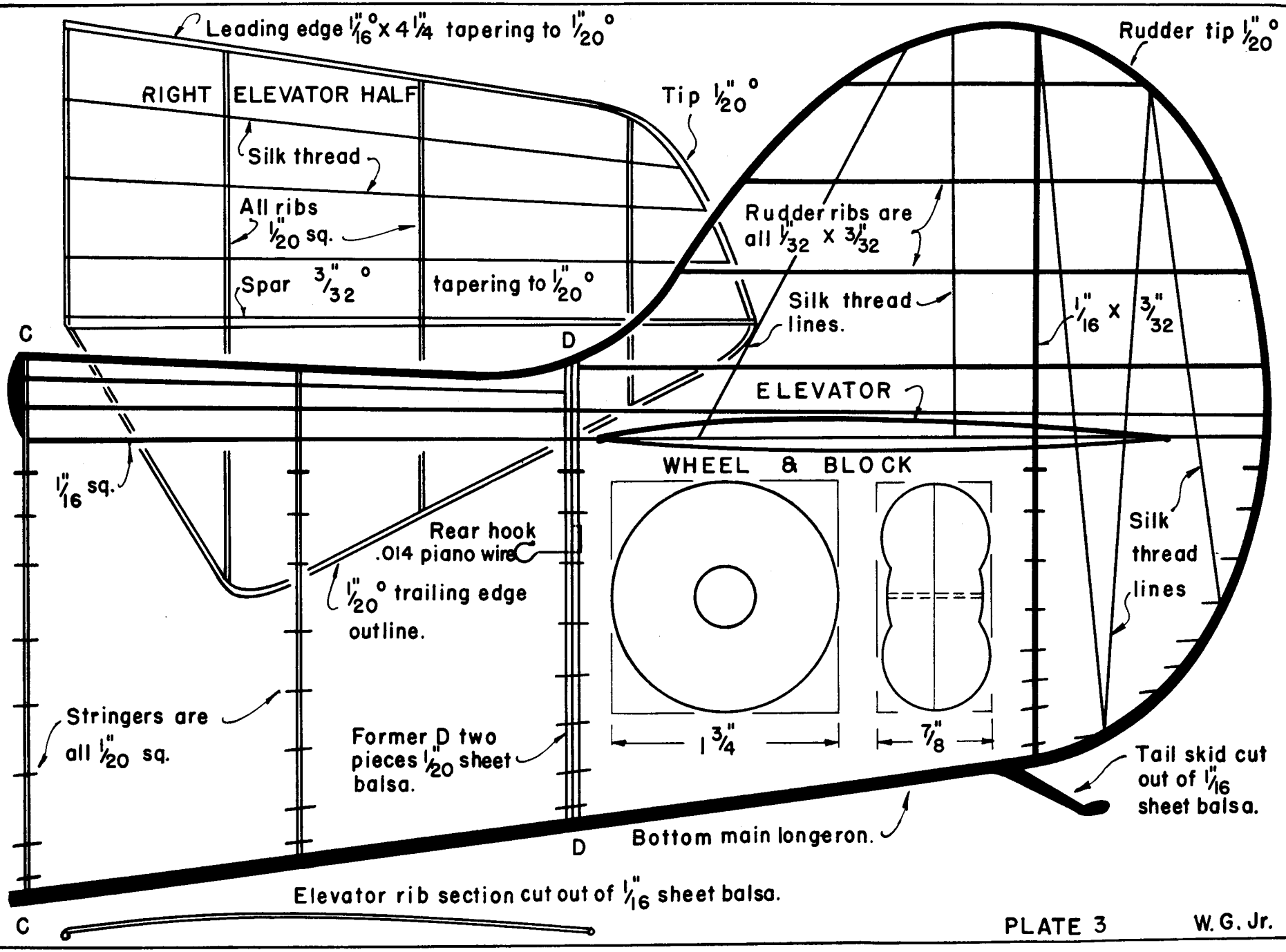
WING	050
FUSELAGE	100
RUDDER	006
PANTS	054
WHEELS	025
PROPELLER	015
ELEVATOR	012
MISC.	015
TOTAL	277 oz.
RUBBER	095
COMPLETE TOTAL	372 oz

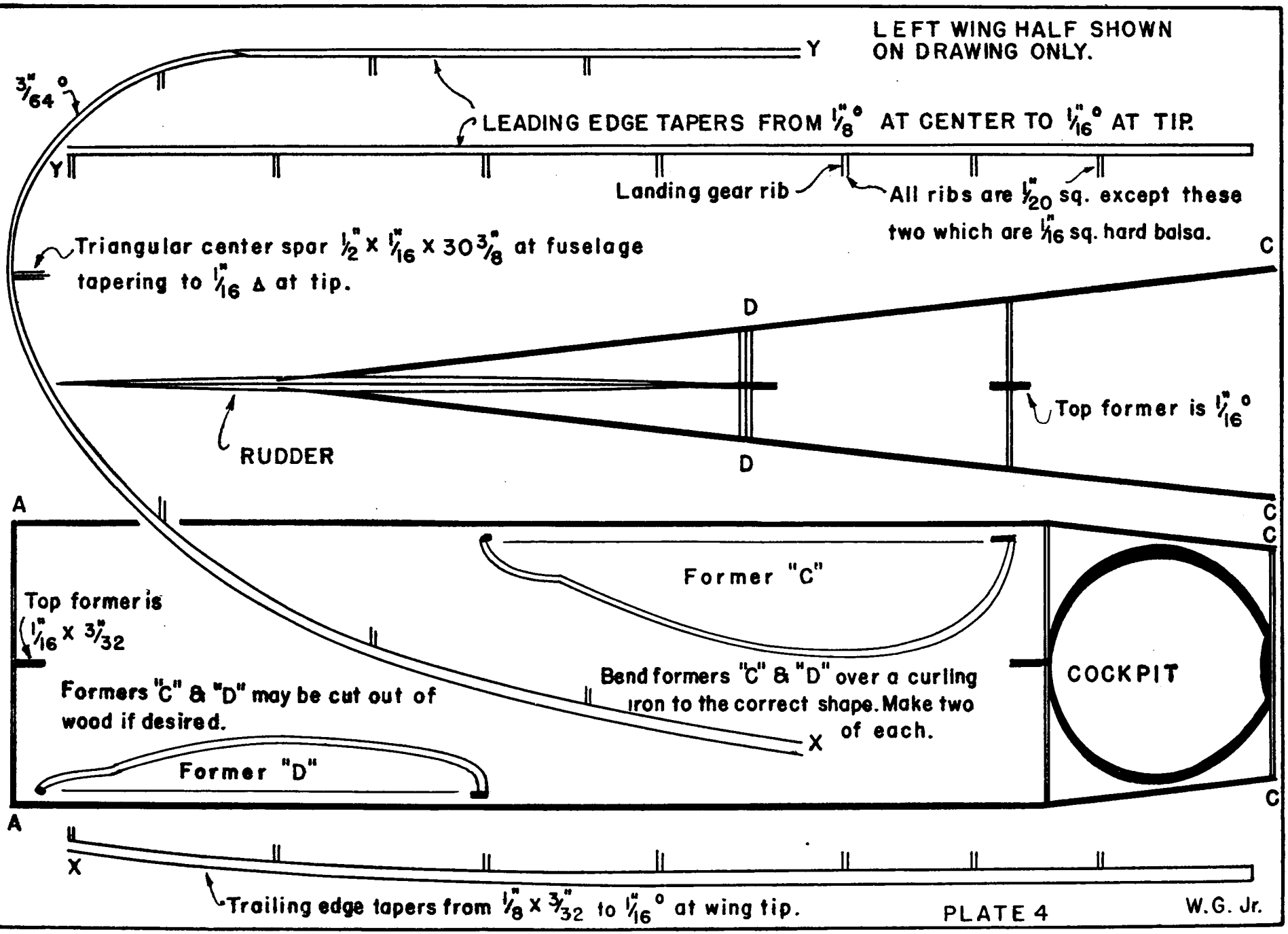


W. GOUGH Jr.

PLATE 1


A
Top longeron 3/32 x 1/16
B
C
Head rest
Cellaphane wind shield
Note photos for shape of prop
Stringers
Make cords of prop one half of diameter.
Scale prop
3/32" balsa
Cupped washers
Nose piece 1/2" tapered.
Nose block 3 5/8" x 1 3/16"
Space stringers evenly around fuselage.
All formers 1/20 sheet balsa
Prop hook .014 wire
All ribs 1/20 square
Triangular main spar
5/16" incidence
A
Lower longeron 1/8 x 1/16
Lower ribs 1/16 square
Landing gear strut made of 3/32 soft light balsa.
Two pants blocks are 1 15/16 x 1 1/16 x 4 1/16 long cut in center.
Color line
Red
Yellow
Black
One half former shape A & B
Top main longeron
Bottom main longeron
PLATE 2
W.G Jr.


Leading edge 1/16" x 4 1/4" tapering to 1/20"
RIGHT ELEVATOR HALF
Tip 1/20"
Rudder tip 1/20"
Silk thread
All ribs 1/20" sq.
Spar 3/32" tapering to 1/20"
Rudder ribs are all 1/32" x 3/32"
Silk thread lines.
1/16" x 3/32"
C
D
ELEVATOR
1/16" sq.
WHEEL & BLOCK
Rear hook .014 piano wire
1/20" trailing edge outline.
Silk thread lines
Stringers are all 1/20" sq.
Former D two pieces 1/20" sheet balsa.
1 3/4"
7/8"
Tail skid cut out of 1/16" sheet balsa.
Bottom main longeron.
D
Elevator rib section cut out of 1/16" sheet balsa.
C
PLATE 3
W.G. Jr.


LEFT WING HALF SHOWN ON DRAWING ONLY.
3/64°
Y
LEADING EDGE TAPERS FROM 1/8° AT CENTER TO 1/16° AT TIP.
Y
Landing gear rib
All ribs are 1/20 sq. except these two which are 1/16 sq. hard balsa.
Triangular center spar 1/2" x 1/16" x 30 3/8" at fuselage tapering to 1/16" Δ at tip.
C
D
RUDDER
D
Top former is 1/16°
C
A
C
Former "C"
Top former is 1/16" x 3/32"
Formers "C" & "D" may be cut out of wood if desired.
Bend formers "C" & "D" over a curling iron to the correct shape. Make two of each.
X
COCKPIT
C
Former "D"
A
X
Trailing edge tapers from 1/8" x 3/32" to 1/16° at wing tip.
PLATE 4
W.G. Jr.