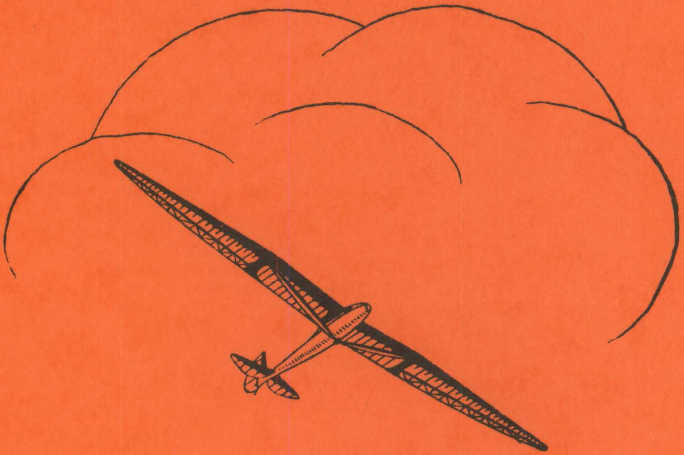

1935-36

MODEL AERONAUTICS

YEAR BOOK — By Frank Zaic

1935-6
Model Aeronautics Year Book

Edited By

FRANK ZAIC

NEW YORK
MODEL AERONAUTICS PUBLICATIONS
1935

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328 East 6th Street New York, N.Y.

PRINTED IN THE U. S. A.

To

Mother

and

Anne

CONTENTS

CONTENTS (Continued)

AN ANNOUCEMENT

The writer is in position to be able to edit a bulletin every second month. The contents of this bulletin to consist of local news, record flights and planes, experimental work and all the information we can dig up on models. We also hope to reprint foreign models and airplanes that are of special interest. Correspondence on models will also be answered in it.

The purpose of the bulletin will be to act as a sort of a clearing house where ideas may be exchanged to our mutual benefits, and so make possible a continued progress in model aeronautics. Another purpose will be to make the hobby more interesting by publishing smile-proking idiosyncrasies (we had to look in to the dictionary too) of fellow 'nuts ala "Daily Blurb."

The success of this venture depends upon your cooperation. We cannot depend on advertising for the finacial gravy as we are in minority and do not contribute very much to the annual revenue. Another reason for need of cooperation is that we must keep the operating cost to a minimum so that the cost of the bulletin may be within reach of all of us, especially as we have to stint on the lunch money to buy the supplies. The writer has had a little experience in printing and he thinks that there is no reason why the bulletin cannot be printed to sell for 10 cents per copy, providing that the contributions are voluntary and the contents of the magazinette obtained from outside source as the writer is unable to spend very much time on experimenting.

Well, there is the proposition. Suggestions and your reactions on a postal will decide the outcome of this venture. In the meantime the writer will begin to assemble contents for the first issue, and he will consider all correspondence publishable unless otherwise requested.

New York, N.Y.
October, 1935

Frank Zaic

FOREWORD

This book was written to show in a simple manner the past and present progress in Model Aeronautics. I tried to cover as much ground as possible in a rather limited space, and I also tried to fill up as many of the empty blanks in the designing information as possible. I must admit that we have still many things to solve before we can say we are really going about this hobby in a scientific manner.

The past year showed indications that there is a slow but steady swing to our form of model building. This is very gratifying as it will make possible sponsering more contests since the sponsor will be assured of good attendance. And, also, we can never tell who will spring up the next revolutionary idea, and the more we have to work the better are our chances of getting somplace. To those of you who are just getting the bug we extend out greetings, and we assure you of a rather pleasant feeling when your brain child works as per expectations. You don't have to tell the rest of the us about your failures as long as you eventually find out what caused them and letting us know the results. All this will naturally stir up your brain cells and there is no telling what will become of you.

The future progress depends on us. We cannot expect help from outside as there simply is not enough money in the game to make it worthwhile from a business viewpoint. One way of keeping going on is to stop passing the bucket and hope that someone will come out with something new. Someone called this state of mind "Monkey Thinking," You know, monkey sees monkey does. It is allright to copy a record ship once in a while and also keep one good model for winning prizes but do not give up experimenting as it is a lot of fun.

Another sad factor that needs correcting is that when someof us get into the open class we have very little for constructing models and all our experience is for naught. Now, if we could somehow get the theories and designs from the older group and give them to Juniors and Seniors to work on,then we would have a combination hard to beat, and would we go places! What do you think?

In a way I am rather proud of this book, but it is up to you to form you own opinion. It was worthwhile spending over two and half months of 16 hour days getting it out. It would have taken much longer if it were not for the whole-hearted cooperation from the contributors and the local super-critics. Thanks a lot, fellars and fellow 'nuts. The king's English might surprise some of the last Year Book readers. You will have to thank John Young for that. I must admit that by the time he was through with his super-proof reading I could hardly recognize my own hieroglyphics. Thanks are also due to his sister, Bunty, for struggling through this dry dribble.

This was the last thing that I wrote, and I feel like taking a cruise around the world and sleep during the entire trip, even when we are in the South Seas.

October, 1935
New York, N.Y.

Frank Zaic

LOW SPEED AERODYNAMICS

At present there is very little information on low speed aerodynamics and what information does exist is more in the nature of comparisons rather than of specifics. This data, however, may well be the starting point from which we can begin, through experiments and experiences, to formulate and clarify our knowledge on this subject.

The following data is applicable only to models having flying speeds of 5 m.p.h. or more, as this is about the lowest value the tests have been carried to. As indoor models are not included in this category, we must be content, for the time being, with the information gathered by experience and practice concerning this field.

Below are shown two charts which compare the aerodynamic efficiency of a model and of a large ship.

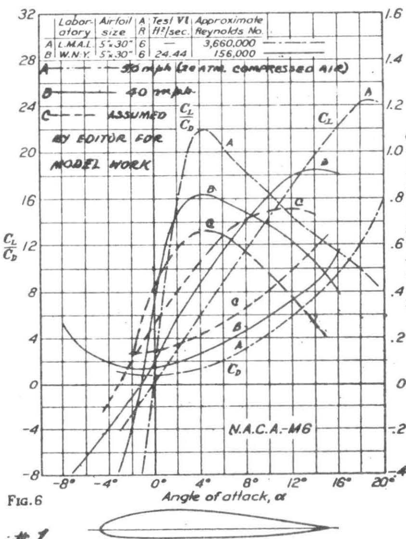
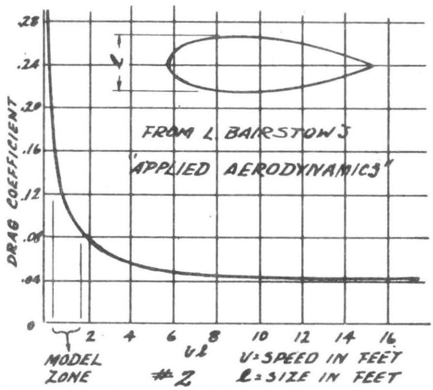
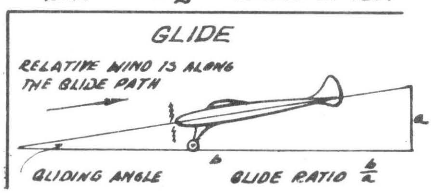


FIG. 6

#1





Graph #1 is a standard graph showing the airfoil characteristics of a given section at different angles of attack. Graph #2 shows how the drag coefficients change with the air speed.

Referring to the airfoil chart we see that we cannot use the regular curves for model work because of the high speeds at which these tests were carried out. The question is, what changes would there be in the curves if the tests were run at model flying speeds? At present we cannot answer this question as no tests have been made under these conditions but we can assume from a comparison of the curves at different speeds, that as we approach the model speed, the value of lift will decrease and the value of drag will increase.

The most interesting point of the above two graphs is that they show how drag coefficients increase greatly with lower speed. See graph #2.

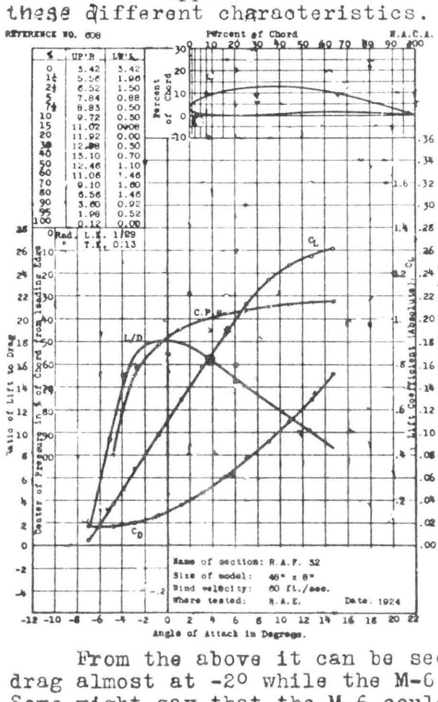
How are we effected by this phenomena?

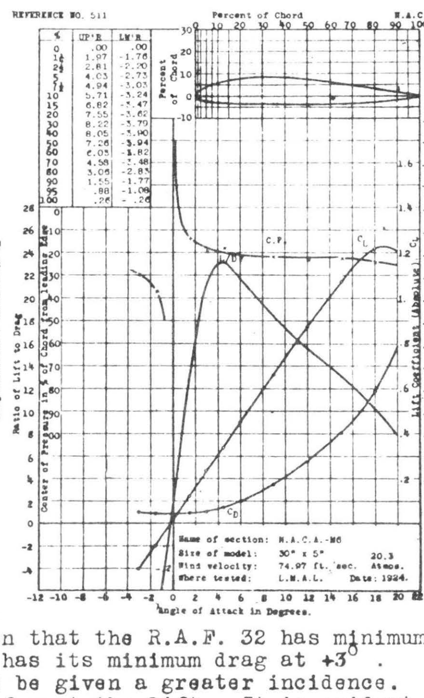
The present outdoor models have speed from 6 m.p.h. up to about 10 m.p.h., the zone in which most of the power is used to overcome drag to get enough flying speed.

It is therefore, readily seen that if we are to increase the average duration we should conserve the power by eliminating all unnecessary drag. The writer has done some work in this field, and he is definitely convinced that our best course to obtain better flights is to pay more attention to streamlining, even if at the cost of extra weight. For an example: The writer has made a model with double the normal wing loading but with carefully streamlined parts. The model flew on the same power and prop as the standard weight-rule ship does. Its performance, however, was above the average considering these facts. After taking off it would assume a fairly horizontal flying position yet would gain altitude just as rapidly as those overpowered jobs that point toward the sky and get height mostly by excessive thrust. This would seem to indicate that the component of lift on the streamlined ship was much greater than that on the ordinary, high-drag kind. The flight and the glide were naturally fast but the duration was still up to standard.

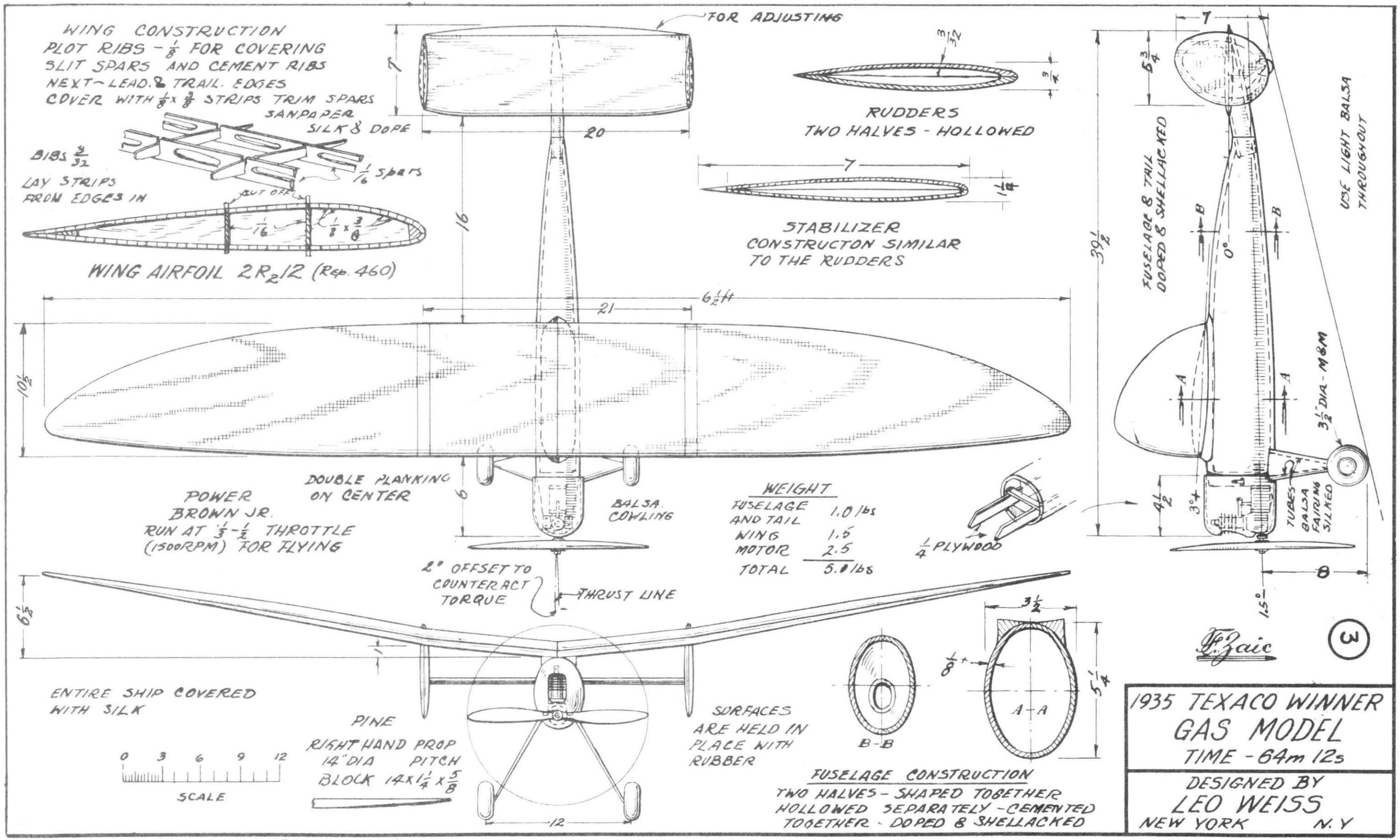
AIRFOILS

To get the best duration with models, it is necessary to use airfoils that have good gliding characteristics. It is, therefore, only natural to use the sections that have been proven on endurance soarers. The reason that such airfoils are used is that they still give reasonable lift at the angle at which they have minimum drag. This is very important as the airfoil naturally seeks that angle at which it has the least drag. Airfoils that do not have this characteristic of developing sufficient lift at negative angles to give the model a good glide must be used in combination with stabilizers set at negative angles so that the foil may be kept at a moderate lifting angle. This arrangement is not desirable as it introduces forces that oppose each other. Below are shown two airfoils with these different characteristics.





From the above it can be seen that the R.A.F. 32 has minimum drag almost at -2° while the M-6 has its minimum drag at +3°. Some might say that the M-6 could be given a greater incidence. It sounds all right but we must not forget the lift. It is evident that the R.A.F. 32 has more lift at -2° than the M-6 has at +3°. Therefore our choice should be the R.A.F. 32.



LEO WEISS IS A CONTRIBUTOR TO "FLYING ACES" MAGAZINE. ABOVE MODEL WILL BE DESCRIBED IN DETAIL IF THERE IS ENOUGH REQUESTS TO THE EDITOR

NATIONAL ADVISORY COMMITTEE
FOR AERONAUTICS

NAVY BUILDING
WASHINGTON, D. C.

TELEPHONE: NATIONAL 5212

IN REPLY
REFER TO NO.

August 30, 1935.

Dear Mr. Zaic:

I was very much interested and pleased to learn of your work with the technical aspects of flying models, particularly with respect to your suggestions about the choice of airfoils. You are undoubtedly right in considering that a section having a high C_{Lmax} should usually be chosen, mainly because such sections will tend to give low drag coefficients at high lift coefficients. The importance of a high maximum L/D should not be over-emphasized because both its value and the lift coefficient at which it occurs vary widely with changes in aspect ratio. For this reason I consider the use of infinite-aspect-ratio plots (right-hand plots of the Committee's Technical Report No. 460) superior to those you use for comparing sections. The greatest objection to such airfoil data for your purpose, however, is the high Reynolds Number. This important consideration can hardly be over-emphasized. The work of the Committee on airfoils at low Reynolds Numbers (comparable with those with which you are dealing) in its smoke flow wind tunnel indicates that the sections behave very differently from airplane wing sections at moderate or full-scale values of the Reynolds Number. - - - -

Very truly yours,

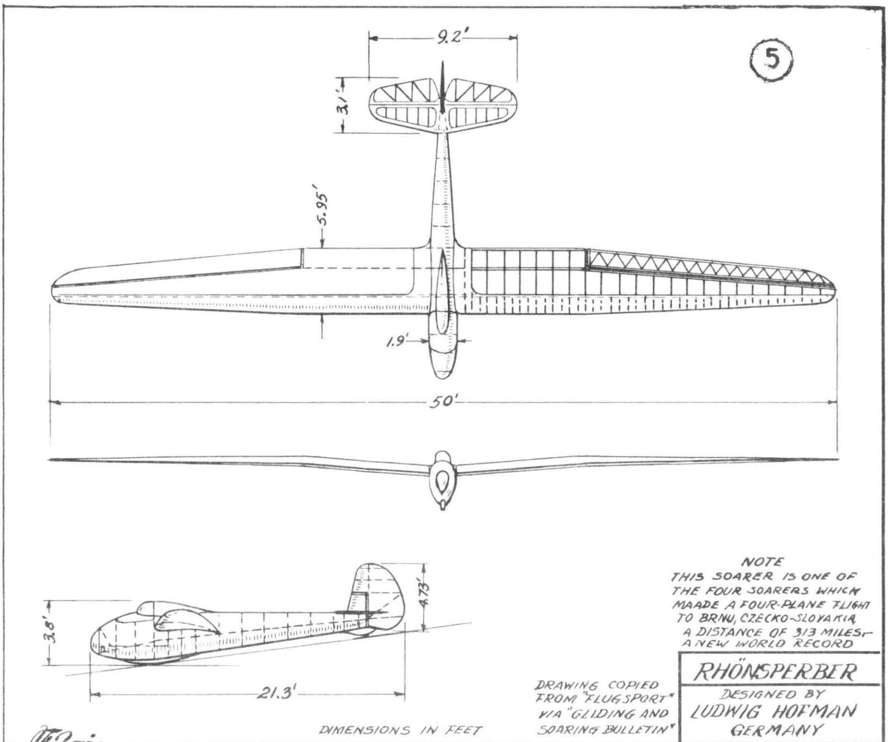
G. W. Lewis,
Director of
Aeronautical Research.

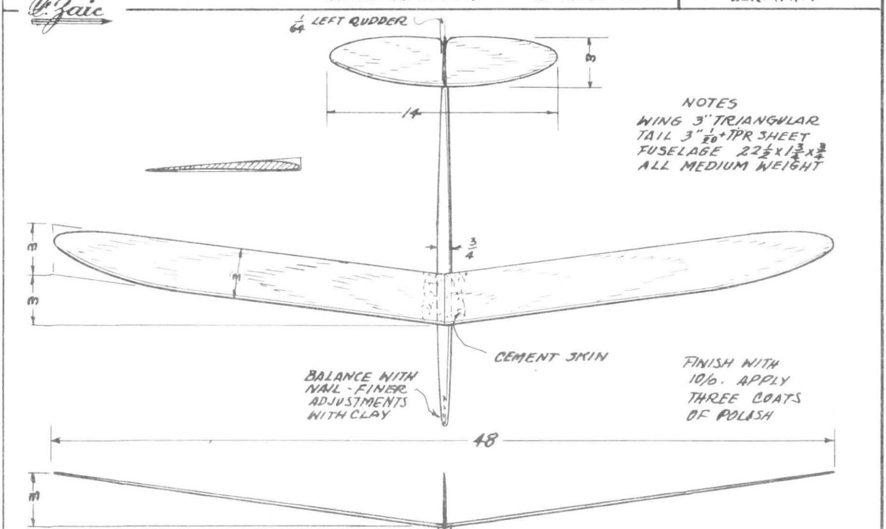
- - - by Editor

GLIDING

The large soarers are designed so that the fuselage, in a glide, lies along the line of glide. In this way the fuselage always has the least possible drag and also does not interfere with the stability. We should try to duplicate this on models. For example: If a model has a glide of 10 to 1 the gliding angle is (6°). Now that we know this angle we should set the wing at an incidence on the fuselage at the angle at which the best L/D occurs. For R.A.F. 32 the setting would be 0° and for M-6 4°. However, it is doubtful if the wing will have enough lift at this incidence for the average model. It is therefore, advisable to increase the angle by 2° above these just mentioned. On streamlined jobs it might be possible to fly the model with the incidence at which the best L/D occurs because of the extra speed. The stabilizer should be set at 0° as at this setting the down-wash will provide the desired setting of the difference between the wing and the stabilizer. The recommended airfoils are mentioned in the model description text.

Weight does not affect the gliding angle. Additional weight merely increases the speed of the glider until the extra speed generates enough lift to keep the model in the glide.


5
9.2'
3.1'
5.95'
1.9'
50'
3.8'
4.73'
21.3'
NOTE
THIS SOARER IS ONE OF THE FOUR SOARERS WHICH MAADE A FOUR-PLANE FLIGHT TO BRNU, CZECKO-SLOVAKIA, A DISTANCE OF 313 MILES— A NEW WORLD RECORD
RHÖNSPERBER
DESIGNED BY
LUDWIG HOFMAN
GERMANY
DRAWING COPIED FROM "FLUGSPORT" VIA "GLIDING AND SOARING BULLETIN"
DIMENSIONS IN FEET
F. Zaic


1/64 LEFT RUDDER
3
14
NOTES
WING 3" TRIANGULAR
TAIL 3" 1/20 + TPR SHEET
FUSELAGE 22 1/2 x 1 3/4 x 3/4
ALL MEDIUM WEIGHT
3
3
3/4
3
CEMENT SKIN
BALANCE WITH NAIL - FINER ADJUSTMENTS WITH CLAY
FINISH WITH 10/0. APPLY THREE COATS OF POLISH
48
3
3
5 1/2
TOW HOOKS FRONT FOR "BREEZY" REAR FOR CALM
1 3/4
1
1/64 NEG.
6
3
13 1/2
BEST TIME 2 TO 5 min
CLASS "C"
ALL-BALSA SOARER
OFFICIAL TIME 62s (100' LINE)
DESIGNED BY
HENRY STRUCK
JACKSON HEIGHTS N.Y.C

OUTDOOR FUSELAGE

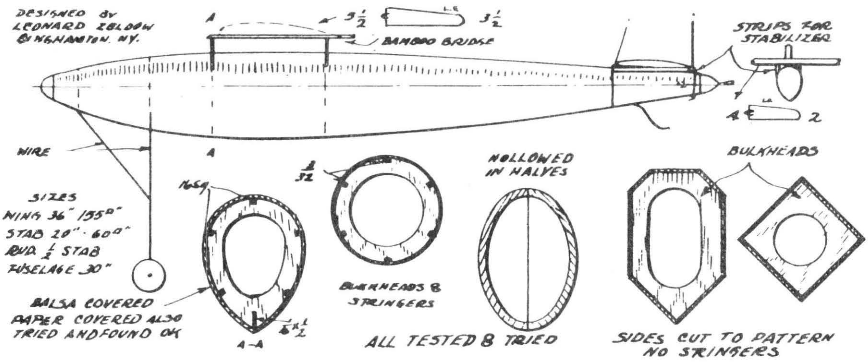
Many new records were made in this class in 1935 but the average time is still under three minutes. There can be only one reason for this and that is that most of us do not adjust these models correctly, either because we do not know how or because the models are damaged and the settings lost. It is, therefore, evident that we must pay more attention to construction and adjusting details in the future.

The present style of construction can readily be grasped from the plans of the record models. Unfortunately, these models still have vulnerable parts to worry about when duplicating them.

FUSELAGE CONSTRUCTION

There is no doubt that the paper-covered balsa framework type of fuselage is the simplest to make, but it is also the weakest. It is only logical to follow the example of the airplane industry and learn the advantages of box and monocouque construction. The fuselage covered or made of 1/32 light balsa sheet compares quite favorably in weight with the paper and wood type but there is no comparison in their relative strengths. Below are shown several balsa fuselage designs that will stand up under punishment.

The adjustment of models is taken care of elsewhere in this book under a separate heading.

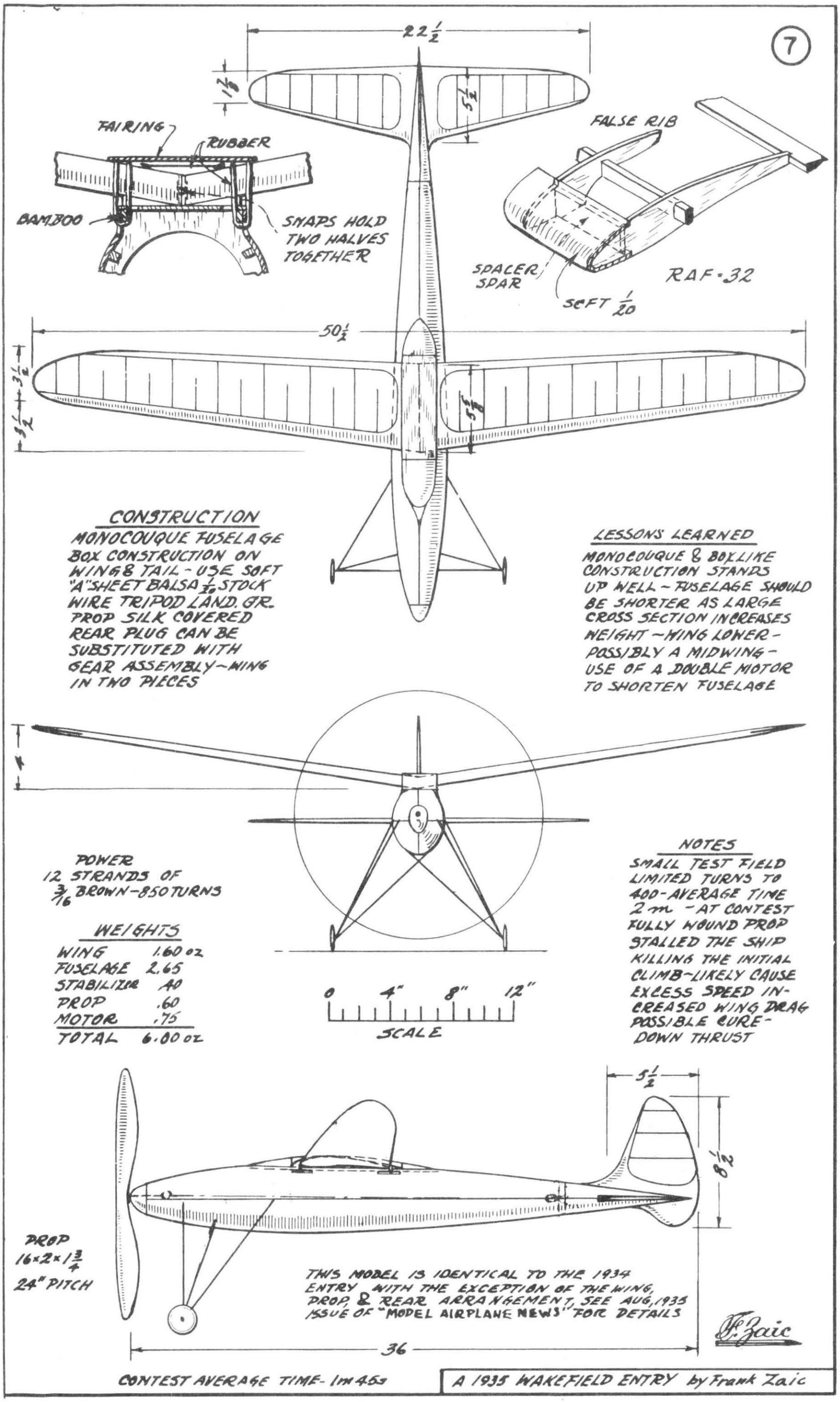


THE OUTLINE AND CROSS SECTION OF THE FUSELAGE

The importance of minimizing drag cannot be over-emphasized, especially in fuselage designs. It was definitely proven by tests that careful streamlining compensates for any additional weight necessary to achieve the streamline shape. This was especially true of the cross sectional profile. It can be readily seen that at a high angle of climb a square fuselage will present a rectangular section to the relative airflow while a near circular form will present a streamline contour.

Wind tunnel tests showed that at 10° angle of attack a square fuselage has seven times more drag than an elliptical fuselage of the same cross sectional area. As the angle increases, the drag of square section keeps on increasing steadily while the drag of elliptical section increases only slightly.

From the above discussion we can see that an elliptical cross section is highly desirable. If an elliptical section cannot be used, the next best thing is to approach it as nearly as possible, by having more sides to the fuselage and rounding off sharp corners.


7
22 1/2
1 7/8
5 1/2
FAIRING
RUBBER
BAMBOO
SNAPS HOLD TWO HALVES TOGETHER
FALSE RIB
SPACER SPAR
RAF-32
SOFT 1/20
50 1/2
3 1/2
3 1/2
5 5/8
CONSTRUCTION
MONOCOUQUE FUSELAGE BOX CONSTRUCTION ON WING & TAIL - USE SOFT "A" SHEET BALSA 1/20 STOCK WIRE TRIPOD LAND. GR. PROP SILK COVERED REAR PLUG CAN BE SUBSTITUTED WITH GEAR ASSEMBLY - WING IN TWO PIECES
LESSONS LEARNED
MONOCOUQUE & BOXLIKE CONSTRUCTION STANDS UP WELL - FUSELAGE SHOULD BE SHORTER AS LARGE CROSS SECTION INCREASES WEIGHT - WING LOWER - POSSIBLY A MIDWING - USE OF A DOUBLE MOTOR TO SHORTEN FUSELAGE
4
POWER
12 STRANDS OF 3/16 BROWN - 850 TURNS
WEIGHTS
WING 1.60 oz
FUSELAGE 2.65
STABILIZER .40
PROP .60
MOTOR .75
TOTAL 6.00 oz
0 4" 8" 12"
SCALE
NOTES
SMALL TEST FIELD LIMITED TURNS TO 400 - AVERAGE TIME 2 m - AT CONTEST FULLY WOUND PROP STALLED THE SHIP KILLING THE INITIAL CLIMB - LIKELY CAUSE EXCESS SPEED INCREASED WING DRAG POSSIBLE CURE - DOWN THRUST
5 1/2
8 1/2
PROP
16×2×1 3/4
24" PITCH
THIS MODEL IS IDENTICAL TO THE 1934 ENTRY WITH THE EXCEPTION OF THE WING, PROP, & REAR ARRANGEMENT, SEE AUG, 1935 ISSUE OF "MODEL AIRPLANE NEWS" FOR DETAILS
F. Zaic
36
CONTEST AVERAGE TIME - 1m 46s
A 1935 WAKEFIELD ENTRY by Frank Zaic

WING

Wings on fuselage models should be of high aspect ratio, at least 9-1. Where airfoils are concerned, those of undercamber designs are recommended. The Clark Y is also good but only on models that just come up to weight rule.

The construction of the wing will be taken up under a separate article.

From observing streamlined models, it seems advisable to fair the wing into fuselage. This will lower the center of resistance and the prop will require less downward thrust to keep the ship from stalling.

On fuselage or tractor wings it is advisable to streamline the tips of the wing. This reduces the tip losses and also aids the rudder by keeping the drag at the tips at a low value. This is especially important on gas jobs.

The dihedral needed on tractors is about $1\frac{1}{4}$ on each side of the wing for every foot of span providing that high aspect ratio wings and a prop whose diameter is not greater than 2/5 of the wing span are used. It is evident that larger dihedral is needed to take care of the increased torque of a larger prop.

TAIL SURFACES

The main requirements of tail surfaces are that they be strong and yet light and be of just the right size for the work they have to do. The following text deals with a simple means of finding the correct area of the stabilizer and the rudder. The rudder will be taken up first.

The area of the rudder must be just right. There is very good reason to believe that many models are unstable just because the rudder is too large or too small or placed in the wrong position.

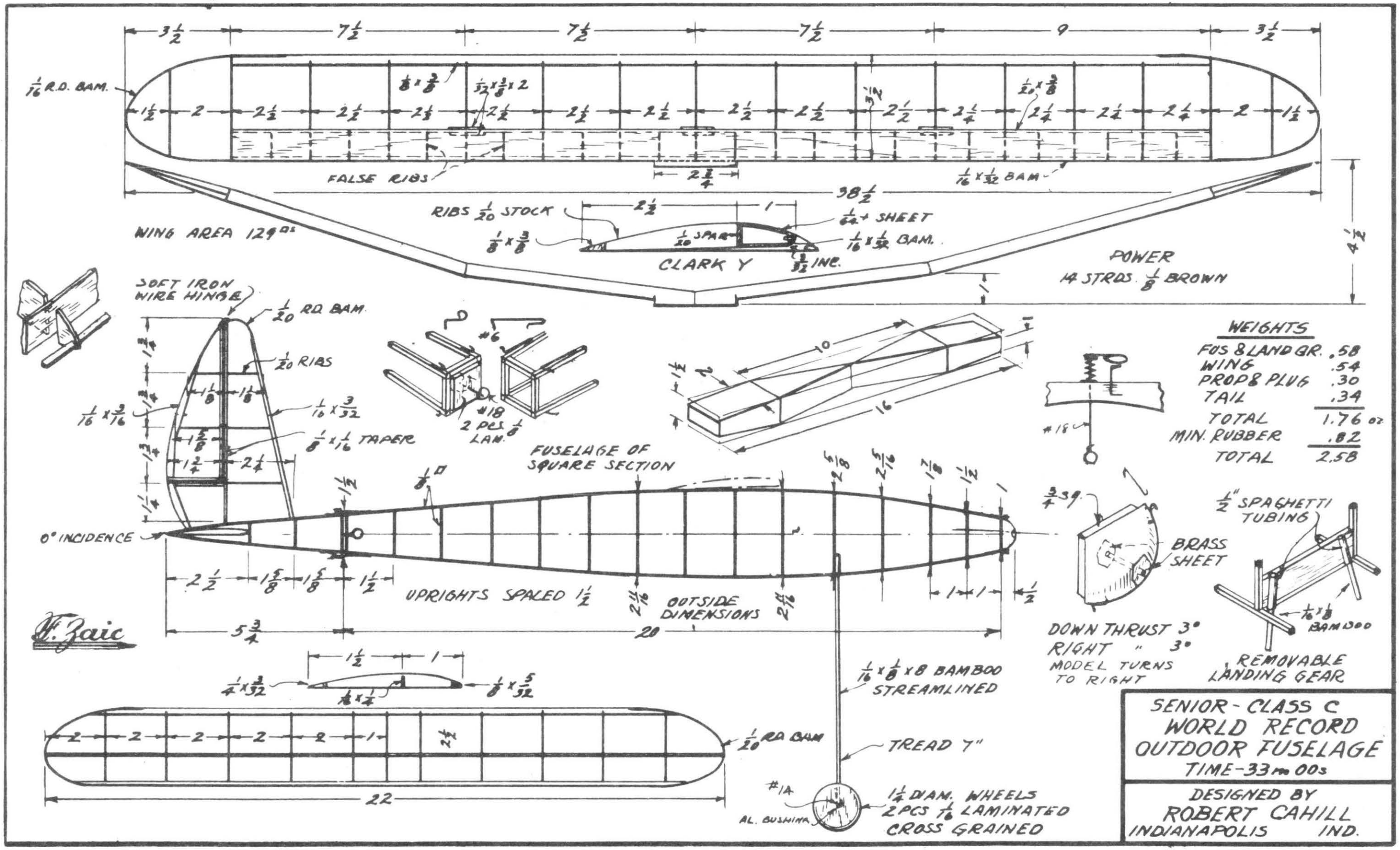
A model with the correct rudder area is very easy to fly and maneuver. The slightest adjustment of the fin will be noticeable in the model's flight. Here are a few indications of improper area.

1. If the rudder is too small the tail of the model will swing from side to side soon after it is released. This action leads up to a stall from which the model gets into a spiral dive.

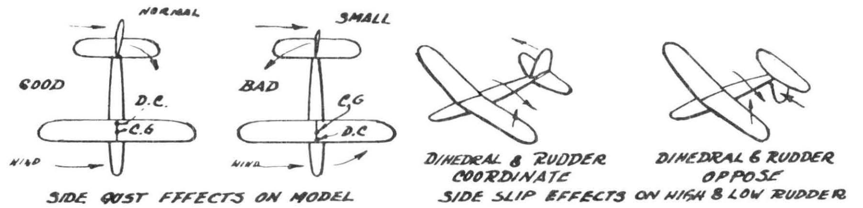
2. If it is too large, the model will persist in pointing into the wind. Any attempt to correct this tendency by adjusting the model so that it will turn, will introduce a set of opposing forces and make the model unstable. For example, if the ship is made to turn by means of the rudder, it will start the turn but as soon as the rudder presents too much effective frontal area to the air stream, the model will swing back again. The result will be the familiar crabbing. In a tight bank or side slip the large rudder will tend to dive the model.

Another factor to consider is the placing of the rudder area. If the rudder is of high aspect ratio or placed above the fuselage, any side gusts will tend to swing the model over and expose the under side of the wings. This will tend to turn the model over on its back or at least cause a side slip.

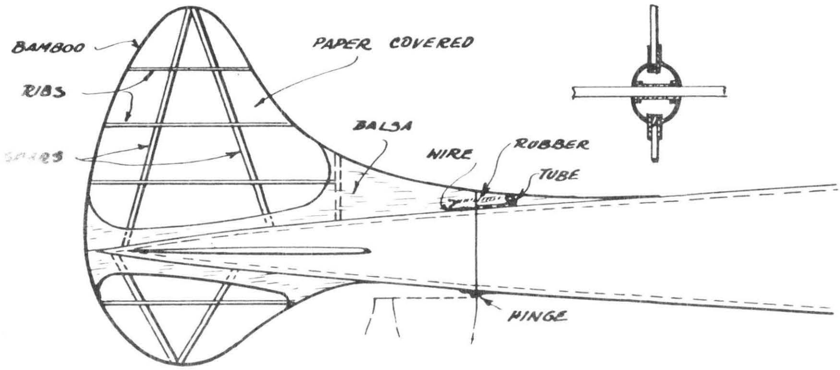
The whole rudder underneath the fuselage is not advisable, both from a structural and aerodynamic viewpoint.



1/16 R.D. BAM.
FALSE RIBS
1/16 x 1/32 BAM.
38 1/2
WING AREA 129 □"
RIBS 1/20 STOCK
1/8 x 3/8
1/20 SPAR
1/64 SHEET
1/16 x 1/32 BAM.
CLARK Y
3/32 INC.
POWER
14 STRDS. 1/8 BROWN
SOFT IRON WIRE HINGE
1/20 RD. BAM.
1/20 RIBS
1/16 x 3/16
1/16 x 3/32
1/8 x 1/16 TAPER
#6
#18
2 PCS 1/8 LAM.
FUSELAGE OF SQUARE SECTION
0° INCIDENCE
UPRIGHTS SPACED 1 1/2
OUTSIDE DIMENSIONS
WEIGHTS
FUS & LAND GR. .58
WING .54
PROP & PLUG .30
TAIL .34
TOTAL 1.76 oz
MIN. RUBBER .82
TOTAL 2.58
3/4 sq.
BRASS SHEET
1/2" SPAGHETTI TUBING
1/16 x 1/8 BAMBOO
DOWN THRUST 3°
RIGHT " 3°
MODEL TURNS TO RIGHT
REMOVABLE LANDING GEAR
F. Zaic
1/16 x 1/8 x 8 BAMBOO STREAMLINED
1/20 RD. BAM.
TREAD 7"
#1A
AL. BUSHING
1 1/2 DIAM. WHEELS
2 PCS 1/16 LAMINATED
CROSS GRAINED
SENIOR - CLASS C
WORLD RECORD
OUTDOOR FUSELAGE
TIME - 33 m 00 s
DESIGNED BY
ROBERT CAHILL
INDIANAPOLIS IND.



SIDE GUST EFFECTS ON MODEL SIDE SLIP EFFECTS ON HIGH & LOW RUDDER

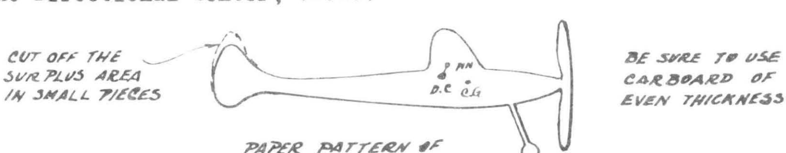


This design permits light but strong construction. The distribution of side pressures along the fuselage is also more equalized by having the fuselage present almost the same side area at all side angles. This is especially important on round fuselages. The frontal drag is also reduced on this design. This rudder still maintains its effectiveness at the stalling point, as the lower area is in a clear stream, and the upper part receives enough air around the narrow part of the fuselage, in front of the stabilizer, to make the fin still useful as a flight-controlling surface.

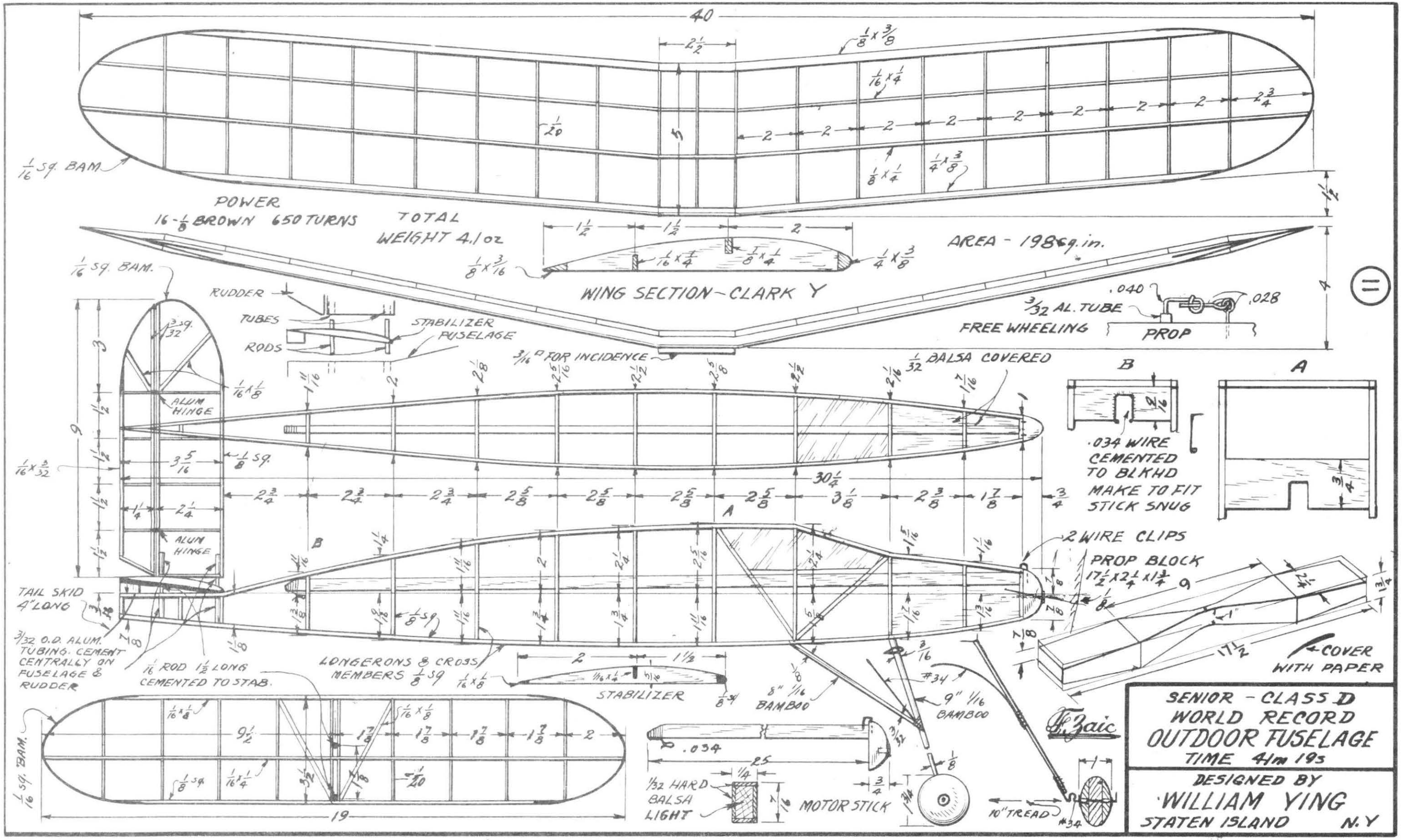
The following method of finding the rudder area has been used successfully by the writer for many years. It is the simplest and most practical method yet devised and is exact enough for our purpose. It was discovered in one of the older text books years ago.

DETERMINATION OF RUDDER AREA

Draw a side view of the new design on a piece of stiff cardboard of even thickness, using the whole of the prop side area in the diagram. The C.G. of the model may be assumed to be at a point half way along the rubber motor. (Checking has shown that on most models the C.G. is almost always at a point near the longditudinal center of the rubber motor.) This will automatically determine the position of the wing. (C.G. 1/3 behind the leading edge.) It is advisable to leave the rudder part larger than estimated. After this preliminary work has been done, make a small hole about 1" behind and ½" above the C.G. point on the rubber motor. Put a pin through this point and keep on trimming the rudder until the pattern is in balance. This balancing point is the center of side areas or the Directional Center, (D.C.)



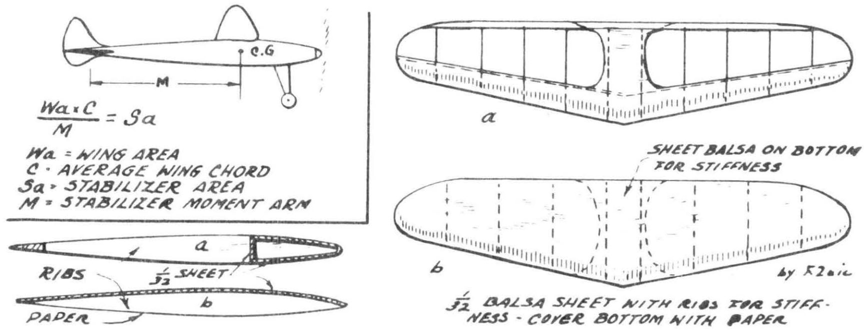
PAPER PATTERN OF THE DESIGN


SENIOR - CLASS D
WORLD RECORD
OUTDOOR FUSELAGE
TIME 41m 19s
DESIGNED BY
WILLIAM YING
STATEN ISLAND N.Y
POWER
16-1/8 BROWN 650 TURNS
TOTAL WEIGHT 4.1 oz
AREA - 198 sq. in.
WING SECTION ~ CLARK Y
STABILIZER
3/16 FOR INCIDENCE
1/32 BALSA COVERED
FREE WHEELING
3/32 AL. TUBE
PROP
.034 WIRE CEMENTED TO BLKHD
MAKE TO FIT STICK SNUG
2 WIRE CLIPS
PROP BLOCK 17 1/2 x 2 1/4 x 1 3/4
COVER WITH PAPER
TAIL SKID 4" LONG
3/32 O.D. ALUM. TUBING. CEMENT CENTRALLY ON FUSELAGE & RUDDER
1/16 ROD 1 1/2 LONG CEMENTED TO STAB.
LONGERONS & CROSS MEMBERS 1/8 SQ
RUDDER
TUBES
RODS
STABILIZER
FUSELAGE
ALUM HINGE
8" 1/16 BAMBOO
9" 1/16 BAMBOO
1/32 HARD BALSA LIGHT
MOTOR STICK
10" TREAD
1/16 SQ. BAM.
F. Zaic

THE STABILIZER

At present there are two types of stabilizers, those using the symetrical or streamlined section and those using the lifting section. The purpose of the symetrical design is just to stabilize the ship when it becomes unstable. The lifting tail, however, contributes both stability and lift, but it is a little more tricky to use. The symetrical type will be dealt with first.

The construction of any stabilizer should be light and strong. Below are shown several different methods of construction. The section used should be of the thin streamline variety such as the M sections are. The M-1 should be used for small ships and the M-2 for larger elevators where stronger spars are needed. The aspect ratio should be high, but do not make a weak elevator as a fluttery stabilizer can do a great deal of harm. The following formula may be used for determining the area of the stabilizer. The C. G. is assumed to be at the longditudinal center of the rubber motor.

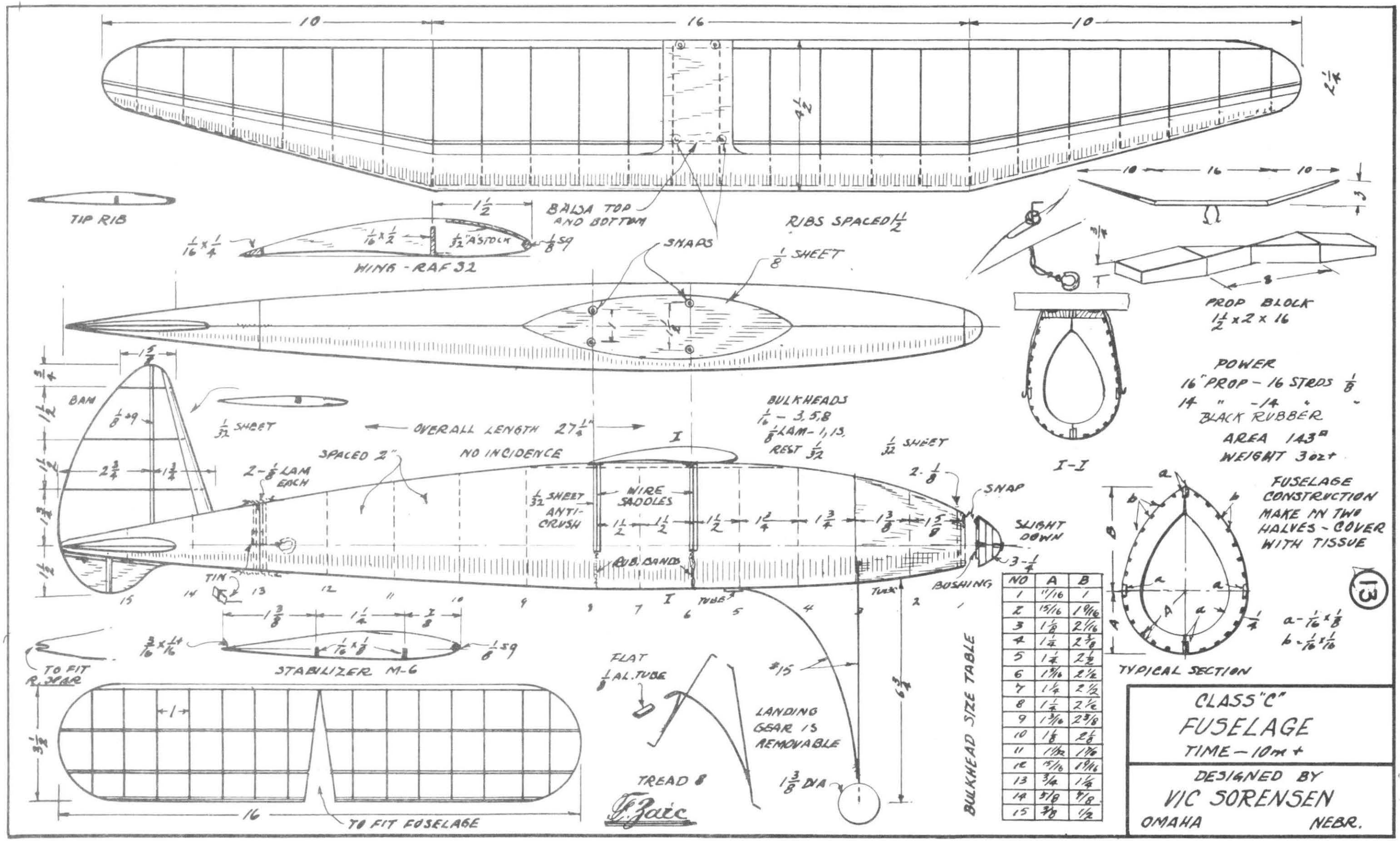


The above formula has been tested over a period of time and found satisfactory for just up-to-the-weight-rule jobs. For heavier models multiply the result by 1.3. The formula is such that it takes care of almost all variables with the exception of the forces set up by that part of the fuselage in front of the C.G. As it is the custom, however, to have motors strung only part way through the body, and as the C.G. is almost always at a point half-way along the motor, we can say that the inertia forces of the body are neutralized about the C.G.

STABILIZERS WITH LIFTING SECTIONS

Some say that two benefits may be derived from the use of the lifting tail. Besides being a means of stabilizing the ship, they say that it also contributes lift and causes the wing to be moved forward. The latter is something greatly to be desired on the average fuselage job. However, the writer is not in accord with this last mentioned theory. He tried the lifting tail but the wing remained over the C.G. After wondering why the wing could not be advanced without causing a stall with this arrangement, he found that the thrust line was too low. Tilting the prop down brought the wing forward. It is, therefore, believed by the author that it is not the lifting tail (which is sometimes set at as much as 2° negative), but the down thrust prop that does the trick. This adjustment gives the effect of a stabilizer set at a positive angle and so one gets the effects of a lifting tail. From this it would seem that an elevator at a positive angle is quite beneficial in many ways to a model's flight. Do not forget this on your next lifting tail.

There is no definite way of computing the area of the lifting tail. The safest course would be to use the same ratios that have been used on a record ship.



BULKHEAD SIZE TABLE

NO	A	B
1	11/16	1
2	15/16	1 9/16
3	1 1/8	2 1/16
4	1 1/4	2 3/8
5	1 1/4	2 1/2
6	1 5/16	2 1/2
7	1 1/4	2 1/2
8	1 1/4	2 1/2
9	1 3/16	2 3/8
10	1 1/8	2 1/8
11	1 1/32	1 7/8
12	15/16	1 9/16
13	3/4	1 1/4
14	5/8	7/8
15	3/8	1/2

CLASS "C"
FUSELAGE
TIME - 10m +

DESIGNED BY
VIC SORENSEN
OMAHA NEBR.

It is evident that stabilizers could be made large enough to take care of all the factors that make for longditudinal instability on models but that would not be in keeping with the spirit of scientific work. We should strive to know just exactly how much we need of a certain thing to do a given job with efficiency.

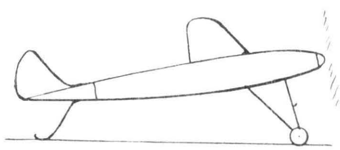
PROPS

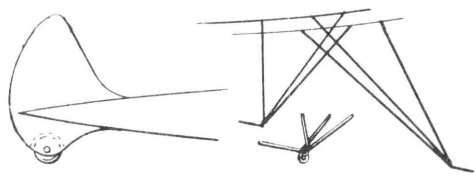
The prop size for any fuselage model depends on the weather and on the drag of the model. Large diameter props should be used on calm days and small on windy or gusty days. Higher pitch props almost 2-1 P/D ratio (30" pitch for 15" diameter), may be used on streamlined models. Lower pitch props with plenty of blade area are necessary for ships with abrupt and blunt lines. The job to work toward is, in the opinion of the writer, a light, sleek ship with plenty of power and a large prop.

LANDING GEAR

The author is more or less sentimentally attached to the wire tripod type of landing gear but any other kind that is clean and that provides adequately for the shock of hard landings will do. Always keep the low drag ideal in mind when choosing landing gear.

The wheels should be of a thin elliptical cross section and should have good axle bearings as these are essential to keep the wheels in line and so prevent the large amount of drag that any offset wheel will cause.





TAIL SKID

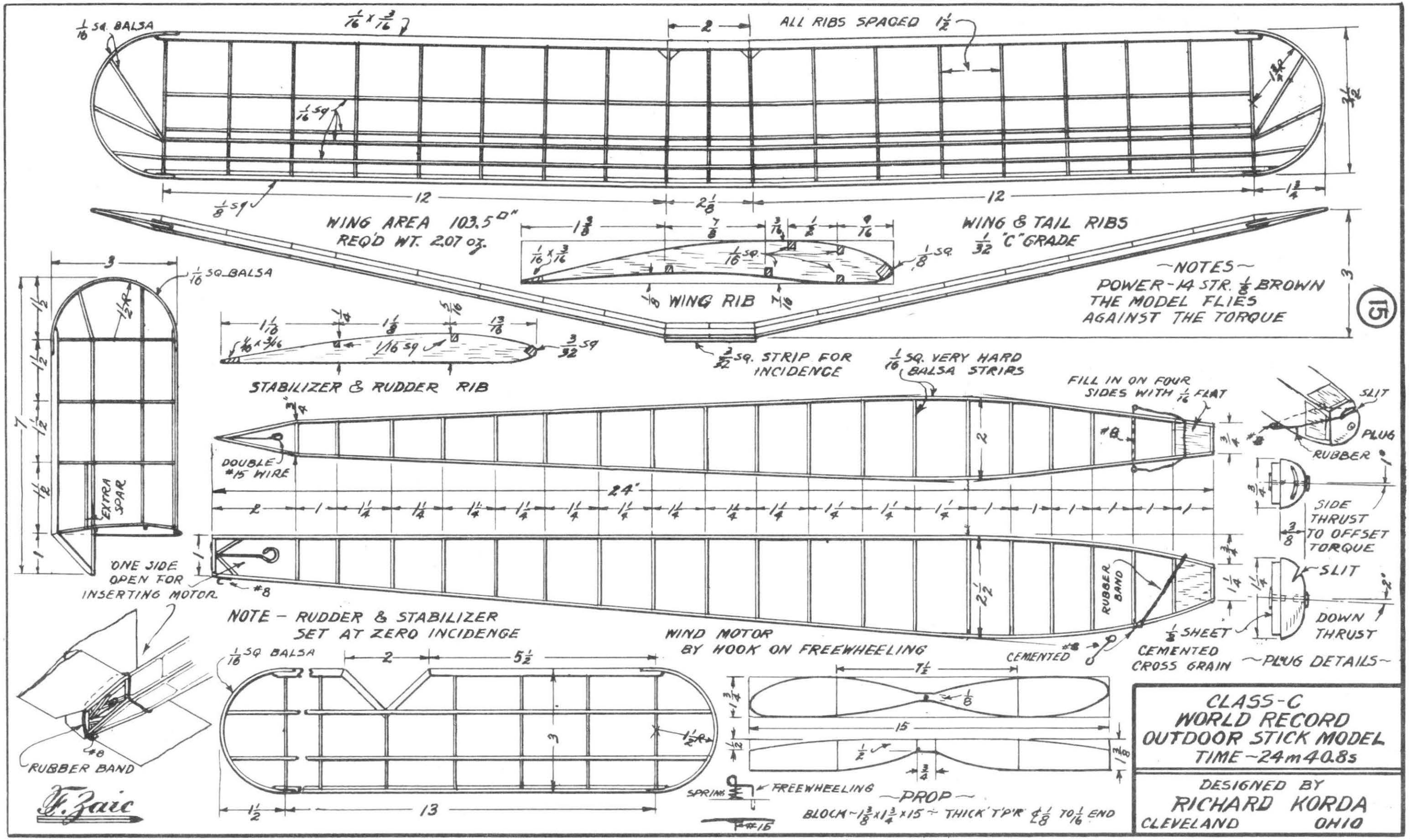
The tail skid should be fairly long so as to give the ship a low angle of attack when it takes off. A small tail wheel is also beneficial, especially on heavy models that have to take off from gravel or concrete. If the rudder is carried around to the bottom of the fuselage, a small wheel may be very easily faired into it to give a clean job.

SINGLE TRACTOR

The single tractor type of ship is almost the same as the fuselage job and will not be discussed here in detail. The same rules are applicable to both designs. The fuselage and motor stick construction is the same as shown for the single pusher with the exception that a boom is almost a necessity. The best flights are made naturally by models that have been carefully adjusted in calm weather. The following text on adjusting is very timely and valuable.

FAMOUS LAST WORDS

"Just one more turn."
"Was this your best prop?
"How interesting! I'll be careful . Oh my!"
"Just a wink. I'll get up at four and start again."
"Awfully sorry. I just closed my eyes and it disappeared."


ALL RIBS SPACED 1 1/2
1/16 SQ. BALSA
1/16 x 3/16
1/16 SQ
1/8 SQ
WING AREA 103.5 □"
REQ'D WT. 2.07 OZ.
WING & TAIL RIBS
1/32 "C" GRADE
WING RIB
~NOTES~
POWER-14 STR. 1/8 BROWN
THE MODEL FLIES
AGAINST THE TORQUE
3/32 SQ. STRIP FOR INCIDENCE
STABILIZER & RUDDER RIB
1/16 SQ. VERY HARD BALSA STRIPS
FILL IN ON FOUR SIDES WITH 1/16 FLAT
SLIT
PLUG
RUBBER
DOUBLE #15 WIRE
EXTRA SPAR
SIDE THRUST TO OFFSET TORQUE
ONE SIDE OPEN FOR INSERTING MOTOR
RUBBER BAND
DOWN THRUST
1/8 SHEET CEMENTED CROSS GRAIN
~PLUG DETAILS~
NOTE - RUDDER & STABILIZER SET AT ZERO INCIDENCE
WIND MOTOR BY HOOK ON FREEWHEELING
CEMENTED
RUBBER BAND
SPRING
FREEWHEELING
~PROP~
BLOCK-1 3/8 x 1 3/4 x 15 - THICK T'P'R 1/8 TO 1/16 END
CLASS-C
WORLD RECORD
OUTDOOR STICK MODEL
TIME~24m 40.8s
DESIGNED BY
RICHARD KORDA
CLEVELAND OHIO
F. Zaic
15

ADJUSTING FUSELAGES AND TRACTOR MODELS

The following are hints from the Indianapolis boys and should explain why the lads bring home the bacon year after year.

1. Try different combinations of power. Sometimes adding only two strands will make a tremendous difference in climb. Have enough power so that the plane will never come down with turns left on the motor.

2. Spend most of your adjusting time on the noseplug. We have our props pulling down and to one side. Make your prop pull "down" to avoid stalling under the initial burst of power and also to get a better glide by having the ship adjusted for a glide. Also have the prop pull to the right to help overcome the Torque. This will help the performance of your model by making it possible for the ship to circle during the whole flight. When using this system it is not necessary to washin the left wing as the offset prop takes care of it. The angle at which the prop should be offset down and to the right, depends on the individual model and can only be determined after test flights.

3. The rudder is turned slightly to make the model circle against the torque but be careful that the model does not go into a spiral dive.

4. Dope the props and sand them with fine sandpaper. The reasons for this are as follows:

1st. To give them a smooth finish so that skin friction may be reduced. This means more efficient use of the power.

2nd. To make it possible to keep the ship in sight for a longer time by seeing the sun flashing on the polished blades.

5. Before every flight be sure that the prop shaft is straight and that the freewheeling will work when its time comes.

6. When using the lifting tail, be prepared to move the wing further up towards the prop than when using the symetrical tail. The C.G., when using a lifting tail, is usually at the trailing edge of the wing and is sometimes even further back. (This without using a sweepback wing.)

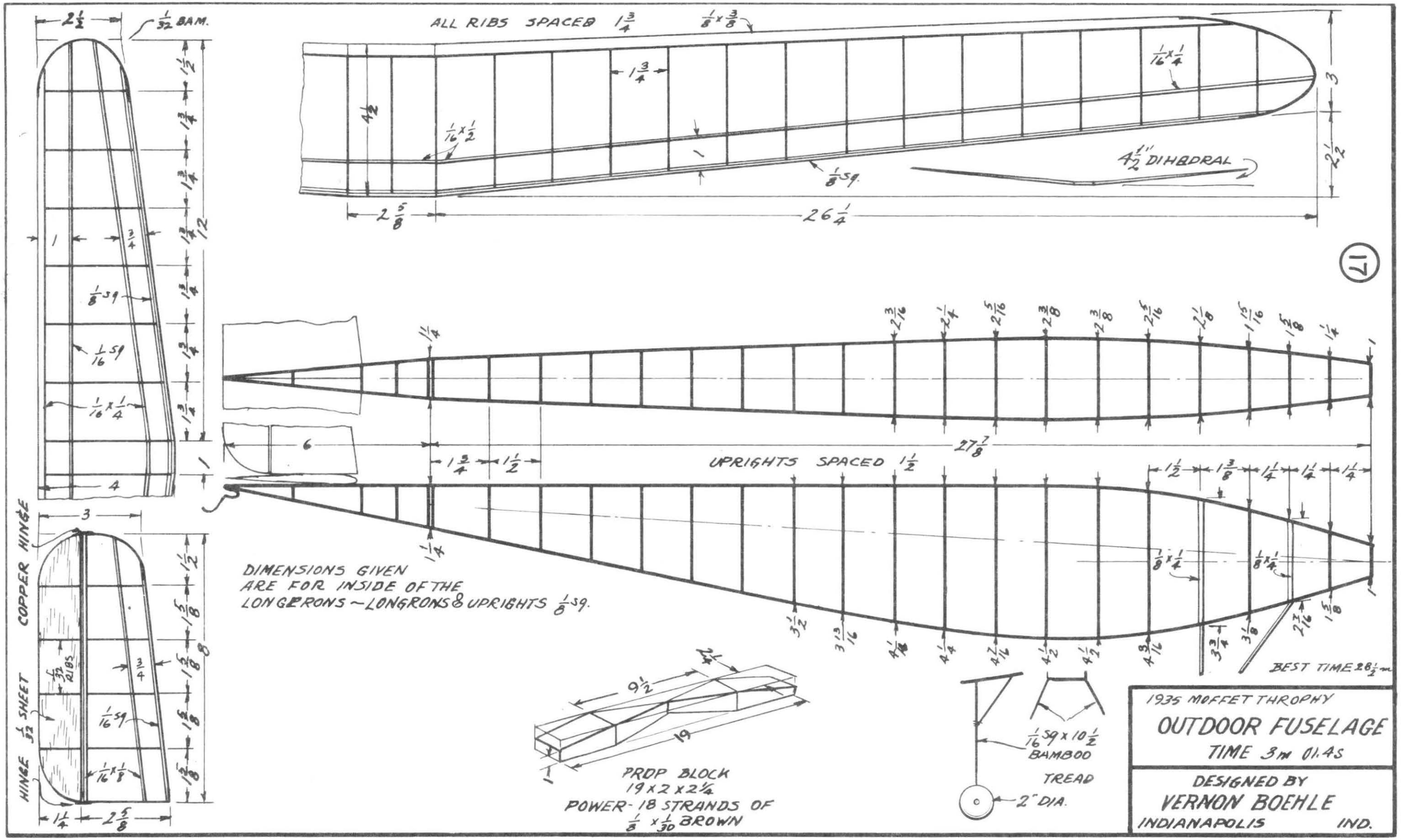
7. Always use rubber tubing on the prop shafts and S hooks.

8. Never expose your rubber to the direct rays of the sun. Take the motor out of your plane between flights and keep it in an airtight jar around which you should wrap wet newspaper or cloth.

9. Test your models well before a contest so that you can take all the bugs out of them and have them adjusted properly when the time comes for an official flight. All you will have to do at the contest is to get one good flight and you will go home with the crockery.

LOUIS GERAMI'S IDEAS ON DESIGN AND FLIGHT ADJUSTMENTS

It is well known that every record flight made outdoors in recent years was made with the help of air currents, and also that almost every contest is won by ships that can ride the wind in case of nasty weather. The hints given below have been accumulated after years of flying experience in the windy and gusty weather of New York City. (Average wind velocity in New York, 16 m.p.h. as compared to Chicago's 13 m.p.h.)



17
ALL RIBS SPACED 1 3/4
4 1/2" DIHEDRAL
UPRIGHTS SPACED 1 1/2
DIMENSIONS GIVEN
ARE FOR INSIDE OF THE
LONGERONS ~ LONGRONS & UPRIGHTS 1/8 SQ.
COPPER HINGE
HINGE 1/32 SHEET
1/32 BAM.
PROP BLOCK
19 X 2 X 2 1/4
POWER - 18 STRANDS OF
1/8 X 1/30 BROWN
1/16 SQ X 10 1/2
BAMBOO
TREAD
2" DIA.
BEST TIME 28 1/2 m
1935 MOFFET THROPHY
OUTDOOR FUSELAGE
TIME 3m 01.4s
DESIGNED BY
VERNON BOEHLE
INDIANAPOLIS IND.

The model should have:

1. Low center of gravity obtained by using light wing and strong landing gear.

2. About 2" dihedral for every foot of span on each side of the wing.

3. A medium-sized, flat rudder having from 10% to 15% of the wing area.

4. A 3° angular difference between the wing and the stabilizer settings.

5. A proven freewheeling.

The above features should make it possible to get the model quite high providing enough power is applied. It seems to me that the average model is very much underpowered. Large diameter props may work well in calm weather but they do not have sufficient thrust to keep the model under control in wind velocities of 15 miles or more. The writer recommends the use of a 14 inch diameter prop turned by 14 strand of 1/8 flat for ships of 150 sq. ins. or under.

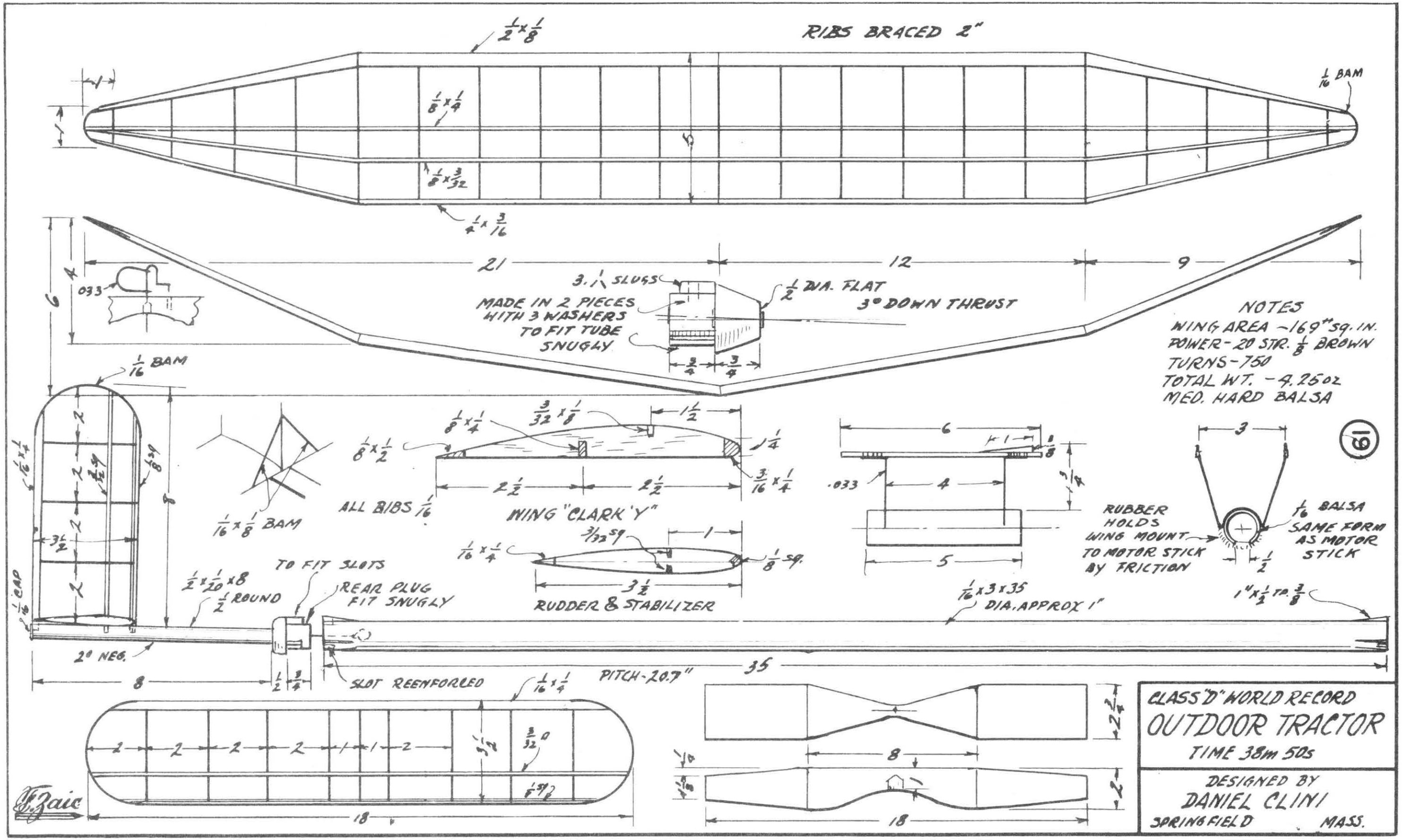
ADJUSTING THE MODEL

Since the main reasons for the following adjustments are a) to get the ship up and b) to have it glide as flatly as possible in about 40 ft. diameter right circles. We first wind the model by hand, let it go and observe how the glide is. Do not pay much attention to how it flies under power. If the ship has a stalling glide when the proper angle (3°) between the wing and elevator settings is present, move the wing back until the model has a flat glide on later tests. If the model has a steep glide and the C.G. is 1/3 back from the leading edge of the wing, the cure is to give more positive incidence to the wing or more negative angle to the elevator. (On all these test flights, the rudder should be set to turn the model into a right turn when gliding.)

When the glide is satisfactory, the power climb may be attended to as follows:

The climb adjustments are made by offsetting the thrust line. If the ship has a tendency to stall, the prop is pointed down by placing a balsa strip between the upper part of the plug and the fuselage until a smooth climb is obtained. If the model has a tendency to dive spirally with the torque, the prop is offset to point to the right until the ship either has a straight up climb or a large circling climb against the torque. A tight turn against the torque requires too much offset of the prop and therefore should not be wholly accomplished by this means.

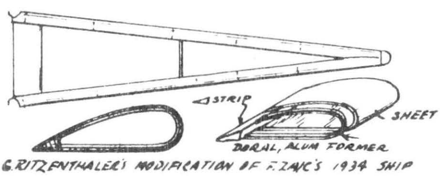
The most efficient, although the trickiest, way of getting a good climb is to have the model circle tightly with the torque. This has the ship flying with the wind for a very short time. For this type of climb the left wing is given more lift and the prop is offset slightly to the right. The degree of washin and prop offsetting depends on the torque of the prop. This method will have to be tried before the builder is able to grasp the fundamentals of this kind of flying.

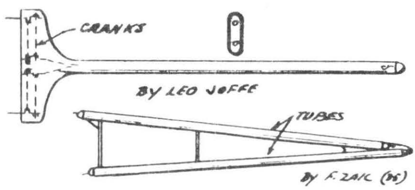

RIBS BRACED 2"
1/2 x 1/8
1/16 BAM
1/8 x 1/4
1/8 x 3/32
1/4 x 3/16
21
12
9
.033
3. 1/4 SLUGS
1/2 DIA. FLAT
3° DOWN THRUST
MADE IN 2 PIECES WITH 3 WASHERS TO FIT TUBE SNUGLY
NOTES
WING AREA -169" SQ. IN.
POWER - 20 STR. 1/8 BROWN
TURNS - 750
TOTAL WT. - 4.25 oz
MED. HARD BALSA
1/16 x 1/8 BAM
1/8 x 2
3/32 x 1/8
1/8 x 1/4
ALL RIBS 1/16
WING "CLARK Y"
3/16 x 1/4
3/32 SQ.
1/16 x 1/4
1/8 SQ.
RUDDER & STABILIZER
RUBBER HOLDS WING MOUNT TO MOTOR STICK BY FRICTION
1/16 BALSA SAME FORM AS MOTOR STICK
1/16 CAP
1/2 x 1/20 x 8
1/2 ROUND
TO FIT SLOTS
REAR PLUG FIT SNUGLY
1/16 x 3 x 35
DIA. APPROX 1"
2° NEG.
SLOT REENFORCED
PITCH - 20.7"
35
18
8
CLASS "D" WORLD RECORD
OUTDOOR TRACTOR
TIME 38m 50s
DESIGNED BY
DANIEL CLINI
SPRINGFIELD MASS.
19
F. Zaic

TWIN PUSHER

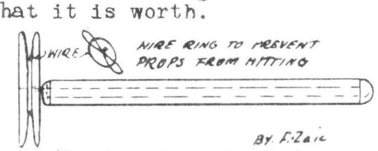
The disadvantage of the present design of twin pusher is that it has to use brute force to get into the air. If it is expected to keep up with tractors in duration it will be necessary to clean it up a bit aerodynamically by streamlining it.

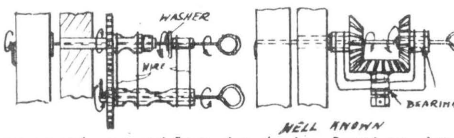
The advantage that the tractor has over the twin is that the tractor has comparatively little drag, and it is therefore able to make really flat glides in comparison with the average mushing twin. There is no reason why we cannot apply a bit of streamlining to the "A" frames. Such frames have been made and found to stand the gaff, and the ships using them seemed to fly using less power. Here are a few suggested designs that have been made without too much trouble.



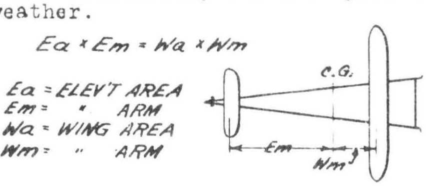


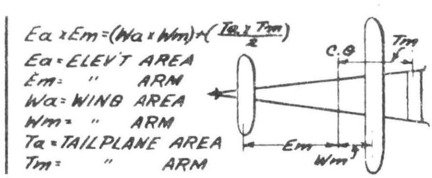
As good as these may be, no one has yet conceived the ultimate design. The editor believes that eventually we will have co-axial props. The gear assembly for this system has been made and no difficulty was experienced in making it. The editor has not as yet incorporated this assembly in any ships and as it will be quite a while before he gets to this matter he passes on the suggestion for what it is worth.





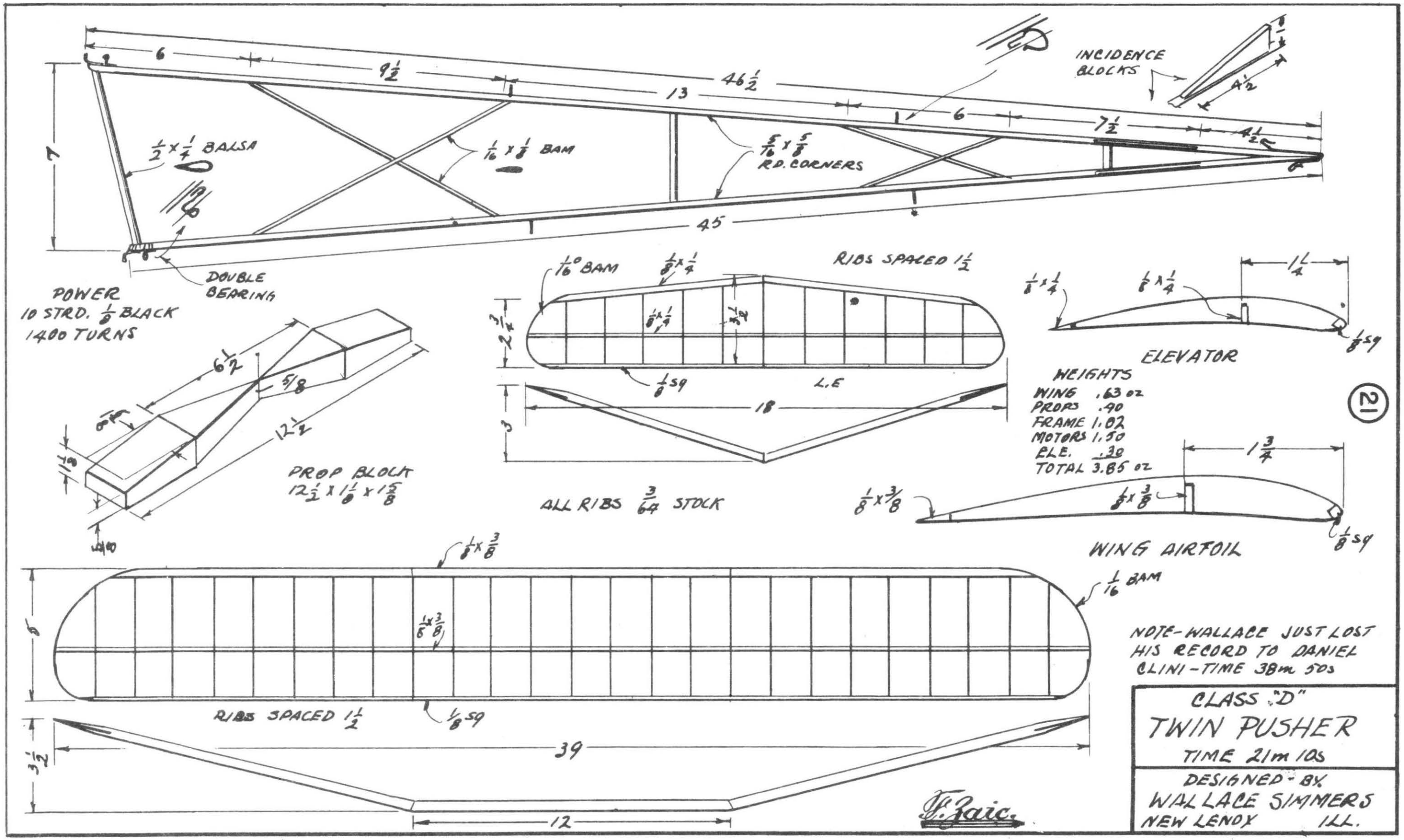
Another important factor we must consider in twin design is the ratio between the areas of the main and auxiliary wings. The editor has used the following formulas to govern this relationship and they have checked in flight tests. In earlier days when he had more spare time, he was able to adjust the model at home by these formulas and all that was needed at a contest was one check flight. This feature of mathematically balanced planes is especially desirable in nasty weather.



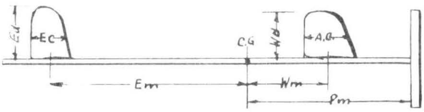


Those of you who can estimate the weights of the various parts of a ship before building it will be able to design the complete ship on paper. The less experienced fellows can make the complete ship, weigh the parts, and then position the surfaces according to the formulas later.

By process of elimination, mostly at the expense of elevator wings, it was found that small, light twins only need elevators having from 20% to 30% of the main wing area. If a tail plane is used, an elevator of 30% up to 38% is about right. In other words the heavier the ship or the greater the area behind the C.G., the greater should be the elevator. On small ships having about 110 sq. ins. of area an elevator 20% of the main wing surface gives the ship a snappy climb.


21
INCIDENCE BLOCKS
46 1/2
45
1/2 x 1/4 BALSA
1/16 x 1/8 BAM
5/16 x 5/8 RD. CORNERS
DOUBLE BEARING
POWER
10 STRD. 1/8 BLACK
1400 TURNS
PROP BLOCK
12 1/2 x 1 1/8 x 1 5/8
1/16° BAM
RIBS SPACED 1 1/2
L.E
1/8 sq
ALL RIBS 3/64 STOCK
ELEVATOR
WEIGHTS
WING .63 oz
PROPS .90
FRAME 1.02
MOTORS 1.50
ELE. .30
TOTAL 3.85 oz
WING AIRFOIL
1/16 BAM
RIBS SPACED 1 1/2
NOTE-WALLACE JUST LOST
HIS RECORD TO DANIEL
CLINI-TIME 38m 50s
CLASS "D"
TWIN PUSHER
TIME 21m 10s
DESIGNED-BY
WALLACE SIMMERS
NEW LENOX ILL.

Another important factor in the design of twin pushers is the relationship between the dihedral of the elevator and wing. The main wing does not need more than an inch of dihedral on each side for every foot of span. The corresponding dihedral of the elevator however, cannot be so arbitrarily determined as the matter of directional stability must be considered. The dihedral of the elevator may be found more or less exactly by figuring out side areas and their moment-arms. The following formula may be solved to give the desired amount of dihedral.



$$\frac{(Wa \times Wm) + (Pa \times Pm)}{Ec \times Em} = Ed$$

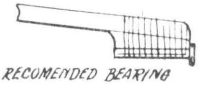
Wa = Average wing chord x dihedral
Wm = Wing's moment arm
Pa = Prop diameter x thickness
Pm = Prop moment arm
Ec = Average chord of the elevator
Em = Elevator's moment arm
Ed = The dihedral of the levator

The best way to have a model gain altitude is to have it climb spirally. This is achieved by first observing the natural turn on the model's initial flight and then, if the turn is not sharp enough to give you a moderately tight spiral climb, by intensifying it by washing-in that half of the elevator that is on the outside of the natural turn.

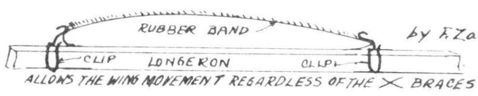
If the ship refuses to turn after the above adjustments have been made, the wing may be set askew. This is a makeshift way to get turn but anything will serve in an emergency. When a non-turning condition exists there can be either one of two things wrong. If the ship persists in pointing into the wind, it shows that the main wing has too much dihedral. To correct this the dihedral of the elevator should be enlarged according to formula. If the reverse is true, and the ship heads downwind all the time, then the elevator dihedral should be decreased or the wing dihedral increased as this condition indicates that there is too much side area at the nose of the ship. Temporary adjustments can be made, however, by figuring out the additional side area required by the front or rear wing as the case may be and then adding a fin of the desired size under the wing in question.

The choice of airfoils on a twin is also very important. A successful combination is the use of the R.A.F. 32 or Eiffel 400 on the elevator and the use of the Clark Y on the main wing. Undercambered sections develop quite a bit of lift at slight negative angles and therefore are to be avoided as main wing foils. If they are used on the rear wing a steep glide usually results. However, fairly good results have been obtained using the R.A.F. 32 on the main wing in combination with a tail plane having an M section.

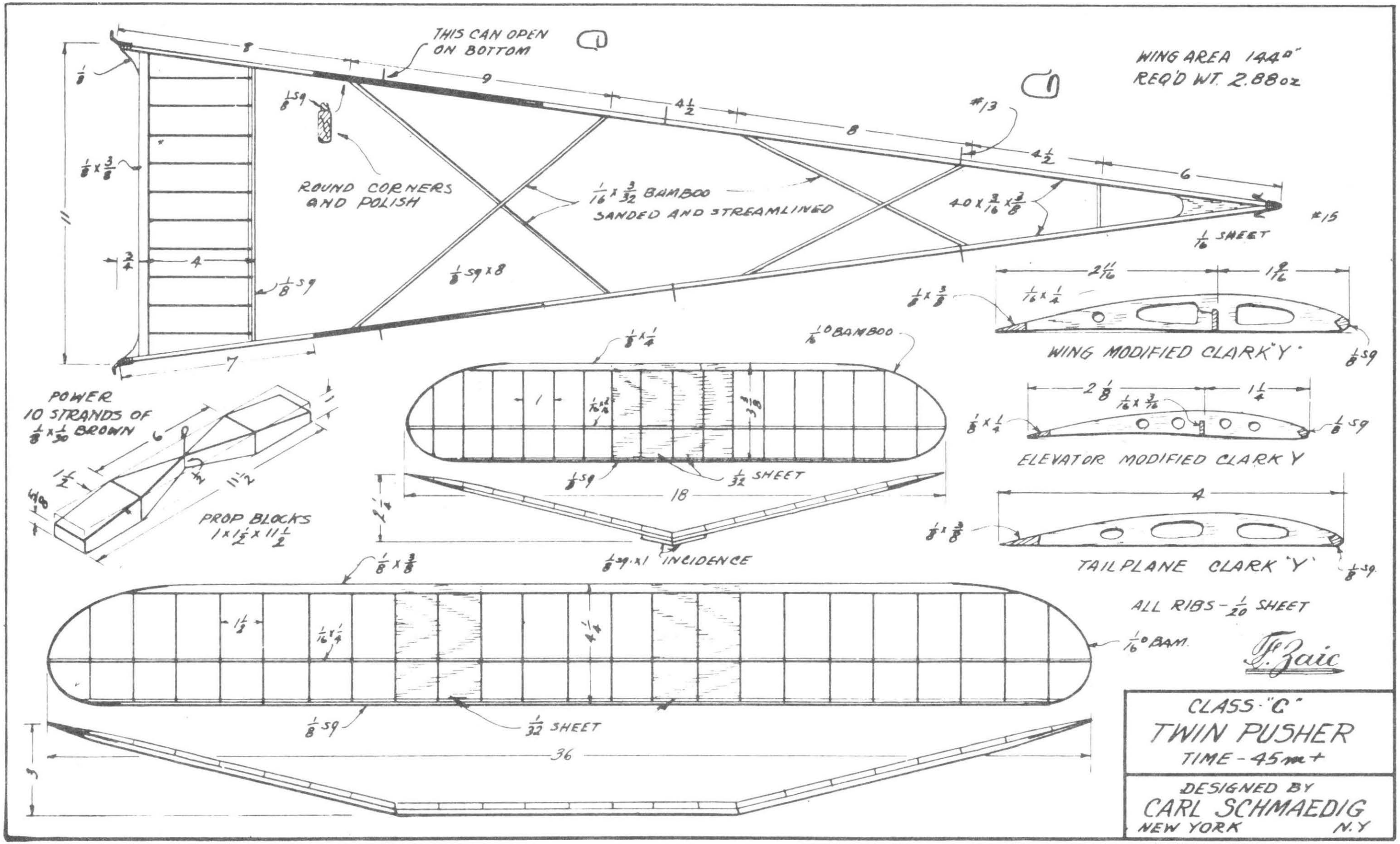
Props of 1x 1½ x 11 seem best for pushers under 150 sq. ins. area while smaller sizes on smaller ships are worth while trying. You will find that smaller props of less pitch than would be normally indicated by your experience with other types of models should be used for best results. This is accounted for by the fact that twin pushers have much more drag than any other type of model and therefore require more power than these other types.



RECOMENDED BEARING



ALLOWS THE WING MOVEMENT REGARDLESS OF THE X BRACES



CLASS "C"
TWIN PUSHER
TIME - 45 sec +
DESIGNED BY
CARL SCHMAEDIG
NEW YORK N.Y.
WING AREA 144 □"
REQ'D WT. 2.88 oz
WING MODIFIED CLARK 'Y'
ELEVATOR MODIFIED CLARK Y
TAILPLANE CLARK 'Y'
ALL RIBS - 1/20 SHEET
1/16 SHEET
1/16 x 3/32 BAMBOO
SANDED AND STREAMLINED
THIS CAN OPEN ON BOTTOM
ROUND CORNERS AND POLISH
1/16 ° BAMBOO
1/32 SHEET
INCIDENCE
PROP BLOCKS
1 x 1 1/2 x 11 1/2
POWER
10 STRANDS OF
1/8 x 1/30 BROWN

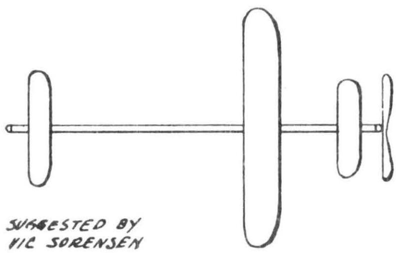
SINGLE PUSHER

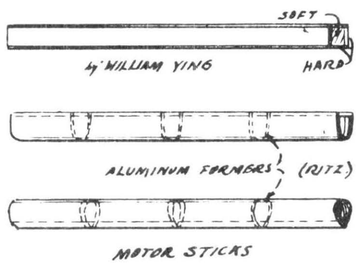
From a theoretical standpoint the single pusher is about the most efficient type of model we can think of. However, it is about the most difficult job to design so that all the factors will work together. The most common fault of the single pusher is that it tends to go into a spiral dive on the slightest provocation. In most cases the misplacing of the D.C. is the cause of this. Insufficient dihedral is usually given to the elevator or a fin is placed in the rear where it probably does not belong.

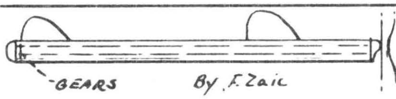
The selection of airfoils should be the same as on the twin. If you wish to use an undercambered main wing it is advisable to use an M section tail plane to correct any diving tendencies in the glide.

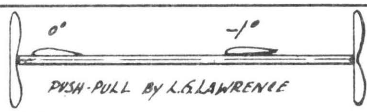
Larger sized props, say about 15 ins. diameter on a 150 sq. in. job can be used on this kind of plane as the single, many stranded motor develops a tremendous torque. The writer is planning to use a double motor on this type of ship with light gears in the front. With this set-up he hopes to get about four minute power flights.

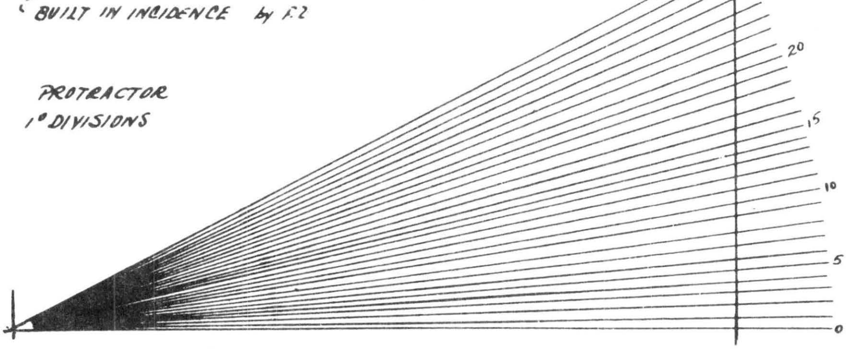
In adjusting the model, spiral flying should be sought. There is no reason why the prop offset system may not be used on single pushers as it is on tractors to overcome erratic flying tendencies. This is just a suggestion as the writer has not tried it.

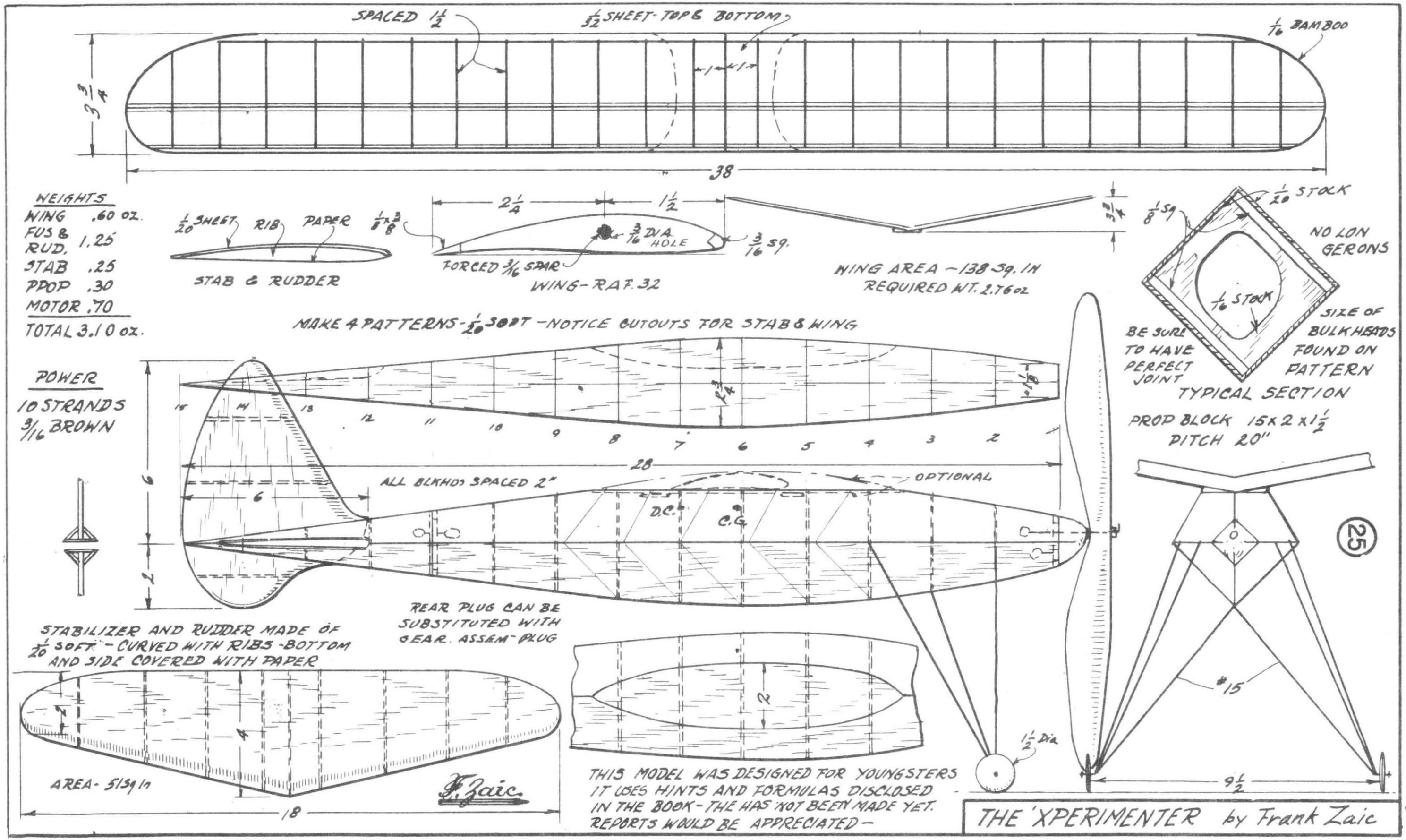











SPACED 1 1/2
1/32 SHEET-TOP & BOTTOM
1/16 BAMBOO
3 3/4
38
WEIGHTS
WING .60 OZ.
FUS & RUD. 1.25
STAB .25
PROP .30
MOTOR .70
TOTAL 3.10 OZ.
1/20 SHEET
RIB
PAPER
STAB & RUDDER
1/8 x 3/8
2 1/4
1 1/2
3/16 DIA HOLE
3/16 SQ.
FORCED 3/16 SPAR
WING-RAF 32
WING AREA -138 SQ. IN
REQUIRED WT. 2.76 OZ
1/20 STOCK
1/8 SQ
NO LONGERONS
1/16 STOCK
BE SURE TO HAVE PERFECT JOINT
SIZE OF BULKHEADS FOUND ON PATTERN
TYPICAL SECTION
PROP BLOCK 15 x 2 x 1 1/2
PITCH 20"
MAKE 4 PATTERNS - 1/20 SOFT - NOTICE CUTOUTS FOR STAB & WING
POWER
10 STRANDS 3/16 BROWN
28
ALL BLKHDS SPACED 2"
OPTIONAL
D.C.
C.G.
REAR PLUG CAN BE SUBSTITUTED WITH GEAR. ASSEM- PLUG
STABILIZER AND RUDDER MADE OF 1/20 SOFT - CURVED WITH RIBS - BOTTOM AND SIDE COVERED WITH PAPER
AREA - 51 Sq In
18
F. Zaic
#15
1 1/2 Dia
9 1/2
25
THIS MODEL WAS DESIGNED FOR YOUNGSTERS IT USES HINTS AND FORMULAS DISCLOSED IN THE BOOK - THE HAS NOT BEEN MADE YET. REPORTS WOULD BE APPRECIATED -
THE 'XPERIMENTER by Frank Zaic

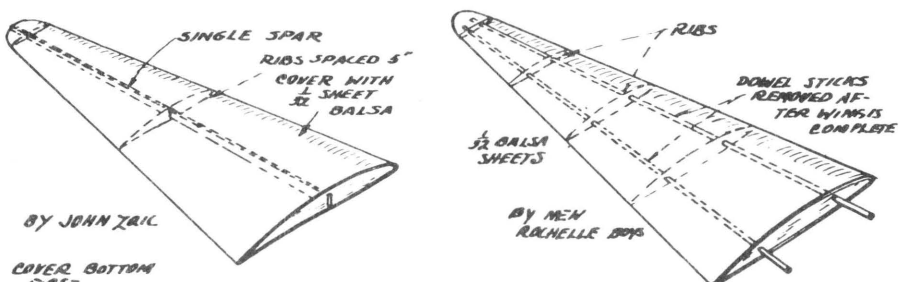
THE WING CONSTRUCTION

To have a dependable model it is necessary to pay special attention to the structure of the wing. The wing must be strong enough to keep its shape and also to be able to withstand the shock of normal landings. Below are shown several designs that have been tried during the past year. The multi-spar construction is not recommended as balsa wood does not stand up well under compression.

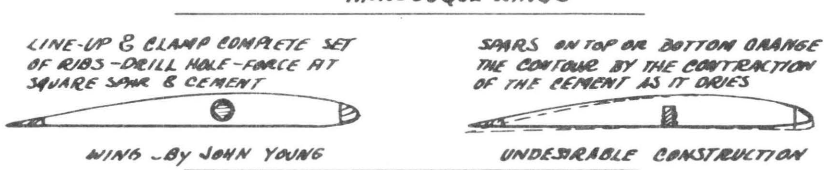
Ribs should be made of 1/32" "C" stock and should be spaced about 1½" apart. Greater spacing is not advisable as paper sags a great deal even when doped. By covering the center portion of the wing with sheet balsa, considerable strength may be added to the structure. This box arrangement also provides a good base for fixing the wing to the fuselage. It is good practice to have balsa sheeting wherever the wing is handled much. Tips should be of 1/16 round bamboo, shaped over a hot metal tube or electric soldering iron.

In covering use regular dope for adhesive. The grain of the paper should run chordwise and the paper should be stretched as tightly over the frame as possible. It should then be sprayed with water. Aniline dye may be dissolved in this water if a color effect is desired. The advantage of aniline dye over colored dope is that the former does not add weight and yet provides a smooth coloring with no light or dark spots. After water doping the paper, one or two coats of banana oil or thin dope should be applied to it. If a small amount of lacquer is mixed with the dope, the wing will have a glossy finish.

A gloss or microfilm affect, if weight is of slight consequence, can be secured by using thin varnish instead of dope. The aniline dyes can still be used in this method, and the paper when so treated, takes on the appearance of colored celluloid, the color depending on the dye used.



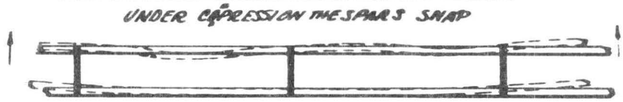
MONOCOQUE WINGS



WING - BY JOHN YOUNG

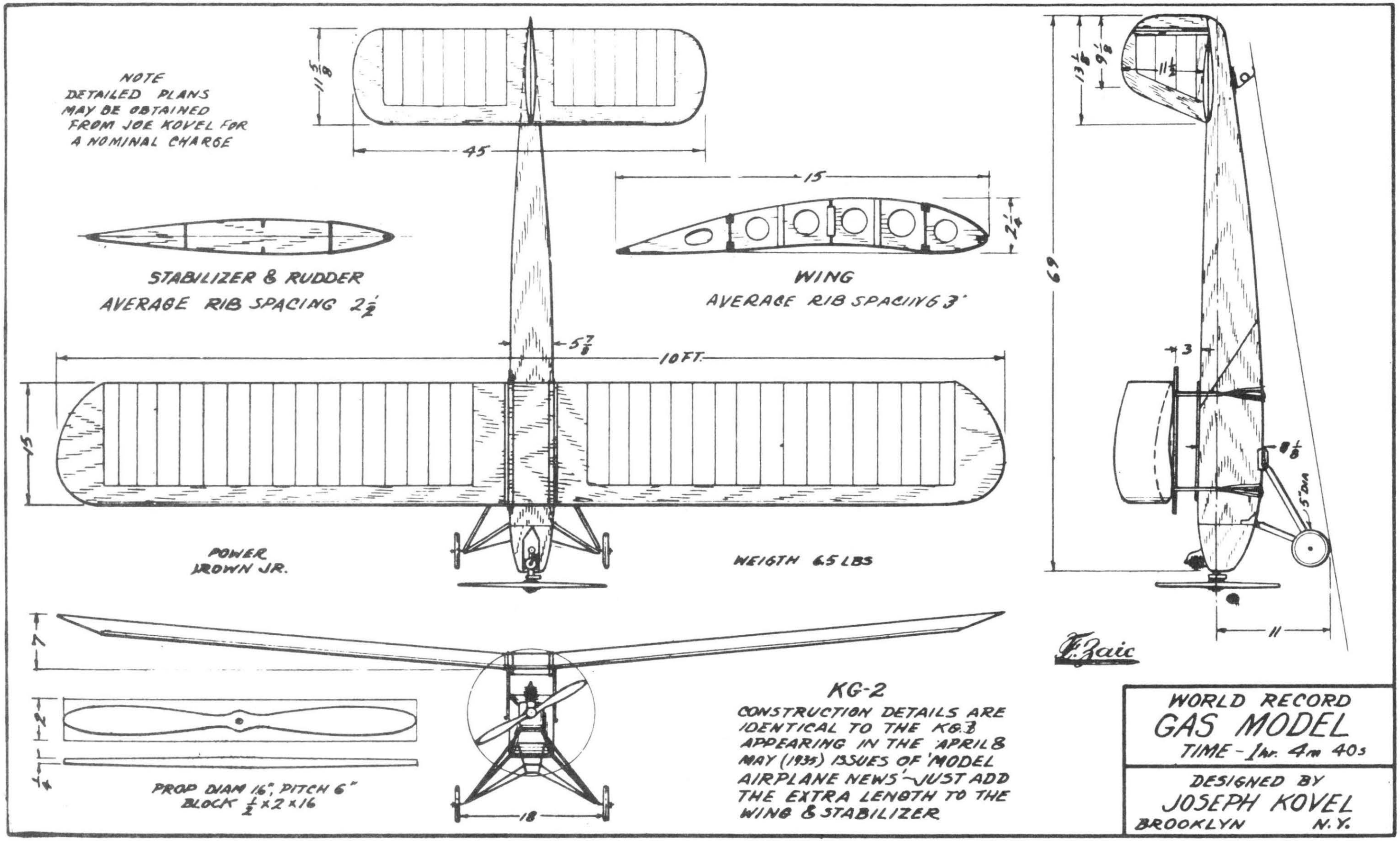
UNDESIRABLE CONSTRUCTION

UNDER COMPRESSION THE SPARS SNAP



MULTI SPAR EFFECTS

SEE PLANS FOR MORE TYPES OF WING CONSTRUCTION



NOTE
DETAILED PLANS
MAY BE OBTAINED
FROM JOE KOVEL FOR
A NOMINAL CHARGE
11 5/8
45
15
2 1/4
STABILIZER & RUDDER
AVERAGE RIB SPACING 2 1/2
WING
AVERAGE RIB SPACING 3"
5 7/8
10 FT.
15
POWER
BROWN JR.
WEIGTH 6.5 LBS
13 1/8
9 1/8
11 1/2
69
3
8 1/8
5" DIA
11
7
2
1/4
PROP DIAM 16", PITCH 6"
BLOCK 1/2 x 2 x 16
18
KG-2
CONSTRUCTION DETAILS ARE IDENTICAL TO THE KG.3 APPEARING IN THE APRIL & MAY (1935) ISSUES OF 'MODEL AIRPLANE NEWS' — JUST ADD THE EXTRA LENGTH TO THE WING & STABILIZER
F. Zaic
WORLD RECORD
GAS MODEL
TIME - 1hr. 4m 40s
DESIGNED BY
JOSEPH KOVEL
BROOKLYN N.Y.

"THE TRIALS AND TRIBULATIONS OF
AN ENGLISH AEROMODELLIST"

By C. S. Rushbrooke

For the purpose of this article I have gone rather deeply into the various aspects and requirements, but must make it clear at the start that the conditions and incidents described are purely my personal experiences, and must not be taken as indicative of conditions everywhere in England.

First let me state that in spite of the comparative smallness of England, conditions affecting the aeromodellist in the North, where I reside, are totally different from those obtained in the South. To a certain extent this can be taken as the reason for the greater activity in the model field found in the Southern counties, though what the North lacks in numbers is more than atoned for in accomplishments and keenness.

As a fair example of what we have to put up with, let us take an ordinary day of flying activities. The majority of our members being seniors, who unfortunately have to work for a living, Sunday is the only day on which it is practical to hold club meetings. In the usual human manner, it is an easy job to rise early on a flying day (as distinct from a working day) and the first thing is to look out at the weather. Any signs of rain or a high wind are greeted with "curses loud and long", and a quick jump back into bed for an extra forty winks,--and the wife keeps diplomatically quiet for the rest of the day!

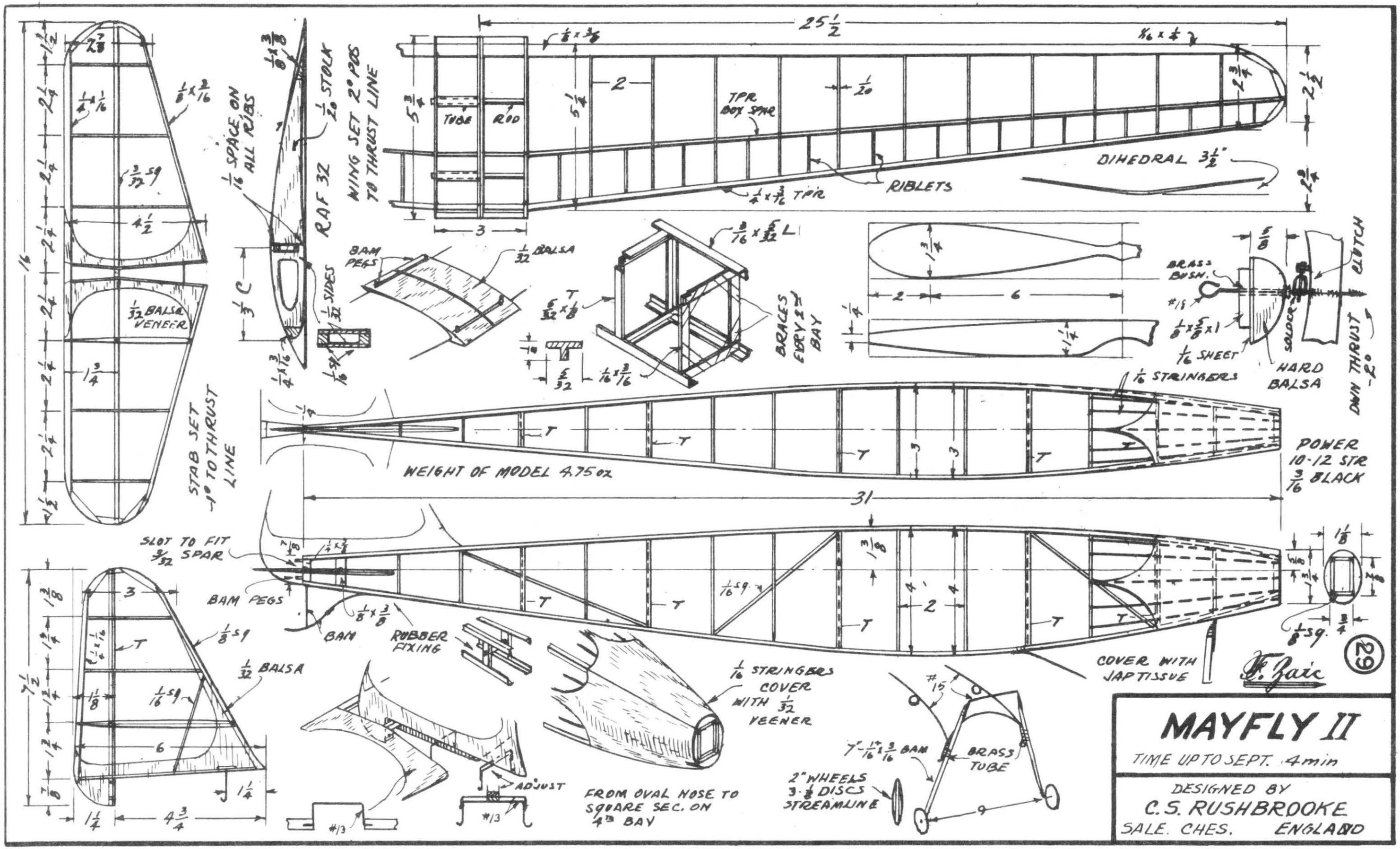
Should one find however, that things look O.K. breakfast is polished off with much haste, some of the "lads" turning up in the meantime. Tracks are made for the ground, (in our case one of the local aerodromes) and everyone gets ready to do their stuff.

Let us take as a good example our competitions day of April 28th. The first item to be held was the annual weight lifting contest, in which any fuselage model is eligible, each machine having to carry as extra load a weight equal to 50% of the model's unladen weight. At 11 a.m. the starting time, conditions were perfect. In fact too perfect for weight-lifting, as the models could have done with a bit of assisting breeze. However, a start was made, very good performances being the order of the day.

The competition finished on a very exciting note, our only lady member having a good lead with a flight of 58.5 secs. only to be pipped on the post by the last flight of the competition, 60 secs. dead. This might not have happened but for the freshening breeze, which was by this time making itself apparent.

An adjournment was made for lunch, after which preparations were made for holding the climbing competition. In this event models R.O.G., the machine taking off nearest to and clearing a tape 6 ft. high, being adjudged the winner.

Now we get to the galling part of things. The breeze, which before lunch had been just nice, now began to strengthen to such an extent that not one model could even reach the tape, let alone clear it! After repeated attempts, and the subsequent crashing of a number of models, the event was abandoned. This incidently, was the third attempt made at holding this particular competition, and if things don't change it looks as if it will never be held.



MAYFLY II
TIME UP TO SEPT. 4 min
DESIGNED BY
C.S. RUSHBROOKE
SALE. CHES. ENGLAND
25 1/2
TPR BOX SPAR
RIBLETS
TUBE
ROD
DIHEDRAL 3 1/2"
1/4 x 3/16 TPR
1/16 SPACE ON ALL RIBS
1/20 STOCK
WING SET 2° POS TO THRUST LINE
RAF 32
1/32 SIDES
BAM PEGS
1/32 BALSA
3/16 x 5/32 L
5/32 x 1/8 T
BRACES EVERY 2nd BAY
BRASS BUSH.
SOLDER
CLUTCH
1/8 x 5/8 x 1
1/16 SHEET
HARD BALSA
DOWN THRUST -2°
1/16 STRINGERS
POWER 10-12 STR 3/16 BLACK
WEIGHT OF MODEL 4.75 oz
31
STAB SET -1° TO THRUST LINE
1/32 BALSA VENEER
SLOT TO FIT 3/32 SPAR
BAM PEGS
BAM
RUBBER FIXING
1/16 STRINGERS COVER WITH 1/32 VEENER
COVER WITH JAP TISSUE
ADJUST
#13
FROM OVAL NOSE TO SQUARE SEC. ON 4th BAY
2" WHEELS 3 1/8 DISCS STREAMLINE
BRASS TUBE
#15
1/32 BALSA
1/16 SQ.
1/8 SQ.

All this indicates our greatest problem, e.g. quickly variable weather and high winds. The damage is not done during flight, but through the unfortunate "cartwheeling" after landing. It's a heart-breaking job to see a model bowling along wing-tip over wing-tip, whilst one is pounding along like fury to retrieve it before it is battered to pieces.

These conditions are, I think, some excuse for the spruce and silk models popular in some districts, though this cannot be said of the L.M.A.S. members, who are "balsa fiends". Personally I have always used, and am firmly of the opinion that the all-balsa model, providing the proper constructional methods are used, can be built stronger and lighter than a corresponding spruce job. A great deal is being done with special section balsa by club members, and some amazing results have been achieved.

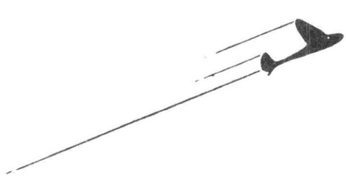
Thermals are noticable by their scarcity, though on the few occasions I have struck them they have proved rather a mixed blessing. A few facts will bear me out in this. My first high-performance job was built in 1933, and did its stuff well enough to secure me a place in the official English Wakefield team of that year. On the day of the contest I was unable to pass the eliminating test, mainly owing to my own thoughtlessness and inexperience, another of our members, Mr. J. W. Kenworthy, bagging the trophy.

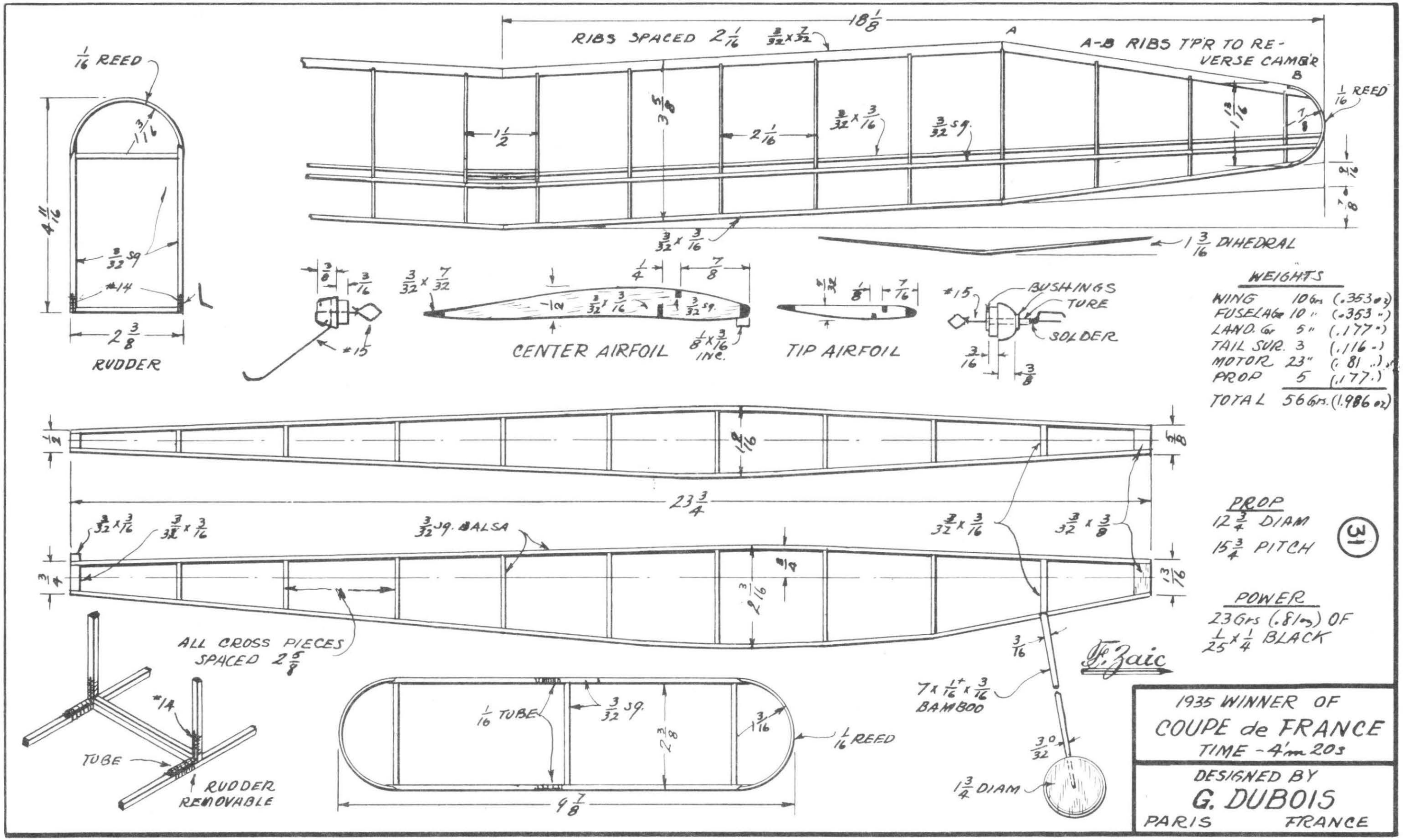
However, the following week I was fortunate enough to win a Challenge Cup with the model. The next Sunday was boiling hot, and after a gliding hop for trimming purposes, I put 300 turns on the job and sent it off. Lovely spiral climb, too lovely, for it just kept going up and up till lost to sight after about 12 minutes, and has never been seen since.

Practically the same thing happened to my 1934 Wakefield model. This would not perform at all well on the great day, owing, like so many others, to the apalling conditions the contest was run under. A few weeks later we were at Woodford aerodrome for our annual attempt for the Farrow Shield, (an All-England club contest which the L.M.A.S. won by a handsome margin.)

After a day of showers the weather improved considerably, and on putting my model up, it disappeared from sight after a timed flight of 6 mins. 16 secs. After a long search the model was given up, but was returned to me two months later in a brown paper bag, it having finished its career by passing through a reaping and binding machine. Another model that day was officially timed for 23m 17s and landed 1 hr. 50 mins. after being launched. English timing however, is only carried out from the starting point, hence the impossibility of comparison with American records.

Conditions here may be summed up as being occasionally quite good, sometimes fair, but the majority of the time ROTTEN. It's most maddening to have a week of really fine weather, only for Sunday to turn up windy or raining. In fact, the English aeromodellist's dream is, "Oh for Yankee conditions, then wouldn't we show 'em what's what!




RIBS SPACED 2 1/16
3/32 x 7/32
18 1/8
A
A-B RIBS T'P'R TO REVERSE CAMB'R
B
1/16 REED
1 1/2
2 1/16
3/32 x 3/16
3/32 SQ.
1 3/16
3/32 x 3/16
1 3/16 DIHEDRAL
RUDDER
2 3/8
4 11/16
#14
#15
CENTER AIRFOIL
TIP AIRFOIL
8 x 3/16 INC.
BUSHINGS
TUBE
SOLDER
WEIGHTS
WING 10 Grs (.353 oz)
FUSELAGE 10 " (.353 ")
LAND. Gr 5 " (.177 ")
TAIL SUR. 3 (.116 ")
MOTOR 23" (.81 ")
PROP 5 (.177)
TOTAL 56 Grs. (1.986 oz)
23 3/4
3/32 SQ. BALSA
3/32 x 3/16
3/32 x 3/8
PROP
12 3/4 DIAM
15 3/4 PITCH
31
POWER
23 Grs (.81 oz) OF
1/25 x 1/4 BLACK
ALL CROSS PIECES SPACED 2 5/8
TUBE
RUDDER REMOVABLE
1/16 TUBE
3/32 SQ.
1/16 REED
9 7/8
7 x 1/16 x 3/16 BAMBOO
1 3/4 DIAM
F. Zaic
1935 WINNER OF
COUPE de FRANCE
TIME - 4'm 20s
DESIGNED BY
G. DUBOIS
PARIS FRANCE

MODEL AIRPLANE PROPELLERS

By Geo. L. Lawrence

Specially Written For Frank Zaic's Yearbook.

The importance of the propeller to the performance of a model is not appreciated by most builders. A model carries just so much energy which is available for driving it. Whether this energy is in the form of wound rubber, compressed air, gasoline or any other form, the amount is limited, and the slower it is necessary to use it, the longer the model will remain in the air. Since the propeller is the means of converting this energy into forward thrust to fly the model, it is of extreme importance to have the propeller waste as little energy as possible.

Most of the propellers used on models develop an efficiency of less than 50%. This is an inexcusable waste of energy and duration as it is possible for a properly designed model propeller to have an efficiency as high as 70% or better. It is the purpose of this article to explain how you can secure higher operating efficiencies from your propellers, and to do this clearly we must first explain just how the propeller works.

The prop is really a set of wings which travel in a helical or twisting path around the propeller shaft. The "LIFT" of these wings is horizontal or parallel to the shaft and the "DRAG" or "RESISTANCE" of these wings is the load which the "TORQUE" or twisting force of the motor must carry. The greater the "LIFT" of these wings or propeller blades the greater the thrust of the propeller, and the lower the "DRAG" of the blades the less power will be needed to drive them and the longer the energy in your motor will last.

Figure 1 is a diagram of a section through a propeller blade showing the directions of the "LIFT" or "THRUST" and the "DRAG" or "TORQUE"

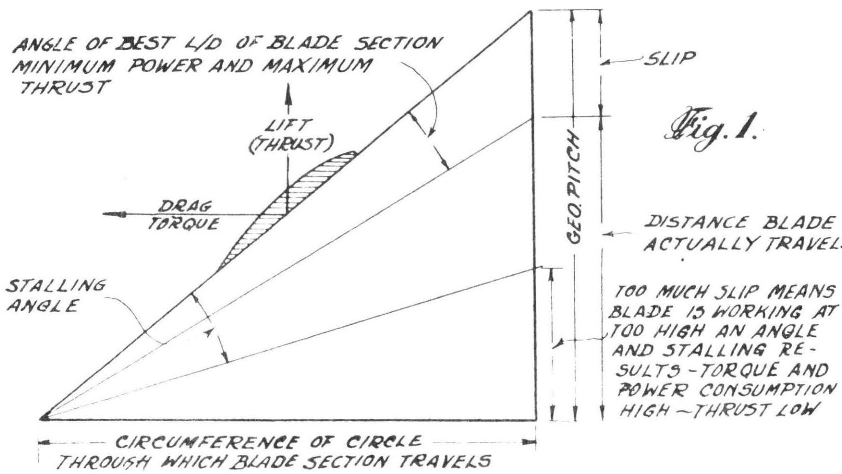
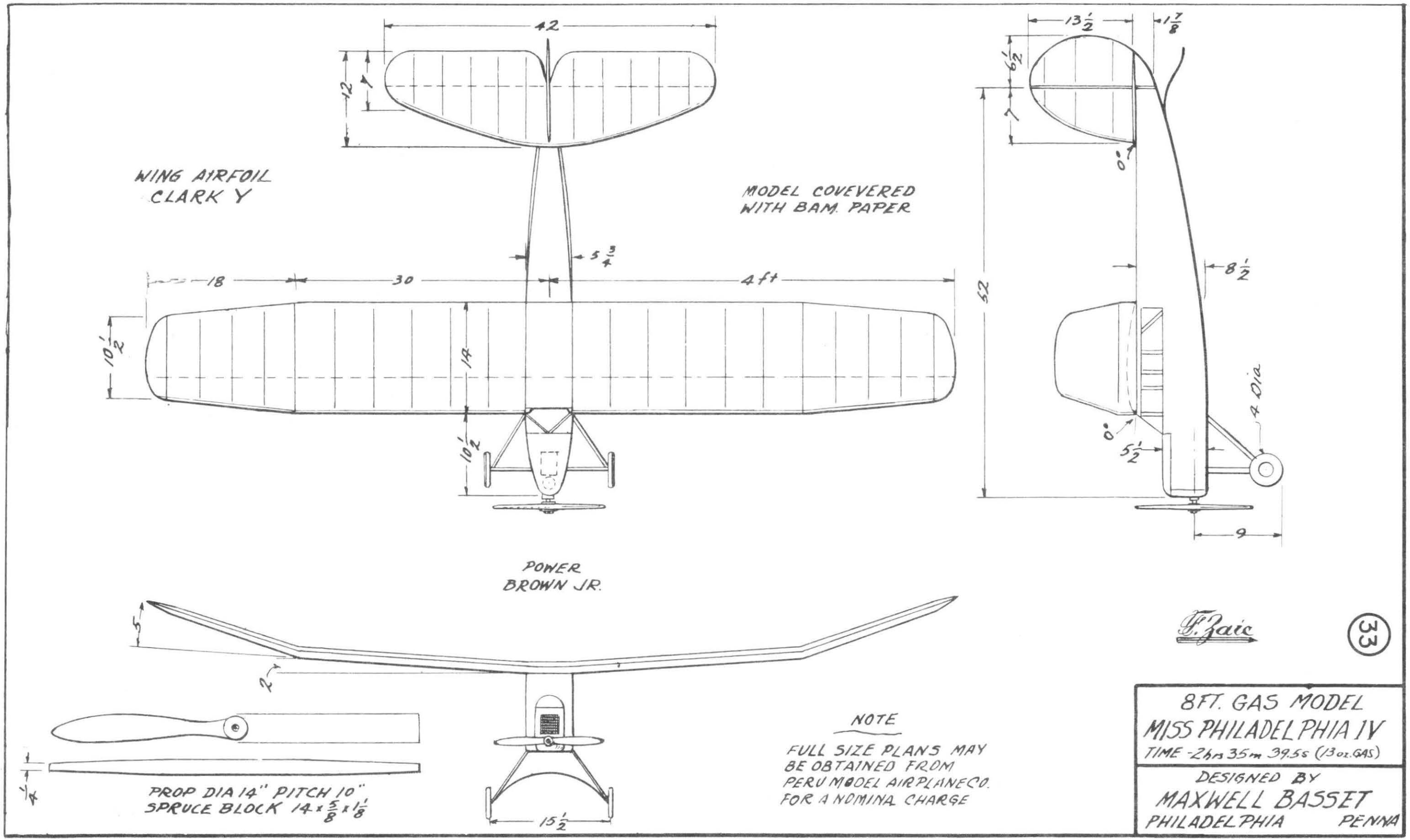
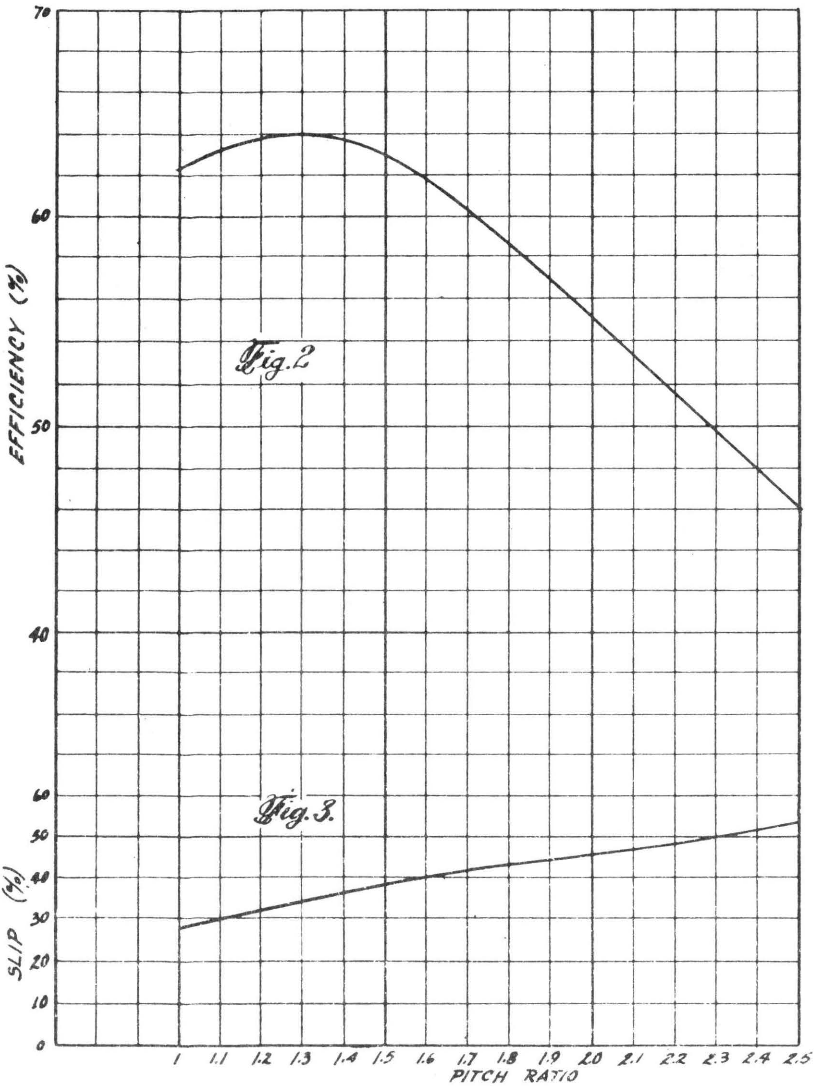


Fig. 1.

Let us assume that the blade section shown is 5" from the shaft, and that its angle is 45°. In one revolution it will travel through the circumference of a 10" circle, (5" radius), which is 31.416". Since the angle is 45° it would travel forward the same distance if it did not slip, which distance would also be the pitch. (The pitch and circumference are the same only at the point on the blade where the angle is 45°.)


33
8 FT. GAS MODEL
MISS PHILADELPHIA IV
TIME - 2hrs 35m 39.5s (13 oz. GAS)
DESIGNED BY
MAXWELL BASSET
PHILADELPHIA PENNA
WING AIRFOIL
CLARK Y
MODEL COVEVERED
WITH BAM. PAPER
POWER
BROWN JR.
NOTE
FULL SIZE PLANS MAY
BE OBTAINED FROM
PERU MODEL AIRPLANE CO.
FOR A NOMINA CHARGE
PROP DIA 14" PITCH 10"
SPRUCE BLOCK 14 x 5/8 x 1 1/8
F. Zaic
42
12
7
18
30
4 ft
5 3/4
10 1/2
14
13 1/2
1 7/8
6 1/2
52
8 1/2
5 1/2
4 Dia
9
5
2
1/4
15 1/2



Propellers having "PITCH RATIOS," (pitch divided by diameter), of 1.0, 1.25, 1.5, 1.75, 2.0 and 2.5 were tested. Figure 2 shows the maximum efficiency obtained with each pitch ratio. It will be seen that propeller #2 with a pitch ratio of 1.25 showed the highest efficiency, but the curve indicates that a pitch ratio of about 1.3 would be slightly better. The efficiency drops lower as the pitch ratio is either decreased or increased. Since the tendency with model propellers is to use too high a pitch the tests were confined to this end of the curve.

Most indoor propellers are made with pitch ratios of 2.0 or higher, and very few outdoor propellers are made having pitch ratios as low as 1.5. The only time there is any excuse for using high pitch propellers is where weight is of great importance, as in the case of indoor models, where the use of a high pitch permits a smaller diameter and the saving in weight will make up for the loss of efficiency. Even so, it will be clear from the curve in Figure 2 that the use of a pitch ratio higher than 1.6 to 1.75 will cause a greater efficiency loss than can possibly be made up by the saving in propeller weight. In outdoor models the propeller weight is not so important and there can be no saving that would justify a pitch ratio higher than 1.5.

Lest you think the writer is wrong on this subject it might be well to say here that the laboratory tests of both the U. S. and British Aeronautical Advisory Committees show a pitch ratio of 1.3 to give the highest efficiency.

Figure 3 shows the percentage of slip at which the highest efficiency was found in the writer's tests and will serve as a guide to propeller performance. The higher the pitch ratio the more the propeller has to slip to reach its best working angle. The slip of your own props can easily be checked by counting the number of turns used and measuring the distance the model travels on a short trial flight.

There are several other points of design which effect propeller efficiency such as the blade shape, camber, etc., but as the writer has not made actual tests to determine these characteristics he can only give you his opinion. With this in mind the following may prove helpful.

Wider blades should be used on small propellers, (in proportion), than on large ones. This is due to what is known as scale effect or the relation of the chord of a wing or blade to the density of the air. It is the writer's opinion that the maximum width of the blades should range from about 10% of the diameter on 24" propellers or over, up to about 20% of the diameter 4" or 5" props.

The blade section should resemble a good wing section, more camber being used on indoor props that turn slowly than on faster turning outdoor props. Even the outdoor props should have some camber as their blade speed is comparatively slow.

A smoothly curved blade outline is advisable with the widest point about two thirds of the radius from the center. The widest point should be nearer the tips on high pitch props than on low pitch ones.

It is practically impossible to accurately design a propeller to fit any new model. The writer recommends keeping on hand an assortment of props of different sizes but all of the same pitch ratio. This pitch ratio should be about 1.3 for outdoor props and about 1.5 for indoor props. A new model should be tested with these props and when one is found that seems slightly too large it can be gradually trimmed down to less area until its slip is just right. A low pitch ratio is best for these trial props so that after a little trimming they will still have a pitch ratio of from 1.5 to 1.75 for outdoor or indoor props, respectively. Accurate, true pitch machine cut propellers can be used to advantage for this trial assortment and can easily be duplicated to avoid breaking the trial set. Machine cut propellers, if made to the proper pitch ratio, will save the model builder much time and will eliminate mistakes in figuring pitch and laying out prop blocks.

It is clear that the propeller cannot fail to slip, in air, if there is any load on it. If it did not slip it could only be because it was pulling no load, and if it was not pulling any load it would be doing no work. If it is doing no work its efficiency is ZERO.

If the propeller slips 100% and does not move forward at all it is not actually pulling or moving its load so it is doing no work. Since it is doing no work its efficiency is ZERO.

If the efficiency is zero with no slip and with 100% slip the most efficient working point must be somewhere between these two extremes. Let us find where and why.

A wing operates most efficiently at the angle to the air at which its drag is lowest in proportion to its lift. This is called the angle of maximum lift over drag, (L/D), and is usually about 5°. As the propeller begins to slip, the blades meet the air at an increasing angle, and when it is slipping enough for the blades to be operating at the angle of maximum L/D it is working at its highest efficiency. This is shown in Figure 1.

Since the air is flowing into the propeller from the front it will seem to be slipping more than it really is when the blades are operating at their best angle.

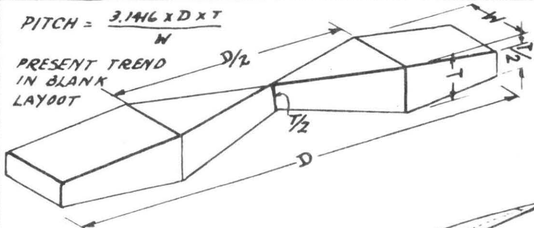
If the load is too great for the area and pitch of the prop, it will slip too much. This makes the blades work at a higher angle and the propeller will lose thrust and stall just as a wing loses lift and stalls if the angle becomes too great. The drag of the blades becomes much greater at the stalling angles with the result that a great deal more power is required to turn it. This increase of drag together with the loss of thrust does terrible things to the efficiency.

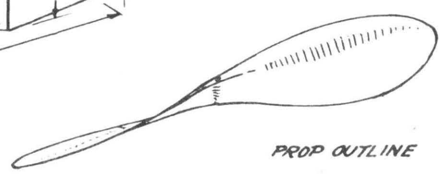
To secure the ideal condition of proper angle and highest efficiency the blades must have just the right amount of surface. Too much area in the blades will not allow the propeller to slip enough for the blades to work at their best angle, and too little area will allow it to slip too much and reach the stalling angle.

Blade area is by no means the only factor that controls the efficiency of the propeller. The pitch is far more important. If the pitch is too low the propeller must make more revolutions to travel a given distance and too much power will be consumed in turning it. If the pitch is too high the propeller lacks "GRIP" and a slight overload will stall it. Even under ideal conditions of correct slip a high pitch propeller cannot develop good efficiency.

The charts in Figures 2 and 3 are the result of hundreds of tests of model propellers. These tests were made on specially designed equipment which enabled the writer to accurately measure the slip, power used, work done by the prop the the resultant efficiency. The tests were made only to determine the best pitch and not with the idea of finding out how high an efficiency could be reached. This and other information will be obtained from future tests. The propellers used in these tests had square tips and straight edges. They were all 10" in diameter, the blades were 1" wide from the tips half way to the center and tapered from this point to a width of ½" at the hub. The blades were about as thick as would be used on a light outdoor prop and the section was perfectly flat on the back. A slight camber was used on the front of the blades to give them the necessary thickness. There is no doubt but that a cambered section and a rounded blade shape would have given higher efficiencies, but these particular tests were made only to determine the best pitch.

NOTES ON PROPS





PROP OUTLINE

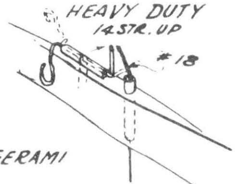
SINGLE PROP MODELS

WING AREA	DIA
100 - 150	12 - 15
150 - 200	15 - 17
200 - 300	18 - 20

COVER PROPS WITH PAPER
" " " SILK
WHEN USING 16 STRANDS OR MORE

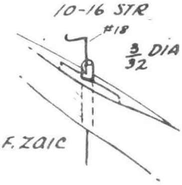
FREE WHEELINGS

HEAVY DUTY
14 STR. UP



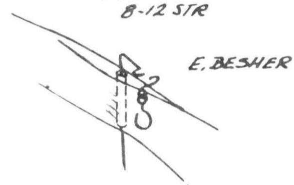
L. GERAMI

AVERAGE
10-16 STR



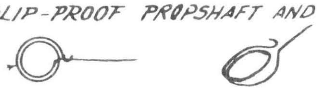
F. ZAIC

AVERAGE
8-12 STR



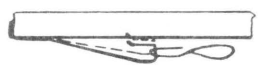
E. BESHER

SLIP-PROOF PROPSHAFT AND 'S' HOOK

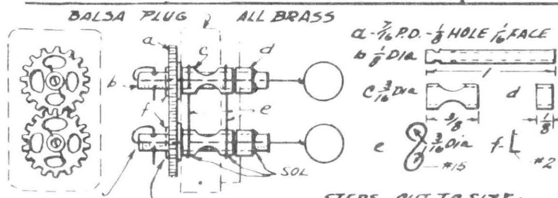


DOUBLE TURN OPEN
BY F. ZAIC

REAR HOOK



BY L.G. LAWRENCE

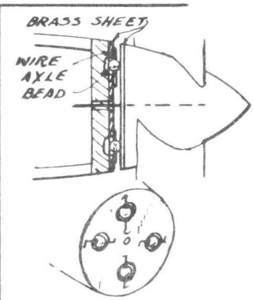


BEND & LOCK
f PIN - BEND & SOL. TO GR. & TUBE

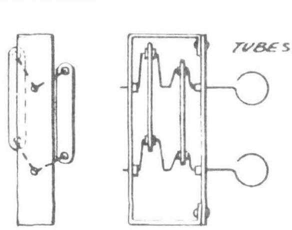
SOURCE
BOSTON GEAR WORKS - N.Y.C.
CHICAGO GEAR WORKS
767 W. JACKSON BLVD. CHICAGO

STEPS - CUT TO SIZE
ATTACH - a. t. b - c. to c.
ASS'M - HOLD SHAFTS & SOL. d.
INSERT SHAFTS & LOCK
WT. (INCL. PLUGS). 25 oz

SIMPLE REAR GEAR ASSEMBLY by F. Zaic



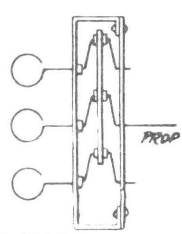
BEARING By V. Sorensen



WIND IN FRONT
USE IN THE REAR

2

10 STRAND
THREE MOTORS GIVE
TORQUE OF ONE 20
STRAND MOTOR BUT
WITH TURNS OF A
10 STRAND MOTOR



WIND IN THE REAR
USED IN THE FRONT

"JIGGERS" By G. RITZENTHALER

GRADING OF BALSA WOOD

It is very difficult for model builders to obtain balsa wood of the same weight and strength characteristics in every order they buy as the majority of supply houses merely cut the wood to size without attempting to grade it for specific use. Since it is desirable, from the builders' viewpoint, to be sure of what he is buying, the following table was set up by Jasco for their convenience.

3.8 lbs. to 4.5 lbs--	Indoor hollow motor sticks and tail booms, 1/64 Stock and prop blocks.
4.5 lbs. to 5.5 lbs--	Indoor Spar stock, Ribs and Tips. Should have stringy grain.
5.5 lbs. to 7.5 lbs--	1/20 Indoor Fuselage Strips, Glider wings and tail surfaces.
7.5 lbs. to 9.5 lbs--	Glider Fuselages and General Outdoor work, Props and etc. for the average models.
9.5 lbs. and up------	Twin Pusher Frames, Props for heavier models, and for Gas Jobs.

(The above poundage is based on pounds per Cu.Ft. scale.)

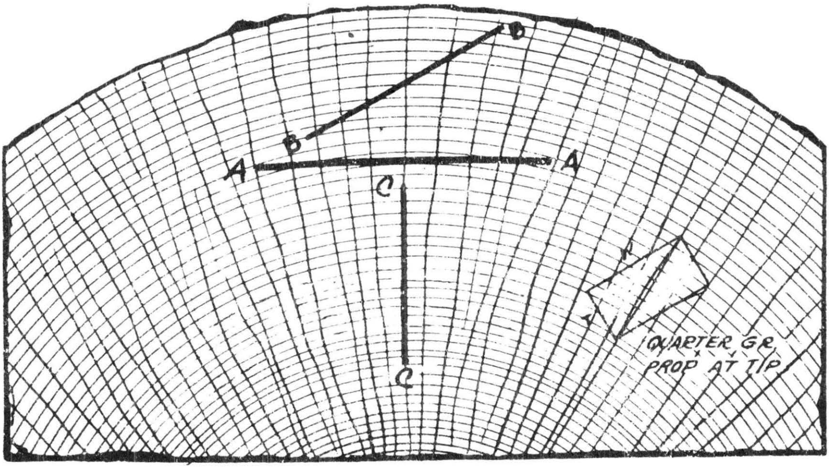
Besides grading the wood by weight it is also necessary to saw it so that the grain will run in a certain manner depending on the use for which the wood is intended.

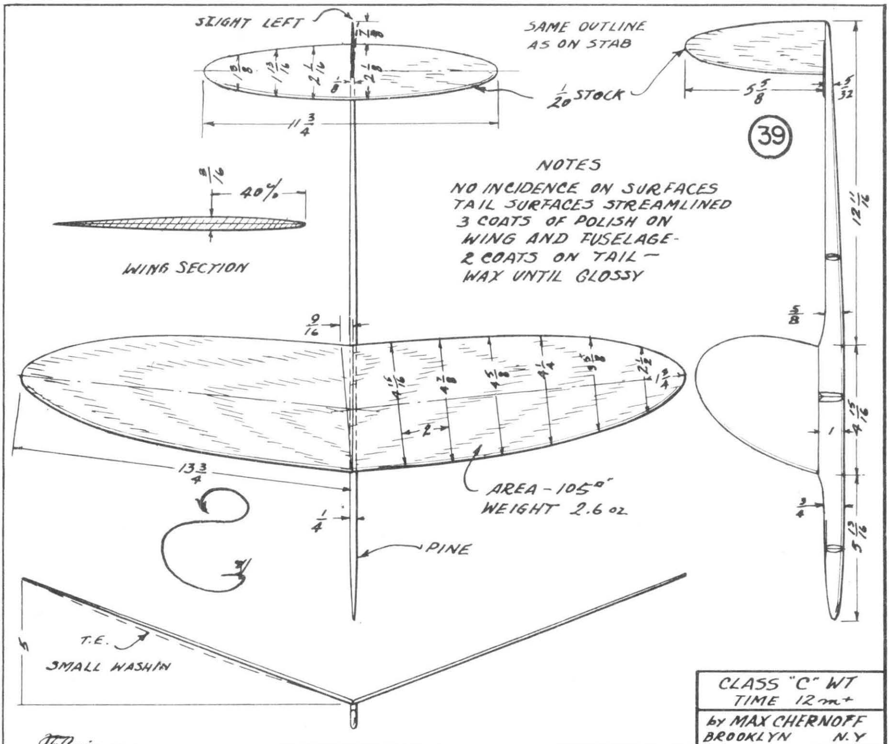
Below is a cross section of a log explaining this point.

Balsa sheets cut along 'A-A' will be excellent for making tubings and wherever curved parts have to be covered with balsa. This cut is made to include as much of the annular ring as possible because this wood is nearly of the same texture throughout since it was all growing at the same time.

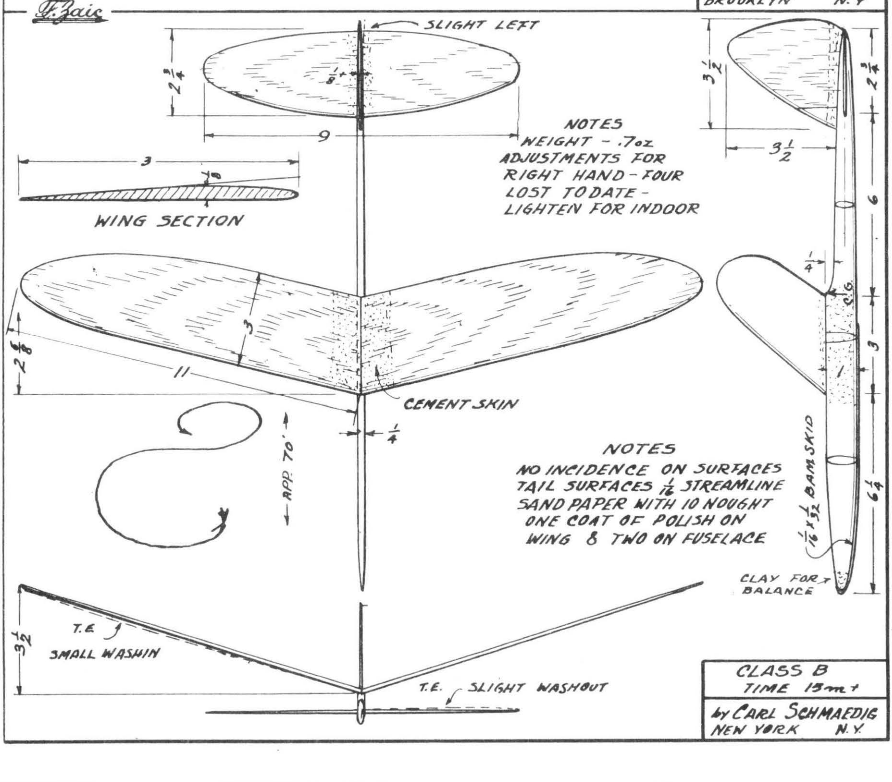
Sheets cut along 'C-C' should be used for ribs or wherever stiffness is needed. This cut has a scallopy surface-appearance. The cut along 'B-B' is the most common and it should be used for all work not covered by the 'A'. and 'C'. cuts.

The pushing of this matter of grading wood rests with the model builders as manufacturers depend on us to supply them with information of our needs. When sending in your next order be sure to specify the grade and the cut by letter. Now that the above information has been disclosed there is no reason why we cannot standardize the grades of dressed balsa.





SLIGHT LEFT
SAME OUTLINE AS ON STAB
1/20 STOCK
11 3/4
5 5/8
5/32
39
NOTES
NO INCIDENCE ON SURFACES
TAIL SURFACES STREAMLINED
3 COATS OF POLISH ON
WING AND FUSELAGE-
2 COATS ON TAIL—
WAX UNTIL GLOSSY
40%
WING SECTION
9/16
12 11/16
5/8
2
13 3/4
AREA - 105□"
WEIGHT 2.6 oz
1/4
PINE
3/4
5 13/16
T.E.
SMALL WASHIN
5
CLASS "C" WT
TIME 12 m+
by MAX CHERNOFF
BROOKLYN N.Y
F. Zaic



SLIGHT LEFT
2 3/4
3 1/2
1/8
9
3 1/2
NOTES
WEIGHT - .7oz
ADJUSTMENTS FOR
RIGHT HAND - FOUR
LOST TO DATE -
LIGHTEN FOR INDOOR
3
WING SECTION
6
1/4
C.G.
3
2 5/8
11
CEMENT SKIN
1/4
APP. 70'
NOTES
NO INCIDENCE ON SURFACES
TAIL SURFACES 1/16 STREAMLINE
SAND PAPER WITH 10 NOUGHT
ONE COAT OF POLISH ON
WING & TWO ON FUSELACE
1/16 x 1/32 BAM. SKID
6 1/4
CLAY FOR BALANCE
T.E
SMALL WASHIN
3 1/2
T.E. SLIGHT WASHOUT
CLASS B
TIME 13 m+
by CARL SCHMAEDIG
NEW YORK N.Y.

GLIDER

Up to 1930 most of the hand-launched gliders were of light and weak construction. The average time was only 10 seconds as the model just could not be thrown high enough. It was like throwing a feather.

At about this time the writer and his brother John began to build ships of heavier and sturdier construction. The duration was a little better but remained comparatively low. This heavier glider was still of the conventional straight wing design. After this we tried different plan arrangements and found that the gliders with sweptback wings gave us much better endurance.

At first the sweepback glider was launched in the conventional way. That is, the ship was thrown straight up in the hope that it would make a snap roll at the top of the throw. A few more months passed and then John, by trying all conceivable adjustments, discovered that by throwing the model sidewise he could get it to a greater height than ever before. Another point in favor of his adjustments and type of launching was that the ship would come "out on top" nearly every time and then would commence circling in such a manner as to take best advantage of any thermal currents.

The first minute glider flight made was the biggest thrill of the year for us. By this time the rest of the N. Y. Aeronuts, especially John Young, began to experiment with this type of model. The result is the present high performance sweepback glider.

If you want really good glider flights your glider must have strength and a minimum of drag and you must have a good launching system. Stability is obtained by using a large dihedral angle on your wing with sweepback. (This arrangement helps to bring the C. G. and the C.R. into line.) Sweepback brings the C.G. to the rear and so makes the fuselage balance more or less around this point. This action is very important as the inertia forces on both sides of the C.G. should be equallized as much as possible. (Sweepback also permits of a stronger wing joint as there is more gluing surface available for use than there is on the joint faces of a straight wing.) The rudder should be made large enough to bring the D.C. behind the C.G.

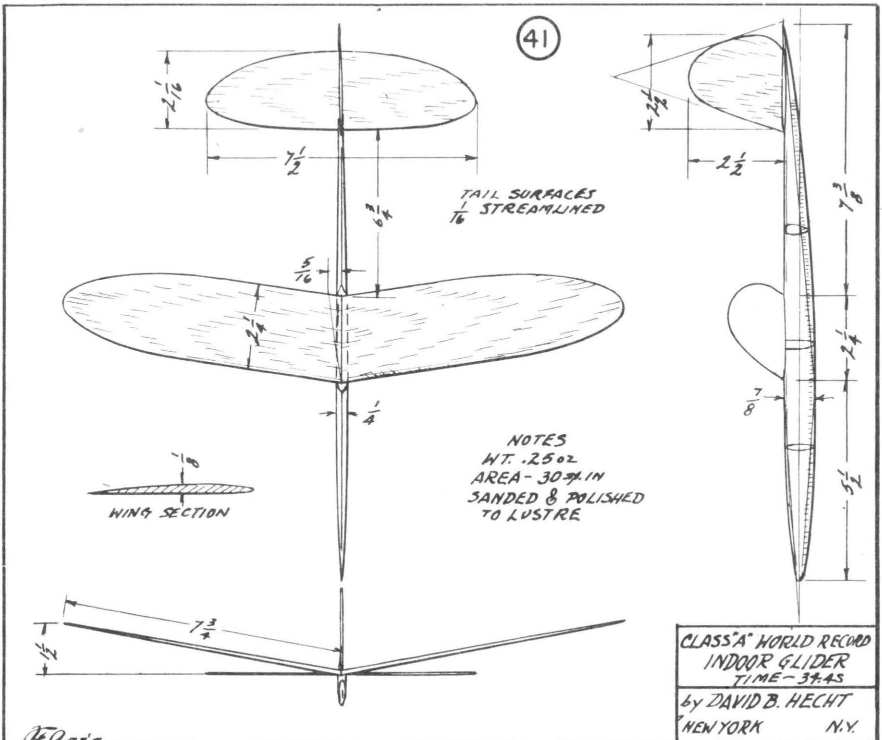
STRENGTH

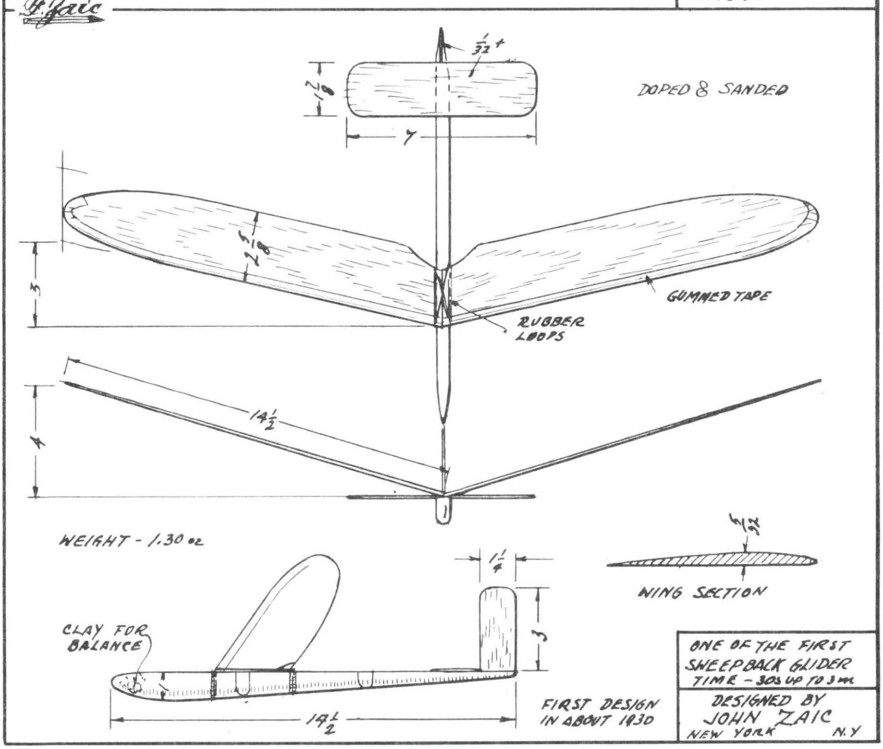
During the launching the whole glider and especially the wing must withstand terrific stresses. It is, therefore, advisable not to make the wing and tail surfaces too thin. Wings of 1/8" medium stock and tail surfaces of 1/16" light stock are usually sufficiently strong for 30-60 square inch jobs.

It is advisable to use hard balsa for the fuselage as this part of the ship "gets the worst of it" on bad landings. Wings and tail surfaces, as stated before, should be made of medium balsa and light balsa respectively. It is important to take the utmost care in making the joints of the various parts of the glider as all that is needed to ruin it is just one faulty joint. When cementing the wing to the fuselage, give the joint at least three coats of cement and be rather generous in spreading the cement an inch or so beyond the center on to both halves of the wing.

SKIN FRICTION

To get the best gliding angle from any glider it is very important that every part not only be streamlined but also polished so as to minimize skin friction. The art of streamlining being quite well known by most of us, we will deal with the reduction of skin friction only.


41
TAIL SURFACES 1/16 STREAMLINED
NOTES
WT. .25 oz
AREA - 30 sq. IN
SANDED & POLISHED TO LUSTRE
WING SECTION
CLASS "A" WORLD RECORD INDOOR GLIDER
TIME - 34.4S
by DAVID B. HECHT
NEW YORK N.Y.
F. Zaic


DOPED & SANDED
GUMMED TAPE
RUBBER LOOPS
WEIGHT - 1.30 oz
WING SECTION
CLAY FOR BALANCE
FIRST DESIGN IN ABOUT 1930
ONE OF THE FIRST SWEEPBACK GLIDER
TIME - 30s UP TO 3 m
DESIGNED BY JOHN ZAIC
NEW YORK N.Y.

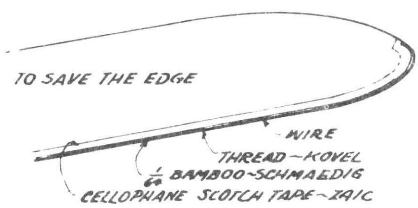
Every part of the glider should be sanded successively with different grades of sandpaper, ranging from rough to smooth, and should then be finished with the smoothest obtainable, (usually about 10.0.) This finishing, forces the fine dust into the pores of the wood thus adding strength to the model. Our job at this point, however, is only half completed. We must now cover the wood surfaces with a celluloid skin that will not only add further strength to the ship but will also give a glassy final finish to the various parts. When this is done we can consider the work of reducing skin friction ended.

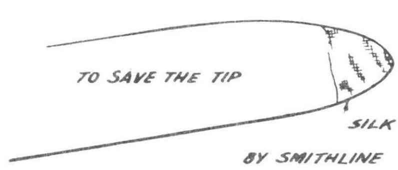
Many glider builders have been successfull using liquid wood filler or water and flour paste (which should be rubbed in and sanded over) to fill in the pores of the wood. For the final polish the best things to use are solutions of banana oil, cement or dope. These finishers should be rubbed in with the fingers and allowed to dry. The parts should then be sanded over with a fine grade of sandpaper. For the final surfacing, polishing wax may be used. However, remember that all these preparations will be of very little help unless they are applied with plenty of elbow grease.

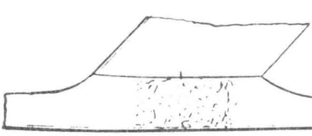
LAUNCHING

Launching is a most important factor in glider flying and it is one that needs frequent practice. There are several methods of launching but only one or two deserve mention. Just as every baseball pitcher has his own individual system, so has the glider launcher. The author has been asked a number of times, "How do these fellows get indoor flights of over 40 seconds and heights of over 80 feet?" Well, if you ovserve the boys at the next contest you will notice that they use all their strength to throw their ships. Anyone equipped with a good throwing arm, a decent glider and a sure launching method can do time with this type of model. The flying adjustments are shown on the drawings.

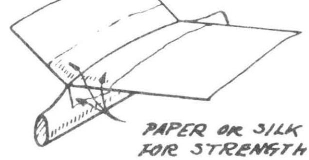
One method of launching is as follows: Grip the glider under the wing and holding it well banked throw it upward at about 45° with a sweeping motion. (Somewhat as you would throw a discus.) The ship will spiral up to the right until the extra lift from the washin on the right wing (looking from the rear) neutralizes the right bank. If the model has been properly thrown, it will "come out on top" and start circling to the left. The most popular method of launching is one in which the glider is thrown like a baseball. The throw, however, is made sidehand and not overhand. (The adjustments should be the same as before.)

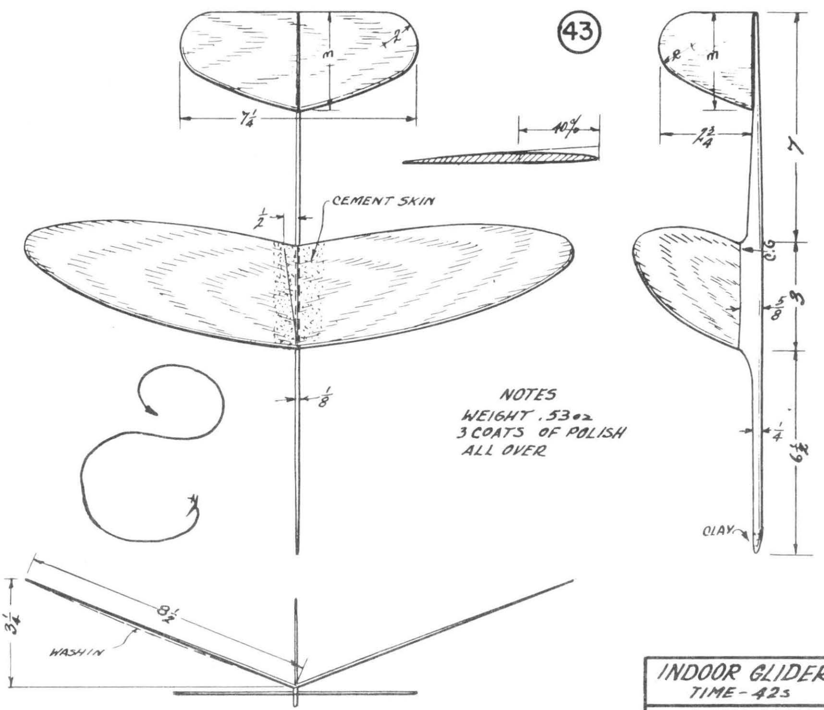






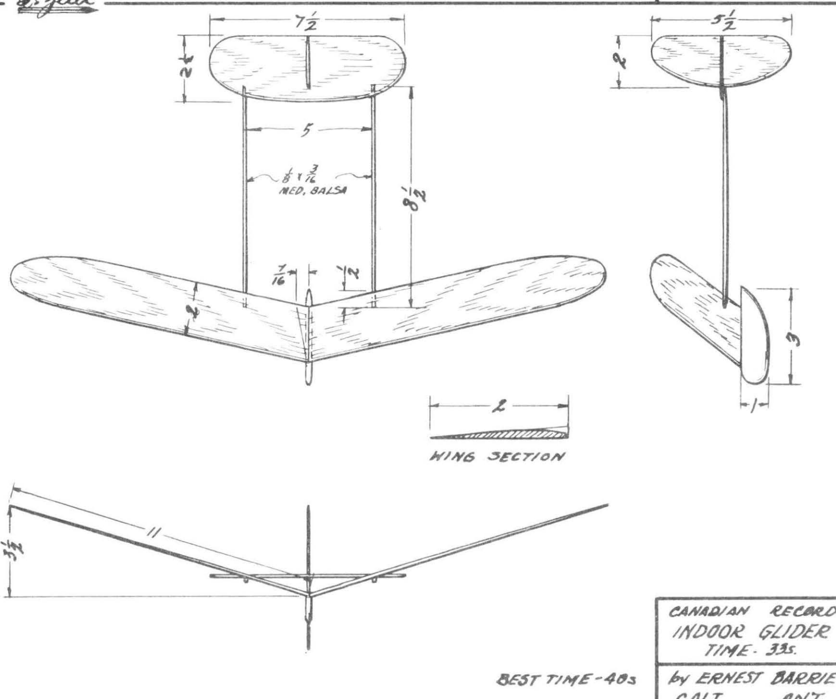
SANDPAPER or SAND-CEMENT
FOR FIRM GRIP





INDOOR GLIDER
TIME - 42s

by COLMAN ZOLA
BROOKLYN N.Y.



CANADIAN RECORD
INDOOR GLIDER
TIME - 33s.

by ERNEST BARRIE
GALT. ONT.

LAUNCHING THE TOWLINE GLIDERS

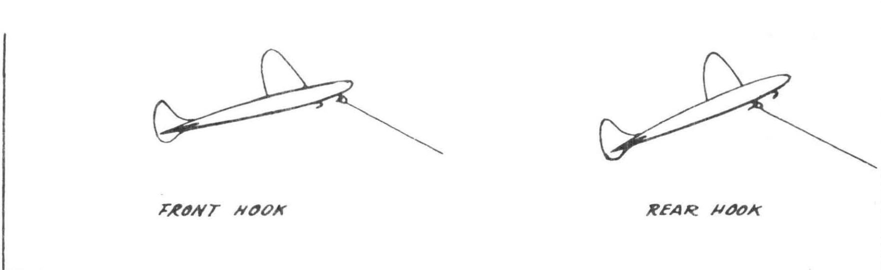
By Henry Struck

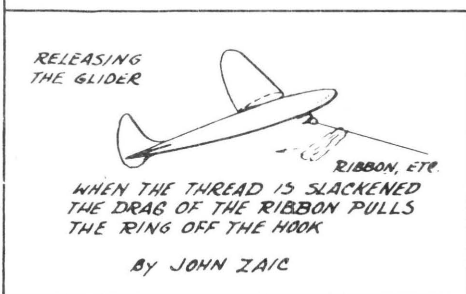
The adjustments of the glider should be such that it has a very flat spiral glide. Do not make the mistake of having it mushing. The position of the towline hook depends on the weather conditions. If the air is calm the hook should be placed so that the model has a good angle of attack which requires lower running speed by having the model kite up. The hook should be moved towards the front in a strong breeze as the extra air speed makes it possible to get the ship to climb without too much effort.

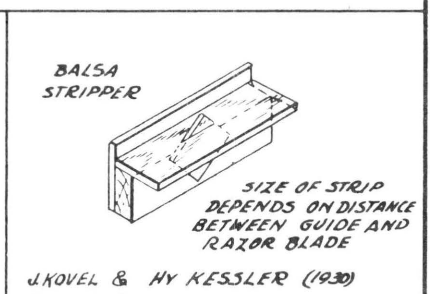
As the model is adjusted for turning, it will naturally tend to turn while being towed. To correct this tendency, the runner slackens the speed and runs towards the side the ship is heading to.

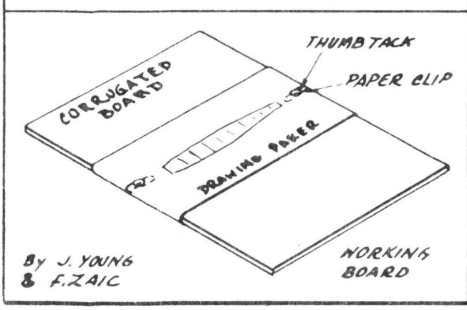
The best moment for releasing the glider is when it is as high as it can go and also in its natural bank. The line can then be given an extra tug and by slackening the speed at the same time the line will drop off the hook. This will also send the glider a little higher and will give it an additional flying speed.

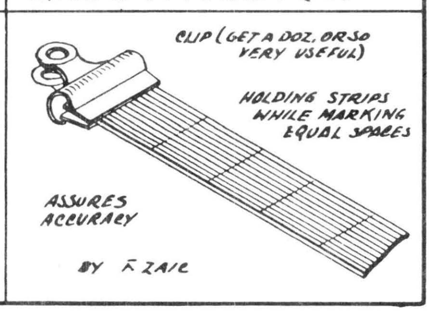
The diameter of the turn varies from 50-60 feet on windy days to a larger diameter on calm days.

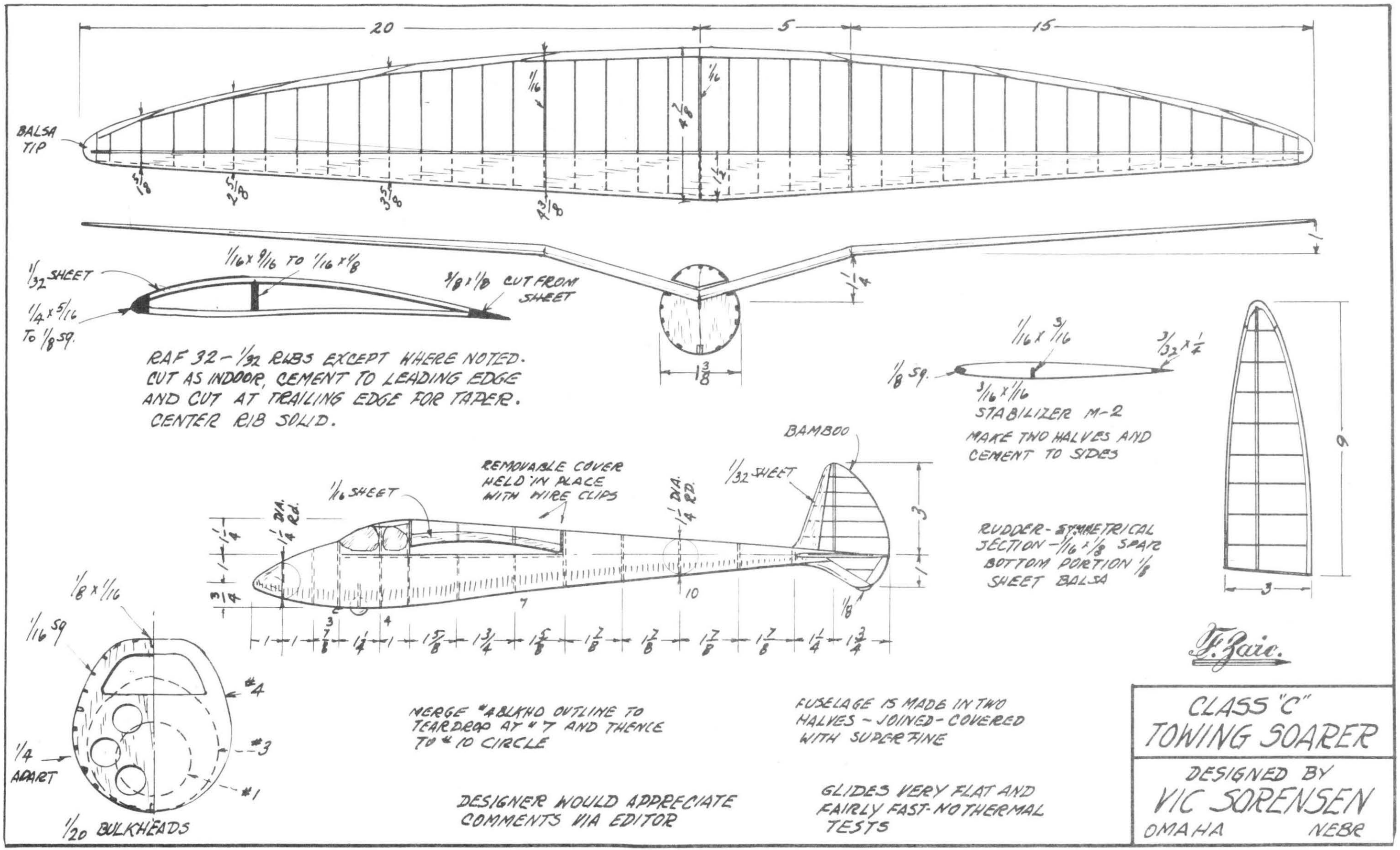












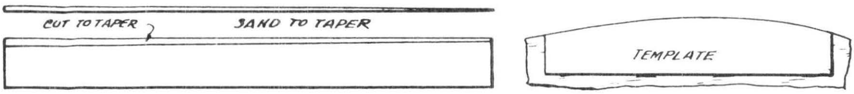
BALSA TIP
RAF 32 – 1/32 RIBS EXCEPT WHERE NOTED. CUT AS INDOOR, CEMENT TO LEADING EDGE AND CUT AT TRAILING EDGE FOR TAPER. CENTER RIB SOLID.
1/32 SHEET
1/4 x 5/16 TO 1/8 SQ.
1/16 x 9/16 TO 1/16 x 1/8
3/8 x 1/8 CUT FROM SHEET
STABILIZER M-2
MAKE TWO HALVES AND CEMENT TO SIDES
BAMBOO
1/32 SHEET
1/16 SHEET
REMOVABLE COVER HELD IN PLACE WITH WIRE CLIPS
1 1/4 DIA. Rd.
1 1/4 DIA. RD.
RUDDER - SYMMETRICAL SECTION - 1/16 x 1/8 SPAR BOTTOM PORTION 1/8 SHEET BALSA
1/8 x 1/16
1/16 SQ
1/4 APART
1/20 BULKHEADS
MERGE #4 BLKHD OUTLINE TO TEARDROP AT #7 AND THENCE TO #10 CIRCLE
FUSELAGE IS MADE IN TWO HALVES - JOINED - COVERED WITH SUPERFINE
DESIGNER WOULD APPRECIATE COMMENTS VIA EDITOR
GLIDES VERY FLAT AND FAIRLY FAST - NO THERMAL TESTS
F. Zaic.
CLASS "C" TOWING SOARER
DESIGNED BY
VIC SORENSEN
OMAHA NEBR

INDOOR CONSTRUCTION

The sizes of the particular components are shown in the drawings of the record ships.

The spars are tapered by sanding the whole balsa sheet into a taper. The strips or the spars are tapered by slicing them off the sheet at an angle. The final shaping should be done with fine sandpaper.

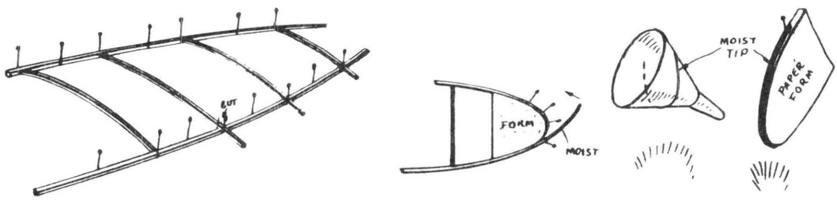
The ribs are sliced from "C" stock balsa sheet, sanded to the required thickness. Use an aluminum, fiber or a bristol board for a template. The ribs are cut to size while assembling the wing.



ASSEMBLING THE WING

Draw the full size plan of the wing on a piece of corrugated board. Stick pins on the spar line just opposite the rib lines. Place the spars on the outline and hold them in place with pins. Cement all the ribs to the leading edge. When dry, trim the ribs by snipping off the part that overlaps the rear spar. Cement in place.

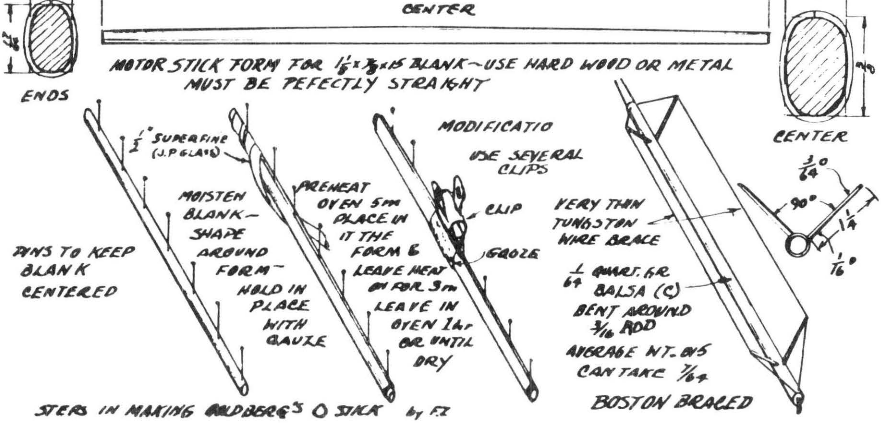
Tips are made by the method shown:

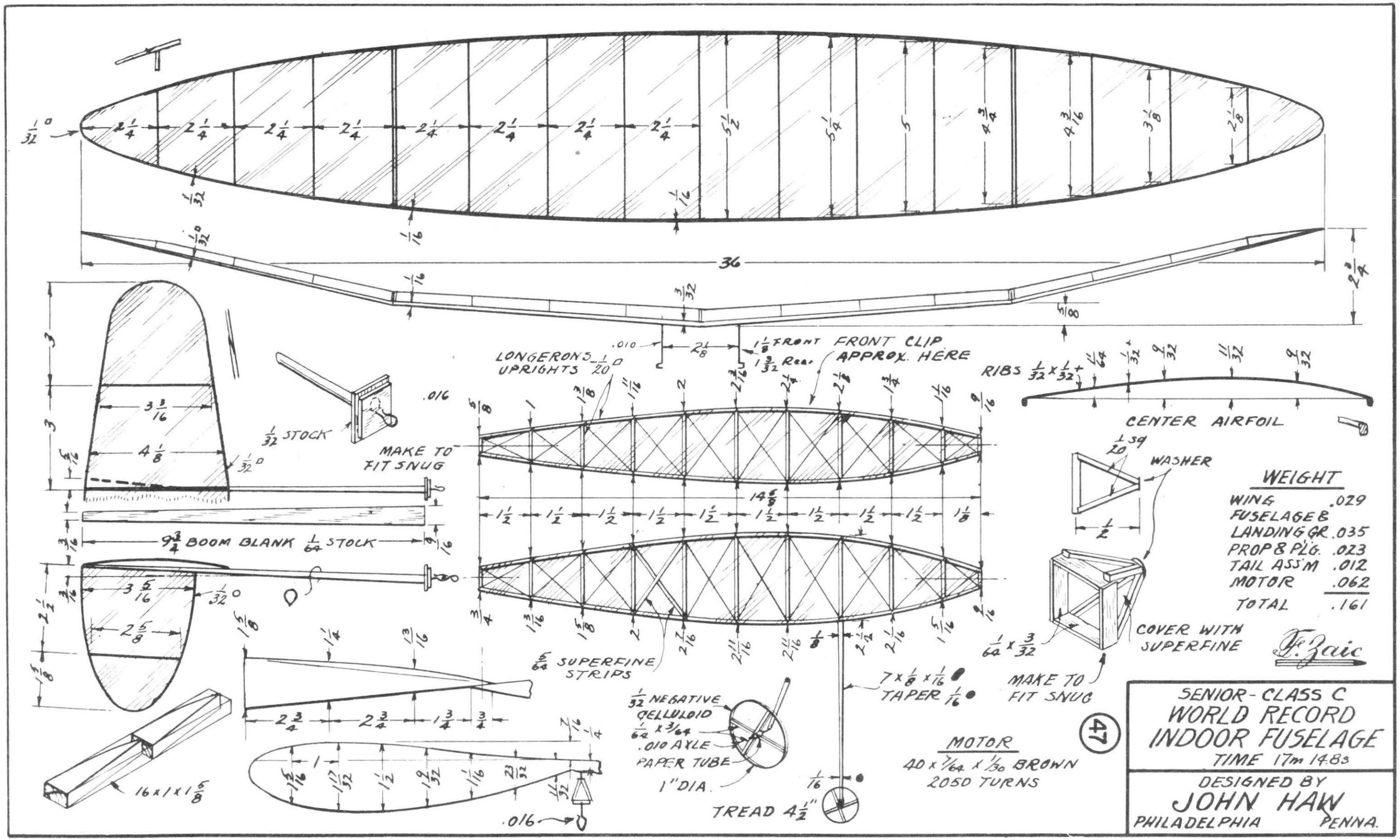


The tail surfaces are made in a similar manner:

MOTOR STICKS & BOOM

Make former out of hard wood or metal. Cut blank to shape; moisten it and bend it around the form as shown.




SENIOR - CLASS C
WORLD RECORD
INDOOR FUSELAGE
TIME 17m 14.8s
DESIGNED BY
JOHN HAW
PHILADELPHIA PENNA.
47
WEIGHT
WING .029
FUSELAGE & LANDING GR. .035
PROP & PLG. .023
TAIL ASS'M .012
MOTOR .062
TOTAL .161
MOTOR
40 x 7/64 x 1/30 BROWN
2050 TURNS
CENTER AIRFOIL
RIBS 1/32 x 1/32 +
FRONT CLIP APPROX. HERE
1 1/8 FRONT
1 3/32 REAR
LONGERONS 1/20 □
UPRIGHTS 1/20 □
36
14 5/8
9 3/4 BOOM BLANK 1/64 STOCK
MAKE TO FIT SNUG
1/32 STOCK
.016
5/64 SUPERFINE STRIPS
1/32 NEGATIVE CELLULOID
1/64 x 3/64
.010 AXLE
PAPER TUBE
1" DIA.
TREAD 4 1/2"
7 x 1/8 x 1/16
TAPER 1/16
WASHER
COVER WITH SUPERFINE
1/64 x 3/32
MAKE TO FIT SNUG
16 x 1 x 1 5/8
F. Zaic

FLYING AND ADJUSTING INDOOR MODELS

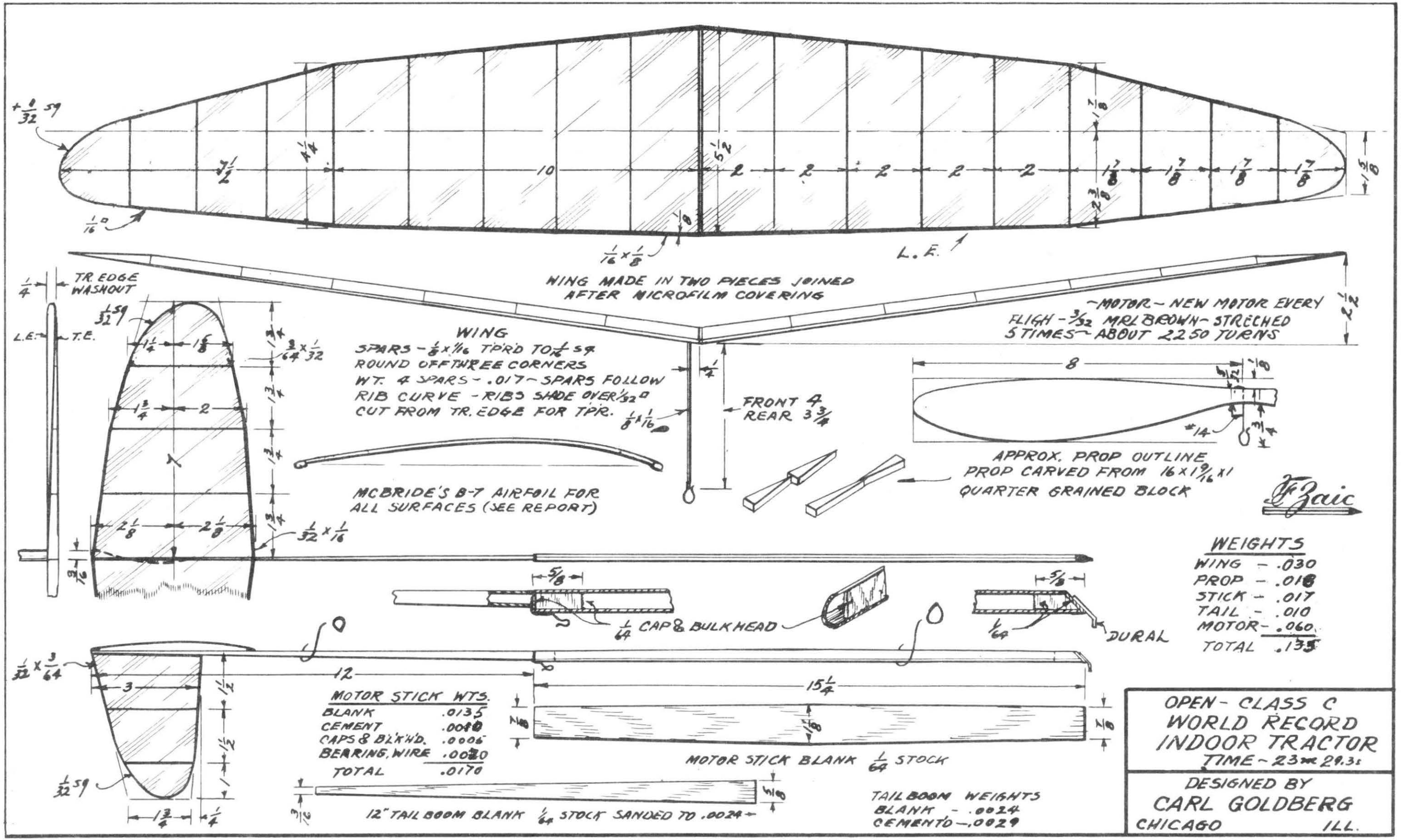
By Carl Goldberg

When launching an Indoor Tractor, hold the model in your natural writing hand, placing the thumb and the first finger on the spot where the wire saddle of the rear wing clip encircles the motor stick. The wire will keep your fingers from crushing the stick, and at the same time allow you a firm grip. Inspect the prop shaft to see that there are no knots of rubber which might make the prop wobble in flight. Usually such knots are present when the motor is tightly wound. Pull them toward the center of the shaft hook and grip the rubber with your free hand about $\frac{3}{4}$" from the hook, allowing the rubber in front of your fingers to unwind until the knots disappear. Loosen your grip slowly, letting the winds from the rear come into the front part of the motor, allowing the prop to spin meanwhile. When it is apparent the knot will no longer give trouble, hold the model up in launching position, which is banked over about 10° in the direction in which the model will normally bank, and with the nose pointing up at exactly the same angle at which you expect the model to climb; then push it gently into the air along the line the motor stick is pointing, and at about the speed at which the model flies.

The best method for adjusting that I know is to set the wing in such a position that the model glides well, and flies smoothly on a few hundred turns. Then make a series of test flights starting with about 800 winds, and adding 200 to each flight. If the model shows any stalling tendency on one of the flights bend the bearing slightly so that the prop leans forward very slightly then try again on the same number of winds. If it works all right, on the next flight again begin adding 200 winds, until you run into more stalling difficulty, which requires a little more of the same medicine. Eventually, by this method you will approach and reach full winds. If the model dives then, bend the bearing back towards its original position a trifle and also turn it so that the prop faces just a shade in the direction in which the ship is to turn.

The writer has been asked a great many times about the advantages of a cambered stabilizer as compared with a flat stabilizer. When using a camber, as the angle of attack is increased, the lift developed is greater than the lift for a flat section, providing the areas are equal. For this reason, it is apparent that a cambered stabilizer will have better "anti-stalling" qualities.

But another, and even more valuable asset of the cambered stabilizer is its use in pulling the ship out of a dive. When a cambered section is set at zero angle or a few degrees negative in the air stream, the section tends to dive. A flat section set at negative angle tends to straighten out to zero degrees. So cambered stabilizers are made with the leading edge just weak enough so that whenever the ship's speed increases, no matter how shallow the dive, the leading edge will bend down, increasing the negative angle of the stabilizer, thus slowing down the ship, and bringing it out of the dive. However, you must be careful to make the leading edge strong enough to withstand the pressure of diving, and rigid enough to maintain its angle when the ship is in normal flight. The proper strength can be found only by experience, as it must not only be strong enough to remain at the proper angle in normal flight, but must also be delicate enough to start assuming a larger negative angle whenever the ship goes a bit faster due to drafts getting under the tail, a weak motor stick, etc.


WING MADE IN TWO PIECES JOINED AFTER MICROFILM COVERING
L. E.
TR. EDGE WASHOUT
WING
SPARS - 1/8 x 1/16 TP'R'D TO 1/16 SQ.
ROUND OFF THREE CORNERS
WT. 4 SPARS - .017 - SPARS FOLLOW RIB CURVE - RIBS SHADE OVER 1/32" CUT FROM TR. EDGE FOR TPR.
FRONT 4
REAR 3 3/4
~MOTOR~ NEW MOTOR EVERY FLIGH - 3/32 MRL BROWN - STRECHED 5 TIMES ~ ABOUT 2250 TURNS
APPROX. PROP OUTLINE
PROP CARVED FROM 16 x 1 9/16 x 1 QUARTER GRAINED BLOCK
#14
DURAL
MCBRIDE'S B-7 AIRFOIL FOR ALL SURFACES (SEE REPORT)
1/64 CAP & BULKHEAD
WEIGHTS
WING - .030
PROP - .018
STICK - .017
TAIL - .010
MOTOR - .060
TOTAL .135
MOTOR STICK WTS.
BLANK .0135
CEMENT .0020
CAPS & BLK'HD. .0006
BEARING, WIRE .0020
TOTAL .0170
MOTOR STICK BLANK 1/64 STOCK
12" TAIL BOOM BLANK 1/64 STOCK SANDED TO .0024
TAIL BOOM WEIGHTS
BLANK - .0024
CEMENT'D - .0029
OPEN - CLASS C
WORLD RECORD
INDOOR TRACTOR
TIME - 23m 29.3s
DESIGNED BY
CARL GOLDBERG
CHICAGO ILL.
F. Zaic

MICROFILM

A satisfactory microfilm solution can be made from standard good clear lacquer, model dope or a mixture of the two, and the right amount of castor oil or tricresyl phosphate. The last two mentioned are called plasticisers and are used to give the film flexibility. Without flexibility, the film is brittle and breaks very easily and when a tear is made, it spreads very rapidly.

Before pouring any solution on the water it is advisable to check the following points:

The film should be made, if possible, in a tank used exclusively for microfilm. If a bathtub is used, be sure that it is scrupulously clean, as the slightest trace of soap will break up the cohesion of water molecules. If the air is too humid or the water too cold, the film will become smoky, by collecting moisture before drying. A cold draft will also cause this. The water should be of normal summer temperature. Hot water will spread the film, and cold water will retard it.

The lifting hoop should be made of 1/8" diameter aluminum wire. (Costs about 2¢ per foot.)

Have at least six inches of cleared space around the hoop, so that the film spreads evenly over it.

Divide the tank into small portions for small size frames. An unlimited water surface area will tend to spread the film until it is too thin for practical purposes.

It is advisable to have some way of measuring the amount of solution used, as it is possible to get film of the same color time after time, providing the same amount of solution is used on similar space.

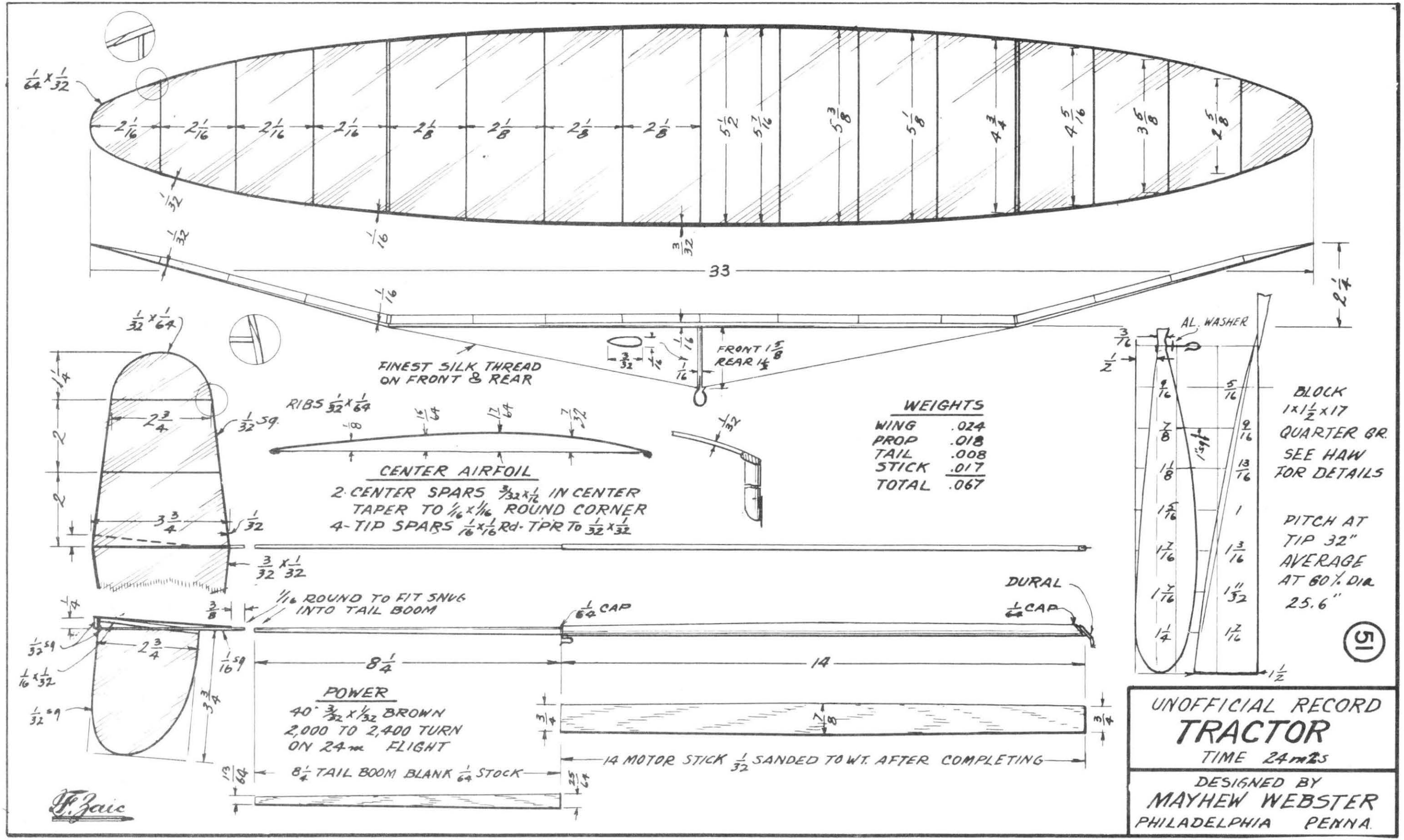
Now that we have the proper equipment we can try our solutions. The first solution should be of just clear lacquer. Pour a short, steady stream on the water and watch the film spread. After a while the edges will begin to crinkle and the whole film will begin to contract. This is a sign that not enough plasticiser is present in the solution. More plasticiser is added in small quantities with trial tests in between. The satisfactory solution proportion will be reached when the edges do not contract and the film is not tacky after 3 mins. of drying.

Now that we have the solution we can begin to make the sheets which can be used on the model. The following table shows the colors of the film which should be used on different classes of models.

Blue Violet--ROG tail
Red Violet--ROG wing
Violet Red--Class B and C tails
Apple Green Class B and C wings
Dark Green--Fuselages

The color depends on the amount of solution used and on the water area upon which it is poured.

To make small sheets, the solution can be poured on one spot. For large and long sheets the solution must be poured in a long continuous stream.



1/64 x 1/32
2 1/16
2 1/8
5 1/2
5 7/16
5 3/8
5 1/8
4 3/4
4 5/16
3 5/8
2 5/8
1/32
1/16
3/32
33
2 1/4
1/32 x 1/64
AL. WASHER
FRONT 1 5/8
REAR 1 1/2
FINEST SILK THREAD
ON FRONT & REAR
RIBS 1/32 x 1/64
CENTER AIRFOIL
2-CENTER SPARS 3/32 x 1/16 IN CENTER
TAPER TO 1/16 x 1/16 ROUND CORNER
4-TIP SPARS 1/16 x 1/16 Rd. TPR TO 1/32 x 1/32
WEIGHTS
WING .024
PROP .018
TAIL .008
STICK .017
TOTAL .067
BLOCK
1 x 1 1/2 x 17
QUARTER GR.
SEE HAW
FOR DETAILS
PITCH AT
TIP 32"
AVERAGE
AT 60% DIA
25.6"
2 3/4
3 3/4
1/32 SQ.
3/32 x 1/32
1/16 ROUND TO FIT SNUG
INTO TAIL BOOM
1/64 CAP
DURAL
8 1/4
14
POWER
40" 3/32 x 1/32 BROWN
2,000 TO 2,400 TURN
ON 24 m FLIGHT
8 1/4 TAIL BOOM BLANK 1/64 STOCK
14 MOTOR STICK 1/32 SANDED TO WT. AFTER COMPLETING
51
UNOFFICIAL RECORD
TRACTOR
TIME 24m 2s
DESIGNED BY
MAYHEW WEBSTER
PHILADELPHIA PENNA.
F. Zaic

Films can be removed from the water by hoop under or above it. Just be sure that the film overlaps the wire and that it does not slip once it is on the hoop. The narrower the hoop, the easier it is to remove the film in one piece. Beginners should not use a hoop more than 10" wide. The film should be removed by gently lifting one side, until it begins to clear the water, and then raising it rapidly, edge first, so that the opposite edge of the hoop leaves the water last. Most of the film that is lost is done so by lifting it too slowly. Never raise the hoop on a level plane, as the water will break or crease the film in the middle.

The film is normally used when the water has evaporated but if you are in a hurry, it can be placed right on the wing frame. The best adhesive is saliva, which is applied only to the outline of the wing or tail surface. A fair adhesive solution can be made from 1 part of rubber cement to 5 parts of benzine. However, this increases the weight as it does not evaporate as completely as the saliva.

The film is applied either by placing the surfaces on it, or by placing the film on the surfaces. The last method is recommended for the beginner. Be sure to have the table area around the wing frame or other parts to be covered, moist so that the film sticks to it and naturally presses on the wing frame.

There are two methods of trimming the film. One is with banana oil or dope on a small brush. The other is with a hot wire or electric soldering iron.

Do not use a very liquid solvent such as acetone as it is liable to run over the spars ruining the covering. The trimming stick or wire should be held about 3/8" from the side of wing frame. The film should melt before the stick, and the edge of it should form a small bead along the spar. Replenish the trimming liquid, or reheat the wire as soon as the film stops melting and touches the trimming medium.

Wings are usually covered in sections, especially if they are large. Smaller wings, such as R.O.G's, can be covered in one operation by the following methods:

1. Cover the wing first and then make the dihedral and crease the surplus film with the breath or water.

2. Divide the film on the hoop and remove the side nearest to the handle. The remaining film is applies as shown on the sketch.

3. Bend the hoop into the dihedral and place the wing on it. In this case the hoop is bent after the film is placed on it. In this case the film is removed from the water by placing the hoop on top of it.

To cement wing sections together, it is best to cement the center portion of the ribs first, and then to bring the spars together.

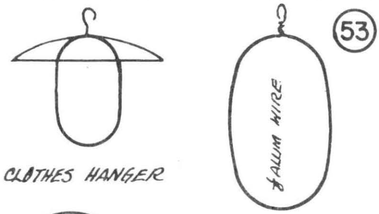
Microfilm jobs can be transported on long trips by using the packing methods shown below.

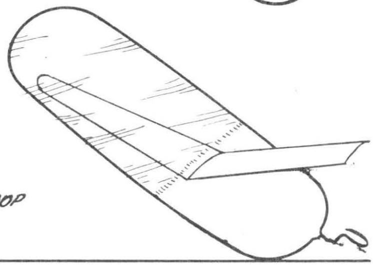
12 Nitrate Dope	4 Collodian
1 Castor Oil	2 Amyle Acetate

Microfilm Formula used by Mayhew Webster

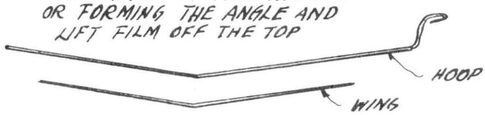
Note ~ Lifting film by placing hoop on top was suggested by Joe Hervat Wis.

EMERGENCY TANK ~ PARAFFIN OR LAQUER
THE COVER OF YOUR MODEL BOX F.Z.

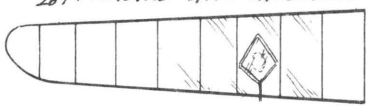




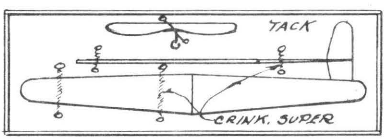
DIHEDRAL FORMED ON
HOOP AFTER LIFTING THE FILM
OR FORMING THE ANGLE AND
LIFT FILM OFF THE TOP



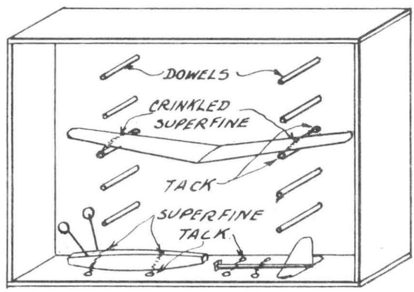
$\frac{1}{20}$ #. REMOVED WITH TWEEZERS



PATCH BY L. SMITHLINE

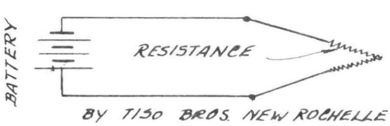


STANDARD INDOOR PACKING



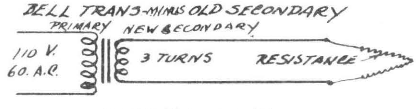
SPECIALLY FOR FILM JOBS by. E. WALEN

USING ELECTRICAL RESISTANCE FOR MICROFILM TRIMMING



BY TISO BROS. NEW ROCHELLE N.Y.

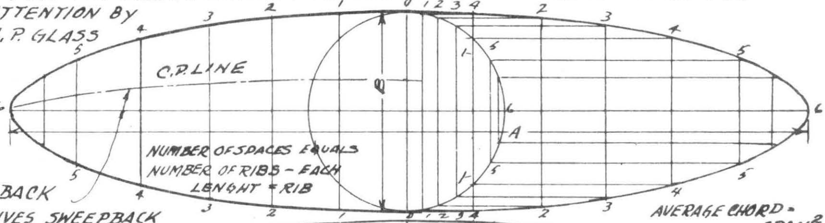
BELL TRANS-MINUS OLD SECONDARY



BY. W. GOOD, MICH

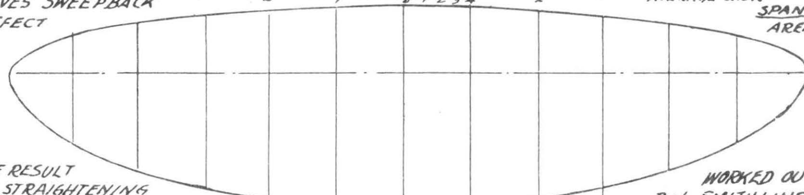
LAYOUT FOR ELLPSE BROUGHT TO OUR
ATTENTION BY
J. P. GLASS

AREA = A x B x .7854



$\frac{1}{3}$ BACK
GIVES SWEEPBACK
EFFECT

AVERAGE CHORD = $\frac{\text{SPAN}^2}{\text{AREA}}$



THE RESULT
OF STRAIGHTENING
OUT $\frac{1}{3}$ BACK LINE

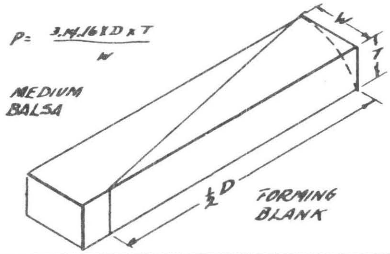
WORKED OUT
BY L. SMITHLINE

MICROFILM PROPELLERS

Developed By Lawrence Smithline

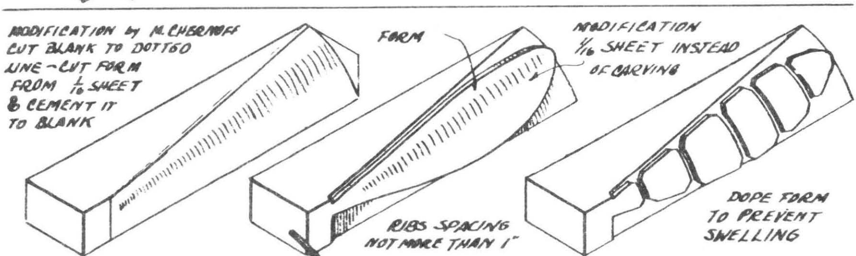
The advantages of microfilm props are evident, and there is no doubt that they will be used more extensively in the future. The highest time made, up to date, with microfilm prop is the 22m 11s flight which Herbert Greenberg made at the 1935 National in St. Louis.

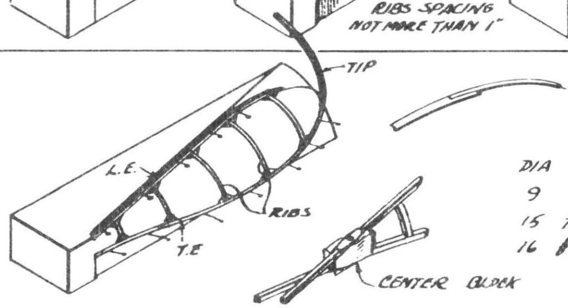
The method of constructing microfilm props, as shown below, has been used for several years and has been proven to be dependable.



INDOOR PROP SIZES

D	W	T
8	1 1/8	5/8
9	1 1/8	3/4
14	1 1/2	7/8
15	1 1/2	1
15	1 3/8	1
16	1 5/8	1
17	1 3/4	1
18	1 7/8	1 1/8





SPAR SIZES

DIA	L.E.	T.E.	TIP
9	1/16 x 1/32	1/32 sq	1/32
15	1/16 x 3/32 TO 1/16 RD	3/32 x 1/32	1/32
16	1/8 x 3/32 TO TO 1/16 RD.	1/8 x 1/32	1/32

RIBS 1/32 sq.

ASSEMBLING PROCEDURE

1. Place the L.E. spar as shown and hold it in place with pin. Moisten it so that it will retain its shape when removed.

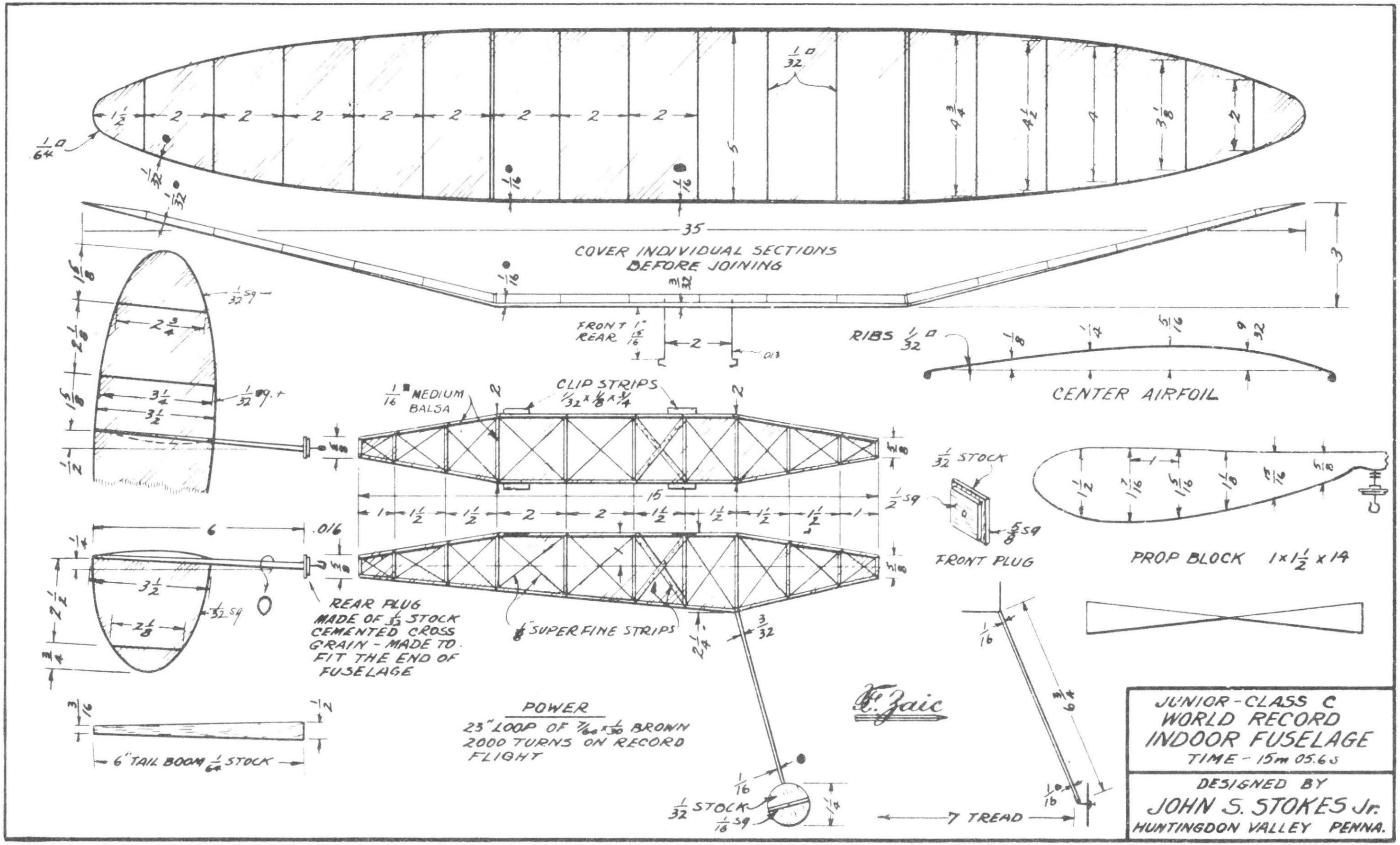
2. Position the T.E. spar. Moisten the tip and bend it around the form by holding it at the extremity. Always have pressure on it or it will kink and spoil the job. Hold it in place with pin.

3. Let the spars dry and cut ribs while waiting. All the ribs can be of the same chord.

4. Cement the ribs to the L.E. When set, trim the excess at the T.E. with razor or curved scissors. Cement and let dry.

5. Remove the outline and prepare the other blade in similar manner.

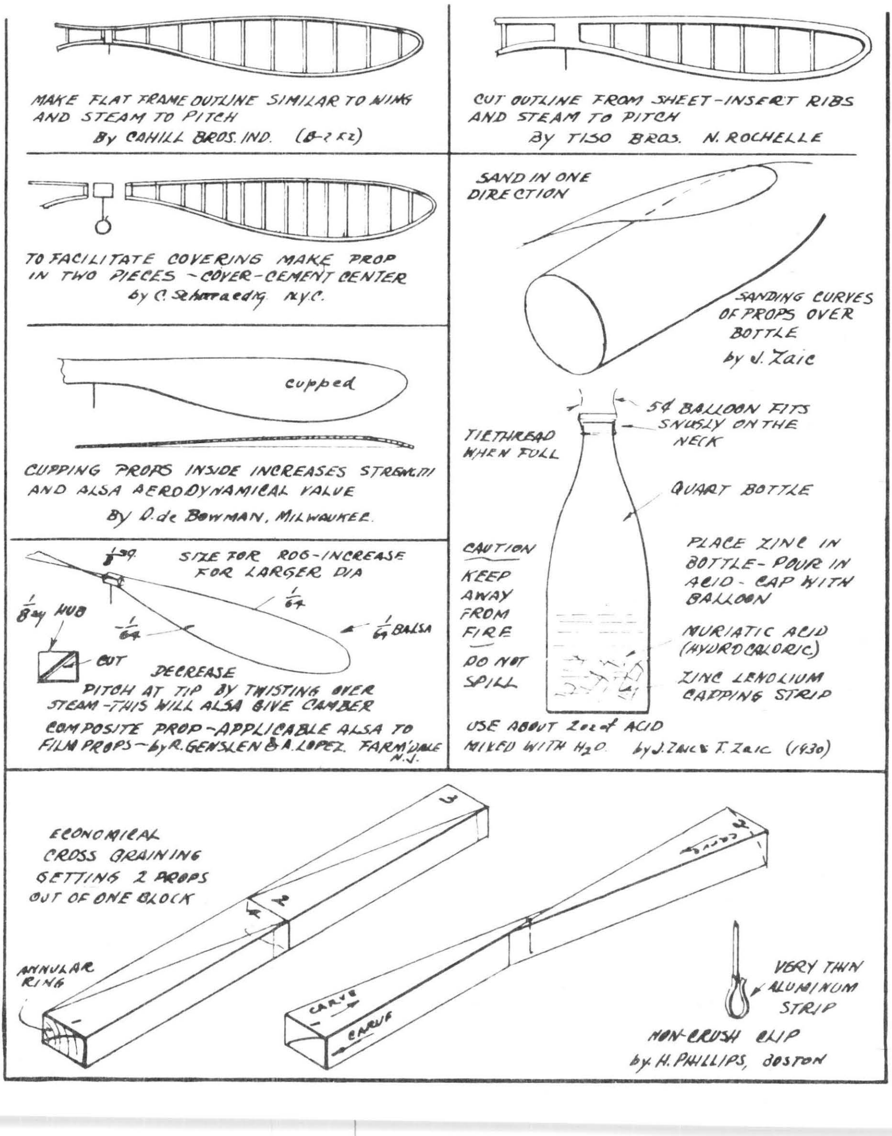
6. Attach the two blades to the center block as shown.

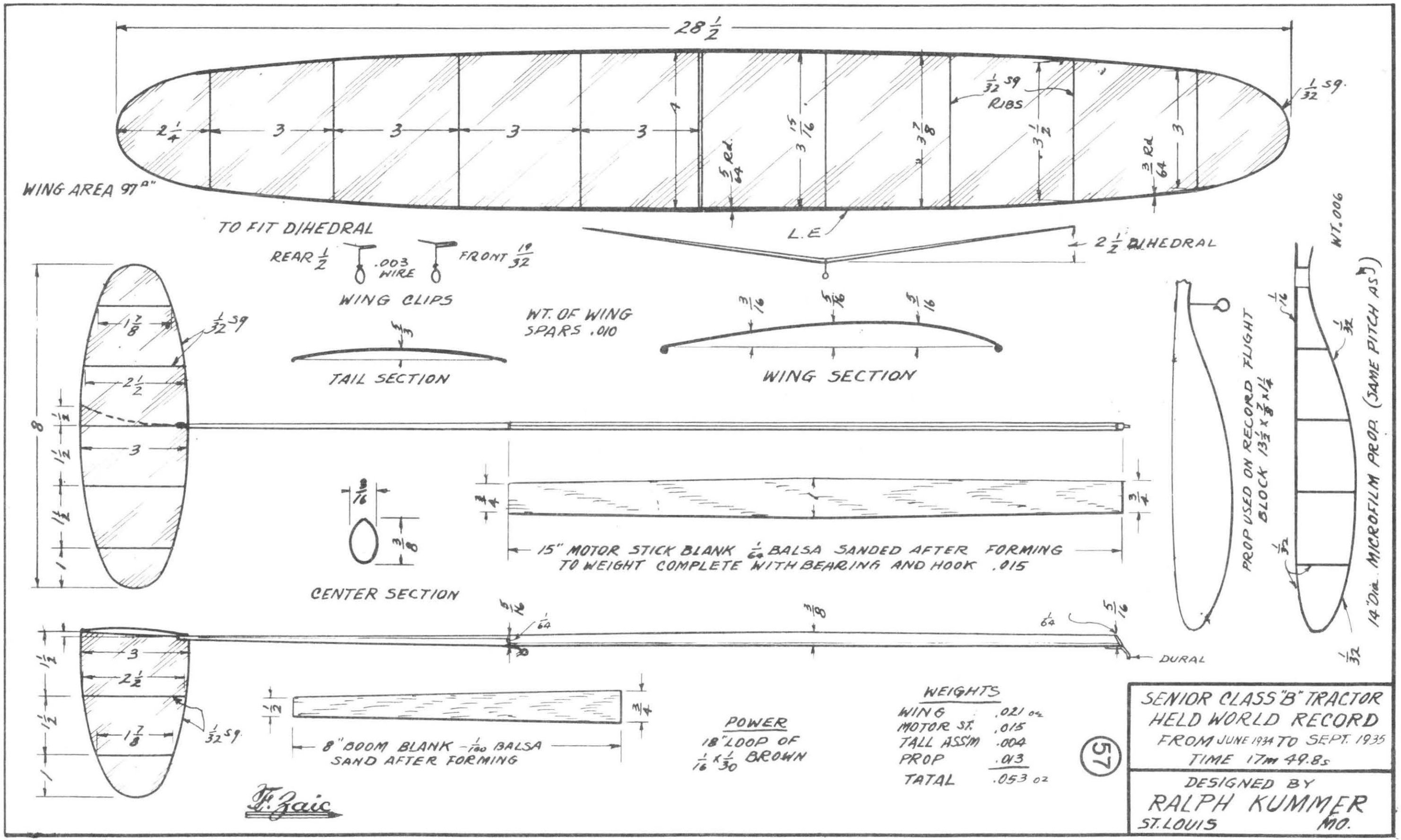

COVER INDIVIDUAL SECTIONS BEFORE JOINING
FRONT 1" REAR 15/16
RIBS 1/32 □
CENTER AIRFOIL
1/16 □ MEDIUM BALSA
CLIP STRIPS 1/32 x 1/8 x 3/4
1/32 STOCK
FRONT PLUG
PROP BLOCK 1 x 1 1/2 x 14
REAR PLUG MADE OF 1/32 STOCK CEMENTED CROSS GRAIN - MADE TO FIT THE END OF FUSELAGE
SUPERFINE STRIPS
6" TAIL BOOM 1/64 STOCK
POWER
23" LOOP OF 7/64 x 1/30 BROWN
2000 TURNS ON RECORD FLIGHT
1/32 STOCK
7 TREAD
F. Zaic
JUNIOR - CLASS C
WORLD RECORD
INDOOR FUSELAGE
TIME - 15m 05.6s
DESIGNED BY
JOHN S. STOKES Jr.
HUNTINGDON VALLEY PENNA.

COVERING

Make a rectangular frame of balsa strips. Cover it with film by transferring the film from a regular hoop. (Four hands required for the following operation.) Twist the frame, equivalent to the prop pitch, and have your partner contact the saliva moistened prop outline on the concave side of the frame. (The prop is covered on the outside or convex side. Trim with hot wire or banana oil. Use the same procedure in covering the other blade. Wrinkles can be removed by passing the prop over an electric bulb, soldering iron, or a hot stove.

While using the prop be careful to hold it at the center at all times. It can be patched up by transferring film to it from small hoop of spare film. Superfine will also do in a pinch. Just moisten the area around the break and the film or the paper will adhere to it.




28 1/2
1/32 SQ
RIBS
1/32 SQ.
2 1/4
3
3
3
3
4
5/64 Rd.
3 15/16
3 7/8
3 1/2
3/64 Rd.
3
WING AREA 97 □"
TO FIT DIHEDRAL
L.E.
2 1/2 DIHEDRAL
REAR 1/2
.003 WIRE
FRONT 19/32
WING CLIPS
WT. .006
1/32 SQ
1 7/8
WT. OF WING SPARS .010
TAIL SECTION
WING SECTION
2 1/2
8
3
1 1/2
1 1/2
1
CENTER SECTION
15" MOTOR STICK BLANK 1/64 BALSA SANDED AFTER FORMING
TO WEIGHT COMPLETE WITH BEARING AND HOOK .015
PROP USED ON RECORD FLIGHT
BLOCK 13 1/2 x 7/8 x 1/4
14" Dia. MICROFILM PROP. (SAME PITCH AS)
DURAL
3
2 1/2
1 7/8
1/32 SQ.
8" BOOM BLANK - 1/100 BALSA
SAND AFTER FORMING
POWER
18" LOOP OF
1/16 x 1/30 BROWN
WEIGHTS
WING .021 oz
MOTOR ST. .015
TALL ASS'M .004
PROP .013
TATAL .053 oz
57
SENIOR CLASS "B" TRACTOR
HELD WORLD RECORD
FROM JUNE 1934 TO SEPT. 1935
TIME 17m 49.8s
DESIGNED BY
RALPH KUMMER
ST. LOUIS MO.
F. Zaic

RUBBER

By J.P.Glass

The following is a resume of well known information on rubber. Indications show that Special Brown rubber is better for all forms of flying because it contains more energy for its weight than any other known to us, providing the necessary precaution are taken. it is possible that a better rubber might supplant it in the near future as rubber researches are constantly uncovering new discoveries, but until we get something better we must try to get the most out of what we have now.

To lubricate the rubber use green soap straight. It can be obtained at any druggist, but be sure to rub it in thouroughly as it is fairly stiff. Rubber should be kept in TIN cans with air tight covers; tin because light is more injurious than air. To get the most power and turns from a motor it is necessary to break it in slowly by prewinding.

GENERAL NOTES ON WINDING

Before you begin to wind be sure that you know the exact number of turns you want. Then strecht the motor five times its lenght no matter what size or number of strands you are using. Wind ½ of the predetermined turns without coming in. This requires a powerful winder, a strong arm and a weak mind, especially when you have over 10 strands to deal with. When you have given it ½ of the total/ come in so that the motor will always have about 2 to 3 inches of elasticity in it. By the time you reached the rear hook, you should have wound in the predetermined number of turns.

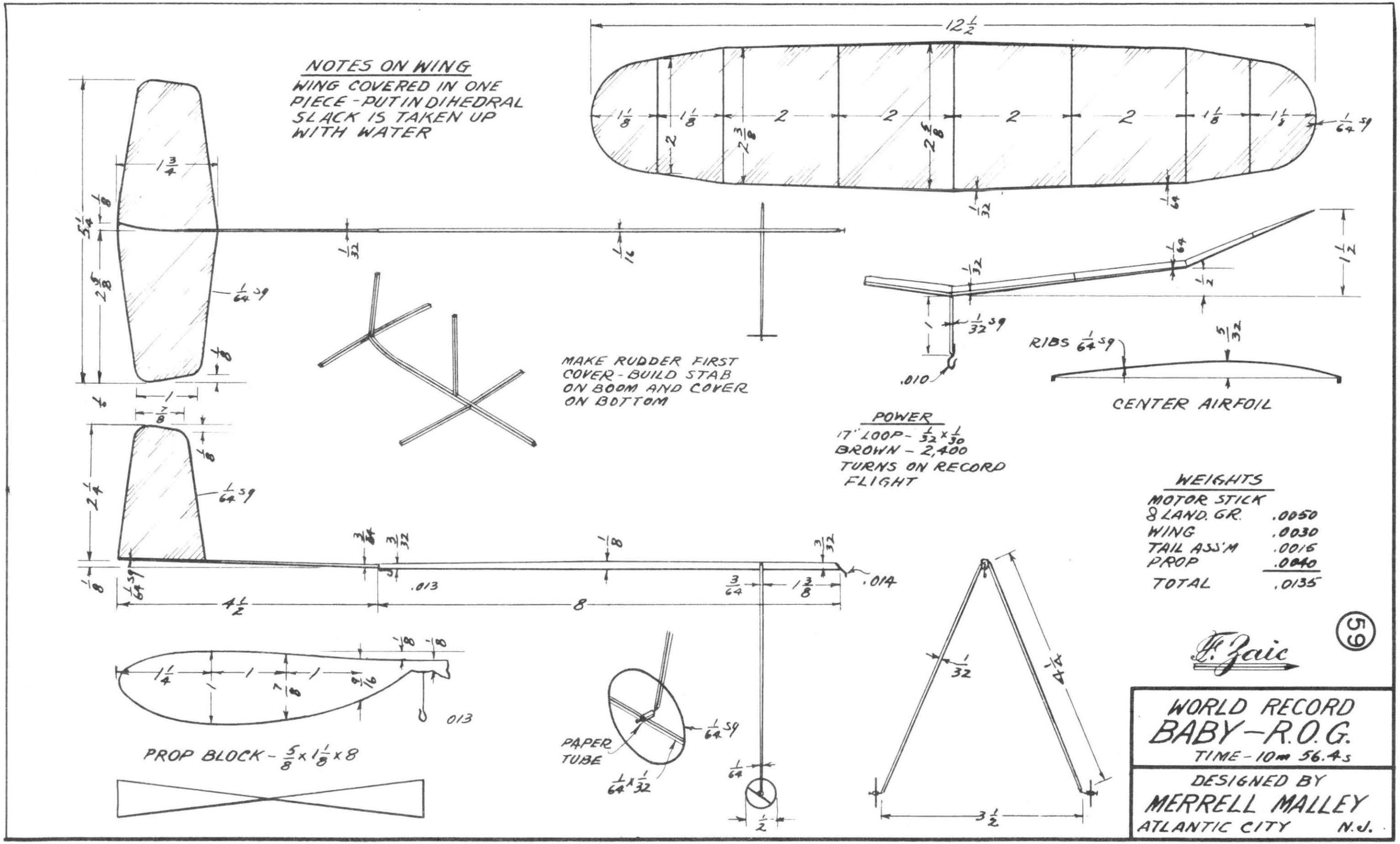
PREWINDING

The first prewind should be about 75% of the maximum turns. The second about 90%, and the third maximum. The third may be used for a flight. Remember that power on the prewind is always higher then on subsequent windups. Also remember that a good rubber will always warn you before breaking by becoming very tight. If it does break it is very likely because of the grit chaff or from nicks made on previous flights. It is therefore advisable to examine your motor carefully before every windup.

Because of the greater power on prewinds, it is possible to get very encouraging test flighs, and it is very disappointing later on when the ship falls short of the mark on the full windup. The cure for this is to test the model by full windup and then letting out the intial burst of power on the floor. The model should slowly climb to about 50 feet and cruise on this decrease of power, and it should come down with very few turns left in the motor. If the ship still has many turns left you had better check the model for possible faults. It is is allright you will have to add more rubber. On other hand if the model persists on climbing you can reduce the rubber. The initial torque of a fully wound motor is about 5 times the normal and it is strong enough to take the ship almost straight up. To keep the ship under control several systems are used, such as the down thrust. The are described on other sections of this book. (The above paragraph is for Indoor models only.)

DAILY BLURB'S ORIGINAL DICTIONARY

ARMORY- Small shed equipped with latest devices for snaring models.
BLACK RUBBER- Choice shreded inner tubing.
BROWN RUBBER- Same only worse. (D.B.Originates in Boston)
FUNERAL MARCH-Trek from floor to model box with remnants of best ship
MODEL TROPHY- Inverted thimble mounted on a rubber pedestal.
RAT- One who let go of your model while you were winding it .


NOTES ON WING
WING COVERED IN ONE PIECE - PUT IN DIHEDRAL SLACK IS TAKEN UP WITH WATER
MAKE RUDDER FIRST COVER - BUILD STAB ON BOOM AND COVER ON BOTTOM
RIBS 1/64 SQ
CENTER AIRFOIL
POWER
17" LOOP - 1/32 x 1/30
BROWN - 2,400
TURNS ON RECORD FLIGHT
WEIGHTS
MOTOR STICK & LAND. GR. .0050
WING .0030
TAIL ASS'M .0015
PROP .0040
TOTAL .0135
PROP BLOCK - 5/8 x 1 1/8 x 8
PAPER TUBE
59
F. Zaic
WORLD RECORD
BABY-R.O.G.
TIME - 10m 56.4s
DESIGNED BY
MERRELL MALLEY
ATLANTIC CITY N.J.

TURNS

It is impossible to have every batch of rubber exactly like the previous batch regardless of what the chemists claims. It is therefore readily seen that we cannot set a maximum turns table and expect it to hold good on all occasions. The table will vary with the conditions and age of the rubber. The following system can be used with your rubber to determine just how many turns you can give to a certain number of strands without making it necessary to test the whole series of strands.

First make about 10 loops, of 2 strands each 10" long, of 1/8 flat. Lubricate, hook one end to a stationary object (doorknob), and wind the rubber until it breaks. It is, of course, understood that you are using the proper winding procedure. After you have broken the 10 loops, check up and find out the maximum turns you can get consistantly. Devide the number of turns by 10 to obtain the turns per inch figure. This figure is the par, or the basic number, and it can be used in computing turns for all multi-strand motors using 1/8. All you have to do is to multiply the par by the coefficient of the particular motor. Here is the simple relationship of the setup:

Par x Coefficient = Number of turns per inch

COEFFICIENT TABLE

No. Strands	Coef.	No. Strands	Coef.
4	.70	14	.35
6	.56	16	.32
8	.48	18	.30
10	.43	20	.28
12	.39		

For Example: On our tests the par was 125 turns per inch maximum, and 115 safe. To find the maximum turns for a 4 strand motor multiply the par (125) by .70, the coefficient for 4 strand motor. Therefore the maximum turns possible is -- 125 x .70 = 87.5 turns per inch. And for the safe number turns the result is as follows: 115 x .70 = 80.5 tunrs per inch. If the motor is 15" long then the safe number of tunrs to put into it is -- 80.5 x 15 = 1,207.5

The coefficient for sizes under 1/8 are as follows;

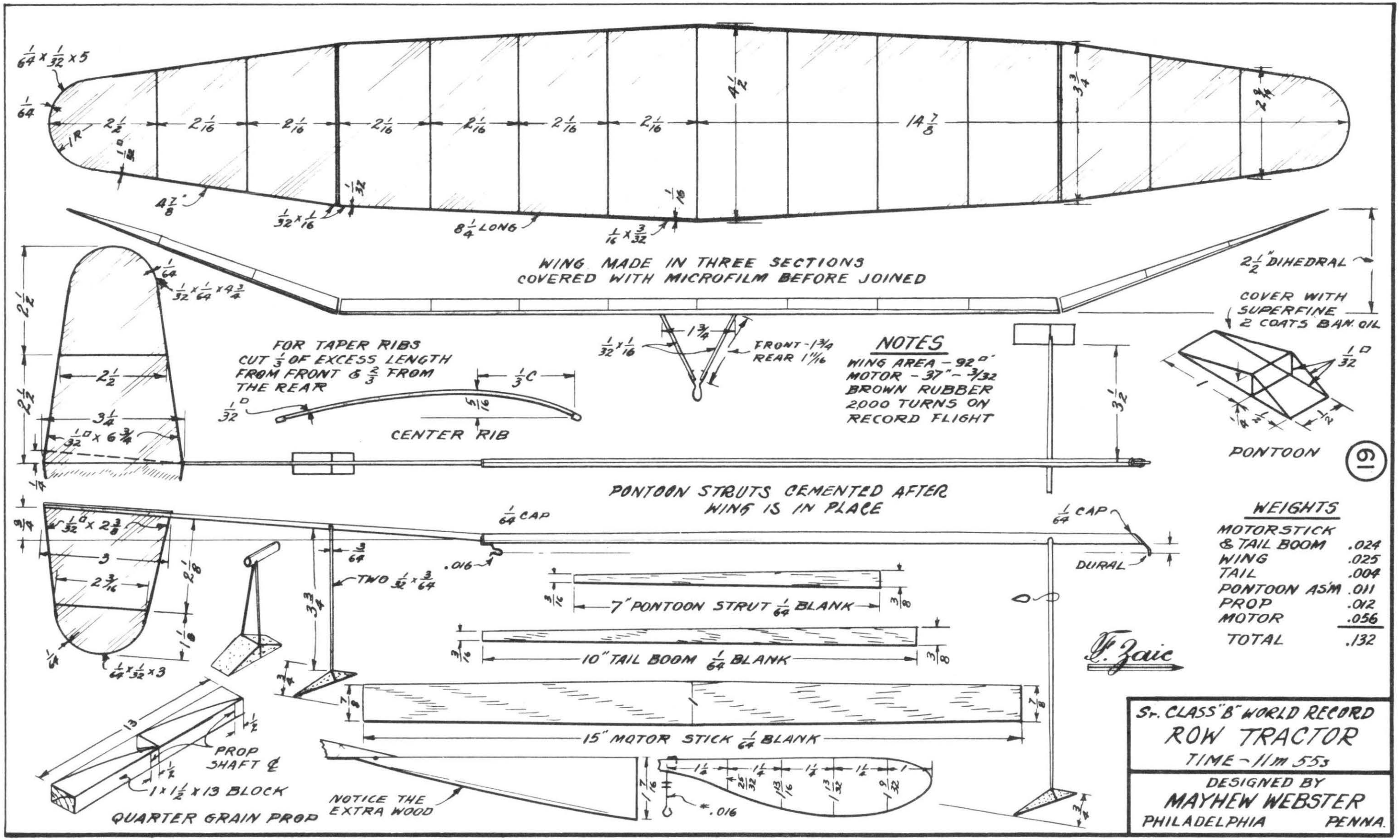
Size	Coef.	Size	Coef.
7/64	1.06	1/16	1.42
3/32	1.13	3/63	1.65
5/64	1.26	1/32	2.05

These coefficients are based on the assumption that rubber is from the same batch, but as this is seldom the case it is advisable to run tests on smaller sizes to be sure of the turns.

The above information is of special value for use in connection with multi-strand motors as it saves quite a bit of testing time, and it is especially easyon the money problem by making it possible to use a small amount of rubber for a complete check on the whole.

PRECAUTIONS

The following precautions are especially applicable to Brown rubber as it is more sensitive to atmospheric,and other conditions, than any other rubber. On hot days keep the rubber away from the sun as few hours of exposure will ruin it. Keep the rubber free


WING MADE IN THREE SECTIONS
COVERED WITH MICROFILM BEFORE JOINED
2 1/2" DIHEDRAL
COVER WITH SUPERFINE 2 COATS BAN. OIL
FOR TAPER RIBS CUT 1/3 OF EXCESS LENGTH FROM FRONT & 2/3 FROM THE REAR
CENTER RIB
FRONT - 1 3/4
REAR 1 11/16
NOTES
WING AREA - 92 □"
MOTOR - 37" - 3/32
BROWN RUBBER
2,000 TURNS ON RECORD FLIGHT
PONTOON
PONTOON STRUTS CEMENTED AFTER WING IS IN PLACE
1/64 CAP
DURAL
TWO 1/32 x 3/64
7" PONTOON STRUT 1/64 BLANK
10" TAIL BOOM 1/64 BLANK
15" MOTOR STICK 1/64 BLANK
WEIGHTS
MOTORSTICK & TAIL BOOM .024
WING .025
TAIL .004
PONTOON ASM .011
PROP .012
MOTOR .056
TOTAL .132
F. Zaic
PROP SHAFT ℄
1 x 1 1/2 x 13 BLOCK
QUARTER GRAIN PROP
NOTICE THE EXTRA WOOD
Sr. CLASS "B" WORLD RECORD
ROW TRACTOR
TIME - 11m 55s
DESIGNED BY
MAYHEW WEBSTER
PHILADELPHIA PENNA.
19

from grit at all times, and if it does become gritty be sure to wash it and then re-lubricate it. Grit will cause a breakage at less than ½ of the total turns. Exposure will also reduce the maximum turns. Always be sure that the lubricate covers the entire surface, because a dry part might stick and tear. Good rubber in good shape should take 90% of maximum turns dependably.

POWERING THE MODEL

The usual problem is to power a model after it has been completely built including the prop. In this case all you can do is to start witha a small amount of rubber and add additional strands or increase the size, until the model flies well.

The second problem is that of a plane completely built with the exception of the prop. In this case select the rubber that will fly the model longest. It can be shown mathematically that if the weight of the rubber is made to equal twice that of the model (2/3) of the total) the plane should fly the longest. Greater rubber increase (over2/3) increases the wing loading faster than it increases the power, and the model will have a shorter duration. If the rubber is only equal to the weight of the model (50% of the total) the plane will fly about 85% as long as that with the greater amount of rubber, but because of less strain on the model and less danger of bad accidents when using lower ration of rubber, it is recomended to use between 50to 60% of the total weight.

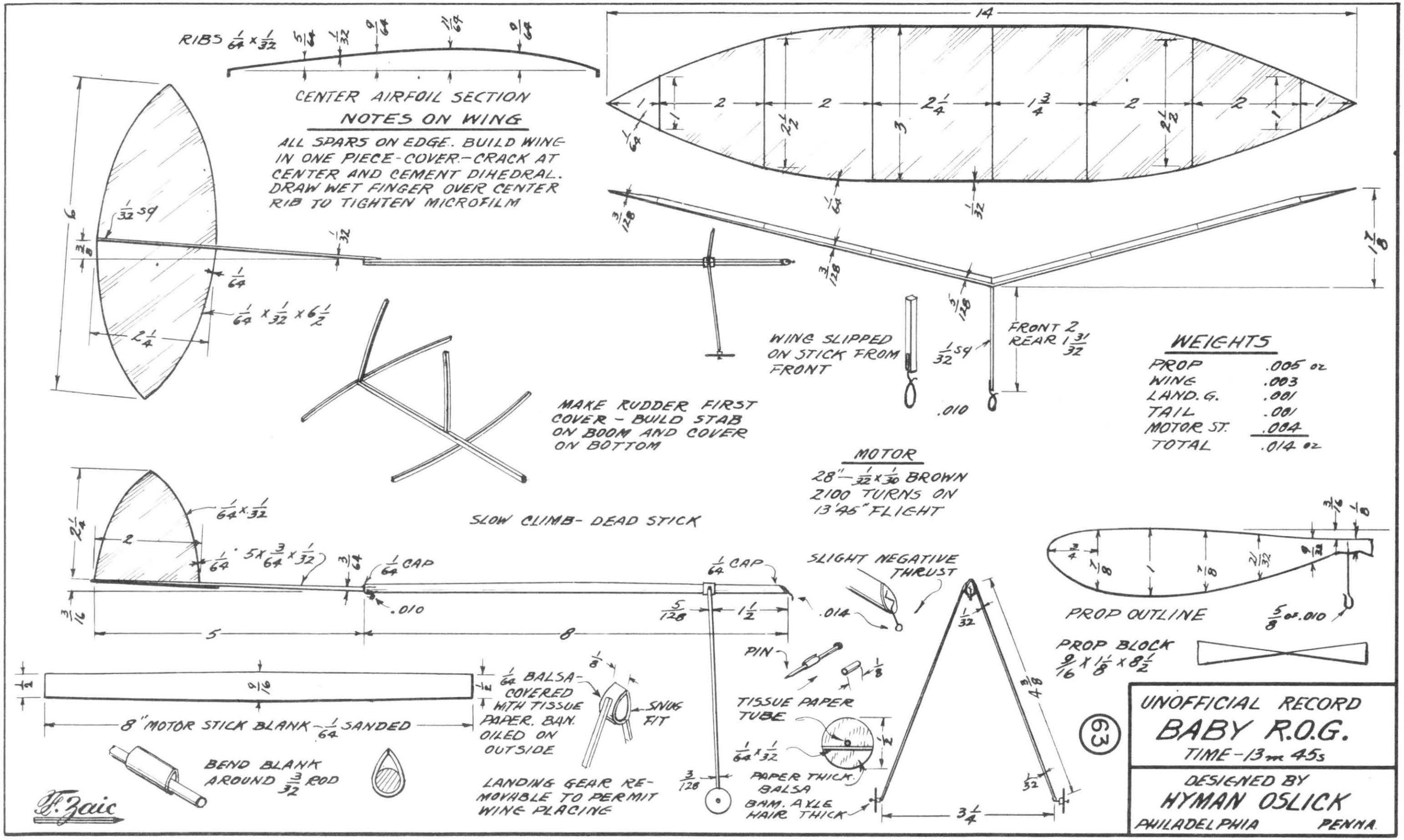
The thirsd case is that of a model being built up to the weight rule for contest flying. Here the rubber should be near as possible to the 100% of the total weight. The nearer to the 100% the better, because as long as you have to have weight you might as well have it in the motor, but be sure to keep within the weight specifications.

The fourth case; If you are just building a model to fly for as long time as possible, the best thing to do is to make the ship as light as it is reasonably possible, even if the rubber ratio goes down to 35%. It might be noted that it is possible to make an Indoor ROG to weight .016 oz. and carry .024 oz of rubber, a ratio of better than 60%.

It is rather unfortunate that we cannot just put on rubber. on outdoor ships because of the torque and strenght factors. It has to be subdivided into certain number of strands of certain lenght. In case of fuselage model where extra body lenght us severely handicapped it is impossible to get a reasonable rubber ratio without some form of gear mechanism. To date the most successful fuselage jobs have not used gears mechanism, but we feel that by using gears or prime movers and by increasing the rubber ratio to over 50% it should be possible to get better flights of actual prop run. The best gear mechnism are such as the 3 or 4 motor prime movers, and 2 to 3 large gears driving a small pinion on the prop shaft of gear ratio of three or four to one.

No gear mechanism can possibly be worth its weight on a scientific model, where the lenght of the motor is not limited, because the most effective arrangement is to lenghten the motor stick and use direct drive. It should be noted that almost all models, aside from the fuselage, are designed to take from 2,000 to 2,500 turns. Such motors are usually of fewer strands than the shorter motors.

D.B. MODEL EXPERT-A punk builder, who can talk faster, prevaricate Con'd greater, and sound more convincing than the other fellow. SCIENTIFIC DESIGN- Rather fictitious name for an old tub that made a lucky flight.---CELLOPHANE-The microfilm sold by Assco.



RIBS 1/64 x 1/32
CENTER AIRFOIL SECTION
NOTES ON WING
ALL SPARS ON EDGE. BUILD WING IN ONE PIECE-COVER.-CRACK AT CENTER AND CEMENT DIHEDRAL. DRAW WET FINGER OVER CENTER RIB TO TIGHTEN MICROFILM
14
1/32 SQ
1/64 x 1/32 x 6 1/2
WING SLIPPED ON STICK FROM FRONT
FRONT 2
REAR 1 31/32
.010
WEIGHTS
PROP .005 oz
WING .003
LAND. G. .001
TAIL .001
MOTOR ST. .004
TOTAL .014 oz
MAKE RUDDER FIRST COVER - BUILD STAB ON BOOM AND COVER ON BOTTOM
MOTOR
28" - 1/32 x 1/30 BROWN
2100 TURNS ON
13'45" FLIGHT
SLOW CLIMB- DEAD STICK
1/64 x 1/32
.5 x 3/64 x 1/32
1/64 CAP
.010
.014
SLIGHT NEGATIVE THRUST
PROP OUTLINE
5/8 of .010
PROP BLOCK
9/16 x 1 1/8 x 8 1/2
8" MOTOR STICK BLANK - 1/64 SANDED
BEND BLANK AROUND 3/32 ROD
1/64 BALSA-COVERED WITH TISSUE PAPER. BAN. OILED ON OUTSIDE
SNUG FIT
PIN
TISSUE PAPER TUBE
PAPER THICK BALSA
BAM. AXLE HAIR THICK
LANDING GEAR REMOVABLE TO PERMIT WING PLACING
UNOFFICIAL RECORD
BABY R.O.G.
TIME - 13m 45s
DESIGNED BY
HYMAN OSLICK
PHILADELPHIA PENNA.
63
F. Zaic

THE CHOICE OF PROPS

Short thick motors require large props. Long and thin motors must have smaller diameter and lower pitch props. In the light of Mr. Lawrence's prop experiments showing the high efficiency for low pitch diameter ratio , it might be desireable to design ships for 2,500 to 3,000 turns.

CONCLUSION

Certain types of models will normally carry a greater percent of rubber than others. The most efficient, from this point of view, is the push-pull with hollow motor stick and general light construction to enable the ship to have 75% of rubber. The next in line is the twin pusher with 65% of rubber. The single tractor and pusher come next because of the necessaty of keeping the torgue down. The fuselage jobs are last. The writer has great hopes for the push-pull and he is sure that we would be repaid by experimenting with it and finding what is neede in a way adjusting. The present set-backs are the neccessaty of a special winder and stability trouble.

INDOOR NOTES: The 3/32 ships have won major contests consistantly since Thompson introduced this size. It is true that 1/8 ships are more dependable to give consistant flights but we feel that more erratic 3/32 ships, in good hands, will allways come out on top, mostly because of lighter weight.

Number of Turns Table for Motors using 1/8 x 1/32 Brown Rubber
Using 115 turns per inch as safe par

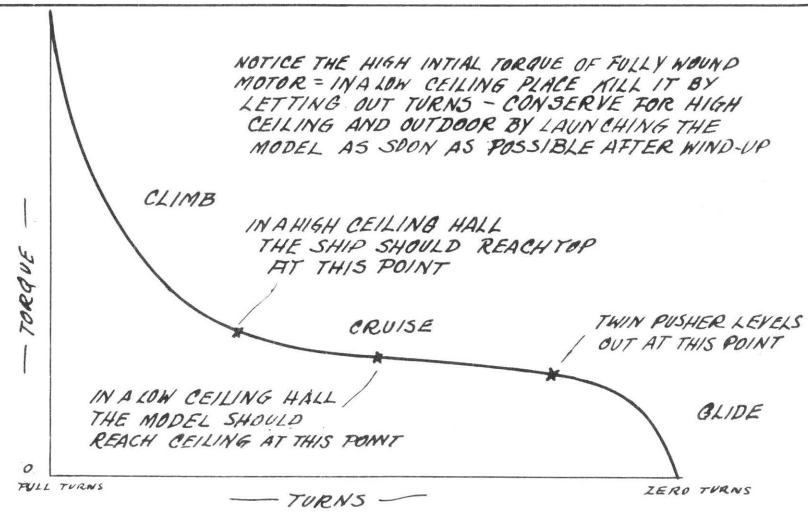
LENGTH

NUMBER OF STRANDS	10"	15"	20"	25"	30"	35"	40"	45"	50"
2	1150	1725	2300	2875	3450	4025	4600	5175	5750
4	800	1200	1600	2000	2400	2800	3200	3600	4000
6	640	960	1280	1600	1920	2240	2560	2880	3200
8	550	825	1100	1375	1650	1925	2200	2475	2750
10	500	750	1000	1250	1500	1750	2000	2250	2500
12	440	660	880	1100	1320	1540	1760	1980	2200
14	400	600	800	1000	1200	1400	1600	1800	2000
16	360	540	720	900	1080	1260	1440	1620	1800
18	340	510	680	850	1020	1190	1360	1530	1700
20	320	480	640	800	960	1120	1280	1440	1600

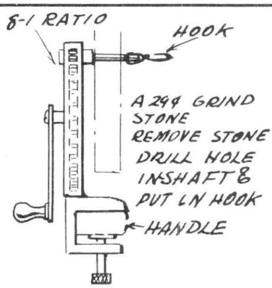
Editor's Note: The above Table was computed by the Editor, using 115 turns as par and the particular coefficient. The result were checked against the actual multi-strand motor tests, and the above figures were found to be very close to the tested figures.
To find the number of turns for Black 1/8 x 1/32 Rubber multiply the above figures by .80.

Turns per Inch on Two Strands of 1/30 Brown

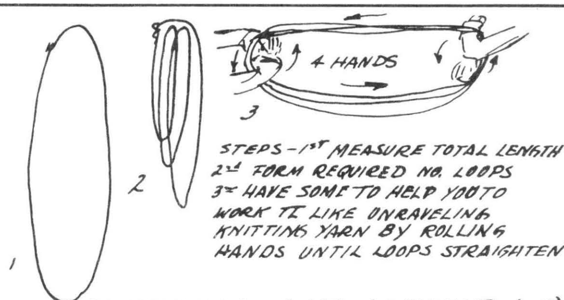
1/32	3/64	1/16	5/64	3/32	7/64	1/8	9/64	5/32	11/64	3/16
225	189	163	145	130	124	115	113	108	100	94
185	(1/32 Black)			103		94	(1/32 Black)			75



TORQUE CHART OF UNWINDING MOTOR by J.P. GLASS

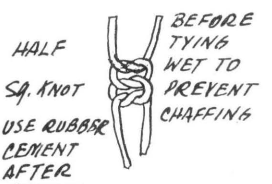


INDOOR WINDER by F. ZAIC



STEPS - 1ST MEASURE TOTAL LENGTH
2ND FORM REQUIRED NO. LOOPS
3RD HAVE SOME TO HELP YOU TO WORK IT LIKE UNRAVELING KNITTING YARN BY ROLLING HANDS UNTIL LOOPS STRAIGHTEN

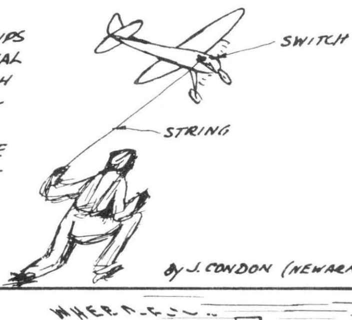
STRAIGHTENING MOTORS by T. BOLAND (1928)



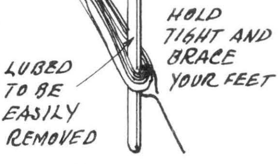
LUB-PROOF KNOT by E. WALEN

HINTS FOR GAS JOBS

FOR TESTING SHIPS HAVE AN EXTERNAL SWITCH - ATTACH THREAD TO IT - START MOTOR AND LET GO THE SHIP - IF IT MIS-BEHAVES PULL THE STRING AND SO STOP THE MOTOR

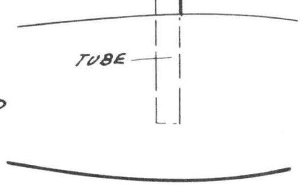


by J. CONDON (NEWARK)



HANDLING HEAVY MOTORS by F. ZAIC

GAS JOBS CAN BE PRETTY DANGEROUS IF THEY GLIDE IN UNAWARE - SO FIT IN A TUBE WITH AN OPEN END EXPOSED TO THE AIR - A VENTURI TUBE WILL ALSO PRODUCE NOISE

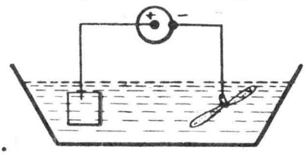


BY F. ZAIC (BOY! AM I CLEVAH!)

COPPERFILM & SILVERFILM -- METAL PLATING

By John Zaic

The development of the technique for the application of copperfilm (copperplating) and silverfilm (silverplating) to wooden objects such as balsa wings and fuselages may be ranked as one of the most progressive steps ever taken in the advance of solid exact scale models. Heretofore, models of the Northrop Alpha, Beta, and Gama, and many other airplanes with a metal stressed skin covering were only within the range of experienced metal-workers and entirely out of the field of ordinary modelbuilders, if a realistic finish was desired. But by simple plating methods, any one of average skill may truly reproduce the shining metal skin coverings of these planes, as well as propellers, etc. for all planes.



The materials needed are as follows:-

- One 1½ volt dry cell.
- One storage battery metal clip.
- One glass bowl - as large as possible.
- One pure copper sheet - 4" x 4" x 1/32".
- One half pound copper sulphate.
- One ounce sulphuric acid.
- Wood filler, lacquer, and high grade lacquer thinner.
- Package finest copper bronze powder.
- Any of the silver plating compounds sold in hardware stores.

The steps in the application are as follows:-

1. The wooden object to be plated should be given a very smooth finish. Fill the pores up with woodfiller, sand carefully, and finally waterproof the object with several thin coats of lacquer.

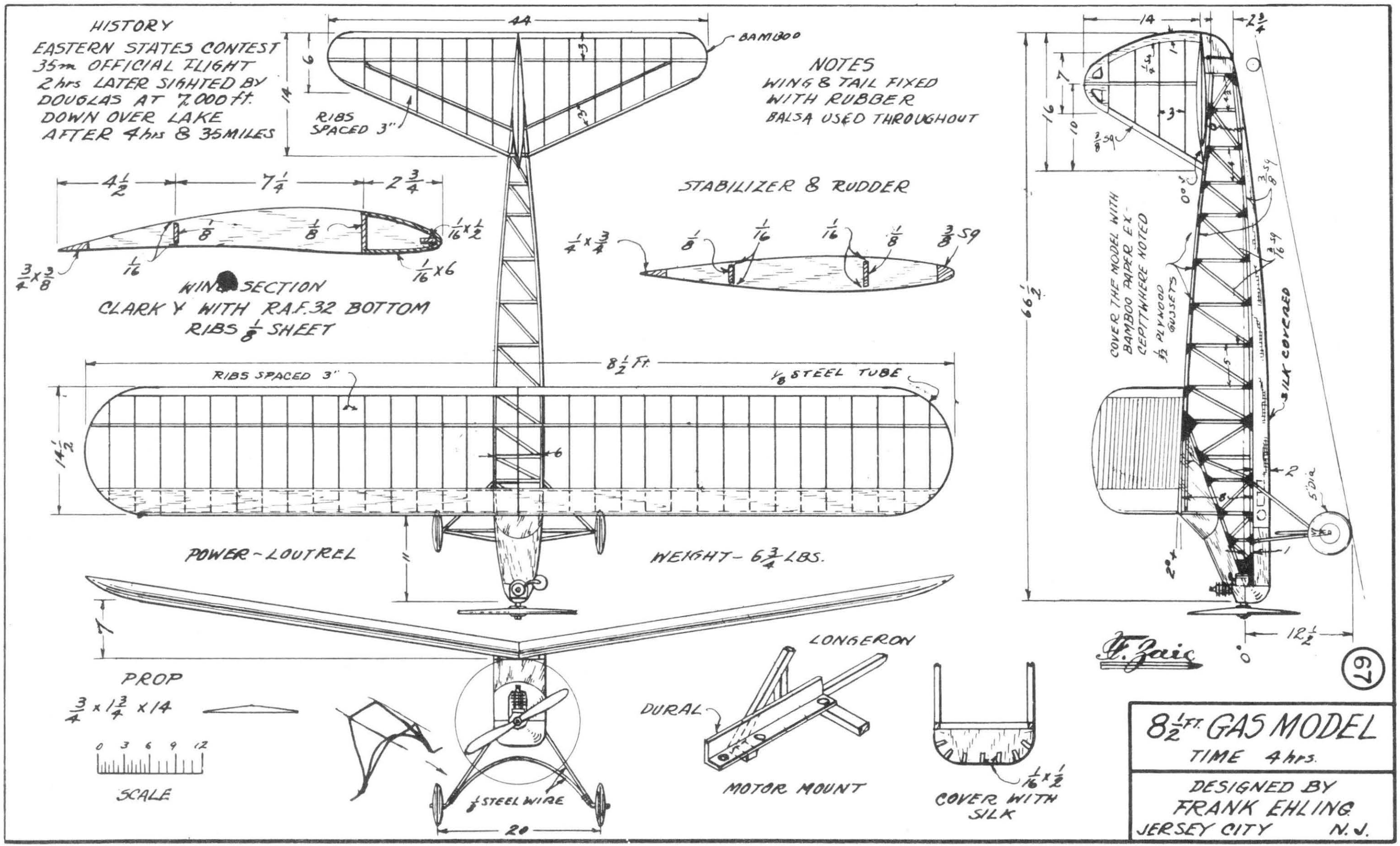
2. In order to electroplate, the surface of the object must be made electrically conductive by coating it with a paint composed of copper bronze powder mixed to a brushing consistency with 10 parts thinner and one part lacquer. Apply two coats with a soft camels hair brush, brushing only in one direction.

3. Fill the glass bowl ¾ full with water, then add enough copper sulphate until a deep blue color is obtained. Add a few drops of sulphuric acid for better conductivity.

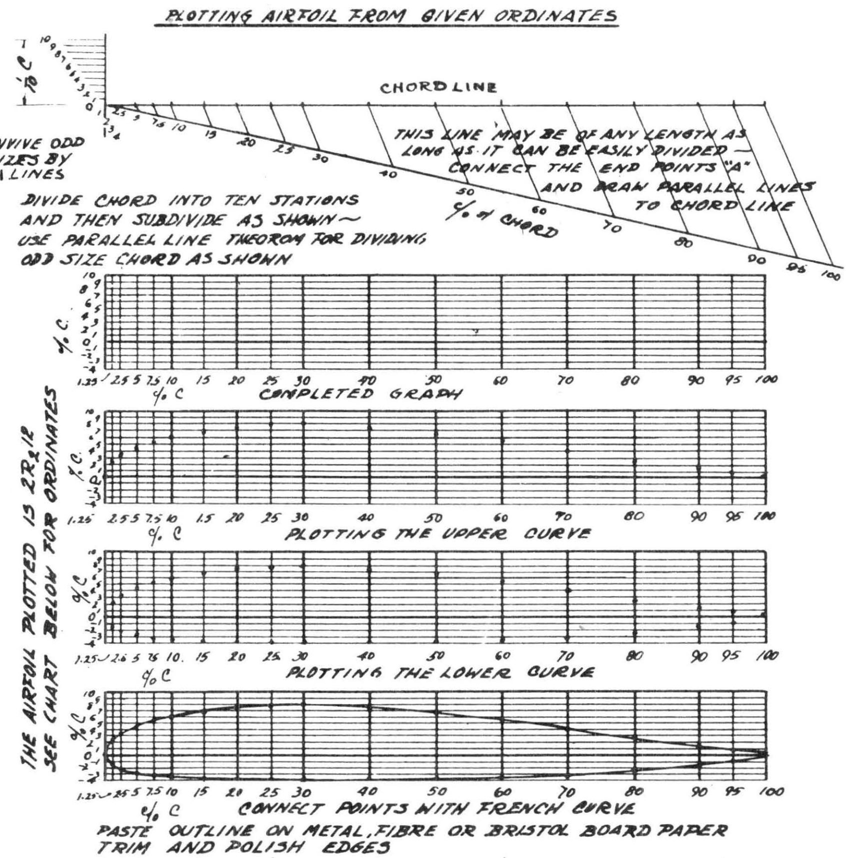
4. With the aid of some wire and the metal clip, connect the object to be plated to the negative side of the battery and then immerse it in the solution. Connect the copper plate to the positive side, and immerse it also, being sure that it does not touch the object. In about 15 minutes a flesh pink film will form on the object. When a film of the desired thickness is obtained, take the object out and wash it. A buffer, emery paper, and powdered pumice all can be used to good advantage in finishing the object to the proper sheen.

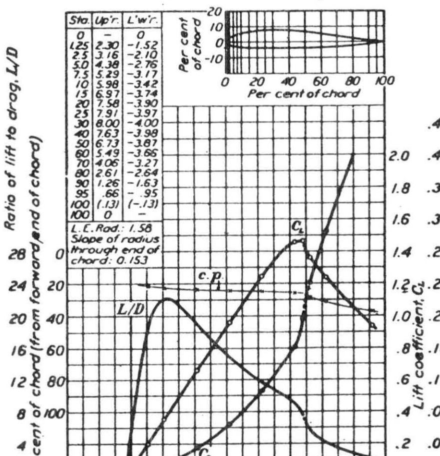
Note:- If a dirty brick mud-like deposit is formed on the object, it is an indication of either too strong a current or of too weak a solution of copper sulphate. First try adding copper sulphate, then, if this doesn't correct the condition, reduce the voltage by a reostat in series with the hook-up.

5. If an imitation aluminum or duralumin finish is desired, this may be done by merely rubbing the already copperplated object with any of the silver plating compounds or pastes sold in hardware stores. A coat of clear lacquer will prevent the silver from tarnishing and will preserve the lustre.



HISTORY
EASTERN STATES CONTEST
35m OFFICIAL FLIGHT
2 hrs LATER SIGHTED BY
DOUGLAS AT 7,000 ft.
DOWN OVER LAKE
AFTER 4 hrs & 35 MILES
44
BAMBOO
RIBS SPACED 3"
NOTES
WING & TAIL FIXED
WITH RUBBER
BALSA USED THROUGHOUT
STABILIZER & RUDDER
WING SECTION
CLARK Y WITH R.A.F. 32 BOTTOM
RIBS 1/8 SHEET
8 1/2 FT.
RIBS SPACED 3"
1/8 STEEL TUBE
POWER - LOUTREL
WEIGHT - 6 3/4 LBS.
COVER THE MODEL WITH BAMBOO PAPER EXCEPT WHERE NOTED
1/32 PLYWOOD GUSSETS
SILK COVERED
5" DIA.
PROP
3/4 x 1 3/4 x 14
SCALE
1/8 STEEL WIRE
LONGERON
DURAL
MOTOR MOUNT
COVER WITH SILK
F. Zaic
67
8 1/2 FT. GAS MODEL
TIME 4 hrs.
DESIGNED BY
FRANK EHLING
JERSEY CITY N.J.





Sta.	Up'r.	L'w'r.
0	–	0
1.25	2.30	–1.52
2.5	3.16	–2.10
5.0	4.38	–2.76
7.5	5.29	–3.17
10	5.98	–3.42
15	6.97	–3.74
20	7.58	–3.90
25	7.91	–3.97
30	8.00	–4.00
40	7.63	–3.98
50	6.73	–3.87
60	5.49	–3.66
70	4.06	–3.27
80	2.61	–2.64
90	1.26	–1.63
95	.66	– .95
100	(.13)	(–.13)
100	0	–

L. E. Rad.: 1.58
Slope of radius through end of chord: 0.153

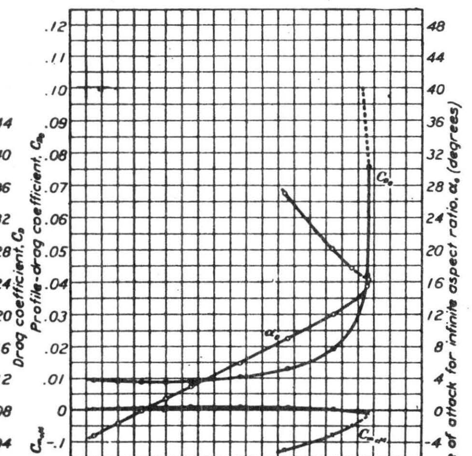
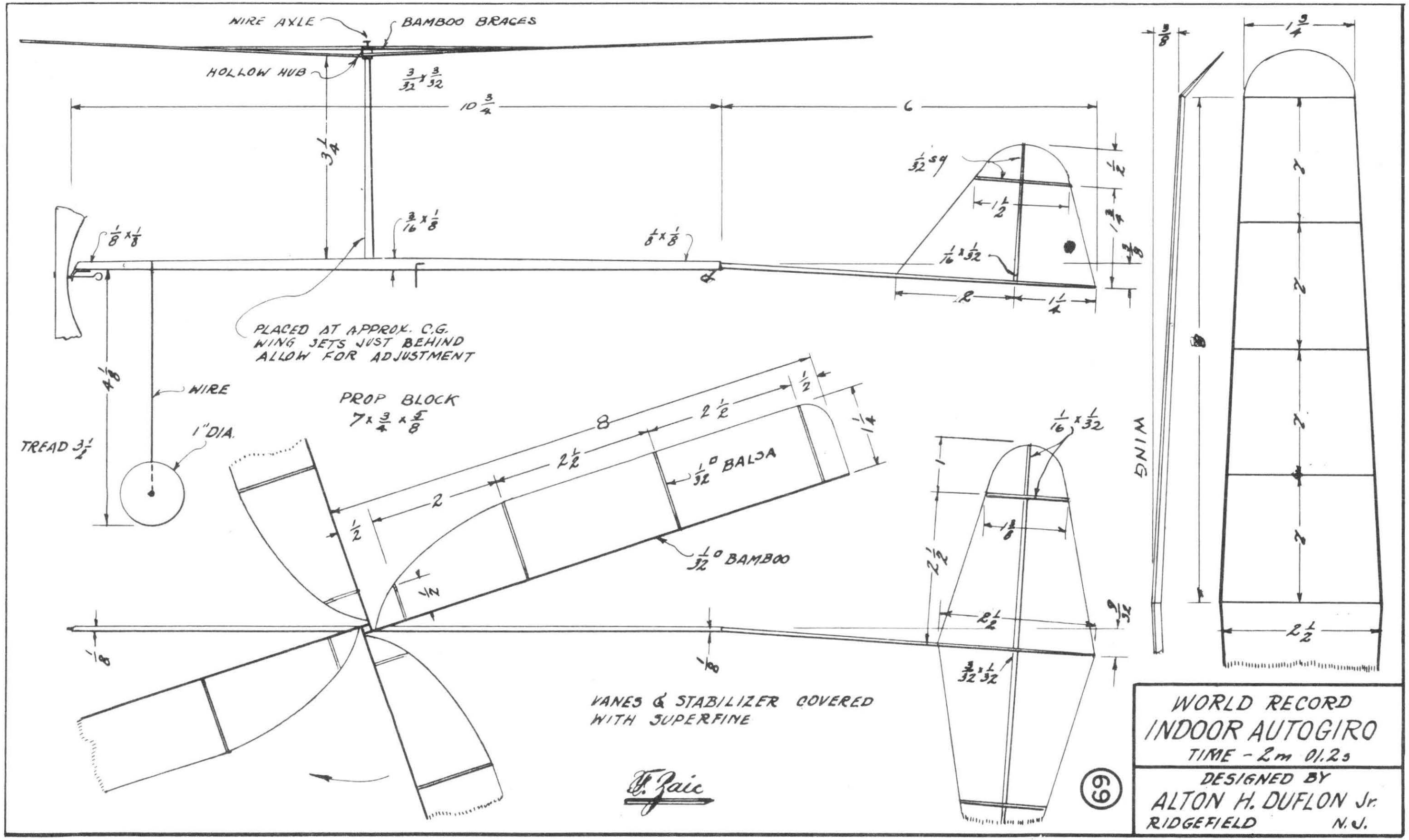
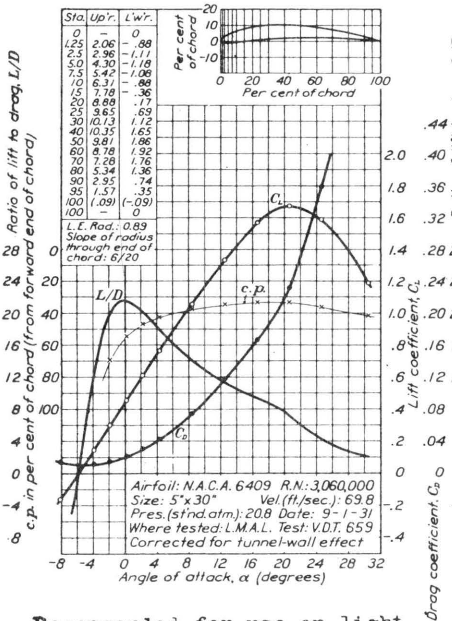
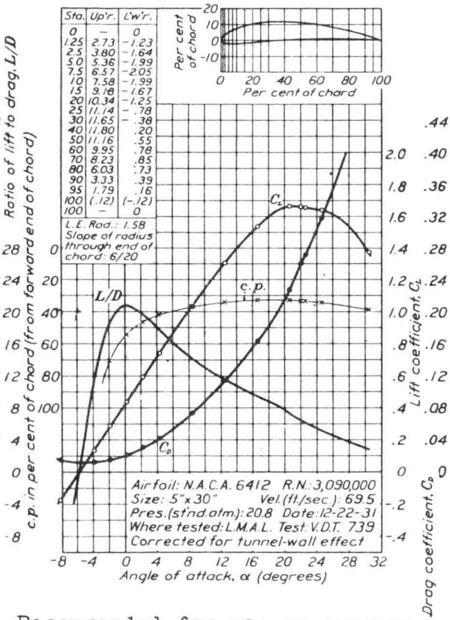


FIGURE 78.—N.A.C.A. 2R₂12 airfoil.

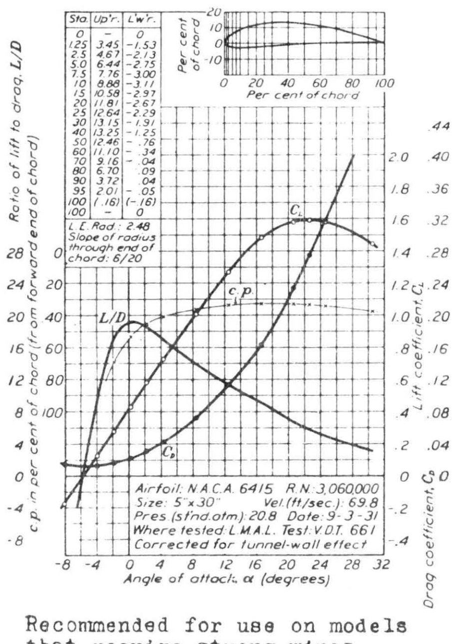

WIRE AXLE
BAMBOO BRACES
HOLLOW HUB
PLACED AT APPROX. C.G.
WING SETS JUST BEHIND
ALLOW FOR ADJUSTMENT
WIRE
1" DIA.
TREAD 3 1/2
PROP BLOCK
7 x 3/4 x 5/8
1/32 □ BALSA
1/32 □ BAMBOO
WING
VANES & STABILIZER COVERED
WITH SUPERFINE
F. Zaic
69
WORLD RECORD
INDOOR AUTOGIRO
TIME - 2m 01.2s
DESIGNED BY
ALTON H. DUFLON Jr.
RIDGEFIELD N.J.



Recommended for use on light endurance models.

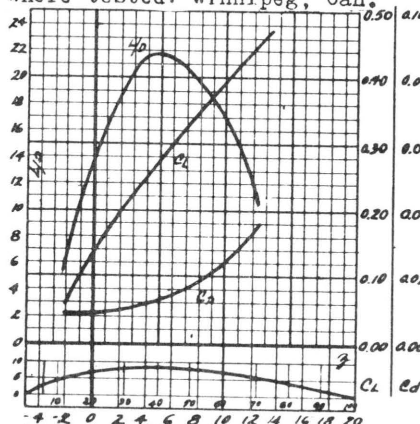


Recommended for use on average model, especially fuselages.



Recommended for use on models that require strong wings.

Name of section: McBride B-7
Wind velocity: 7 f.p.s.
A.R. test section: 3.44
Tested by: McBride, March 1932
Where tested: Winnipeg, Can.

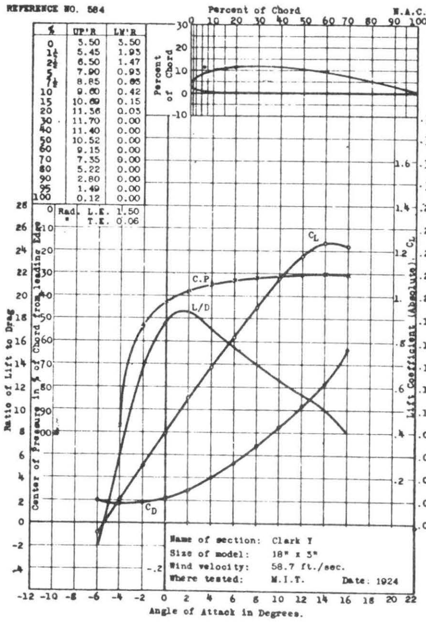


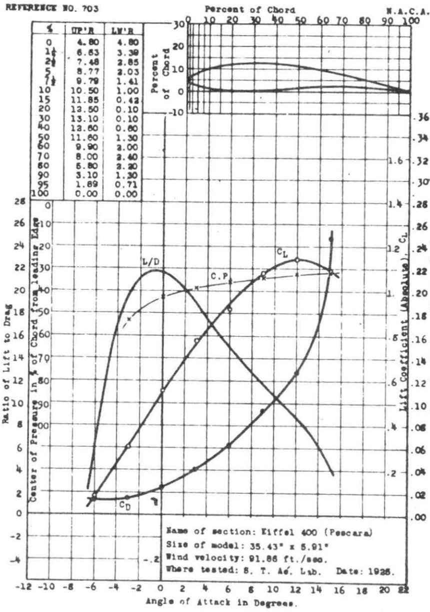
Angle of Attack in Degrees

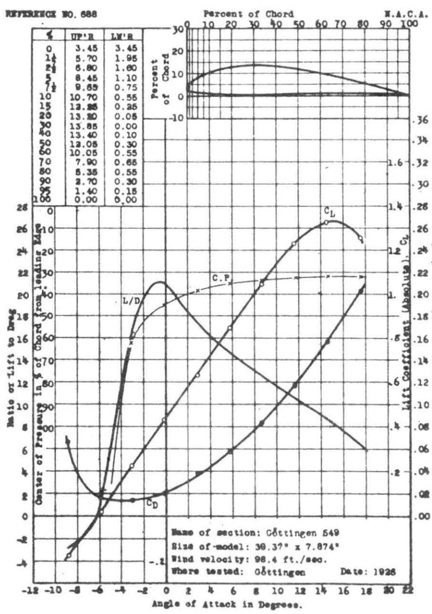
STATIONS IN % OF CHORD

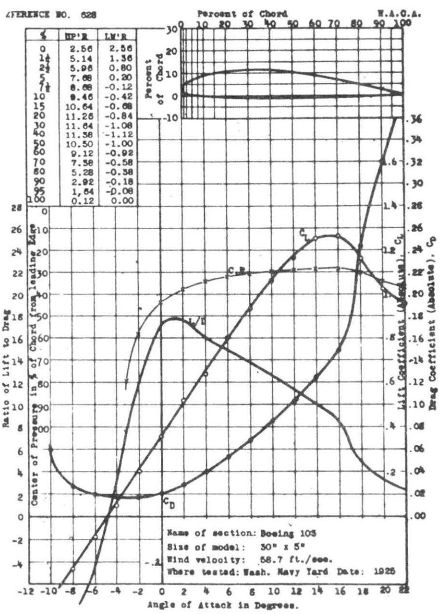
0	5	10	20	30	40	50	60	70	80	90	100
0.0	2.35	4.40	6.70	7.80	8.30	7.90	6.90	5.60	3.90	2.00	0.0

CAMBER IN % OF CHORD

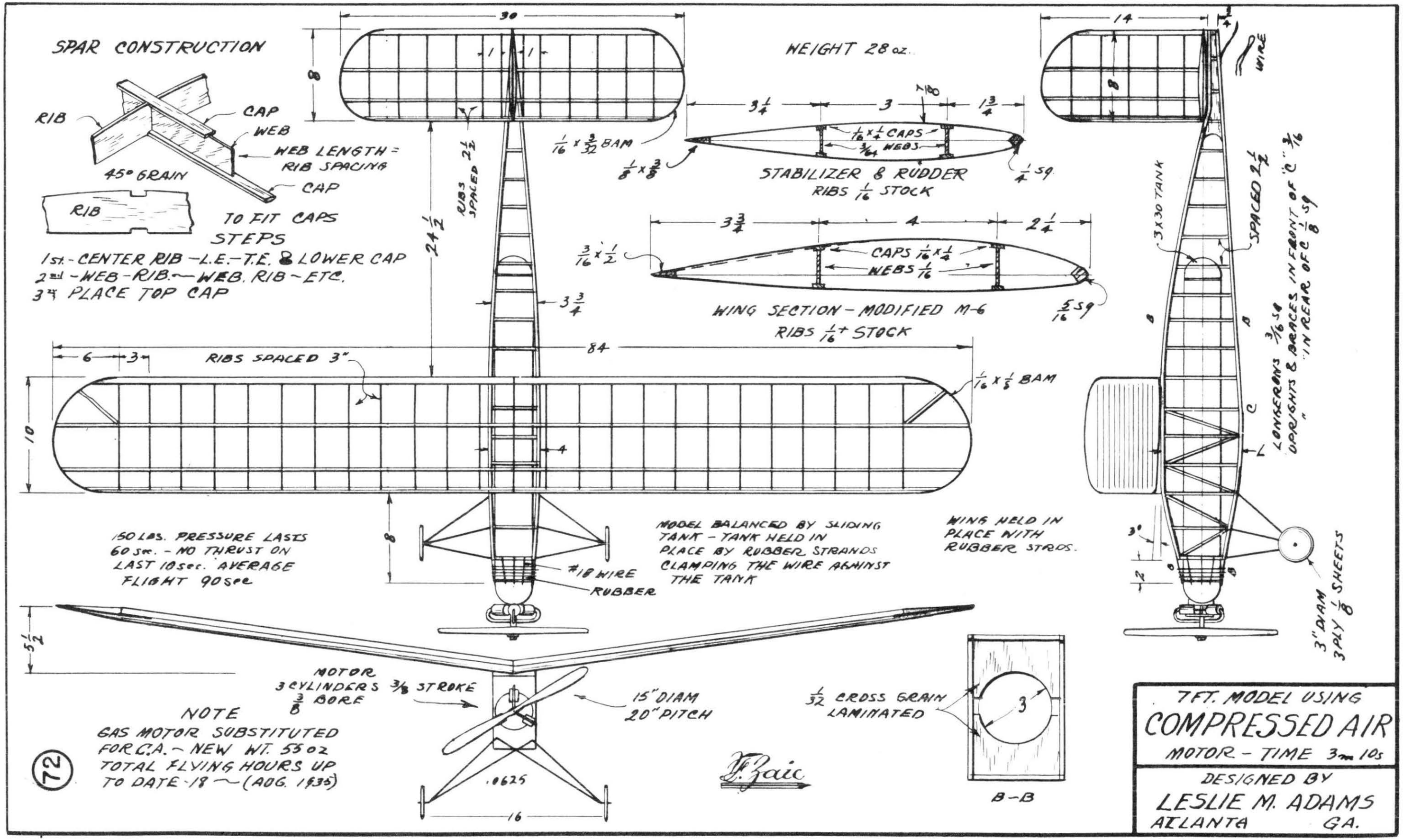








ADDITIONAL AIRFOIL SECTIONS may be found in N.A.C.A. Reports Nos. 93, 124, 182, 244, 286, 315, and 460. These reports may be seen in your library or be purchased on application to the --- Superintendent of Documents,---Government Printing Office, --- Washington, D.C. For further information write to the National Advisory Committe for Aeronautics, Navy Building, Washington, D.C.



SPAR CONSTRUCTION
RIB
CAP
WEB
WEB LENGTH = RIB SPACING
45° GRAIN
CAP
RIB
TO FIT CAPS
STEPS
1st - CENTER RIB - L.E. - T.E. & LOWER CAP
2nd - WEB - RIB - WEB, RIB - ETC.
3rd PLACE TOP CAP
30
8
1
1
RIBS SPACED 2 1/2
24 1/2
1/16 x 3/32 BAM
1/8 x 3/8
3 3/4
WEIGHT 28 oz.
3 1/4
3
1 3/4
1/16 x 1/4 CAPS
3/64 WEBS
1/4 SQ.
STABILIZER & RUDDER
RIBS 1/16 STOCK
3 3/4
4
2 1/4
3/16 x 1/2
CAPS 1/16 x 1/4
WEBS 1/16
5/16 SQ
WING SECTION - MODIFIED M-6
RIBS 1/16" STOCK
6
3
RIBS SPACED 3"
84
1/16 x 1/8 BAM
10
4
8
#18 WIRE
RUBBER
150 LBS. PRESSURE LASTS 60 sec. - NO THRUST ON LAST 10 sec. AVERAGE FLIGHT 90 sec
MODEL BALANCED BY SLIDING TANK - TANK HELD IN PLACE BY RUBBER STRANDS CLAMPING THE WIRE AGAINST THE TANK
WING HELD IN PLACE WITH RUBBER STRDS.
14
1/4
WIRE
8
3 X 30 TANK
SPACED 2 1/2
LONGERONS 3/16 SQ
UPRIGHTS & BRACES IN FRONT OF "C" 3/16
" IN REAR OF C 1/8 SQ
B
B
C
C
3°
2
B
B
3" DIAM 3 PLY 1/8 SHEETS
5 1/2
MOTOR 3 CYLINDERS 3/8 STROKE 3/8 BORE
15" DIAM 20" PITCH
NOTE
GAS MOTOR SUBSTITUTED FOR C.A. - NEW WT. 55 oz
TOTAL FLYING HOURS UP TO DATE - 18 - (AUG. 1935)
72
.0625
16
F. Zaic
1/32 CROSS GRAIN LAMINATED
3
B-B
7 FT. MODEL USING
COMPRESSED AIR
MOTOR - TIME 3 m 10 s
DESIGNED BY
LESLIE M. ADAMS
ATLANTA GA.

SOCIETY OF MODEL AERONAUTICAL ENGINEERS

(The Body governing Model Aeronautics in Great Britain, by agreement with the Royal Aero Club.)

OFFICIAL LIST OF BRITISH RECORDS, 1935

FUSELAGE MACHINES

Rising off Ground	G. M. Merrifield	9m 50.0s
Rising off Water	M. E. Hunt	1m 46.0s
Hand Launched	A. D. Paine	23m 10.0s
Speed	C. H. Debenham	33.25 m.p.h.
Auto-Gyro (H.L.)	S. R. Crow	14.4s
GLIDER		
Hand Launched	W. E. Evans	3m 10.0s
FARMAN TYPE		
Hand Launched	C. A. Rippon	31.2s
TAILLESS TYPE		
Hand Launched	F. B. Baggs	1m 30.0s
PETROL DRIVEN MACHINES		
R.O.G.	C. E. Bowden	12m 48.0s
C. A. MACHINES		
Fuselage R.O.G.	D. A. Pavely	1m 7.6s
Non-Fuselage R.O.G.	D. A. Pavely	1m 10.0s

SPAR MACHINES

TWIN PUSHER		
Rising off Ground	S. C. Hersom	4m 7.0s
Rising off Water	S. C. Hersom	1m 5.0s
Hand Launched	T. D. C. Chown	2m 25.0s
TWIN PUSHER AUTO-GYRO		
Hand Launched	D. A. Pavely	25.8s
TRACTOR		
Rising off Ground	D. A. Pavely	1m 51.2s
Rising off Water	S. C. Hersom	43.0s
Hand Launched	P. L. Wilson	2m 10.0s
GLIDER		
Hand Launched	W. E. Evans	2m 10.0s
FARMAN TYPE		
Rising off Ground	C. A. Rippon	32.4s
Hand Launched	C. A. Rippon	37.8s

MODEL AIRCRAFT LEAGUE OF CANADA

Junior Branch, Aviation League of Canada

OFFICIAL CANADIAN MODEL AIRCRAFT RECORDS

INDOOR

STICK R.O.G.

Junior:	Clarence Dunn, Hamilton Ont.	4m 19s
Senior:	Ernest Houslander, Hamilton Ont.	8m 34s
Adult:	Ted Booth, Hamilton Ont.	5m 27s

STICK HAND LAUNCHED

Junior:	Don McIntyre, Guelph Ont.	5m 43s
Senior:	Harry Burrows, Toronto Ont.	17m 14s
Adult:	John T. Dilly, Galt Ont.	13m 56s

FUSELAGE R.O.G.

Junior:	George Reed, Toronto Ont.	3m 56s
Senior:	Albert Levy, Toronto Ont.	8m 56s
Adult:	John T. Dilly, Galt Ont.	6m 23s

FLYING SEMI-SCALE

Junior:	Jack Barton, Weston Ont.	1m 46s
Senior:	Harold Frier Birch, Cliff Ont.	2m 19s
Adult:	Albert Levy, Toronto Ont.	4m 14s

GLIDER HAND LAUNCHED

Senior:	Ernest Barrie, Galt Ont.	33s

OUTDOOR

STICK HAND LAUNCHED

Junior:	Jack Purvis, Toronto Ont.	5m 20s
Senior:	Vic Davey, Winnipeg Man.	5m 41s

WAKEFIELD

Junior:	Jeff Noble, Toronto Ont.	49s
Senior:	Bill Hunt, Vancouver B.C.	2m
Adult:	Fred J. Rogerson, Hamilton Ont.	1m 12s

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