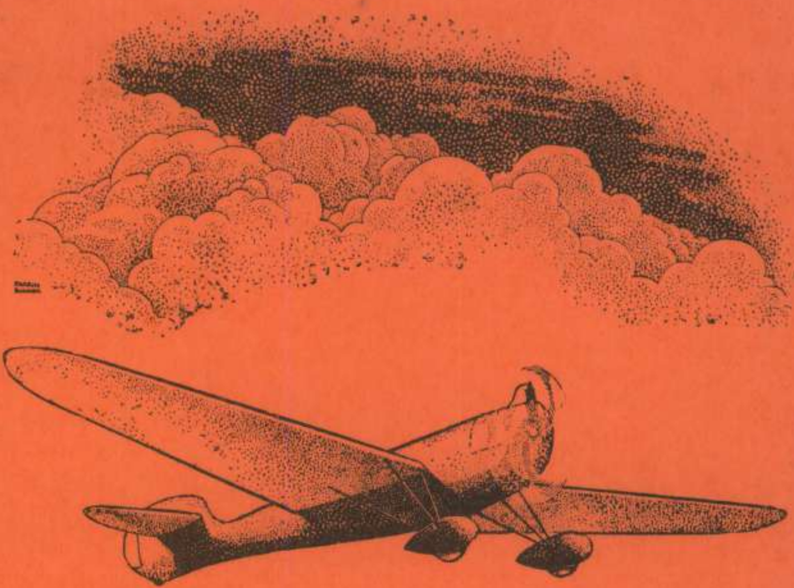

1937
MODEL AERONAUTICS YEARBOOK

BY FRANK ZAIC

1937 MODEL AERONAUTICS YEAR BOOK

Edited By

FRANK ZAIC

NEW YORK

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To Dad

and

Lieut. H. W. Alden, U.S.N.

Foreword

In behalf of the model fraternity, we would like to thank Lieut. H. W. Alden for his splendid work in organizing the activities of the Junior N. A. A. He was the man behind the four recent National Contests, and also promoted the American end of the Wakefield competition. Lieut. Alden also formulated the present N. A. A. model airplane rules, which are now accepted almost universally. He is a model builder of very long standing, and his only regret now is that the organizing activities of the game keep him from the building end. He has had to go through many discouraging periods, sacrificing a great deal of his time and money to make model aeronautics a hobby par excellence.

To our over-border and over-seas friends: we are sure that you have many men of similar calibre among you, who hide their personal lights behind some organization, and who work late into the night so that you and I can enjoy the next contest day with the minimum of technical restrictions. We hope that you will give them your full support and encouragement. The future of the game depends upon these leaders who make many sacrifices for our hobby, without thought of monetary return.

It would have been impossible to prepare a book of this size in such a short time as four "high-pressure" months if it were not for the whole-hearted cooperation of the contributors. It would also have been quite impossible to produce this book at such low cost if it were not for their generosity in giving their material without expecting any reembursement. We work on a close financial margin, and the best that we can do at present is to welcome them to the membership of the distinguished group of past contributors, and to present them with a complimentary copy of the Year Book, just as long as it is published. You can show your appreciation to them by using their ideas and by writing to them in care of the Year Book telling how their designs or their ideas have worked for you.

Sincere thanks are also due to Dave Hecht for his work in proof-reading, correcting, and typing, as well as helping us to pass the time pleasantly while we were rather detached from the rest of the world. We are also indebted to J. P. Glass for his valuable advice and proof-reading of the technical chapters. We still blush when we remember some slips that almost sneaked into the book.

In closing, we wish to thank the past readers for making the continuance of these Year Books possible by their subscriptions. A glance through the book will show that we are making rapid strides towards true scientific designing. Although we practically have drained our note book, we are sure that the coming year will bring many new and startling discoveries. The size of this year's book should convince the most sceptical that it pays us all to contribute our ideas, as the more we know, the greater are the horizons of model knowledge that unfold before us.

January, 1937
New York City

Frank Zaic

THEORY

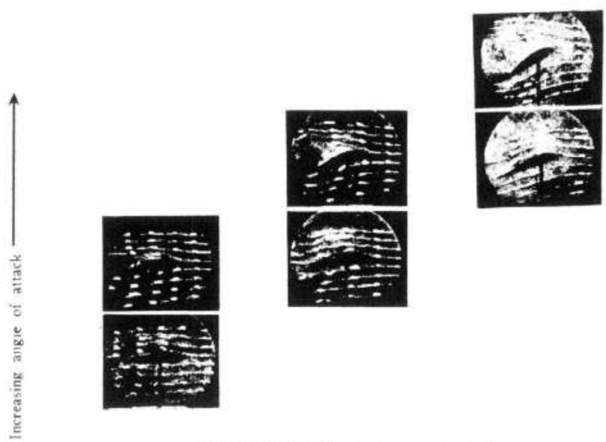
LOW SPEED AERODYNAMICS

The goal of the contest model builder is to have his models remain in the air for the longest possible time. To obtain maximum duration from the pure merits of the model, he must know just how the air acts on models at their relatively low speeds. By knowing just how the air behaves at low speeds he can pattern his model to conform to a shape most efficient for low speeds. The results of such procedure will be the possibility of flying models very economically, which in turn will prolong their limited power.

Although interest in low speed aerodynamics is expressed by most model builders, very little testing has been done. However, the desire for facts is spreading, and several clubs are constructing slow speed wind tunnels. It is quite possible that by next year we will have some positive results. Until then, we can only review the present thought about the subject.

It might be mentioned here that a great deal can be learned about low speeds from early Aerodynamics books, dated from 1900 to 1914. Unfortunately, most of the formulas were assumed for speeds over 30 miles per hour. The real low speed tests (2-10 miles per hour) are presented as comparisons, to show that certain laws do not hold to specific bounds throughout the whole range of speeds.

One of the best proofs that we cannot accept the present airfoil chart values for model work, without modifications, is presented by the following photographs from an article appearing in the Journal of Aeronautical Sciences, Aug., 1936, prepared by H. C. H. Townend, National Physical Laboratory, England. The light lines showing the air flow are streams of electrically heated air which were photographed through the use of certain optical properties of heated air.



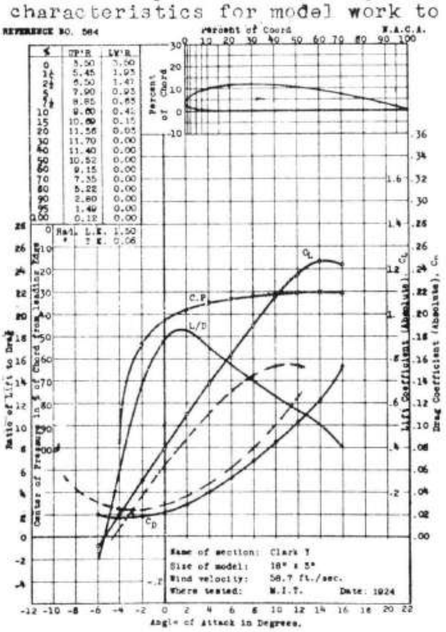
In Photograph 1. the airfoil is at zero degrees angle of attack. The close spacing of the spark dots shows that the air speed is comparatively slow. In this position the lift of the airfoil is small. You all know that to increase the lift, the angle of attack (the angle between the airfoil and the airflow) must be increased, and that the greater the angle, the greater is the lift. However, there is an end to this happy conincidence. After a certain angle is reached, the air refuses to flow smoothly (see Photograph 2.), and it spills over the leading edge and becomes turbulent. When such a condition arises the lift drops off, and consequently the plane stalls because there is not enough lift to keep it up. The stalling angle depends upon the air speed and also upon the airfoil.

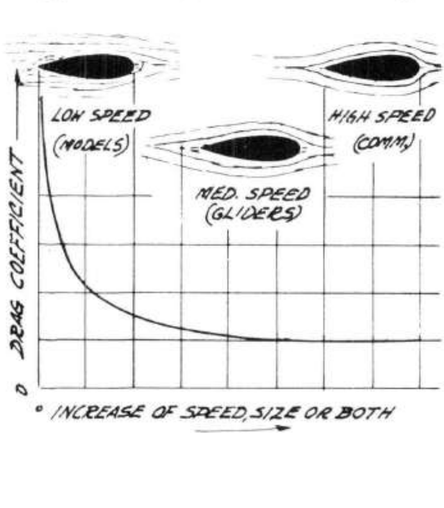
In Photograph 2. we see the airfoil in a stalled position. The air speed is the same as that in Photograph 1. Note the low angle of attack and also the rolling action of the air behind the wing. In this position the effect of the upper camber is lost and we can only depend upon the lower surface to lift. It would be very unwise to try to pull the wing through the air in this condition, as the power necessary to overcome the drag of the turbulent air would be tremendous. This might explain why certain models with improper line-up refuse to gain altitude no matter how much power is applied.

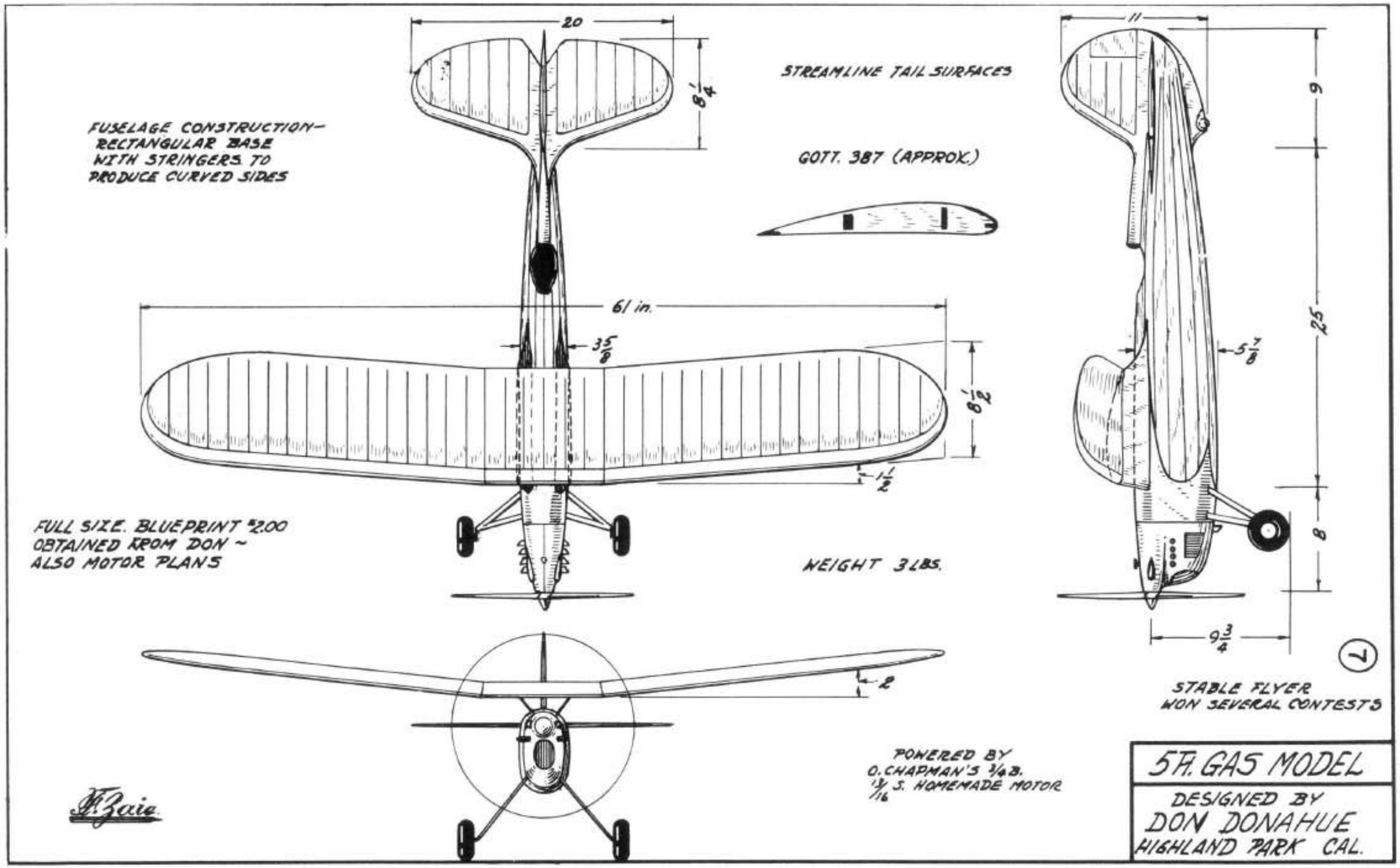
Photograph 3. shows the airfoil at the same angle of attack as in Photograph 2., but with the air speed increased. Notice how the burbling or stalling air has straightened out, and so has restored the lift of the upper camber. From this illustration we can see that a high speed plane can fly at higher angles of attack than a low speed job, without stalling. Photos 4., 5., and 6. amplify the principle.

Special note should be made of the fact that by judging from the spacing of the spark dots, the air speed in Photographs 5. and 6. is about three times that of Photographs 1. and 2. Also note that the angle of attack is 10° in Photograph 2., 18° in Photograph 4., and 28° in Photograph 6.

It has also been proved that the lift coefficient is much smaller at low speeds than at high. Therefore we can assume airfoil characteristics for model work to be approximately as shown in Fig.A





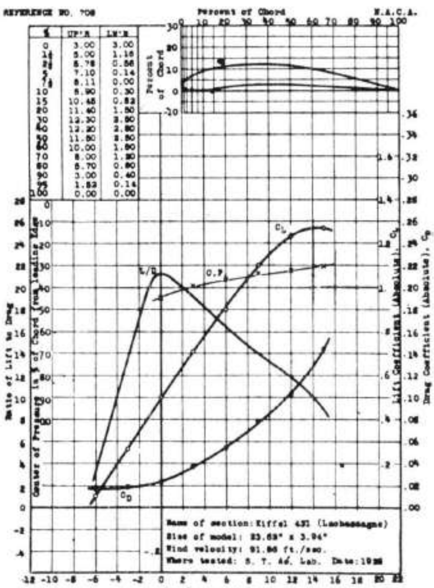

20
$8\frac{1}{4}$
STREAMLINE TAIL SURFACES
11
9
FUSELAGE CONSTRUCTION—
RECTANGULAR BASE
WITH STRINGERS TO
PRODUCE CURVED SIDES
GOTT. 387 (APPROX.)
61 in.
$3\frac{5}{8}$
25
$5\frac{7}{8}$
$8\frac{1}{2}$
$1\frac{1}{2}$
FULL SIZE BLUEPRINT #2.00
OBTAINED FROM DON ~
ALSO MOTOR PLANS
WEIGHT 3 LBS.
8
$9\frac{3}{4}$
7
2
STABLE FLYER
WON SEVERAL CONTESTS
POWERED BY
O. CHAPMAN'S 3/4 B.
$1\frac{3}{16}$ S. HOMEMADE MOTOR
5 FT. GAS MODEL
DESIGNED BY
DON DONAHUE
HIGHLAND PARK CAL.
H. Zaic

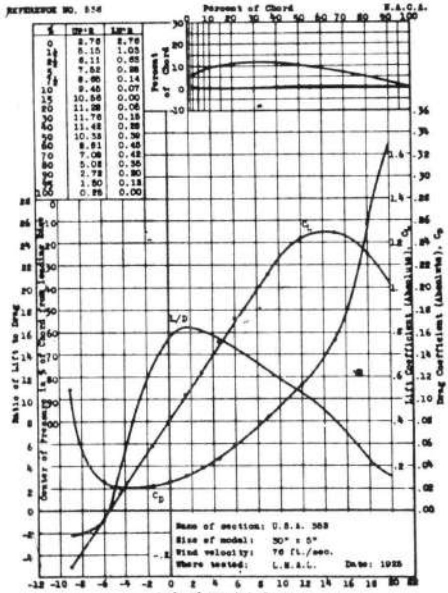
The drag will also be found to be actually greater for models than that calculated from the standard drag coefficients. This can also be explained by the photographs. Since the drag is the result of disturbing the airflow, and the airflow is easily disturbed at low speeds, the drag coefficients are much greater for low speeds than for higher speeds. See Fig. B. for the coefficient difference and also Fig. A. which shows the drag curve assumed for model work.

These proofs should convince the most sceptical that it pays to streamline at low speed. We should not use the record list as a basis for an argument against streamlining as the record flights were almost all made with the aid of thermal currents. What we want is a much higher average flight. The chances of getting a ten minute flight are about 1 in 50, and a five minute flight, about 1 in 20. The odds are getting better year by year, as we pay more heed to low speed aerodynamics.

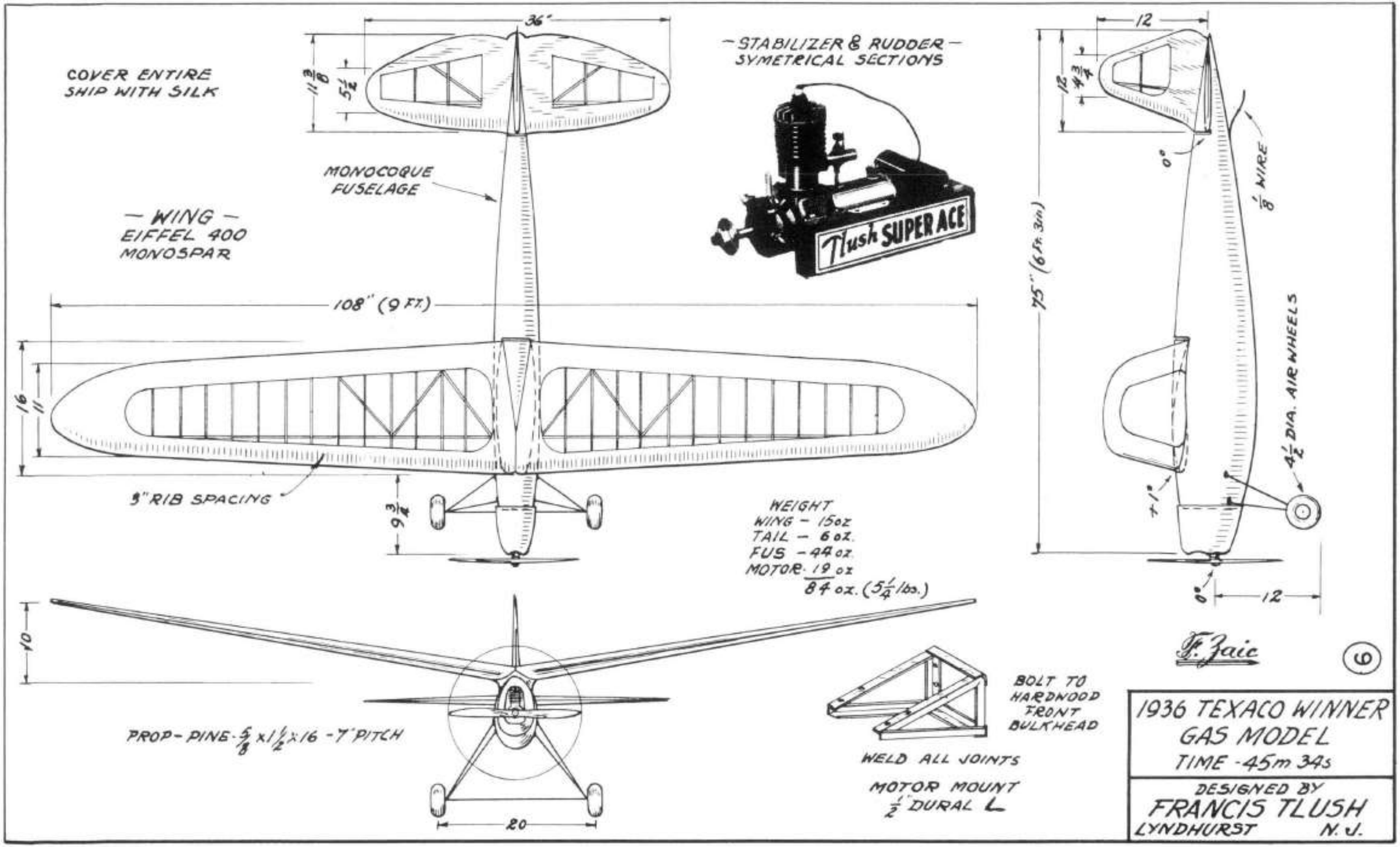
Just where does the drag come in on all this? Well, the point is that if, for example, it requires 2 oz. of thrust to fly a model, at least one oz. of this thrust is used up in overcoming the drag of the fuselage, landing gear, and tail. If we did not have all these things, it would be possible to fly the model twice as long for the same power, thereby doubling our duration in calm air, as well as doubling our chances of catching a thermal. With this in mind, let us remember how the airflow behaves at low speeds, so that we may pattern the model to conform to the shape most suitable for low drag.

The best possible shape for each part, as well as the effect of streamlining on stability, will be considered under their own headings.





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.


COVER ENTIRE SHIP WITH SILK
36"
11 3/8
5 1/2
— STABILIZER & RUDDER — SYMETRICAL SECTIONS
Tlush SUPER ACE
MONOCOQUE FUSELAGE
— WING — EIFFEL 400 MONOSPAR
108" (9 FT.)
16
11
9" RIB SPACING
9 3/4
WEIGHT
WING – 15 oz
TAIL – 6 oz.
FUS – 44 oz.
MOTOR 19 oz
84 oz. (5 1/4 lbs.)
12
4 3/4
0°
1/8 WIRE
75" (6 Ft. 3 in)
4 1/2 DIA. AIR WHEELS
+1°
0°
10
PROP – PINE 5/8 x 1 1/2 x 16 – 7" PITCH
20
BOLT TO HARDWOOD FRONT BULKHEAD
WELD ALL JOINTS
MOTOR MOUNT 1/2" DURAL L
F. Zaic
6
1936 TEXACO WINNER GAS MODEL
TIME – 45m 34s
DESIGNED BY FRANCIS TLUSH
LYNDHURST N. J.

AIRFOILS

The first step in designing a contest model is to decide upon the size desired. After this is done an approximation of the weight should be made. From the weight estimate, the area of the wing should be determined. Before the final decision is made, remember that the performance of the model depends a great deal upon its wing loading, so crowd in as much area as the rules allow. The next and perhaps the most important step is to select the airfoil.

Since airfoils stall at lower angles, at low speeds, we must select a section that has sufficient lift at low angles of attack. The sections having this quality are those whose thickness exceeds 8% of the chord and whose lower portions are flat or undercambered (concave). Although lift increases with an increase in thickness, an excessive increase in drag and other disadvantages become evident with the use of section of over 15% chord thickness, at low speeds. A thickness of 12% of the chord seems to be the best compromise.

Fig. 1.

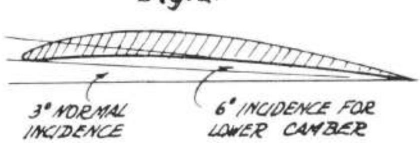
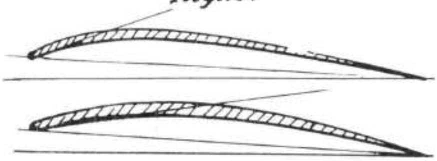
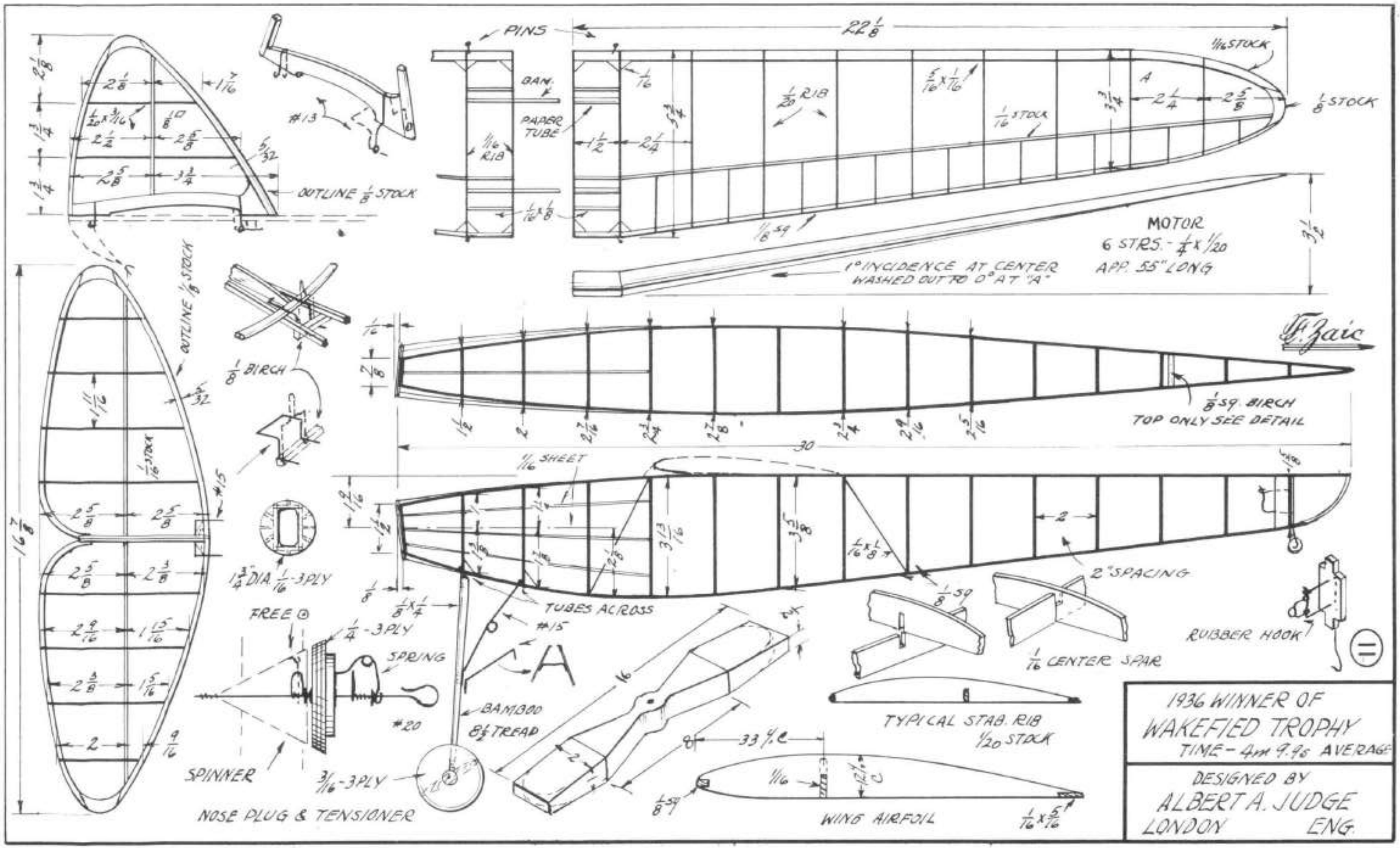


Fig. 2.



One way of increasing the lift without the addition of too much drag is to use an undercambered airfoil. The reason that the undercambered section develops more lift than a similar section with a flat bottom is that the airflow acts at a greater angle against the lower portion of the airfoil. See Fig. 1. Thus we can increase the angle of attack of the lower portion of the airfoil, without increasing the angle of the upper portion. (Remember that it is the air going over the upper camber which burbles at high angles of attack.) This increase of lift becomes especially prominent at angles greater than 0°. Since we usually set the airfoil at about 3° positive we can use the undercamber advantageously. The undercamber may be quite deep, but we must keep in mind that too much of it will cause appreciable drag by the eddy behind the leading edge. See Fig. 2. From this diagram we can see that the highly undercambered section should have the maximum height at about 40% of the chord to minimize the eddy tendencies. The undercambered sections have a greater center of pressure travel and also a lower lift-drag ratio. However, these points should not be used as criterions in selecting the airfoil. What we want is enough lift, even at the expense of a bit of additional drag (which is very small in comparison with the rest of the model). The center of pressure travel is taken care of by the abnormal size of stabilizer used on models.

Every so often someone asks why a stable section like an M-6 should not be used instead of an RAF 32. Then the fact that the RAF 32 lifts as much at 0°, as the M-6 does at 7° is pointed out. "But why don't you set the M-6 at 7° and get the same lift as the RAF 32, and get the advantages of a more stable section?" --Well, the fallacy here is that most sections stall within a few degrees of each other. The M-6 with 7° setting will stall much sooner than the RAF 32. For example; if the M-6 stalls at 20° it has 13° leeway, and if the RAF 32 stalls at 18° it has 18° leeway. These figures, by the way, are for full size work. The stalling angle is much lower for model sizes-- possibly half of the above figures, and the leeway is that much smaller.


1936 WINNER OF
WAKEFIED TROPHY
TIME - 4m 9.9s AVERAGE
DESIGNED BY
ALBERT A. JUDGE
LONDON ENG.
11
PINS
BAM.
PAPER TUBE
1/16 RIB
1/16 STOCK
1/8 STOCK
1/20 RIB
1/8 SQ
MOTOR
6 STRS. - 1/4 x 1/20
APP. 55" LONG
1° INCIDENCE AT CENTER
WASHED OUT TO 0° AT "A"
OUTLINE 1/8 STOCK
#13
1/8 BIRCH
1/8 SQ. BIRCH
TOP ONLY SEE DETAIL
1/16 SHEET
TUBES ACROSS
#15
1 3/4" DIA. 1/16 - 3PLY
FREE
1/4 - 3PLY
SPRING
#20
SPINNER
3/16 - 3PLY
NOSE PLUG & TENSIONER
BAMBOO
8 1/2 TREAD
2" SPACING
1/16 CENTER SPAR
RUBBER HOOK
TYPICAL STAB. RIB
1/20 STOCK
WING AIRFOIL
33 1/3 C
F. Zaic

In choosing the airfoil, the structural requirements of the particular model must be kept in mind. The best airfoil is useless if the wing does not keep its shape, or if it breaks at the slightest collision. In fact, all the advantages of the finest airfoil can be spoiled by poor balance, improper incidence, and high total drag.

After considering structural requirements of airfoils, the following standard sections will be found suitable for model work: RAF 32, Eiffel 400, U. S. 35B, Gottingen 392, Eiffel 431, Gott. 496, Gott. 529, ISA 923b, and Clark Y. (Also see sections developed by model builders.) The specific recommendation is made under the individual report. On these reports you will also find the approximate values for model work. Use them and check their accuracy.

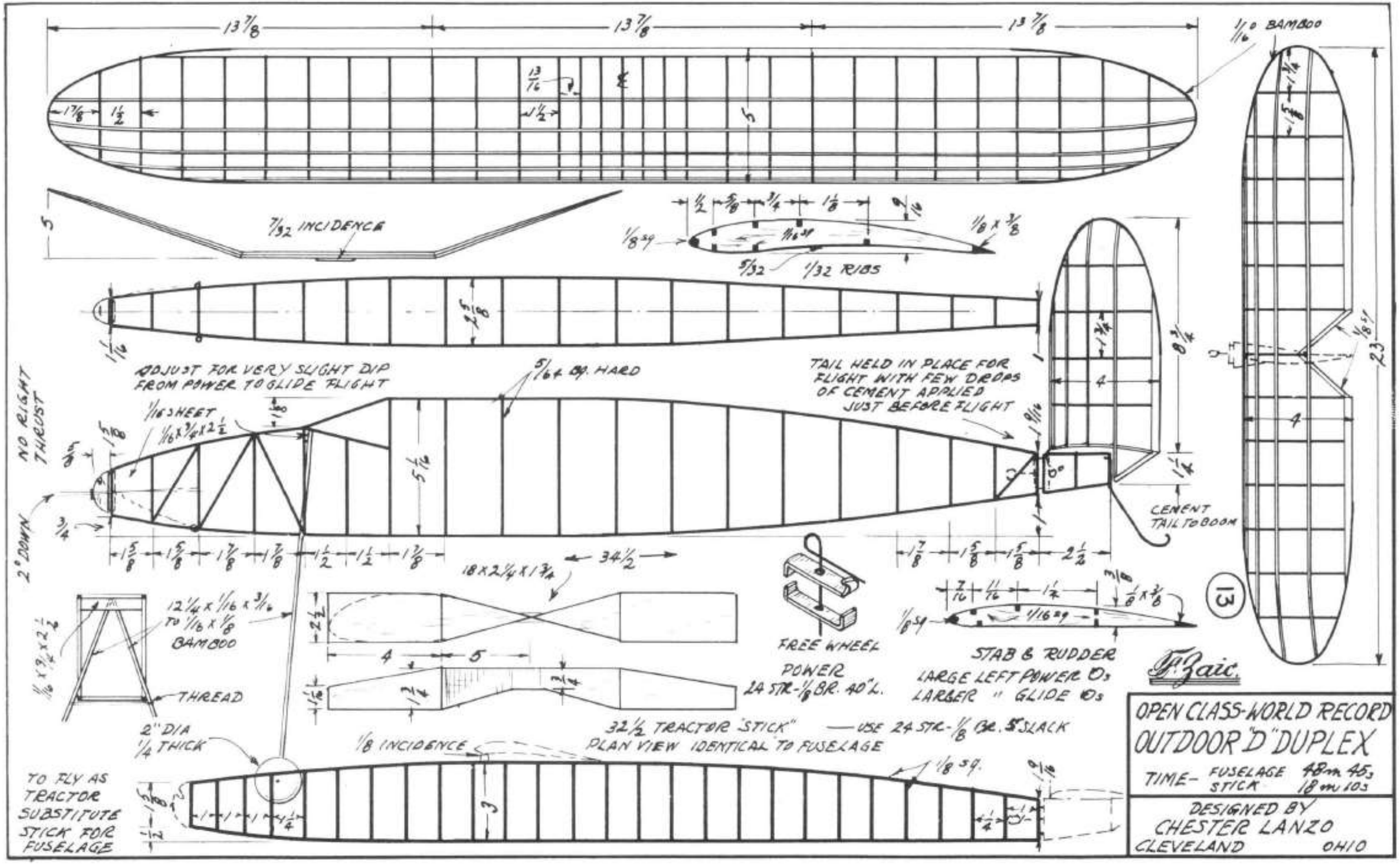
The Editor believes that the best practical section is the RAF 32 which was introduced to use on models by him several years ago. Its characteristics are very good, as it has all the desirable points. It may be used in thinner or thicker form for light or heavy models. The Eiffel 400 almost matches it in characteristics, but the thin trailing edge, and the comparatively high leading edge place it second.

Airfoil Characteristics Charts

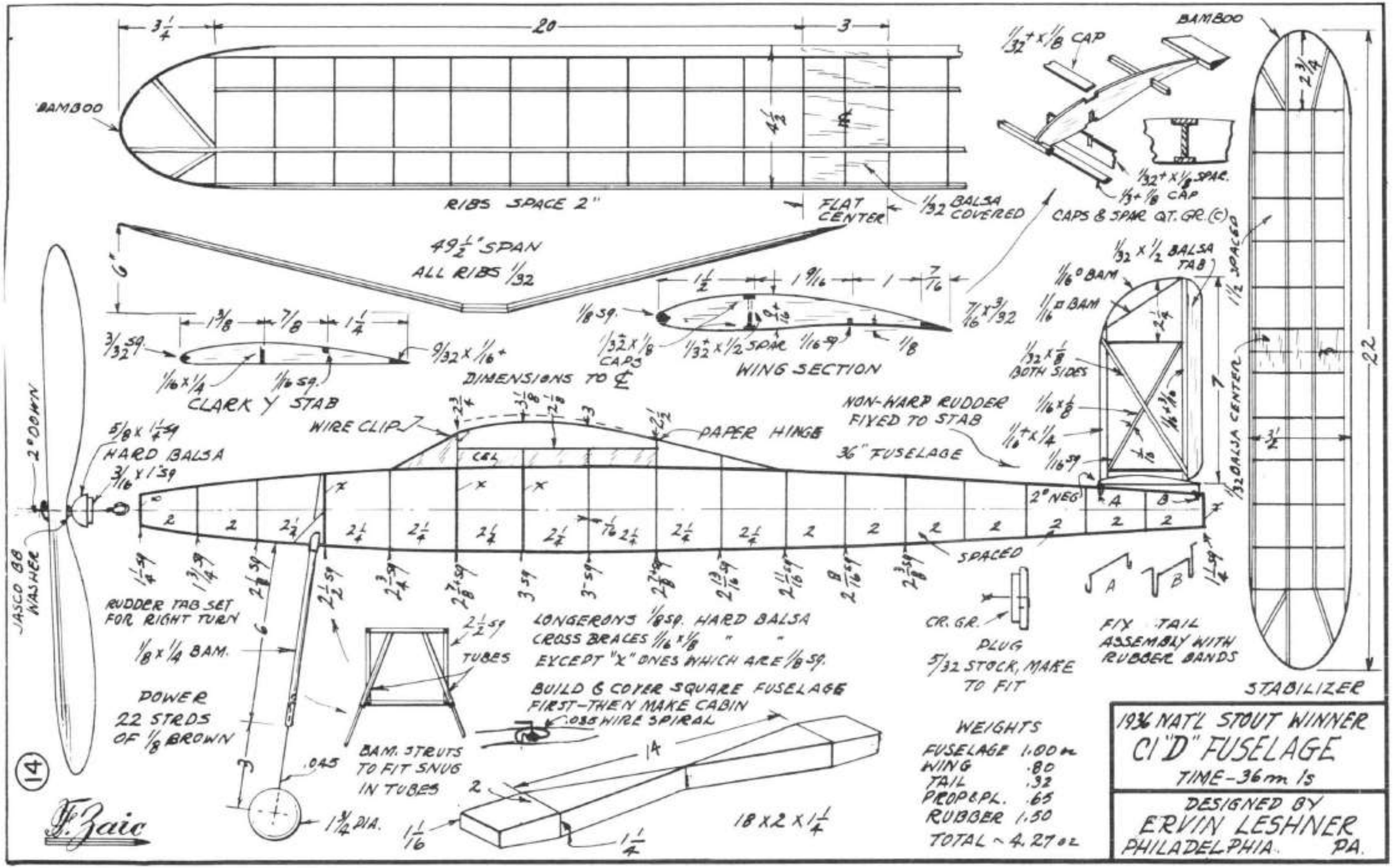
Airfoil characteristics charts show the wind tunnel results. translated so that they can be used for power planes and gliders. Eventually we will have such charts for model work, and therefore a short summary of the chief curves will give an inkling as to what they are all about, to those who do not know how to use them. The curve labeled C_L shows the coefficient of lift at different angles of attack. Note that the slope of the graph is almost the same for all airfoils. The only difference is that the curves cross the 0° line at different points. Notice that the airfoils chosen for model work have this line quite high. The higher this crossing, the better the section, providing that it is not too thick. The termination of the upward trend just before the slope downward indicates that the section has reached its maximum lifting point, and that it is close to the burbling point if not actually in it. This stalling point occurs sooner at low speeds, and also occurs slightly sooner for high aspect rations. The method of using lift graph for calculations is as shown in the example.

The next curve is the C_D line. This shows the drag values at different angles of attack. For best results this line should be as close to the .00 mark as possible, providing that the section has enough lift. The C_D line is the result of two kinds of drag, the parasitic and the induced. Parasitic drag is that part of the resistance which is caused by moving objects disturbing the airflow. It is the drag with which we are all familiar when streamlining is talked about. The induced drag is evident mostly on inclined planes such as wings and tail surfaces. It is caused by the airflow from the compressed air area under the airfoil into the rarefied upper portion. See Fig. 3. At the tips this equalizing flow is especially great. The degree depends upon the size of the tip. The larger and blunter tips will have a greater flow, while the small and gradually tapered tip will have a comparatively small spill-over with consequent smaller disturbance of the air. The drag is calculated as shown. (The topic of induced drag brings us right into the Aspect Ratio question, but as we are on chart reading, the Aspect Ratio will be discussed later.)

The curves that remain are the C. P. (center of pressure) and the L/D (the lift divided by the drag). The C. P. line shows the center of all lifting components at the particular angle. For example, in the airfoil shown, the center of lift at zero degrees is 45% behind the leading edge.



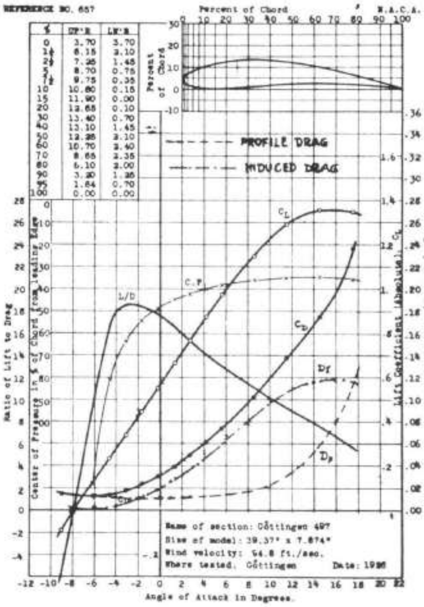
1/16 BAMBOO
7/32 INCIDENCE
1/8 sq.
1/32 RIBS
1/8 x 3/8
ADJUST FOR VERY SLIGHT DIP FROM POWER TO GLIDE FLIGHT
5/64 sq. HARD
1/16 SHEET
NO RIGHT THRUST
2° DOWN
TAIL HELD IN PLACE FOR FLIGHT WITH FEW DROPS OF CEMENT APPLIED JUST BEFORE FLIGHT
CEMENT TAIL TO BOOM
18 x 2 1/4 x 1 3/4
12 1/4 x 1/16 x 3/16 TO 1/16 x 1/8 BAMBOO
THREAD
FREE WHEEL
POWER
24 STR.-1/8 BR. 40" L.
STAB & RUDDER
LARGE LEFT POWER Os
LARGER " GLIDE Os
2" DIA 1/4 THICK
1/8 INCIDENCE
32 1/2 TRACTOR "STICK" — USE 24 STR.-1/8 BR. 5" SLACK
PLAN VIEW IDENTICAL TO FUSELAGE
TO FLY AS TRACTOR SUBSTITUTE STICK FOR FUSELAGE
13
F. Zaic
OPEN CLASS-WORLD RECORD
OUTDOOR "D" DUPLEX
TIME- FUSELAGE 48m 45s
STICK 18m 10s
DESIGNED BY
CHESTER LANZO
CLEVELAND OHIO



1936 NAT'L STOUT WINNER
Cl "D" FUSELAGE
TIME–36 m 1s
DESIGNED BY
ERVIN LESHNER
PHILADELPHIA PA.
BAMBOO
RIBS SPACE 2"
FLAT CENTER
1/32 BALSA COVERED
49 1/2" SPAN
ALL RIBS 1/32
1/32+ x 1/8 CAP
1/32+ x 1/8 SPAR
1/32+ 1/8 CAP
CAPS & SPAR QT. GR. (C)
WING SECTION
1/8 SQ.
1/32 x 1/8 CAPS
1/32+ x 1/2 SPAR
1/16 SQ.
7/16 x 3/32
CLARK Y STAB
3/32 SQ.
9/32 x 1/16+
1/16 x 1/4
1/16 SQ.
DIMENSIONS TO ℄
1/32 x 1/2 BALSA TAB
1/16 □ BAM
1/32 x 1/8 BOTH SIDES
NON-WARP RUDDER FIXED TO STAB
36" FUSELAGE
1/32 BALSA CENTER
1 1/2 SPACED
2° DOWN
5/8 x 1 1/4 SQ. HARD BALSA
3/16 x 1" SQ.
WIRE CLIP
CEL.
PAPER HINGE
2° NEG
SPACED
JASCO BB WASHER
RUDDER TAB SET FOR RIGHT TURN
1/8 x 1/4 BAM.
LONGERONS 1/8 SQ. HARD BALSA
CROSS BRACES 1/16 x 1/8 " "
EXCEPT "X" ONES WHICH ARE 1/8 SQ.
TUBES
CR. GR.
PLUG
5/32 STOCK, MAKE TO FIT
FIX TAIL ASSEMBLY WITH RUBBER BANDS
STABILIZER
BUILD & COVER SQUARE FUSELAGE FIRST–THEN MAKE CABIN
.035 WIRE SPIRAL
POWER
22 STRDS OF 1/8 BROWN
BAM. STRUTS TO FIT SNUG IN TUBES
.045
1 3/4 DIA.
18 x 2 x 1 1/4
WEIGHTS
FUSELAGE 1.00 oz
WING .80
TAIL .32
PROP & PL. .65
RUBBER 1.50
TOTAL ~ 4.27 oz
14
F. Zaic

The lift over drag ratio is an indicator of how much the lift is greater than the drag. Remember the L/D line should not be the only deciding factor in the selection of an airfoil.

The formulas used to calculate lift and drag are as follows, as per the N. A. C. A. reports:



LIFT FORMULA

$$\text{Lift (in lbs.)} = C_L \frac{\rho}{2} S V^2$$

DRAG FORMULA

$$\text{Drag (in lbs.)} = C_D \frac{\rho}{2} S V^2$$

C_L = Lift Coefficient
C_D = Drag Coefficient
ρ = Density of air .00237 (at 15°C & 760mm
S = Surface area in sq.ft.
V = Air Speed in Ft. Sec.

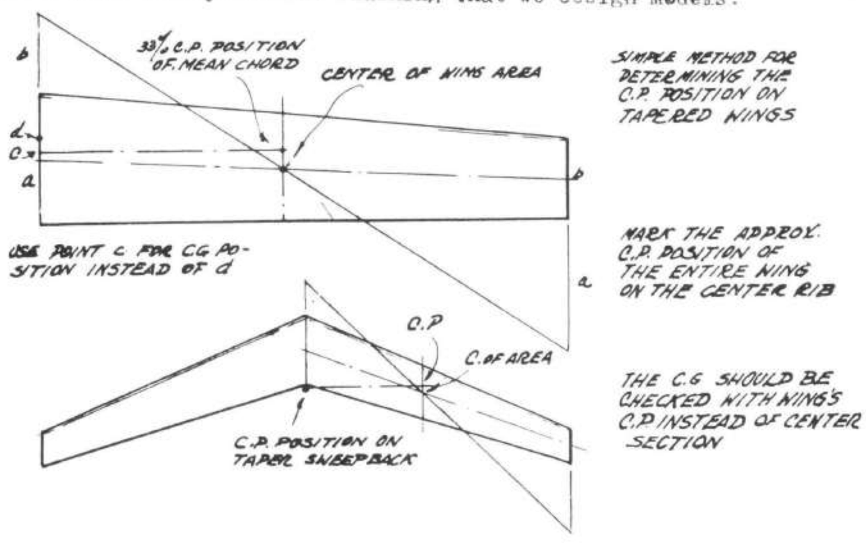
EXAMPLE

To find lift and drag of a wing whose area is 8 sq.ft., section Gőtt. 497 at 2° pos. Air speed 20mph (29.33 ft.sec.)

Lift = .7 X .001185 X 8 X 29.33^2
Ans, 5.268~~552640~~ lbs.

Drag = .045 X .001185 X 8 X 29.33^2
Ans. .3569~~7838400~~ lbs.

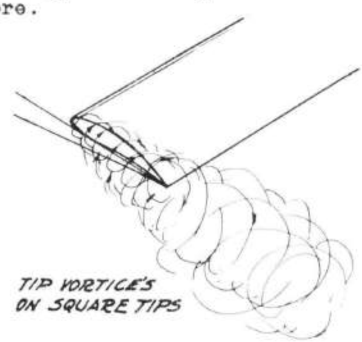
When we have charts for low speed work, we will be able to find out the minimum speed at which the wing will lift the weight of the model. The calculation of total drag can be based on this speed, and once the drag is known, the proper design of the propeller can be easily selected. When we will make models in this way, we really will be able to say without blushing that we design models.



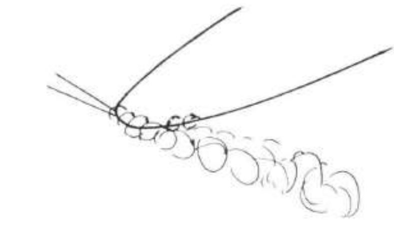
Aspect Ratio

Aspect Ratio seems to be the favorite topic of most writers. The only difficulty is that some recommend high aspect ratio and others recommend low. Sometimes opposite recommendations appear in the same issue of a magazine, which is rather confusing, to say the least. Well, let's see just what aspect ratio is, and how it affects the wing efficiency.

Aspect ratio is the ratio expressed by dividing the span by the average chord. Its effect upon the wing's efficiency, is that it determines the size of the tip whorls and other whorls caused by the pressure differential between the upper and lower cambers. A low aspect ratio wing will naturally cause greater tip losses than a high aspect ratio wing. These losses result in less lift and greater drag. The drag is called induced drag, and has been described before.



TIP VORTICES
ON SQUARE TIPS



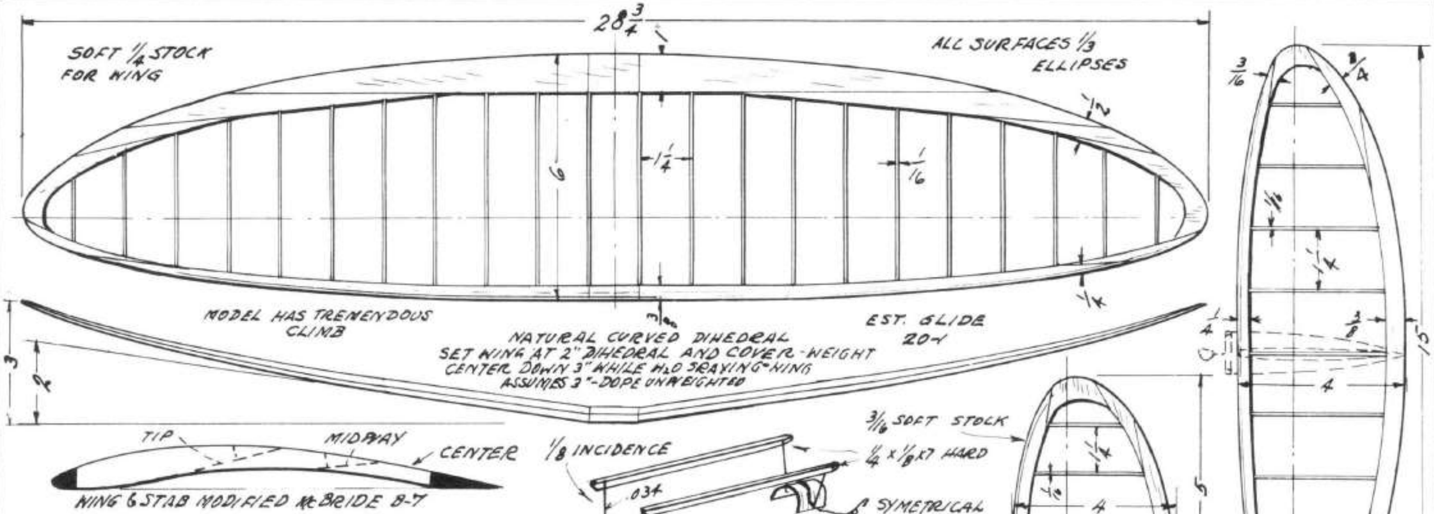
TIP VORTICES
ON TAPERED TIPS

As previously mentioned, the drag shown on a regular airfoil report is composed of two parts, that due to tip losses, induced drag, and the profile drag which is due to the friction of the airflow by the passing wing. The formula for induced drag is:

$$\text{Induced Drag} = \frac{C_L^2}{\pi \times \text{Aspect Ratio}}$$

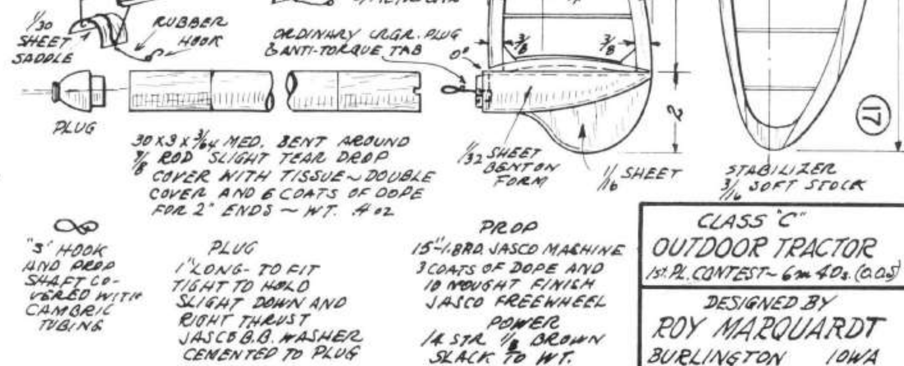
As can be ascertained from the formula, an increase in the aspect ratio decreases induced drag. From this we can see that high aspect ratio is especially important in soaring gliders where the lift coefficient is very high because of the thick airfoils used. On a model the lift coefficients are comparatively low because of the low air speed and comparatively low angles of attack, and the section or parasite drag is comparatively very high, also due to the low speed. For the reason that the parasite drag is more important in models than the induced drag, it is best to reduce the parasite drag by using a large section, which of course with a limited area means a lower aspect ratio. It is just one of the minor differences between models and power ships.

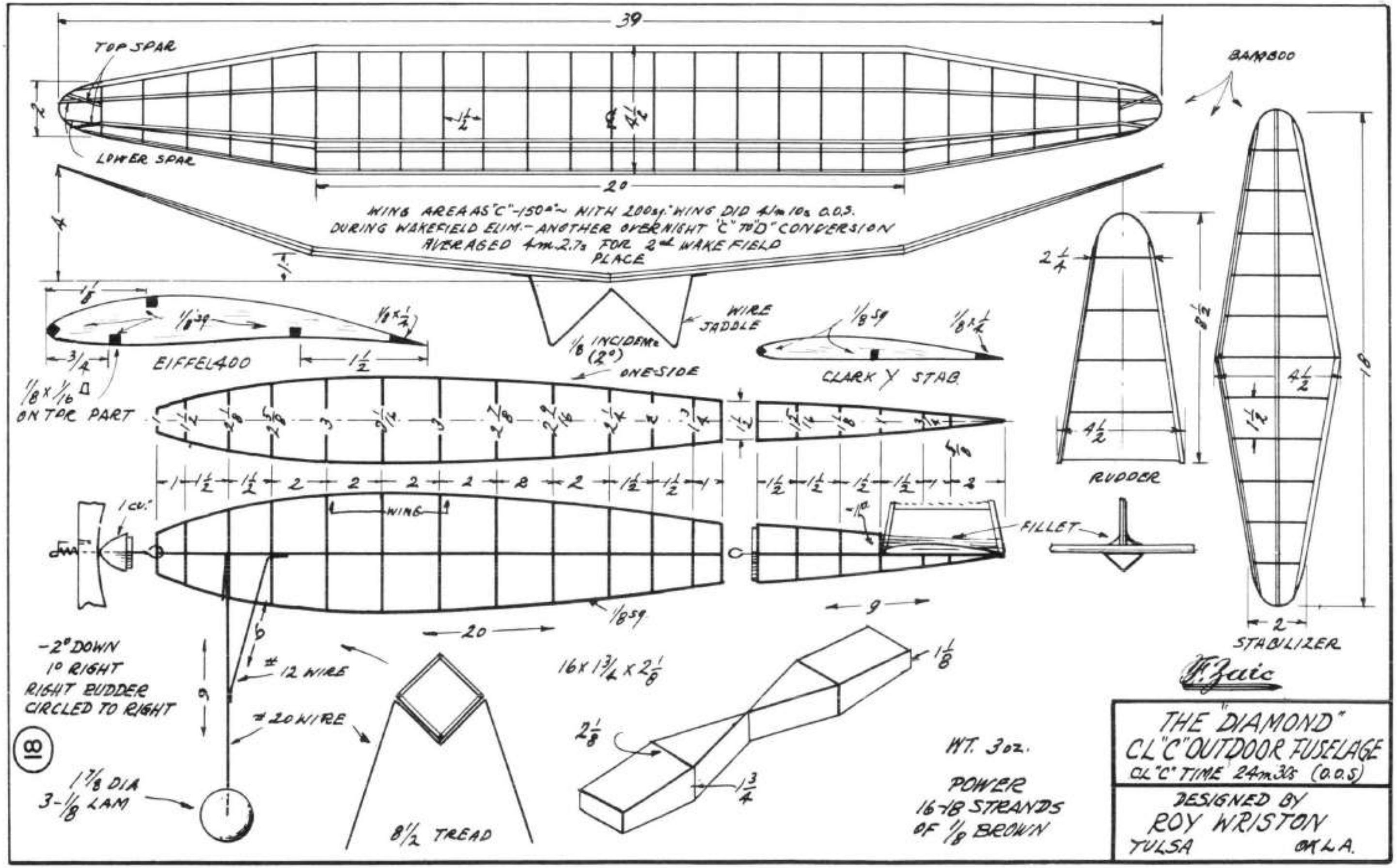
The exact aspect ratio depends on the design of the model. If the model is large the aspect ratio may be fairly high as the airfoil is wide, but for small designs the aspect ratio should be low enough to provide an airfoil shape sufficiently large for aerodynamical effect. Judging from experience, airfoils with a chord of under 3" are seldom of true shape, and have results approaching flat plate characteristics. Therefore, no matter what the aspect ratio is, the tip airfoil should never be smaller than three inches. By using three inches as the minimum tip chord, the aspect ratio can be very easily decided upon if the wing area is know. An aspect ratio of about 7 to 10 will take care of most models, both in overcoming the torque and in providing stability.



MARQUARDT S-1 AIRFOIL

Cut to shape with band or jig saw from balsa block. Slice off 1/16 thick sections with stripper. Cut off for leading edge spar according to position on the span. Cut trailing edge for taper. The upper curve is B-7 and the lower is as shown to provide deep camber in center, a near R.A.F. 32 near mid-way and a streamlined tip. Notice that there is sufficient thickness over the whole span. Section flown in numerous contests to a first place. The idea of using a McBride B-7 for outdoor use originated with one of the Chicago boys.





39
TOP SPAR
LOWER SPAR
BAMBOO
20
WING AREA AS "C" -150"~ WITH 200sq." WING DID 4/m 10s O.O.S.
DURING WAKEFIELD ELIM.- ANOTHER OVERNIGHT "C" TO "D" CONVERSION
AVERAGED 4m.2.7s FOR 2nd WAKEFIELD
PLACE
EIFFEL 400
1/8 x 1/16 ON TOP PART
WIRE SADDLE
1/8 INCIDENCE (2°)
ONE SIDE
CLARK Y STAB.
RUDDER
STABILIZER
FILLET
WING
1 CU."
-2° DOWN
1° RIGHT
RIGHT RUDDER
CIRCLED TO RIGHT
12 WIRE
20 WIRE
1 7/8 DIA
3-1/8 LAM
8 1/2 TREAD
16 x 1 3/4 x 2 1/8
WT. 3oz.
POWER
16-18 STRANDS
OF 1/8 BROWN
THE "DIAMOND"
CL "C" OUTDOOR FUSELAGE
CL "C" TIME 24m 30s (O.O.S)
DESIGNED BY
ROY WRISTON
TULSA OKLA.
18

The shape of the tips should be carefully designed, especially on low aspect ratio designs. An elliptical outline starting at a distance of about twice the tip chord from the tip, is about the best. When making tips, be sure that they are smooth and do not offer a resistance turning moment to be overcome by the rudder.

Aerodynamic Characteristics of Wing Tips

It is a known fact that the tips on a tapered wing stall before the center section, and that on a straight wing the center portion stalls first.

The tip stall on a tapered wing is explained by the fact that on such wings we have two extreme sizes of airfoils, the large at the center and the small at the tips. It is this difference in size that causes the early tip stall on a tapered wing. The small airfoils do not hold the airflow as well as the larger sections at high angles, with a consequent early stall for the small airfoils. This can be substantiated by noting that the smaller the airfoil becomes, the closer it approaches the flat plate in its characteristics (the break of airflow at low angles). It may be noted here that the airflow breaks away very easily from sharp corners, and since small airfoils have very little curvature, the early stall effects are especially prominent.

The reason that the center portion of a straight wing stalls first is that the tips have a relatively continuous flow of air from underneath the wing at all angles. When the wing does stall, the overflow over the center breaks away from the airflow, while the tips still get a fairly smooth flow from the pressure differential, thereby increasing the tip stalling angle.

The question, "Why does not the same phenomenon hold true for tapered wings?", can best be answered by noting that on a tapered wing the airfoil gradually decreases in size, so that the tip sections are comparatively small for quite a distance near the tip and that the pressure differential is also smaller because of the gradual taper.

The advantages of having the tips stall last are apparent when we consider that in a stall the tip portion of the wing is behind the C. G., and therefore will help to restore the model to a level or flying position. See Fig. 4. The tips may be washed out to decrease incidence and stall later than the center section, but this gives us a loss of lift. A much better method, which has been recently introduced by engineers, is to thicken the tip airfoil, especially the leading edge, as shown. See Fig. 4a. This provides the needed rib curvature for a late stall.

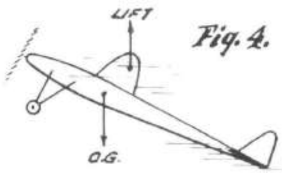
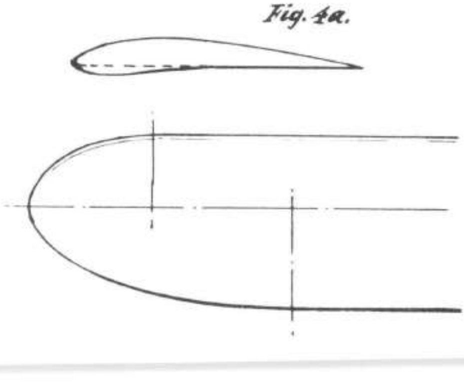


Fig. 4.

Fig. 4a.



MAKING GOOD TIPS BY A
SERIES OF ELLIPSES
By Henry Stiglmeier

STABILITY

The stability of a model may be divided into several divisions: longitudinal or "up and down" stability, rolling or rotating stability, and directional stability. The longitudinal stability is taken care of by the proper position of the C. G. and the stabilizer. The rolling stability is obtained by the proper dihedral and side area, plus the correct position of the C. G. The directional stability is taken care of by having the center of side area behind the C. G., to enable the model to swing into the wind in case of sudden gusts.

Longitudinal Stability and the Stabilizer

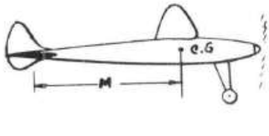
Longitudinal stability seems to be well under control because of the present tendency to use large stabilizers, which keep the wing well within the narrow safety margin of angle of attack, caused by low speed. Another present tendency is to use slightly lifting tails to help lower the wing loading. The lifting tail can be used to advantage, providing the builder knows how to use it.

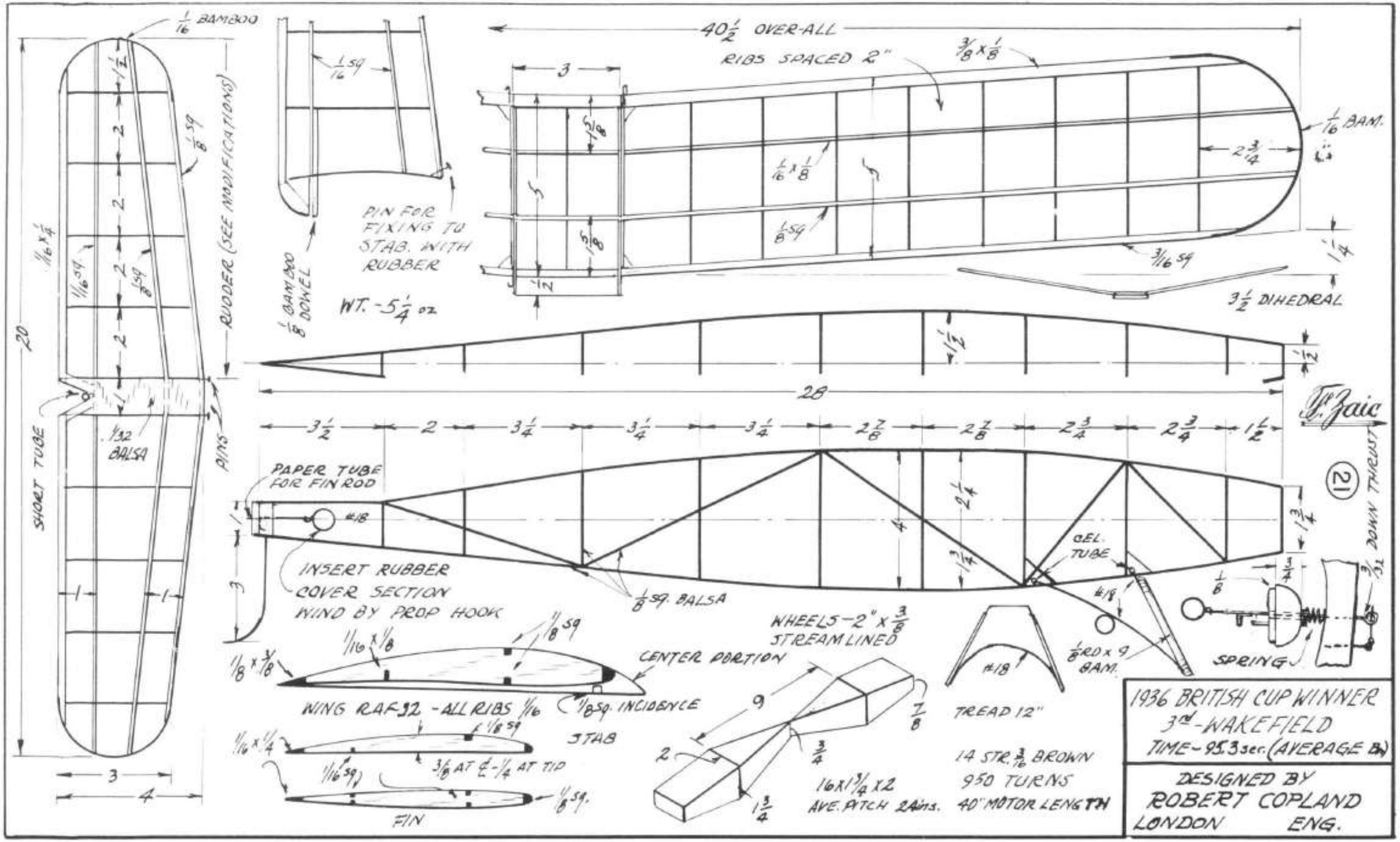
The area of the stabilizer may vary a great deal without affecting the performance of the model, except for finer adjustments for smaller areas, and a slight increase of drag for larger areas. The present trend in stabilizer design is to use from 30% to 40% of the wing area for the stabilizer area. In figuring this area, the moment arem the weight of the model, and the chord and area of the wing should be taken into consideration. The light model and the model with a small chord wing may use a smaller stabilizer because light models are subject to less violent displacements. For heavier models and for models with large chord wings, the full 40% may be used to enable the tail to dampen out the upsetting forces. The area of the stabilizer is also determined by the tail moment arm. A short moment arm necessitates large area, while a long moment arm can stabilize the model with a much smaller stabilizer. The size of the fuselage in front of the wing also has a slight bearing on the final area. The longer portion requires a larger stabilizer to dampen out any possible oscillations caused by the large inertia distance.

The ideal stabilizer keeps the model just below the stalling point and has a higher stalling angle than the wing, to bring the model level without loss of altitude after the wing stalls. One way of raising the stalling angle of the stabilizer is to use a low aspect ratio on the stabilizer, with the trailing edge almost straight and the leading edge swept back. In case of a lifting stabilizer, use an airfoil that stalls later than the wing. Wallace McBride of Winnepeg, Canada, reports that tip rudders help in recovery by preventing the tip airflow from spilling over the end of the tips at high angles of attack, thereby giving the stabilizer extra high lift at large angles, just when it is needed most.

Since it is a poor practise to approximate important areas, we would benefit a great deal if we were to formulate a simple equation for the stabilizer area. The formula used by aeronautical engineers is:

$$\text{Stabilizer Area} = \frac{\text{Wing Area} \times \text{Coefficient} \times \text{Average Chord}}{\text{Stabilizer Moment Arm}}$$





1936 BRITISH CUP WINNER
3rd - WAKEFIELD
TIME - 95.3 sec. (AVERAGE 3)
DESIGNED BY
ROBERT COPLAND
LONDON ENG.
40½ OVER-ALL
RIBS SPACED 2"
3/8 x 1/8
1/16 BAM.
3½ DIHEDRAL
WT. - 5¼ oz
PIN FOR FIXING TO STAB. WITH RUBBER
1/8 BAMBOO DOWEL
1/16 BAMBOO
RUDDER (SEE MODIFICATIONS)
SHORT TUBE
1/32 BALSA
PINS
PAPER TUBE FOR FIN ROD
INSERT RUBBER COVER SECTION WIND BY PROP HOOK
1/8 SQ. BALSA
WHEELS - 2" x 3/8 STREAMLINED
CEL. TUBE
1/8 RD x 9 BAM.
SPRING
DOWN THRUST
CENTER PORTION
1/8 SQ. INCIDENCE
WING RAF-32 - ALL RIBS 1/16
STAB
3/8 AT ℄ - 1/4 AT TIP
FIN
TREAD 12"
14 STR. 3/16 BROWN
950 TURNS
40" MOTOR LENGTH
16 x 1¾ x 2
AVE. PITCH 24 ins.
F. Zaic
21

The coefficients vary for different designs. The coefficient used for transports is about .35, while for light planes, the coefficient is sometimes as much as .50. For model work, use 1.00 for light ships and 1.35 for heavier jobs. A good procedure to follow is to record the wing area, average chord, stabilizer area, and the moment arm of every model we make. If we know these figures we can very easily determine the coefficient for later reference by using the following equation:

$$\text{Coefficient} = \frac{\text{Stabilizer Area x Moment Arm}}{\text{Wing Area x Average Chord}}$$

After a while we will have a complete set of coefficients for each type of model, and also for stabilizers using different airfoils.

Although a flat or symmetrical stabilizer may lift if it is set at a positive angle, the practical difference between the lifting tail and the flat or symmetrical tail is that the lifting tail contributes lift and brings the C. G. back, sometimes even behind the wing, while for a non-lifting tail the C. G. is not more than 30% of the chord of the wing behind the leading edge.

To adjust a non-lifting stabilizer model, the C. G. should be 30% of the chord behind the leading edge. The wing should be left at this point no matter how the model flies. All the adjusting should be done with incidences. The incidence of the wing should be about 3° positive and the stabilizer should be set at zero, or even slightly plus, to take care of the downwash. Now if the model dives with this setting, increase the incidence of the wing very slightly, if a thick wing section is used; and increase the incidence of the stabilizer if a thin wing section is used. Always keep in mind that the wing must have enough lift to fly the model with the C. G. at the 30% of the chord position. As soon as the position of the wing is changed complications set in and adjusting becomes difficult for maximum efficiency. It is quite possible to adjust for fair flying and gliding by moving the wing back and forth, but what we want is the best that the model can do.

The stabilizing action of the non-lifting tail is shown in Fig.5.

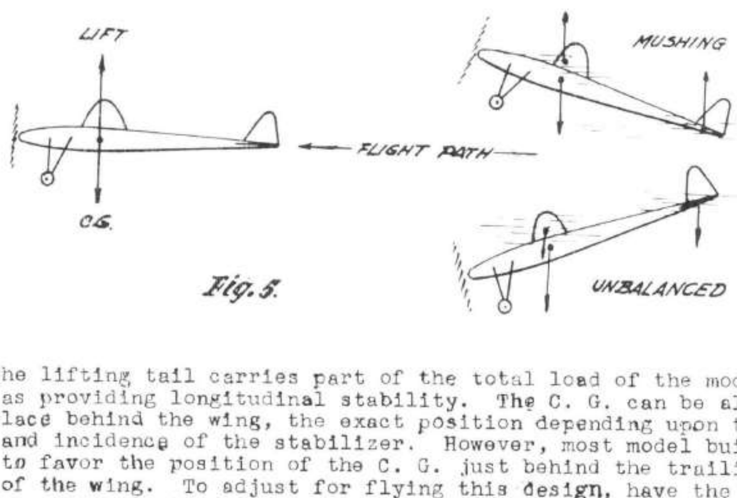
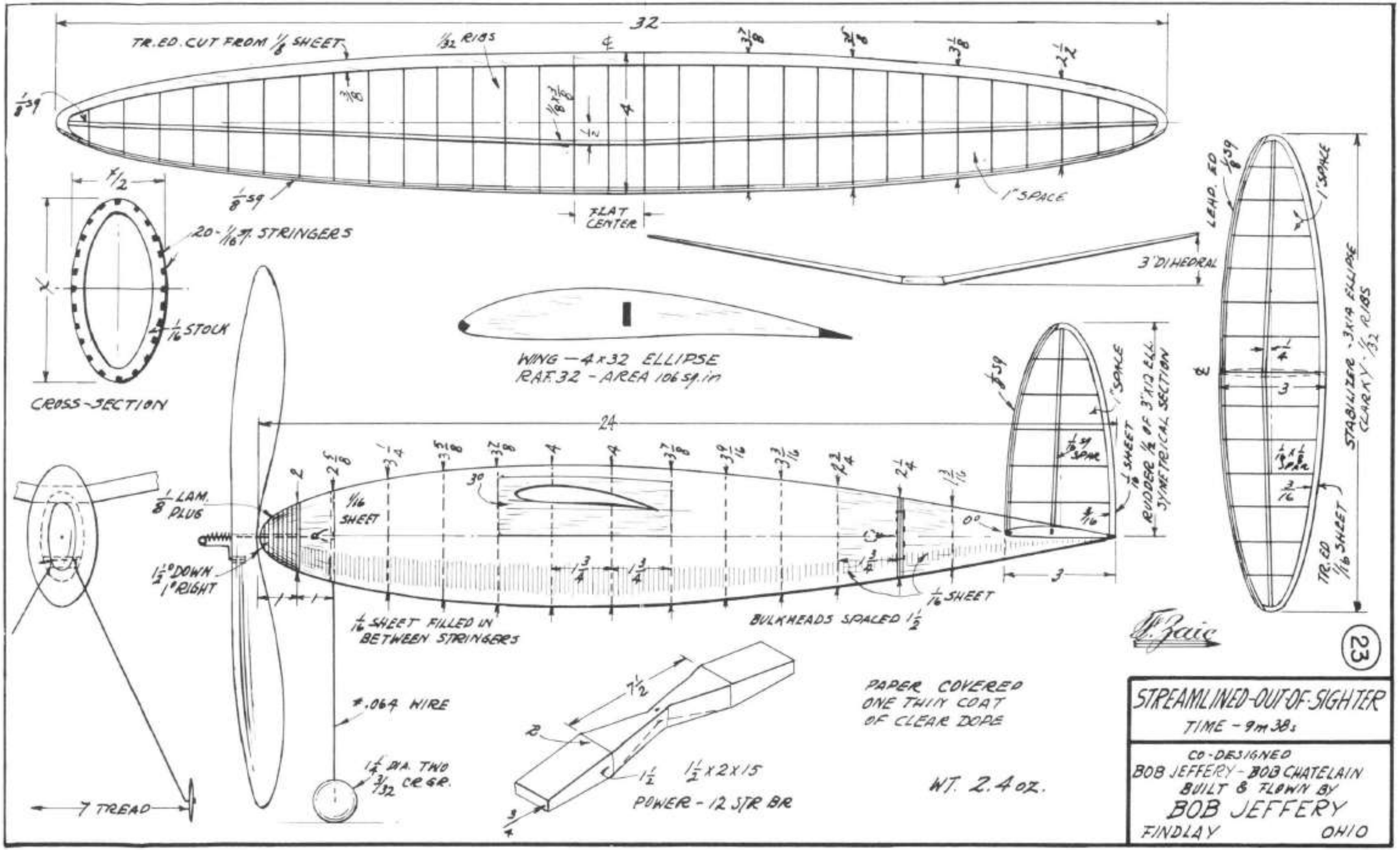


Fig. 5.

The lifting tail carries part of the total load of the model as well as providing longitudinal stability. The C. G. can be almost any place behind the wing, the exact position depending upon the size and incidence of the stabilizer. However, most model builders seem to favor the position of the C. G. just behind the trailing edge of the wing. To adjust for flying this design, have the wing at 3° positive incidence and the C. G. behind the trailing edge, then do all adjusting by varying the stabilizer's incidence until a satisfactory flight is obtained.



32
TR. ED. CUT FROM 1/8 SHEET
1/32 RIBS
FLAT CENTER
1" SPACE
20 - 1/16 SQ. STRINGERS
1/16 STOCK
CROSS-SECTION
3" DIHEDRAL
WING — 4 x 32 ELLIPSE
RAF. 32 - AREA 106 sq. in
LEAD. ED. 1/8 SQ.
STABILIZER - 3 x 14 ELLIPSE
CLARK Y - 1/32 RIBS
TR. ED. 1/16 SHEET
RUDDER 1/2 OF 3" x 12 ELL.
SYMETRICAL SECTION
1/16 SHEET
24
1/8 LAM. PLUG
1/16 SHEET
1 1/2° DOWN
1° RIGHT
1/16 SHEET FILLED IN BETWEEN STRINGERS
BULKHEADS SPACED 1 1/2
#.064 WIRE
1 1/4 DIA. TWO 3/32 CR. GR.
7 TREAD
1 1/2 x 2 x 15
POWER - 12 STR BR
PAPER COVERED
ONE THIN COAT
OF CLEAR DOPE
WT. 2.4 oz.
23
STREAMLINED-OUT-OF-SIGHTER
TIME - 9m 38s
CO-DESIGNED
BOB JEFFERY - BOB CHATELAIN
BUILT & FLOWN BY
BOB JEFFERY
FINDLAY OHIO

The sections used in the stabilizer vary from symmetrical for non-lifting tails, to single surface cambered sections for lifting tails. In selecting airfoils for lifting tails, keep in mind the fact that the stabilizer may develop too much lift and keep the model flying low and fast, or may force the model into a dive from which there is no recovery. See Fig. 6.

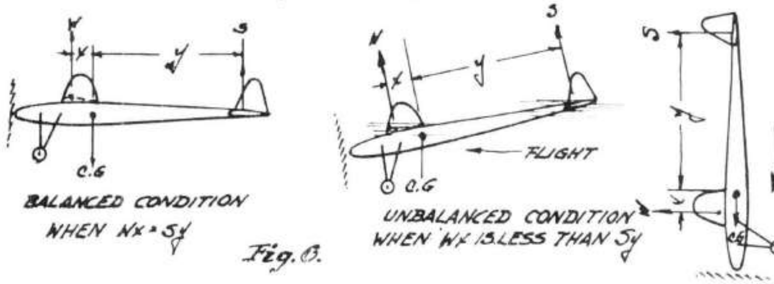
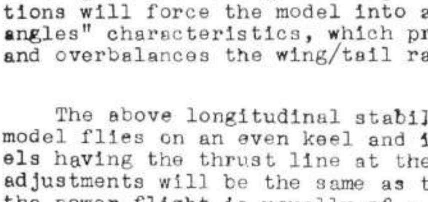


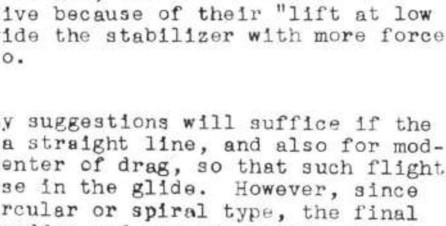
Fig. 6.

The ideal wing-tail combination for a lifting tail model is to have the force of the wing's lift x its moment arm, greater than the force of the stabilizer's lift x its moment arm, when the angle of attack is from negative to about 3° positive. At greater positive angles, the stabilizer should have a larger force, to keep the wing within the safety zone. If the stabilizer's force is larger than that of the wing at angles below 3° positive, the model will have a tendency to fly tail high, or even dive. See Fig. 6. It is therefore evident that the stabilizer should be so designed that the airfoil will have relatively little lift at zero degrees angle of attack. The safest sections that will fulfil this requirement are of the M-6 variety. The flat bottom or Clark Y type should be about the limit in the direction of undercamber. The heavily undercambered stabilizers work well so long as the incidence is positive and the wing is able to take care of its side of the load, but as soon as the model gets into a negative angle of attack, the undercambered sections will force the model into a dive because of their "lift at low angles" characteristics, which provide the stabilizer with more force and overbalances the wing/tail ratio.

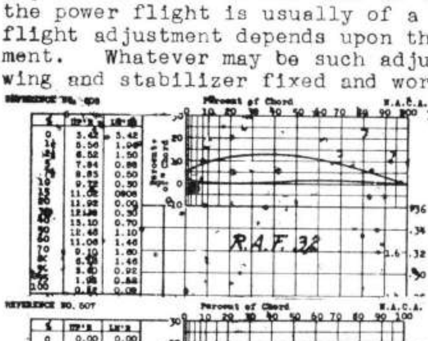
The above longitudinal stability suggestions will suffice if the model flies on an even keel and in a straight line, and also for models having the thrust line at the center of drag, so that such flight adjustments will be the same as those in the glide. However, since the power flight is usually of a circular or spiral type, the final flight adjustment depends upon the rudder and counter torque adjustment. Whatever may be such adjustments, keep the position of the wing and stabilizer fixed and work only on the turning controls



%	Up'r	Lw'r
0	3.42	3.42
1¼	5.56	1.0[illegible]
2½	6.52	1.50
5	7.84	0.88
7½	8.85	0.50
10	9.[illegible]	0.30
15	11.0[illegible]	0.08
20	11.92	0.00
30	12.[illegible]	0.30
40	13.10	0.70
50	12.48	1.10
60	11.08	1.46
70	9.10	1.80
80	6.[illegible]	1.46
90	[illegible]	0.92
95	1.9[illegible]	0.[illegible]
100	0.[illegible]	0.08

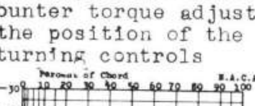


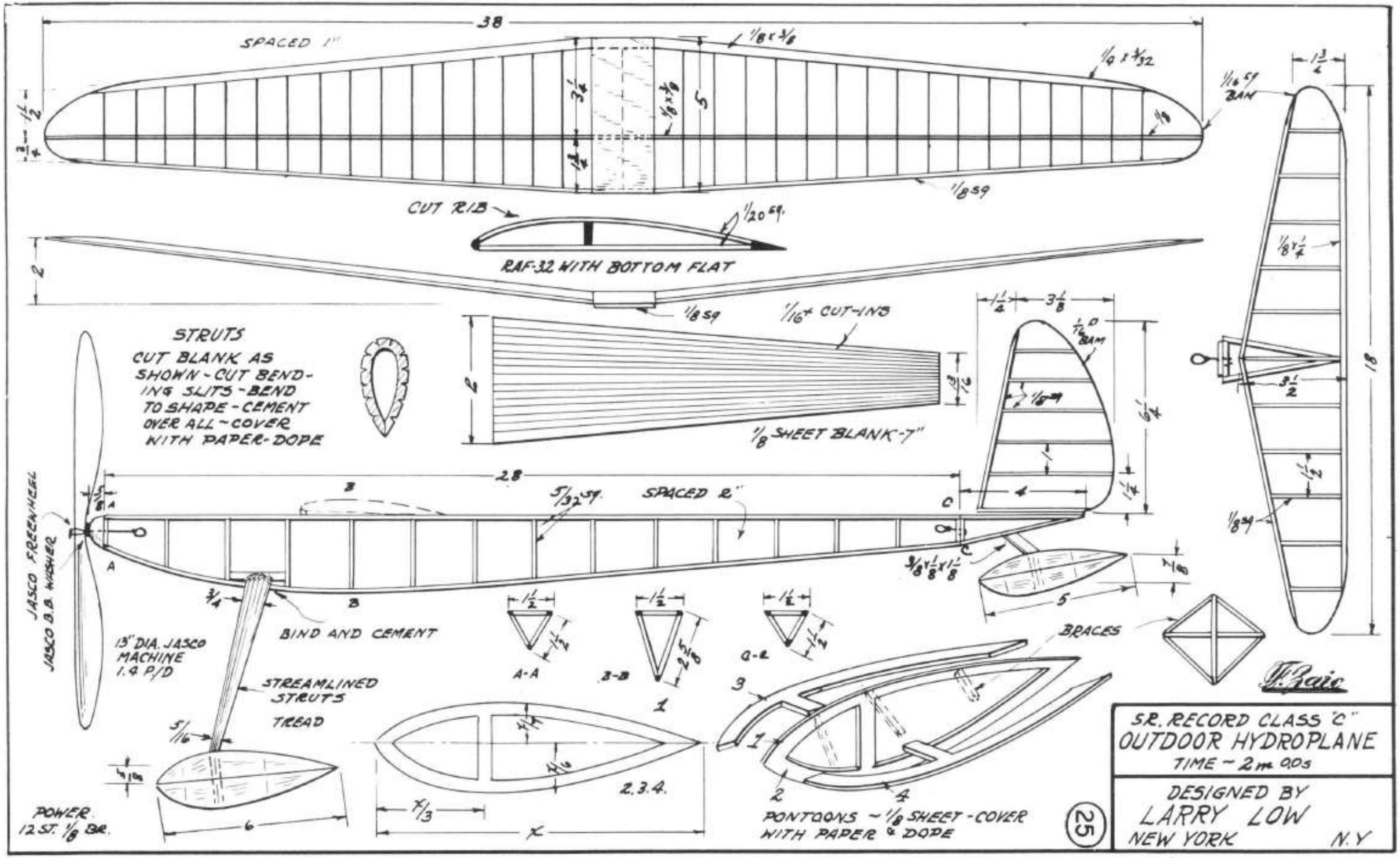
%	Up'r	Lw'r
0	4.80	4.80
1¼	6.63	3.30
2½	7.48	2.85
5	8.77	2.03
7½	9.79	1.41
10	10.80	1.00
15	11.85	0.42
20	12.80	0.10
30	13.10	0.10
40	12.60	0.80
50	11.60	1.30
60	9.90	2.00
70	8.00	2.40
80	5.80	2.20
90	3.10	1.30
95	1.69	0.71
100	0.00	0.00



%	Up'r	Lw'r
0	0.00	0.00
1¼	1.30	-1.30
2½	1.74	-1.74
5	2.33	-2.33
7½	2.74	-2.74
10	3.06	-3.05
15	3.49	-3.49
20	3.78	-3.78
30	4.03	-4.03
40	4.00	-4.00
50	3.74	-3.74
60	3.30	-3.30
70	2.71	-2.71
80	1.99	-1.99
90	1.15	-1.15
95	0.69	-0.69

%	CAM
0	0 0
5	2.35
10	4.40
20	6.70
30	7.80
40	8.30
50	7.90
60	6.90
70	5.60
80	3.90
90	2.00
100	00





38
SPACED 1"
1/8 x 3/8
1/8 x 3/32
1/16 SQ BAM
1/8 SQ
CUT RIB
1/20 SQ.
RAF-32 WITH BOTTOM FLAT
1/16+ CUT-INS
STRUTS
CUT BLANK AS SHOWN - CUT BENDING SLITS - BEND TO SHAPE - CEMENT OVER ALL - COVER WITH PAPER-DOPE
1/8 SHEET BLANK-7"
28
5/32 SQ.
SPACED 2"
JASCO FREEWHEEL
JASCO B.B. WASHER
BIND AND CEMENT
13" DIA. JASCO MACHINE 1.4 P/D
STREAMLINED STRUTS
TREAD
BRACES
A-A
B-B
C-C
PONTOONS ~ 1/8 SHEET - COVER WITH PAPER & DOPE
POWER 12 ST. 1/8 BR.
SR. RECORD CLASS "C"
OUTDOOR HYDROPLANE
TIME ~ 2m 00s
DESIGNED BY
LARRY LOW
NEW YORK N.Y
25

SPIRAL STABILITY

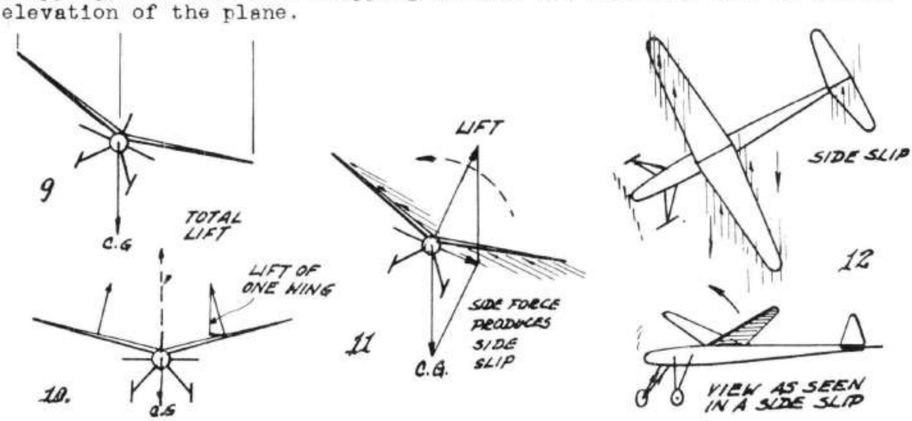
Dihedral and Rudder

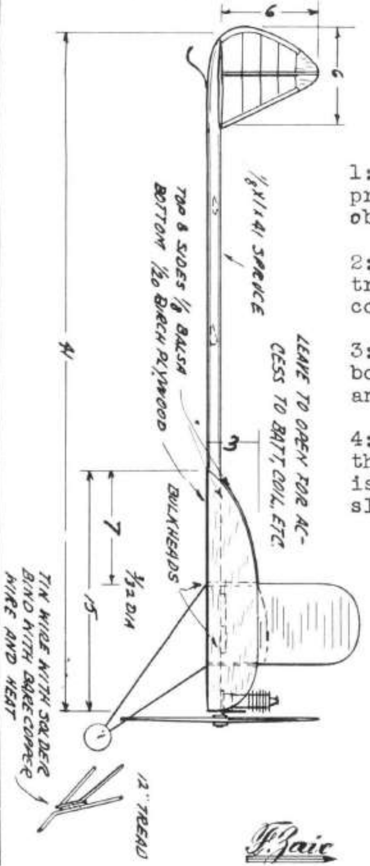
Most stability problems are caused by the lack of knowledge concerning the forces that tend to roll (barrel roll, bank) or turn the model. On a stable model these forces are kept under control by the dihedral and rudder or fin. On an unstable model these controls are usually poorly proportioned with respect to each other. In designing these elements, keep in mind that they must remain within certain bounds, and that the "little extra to be on the safe side" usually causes most of the trouble.

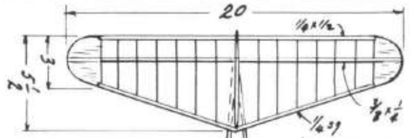
The purpose of the dihedral is to keep the model in its most effective flying position. To accomplish this, it must perform a large variety of corrective functions, such as counteracting the torque and preventing excessive side slipping and banking on the turns. All of these things must be done with the minimum of dihedral, to keep the wing efficiency high. See Fig. 8 for comparison.

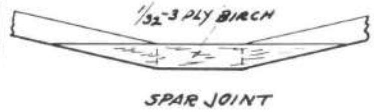
Fig. 8.

The general impression among the model builders is that the dihedral functions as in Fig. 9. This is the old theory, and does not explain why some models with little dihedral possess certain definite stability factors. To explain the modern theory, we must realize that the lift of the wing elements is always perpendicular to the wing surface, and that the resultant of lift is passing through the C. G. See Fig. 10. Now if the model is upset as shown in Fig. 11, the lift of the wing and the weight of the model produce a side force. This side force induces a side slip, so that the airflow now affects the wing as shown in Fig. 12. From this figure it can be easily perceived that the lower wing has more lift than the upper by virtue of its greater angle of attack. This tends to raise the model into a level position. The important point to remember here is that every such corrective tendency is brought about when the model is side slipping, and that side slipping affects the surfaces seen in a side elevation of the plane.







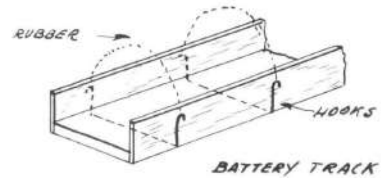


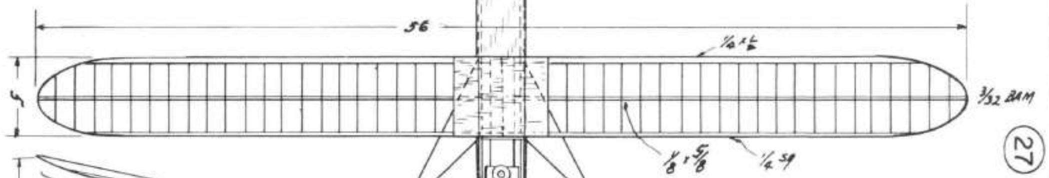
1:- Place wheels before prop to save prop, motot and etc. when model hits obstructions or when it dives

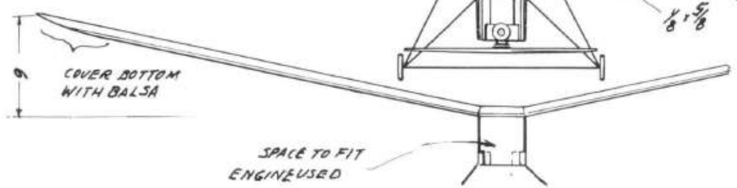
2:- To keep model in sight have wing transparent with clear dope and use color dope for outline and scallops.

3:- Place the battery track on the bottom of the fuselage for low C.G. and easy balancing.

4:- Use moderate thick sections. A thin section climbs well but the glide is poor. A thick section is slightly slower but it glides much better.







27

56 in. GAS MODEL
FLYING STICK

DESIGNED BY
FRANK EHLING
JERSEY CITY N.J.

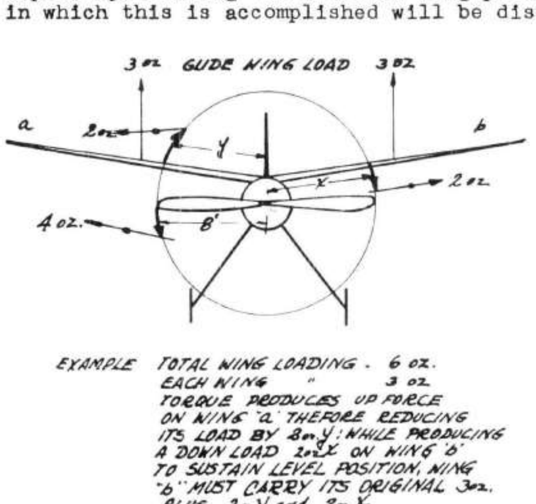
Effect of a High Fin on Stability

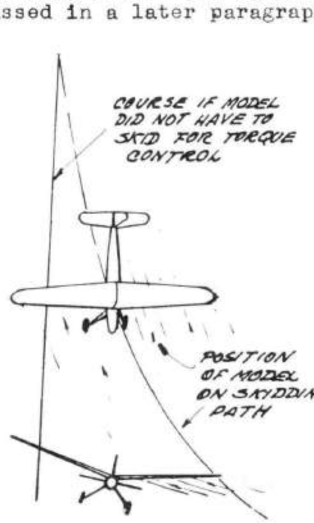
Another method of obtaining stability is to mount the wing on a fin. The stability is obtained when the model side slips, because this fin area exerts a leveling force as shown in Fig. 13. However, it is not as effective as the normal dihedral which makes use of the lift to bring the model level. The high fin may be used, in which case the dihedral may be decreased, but not entirely eliminated. When using a fin, remember that it acts as a rudder also, so be sure to check its position before every flight.

Fig. 13.

Torque and Dihedral

The torque of the motor is the most upsetting force with which we must contend. It actually transfers the wing loading, so that one wing must lift more than the other. See Fig. 14. If the wing is perfectly lined up, and the rudder and thrust line are set at neutral, the only counter-torque element is the dihedral. The action of the dihedral is as follows: the torque causes the model to roll into a side slip. As the wing side slips, it produces more lift on one side and the dihedral tends to straighten out the model. The torque roll continues, however, until the wing produces enough extra lift to equalize the torque force, thereby producing a balance. The reason that the model now circles is because the lower wing has much more drag due to its higher angle of attack. The danger of controlling the torque by only this method is that the rubber torque is so variable that the initial force might be so large that it will overcome the dihedral counter-torque force, and force the model into a spiral dive. There are other means of applying counter-torque, but they all depend upon having the affected wing produce more lift. The manner in which this is accomplished will be discussed in a later paragraph.





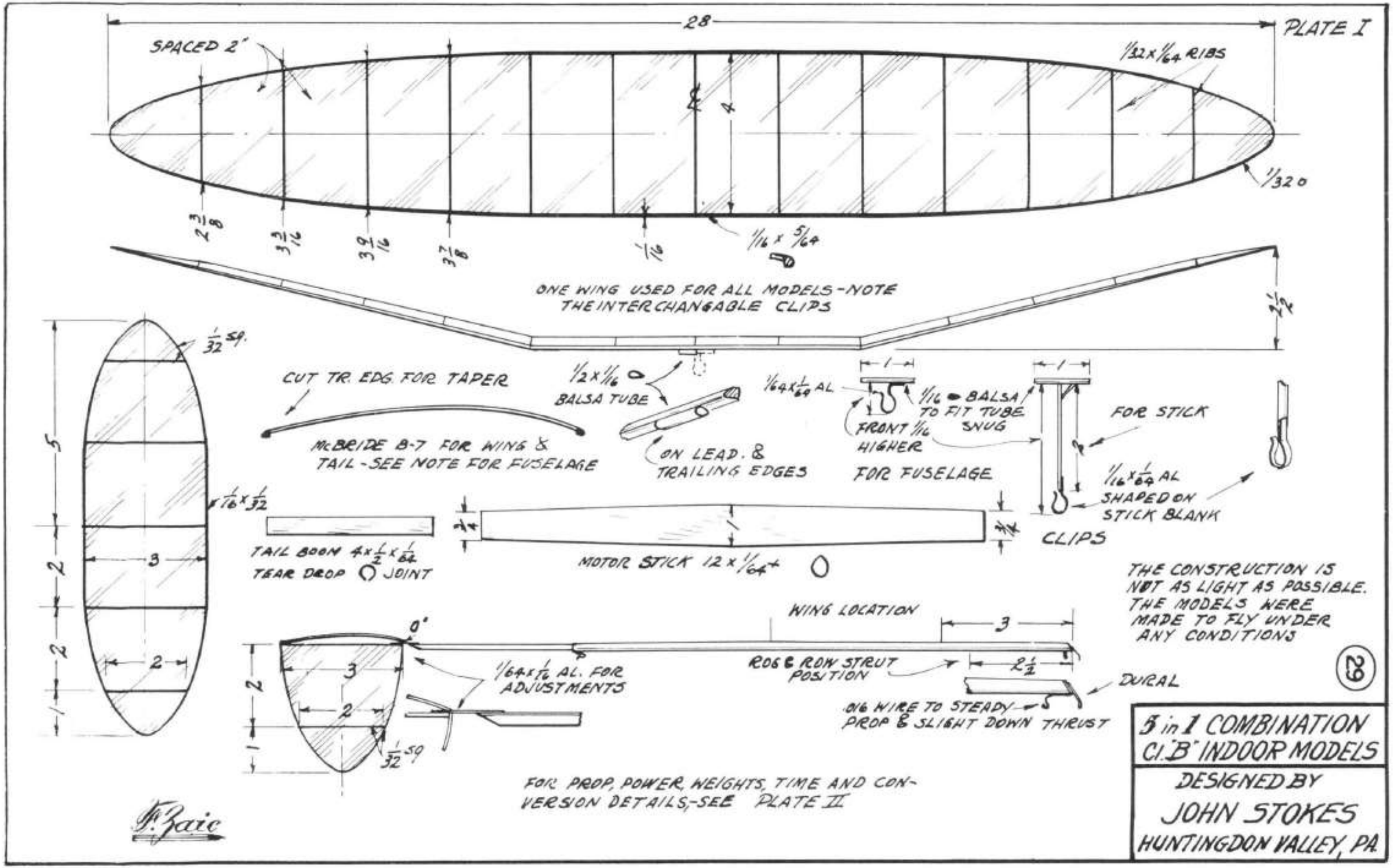


PLATE I
28
SPACED 2"
1/32 x 1/64 RIBS
1/32 O
2 3/8
3 3/16
3 9/16
3 7/8
1/16
1/16 x 5/64
4
ONE WING USED FOR ALL MODELS - NOTE THE INTERCHANGABLE CLIPS
2 1/2
1/32 SQ.
5
1/16 x 1/32
3
2
2
2
1
CUT TR. EDG. FOR TAPER
McBRIDE B-7 FOR WING & TAIL - SEE NOTE FOR FUSELAGE
1/2 x 1/16
BALSA TUBE
ON LEAD. & TRAILING EDGES
1/64 x 1/64 AL
1
1/16 BALSA TO FIT TUBE SNUG
FRONT 1/16 HIGHER
FOR FUSELAGE
FOR STICK
1/16 x 1/64 AL SHAPED ON STICK BLANK
CLIPS
TAIL BOOM 4 x 1/2 x 1/64
TEAR DROP JOINT
MOTOR STICK 12 x 1/64+
THE CONSTRUCTION IS NOT AS LIGHT AS POSSIBLE. THE MODELS WERE MADE TO FLY UNDER ANY CONDITIONS
WING LOCATION
3
0°
1/64 x 1/16 AL. FOR ADJUSTMENTS
ROG & ROW STRUT POSITION
2 1/2
DURAL
.016 WIRE TO STEADY PROP & SLIGHT DOWN THRUST
1/32 SQ.
29
FOR PROP, POWER, WEIGHTS, TIME AND CONVERSION DETAILS, - SEE PLATE II
F. Zaic
5 in 1 COMBINATION Cl. "B" INDOOR MODELS
DESIGNED BY JOHN STOKES HUNTINGDON VALLEY, PA.

So far, we know that the only time that the dihedral comes into play is when we get a side slip and a consequent side airflow. This side airflow affects the side of the model, and the reaction of the model depends upon the manner in which the side area is proportioned around the center of gravity. It is apparent that if the areas are balanced nothing will happen, but the moment that the balance is disturbed, the side that has the most area will tend to swing into its least resistance position. See Fig. 16. For our purpose, it is best to have the tail portion of greater area so that the model will tend to point into the airflow whenever a side gust occurs. However, it must not be too great or the wing will have but a small chance to recover by the dihedral-side slip effect, since the tail portion will always be trying to point the model into the newly formed airflow, and so eliminate the needed side flow for the dihedral to take effect. The ideal situation is that in which a slight side slip does not affect the side area proportion.

Rudder

In a side gust or cross wind the model with a small rudder will be turned so as to fly with the wind, and the model with a large rudder will point into the wind. Of the two, the large rudder is preferable, as a gust is liable to upset the small rudder model while it is turning. See Fig. 16. In a side slip with its accompanying side airflow, the model with a small rudder will tend to increase the side slip by having the tail portion drop. It is also possible that such lowering of the tail portion will increase the angle of attack to a stalling position in which case the entire model will be out of control. The larger rudder model will tend to face the side airflow, preventing the model from side slipping, and banking it instead. However, remember that the rolling tendency due to the torque is still present and continues to produce the side slip, forcing the model into a tight banking circle, with a consequent spiral dive. A rudder of the correct area will allow the wing to have a slight side slip, and when that is exceeded, will bank it into a slipping turn. See Fig. 17.

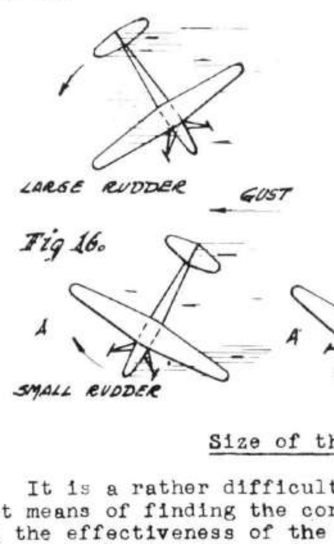


Fig 16.

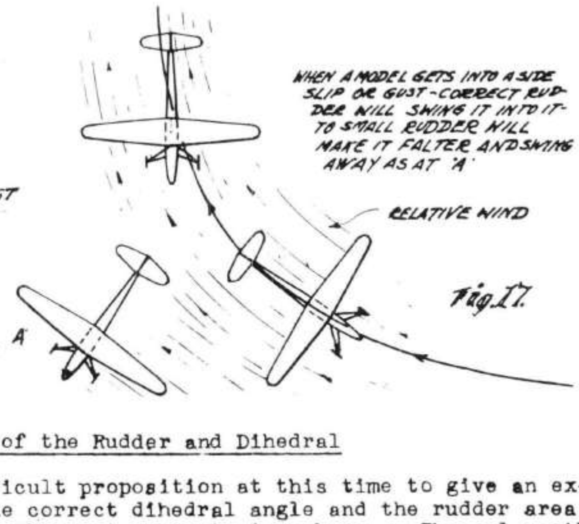
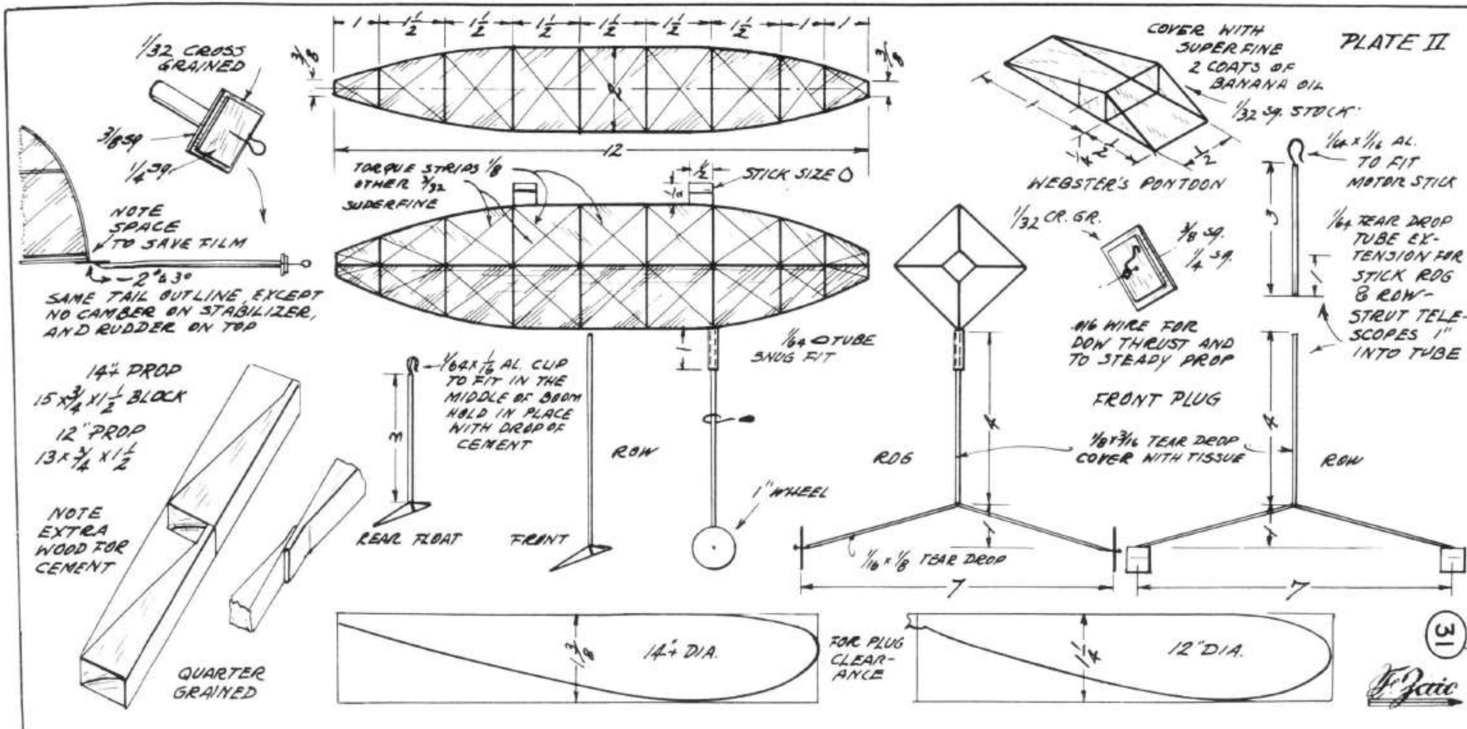


Fig. 17.

Size of the Rudder and Dihedral

It is a rather difficult proposition at this time to give an exact means of finding the correct dihedral angle and the rudder area, as the effectiveness of the various parts is unknown. The only method is to approximate as closely as possible from experience, and then to watch the performance of the model, noting its actions. If we can tell which forces are dominating the situation, it is then a simple matter to make the necessary corrections, if something is wrong.



WTS. — FUSELAGE		STICK		NOTES
FUSELAGE	.020 oz	STICK	.016 oz.	PONTOON ASSEM' .011
WING	.020	WING	.020	LANDING GR. STICK .003
TAIL ASSEM'	.010	TAIL	.006	25" (OR MORE) LOOP USED
PROP	.011	PROP	.014	(TO FIT FLYING CONDITIONS ~ 1/30 GAGE
LANDING GR	.005	TOTAL	.056 oz	BROWN RUBBER
TOTAL	.066 oz			

DESIGN	PROP	POWER	FLIGHT	TIME
FUSELAGE ROG	12	1/16 " 5/64	JR. RECORD	14m 15.3s
" ROW	12	5/64		
STICK H.L.	14+	1/16 " 5/64	JR. RECORD	18m 12.2s
" ROG	14+	5/64	JR. RECORD	17m 19.3s
" ROW	12	1/16 " 5/64	TEST	7m 47.8s

5 in 1 COMBINATION
Cl. "B" INDOOR MODELS

DESIGNED BY
JOHN STOKES
HUNTINGDON-VALLEY, PA.

If the rudder area or the area behind the C. G. is too large or if the dihedral is too small, a side gust will tend to turn the model into the wind. As it turns, the outside wing travels faster and produces more lift with a consequent bank. The moment the wing banks, we get a side slip in which the whole side of the model is affected. The greater side area behind the C. G. noses the model still further into the bank, and this is followed by more side slipping until eventually the model is in a vertical turn, and finally a tight spiral dive. The above cycle may also be started by setting the rudder for a sharp turn, which is almost equivalent to the side gust effect. Torque also rolls the ship into a side slip. The conclusion that may be drawn is that if the center of side area is too far behind the C. G. and the dihedral is small, the model will be very unstable or easily affected by side airflows, and in great danger of spinning. The cure for this is to decrease the rudder area or the side area behind the C. G. or to increase the dihedral.

With the present tendency to make all controlling surfaces extra-large, it is unlikely that the rudder area will ever be too small, or the Center of Side Area in front of the C. G. However, if the model tends to bank one way, and then the other, or if it slips from side to side, the indications are that the dihedral must be too large or that the side area is just on or is in front of the C. G. Check the side area position, and if it is behind the C. G. decrease the dihedral, and if it is in front of the C. G., increase the rudder area.

Position and Shape of the Rudder

It has been noted that the rudder has a powerful effect and that it should be so placed and shaped so that its action will be gradual If the rudder is of high aspect ratio and placed above or below the fuselage, the slightest side airflow will tend to upset the model. Of the two, the upper position is preferable, as it tends to keep the model on an even keel, while the lower design tends to overturn the model. The logical solution to the problem is to make the rudder of low aspect ratio, and to divide the area above and below the fuselage as shown in Fig. 19.

Fig. 19.

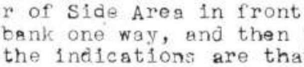
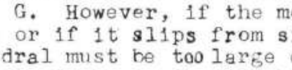


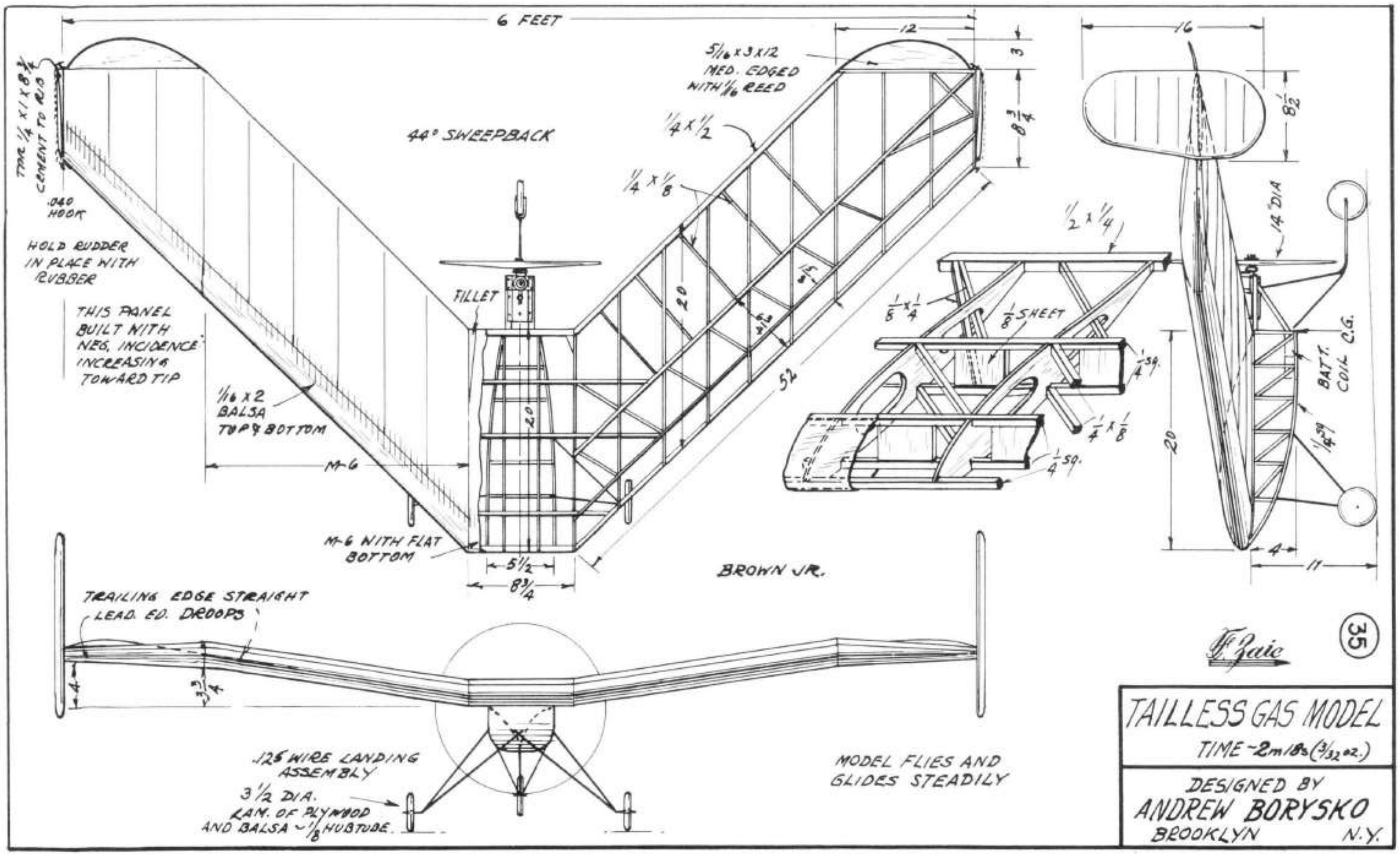
Fig. 20.



Round or elliptical fuselages offer comparatively small resistance when exposed to the side airflow and they are not very effective with respect to side area control. In such cases, it is recommended that fins be made on the front of the fuselage and that the rudder be made as shown in Fig. 20. In a side slip, such an arrangement will tend to slow down the sliding motion and also present forces of similar strength, due to the flat fins in the front and rear.

Twin Rudders

Twin rudders seem to be aerodynamically sound, and it is quite possible that they are more effective than the single rudder design, because of their smaller fuselage interference. They also benefit the longitudinal stability by raising the stabilizer's stalling angle. Their total area should be slightly greater than that calculated for a single rudder. When using double rudders, be sure that the line-up is identical for both, and that they are well fixed to a strong stabilizer.



6 FEET
12
3
8 3/4
5/16 x 3 x 12
MED. EDGED
WITH 1/16 REED
44° SWEEPBACK
1/4 x 1/2
1/4 x 1/8
TPR. 1/4 x 1 x 8 3/4
CEMENT TO RIB
.040
HOOK
HOLD RUDDER
IN PLACE WITH
RUBBER
THIS PANEL
BUILT WITH
NEG. INCIDENCE
INCREASING
TOWARD TIP
1/16 x 2
BALSA
TOP & BOTTOM
M-6
M-6 WITH FLAT
BOTTOM
FILLET
20
52
5 1/2
8 3/4
BROWN JR.
1/2 x 1/4
1/8 x 1/4
1/8 SHEET
1/4 SQ.
1/4 x 1/8
16
8 1/2
14" DIA
BATT.
COIL
C.G.
1/4 SQ.
4
11
TRAILING EDGE STRAIGHT
LEAD. ED. DROOPS
4
3 3/4
.125 WIRE LANDING
ASSEMBLY
3 1/2 DIA.
LAM. OF PLYWOOD
AND BALSA ~ 1/8 HUBTUBE.
MODEL FLIES AND
GLIDES STEADILY
35
F. Zaic
TAILLESS GAS MODEL
TIME ~ 2m 18s (3/32 oz.)
DESIGNED BY
ANDREW BORYSKO
BROOKLYN N.Y.

Counter-Torque Adjustments

As previously shown, the propeller torque transfers part of the wing loading to one side of the wing and causes the model to roll, unless corrective measures are applied. One of these corrective measures is the dihedral, but since a large amount of dihedral lowers the wing efficiency, the dihedral must necessarily be as small as possible. Another measure used is to change the incidence of the wing so that one half has more than the other, with a consequent increase of lift. A modification of this method is to increase the area of one half of the wing. The only objection to these methods is that as soon as the power is expended the counter-torque setting produces spiral instability if the adjustments are excessive. Recently, the side thrust control of torque has been used successfully when used with moderation. The principle here is that the angle of thrust produces a turning tendency which causes the torque wing to travel relatively faster and so produce the needed counteracting lift. While the model is under the side thrust influence, it is in a skidding turn, and it is here that the danger lies. If the center of side area is not properly balanced, the model may become unstable. See Fig. 21, for force diagram. The rudder may also be used but its effect will not be as pronounced as the thrust. However, the principle is the same-- that of forcing the model to turn in order to produce the needed counter-torque lift. The rudder effect depends upon the power and propeller, and the speed of the model. It is small on low power ships, and large on high power ships such as gas jobs.

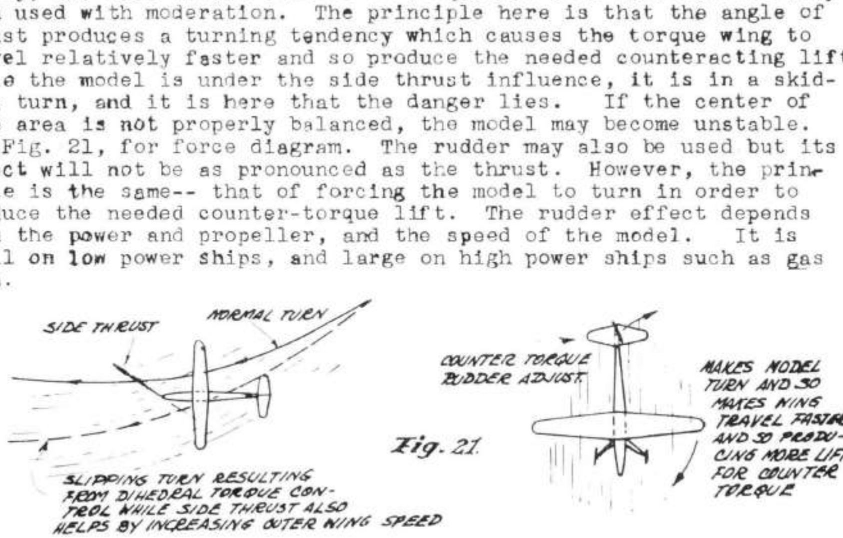
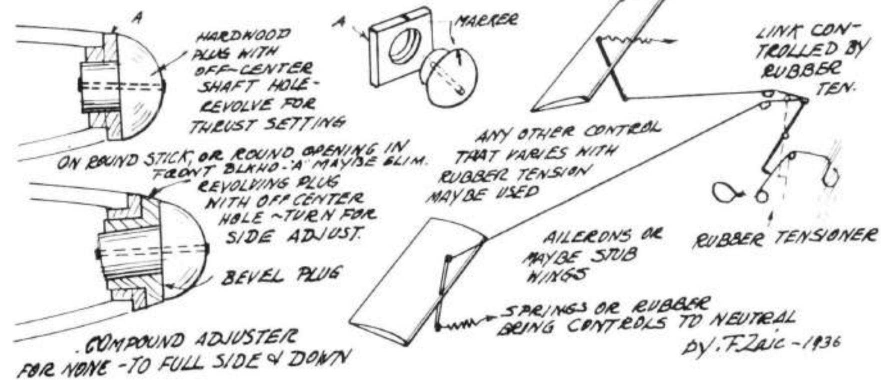
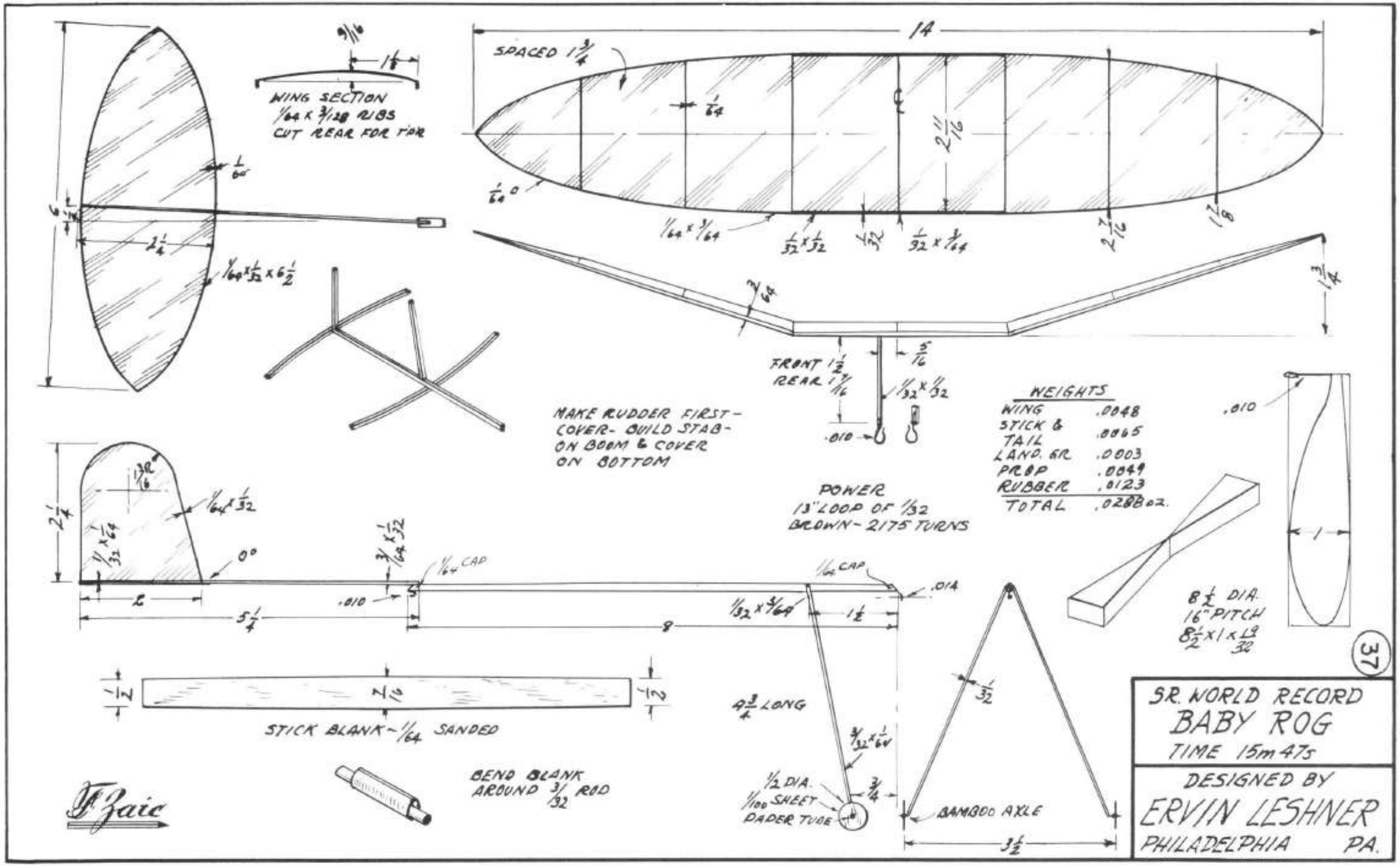


Fig. 21.

The logical solution of the counter-torque adjustment problem is to use a small amount of each type of adjustment and to allow the model to turn with the torque, so that when the power is completely expended, the model will turn in the opposite direction with no upsetting tendency. Another method is to have an automatic aileron control, self-adjustable by the motor torque. Whichever method you use to counteract the torque, remember that it is the wing that actually produces the result.




37
SR. WORLD RECORD
BABY ROG
TIME 15m 47s
DESIGNED BY
ERVIN LESHNER
PHILADELPHIA PA.
WING SECTION
1/64 x 3/128 RIBS
CUT REAR FOR T.OR
SPACED 1 3/4
14
2 11/16
1/64 x 3/64
1/32 x 1/32
1/32 x 3/64
1/64 x 1/32 x 6 1/2
FRONT 1 1/2
REAR 1 7/16
1/32 x 1/32
MAKE RUDDER FIRST-
COVER- BUILD STAB-
ON BOOM & COVER
ON BOTTOM
WEIGHTS
WING .0048
STICK & TAIL .0065
LAND. GR. .0003
PROP .0049
RUBBER .0123
TOTAL .0288 oz.
POWER
13" LOOP OF 1/32
BROWN- 2175 TURNS
8 1/2 DIA.
16" PITCH
8 1/2 x 1 x 19/32
1/64 CAP
1/32 x 3/64
4 3/4 LONG
1/2 DIA.
1/100 SHEET
PAPER TUBE
BAMBOO AXLE
3 1/2
STICK BLANK - 1/64 SANDED
BEND BLANK
AROUND 3/32 ROD
F. Zaic

THE THREE CENTERS

<u>The Center of Gravity, the Center of Drag, and the Thrust Line</u>

To enable us to get a good glide while using the power flight adjustments, we must consider the position and effect of the various forces. The center of gravity and the thrust line can be fixed, but the center of drag keeps wandering with every change in the relative airflow. It is this varying position which often makes adjusting difficult. The strength of these three forces depends upon their relation to each other, as well as upon the flying conditions.

The vertical position of the C. G. is usually determined by the rubber motor line, the weight of the wing, and the weight of the landing gear. Since the weight of the landing gear does not often equal that of the wing, we can assume the C. G. to be slightly above the rubber line. The fore and aft position also depends upon the center of the rubber line. Since the weight of the tail surfaces usually balances the weight of the prop, we have only to consider the wing and landing gear. Since these two are in front of the rubber motor center we can assume the final C. G. to be in front of this center, with the exact position determined by the weight of each item. You may test this premise for yourself by balancing a completed model.

The thrust line depends upon the axis of the propeller shaft, and can be made independent of the rubber line by the use of a suitable plug. In making these plugs, remember that there is side friction at the rear of the junction of the shaft and the plug, and that this friction should be minimized by the use of a metal tube, and eyelets and washers.

The center of drag is the point at which the drag of the individual parts is balanced. Since the drag changes with the speed and shape presented to the airflow, the center keeps shifting under different flying conditions. On a normal model, the C. D. is high because of the high wing. The forces on a normal model are as shown in Fig. 22, and the action of the various centers is as follows:

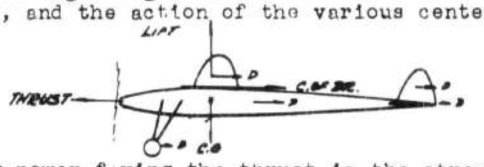


Fig. 22.

During power flying the thrust is the strongest forward force. Gravity, acting through the C. G., contributes slightly when the ship in a diving position, but it also detracts in a climb. The reaction of the center of drag with the thrust line usually determines the position of the model in respect to the flight line. A high center of drag has a tendency to increase the angle of attack, and if no counteracting force is applied will eventually stall or loop the model. However, we do have a counteracting force in the stabilizer, which tries to keep the angle of attack within safe bounds and so preserve stability. See Fig. 23. Note that the stabilizer's corrective force must take care of the drag force as well as the lift of the wing.

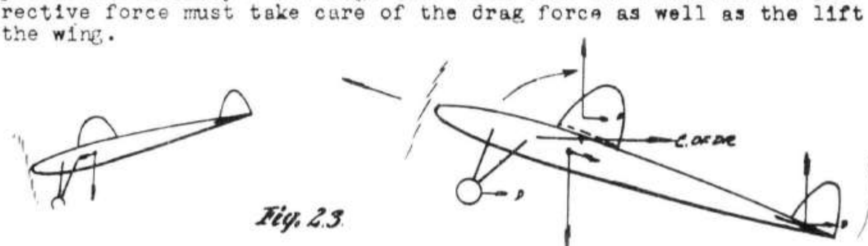
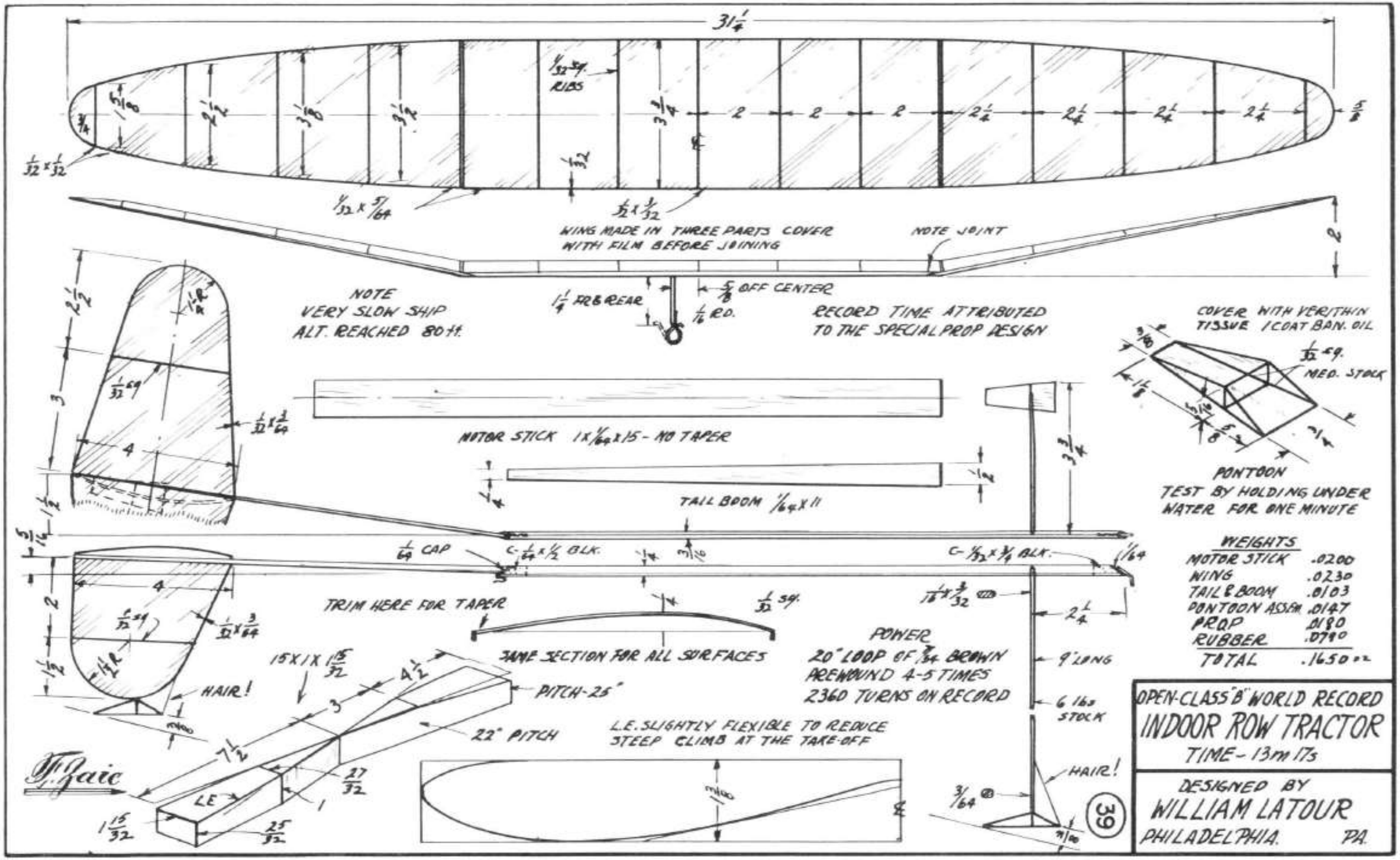


Fig. 23.



WING MADE IN THREE PARTS COVER WITH FILM BEFORE JOINING
NOTE JOINT
NOTE
VERY SLOW SHIP
ALT. REACHED 80 ft.
RECORD TIME ATTRIBUTED TO THE SPECIAL PROP DESIGN
5/8 OFF CENTER
COVER WITH VERITHIN TISSUE 1 COAT BAN. OIL
MED. STOCK
MOTOR STICK 1 X 1/64 X 15 - NO TAPER
PONTOON
TEST BY HOLDING UNDER WATER FOR ONE MINUTE
TAIL BOOM 1/64 X 11
WEIGHTS
MOTOR STICK .0200
WING .0230
TAIL & BOOM .0103
PONTOON ASSEM. .0147
PROP .0180
RUBBER .0790
TOTAL .1650 oz
1/64 CAP
TRIM HERE FOR TAPER
SAME SECTION FOR ALL SURFACES
POWER
20" LOOP OF 7/64 BROWN
PREWOUND 4-5 TIMES
2360 TURNS ON RECORD
9" LONG
6 lbs STOCK
HAIR!
PITCH-25"
22" PITCH
L.E. SLIGHTLY FLEXIBLE TO REDUCE STEEP CLIMB AT THE TAKE-OFF
15 X 1 X 1 15/32
F. Zaic
39
OPEN-CLASS "B" WORLD RECORD
INDOOR ROW TRACTOR
TIME - 13m 17s
DESIGNED BY
WILLIAM LATOUR
PHILADELPHIA. PA.

The objection to this arrangement is that with an increased angle of attack, a greater frontal area is introduced which adds to the total drag. The setting of the stabilizer required to counteract the drag force is that of increased incidence or the use of a high lift airfoil. This setting tends to dive the model in the glide, as the drag force is decreased at lower speeds. To offset this, the wing must be moved forward, which adds an additional corrective load to the stabilizer while in power flight. The setting is now as shown in Fig. 24. Note that this arrangement is the one used on almost all of the present types of models. From the above we can see why we use such large, and very often lifting, stabilizers, and why the C. G. is almost at the trailing edge, when a high wing is used.

Fig. 24.

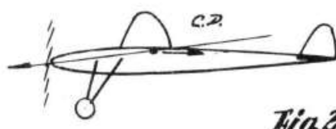


Fig. 25.

Another way to counteract the high center of drag is to have the thrust line pass through the C. D. as shown in Fig. 25. This relieves the stabilizer considerably, but not altogether, as the center of drag shifts from the thrust line, at different speeds and angles. During the glide of a down thrust model, the stabilizer controls the situation as described.

We have seen that a high center of drag requires balancing with other forces, and that a greater frontal area is exposed, with consequent lowered total efficiency. The ideal theoretical combination would be to have these forces meet at one point. Such a design calls for a low or midwing. Comparatively few low-wing or midwing models have been made, and the results have been merely average. It is quite possible that a more thorough practical investigation will eventually bear out the above theory for model work. At the present time it would seem that a high center of drag provides an automatic adjuster of the angle of attack, i.e. when the speed is great, the angle is increased, and when the speed is low, the angle is low. However, this setup places adjusting in the cut and try class, and is also responsible for many longitudinal stability problems.

The effect of having the center of drag below the C. G. and thrust line is évident from Fig. 26. The stabilizer corrections will be just the opposite of those recommended for the high C. D.

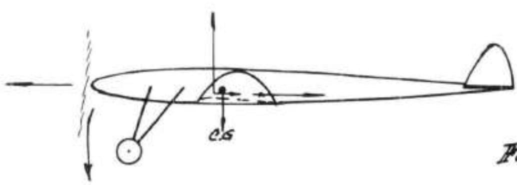
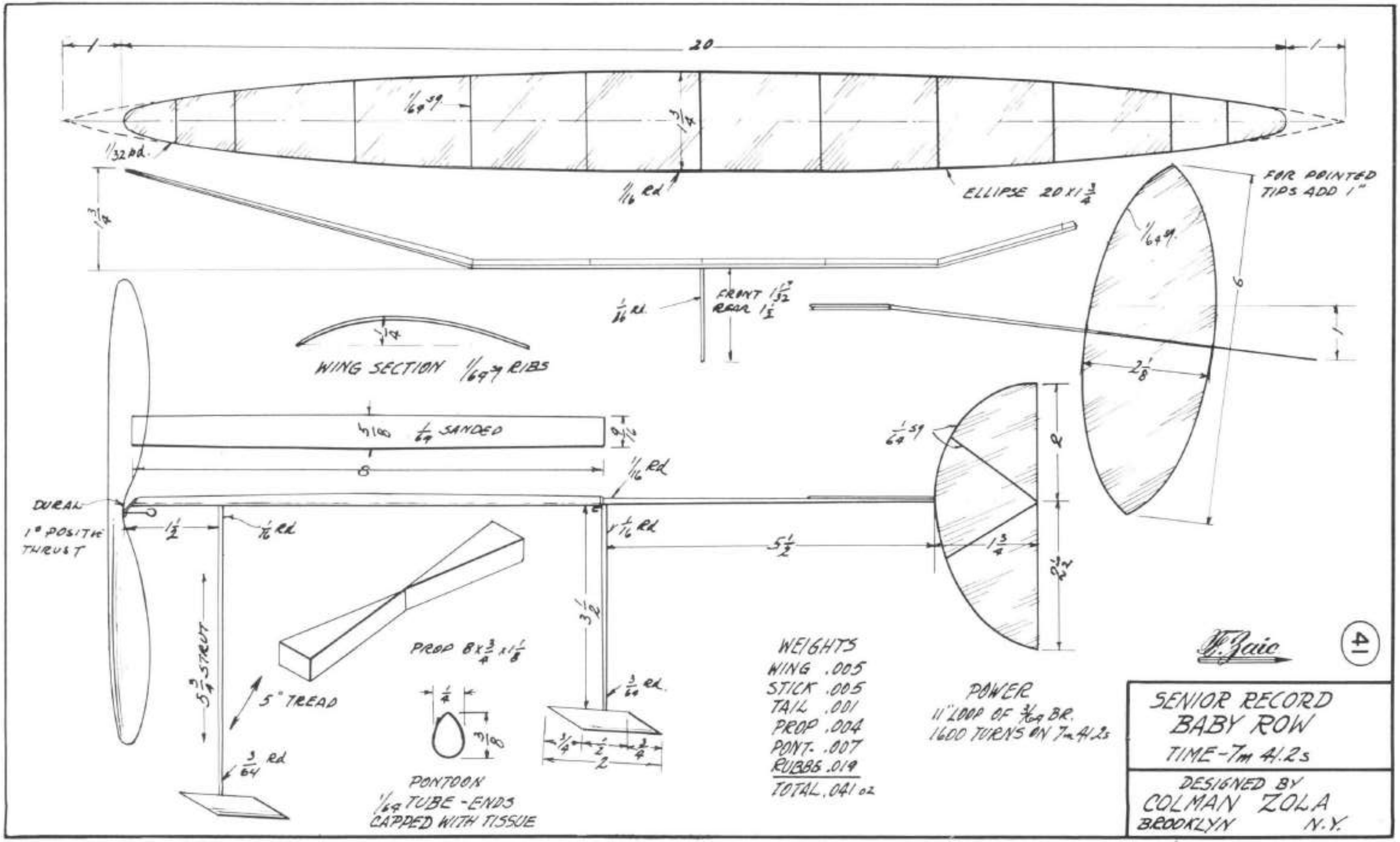


Fig. 26.

The degree of downthrust and stabilizer setting depends upon the particular model. The first adjustments should be made to obtain a good glide by setting the wing and the stabilizer. Then the power flight should be adjusted with the aid of downthrust. If the required downthrust is too great, increase the stabilizer's incidence and move the wing forward slightly, and then try again with this combination. To obtain a fine downthrust gradation use a variable nose plug as shown in Fig. 27.



20
FOR PRINTED TIPS ADD 1"
ELLIPSE 20 X 1 3/4
1/16 Rd
1/32 Rd.
1/64 sq.
WING SECTION 1/64 sq RIBS
FRONT 1 5/32
REAR 1 1/2
1/16 Rd.
1/64 sq
1/64 sq
8
1/64 SANDED
DURAL
1° POSITIVE THRUST
1/16 Rd
1/16 Rd
5 1/2
5 3/4 STRUT
5" TREAD
3/64 Rd
3/64 Rd.
PROP 8 X 3/4 X 1 1/8
PONTOON
1/64 TUBE - ENDS CAPPED WITH TISSUE
WEIGHTS
WING .005
STICK .005
TAIL .001
PROP .004
PONT. .007
RUBBS .019
TOTAL .041 oz
POWER
11" LOOP OF 3/64 BR.
1600 TURNS ON 7m 41.2s
41
SENIOR RECORD
BABY ROW
TIME - 7m 41.2s
DESIGNED BY
COLMAN ZOLA
BROOKLYN N.Y.

PROPELLERS

The present tendency of using a standard size propeller for a particular type of model gives us very little opportunity to learn exactly how the propeller operates. Although the subject is well covered in technical books, popular explanation still leaves us in doubt about several important points. Several of the most important are: What determines the slip of the prop? What effect has the airfoil and what effect has the blade area? When should the pitch be high or low? How is the angle of attack of the prop determined? What pitch-diameter ratio is best? What is the best prop for a particular model?

Explanations that can be found in technical books are based on the wing or airfoil theory. That is, it is assumed that the propeller blades are a set of wings which are rotated in order to produce lift. As such, they are subject to all of the reactions attributed to the regular wing. (We should therefore be careful to use the most efficient blade outline and airfoil, just as for an ordinary wing, especially since the propeller is the only means of converting our limited power into forward motion.) The following text will describe the forces acting on the propeller while it is in various positions, and is presented in the wing principle theory.

Assuming that a rotating propeller has no load to pull and that the airfoil is symmetrical, its path would follow the line of least resistance. See Fig. 28. You will notice that the path of that particular prop portion is along the line of the geometrical pitch, and that the lift is zero while the drag is at its minimum value. (If a cambered section were used the resulting pitch would be as shown by the dotted line, due to the lift of such airfoils at zero angles of attack.) Very little power is required to rotate the propeller when it is in this position. However, no work is being done since the lift is zero. The distance such a propeller travels in one revolution depends upon the angle of the blades. It is evident that a high angle will give a greater distance than a smaller one.

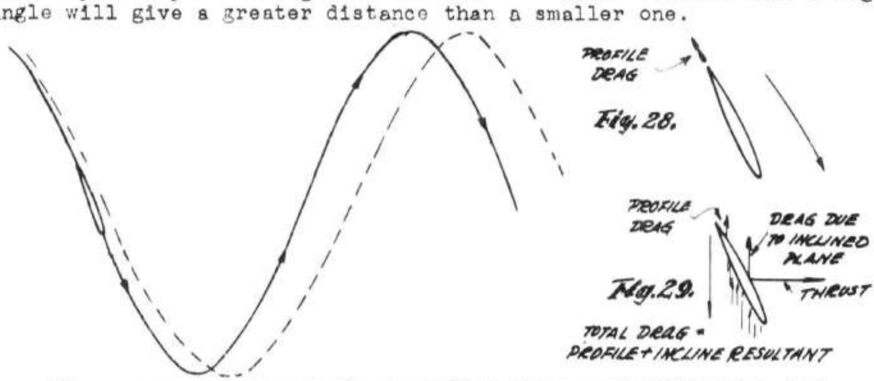
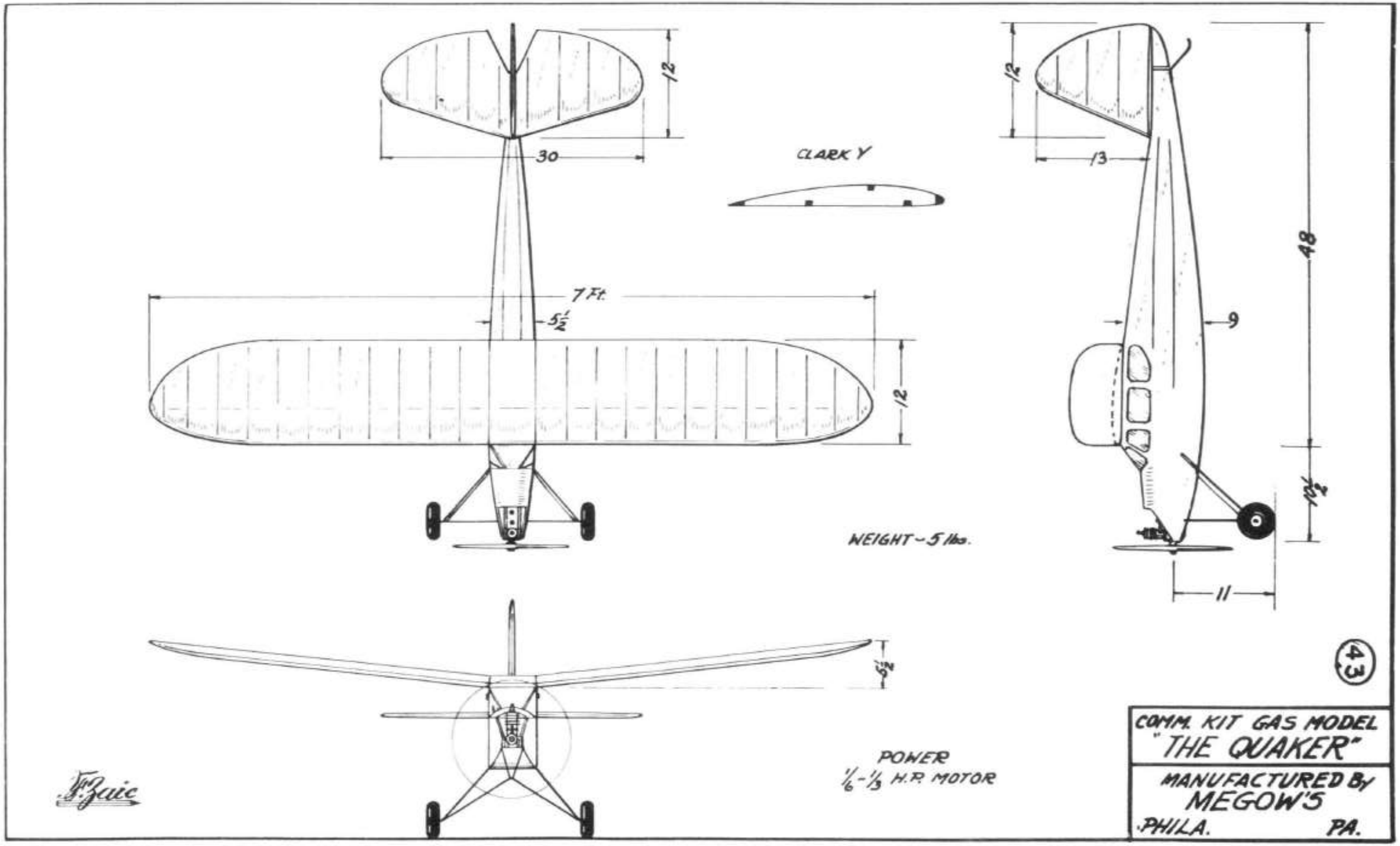
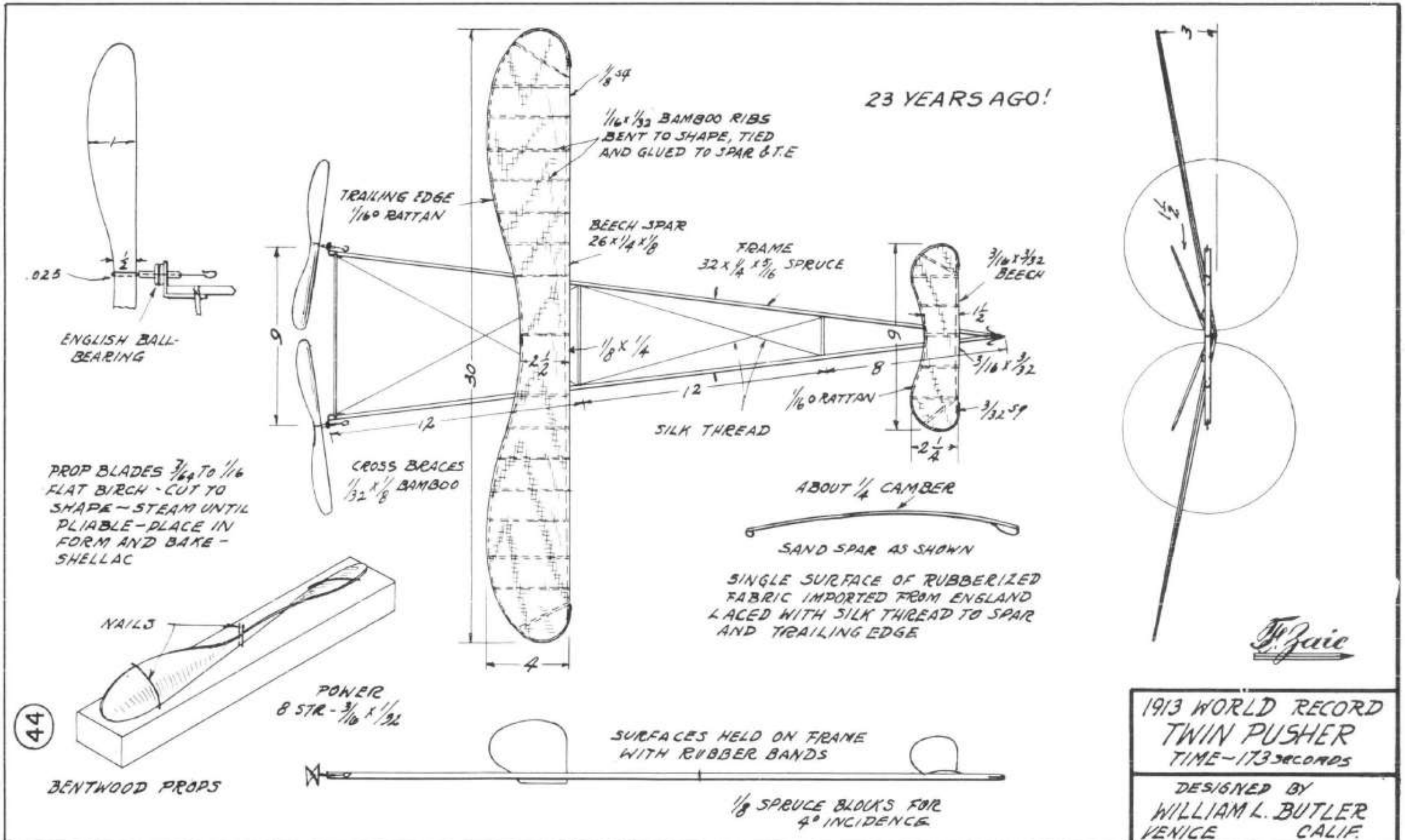


Fig. 28.
Fig. 29.

If we were to prevent the propeller from moving forward, but still permitted it to rotate, the reaction of the blades upon the air would be as shown in Fig. 29. The path of the blade is now perpendicular to the center line, and the angle of attack is very high, with consequent high lift and drag. The exact value of these two forces can be calculated by breaking up the blade into several segments and by calculating with formulas, the lift and drag of the entire prop while it is revolving at a certain speed. The important point to remember is that the rotating action of the angled blade is producing a forward force and also an anti-rotating force. To get the forward force we must overcome the anti-rotating force. We do this by furnishing the necessary power.



12
30
CLARK Y
7 Ft.
$5\frac{1}{2}$
12
WEIGHT - 5 lbs.
12
13
48
9
$10\frac{1}{2}$
11
$5\frac{1}{2}$
POWER
$\frac{1}{6}$-$\frac{1}{3}$ H.P. MOTOR
F. Zaic
43
COMM. KIT GAS MODEL
"THE QUAKER"
MANUFACTURED BY
MEGOW'S
PHILA. PA.



1913 WORLD RECORD
TWIN PUSHER
TIME - 173 SECONDS

DESIGNED BY
WILLIAM L. BUTLER
VENICE CALIF.

The above two examples showed the extreme positions in which the propeller may be. In both positions, the useful work is nil; in the first case, the propeller had no load to pull, and in the second case it was held stationary by a force greater than its thrust or lift. Useful work is accomplished somewhere between these two extremes.

If, for example, the propeller were fixed to a trolley with a load which requires a force of 10 pounds to start it and keep it in motion, a one pound thrust will not budge it. To move the trolley we must either increase the thrust or reduce the load, or perform some sort of compromise. Assuming that we compromise, and the load is now 5 pounds and the thrust is also 5 pounds at a specific r.p.m., the trolley will still remain stationary as the forces are only neutralized, because the propeller is still spinning with the blade path at right angles to the center line. Now if the speed of the propeller is increased ever so slightly, the increase of thrust will be greater than the load, and the trolley will move forward. At the instant that the trolley begins to move forward, the angle of attack is decreased and the thrust is the same as it was before, when the trolley was at a standstill. The difference is that the r.p.m. are higher and that the path of the propeller blades is in a forward direction. Consequently, with every prop turn, the trolley advances forward. The exact distance it travels forward depends upon the angle of the path of the blades, the diameter of the prop, and the number of revolutions per minute.

If the conditions do not change, the trolley will travel forward at a uniform rate for an indefinite period of time. However, let us suppose that part of the load drops off the trolley so that the load is decreased. At the moment that the load decreases the trolley speeds up because the thrust is greater. But as mentioned above, the angle of attack also changes with the speed, until the angle is reached at which the thrust is equal to the load. These conditions are represented in Fig. 30. Here we see that the angle of the path of the propeller blades has been increased and that the distance now covered in one revolution is much greater, so that if the number of revolutions per minute remain the same, the speed of the trolley increases.

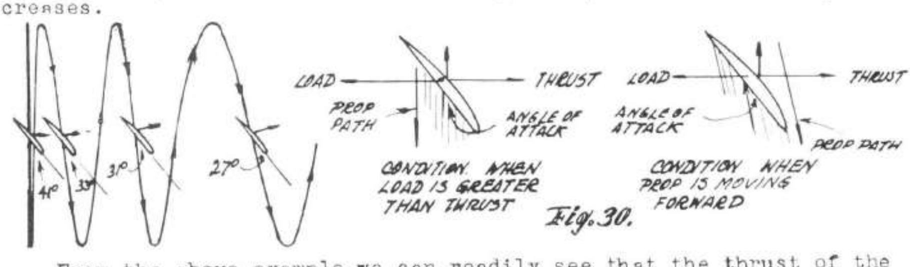


Fig. 30.

From the above example we can readily see that the thrust of the propeller always equals the load except at the moment that the conditions change, that the distance covered in one revolution depends upon the angle of the blade path, and that the speed depends upon the number of revolutions made within a certain time.

To clarify the statement that the thrust and load are almost always equal, let us explain it by the use of the analogy of the trolley. If the load is greater than the thrust it will tend to slow down the trolley. But as soon as the forward speed is reduced the angle of attack is increased with its consequent increase of lift, for the increase of thrust, except that in this case the angle of attack is lowered with an increase of forward speed, with a consequent lowering of thrust, until it is equal to the load. The whole thing may be boiled down to the fact that the propeller blades, in wishing to go forward, are hindered by the drag of the model, and that this drag must be neutralized by the thrust.

It is evident that the trolley may be replaced with a plane, and that as soon as the forward motion is fast enough for the particular model the flight will begin. Note that the thrust of the propeller always equals the drag of the model, regardless of the speed the model may be travelling. It can also be seen that enough thrust must be developed to produce the necessary flying speed.

The above are fundamental principles, and we should keep them in mind when designing a propeller. From them we can see that a comparatively small propeller must be revolved at high speed, and that a large propeller may go slower. The choice of the propeller pitch rests upon the power available. With gas engines we may use small pitch, high speed props, and for rubber we must use the larger pitch, slowly rotating type. To get the utmost efficiency from a propeller, we must make it so that we get the maximum output for the power we use. To achieve this end we must go into more detailed propeller operation description.

The more exact force diagram of the propeller segments is shown in Fig. 31. The most important point to consider is the direction of the lift force. Notice that if it is placed into a force diagram it produces an anti-rotation force. This force becomes greater as the angle of the blades is increased. Besides the anti-rotation force produced by the lift, the power must also overcome the ordinary airfoil drag. Thus the total torque is equal to the anti-rotation force produced by the lift and the airfoil drag. From this we can see that low pitch props with large angles of attack will produce the most favorable lift forces, but that in such positions the props may produce enough thrust only at high speed prop revolutions, which are undesirable for rubber models.

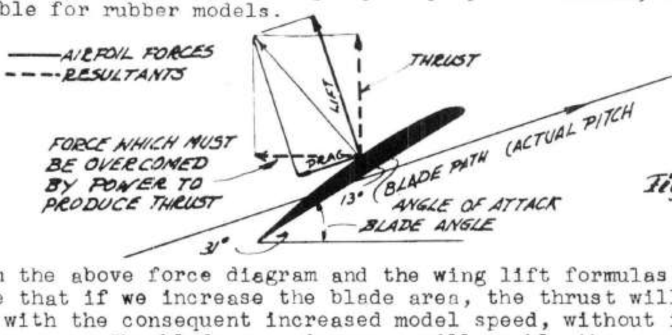
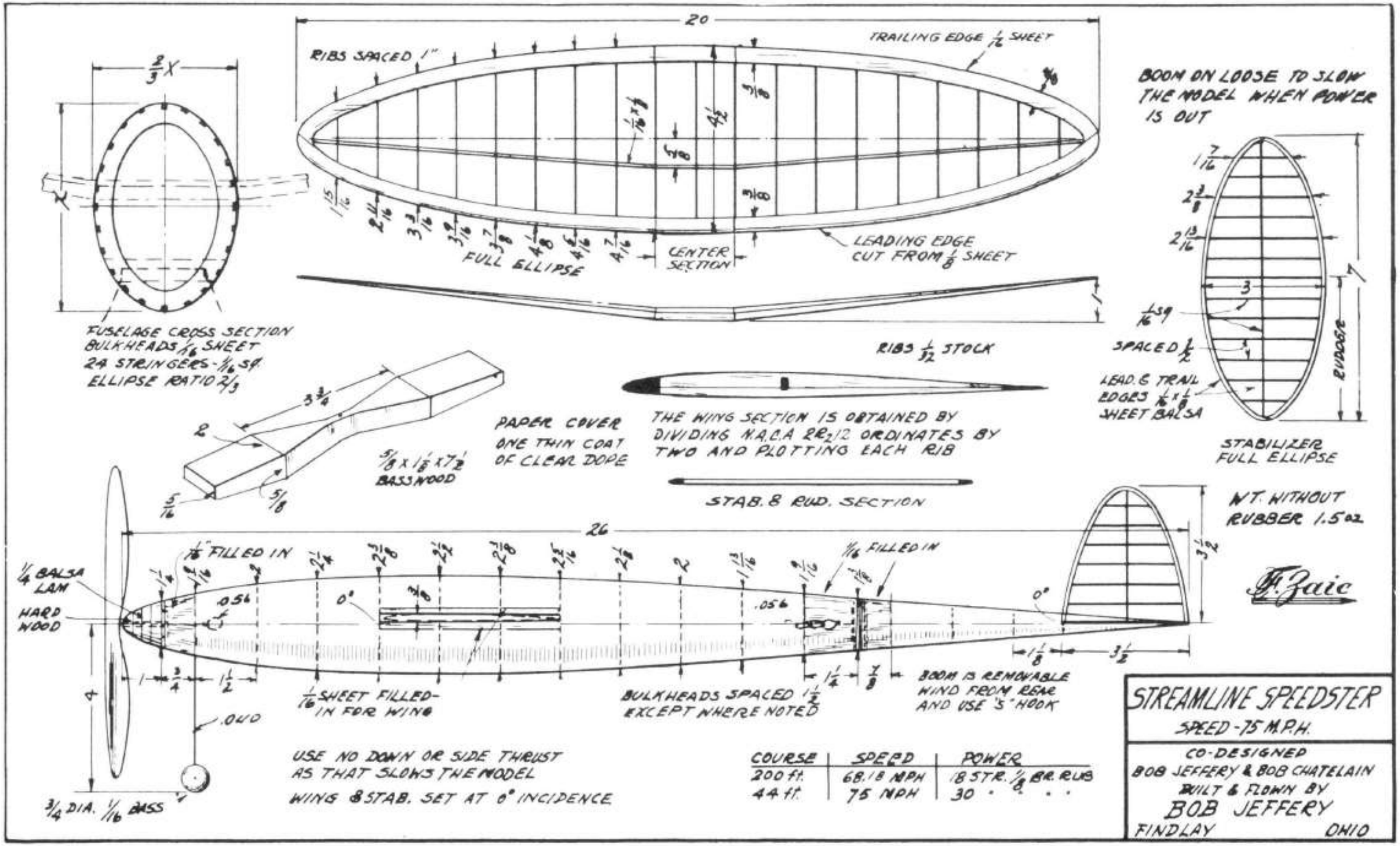
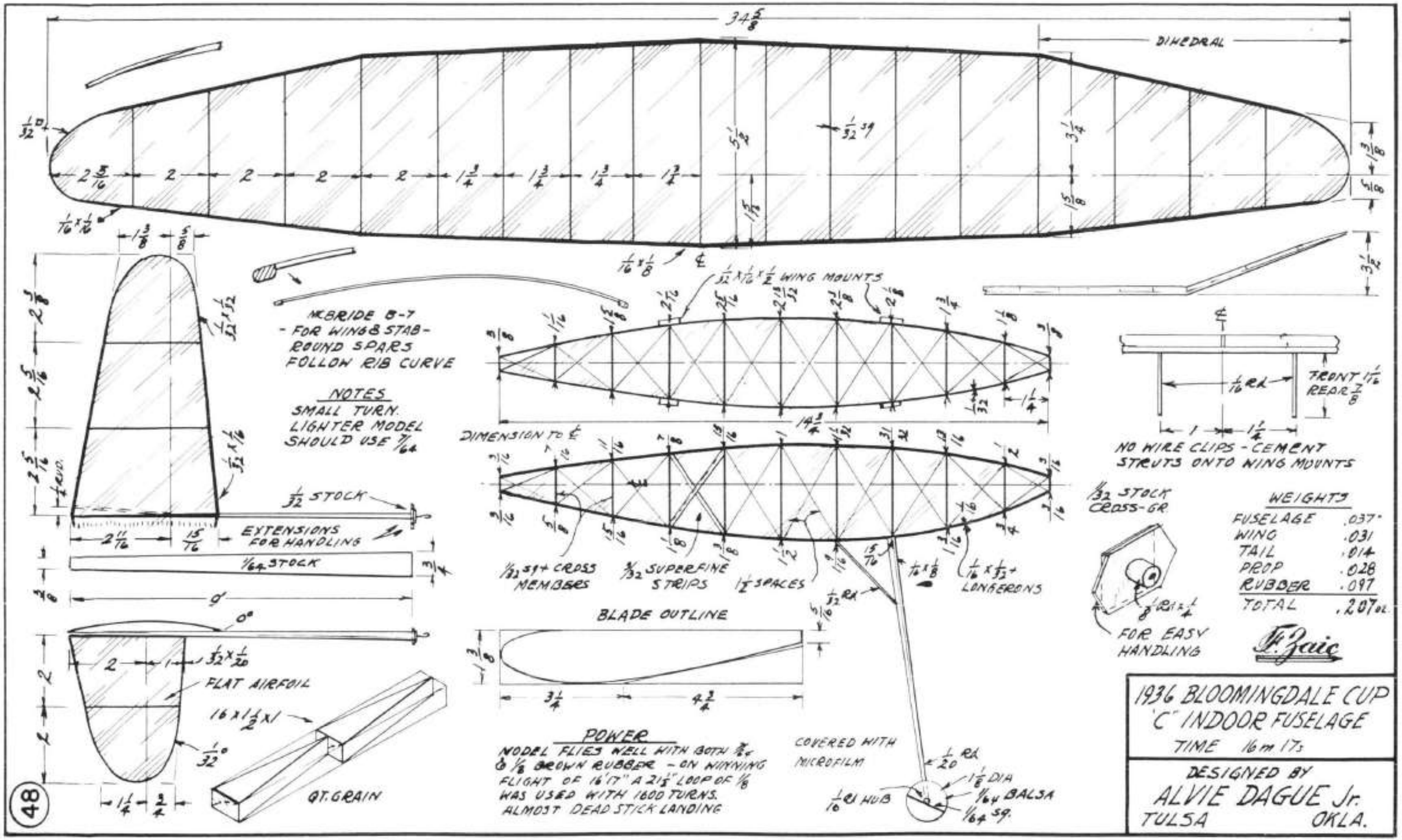


Fig. 31.

From the above force diagram and the wing lift formulas, we can also see that if we increase the blade area, the thrust will be increased with the consequent increased model speed, without increasing the r.p.m. The blade area increase will enable the prop to develop sufficient thrust at comparatively low angles of attack, so that the drag coefficient will be lower. The ideal angle of attack will be at the point where the L/D ratio of the particular section is the highest. At this point the efficiency will be the greatest since we get the most lift for the power expended. (It is quite possible that model propellers do work at this angle when the prop rotates at high speed under the initial burst of power of the rubber motor. However, as the power slackens, the model slows down until there is just enough power to produce the needed thrust for flying speed, and the angle of attack is then quite high in order to produce the needed thrust.) To remain at this ideal angle of attack the propeller must continue developing enough lift to keep it in that position. If the total drag or load of the model is high, the thrust must be great, while low drag or streamlined models can fly with a smaller thrust. From this we can conclude that a high drag model requires a larger prop area than does the low drag design. The exact areas can be calculated if we know the flying speed, the diameter and pitch of the prop, the drag, and the power at the cruising point. However, some of these factors are still incalculable and for the present we must be content with what experience has shown.


20
RIBS SPACED 1"
TRAILING EDGE 1/16 SHEET
FULL ELLIPSE
CENTER SECTION
LEADING EDGE CUT FROM 1/8 SHEET
BOOM ON LOOSE TO SLOW THE MODEL WHEN POWER IS OUT
2/3 X
FUSELAGE CROSS SECTION
BULKHEADS 1/16 SHEET
24 STRINGERS - 1/16 SQ.
ELLIPSE RATIO 2/3
RIBS 1/32 STOCK
PAPER COVER
ONE THIN COAT OF CLEAR DOPE
THE WING SECTION IS OBTAINED BY DIVIDING N.A.C.A. 2R₂12 ORDINATES BY TWO AND PLOTTING EACH RIB
5/8 x 1 1/8 x 7 1/2 BASSWOOD
STAB. & RUD. SECTION
SPACED 1/2
LEAD. & TRAIL EDGES 1/16 x 1/8 SHEET BALSA
RUDDER
STABILIZER FULL ELLIPSE
WT. WITHOUT RUBBER 1.5 oz
26
1/16" FILLED IN
1/16 FILLED IN
1/4 BALSA LAM
HARD WOOD
.056
1/16 SHEET FILLED-IN FOR WING
BULKHEADS SPACED 1 1/2 EXCEPT WHERE NOTED
BOOM IS REMOVABLE WIND FROM REAR AND USE "S" HOOK
.040
3/4 DIA. 1/16 BASS
USE NO DOWN OR SIDE THRUST AS THAT SLOWS THE MODEL
WING & STAB. SET AT 0° INCIDENCE
COURSE | SPEED | POWER
200 ft. | 68.18 MPH | 18 STR. 1/8 BR. RUB
44 ft. | 75 MPH | 30 " " " "
F. Zaic
STREAMLINE SPEEDSTER
SPEED - 75 M.P.H.
CO-DESIGNED
BOB JEFFERY & BOB CHATELAIN
BUILT & FLOWN BY
BOB JEFFERY
FINDLAY OHIO



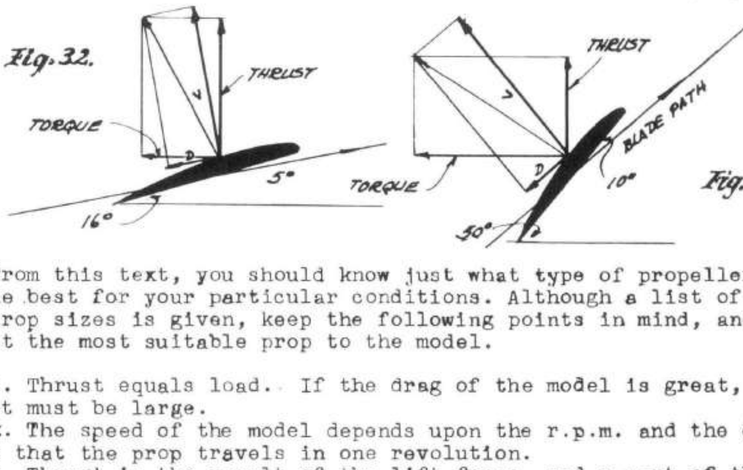
DIHEDRAL
McBRIDE B-7
- FOR WING & STAB -
ROUND SPARS
FOLLOW RIB CURVE
NOTES
SMALL TURN.
LIGHTER MODEL
SHOULD USE 7/64
1/32 x 1/16 x 1/2 WING MOUNTS
DIMENSION TO ℄
1/32 STOCK
EXTENSIONS
FOR HANDLING
1/64 STOCK
FLAT AIRFOIL
QT. GRAIN
1/32 SQ + CROSS
MEMBERS
3/32 SUPERFINE
STRIPS
1 1/2 SPACES
1/16 x 1/32 + LONGERONS
BLADE OUTLINE
POWER
MODEL FLIES WELL WITH BOTH 7/64 & 1/8 BROWN RUBBER - ON WINNING FLIGHT OF 16' 17" A 21 1/2" LOOP OF 1/8 WAS USED WITH 1600 TURNS. ALMOST DEAD STICK LANDING
COVERED WITH
MICROFILM
1/16 RD HUB
1 1/8 DIA
1/64 BALSA
1/64 SQ.
NO WIRE CLIPS - CEMENT
STRUTS ONTO WING MOUNTS
FRONT 1 1/16
REAR 7/8
1/32 STOCK
CROSS-GR.
FOR EASY
HANDLING
WEIGHTS
FUSELAGE .037
WING .031
TAIL .014
PROP .028
RUBBER .097
TOTAL .207 oz.
F. Zaic
1936 BLOOMINGDALE CUP
"C" INDOOR FUSELAGE
TIME 16 m 17 s
DESIGNED BY
ALVIE DAGUE Jr.
TULSA OKLA.
48

Pitch and Diameter

We have seen that the forward speed depends upon the distance that a segment travels in one revolution of the prop and its relation to the angle of attack. The forward speed can be increased by increasing the distance that the segment travels, as well as by setting it at a steeper angle. Both of these are accomplished at the expense of drag, and of the two, the increase of the distance of segment travel (or diameter) is the most economical. However, if the diameter becomes excessive for practical purposes, and we still have power to spare, we can increase the angle or the pitch. These facts become very useful when we are designing a model. If the model is intended for high speed, the propeller should be of such diameter and pitch that the power will revolve it at high speed at the maximum efficiency. These conditions call for a prop whose angle of attack would be such that most of the lift is in the flight direction, and whose diameter would be as large as the power would allow for the speed. This means that the P/D ratio should be small (pitch 20"/diameter18", 1.1). See Fig. 32.

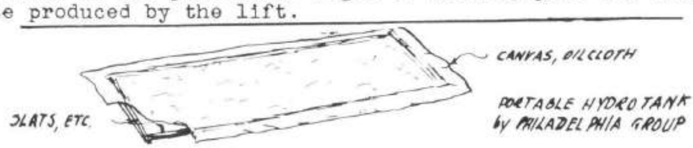
If the model is intended for cruising then the prop should conserve the power for as long as possible. This can be accomplished by using a large diameter as well as large blade angles. This type of prop will revolve slowly but it will still give the needed thrust for the flying speed. In this case the P/D ratio is high (pitch 36"/diameter 18", 2.0). See Fig. 33.

The drag of the model should also determine the P/D ratio. It can readily be seen that a streamlined model can have a high speed with a slow but high pitch prop, since the needed thrust is lower than for the blunter ship. However, the prop does not work at its best efficiency point, and if it is possible to increase the motor length, do so by all means, and decrease the pitch of the propeller.



From this text, you should know just what type of propeller will be the best for your particular conditions. Although a list of standard prop sizes is given, keep the following points in mind, and try to fit the most suitable prop to the model.

1. Thrust equals load. If the drag of the model is great, the thrust must be large.
2. The speed of the model depends upon the r.p.m. and the distance that the prop travels in one revolution.
3. Thrust is the result of the lift force, and a part of the lift force produces an anti-rotating force.
4. The power required must be equal to the drag of the propeller's airfoil at the particular angle of attack, plus the anti-rotating force produced by the lift.



Blade Outline and Construction Hints

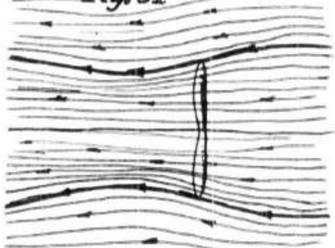
The volume of air influenced by the rotating propeller is shown in Fig. 34. Notice that the airflow begins quite a distance in front of the propeller, and that the increase of airspeed behind it reduces the air pressure so that the slip stream is actually of smaller diameter than the propeller. However, the peculiar flow formation near the tips should not beguile us into believing that the tips are unimportant. The tip losses or eddies are still there, and the tip shape and aspect ratio are just as important on the propeller as on ordinary wings. Conclusive proof of the fact that losses occur at the tips was made by the Editor. The experiment was performed as shown in Fig. 35. The interesting part is that the silk thread actually moved forward into the blades while held behind the propeller. This effect was especially strong on a square tip design propeller.

The elliptical tip blade outline seems to be about the best. The blade area should be concentrated at the one half point so as to minimize tip losses and high drag at the hub. In fact it is desirable to cut the blank so that the pitch angle will be about the same at the hub vicinity. The blank layout, blade outline, and the recommended sizes of propellers are shown in Fig. 36.

For balsa props, use balsa blanks of about 10 lbs./cu. ft. hardness. If it is at all possible, try to have the grain crisscrossing parallel with the width of the blank. This will provide identical grain on both blades, and also give a strong hub.

Very little can be said about carving for the youngsters, except that practice makes perfect. However, no trouble should be experienced if the blank is well laid out and carving is done slowly with a sharp knife.

Fig. 34



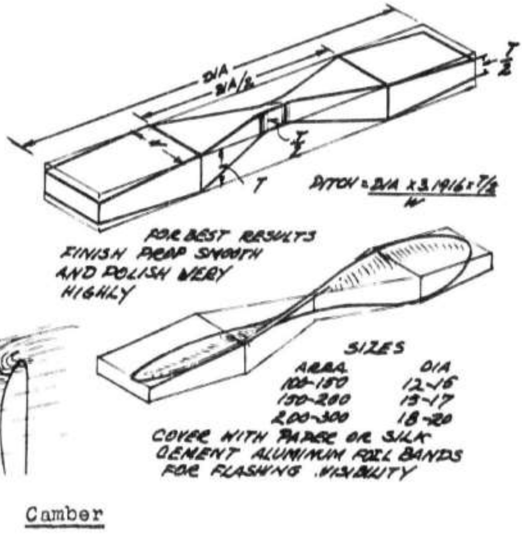
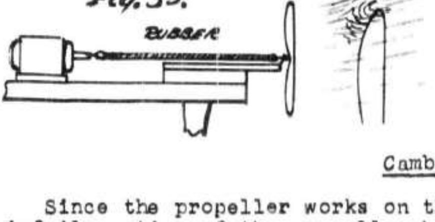
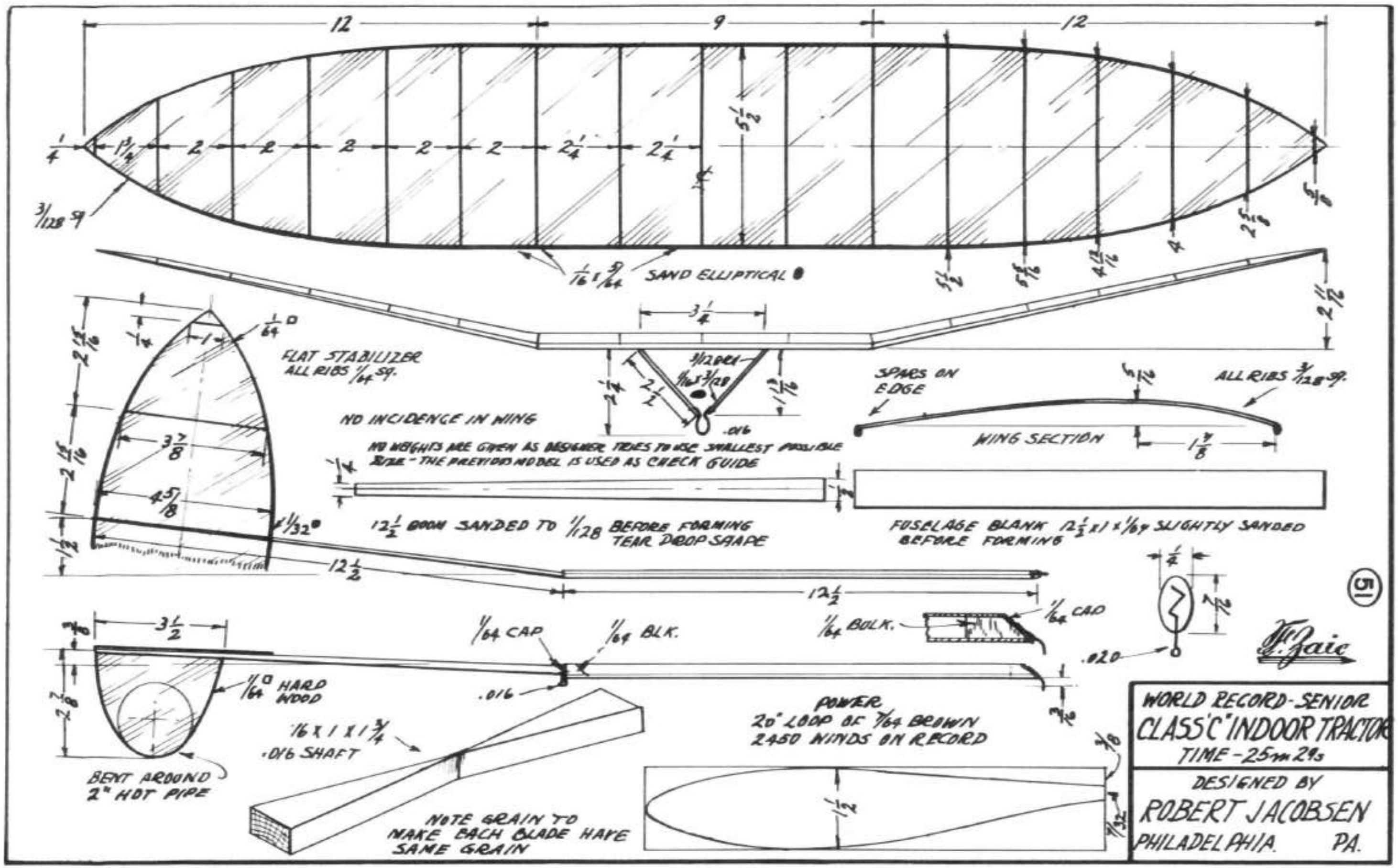


Fig. 35.

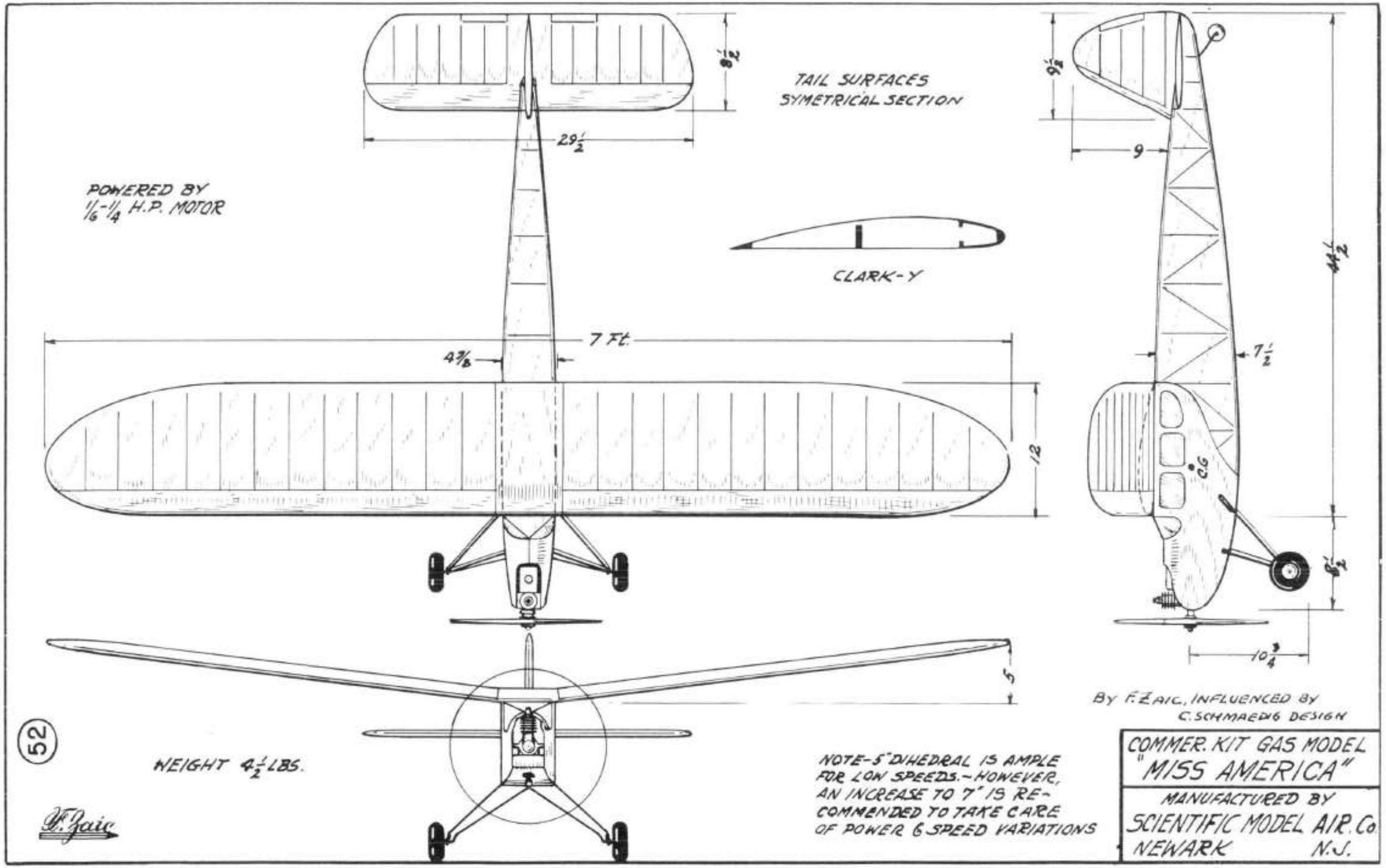


Camber

Since the propeller works on the regular airfoil principle, the airfoil section of the propeller has reactions similar to those of the main wing. Therefore, the camber should be decided by the design of the model. Fast and short motor propellers may have a Clark Y section while slow, duration propellers may be very deeply undercambered. Just remember that undercamber gives greater lift at a given incidence than a flat-bottom section, but that the drag is also greater. If you have plenty of power which you want to be used up slowly, use plenty of undercamber.



SAND ELLIPTICAL
FLAT STABILIZER
ALL RIBS 1/64 SQ.
NO INCIDENCE IN WING
NO WEIGHTS ARE GIVEN AS DESIGNER TRIES TO USE SMALLEST POSSIBLE SIZE - THE PREVIOUS MODEL IS USED AS CHECK GUIDE
SPARS ON EDGE
ALL RIBS 3/128 SQ.
WING SECTION
12 1/2 BOOM SANDED TO 1/128 BEFORE FORMING TEAR DROP SHAPE
FUSELAGE BLANK 12 1/2 x 1 x 1/64 SLIGHTLY SANDED BEFORE FORMING
1/64 CAP
1/64 BLK.
1/64 BULK.
1/64 CAP
1/64 HARD WOOD
BENT AROUND 2" HOT PIPE
1/6 x 1 x 1 3/4
.016 SHAFT
NOTE GRAIN TO MAKE EACH BLADE HAVE SAME GRAIN
POWER
20" LOOP OF 1/64 BROWN
2450 WINDS ON RECORD
51
WORLD RECORD-SENIOR
CLASS"C" INDOOR TRACTOR
TIME - 25m 29s
DESIGNED BY
ROBERT JACOBSEN
PHILADELPHIA PA.



52
TAIL SURFACES
SYMETRICAL SECTION
POWERED BY
1/6-1/4 H.P. MOTOR
CLARK-Y
7 Ft.
4 3/8
12
29 1/2
8 1/2
9 1/2
9
7 1/2
44 1/2
8 1/2
10 3/4
5
C.G
WEIGHT 4 1/2 LBS.
NOTE-5" DIHEDRAL IS AMPLE
FOR LOW SPEEDS.-HOWEVER,
AN INCREASE TO 7" IS RE-
COMMENDED TO TAKE CARE
OF POWER & SPEED VARIATIONS
BY F. ZAIC, INFLUENCED BY
C. SCHMAEDIG DESIGN
COMMER. KIT GAS MODEL
"MISS AMERICA"
MANUFACTURED BY
SCIENTIFIC MODEL AIR. Co
NEWARK N.J.
F. Zaic

Aerodynamic Reactions of Freewheeling Propellers

"To freewheel or not to freewheel..." has been the question for quite a while. The best way to settle this soliloquy is to analyze a propeller while it is standing still and while it is freewheeling. The action of the airflow on a still propeller is shown in Fig. 37. Note that the angle of attack varies with the point on the blades. That is, it is high at the tips and low at the hub. The forces set up are relatively great, due to the large angle of attack. The lift force tends to rotate the model via the prop shaft, and tries to upset it unless counter adjustment is provided. This is an especially bad feature since the force is in the counter-torque direction, which is also favored by the normal model adjustments. The drag force is directly backwards which make the total prop drag calculations comparatively simple.

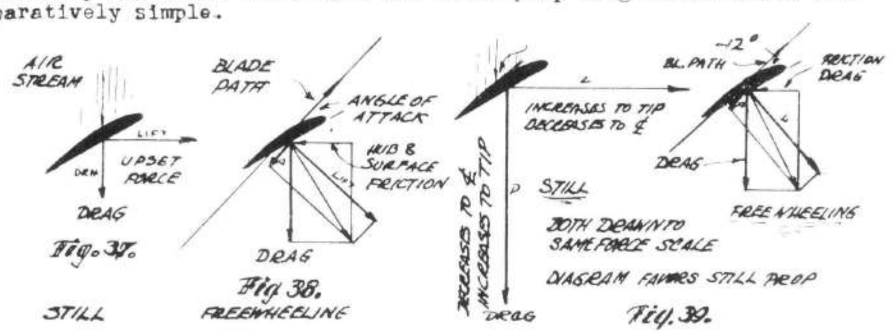


Fig. 37. STILL

Fig. 38. FREEWHEELING

Fig. 39.

The airflow reaction on a freewheeling propeller is shown in Fig. 38. The angle of attack here is much lower. The exact angle depends upon the component of lift needed to overcome the drag of the propeller. Of one fact we can be sure, and that is that the angle is negative to the normal airfoil to such a degree that the lift is also negative. If the angle were above that point, the propeller would revolve in a counterpower turn direction. Since the zero angle is determined by the center line of the airfoil we can see that undercambered props will have much more drag than symmetrical or flat bottom sections. This increase of drag will require a larger lift component to overcome it, and since both the drag and lift forces are in a backward direction, they both constitute drag. There is nothing that we can do about this except to minimize drag as much as possible so that the total will be reduced. This can be done by having a very smooth finish on the blades, by using the best ball bearing washers, and by having a freewheeling that does not depend upon a spring for its operation. If a spring is used, the pressure it exerts against the hub causes additional friction which must be overcome by the lift force. The logical solution is to use a freewheeling of the spiral type or any similar type, and a rubber tensioner to spring the shaft out.

Note from the diagram that we have no rotating force trying to roll the model. The only rotating force is the one which neutralizes the drag, which in turn has a very slight rolling effect at the hub caused by the friction. The exact drag of both types of propeller action can be only estimated. An attempt was made (see Fig. 39), but this should not be considered conclusive.

From the above it would seem that the freewheeling propeller is better, as it usually has lower drag and does not affect the model adjustments. The drag may be slightly higher than that of a still prop on certain occasions (such as in the case of very high pitch), but it still seems better. The fixed position will be all right if the blades can be made to straighten out and conform to the airflow. Of course, a perfect folding prop would solve the whole problem.

THE GLIDE

Although it is the usual procedure to describe the glide at the conclusion, the Editor deemed it advisable to present it at this early point, to emphasize the fact that the greater part of the duration of the model depends upon it. Since it is so important, it is worth our while to design the model with the idea of increasing the glide as much as practically possible.

Once the power is exhausted the only thing left to produce propulsion is the weight of the model. Gravity exerts a downward force on the model equal to its weight, and the aerodynamic balance changes this force into a sloping movement known as the glide. It is evident that the model which uses this force most economically will remain in the air longest. This can be done by having a well balanced and streamlined model. The following example shows why an efficient ship has a better glide than an inefficient design.

We have two models of identical wing loading. The wings and tails are identical, and the balance is perfect in both. The only difference between the models is that one has smooth lines, while the other is about as aerodynamically efficient as the cowcatcher on a locomotive. Both models must fly at the same speed to produce the same lift. It is therefore evident that the model with poor lines will need more power to keep up with the streamlined job. Now when the models go into a glide, the streamlined ship will dip only slightly to keep up its flying speed, while the high drag model will have to point down quite a bit to get to its flying speed. The conclusion drawn is that the inefficient ship will come down much more steeply, with a consequent loss of duration.

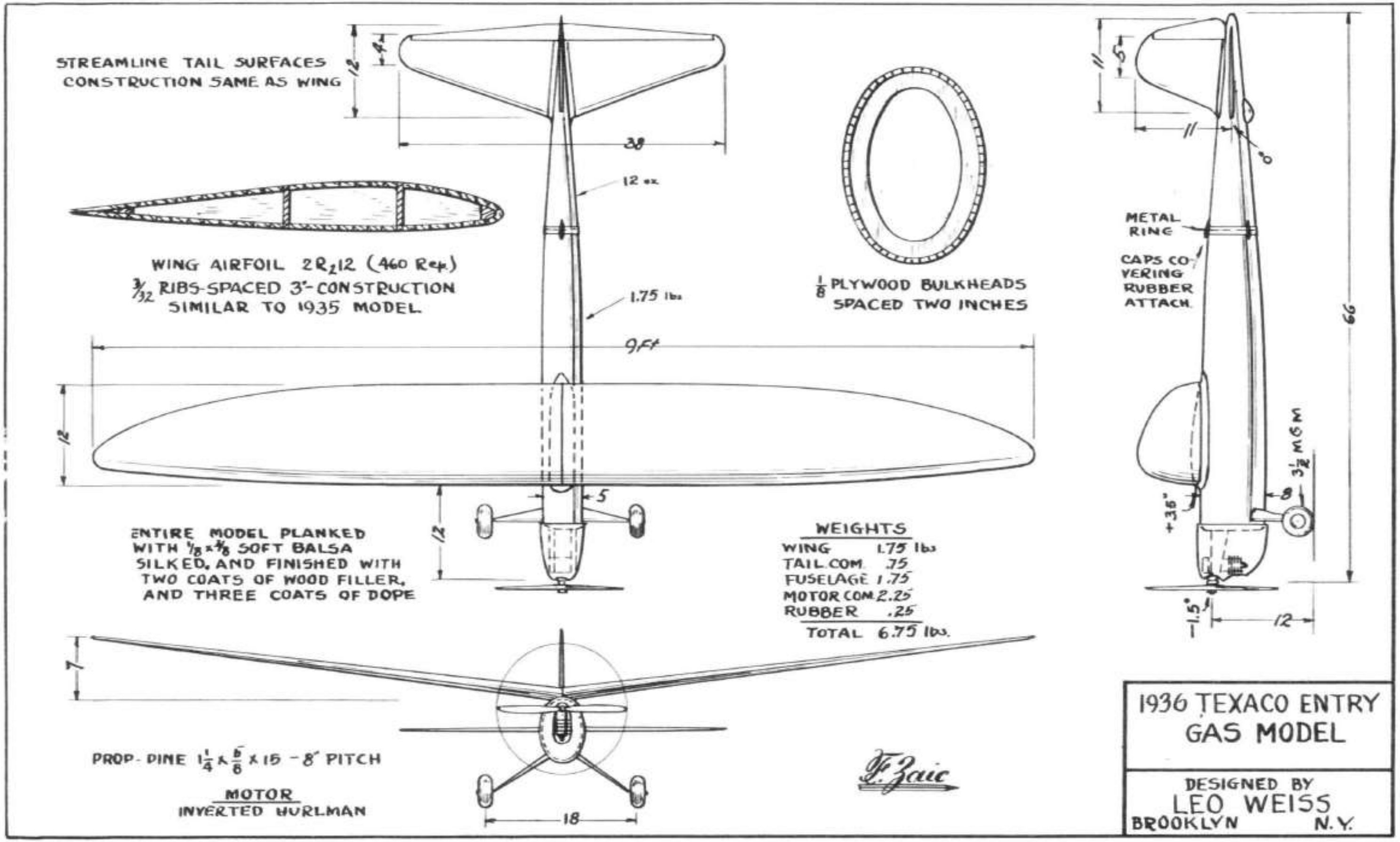
The gliding angle can be very easily predicted if the lift and drag of the model are known. For example, if the lift of a model is four ounces, and it requires one half ounce of thrust to keep its flying speed, the lift over drag (L/D) ratio is 8-1, That is, the lift is eight times the drag. This means that for every foot the model has to descend to keep up flying speed, it will travel eight feet and the gliding ratio will therefore be 8-1. From this example we evolve the following formula:

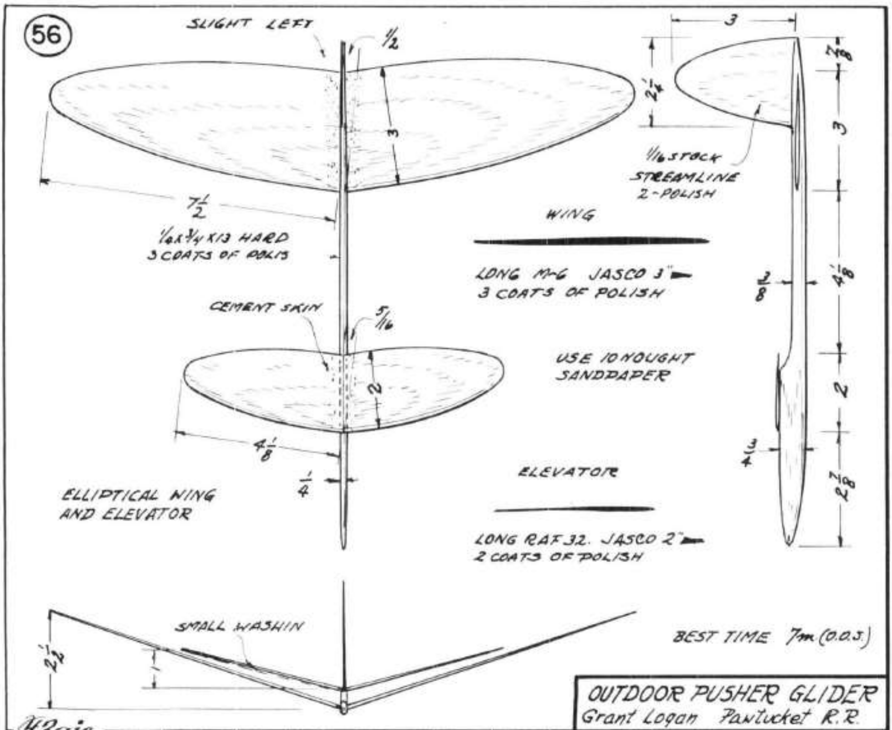
$$\text{Gliding Ratio} = \frac{\text{Lift of the Model}}{\text{Drag of the Model}}$$

We can see from this simple relation that an increase of lift will improve the glide, and that an increase of drag will detract from it. The ideal model should have a minimum of drag and the lowest possible wing loading. (This allows the model to fly slower, thus reducing the drag.) The low drag can be obtained by using streamlining at all practical points. If the model must confrom to the weight rules do not make it heavier than necessary, and use high-lift airfoils, as recommended in the airfoil chapter. A small additional amount of weight may be used if streamlining is impossible without it.

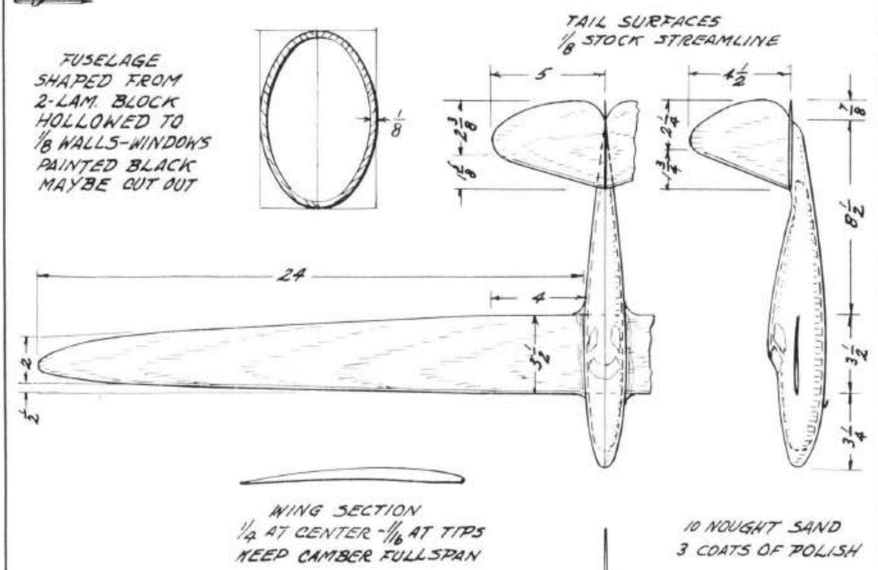
A steep glide is caused by low lift, high drag, or a combination of both. (It is assumed that the adjustments are as recommended in the "Stability" text.) Lack of lift can be easily corrected if a fairly high-lift airfoil is used, by increasing the incidence of the wing and tail. This will increase the lift greatly without increasing the drag very much. However, if the model stalls or mushes with such an adjustment, the glide can be improved only by decreasing the drag.

For maximum efficiency, unless an automatic variable control is used, the glide adjustments must be flight adjustments. How to obtain this combination will be explained later.


STREAMLINE TAIL SURFACES
CONSTRUCTION SAME AS WING
WING AIRFOIL 2R₂12 (460 Re+)
3/32 RIBS-SPACED 3"- CONSTRUCTION
SIMILAR TO 1935 MODEL
1/8 PLYWOOD BULKHEADS
SPACED TWO INCHES
12 oz
1.75 lbs
9 Ft
38
METAL RING
CAPS COVERING RUBBER ATTACH.
66
3½ M G M
+3.5°
-1.5°
ENTIRE MODEL PLANKED
WITH 1/8 x 3/8 SOFT BALSA
SILKED, AND FINISHED WITH
TWO COATS OF WOOD FILLER,
AND THREE COATS OF DOPE
WEIGHTS
WING 1.75 lbs
TAIL COM. .75
FUSELAGE 1.75
MOTOR COM. 2.25
RUBBER .25
TOTAL 6.75 lbs.
PROP- PINE 1¼ x 5/8 x 15 - 8" PITCH
MOTOR
INVERTED HURLMAN
F. Zaic
1936 TEXACO ENTRY
GAS MODEL
DESIGNED BY
LEO WEISS
BROOKLYN N.Y.



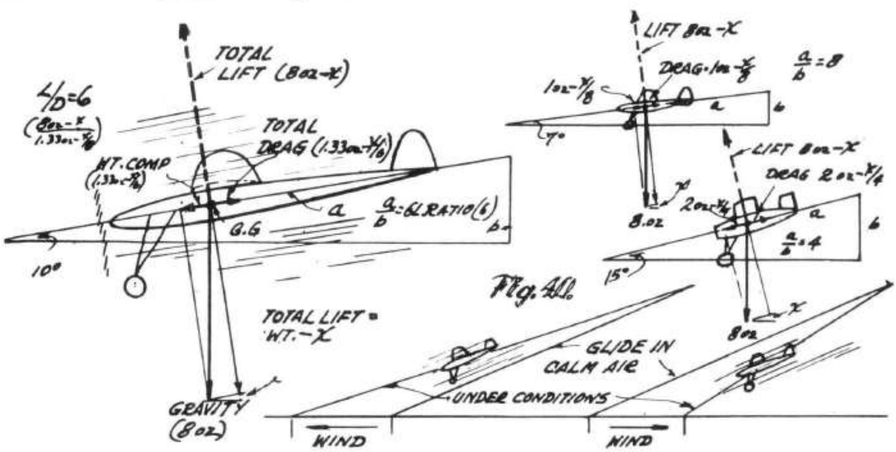
OUTDOOR PUSHER GLIDER
Grant Logan Pawtucket R.R.



ALL BALSA TOWLINE GLIDER
by J. EGGLESTON OMAHA, NEBR.

Since gliding requirements usually necessitate a well designed model, we should remember the following facts about gliding.

1. The gliding angle depends upon the lift and drag (L/D) ratio.
2. The speed of the model is controlled by its wing loading; a model with a light wing loading attains sufficient lift at low speed, and one with a high wing loading needs high speeds to get sufficient lift. If the gliding angle is the same, the wing loading determines the duration.
3. It is a poor policy to increase the angle of attack or incidence too much for improved glide, as at low speeds this procedure places the model in a critical position in relation to the stalling point.
4. The distance that a model travels with relation to the ground depends upon the air conditions. Therefore the gliding ratio cannot be determined by estimating the height at which the glide started, and the distance traveled from that point. See Fig. 40. Nor should the gliding ratio be assumed to be that distance between the point of launching from hand to the landing point, as the initial speed is greater than the normal glide, and the closeness of the ground also has a cushioning effect, because of the compression of the air between the wing and the ground.



For Clarification

"The angle of incidence is the angle between the chord line and the thrust line".
"The angle of attack is the angle between the chord line and the path of relative wind".

The above definitions are official for power plane use. Since the construction and position of the elements of models vary greatly from one design to another we might accept the following definitions for model work:

"The angle of incidence is the angle between the chord line and the line drawn from the center of the prop to the rear hook". Let us make this definition semi-official, so that we will know what is meant when we mention "two degrees downthrust" or "one degree positive", etc.

"The angle of attack in smooth air is the angle between the chord line and the path in which the model is moving". Sudden gusts change the angle of attack until the model readjusts itself to the new flow, when it will again be about the same.

PRACTICE

OUTDOOR

Fuselage

The four longeron type of framework construction still dominates fuselage construction. The simplicity and ease of construction make it a favorite among builders, especially those who have little time for model work. This type has served well under the prevailing weight rules, because the low wing loading of the model has helped to offset many of the disadvantages. However, the expected change in weight rules will put it into the discard and new types of construction will become popular.

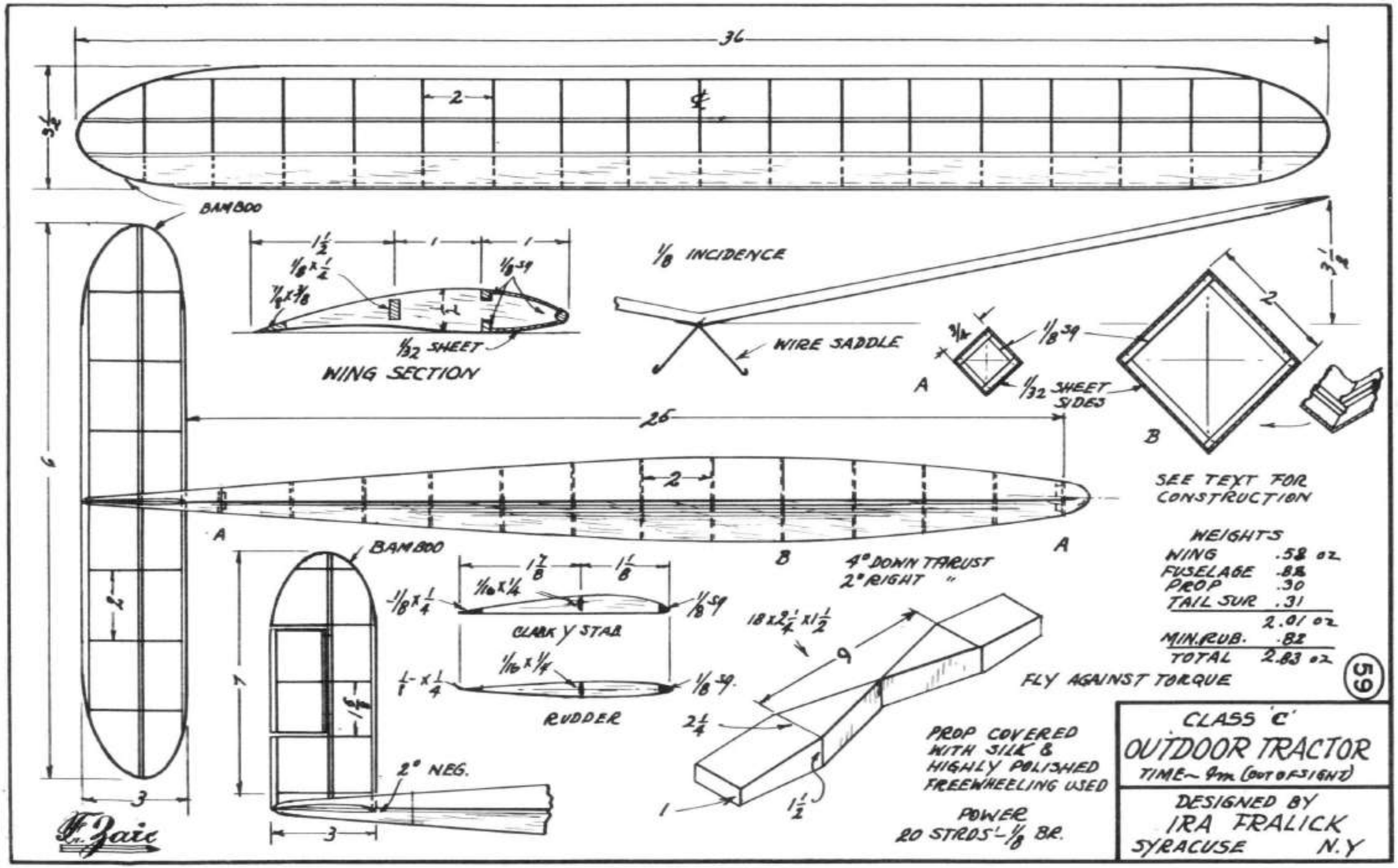
The official 1937 Wakefield rules require a minimum weight of 8 ounces for the 190-210 sq. in. model. The N. A. A. rules are almost sure to be jumped up to 3 oz. per 100 sq. in. (just multiply the wing area by .03 to obtain the required weight in oz.). It is highly improbable that these rules will ever be lowered. The heavier wing loading will not change the general design very much except that the various points of junction will be cleared up, and the fuselage will have to be strengthened to take more power. The builder who makes the most efficient use of the high power ratio will undoubtedly win the contest.

The strength of the regular longeron type of fuselage can be greatly by using larger and stronger balsa and covering it two ply or with bamboo paper. However, the mortality rate will still be high--mainly because of rubber breakage and collisions. We must remember that the increase in weight will speed up the model and endow it with plenty of kinetic energy.

It is problematical how well the removable motorstick will fare with this change. The removable motor stick has its points, and it is possible that a well made built-up stick will hold up under the 20 odd strands. It is amazing how strong balsa can be if it is used correctly. The next proposition is the all-balsa fuselage design, and it is the opinion of the Editor that this type deserves most attention for the coming era of half-pound jobs.

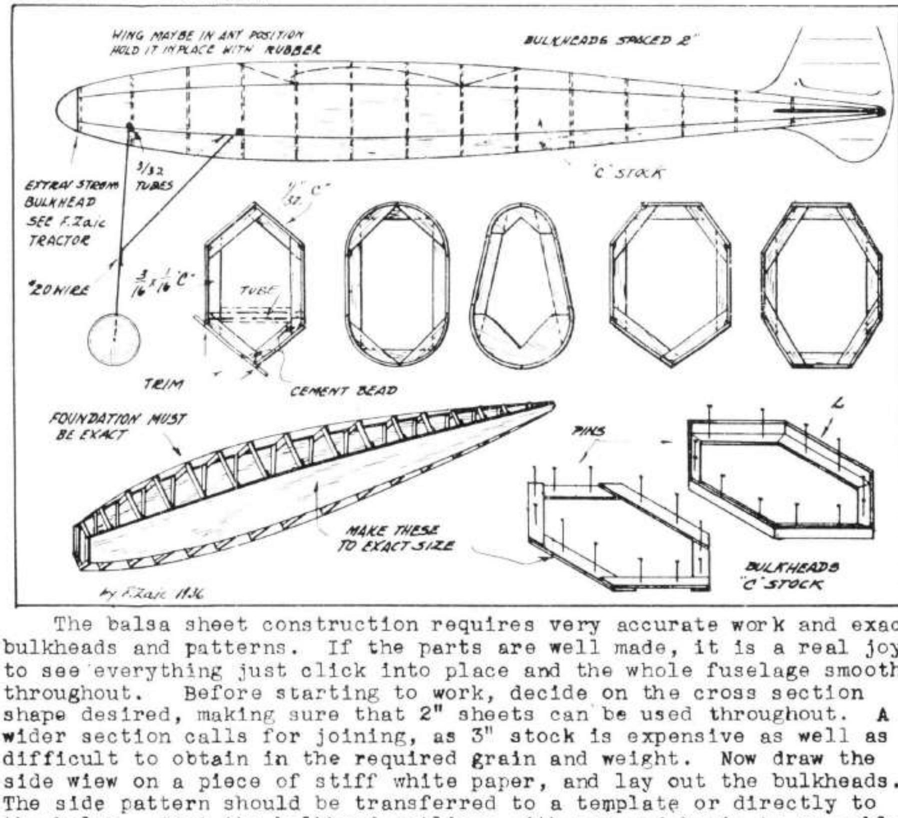
There are several different types of fuselage constructions described in the plans or individually, and there is no need for describing them here. Therefore this particular section will deal with only the sheet balsa design

There are many forms or the all-balsa fuselage, ranging anywhere from the elliptical to the square section. Of course, the elliptical one is best from all viewpoints, with the exception of the time required to construct it and the necessity of using high grade supplies The next best is the round cross section type. This is much simpler to make as the bulkheads are round, and the covering balsa can be made in patterns. On such fuselages the work will be simplified if the model has straight lines. On all circular jobs the bulkheads should be of "C" stock and the covering of "A". The other forms consist of variations of the several flat-sided type, and also those with curved tops and bottoms.



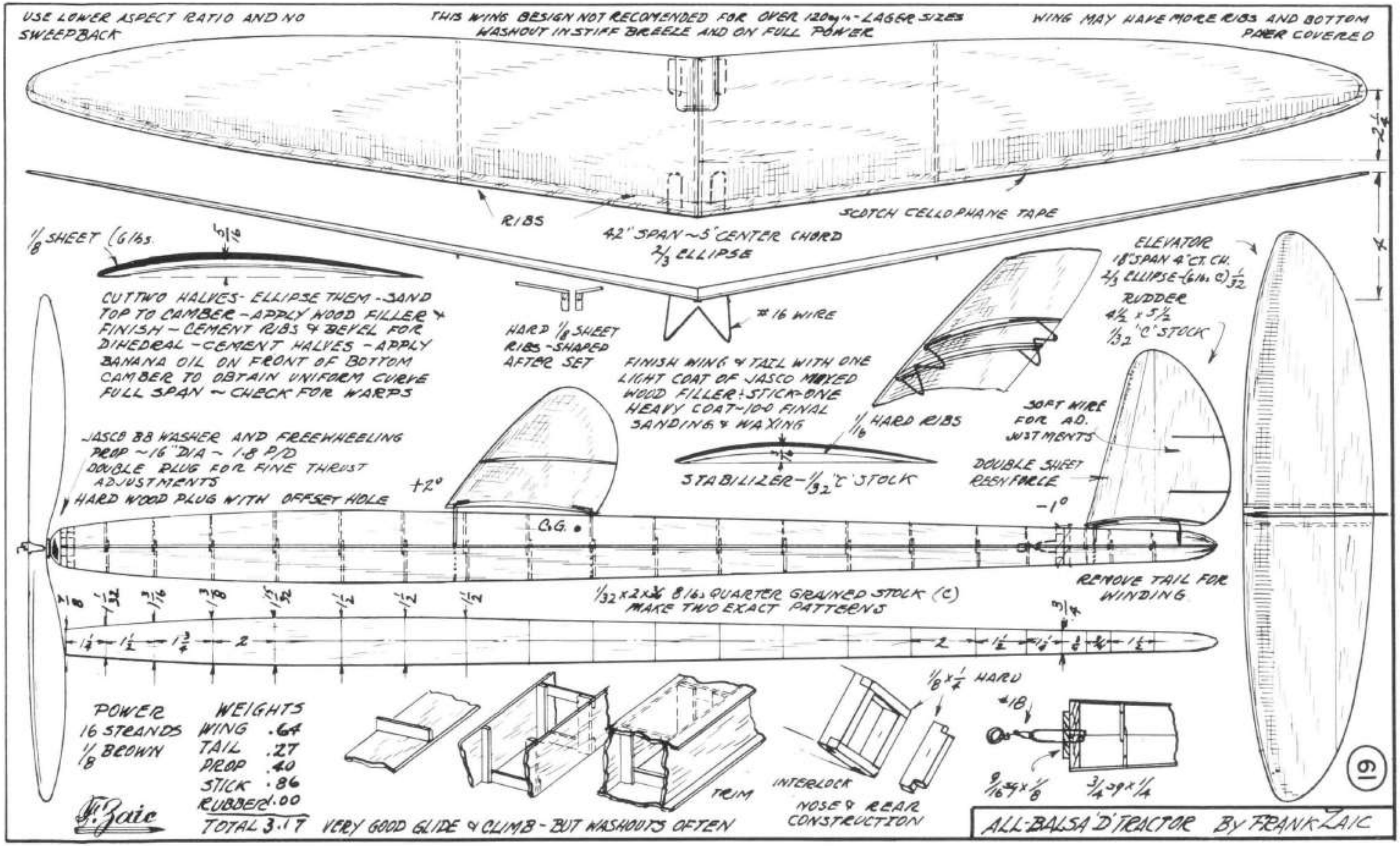
36
BAMBOO
WING SECTION
1/32 SHEET
1/8 INCIDENCE
WIRE SADDLE
1/8 SQ
1/32 SHEET SIDES
SEE TEXT FOR CONSTRUCTION
WEIGHTS
WING .58 OZ
FUSELAGE .88
PROP .30
TAIL SUR .31
2.01 OZ
MIN. RUB. .82
TOTAL 2.83 OZ
4° DOWN THRUST
2° RIGHT "
CLARK Y STAB
RUDDER
2° NEG.
FLY AGAINST TORQUE
PROP COVERED WITH SILK & HIGHLY POLISHED FREEWHEELING USED
POWER 20 STRDS 1/8 BR.
59
CLASS 'C'
OUTDOOR TRACTOR
TIME ~ 9m (OUT OF SIGHT)
DESIGNED BY
IRA FRALICK
SYRACUSE N.Y
F. Zaic

The Editor has made the several models shown in sketches during the past summer, and all of them have held up well under all conditions. The secret here is to use "C" or quarter-grained stock throughout. By using this grain the sheet need not be more than true 1/32" thick for any model using up to 20 strands. 8-9 lb. balsa should be used. The corner type of joints give a stringer effect, making longerons unnecessary. The beauty of this construction is that the weight compares favorably with the ordinary type of fuselage with a much greater safety factor. It is quite possible to have a big section knocked out of a side without losing stiffness, and the repair work is a matter of minutes, as the model can be flown as soon as the patch is set for a hold-on, while a broken longeron calls for a major operation with splints and upsets the adjustments as well. The construction time with balsa sheet is less, providing that the layout and material are on hand.

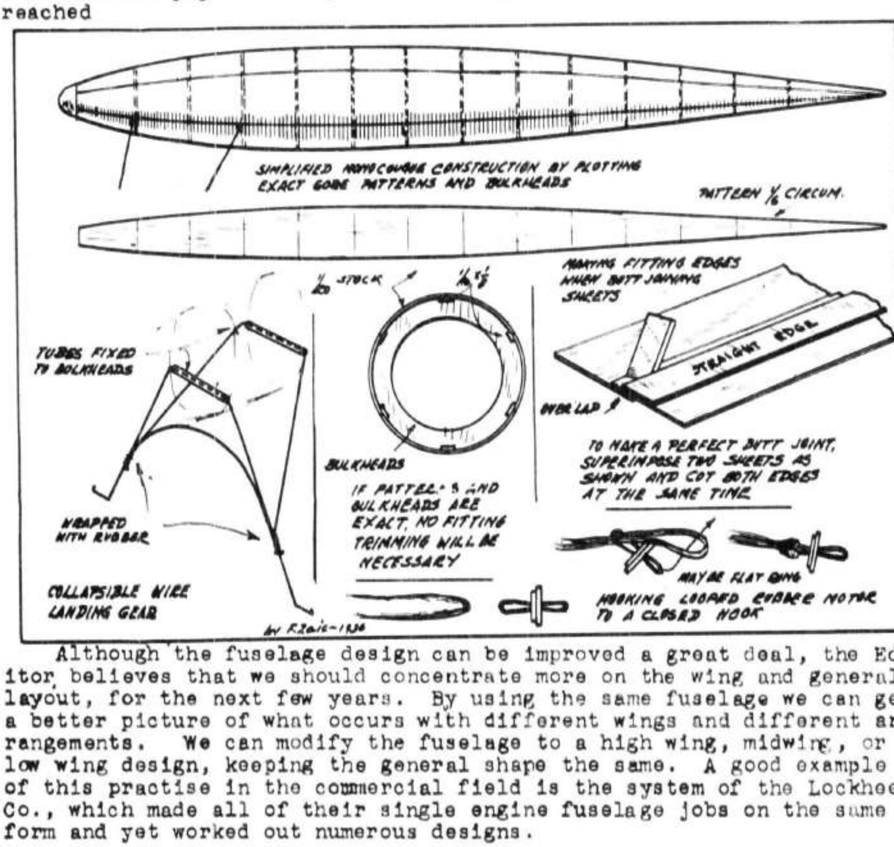


The balsa sheet construction requires very accurate work and exact bulkheads and patterns. If the parts are well made, it is a real joy to see everything just click into place and the whole fuselage smooth throughout. Before starting to work, decide on the cross section shape desired, making sure that 2" sheets can be used throughout. A wider section calls for joining, as 3" stock is expensive as well as difficult to obtain in the required grain and weight. Now draw the side wiew on a piece of stiff white paper, and lay out the bulkheads. The side pattern should be transferred to a template or directly to the balsa. Coat the bulkhead outlines with wax and begin to assemble them. There are several forms shown, and you can use the one most suitable to your own particular conditions. Be sure to make them exact and do not spare the cement.

The assembly is quite simple. Cement the end bulkheads first, and then cement the center to the sides. Be sure to cement them on the exact spots. After all of the bulkheads are in place, the landing gear tubes can be fixed in place. The remaining sides are cemented on without the aid of a pattern. The surplus is trimmed off after the cement is set. In joining the balsa sheets, use a generous amount of cement to from a bead along the joint. The final finish is to sand and dope. For super-strength, cover with paper.


USE LOWER ASPECT RATIO AND NO SWEEPBACK
THIS WING BESIGN NOT RECOMENDED FOR OVER 120 sq in - LAGER SIZES WASHOUT IN STIFF BREEZE AND ON FULL POWER
WING MAY HAVE MORE RIBS AND BOTTOM PAPER COVERED
RIBS
SCOTCH CELLOPHANE TAPE
1/8 SHEET (6 lbs.
5/16
42" SPAN ~ 5" CENTER CHORD
2/3 ELLIPSE
ELEVATOR
18" SPAN 4" CT. CH.
2/3 ELLIPSE-(6 lbs. C) 1/32
RUDDER
4½ x 5½
1/32 "C" STOCK
CUT TWO HALVES- ELLIPSE THEM - SAND TOP TO CAMBER - APPLY WOOD FILLER & FINISH - CEMENT RIBS & BEVEL FOR DIHEDRAL - CEMENT HALVES - APPLY BANANA OIL ON FRONT OF BOTTOM CAMBER TO OBTAIN UNIFORM CURVE FULL SPAN ~ CHECK FOR WARPS
HARD 1/8 SHEET RIBS - SHAPED AFTER SET
#16 WIRE
FINISH WING & TAIL WITH ONE LIGHT COAT OF JASCO MIXED WOOD FILLER & STICK - ONE HEAVY COAT - 10-0 FINAL SANDING & WAXING
1/16 HARD RIBS
SOFT WIRE FOR AD. JUSTMENTS
DOUBLE SHEET REENFORCE
JASCO BB WASHER AND FREEWHEELING PROP ~16" DIA ~ 1.8 P/D
DOUBLE PLUG FOR FINE THRUST ADJUSTMENTS
HARD WOOD PLUG WITH OFFSET HOLE
+2°
STABILIZER - 1/32 "C" STOCK
-1°
C.G.
REMOVE TAIL FOR WINDING
1/32 x 2 x 36 8 lbs QUARTER GRAINED STOCK (C)
MAKE TWO EXACT PATTERNS
POWER
16 STRANDS
1/8 BROWN
WEIGHTS
WING .64
TAIL .27
PROP .40
STICK .86
RUBBER 1.00
TOTAL 3.17
TRIM
INTERLOCK
NOSE & REAR CONSTRUCTION
1/8 x 1/4 HARD
#18
9/16 sq x 1/8
3/4 sq x 1/4
VERY GOOD GLIDE & CLIMB - BUT WASHOUTS OFTEN
F. Zaic
ALL-BALSA "D" TRACTOR BY FRANK ZAIC
19

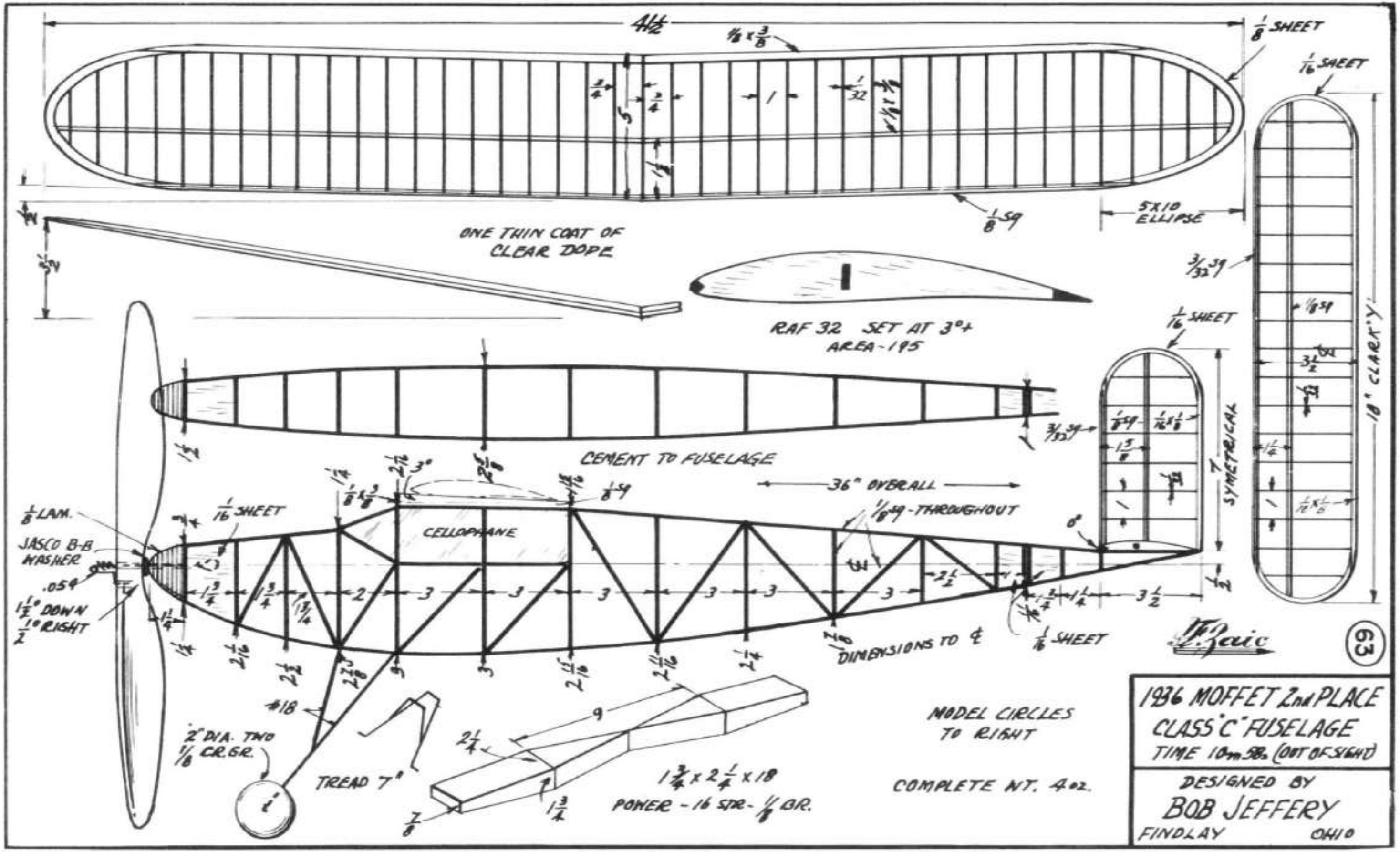
The above covered the polylateral fuselage. If a square or a triangular fuselage is used, the bulkheads can be made while assembling is taking place. Cut to size the side patterns and cement them in the proper places. If the fuselage is absolutely square or equilateral, all strips can be cut at one time and set aside. The sides are assembled by cementing the upper and lower strips and then covering with sheet. This method is especially recommended for enclosed rubber stick models. It compares well with the tubular type of construction. This type of construction lends itself very well to mass production. This idea should be especially appealing to clubs as the side patterns and bulkhead jigs can be passed around, once a satisfactory design is reached



Although the fuselage design can be improved a great deal, the Editor believes that we should concentrate more on the wing and general layout, for the next few years. By using the same fuselage we can get a better picture of what occurs with different wings and different arrangements. We can modify the fuselage to a high wing, midwing, or low wing design, keeping the general shape the same. A good example of this practise in the commercial field is the system of the Lockheed Co., which made all of their single engine fuselage jobs on the same form and yet worked out numerous designs.

Aerodynamical Notes

The main consideration in fuselage models is to have the fuselage as much as possible in line with the flight path. It is here that the round and elliptical jobs shine above the square section. The square job of streamlined outline is fair if kept in line, but the moment it becomes angled the drag increases tremendously. It is for this reason that a fuselage set on edge is better than one which is level. Try to come as close as possible to the ellipse by breaking up the perimiter into numerous sides or else by rounding off the top and bottom. Design the models so that the thrust line will go through the center of the fuselage, or at least adjust it so that the fuselage will be in line in the glide. All of these points will mean a great deal when the wing loading is increased during the coming year. Other aerodynamical points are covered in the Theory chapter.



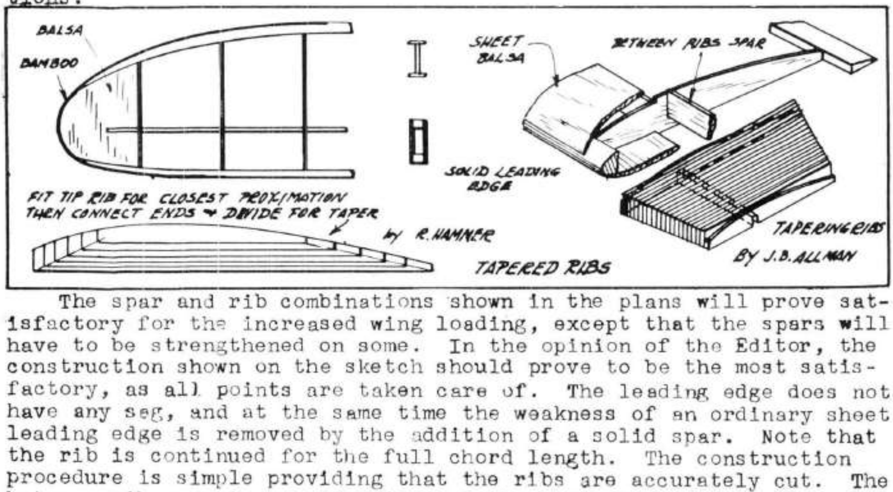
1936 MOFFET 2nd PLACE
CLASS "C" FUSELAGE
TIME 10m 58s (OUT OF SIGHT)
DESIGNED BY
BOB JEFFERY
FINDLAY OHIO
63
ONE THIN COAT OF CLEAR DOPE
RAF 32 SET AT 3°+
AREA-195
CEMENT TO FUSELAGE
36" OVERALL
1/8 SQ.-THROUGHOUT
CELLOPHANE
DIMENSIONS TO ℄
MODEL CIRCLES TO RIGHT
COMPLETE WT. 4 oz.
POWER - 16 STR. - 1/8 GR.
TREAD 7"
2" DIA. TWO 1/8 CR.GR.
#18
1/8 LAM.
JASCO B-B WASHER
.054
1 1/2° DOWN
1/2° RIGHT
5X10 ELLIPSE
18" CLARK "Y"
SYMETRICAL
1/8 SHEET
1/16 SHEET

WINGS

The most common wing failure is the breakage of the spars when an excessive up or down force is applied. A head-on collision usually only dents or cracks the leading edge. From this we see that we must improve the vertical structure, as the horizontal structure is sufficiently strong due to the rib and covering combination. It has also been noticed that the wings with many small spars of almost square cross section have a higher breakage rate than those wings in which the spars are deep and narrow. It therefore seems advisable to follow regular aircraft practice, by using deep and narrow spars.

The strength of a deep spar can be increased without additional weight if quarter-grained or "C" stock balsa is used. This cut is very stiff and when the spar is under pressure, will tend to keep the spar in line instead of crinkling. The moment the spar wood rolls, its value as a spar is lost.

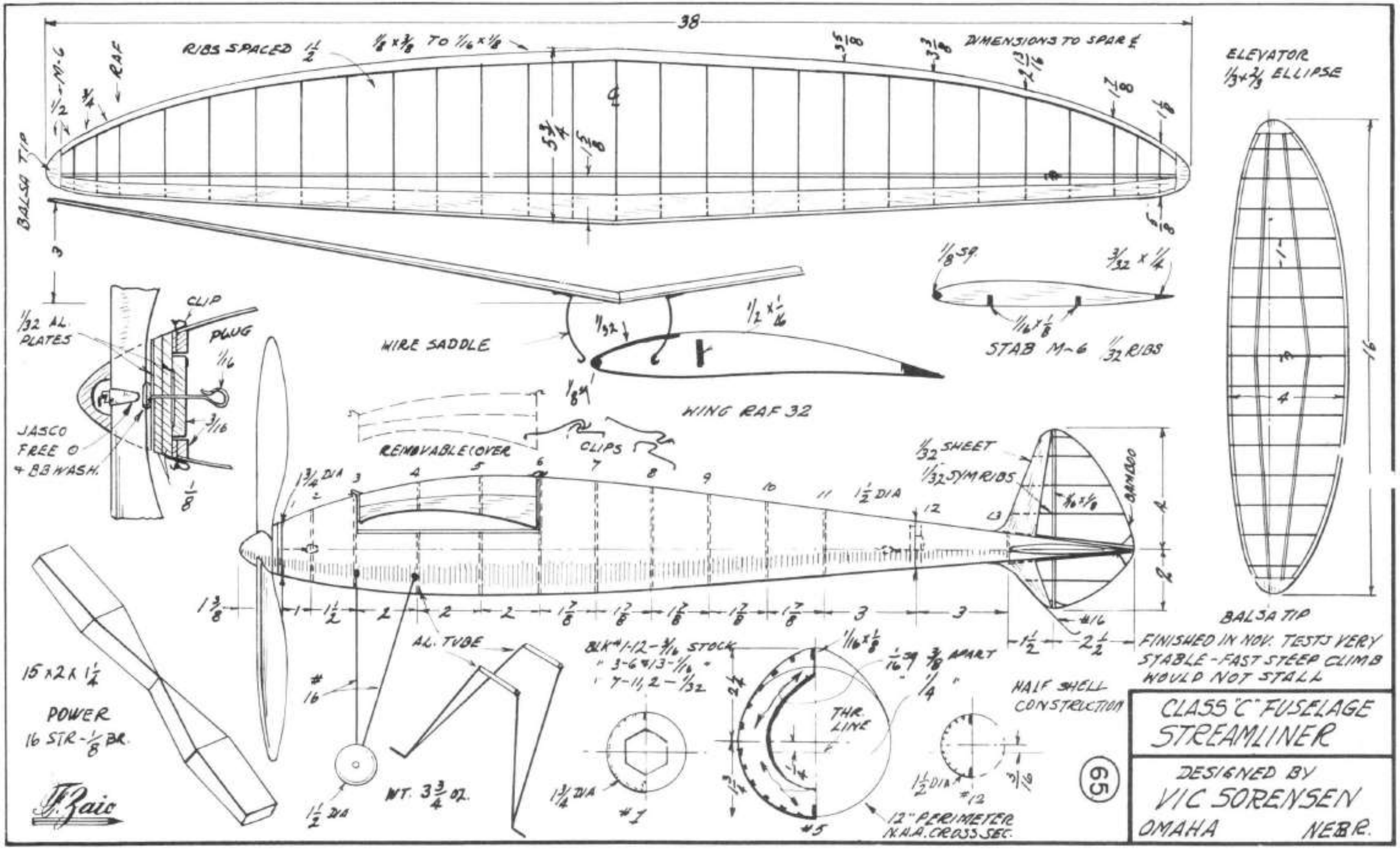
On a normal model a single spar will be sufficient for models having a chord of not more than five inches. A larger chord necessitates more spars or a strong single spar with a built up leading edge to serve as a box spar. Structural sections also give a high strength-weight ratio. If they are unobtainable ready made, the simplest to make are the box spar and the I section. It is surprising how strong parts can be made with the use of these sections.



The spar and rib combinations shown in the plans will prove satisfactory for the increased wing loading, except that the spars will have to be strengthened on some. In the opinion of the Editor, the construction shown on the sketch should prove to be the most satisfactory, as all points are taken care of. The leading edge does not have any sag, and at the same time the weakness of an ordinary sheet leading edge is removed by the addition of a solid spar. Note that the rib is continued for the full chord length. The construction procedure is simple providing that the ribs are accurately cut. The between-rib spar is usually fitted in by individual sections.

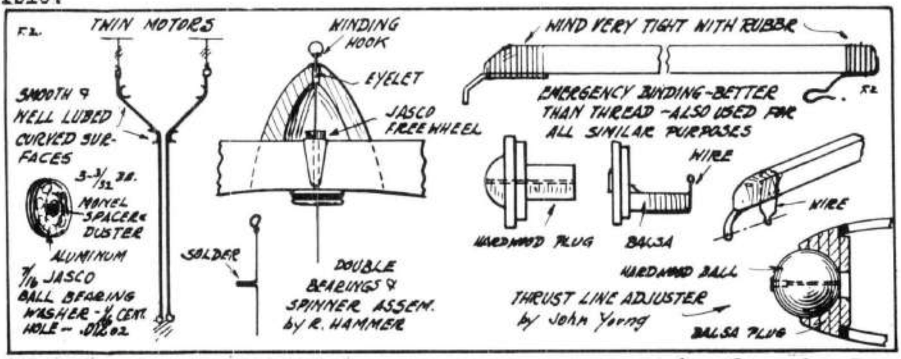
The ribs must be made of "C" stock to obtain the greatest benefit from the weight of the wood. Here again the grain serves the purpose of keeping the desired airfoil section and also provides adequate torsional strength. In designing the wing structure always be sure to have a full chord rib. Such ribs keep their shape well and also lessen the chances of having the leading edge rip off. If the rib is cut in two to provide for the spar structure, the cement and covering are the only things that keep the structure together.

Another point to keep in mind is to use strong ribs at the center and tip. The tip rib should receive special consideration as it takes the brunt of most collisions. If the tip rib and the tip itself are weak, it takes a comparatively small force to break them, and once they are gone, the rest of the ribs and spars just crumble as the force is now concentrated on each individual item, and not on the wing as a unit.


38
RIBS SPACED 1 1/2
1/8 x 3/8 TO 1/16 x 1/8
DIMENSIONS TO SPAR ℄
M-6
RAF
BALSA TIP
ELEVATOR
1/3 + 2/3 ELLIPSE
CLIP
1/32 AL. PLATES
PLUG
WIRE SADDLE
1/8 SQ.
3/32 x 1/4
1/16 x 1/8
STAB M-6 1/32 RIBS
1/2 x 1/16
WING RAF 32
JASCO FREE O + BB WASH.
REMOVABLE COVER
CLIPS
1/32 SHEET
1/32 SYM RIBS
BAMBOO
1 3/4 DIA
1 1/2 DIA
BALSA TIP
15 x 2 x 1 1/4
POWER
16 STR - 1/8 BR.
AL. TUBE
#16
BLK #1-12-3/16 STOCK
" 3-6 & 13-1/16 "
" 7-11, 2-1/32
1/16 x 1/8
1/16 SQ. 3/8 APART
1/4 "
THR. LINE
HALF SHELL CONSTRUCTION
1 1/2 DIA
1 3/4 DIA
#1
#5
#12
12" PERIMETER
N.A.A. CROSS SEC.
WT. 3 3/4 OZ.
FINISHED IN NOV. TESTS VERY STABLE - FAST STEEP CLIMB WOULD NOT STALL
CLASS "C" FUSELAGE STREAMLINER
DESIGNED BY
VIC SORENSEN
OMAHA NEBR.
65
F. Zaic

The best tip structure is a combination of balsa and bamboo. The balsa wood keeps the outline and prevents the bamboo from warping up or down. The bamboo transmits the load to the entire tip instead of permitting it to be concentrated at one point, such as occurs with balsa alone.

There is little else to be added, aside from repeating the advantages of covering the center section with balsa, and also the advisability of having as few breaks in the wing for dihedral as possible.



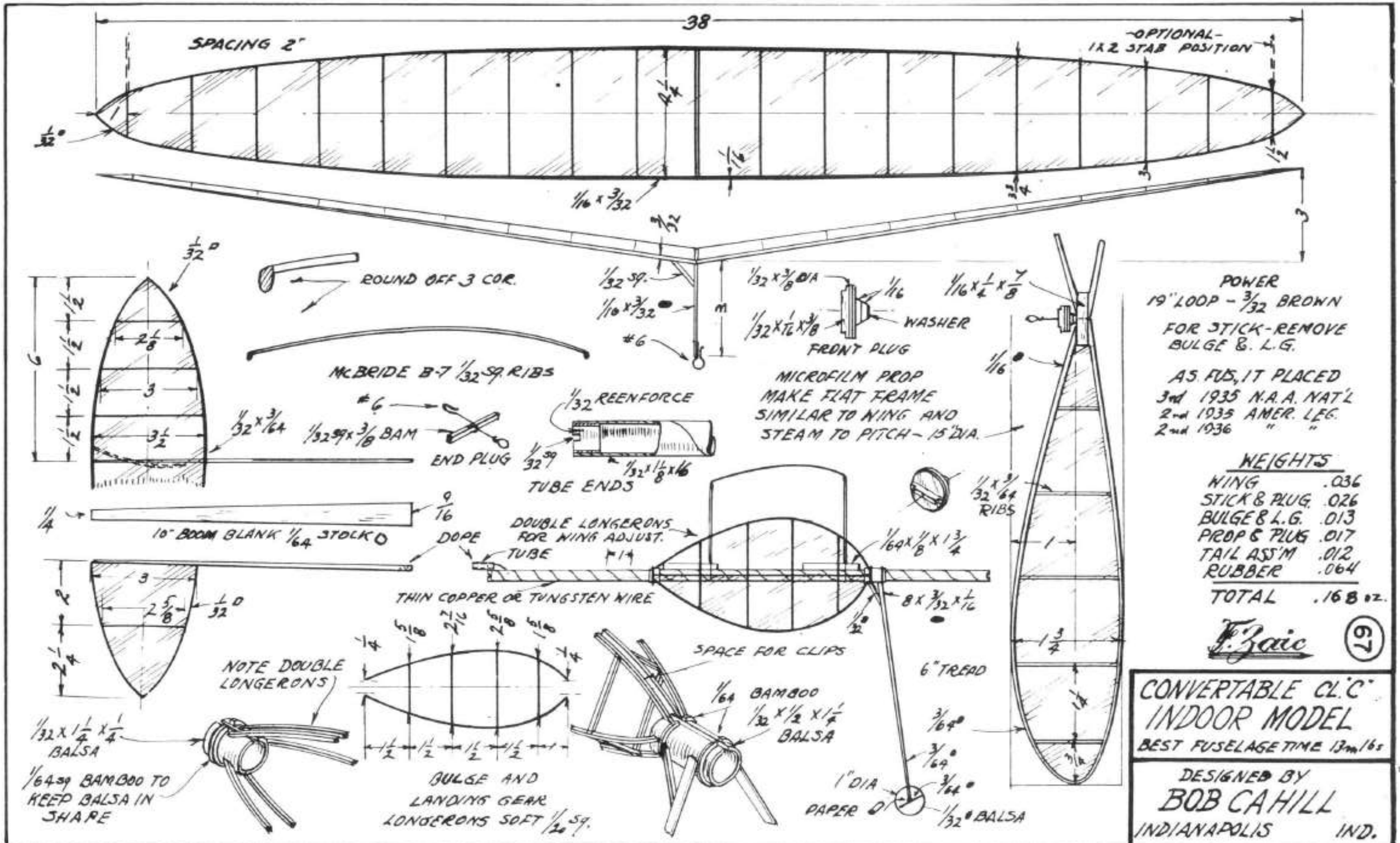
TALKING ABOUT RADIO-CONTROL........................ by Alexander Buga

When I last wrote you about my radio-controlled ship, I was sure that it would work. Since then I have found that what works on paper does not always work in practice, and that it takes quite some time to iron out all of the bugs. At present I have the rachet wheel arrangement all worked out and by feeding a small dry cell to the relay of the wheel, I have perfect control over the electromagnets operating the controls.

I built a small gas job to test the amount and type of control necessary to perform certain maneuvers, such as a right or a left turn, and ascent or descent. I found that if you have a stable model with a rudder that is not too large, you can easily turn the ship by only having the right or left aileron down. Also, the amount of movement necessary is very small, which makes it possible to have the solinoid adjacent to the aileron. I intend to use statically and aerodynamically balanced ailerons.

With regard to the radio end of the problem, I can say the following: with my receiving set I pick up short wave on the 20 meters band quite well, but the moment I start the motor I have static galore, mainly because of my 8 ft. antenna and the closeness of the spark plug. I have tried shielding the motor and it now works quite well, but I still get static and enough interference to make my controls unreliable. The sensitive relay had given me trouble by often failing and then by operating in accordance with the motor vibrations. I am now experimenting with a relay that will operate from the oscillation of the set, rather than depending upon the wattage given out at the output. The trouble I am experiencing with this type is that the set I have is a regenerative with automatic grid bias adjustment and the oscillation sometimes goes off kilter. I am doing all my experimenting with a fly power Hartley transmitter with a short aerial so that I do not cause disturbance in my neighborhood. I hope to finish the experimenting soon, so that I can assemble the parts and give unit a flight test.

Editor's Note: A Federal license is required for transmitting. If you are not licensed, get in touch with your local radio amateur and have him help you with the transmitting end.



38
SPACING 2"
-OPTIONAL-
1 X 2 STAB POSITION
1/16 x 3/32
ROUND OFF 3 COR.
McBRIDE B-7 1/32 SQ. RIBS
1/32 SQ.
1/16 x 3/32
#6
1/32 x 3/8 DIA
1/32 x 1/16 x 3/8
1/16
WASHER
FRONT PLUG
1/16 x 1/4 x 7/8
MICROFILM PROP
MAKE FLAT FRAME
SIMILAR TO WING AND
STEAM TO PITCH - 15" DIA.
POWER
19" LOOP - 3/32 BROWN
FOR STICK - REMOVE
BULGE & L.G.
AS FUS, IT PLACED
3rd 1935 N.A.A. NAT'L
2nd 1935 AMER. LEG.
2nd 1936 " "
WEIGHTS
WING .036
STICK & PLUG .026
BULGE & L.G. .013
PROP & PLUG .017
TAIL ASS'M .012
RUBBER .064
TOTAL .168 oz.
1/32 x 3/64
1/32 SQ. x 3/8 BAM
END PLUG
1/32 REENFORCE
1/32 SQ.
1/32 x 1 1/8 x 16
TUBE ENDS
1/32 x 3/64 RIBS
10" BOOM BLANK 1/64 STOCK
DOUBLE LONGERONS
FOR WING ADJUST.
DOPE
TUBE
THIN COPPER OR TUNGSTEN WIRE
1/64 x 1/8 x 1 3/4
8 x 3/32 x 1/16
6" TREAD
NOTE DOUBLE
LONGERONS
1/32 x 1 1/4 x 1/4
BALSA
1/64 SQ. BAMBOO TO
KEEP BALSA IN
SHAPE
BULGE AND
LANDING GEAR
LONGERONS SOFT 1/20 SQ.
SPACE FOR CLIPS
1/64 BAMBOO
1/32 x 1/2 x 1/4
BALSA
1" DIA
PAPER
1/32 BALSA
F. Zaic
67
CONVERTABLE CL. "C"
INDOOR MODEL
BEST FUSELAGE TIME 13m 16s
DESIGNED BY
BOB CAHILL
INDIANAPOLIS IND.

Hand Launched Gliders

by Tex Rickard

In my experiments with gliders, I have found that there are two types of designs which are dissimilar but which can be made to give almost identical performance indoors. The first type and the one most often used, is the one with a short elevator arm and a long nose. I have used as high as a 2-1 ratio; that is, a 4" elevator arm and an 8" nose length. I find this to be an excellent arrangement for low ceiling flying, although altitudes of up to 100 feet may be obtained with it if it is adjusted correctly. The second type uses just the opposite ratio relation; i.e., an elevator arm of 8" and a 5" or 6" nose. The tail surfaces can be made much smaller because of the longer moment arm. Such gliders seem to get up higher, and also have better floating tendencies. When using these gliders, it is necessary to wash in the elevator. If this is not done, the glider will require too much clay for balancing at the 1/3 chord position.

I still use cambered rudders on all my gliders. They give a much more uniform circle and make adjusting easier during the contest. The thicker section also provides a larger cementing surface to take care of the terrific launching heaves.

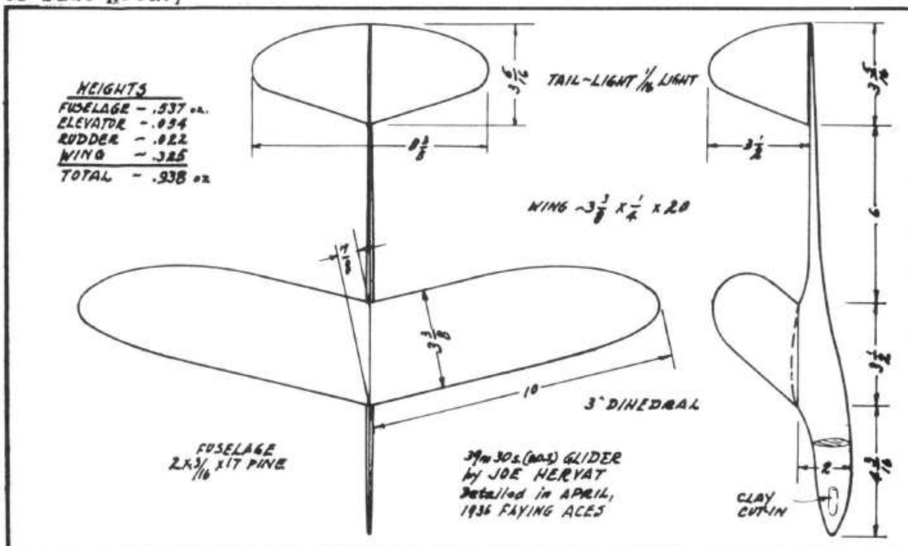
I have made several tests with the fuselage sizes, and I find that 1/8" hard balsa stock will stand up better than the 1/4" stock. There is very little weight difference, and in practice the hard balsa is a bit lighter. I was definitely convinced of this fact when I made two .46 oz. gliders whose fuselages were of 1/4" stock. One ship lost its tail portion when lauched and the other flew into a post and snapped the stick. Then I rebuilt the gliders using the 1/8" stock. The weights decreased to .44 and .45 oz., showing that there is some difference in the weight even though the wood is as hard as oak. The new fuselages stood the knocks better than any 1/4" stock I have seen. It seems that the hard wood bends and absorbs the shock much more readily while the softer but thicker stock shatters.

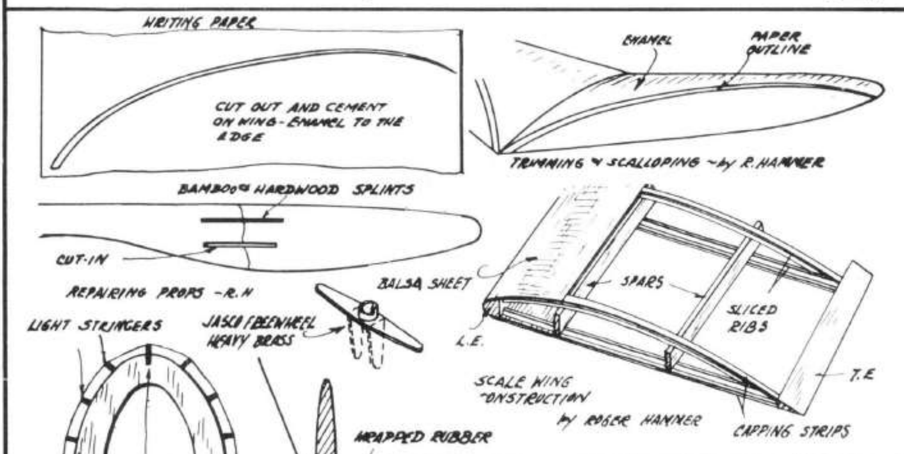
It takes me about 2 or 3 hours to finish a wing, and I use all the latest tricks to get the utmost out of the throw. I undercamber the wing slightly for low ceiling flying and use a flat bottom for high climb. I use three coats of polish until the wing has a smooth glass-like surface, with intermediated 10 nought sandings. I make certain that the wing and fuselage junction is strong by applying several layers of cement until the joint has cement fillets. For a final finish I use Cedar Wax Floor Polish. This is rubbed on the completed model with a soft cloth. Remember that the cement will not hold to waxed surfaces.

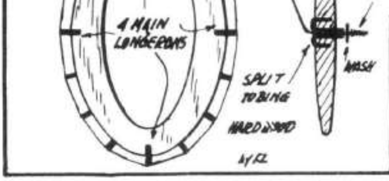
My wing is set at zero incidence but the right wing is given a slight washin (wash in the left wing for a left hand throw). The camber on the rudder is set for a left turn, and the trailing edge of the stabilizer is warped down about 1/32". This gives the elevator a positive angle which will tend to make the model go over the hump at the peak of the throw without dipping. The exact warping has to be determined experimentally. Too much of it will dive the model and too little will make the model dip and stall. The best launch for this setting is to launch the glider as straight up as possible without banking it at all. By launching the glider without much bank, all the speed and momentum are saved for the climb. It also lessens the strain ordinarily applied to wings on vertical climbing turns. You cannot imagine the difference that the positive elevator adjustments will have on your glider until you have actually tried it out.

I believe that Joe Hervat's outdoor glider is about the finest design that I have seen. I have built one and can get about 150 feet of altitude and over on windy days. It can ride the wind well and has a beautiful glide when in good shape.

(Editor's Note: The general outline of Joe Hervat's glider is as shown on the sketch. It is the Editor's belief that the peculiar fuselage shape has a great deal to do with the good spiral stability. From observing one of these designs it was noted that recovery from a side slip was very fast, and that there was no tendency to go into a spin, such as is often found in other gliders. This would seem to indicate that we should pay more attention to our old friend, the Center of Side Area.)







Use wet paper for covering round fuselages, as it can be easily shaped to round surfaces, and much more area can be covered at one time, without cutting narrow strips.

Farrin Bunker

INDOOR

The construction and the flying procedure of the indoor model have been well covered in the preceding Year Book and in numerous articles appearing in the model magazines. Therefore only new hints of the last year have been sketched.

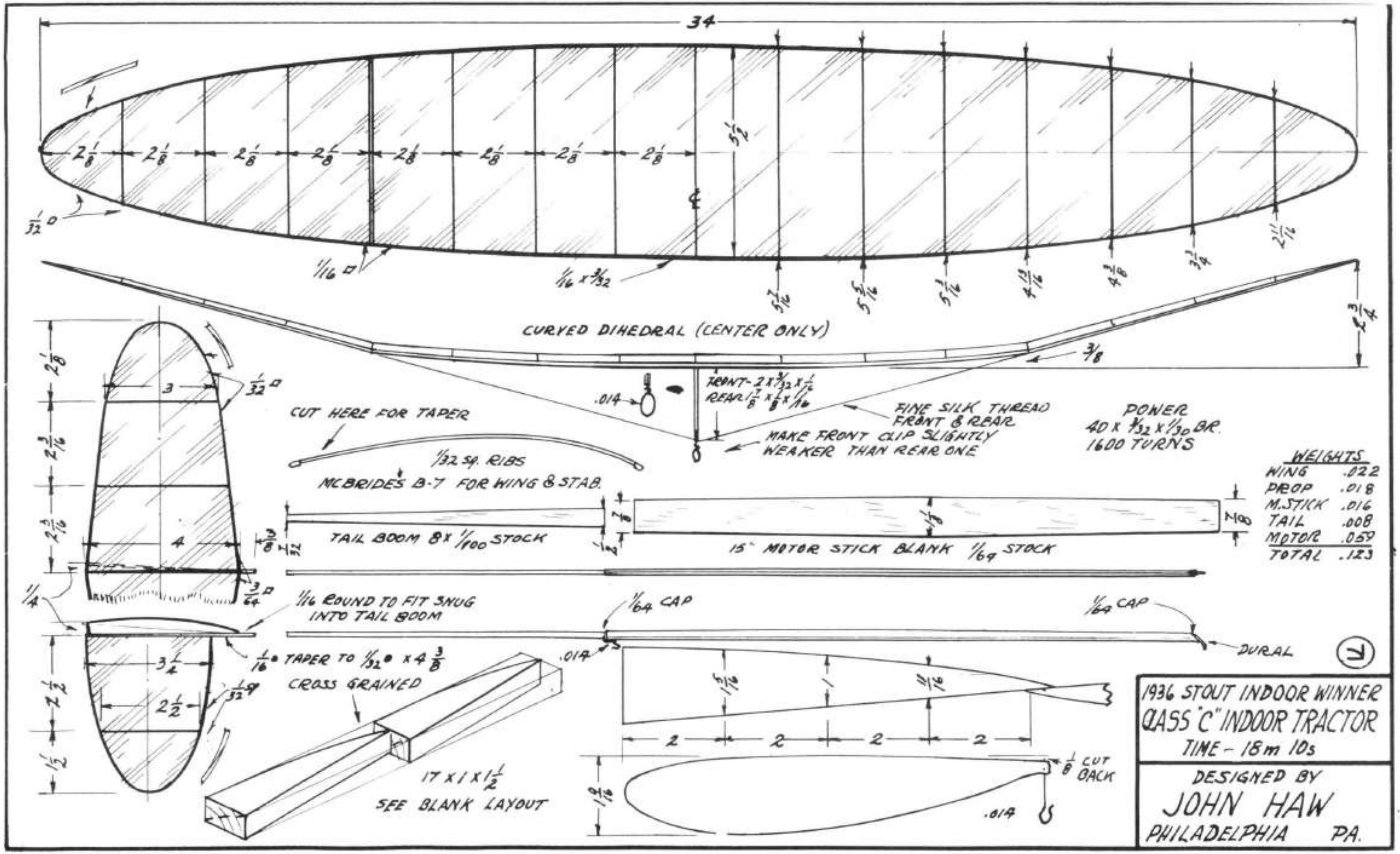
Success in indoor building and flying depends mostly upon the individual. High time can only be attained by knowing how to adjust, as well as how to make strong models with the minimum weight. Fairly good duration may be achieved by most builders, providing that they build a smooth steady model and pay particular attention to adjusting so that the counter forces will be at a minimum.

The most important point to remember when making a model from a plan, is to have all parts the same weight as shown on the plan. An accurate scale is indispensable. But remember, there is a difference between the contest model and the record model. In most cases, the record model was flown under the most favorable conditions, while a contest model usually has to overcome many difficulties, mainly low ceilings and drafts. Therefore, the contest model should be built and designed to meet any expected conditions. For wintry days, the model should be strong, so that it can be handled with stiff, cold fingers. For a low ceiling don't forget to let out turns, and use plenty of slack rubber. By keeping in mind that a contest model does not necessarily have to be a record-breaking one, you should be able to develop a cup-getter suitable for your particular conditions.

Microfilm

Microfilm can be easily made by using high grade clear lacquer and sufficient amount of Castor Oil or Trycresyl Phosphate to make it flexible. Just add the plasticiser drop by drop until the desired solution is obtained. About an ounce of plasticiser for every quart of lacquer will usually prove to be a satisfactory mixture. It is best to make a large amount of solution in a single mixture. This makes the plasticiser additions less critical, and provides sufficient amount of solution for a long period in case the drop count is lost. It has also been found that aged solution is best. For best results in making film, be sure that the water is perfectly clean, especially from soap. Also keep the temperature between 70° and 80°. Cold water or drafts retard the spreading if not make it impossible. Joe Hervat's method of removing the film by placing the hoop on the top of the film has been proven to be very good.

Double Bearings stop prop vibrations. Permit side and up or down adjustments. By using side thrust the prop is pulling in circle line instead of on a tangent, requiring less rudder and make tighter circles possible.
By Don Donahue



34
CURVED DIHEDRAL (CENTER ONLY)
FRONT - 2 X 3/32 X 1/2
REAR 1 7/8 X 1/8 X 1/16
FINE SILK THREAD FRONT & REAR
MAKE FRONT CLIP SLIGHTLY WEAKER THAN REAR ONE
POWER
40 X 3/32 X 1/30 BR.
1600 TURNS
CUT HERE FOR TAPER
1/32 SQ. RIBS
MCBRIDES B-7 FOR WING & STAB.
TAIL BOOM 8 X 1/100 STOCK
15" MOTOR STICK BLANK 1/64 STOCK
WEIGHTS
WING .022
PROP .018
M.STICK .016
TAIL .008
MOTOR .059
TOTAL .123
1/16 ROUND TO FIT SNUG INTO TAIL BOOM
1/64 CAP
1/64 CAP
DURAL
1/16 TAPER TO 1/32 X 4 3/8
CROSS GRAINED
17 X 1 X 1 1/2
SEE BLANK LAYOUT
1/8 CUT BACK
1936 STOUT INDOOR WINNER
CLASS "C" INDOOR TRACTOR
TIME - 18m 10s
DESIGNED BY
JOHN HAW
PHILADELPHIA PA.

Indoor Pusher ....by Jimmy Throckmorton

There has not been very much written about pusher models, and the hints listed below were found by the tedious but practical "test and try" method, during six years of experimenting with indoor pushers.

1. Have a sturdy elevator and boom. More ships are erratic and unsuccessful because of this than from any other cause. The motor sticks must also be straight and strong, or the ship will almost impossible to adjust.

2. It is of the utmost importance to have the Center of Gravity near the elevator end of the model. This calls for the prop to be as light as possible. The wing, you will find, can be made lighter than a tractor wing, and will still stand up.

3. I have seen dozens of pushers fly well for a minute or two and then begin to spin or settle down prop first. I found that by placing a rudder in front, the flight is normal throughout and is definitely improved. The rudder is needed in the front to balance the side areas caused by the wing and prop. The dihedral of the elevator is usually to small. The rudder in front and below has better control with less area with a consequent saving in weight and a lowering of the C. G. A high Center of Gravity is usually the main fault of most pushers.

4. I balance the torque by offsetting the thrust line and I get my turn with the use of the rudder.

I believe that the pusher stands an equal chance with the tractor. The model shown would tick off 15 minutes consistently. With redesigning and the incorporation of the latest ideas, maximum areas, and a good microfilm prop, the pusher will be able to fly more slowly and will come into the 20 minute class. I hope to demonstrate this fact in the Open class, if time permits.

AERONUTTICS

"And when I die, I want to go where lubbed knots stay tied."

"The only tree in the place and my model had to hit it!"

Poor Chap; so young; calm most of the time but keeps muttering, "Why! oh why! did I back stroke!"

Air Molecule Altimatum from the city of Airmoleculistia:
"Tit for Tat. You mess us and we will mess you."

"I owe it all to Assco," said Mr. Peguin after his first solo.

It's always swear weather when model builders compete together.

A contestant's greatest asset is his lie-ability.

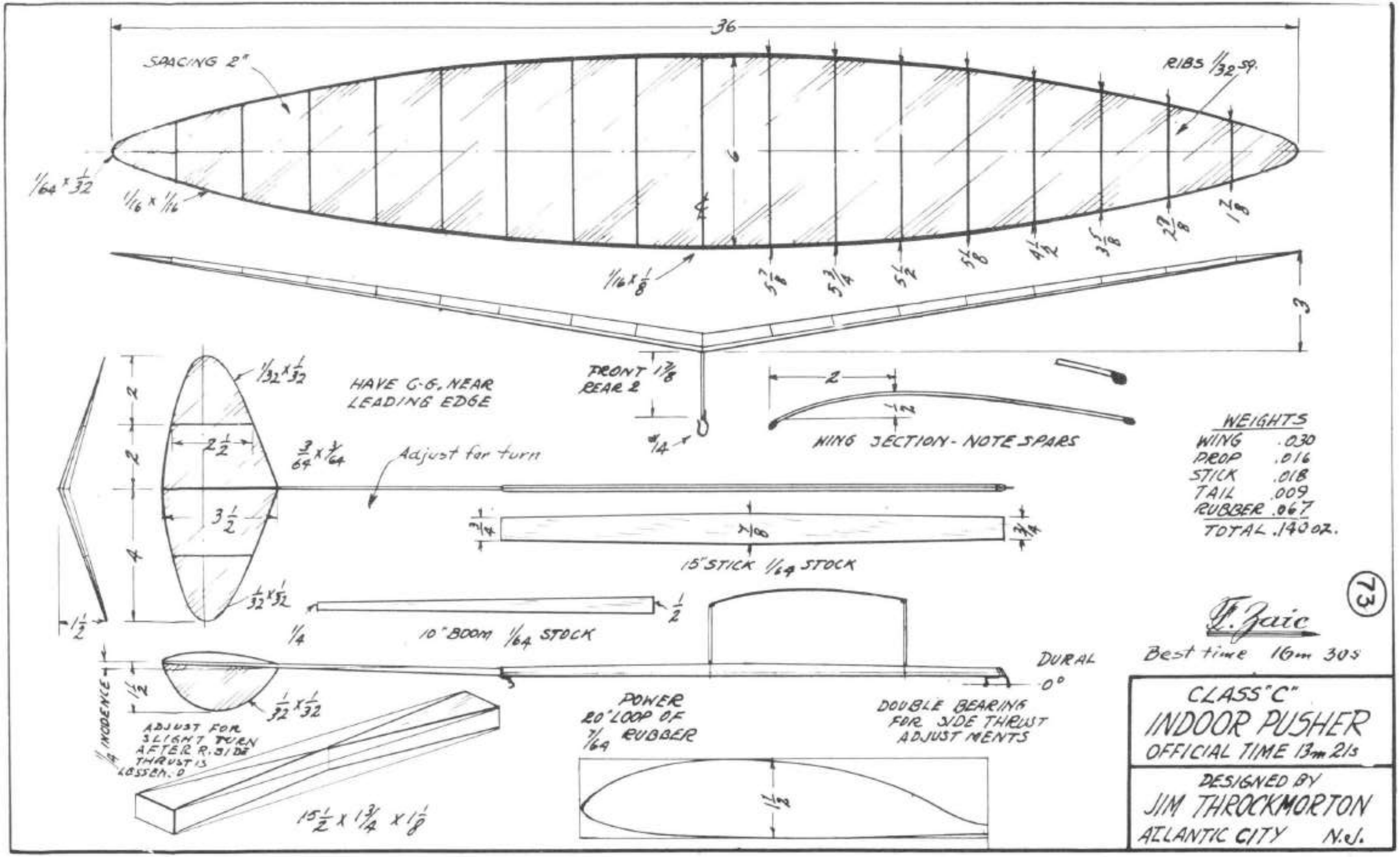
Statiscally speaking: If all model builders were laid end to end, a steam roller would come very handy.

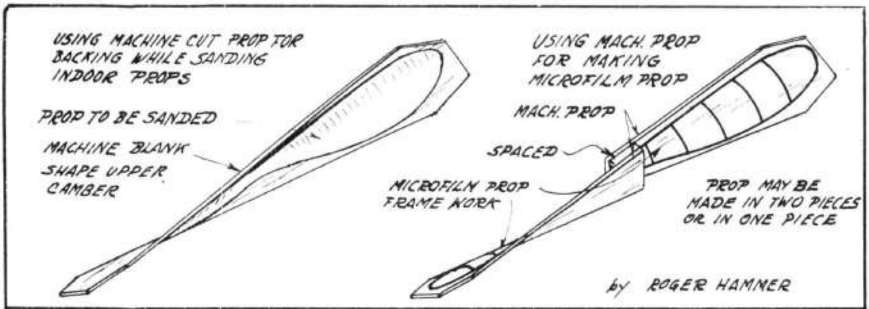
"Oh, so that's dope! I always thought dope was something the pilot had to take before going up."

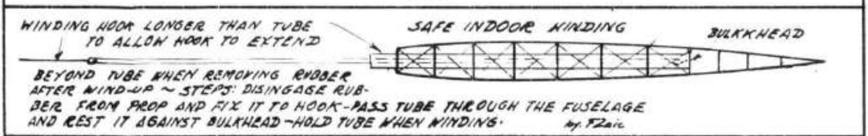
"All I said was,'It looks nice with all that lacquer but will it fly?' Then his eyes went queer."

Correction: Substitute'GUESSTIMATED' for Scientic Design.
(Merrifield)

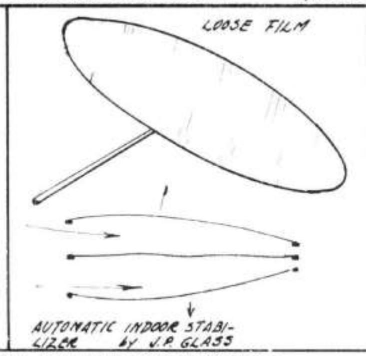
"How do you like the new 'ANTI-AIRCRAFT' rules?
(Schumacher)

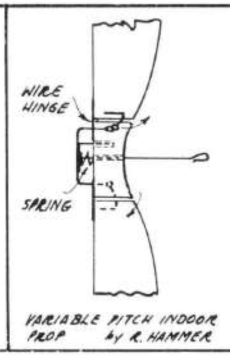

36
SPACING 2"
RIBS 1/32 SQ.
1/64 x 1/32
1/16 x 1/16
1/16 x 1/8
6
FRONT 1 7/8
REAR 2
#14
HAVE C.G. NEAR
LEADING EDGE
Adjust for turn
1/32 x 1/32
3/64 x 1/64
WING SECTION - NOTE SPARS
WEIGHTS
WING .030
PROP .016
STICK .018
TAIL .009
RUBBER .067
TOTAL .140 OZ.
15" STICK 1/64 STOCK
10" BOOM 1/64 STOCK
DURAL
0°
73
F. Zaic
Best time 16m 30s
1/4 INCIDENCE
ADJUST FOR SLIGHT TURN AFTER R. SIDE THRUST IS LOSSEN.D
POWER
20" LOOP OF 1/64 RUBBER
DOUBLE BEARING FOR SIDE THRUST ADJUSTMENTS
15 1/2 x 1 3/4 x 1 1/8
CLASS "C"
INDOOR PUSHER
OFFICIAL TIME 13m 21s
DESIGNED BY
JIM THROCKMORTON
ATLANTIC CITY N.J.

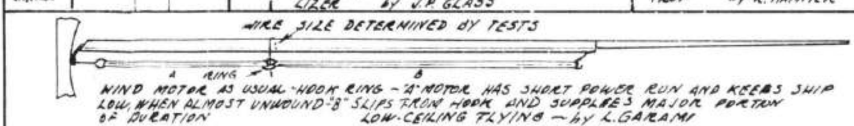

USING MACHINE CUT PROP FOR BACKING WHILE SANDING INDOOR PROPS
PROP TO BE SANDED
MACHINE BLANK
SHAPE UPPER CAMBER
USING MACH. PROP FOR MAKING MICROFILM PROP
MACH. PROP
SPACED
MICROFILM PROP FRAME WORK
PROP MAY BE MADE IN TWO PIECES OR IN ONE PIECE
by ROGER HAMMER

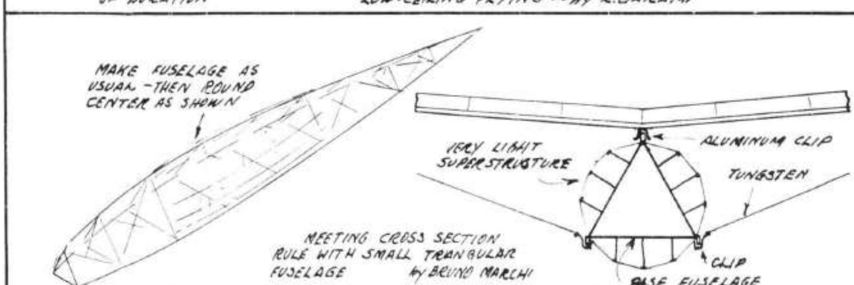

WINDING HOOK LONGER THAN TUBE TO ALLOW HOOK TO EXTEND
SAFE INDOOR WINDING
BULKHEAD
BEYOND TUBE WHEN REMOVING RUBBER AFTER WIND-UP ~ STEPS: DISINGAGE RUBBER FROM PROP AND FIX IT TO HOOK-PASS TUBE THROUGH THE FUSELAGE AND REST IT AGAINST BULKHEAD-HOLD TUBE WHEN WINDING.
by F.Zaic

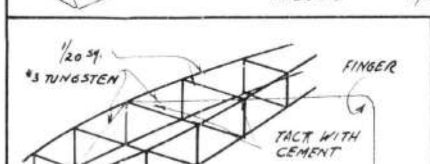

EMERGENCY STEAM
HOLE
MICROFILM CAN, FILLED WITH H_2O
WIRE
CANDLE
by CAHILL

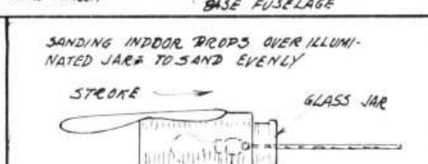

LOOSE FILM
AUTOMATIC INDOOR STABILIZER by J.P. GLASS


WIRE HINGE
SPRING
VARIABLE PITCH INDOOR PROP by R. HAMMER


WIRE SIZE DETERMINED BY TESTS
A
RING
B
WIND MOTOR AS USUAL-HOOK RING - "A" MOTOR HAS SHORT POWER RUN AND KEEPS SHIP LOW, WHEN ALMOST UNWOUND "B" SLIPS FROM HOOK AND SUPPLIES MAJOR PORTION OF DURATION
LOW-CEILING FLYING ~ by L. GARAMI


MAKE FUSELAGE AS USUAL - THEN ROUND CENTER AS SHOWN
ALUMINUM CLIP
VERY LIGHT SUPERSTRUCTURE
TUNGSTEN
MEETING CROSS SECTION RULE WITH SMALL TRANGULAR FUSELAGE by BRUNO MARCHI
CLIP
BASE FUSELAGE


1/20 SQ.
#3 TUNGSTEN
FINGER
TACK WITH CEMENT
TUNGSTEN BRACING by J.A GLASS
WEIGHTED TUNGSTEN


SANDING INDOOR PROPS OVER ILLUMINATED JARS TO SAND EVENLY
STROKE
GLASS JAR
EXTENSION LIGHT
by WILLIAM HARISON

Finishes and Flying Scale

by Roger Hammer

Flying Scale Models

It is possible to make almost exact scale models fly well provided that care is taken so that they will be adjusted properly. Before attempting the initial flight, check the incidences, which should be the scale settings. Remove all unintentional warps. The C. G. position should correspond with that of the full size ship; that is, it should be at a point 30% of the chord behind the leading edge. If necessary, weight the nose with lead or clay.

The first step in testing is to place the model on smooth ground, raise the tail until the model is in a horizontal position, and then to give the model a sufficiently strong shove to make it clear the ground. Make any necessary corrections with intermediate flights until a smooth glide and a slight right turn are obtained. If the model stalls, weight the nose, and if it dives set the stabilizer at negative. The turn is obtained by the rudder adjustment. The model is now ready for the next test.

Launch the model with a strong and straight forward throw from a three foot altitude at a 10° negative angle. If the model is correctly adjusted, it will remain at the 10° negative angle and have a slight right turn. The next step is to wind the motor about $\frac{1}{4}$ of its maximum turns and to launch the model about 12" from the ground down about 10°. If the model is underpowered, the glide will just be prolonged and the model will land with winds. If it is overpowered, it will zoom and stall. The model that is correctly powered will rise about one foot and then gradually assume the gliding position. Notice the turn carefully at this stage. If it is excessive, the model will spiral dive when full power is used. If the model behaves correctly, the same testing procedure may be carried through $\frac{1}{2}$ turns and $\frac{3}{4}$ turns, until the maximum wind up is reached. If the model does not climb, increase the power and recheck from the beginning for the C. G. and other points. For the zooming model, remove a bit of rubber and try again after checking the balance. If it now mushes to the ground, the trouble probably lies in the thrust line. Replace the rubber and set the prop to point down until a satisfactory flight is obtained.

Be sure to go through this test procedure before attempting full turn flights. Many good models are ruined just because the builder is too impatient to take his time in ironing out the kinks.

Flight Characteristics of Different Designs

PARASOL MONOPLANES should be capable of tight and steeply climbing turns with the torque and should obtain good altitude. Ex.: Fairchild 22.

CONVENTIONAL MONOPLANES should circle with the torque in circles of about 40 to 60 feet diameter, with very shallow banking but climbing rapidly. Ex.: Fairchild 24, Cessna and others.

MIDWINGS are a bit more tricky to obtain satisfactory results. These models should turn in large diameter circles of about 100 feet with medium climb so that the climb will be comparatively shallow to prevent a stalling tendency at the end. The midwing adjustments should be for a slight zoom at the beginning, turns of about 100 feet and flat climb. Ex.: Bull Pup, Corbin Racer, Art Chester Racer.

LOW WINGS usually take a straight run and begin to bank after they reach about 20 feet altitude. Low wings made by the writer have climbed fairly steeply in large circles. No difficulty was experienced with stalling when the power was exhausted. Ex.: Howard Ike and Pete, and numerous commercial and military designs.

BIPLANES have the same flight characteristics as the conventional monoplanes. The adjustments are practically the same as mentioned at the beginning of the article. Double check for incidences and any warps. Note: the right turn should occur on all models after the power has been expended.

Flying Scale Propellers

Since the diameter is restricted by the scale landing gear, the needed thrust is obtained by making the blades very wide, almost a paddle shape. For example, a 7" diameter prop should have blade width of about 1½". The blade section should be a regular airfoil section with about 1/4" undercamber. The props should be made of very hard balsa (15 lbs./cu. ft.) or pine especially since weight is usually needed at the front.

Paint and Lacquer Finishing

The method of finishing depends upon the surface upon which the finish is to be applied. However, the pores of the surface must be filled in first, in all cases. Several coats of clear dope will do the trick for paper, which has a rather poreless but absorbing surface. On wood and silk, which has deep pores, use Jasco Prepared Wood Filler. It has a nitro-cellulose base upon which dope, lacquer, or paint can be applied without fear of the filler rising from under the finished surface. It also contains the lightest possible filler ingredients obtainable and which no standard commercial filler has. It is of a clean white color, and is plasticised to prevent the warping of thin surfaces. It can be sanded smooth with ordinary sandpaper without fear of clogging the sandpaper. It should be applied with a brush.

The pain or lacquer should be flowed on the surface with a good soft brush, preferably a red sable brush. For a paper finish, one or two coats will be sufficient. For wood and silk, the number of coats depends upon the type of model. If lightness is desired, about two coats will do, but for the best possible finish, add as many coats as are necessary to completely hide the surface normally seen through the lacquer and paint. After several coats have been applied, they should be rubbed down with 320 "Wet or Dry" paper. Add several more coats and rub down with 400A "WoD" paper. For the final finish, rub down with a polishing compound such as Valspar Rubbing and Polishing Compound. For additional weather and moisture protection apply two coats of Simonize. Apply it with a wet cloth to prevent the burning of the finish. A high gloss may be obtained by rubbing briskly with a soft cloth like flannel.

NOTE: Be sure to let the lacquer, paint, or dope dry thoroughly between each coat, and allow it to harden before rubbing.

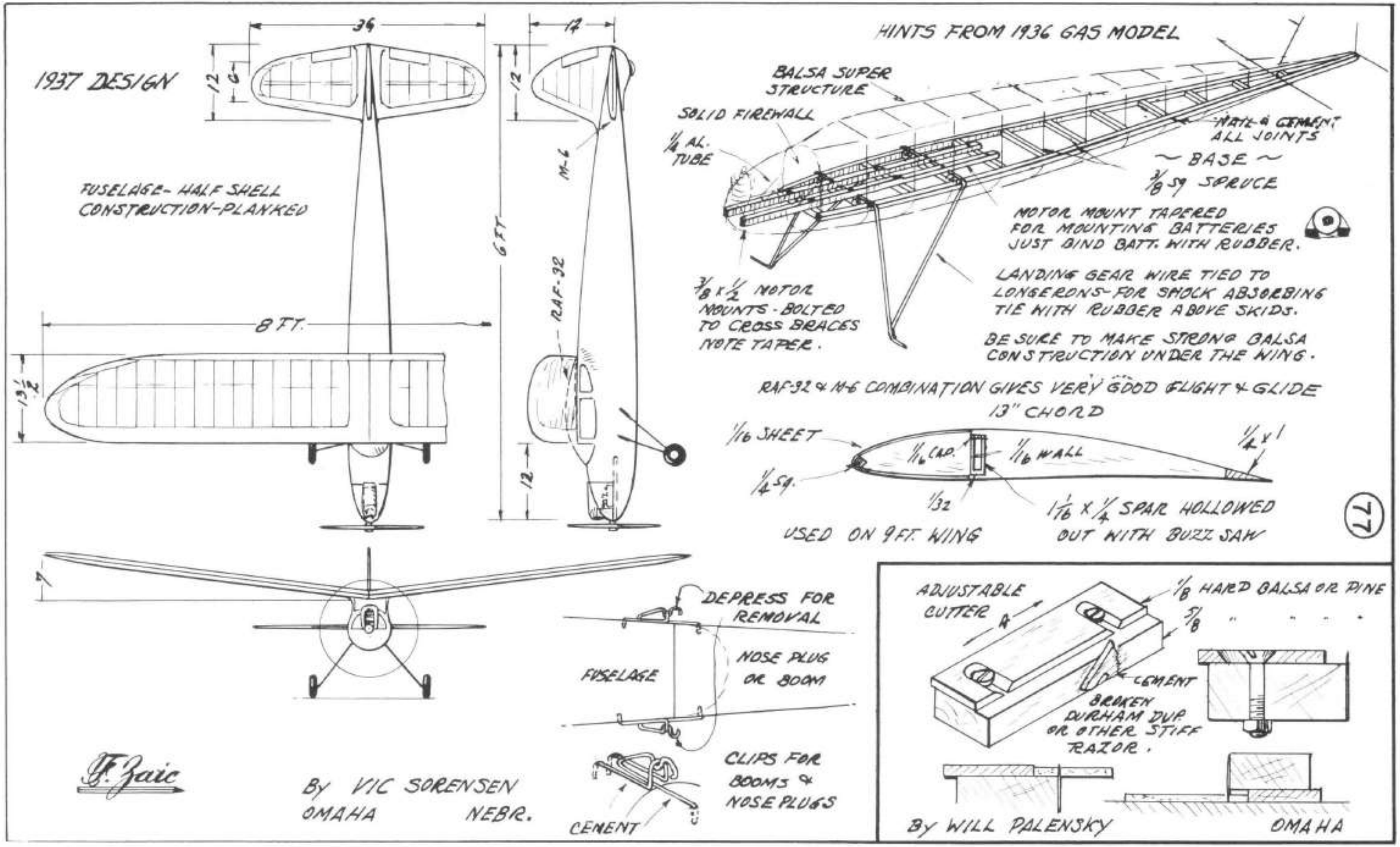
For a glider finish, just use one or two coats of Jasco Prepared Wood Filler, sand very smooth with 10 Nought and finish with Simonize For weight rule gliders, several coats of plasticised dope should be applied before Simonizing. Be sure to apply the Filler evenly, first with the grain and then against it. The surface should be sanded until the paper begins to scrape the top of the wood.

AMERICAN MAGAZINES FEATURING MODEL NEWS

Model Airplane News 551 Fifth Ave. New York, N.Y.	Bill Barnes 79-7th Ave. New York, N.Y.	Flying Aces 67 W. 45th St. New York, N.Y.	Popular Aviation 608 So. Dearborn St. Chicago, Ill.

Model Craftsman
330 W. 42nd St.
New York, N.Y.

MODEL AERONAUTICS 83 E 10th St. New York, N.Y.	First issue Mar. 1937. 15¢. Devoted to scientific research. Edited by: Frank Zaic


1937 DESIGN
36
12
6
12
6 FT.
12
M-6
RAF-32
8 FT.
13 1/2
12
7
FUSELAGE- HALF SHELL
CONSTRUCTION-PLANKED
HINTS FROM 1936 GAS MODEL
BALSA SUPER STRUCTURE
SOLID FIREWALL
1/4 AL. TUBE
NAIL & CEMENT ALL JOINTS
~ BASE ~
3/8 SQ SPRUCE
MOTOR MOUNT TAPERED FOR MOUNTING BATTERIES JUST BIND BATT. WITH RUBBER.
3/8 x 1/2 MOTOR MOUNTS - BOLTED TO CROSS BRACES NOTE TAPER.
LANDING GEAR WIRE TIED TO LONGERONS- FOR SHOCK ABSORBING TIE WITH RUBBER ABOVE SKIDS.
BE SURE TO MAKE STRONG BALSA CONSTRUCTION UNDER THE WING.
RAF-32 & M-6 COMBINATION GIVES VERY GOOD FLIGHT & GLIDE
13" CHORD
1/16 SHEET
1/16 CAP.
1/16 WALL
1/4 x 1
1/4 SQ.
1/32
1 1/16 x 1/4 SPAR HOLLOWED OUT WITH BUZZ SAW
USED ON 9 FT. WING
DEPRESS FOR REMOVAL
NOSE PLUG OR BOOM
FUSELAGE
CLIPS FOR BOOMS & NOSE PLUGS
CEMENT
ADJUSTABLE CUTTER
A
1/8 HARD BALSA OR PINE
5/8 " " "
CEMENT
BROKEN DURHAM DUP. OR OTHER STIFF RAZOR.
F. Zaic
BY VIC SORENSEN
OMAHA NEBR.
BY WILL PALENSKY
OMAHA

GASOLINE MODELS

Most of the present gas model designs have been derived from rubber powered models, and the high percentage of crackups emphasizes the unsoundness of this procedure. The speed of the gas model is much greater and it approaches the border of the regular power plane design closely enough to permit the use of the benefits of regular aeronautical research.

The first step in designing a model is to decide upon the engine to be used. Once the power is known, the model can be designed for any desired purpose. The decision may be guided by the following suggested maximum total weight of the model, for the engines now on the market.

Make of Engine	Sugg. Max. Wt.	Make of Engine	Sugg. Max. Wt.
Elf	2½ lbs.	Brown	7 lbs.
Baby Cyclone	4 lbs.	Tlush	7 lbs.
Gwin	6 lbs.	Grayspec (Br.)	9 lbs.
Loutrel	6 lbs.	Forster	10 lbs.
Ohlsson	7 lbs.	Comet (Br.)	10 lbs.

These figures are based on a wing loading of .5 lb./sq. ft. A lighter wing loading permits an increased maximum weight, while a heavier wing loading calls for a lower maximum weight. These figures are approximate, and are based on the maximum engine output. Do not expect a sulky and half-hearted motor to fly a heavy model.

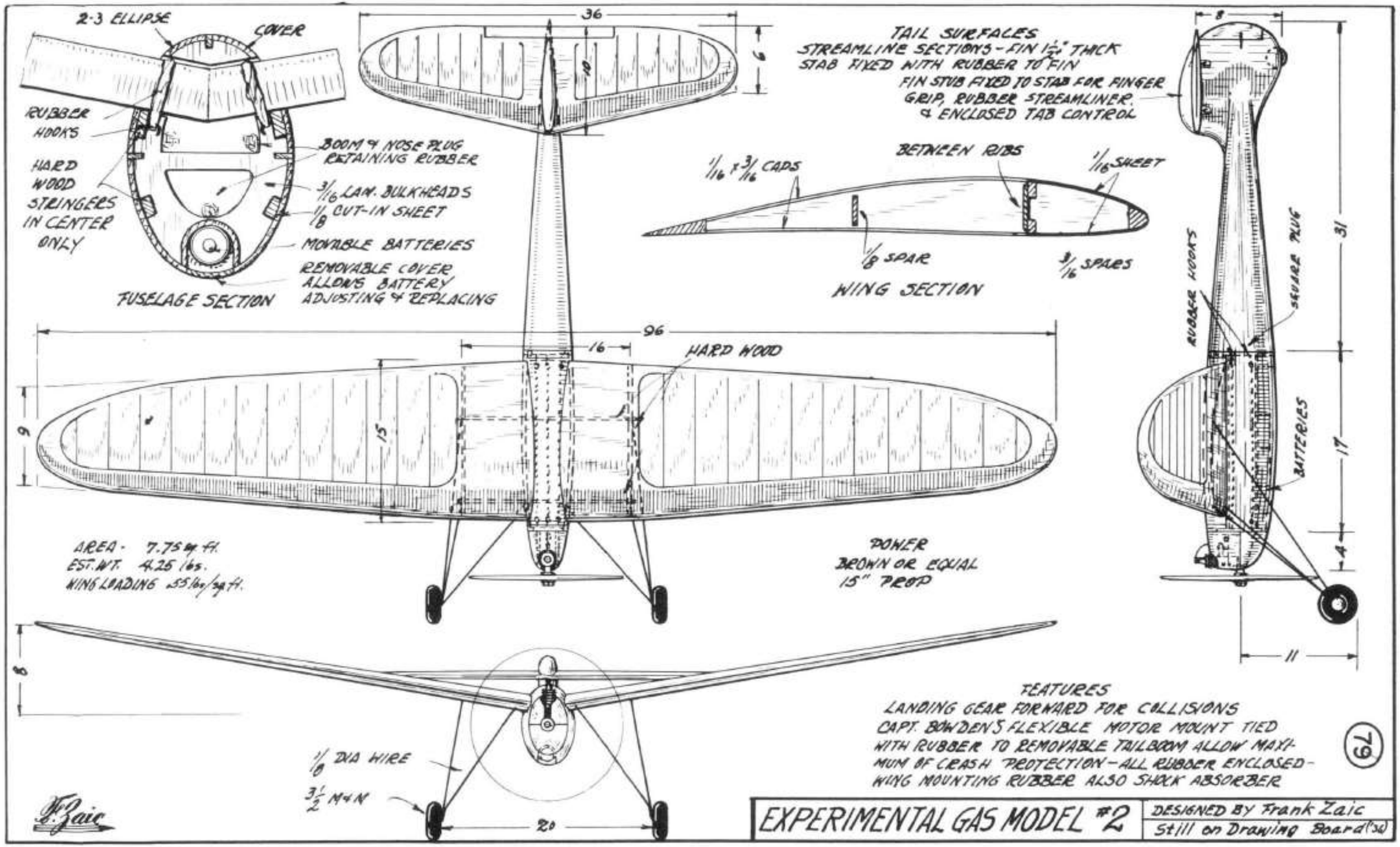
Wing

The actual weight of the model should be about 75% of the suggested maximum in order to allow for a reserve. With the weight and wing loading known, the area of the wing can be easily determined. The wing loading should range from 5 to 8 oz./sq. ft. for endurance models, and may be as high as 12 oz./sq. ft. for fast and high climb jobs. It should also be noted that large models will usually have a higher wing loading because of the needed structural strength.

The general theory as presented at the beginning of the book is applicable in all phases to the gas model. The choice of the airfoil depends upon the wing loading. The Clark Y and N-11 are quite suitable for light loading (5-6 os./sq. ft.) while a thicker and higher cambered section is needed for a heavier loading. The RAF 32, Eiffel 431, and similar sections will serve very well for 8 oz./sq. ft. For still heavier loadings, the NACA 6415 and NACA 97 will do.

An approximate lift and drag calculation can be obtained by using the regular lift and drag formulas. It is highly recommended that you become used to working with these formulas. By constant practise and observation you will be able to note whether an airfoil does its theoretical work.

The wing construction should make use of deep spars, structural sections, balsa covered leading edges with a box spar combination, fairly close spaced ribs of "C" stock, and tips of a combination of balsa and bamboo or metal tubing.



2-3 ELLIPSE
COVER
RUBBER HOOKS
HARD WOOD STRINGERS IN CENTER ONLY
BOOM & NOSE PLUG RETAINING RUBBER
3/16 LAM. BULKHEADS
1/8 CUT-IN SHEET
MOVABLE BATTERIES
REMOVABLE COVER ALLOWS BATTERY ADJUSTING & REPLACING
FUSELAGE SECTION
36
6
10
TAIL SURFACES
STREAMLINE SECTIONS - FIN 1/2" THICK
STAB FIXED WITH RUBBER TO FIN
FIN STUB FIXED TO STAB FOR FINGER GRIP, RUBBER STREAMLINER & ENCLOSED TAB CONTROL
BETWEEN RIBS
1/16 x 3/16 CAPS
1/16 SHEET
1/8 SPAR
3/16 SPARS
WING SECTION
8
31
RUBBER HOOKS
SQUARE PLUG
BATTERIES
17
4
11
96
16
HARD WOOD
9
15
AREA - 7.75 sq. ft.
EST. WT. 4.25 lbs.
WING LOADING .55 lbs/sq. ft.
POWER
BROWN OR EQUAL
15" PROP
8
1/8 DIA WIRE
3 1/2 M & N
20
FEATURES
LANDING GEAR FORWARD FOR COLLISIONS
CAPT. BOWDEN'S FLEXIBLE MOTOR MOUNT TIED WITH RUBBER TO REMOVABLE TAILBOOM ALLOW MAXIMUM OF CRASH PROTECTION - ALL RUBBER ENCLOSED - WING MOUNTING RUBBER ALSO SHOCK ABSORBER
EXPERIMENTAL GAS MODEL #2
DESIGNED BY Frank Zaic
Still on Drawing Board ('36)
F. Zaic
79

Fuselage

The length of the fuselage depends upon the area of the wing and the motor distance from the C. G. A fair rule to follow is to use the following formula:

$$\text{Fuselage length in inches} = \frac{\text{Wing area in square inches}}{15}$$

The motor position is usually at about one half of the chord from the leading edge. The calculated fuselage length may be decreased if the motor is closer to the C. G. than this.

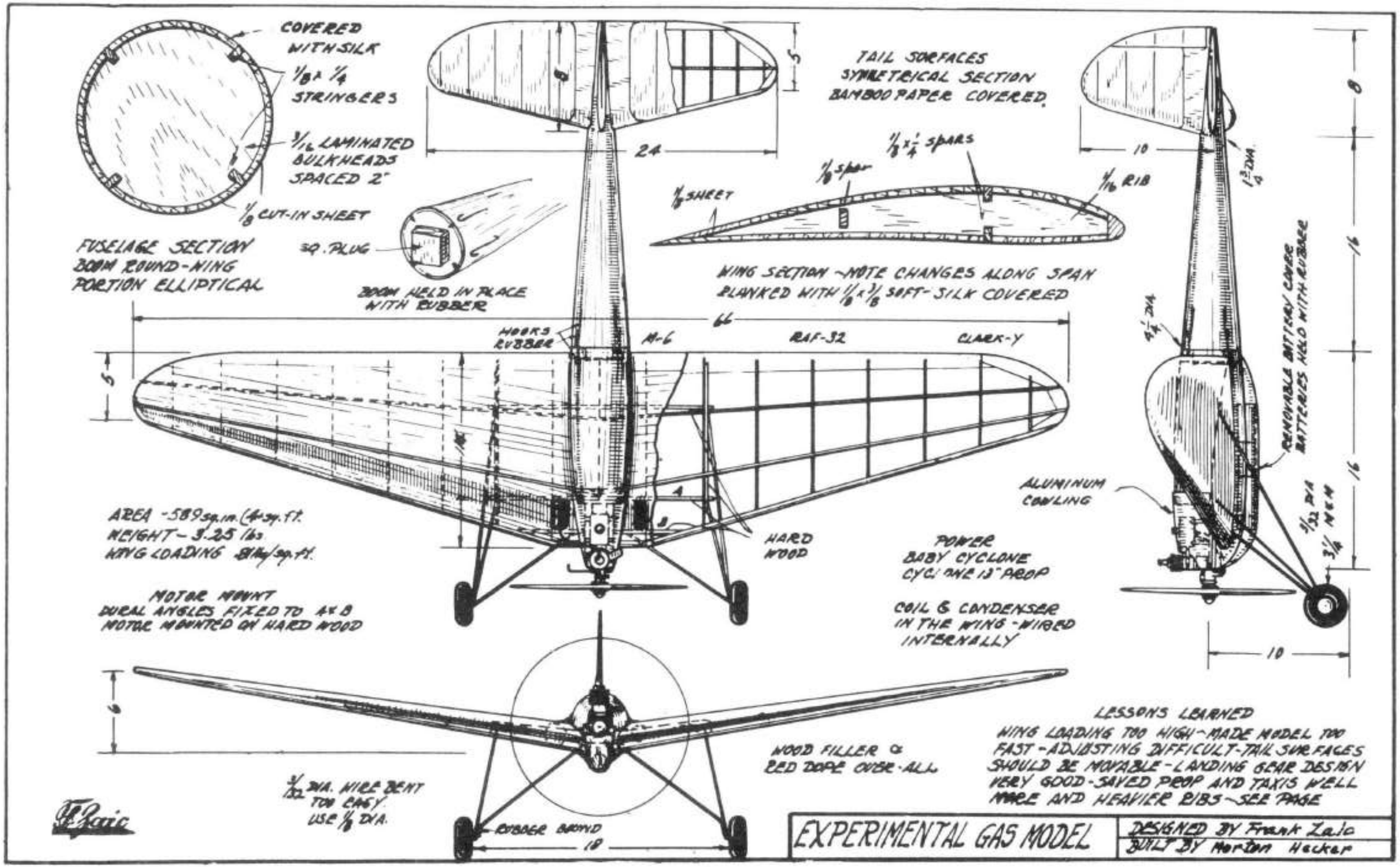
The fuselage should be as streamlined as possible. The repeated high performance of well adjusted streamlined models should convince us that it pays to streamline. If the Nth degree cannot be achieved, try to come as close to it as possible. Square sections should have rounded corners or false turtlebacks. The width/depth ratio of a rectangular section should be about 1/2. Be sure to faire the motor and to use cowlings that are hinged so that adjustments may be made easily without taking the whole front apart. The point to remember is that a low drag model can fly with much less power than a blunt design provided that the wing loading is the same. This will provide a generous power reserve in high winds and also allow a lower fuel consumption on ideal days. Another point is that the power may fluctuate to quite a degree without making much difference in the flight of the streamlined model, while the "flying brick" type of model usually will need full throttle for satisfactory performance. The streamline idea should be applied to the whole model and every point should be considered.

Construction

The simplest fuselage construction is the regular longeron and cross-brace framework. For small models, 3/16" sq. hard balsa will be found adequate. For 5 to 7 ft. span designs, use 1/4" sq. hard balsa. Use 3/8" sq. for larger models. Diagonal braces help to stiffen the structure, and although the covering may provide enough stiffness it is advisable to use diagonals near the nose and tail. Monocoque construction is comparatively simple providing that the bulkheads are plotted carefully. The bulkheads may be of 1/8" to 3/16" laminated balsa sheets or 3/32" to 1/8" soft plywood. A round section is the simplest to plot. The elliptical section is also easy, if an ellipse such as the one shown, is used. The monocoque covering should be of 1/8" soft balsa stock in strips, or in sheets with slight cut-ins for bending. These may be covered with paper or silk. The most important point to keep in mind when building fuselages is to use plenty of cement and to apply several intermediate coats.

Landing Gear

The simplest and most practical landing gear is one made of 3/32" or 1/8" diameter steel wire, arranged in a tripod. In many cases, the wire may be fixed directly to the fuselage with cement and thread. This arrangement is a bit stiff and a much better practice is to pivot the front struts and to tie the rear with rubber to allow for shocks. The wire can be shaped by fastening it in a vise and hammering just above the vise until the desired bend is obtained. The wire is too hard to drill or tap until it has been annealed. This can be done by heating it red hot and then plunging it into water. The joining of the three wires at the apex of the tripod always presents a problem. The rubber thread method used by Roger Hammer has been proved to be almost perfect. It permits the landing gear to be folded for packing and yet holds the wire together very satisfactorily. It is even better than the wire bound and soldered joint which sometimes loosens


COVERED WITH SILK
1/8 x 1/4 STRINGERS
3/16 LAMINATED BULKHEADS SPACED 2"
1/8 CUT-IN SHEET
FUSELAGE SECTION BOOM ROUND-WING PORTION ELLIPTICAL
SQ. PLUG
BOOM HELD IN PLACE WITH RUBBER
24
5
8
TAIL SURFACES SYMMETRICAL SECTION BAMBOO PAPER COVERED.
1/8 x 1/4 SPARS
1/8 SPAR
1/8 SHEET
1/16 RIB
WING SECTION ~ NOTE CHANGES ALONG SPAN PLANKED WITH 1/8 x 3/8 SOFT - SILK COVERED
10
1 3/4 DIA.
16
16
4 1/4 DIA.
REMOVABLE BATTERY COVER BATTERIES HELD WITH RUBBER
66
HOOKS RUBBER
M-6
RAF-32
CLARK-Y
5
A
B
HARD WOOD
ALUMINUM COWLING
3/32 DIA
3/4 W & M
AREA - 589 sq. in. (4 sq. ft.)
WEIGHT - 3.25 lbs
WING LOADING .81 lbs/sq. ft.
MOTOR MOUNT DURAL ANGLES FIXED TO A & B MOTOR MOUNTED ON HARD WOOD
POWER BABY CYCLONE CYCLONE 13" PROP
COIL & CONDENSER IN THE WING - WIRED INTERNALLY
10
6
LESSONS LEARNED
WING LOADING TOO HIGH ~ MADE MODEL TOO FAST - ADJUSTING DIFFICULT - TAIL SURFACES SHOULD BE MOVABLE - LANDING GEAR DESIGN VERY GOOD - SAVED PROP AND TAXIS WELL MORE AND HEAVIER RIBS ~ SEE PAGE
WOOD FILLER & RED DOPE OVER-ALL
3/32 DIA. WIRE BENT TOO EASY. USE 1/8 DIA.
RUBBER BAND
18
EXPERIMENTAL GAS MODEL
DESIGNED BY Frank Zaic
BUILT BY Morton Hecker

Tail Surfaces and Dihedral

The tail surfaces should be strong enough to retain their shape after covering and doping. A warped surface can give a great deal of trouble, especially if the warp is small and the cause of the misbehaviour of the model is attributed to some other pat. The area of the stabilizer can be computed by the formula given in the Theory chapter, in which the coefficient used should be .70.

An incorrect rudder and dihedral ratio is the cause of most spiral dives. The reason will be found in the Theory chapter. As mentioned there, the dihedral angle depends a great deal upon the torque. Since the torque varies a great deal with different props and motors we can only approximate the correct amounts from experience. A minimum dihedral of 5" is recommended for wings having spans of under four feet. For larger wing spans, 1" to 1¼ under both tips for each foot of span will suffice. The size of the rudder should be calculated as accurately as possible, as shown in the Theory chapter. Don't forget that in a gas model that "that little extra to make sure" is sometimes very disastrous. If your present model spins very easily, check the dihedral and rudder. Then either increase the dihedral or decrease the rudder area. Remember that spins cause more damage than any other accident except head-on collisions, and that incorrect side area distribution is the most common cause of the spin.

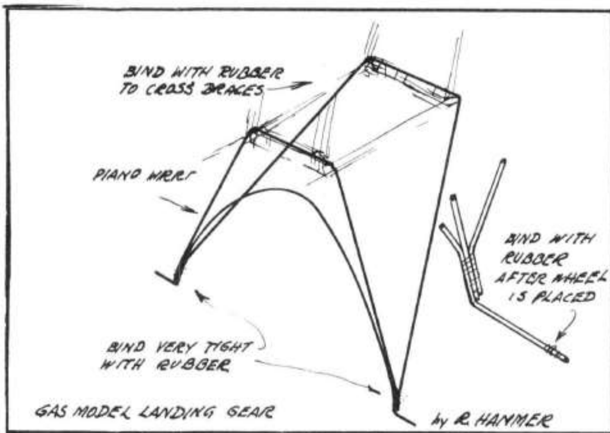
Propeller

Gas model props have a comparatively low blade angle caused by the large diameter and low pitch. The usual pitch-diameter ratio is about .6, which is slightly less than that used on full size ships. By referring back to the Prop theory you will notice that at such low angles the lift component of the airfoil reaction is almost in line with the thrust line. Therefore the torque is almost all due to the drag of the section. Knowing that the torque is our greatest drawback and that it is caused by the drag of the prop section, we can lessen it by being very careful of how we make the blades. To obtain the highest L/D we must carve the section to a definite airfoil, and also smooth and polish the blades. The Clark Y is a good airfoil section for props.

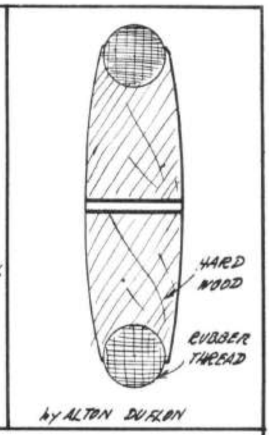
Prop blanks should be made of a hard wood, such as birch, hickory, walnut, or bass, or any other wood that has a close grain and does not split easily. For laminated props, 1/8" walnut and birch sheets will do. Be sure to use good Casein glue and provide an even and high pressure while the glue is setting. The carving can be simplified a great deal if the blank is laid out before carving. The blank layout must be such that every point has the same pitch. This can be done by drawing the outline first and then computing the thickness along the diameter. The actual carving can be done with a rasp file, sanding disk, and knife. Leave the hub portion strong and thick and taper the thickness gradually towards the tips. Remember that heavier props will give a much smoother motor run and also make starting easier due to their greater inertia.

Conclusion

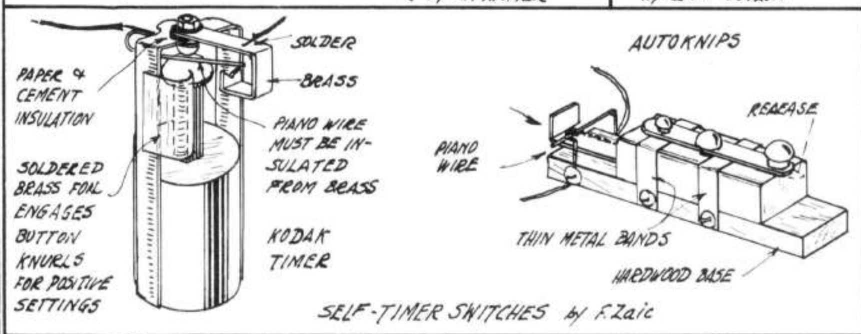
Other gas model points are covered in the contribution section, and it is not necessary to repeat them here. Before concluding, it might be mentioned that we must not be too careless with gas models. They are actually dangerous if we let them roam over the countryside. Use self-timers for testing in restricted fields. Also design the models so that when they do collide, the impact will be upon absorbing structure. This can be done by placing the motor in a pusher position or above the wing, and also by having the landing gear extend beyond the prop rotations. Keep these points in mind so that we may enjoy the sport without restrictions.



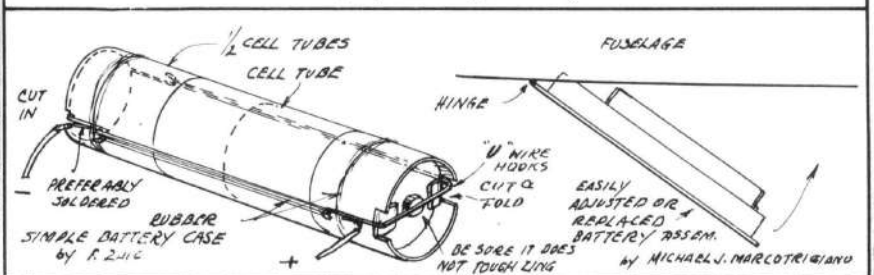
GAS MODEL LANDING GEAR by R. HANMER



by ALTON DUFLON

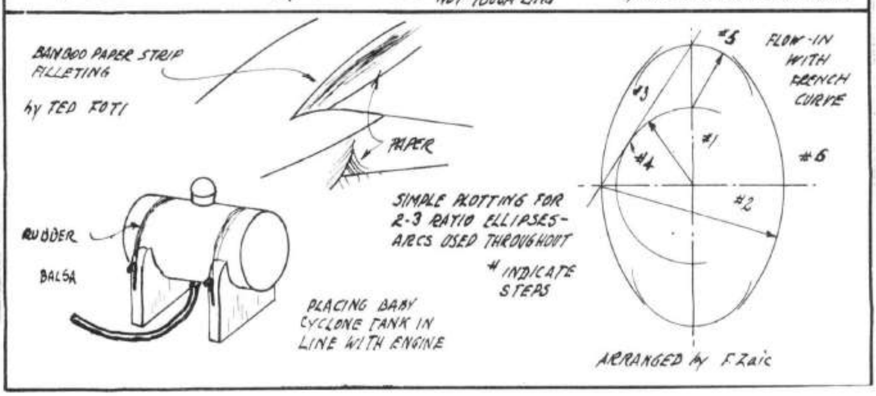


SELF-TIMER SWITCHES by F. Zaic



SIMPLE BATTERY CASE by F. Zaic

by MICHAEL J. MARCOTRIGIANO



ARRANGED by F. Zaic

Co-Axial Propeller

by Jim Haffey

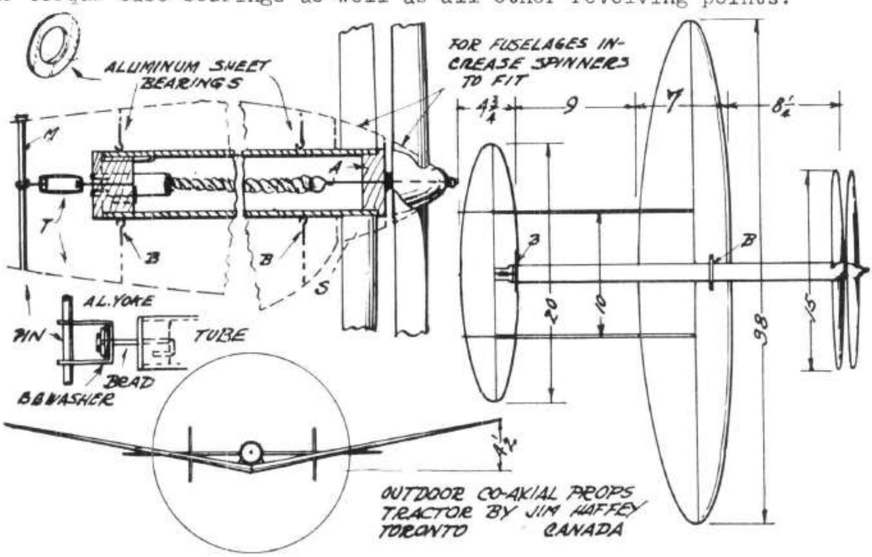
The torque problem in models is very important due to the large propeller and relatively powerful rubber motor. It is a source of surprise to me to see that more model builders are not interested in this solution of the torque problem.

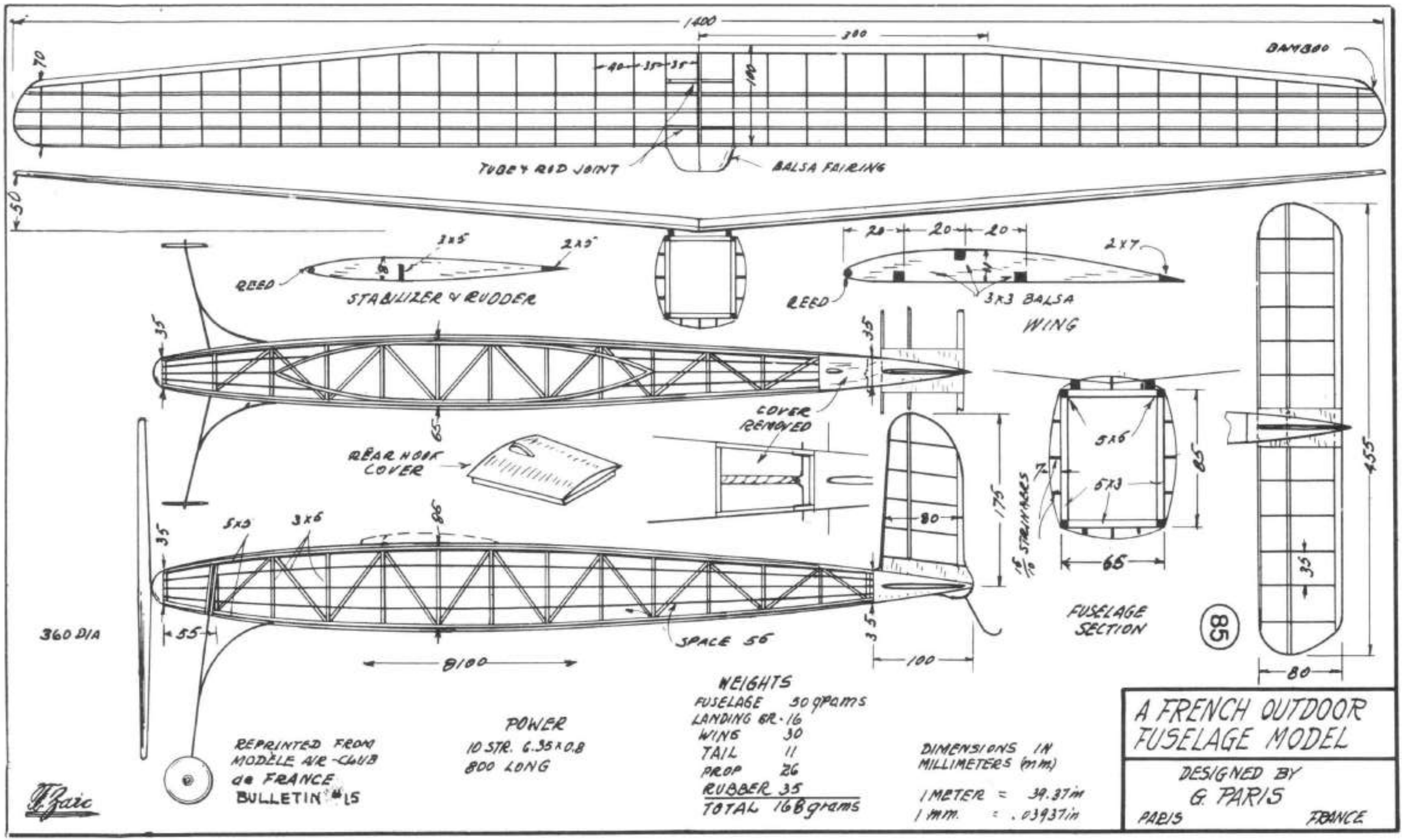
The main drawbacks of co-axial props are the weight, the difficulty of making suitable gears, and also the difficulty of winding the rubber with a winder when a torque tube in heliocopter form is used. The method which I have used successfully for over a year is to use a torque tube, but with modifications, to enable me to wind the motor with a winder. Incidentally, flight results have been more than satisfactory. The above method may be used on all types of models. The only change is in the sizes of the component parts.

The torque tube system is used by providing a bearing in the front and rear and a revolving anchorage. There is very little bearing friction, and the prop pull is taken care of by the ball bearing washer.

Construction: The torque tube is made of 3/64" sheet balsa. For extra powerful models it is advisable to use two or three 1/32" sheets, rolled one on top of each other. The front portion consists of plug "A" which fits smugly in the spinner "S" which is cemented to the tube. The two bearings "B" are made of sheet aluminum. The holes are made to allow the tube to rotate freely without vibration. The holes should be finished with a blunt reamer to provide a round contact surface. Coat the tube with 5 or 6 coats of cement where it contacts the bearings. Do this every 30 or 40 flights to make up for wear. The rear plug is not cemented to the tube because of replacement of rubber, but is made to fit snugly. The spinner "T" must be very smooth in operation. For light jobs a light trout fishing troll will do, but for heavier motors make as shown in the sketch. If the model is of the fuselage type, the whole assembly can be made removable by providing the anchor pin "M".

The rubber is wound by the front prop shaft, and may be stretched by removing the plug "A". Freewheeling need be applied to only the front prop in the usual manner. Be sure to use plenty of Vaseline on the torque tube bearings as well as all other revolving points.





1400
300
BAMBOO
70
40
35
35
100
TUBE & ROD JOINT
BALSA FAIRING
50
3x5
2x5
REED
STABILIZER & RUDDER
20
20
20
2x7
REED
3x3 BALSA
WING
35
65
COVER REMOVED
REAR HOOK COVER
5x6
5x3
85
175
80
1/16 STRINGERS
65
FUSELAGE SECTION
455
35
80
85
5x5
3x6
86
35
360 DIA
55
SPACE 56
8100
100
WEIGHTS
FUSELAGE 50 grams
LANDING GR. 16
WING 30
TAIL 11
PROP 26
RUBBER 35
TOTAL 168 grams
POWER
10 STR. 6.35 x 0.8
800 LONG
REPRINTED FROM
MODÈLE AIR-CLUB
de FRANCE
BULLETIN #15
DIMENSIONS IN
MILLIMETERS (mm)
1 METER = 39.37 in
1 mm. = .03937 in
A FRENCH OUTDOOR
FUSELAGE MODEL
DESIGNED BY
G. PARIS
PARIS
FRANCE

Low Speed Airfoils

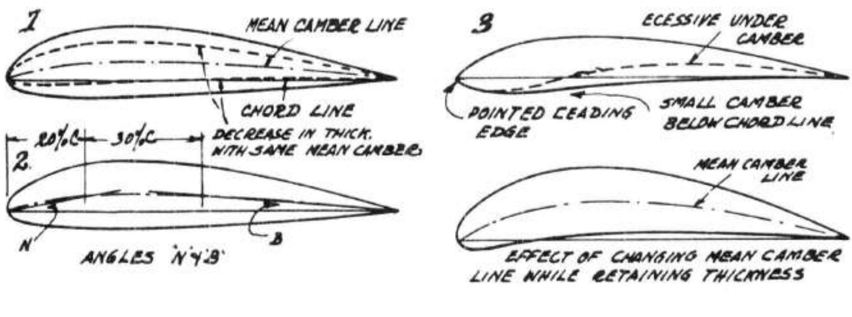
by Fred J. Rogerson
Reprint from "Canadian Aviation"

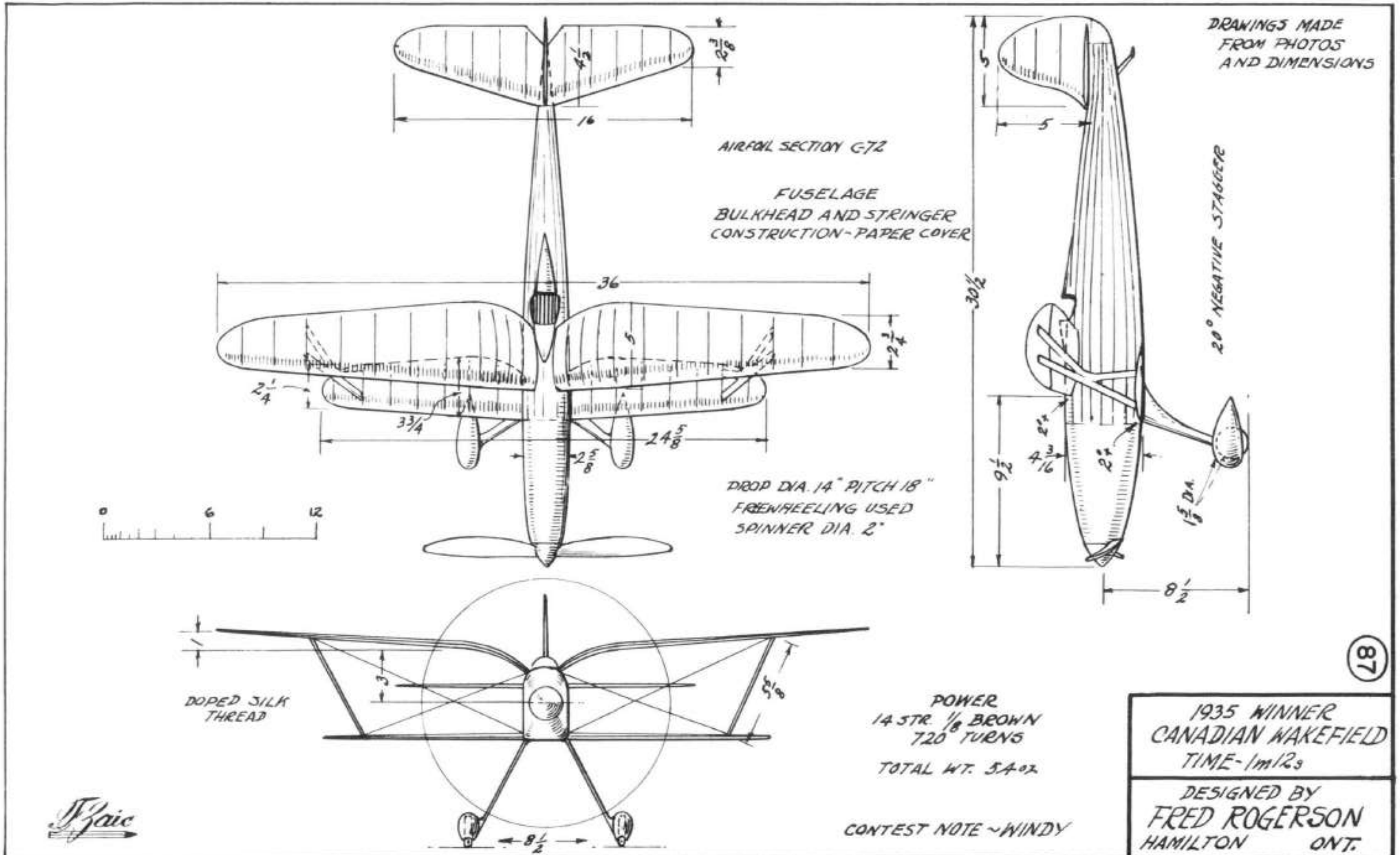
Realizing that we have been handicapped by lack of data concerning low speed airfoils, I decided to make a series of free flight tests. I built a weight rule model and a number of wings with identical plan forms, areas, and weights, but with different airfoil sections. Then with the aid of a stop watch, a 100 foot tape line, and plenty of blue sky, I proceded to make some tests.

Early in the experiment, I found that the Reynolds number is not a reliable measure for comparing airfoil sections at low speed. The rule adopted by the Germans for comparing glider sections seems more suitable for our purpose, especially since the speed of soaring gliders is reasonably slow, and the prime requisite of a model is to soar well. This comparison rule is based on the median line (mean chord line). The greater the arching of this line, the maximum thickness remaining the same, the slower will be the sinking velocity and greater the soaring ability. See Fig. 1. This I found to hold true with the airfoils tested.

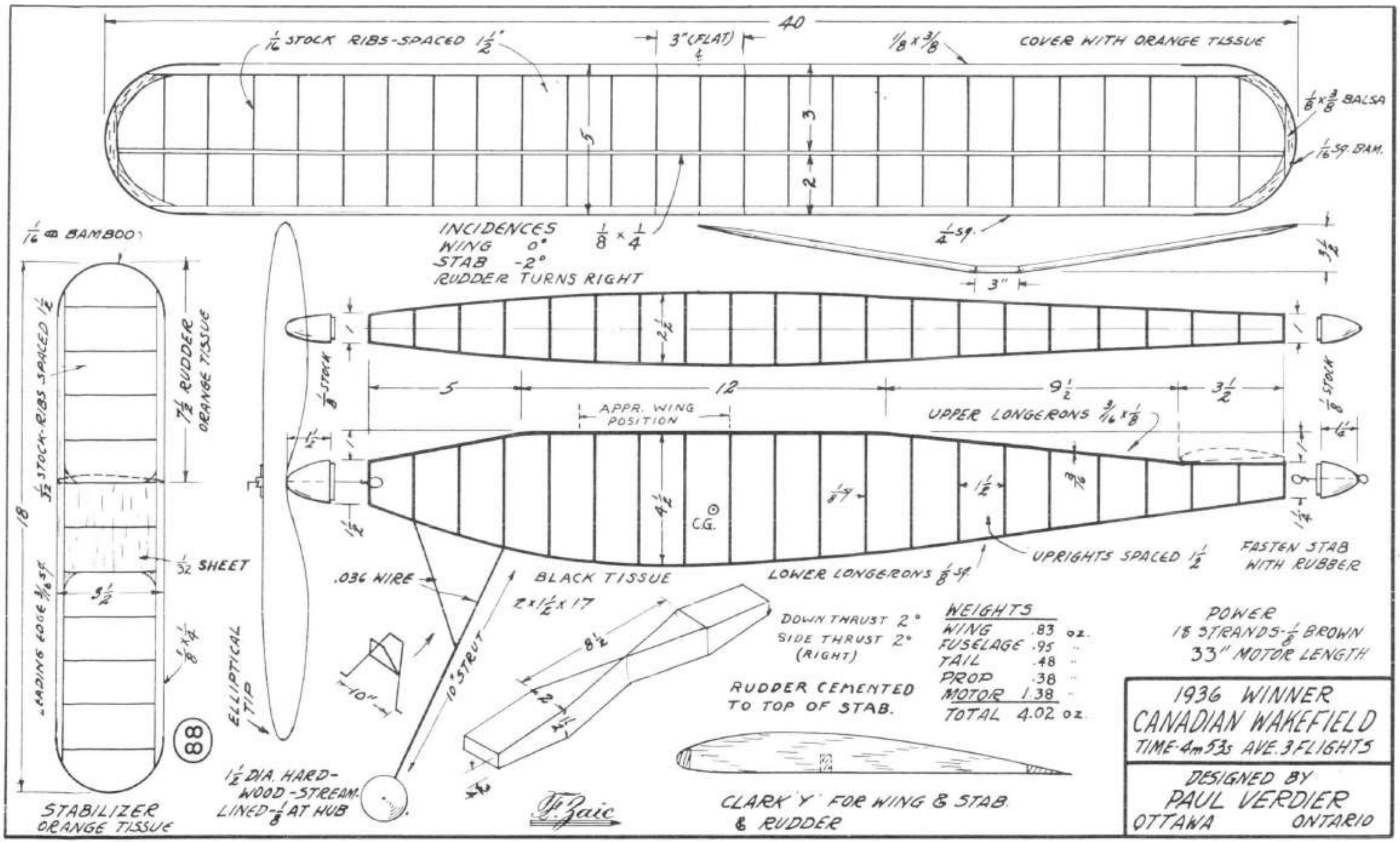
The above rule serves gliders very well, since they are continuously gliding down, but for power model work we must consider other factors, mainly, that of getting the greatest height with the limited power. Although airfoils with a thickness relation of 1:5 have proved successful, it would be next to impossible to design a propeller of reasonable proportions that would fly such a wing to sufficient altitude for the mean camber to get in its work. I found that the power required depends a great deal upon the angle (N) at which the leading edge meets the air, and also the maximum thickness of the airfoil. See Fig. 2. A "Phillips" entering edge can be used to reduce the value of N and yet retain the good mean camber. See Fig. 3. In the tests, pointed leading edges, and those of very small radius showed up reasonably well for this purpose. They also provided better stability at large angles of attack. I believe that the reason for this latter characteristic is that the dividing line between the upper and lower airflow is determined by the form of the leading edge. The blunter edge will tend to change the C. P. gradually, while the pointed edge delays the shifting, until at large angles of attack it shifts suddenly, causing a stable moment.

The airspeed of a model airfoil is too low to build up high pressure at the leading edge, as in commercial practise. The absence of this condition causes a very heavy boundary layer of turbulent air about the airfoil which reduces the lift/drag value. However, the pointed airfoils cut their way cleanly through the air, causing very little resistance, although the lift value is slightly reduced with this feature.





DRAWINGS MADE FROM PHOTOS AND DIMENSIONS
AIRFOIL SECTION G72
FUSELAGE
BULKHEAD AND STRINGER CONSTRUCTION - PAPER COVER
20° NEGATIVE STAGGER
PROP DIA. 14" PITCH 18"
FREEWHEELING USED
SPINNER DIA. 2"
DOPED SILK THREAD
POWER
14 STR. 1/8 BROWN
720 TURNS
TOTAL WT. 5.4 oz
CONTEST NOTE ~ WINDY
87
1935 WINNER
CANADIAN WAKEFIELD
TIME - 1m 12s
DESIGNED BY
FRED ROGERSON
HAMILTON ONT.



40
1/16 STOCK RIBS-SPACED 1/2"
3" (FLAT)
1/8 x 3/8
COVER WITH ORANGE TISSUE
1/8 x 3/8 BALSA
1/16 SQ. BAM.
5
3
2
1/8 x 1/4
1/4 SQ.
3 1/2
3"
INCIDENCES
WING 0°
STAB -2°
RUDDER TURNS RIGHT
1/16 BAMBOO
1/32 STOCK-RIBS SPACED 1 1/2
7 1/2 RUDDER
ORANGE TISSUE
18
1/32 SHEET
3 1/2
LEADING EDGE 3/16 SQ.
1/8 x 1/4
1/8 STOCK
2 1/2
5
12
9 1/2
3 1/2
APPR. WING POSITION
UPPER LONGERONS 3/16 x 1/8
1 1/4
4 1/2
C.G.
1/8 SQ.
1 1/2
3/16
UPRIGHTS SPACED 1 1/2
FASTEN STAB WITH RUBBER
.036 WIRE
BLACK TISSUE
LOWER LONGERONS 1/8 SQ.
2 x 1 1/2 x 17
8 1/2
DOWN THRUST 2°
SIDE THRUST 2° (RIGHT)
WEIGHTS
WING .83 OZ.
FUSELAGE .95
TAIL .48
PROP .38
MOTOR 1.38
TOTAL 4.02 OZ.
POWER
18 STRANDS-1/8 BROWN
33" MOTOR LENGTH
ELLIPTICAL TIP
10°
10" STRUT
RUDDER CEMENTED TO TOP OF STAB.
88
1 1/2 DIA. HARD-WOOD-STREAM-LINED-1/8 AT HUB
STABILIZER
ORANGE TISSUE
F. Zaic
CLARK 'Y' FOR WING & STAB. & RUDDER
1936 WINNER
CANADIAN WAKEFIELD
TIME-4m 53s AVE. 3 FLIGHTS
DESIGNED BY
PAUL VERDIER
OTTAWA ONTARIO

AIRFOIL	N in Degrees	B in Degrees	Max. Thick. % of Chord
St.Cyr 52 Caudron	8.0	3.5	10.
Gottigen 436	9.0	4.0	11.08
C-72	9.0	4.5	11.73
G. Light	9.5	5.25	11.7
U.S.A. 40	8.5	4.5	13.72
Driggs	11.0	3.5	13.72
N.A.C.A. 6409	13.0	6.75	9.0
Eiffel 385	8.0	3.5	13.3
Grant	11.5	6.0	13.4
Gottigen 81	16.0	7.0	7.3
R.A.F. 32	10.4	6.25	12.7
Martin 40	11.5	6.3	22.1
Clark Y	12.0	5.0	11.7

The lift of an airfoil is in proportion to the maximum thickness and the angle (B) made by the chord line and the mean camber line at a point 50% from the trailing edge. See Fig. 2. The chord is defined as the line between the extreme leading edge and the trailing edge. It should not be confused with the datum line, from which the airfoil is layed out. Undercamber carefully applied is an efficient method of increasing lift

These are the most important airfoil characteristic requirements, and can be applied to any section we choose. Table I shows the angle of the leading edge to the airflow (N), the angle between the chord and mean camber lines (B), and the airfoil. The choice will be left to the reader as the requirements depend upon the wing loading of the model.

The test wing construction consisted of a 3/32" x 1/4" leading edge, a 1/16" x 1/8" top spar, a 1/16" x 1/4" trailing edge, and rib spacing of 1½". The grain of the tissue was parallel with the chord and the wing was doped with water and two coats of clear dope. On a highly cambered section, the sag in the covering was found to be as much as 1/8" at a point about 20% from the leading edge. After the first tests these wings were covered with 1/64" sheet balsa from a point 30% from the leading edge on the upper surface to a point 20% on the lower surface. This gave an average increase in duration of 25 to 30%. Still greater improvement should be obtained from wings covered entirely with balsa

Speaking generally, an airfoil should have:

1. A general pleasing streamlined appearance, without any very abrupt changes in the curvature.
2. A leading edge of small radius, or one that is pointed.
3. The maximum height of the mean camber line at a point 40 to 50% from the leading edge.
4. No excess upper camber or under camber, as this may mean excessive drag with no compensating increase of lift.
5. No excessive camber below the chord line of the "M" type of airfoils, as this will decrease the lift.
6. A mean camber of .045 to .055 of the chord, as this seems to give the best performance.

To predict or calculate the performance of any wing, the finished wing must have no sag in the covering. I might add that in tests a .1 oz. greater wing loading per sq. ft. makes the difference between soaring and a straight glide in. I have found that the "Grant Section", as used on C. H. Grant's twin pusher and twin tractor, a very good all-around section. The greatest draw-back is that it absorbs considerable power from a single motored job.

Twin Pusher

by Edward I. Manulkin

You old timers will remember that in the days before 1934, twin pushers were winning almost every contest, bringing to their builders every sort of prize, from kits to trips to Europe. Usually the winning flight time was about three minutes. Very few of the pre-1934 tractors compared well with twins in performance.

This state continued until about two years ago, when the experienced builders began to understand more thoroughly the importance of streamlining, of design, and of proper adjusting. Since the single tractor was the easiest to streamline and to adjust, the twin pusher was greatly neglected, so that at present most of the records are held by tractors. You will note that it was the application of streamlining and adjusting that caused the increase of tractor time. Of the two, probably adjusting is the more important.

Some reasons why the tractor has superseded the standard twin pusher are:

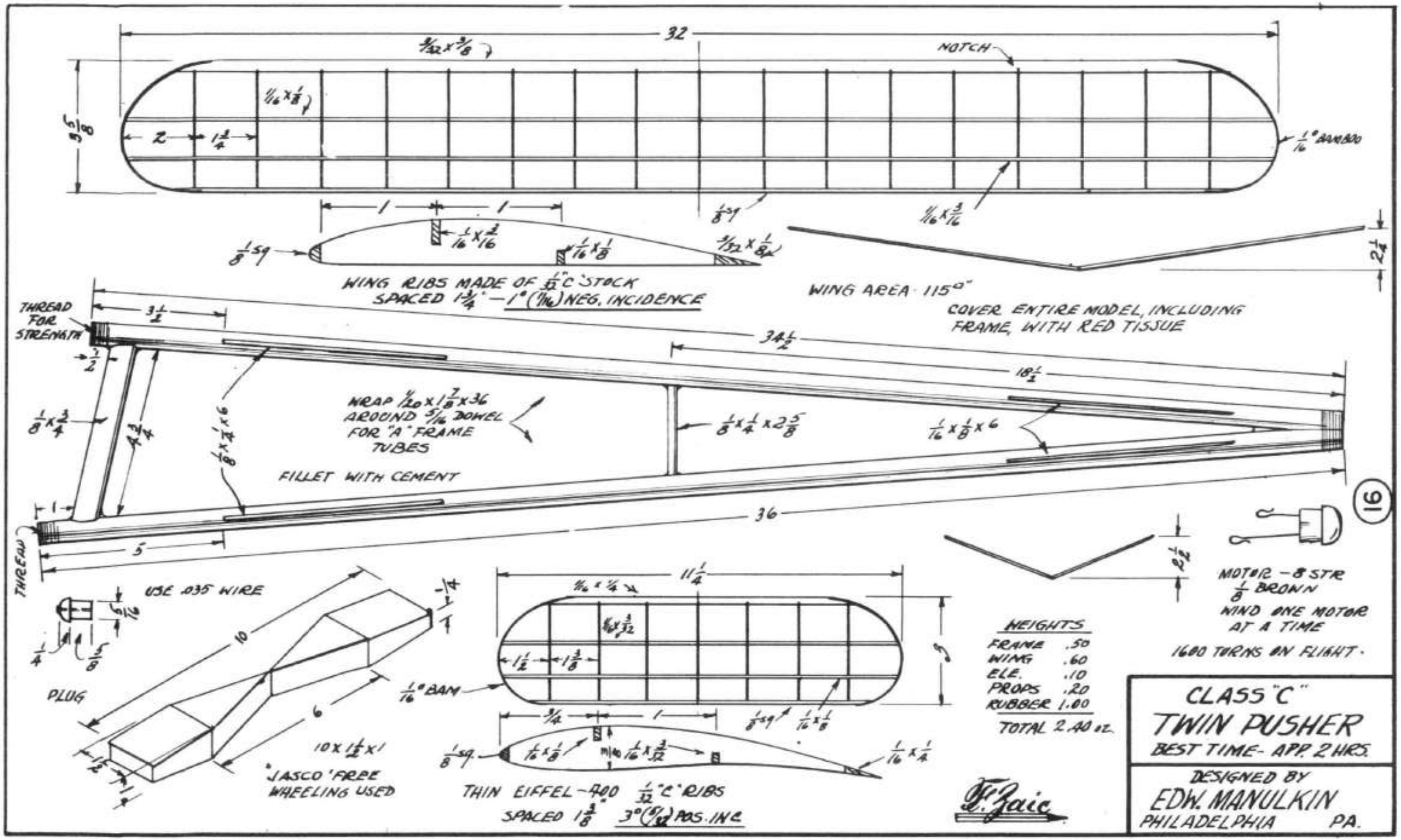
1. The enclosing of the rubber motor, thereby eliminating that source of drag in glide and flight, as well as eliminating rubber shifting.
2. The use of soaring airfoils.
3. The use of larger and slower props, permitted because of the decrease of drag.

It can readily be seen that the standard "A" frame with exposed rubber is at a disadvantage against the slick tractor. Such twins fly by the use of sheer brute power, and it is this feature that is their downfall, as in the case of all brutes. However, new streamlined versions of the twin pusher began to appear early in 1934, but not very much attention was paid to them in the grand rush to get on the tractor's bandwagon. Those who did build these new designs were pleasantly surprised when they found that these streamlined models would fly with less power and larger props, as well as have a flatter glide.

I have been building outdoor twin pushers for about five years. I obtained durations of up to 12 minutes with the orthodox designs, after patient surface layout and numerous adjustments. However, when I designed and built my first streamlined twin, my duration increased tremendously. My first official flight in a contest resulted in an out-of-sight flight. It was recovered a few days later, about 3 miles from the starting point. During the second contest, it climbed like an elevator until the power was exhausted and then soared out of sight after about 17 minutes. This time it was recovered after I was informed of its whereabouts by mail. The distance of this flight was about 15 miles from the starting point. This flight strengthened my belief that tractors were not as superior as some would have us believe. The combination of a staggered "A" frame and enclosed motors seems to point the way toward wresting the duration record from tractors, especially when the new weight rules are put into effect. A conservative estimate of the duration of that remarkable flight is two hours or more. The point to keep in mind though, is that every flight was of top-notch quality.

I have never had any real difficulties with twin pushers. However, I have found the following adjusting hints handy, and they may prove of value to other twin pusher flyers.

1. If the model flies well under power but stalls in the glide, check the relative incidences. The cause is usually excessive incidence. 1° negative for the wing and 3° positive for the elevator is just about right.



32
NOTCH
WING RIBS MADE OF 1/32" C STOCK
SPACED 1 3/4" — 1° (1/16) NEG. INCIDENCE
WING AREA 115 □"
COVER ENTIRE MODEL, INCLUDING FRAME, WITH RED TISSUE
THREAD FOR STRENGTH
WRAP 1/20 x 1 7/8 x 36 AROUND 5/16 DOWEL FOR "A" FRAME TUBES
FILLET WITH CEMENT
34 1/2
18 1/2
36
THREAD
USE .035 WIRE
PLUG
10 x 1 1/2 x 1
"JASCO" FREE WHEELING USED
THIN EIFFEL-400 1/32 "C" RIBS
SPACED 1 3/8" 3° (5/32) POS. INC.
WEIGHTS
FRAME .50
WING .60
ELE. .10
PROPS .20
RUBBER 1.00
TOTAL 2.40 oz.
MOTOR — 8 STR 1/8 BROWN
WIND ONE MOTOR AT A TIME
1600 TURNS ON FLIGHT.
16
CLASS "C"
TWIN PUSHER
BEST TIME - APP. 2 HRS.
DESIGNED BY
EDW. MANULKIN
PHILADELPHIA PA.

2. If the model refuses to turn, the trouble may be caused by too much dihedral in the wing or elevator. A safe rule to follow is to use 1 inch per foot of wing span for the wing, on each side, and $1\frac{1}{2}$ inches per foot of elevator span for the elevator, on each side.

3. Use freewheelings that work every time. You never can tell which flight will use them most.

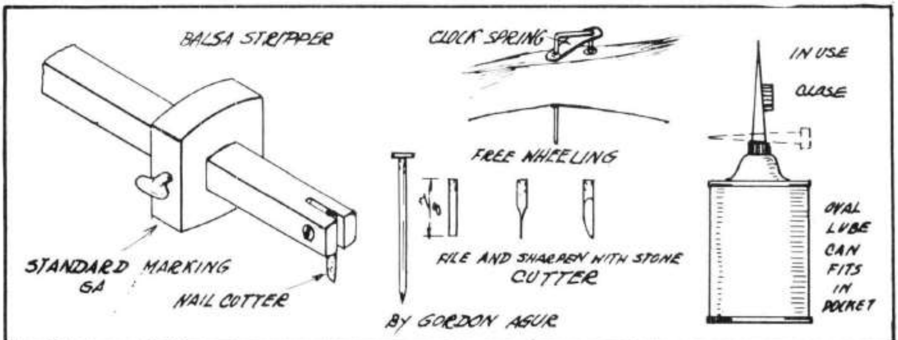
4. Props should spin very freely and not grind at the bearing. Ball bearing washers are excellent for eliminating such friction.

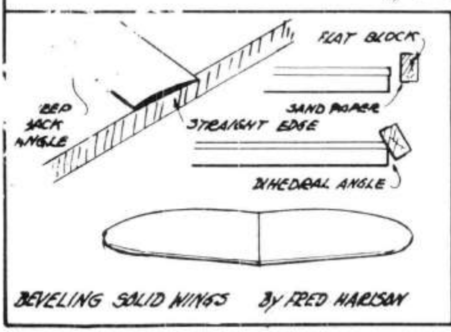
5. Make sure that props are in line and do not hit each other under power or in the glide. Use double bearings to prevent this and also to insure true running.

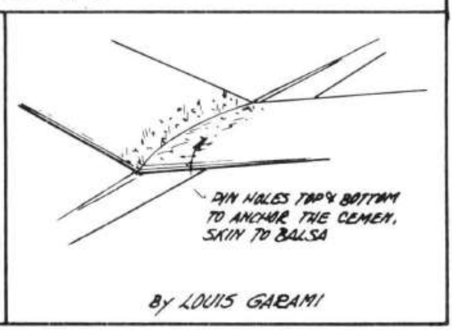
6. The "A" frame should be very rigid. When your twin does a half-roll-loop into the ground, you can be sure that the torque has twisted the frame.

7. Use plenty of power and have a light, streamlined ship. This combir·ation has broken many records.

If the above remarks are kept in mind at the next contest or while making a new model, you may be reasonably sure of seeing your handiwork "a slight speck in the blue ceiling", giving those tractor boys something to worry about. (Ed. note: and anyway it takes a <u>man</u> to wind up a powerful twin!)

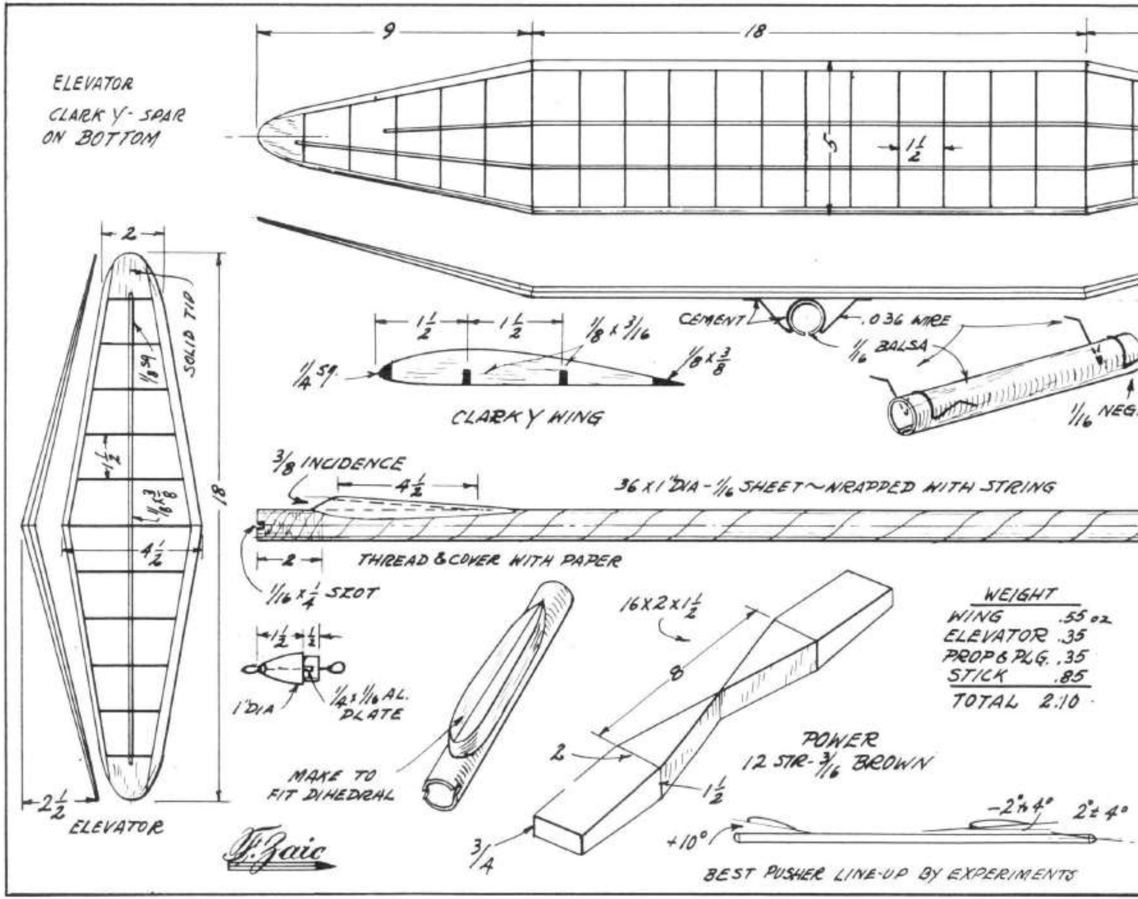






CONCERNING TOWLINE GLIDERS-------------------------By John Eggleston

1. Be absolutely sure that each wing is perfectly balanced. Slightest off balance will produce a roll.
2. Al ways fillet the wing butts. The added strength more than offsets the additional weight.
3. Do not fly a sailplane in a high wind. The chances of a good flight are scarce.
4. Use the lightest string possible. I use No. 30 colored thread.
5. Never pull the string just before launching the model. This makes the model stall with chance of spinning or other instabilities.
6. To help the eyesight, polish the fuselage, use colored tissue, stain with a little red dope mixed with clear. Silver high points.



CLASS "C" SINGLE
OUTDOOR PUSHER
TIME - 1 hr. +

DESIGNED BY
TORREY CAPÓ
BOSTON MASS.

Papier-Mache Model

by Fred Mayfield

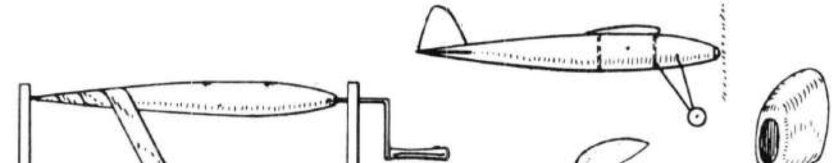
Usually papier-mache work is made by soaking paper in water until it becomes pulpy and then making a mixture from this pulp and a small amount of Plaster of Paris. This mixture is plastic enough to be worked with the hands or moulded from patterns, into any desired shape. When the water evaporates, the result is a light and fairly strong form. For model work the procedure used is slightly different, in that the paper is not reduced to a pulp, but is used in sheet form.

The first step in preparing the parts of a papier-mache model is to carve a form or a pattern of the part to be constructed. This form can be made of white pine or balsa. The flat wing mounting of a fuselage can be carved to shape or built up with clay. Any other protuberances (such as headrests, wing fillets, etc.) can also be built up of clay. The pine form should then be sanded smooth and varnished. If balsa is used, several coats of shellac should be applied. The form should also be rigged up so that it can be rotated on its lateral center line as shown. The papier-mache construction procedure is as follows:

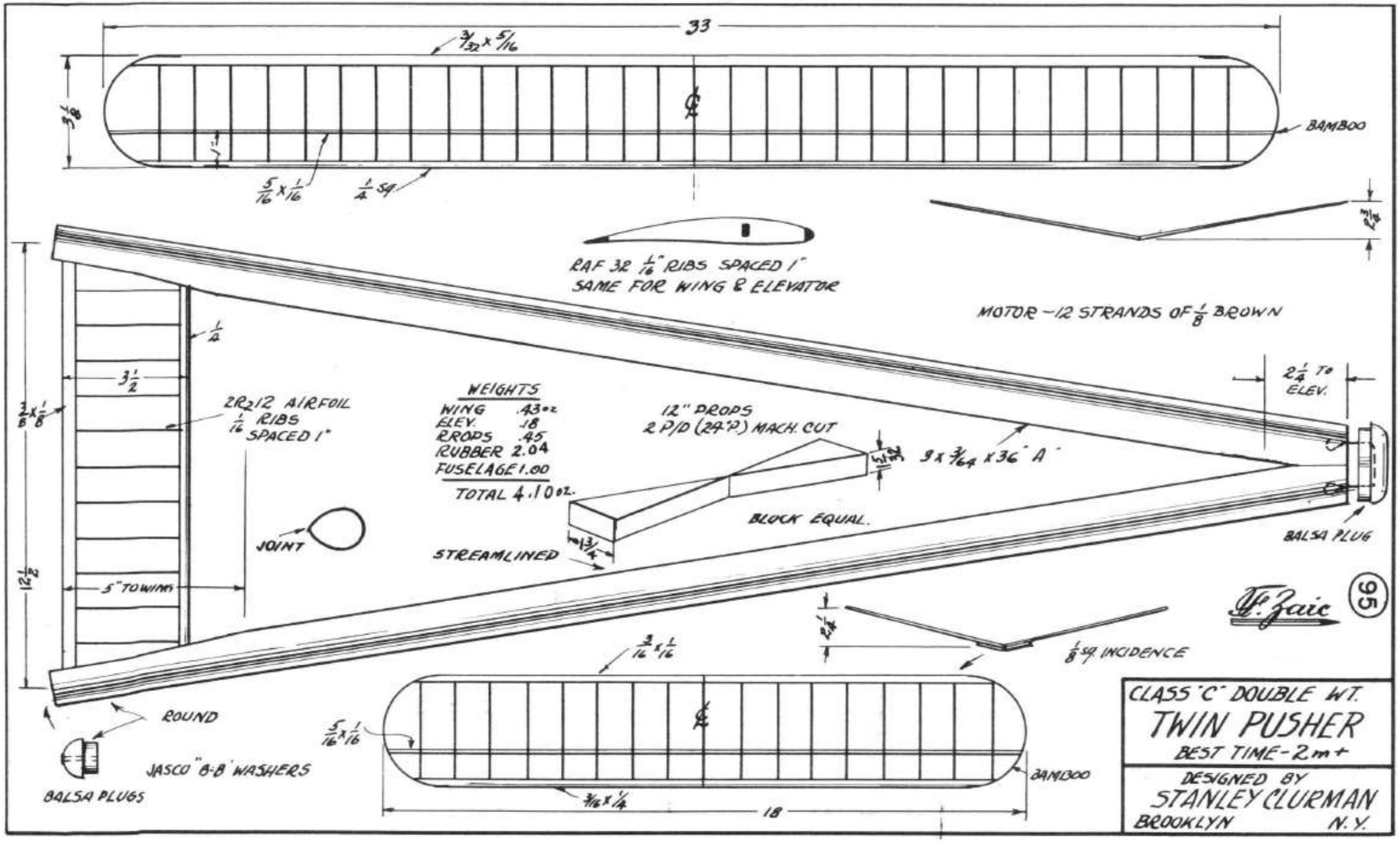
Cut a sheet of bamboo paper into strips approximately 2" x 8". Cut up only one sheet at a time until you know just about how many you will need. Grease the form well with Vaseline, cold cream, or some other greasy substance. Be sure to apply it liberally so that the paper will not stick to the form. Next, mix a bowl of wallpaper paste. (Common library paste may be used if it is mixed with water until creamy. However, it is quite expensive.) Now drag one of the paper strips through the paste. Wipe off the excess. Apply this coated paper strip to the form in a spiral direction by rotating the form. Repeat this process with other strips until the form is completely covered with one coat of paper. Be sure to have a slight overlap at the junction of the strips.

Another layer of paper is to be applied in the same manner, except that the spiral should run in the opposite direction. We need still another layer to obtain a safe margin of strength. This third coating is applied in the same direction as the first. For normal work, three coats will suffice. Use more layers if greater strength is desired. Let the completed job dry for about 24 hours to allow the paste to set and dry.

To remove the fuselage from the form, cut the fuselage on the bottom either in front or in the back and slide it off the form. If it sticks, or if the shape does not allow the removal to be made in this fashion, cut it full length. If it sticks too hard to the form it may be necessary to cut it along the top as well. I found that two bulkheads situated directly beneath the wing mounts are the only necessary internal supports. These should be made first of cardboard and fitted in and then cut out of laminated 1/16" sheet. After the bulkheads have been glued in place, the seam should be glued and sealed with a 1/2" strip of bamboo paper.



STREAMLINERS COWLINGS



33
3/32 x 5/16
3 1/8
BAMBOO
1"
5/16 x 1/16
1/4 SQ.
2 3/4
RAF 32 1/16" RIBS SPACED 1"
SAME FOR WING & ELEVATOR
MOTOR - 12 STRANDS OF 1/8 BROWN
1/4
3 1/2
2 1/4 TO ELEV.
2R2 12 AIRFOIL
1/16 RIBS
SPACED 1"
3/8 x 1/8
WEIGHTS
WING .43 oz
ELEV. .18
PROPS .45
RUBBER 2.04
FUSELAGE 1.00
TOTAL 4.10 oz.
12" PROPS
2 P/D (24" P.) MACH. CUT
5/32
9 x 3/64 x 36" "A"
BLOCK EQUAL.
JOINT
STREAMLINED
1 3/4
BALSA PLUG
12 1/2
5" TO WING
F. Zaic
95
2 1/4
1/8 SQ. INCIDENCE
3/16 x 1/16
ROUND
5/16 x 1/16
BAMBOO
JASCO "B-B" WASHERS
BALSA PLUGS
3/16 x 1/4
18
CLASS "C" DOUBLE WT.
TWIN PUSHER
BEST TIME - 2m+
DESIGNED BY
STANLEY CLURMAN
BROOKLYN N.Y.

Little Things Count

by Clement Turansky

At present I have one Baby Cyclone and two Brown Engines. I have found that by using the Pyroil that comes in the yellow can marked "A", in my fuel mixture, I can get more power and speed from the engine. I broke in my new Brown with Pyroil for six hours. The motor boys at the Buffalo meet said that my motor was the most powerful one there. It pulled the ship up to about 1,000 feet in one and one half minutes.

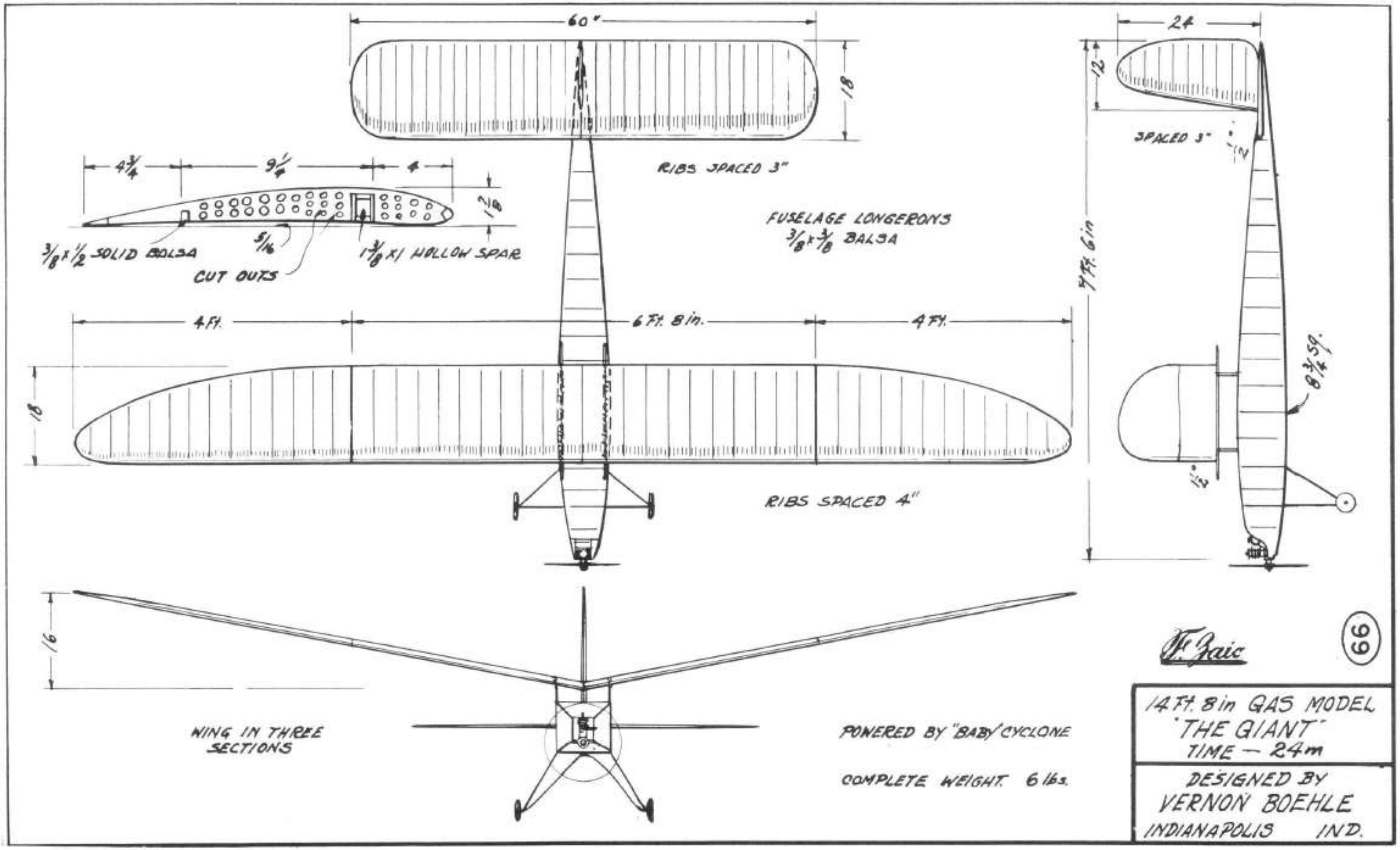
Pyroil is liquid graphite. When it is mixed with the fuel in the proportion recommended on the label, it forms a surface skin on the cylinder and piston walls and thus increases the compression ratio. Pyroil should also be used after the motor is broken in, in order to keep the compression up and prevent freezing. However, remember to use the fuel mixture as specified by the manufacturers. Pyroil just keeps the compression up by filling in scored spots and possible tolerances between the piston and cylinder walls. After I broke in my Cyclone with Pyroil I timed the engine for $11\frac{1}{2}$ minutes on $\frac{1}{2}$ oz. of gas, and I was running the engine wide open at that. However, <u>Pyroil is not a cure-all.</u> Use only the recommended proportions.

If your Cyclone is hard to start, or if it bucks, check the contact points. They should be about .010" apart in the open position. If they are not, get an object of this thickness, and bend the turn-down portion of the contactor until an .010" gap is obtained. By doming or rounding the contact points, the life of the batteries will be prolonged, and the contacts will be much cleaner and firmer. But be sure that when they are so filed that you keep them bright, as the sparks may build up a hard insulating surface. I am also using a spring between the needle valve washers and the engine, to prevent the valve from turning and changing the mixture. Also, be sure that you do not have a mixture that is too lean, because as the model gains altitude the engine is liable to conk.

On my gas model I used a slight right rudder, and the ship would bank sharply or would dive in with the torque, under power. Then I applied the regular rubber model correction by shifting the wing so that the left side was about 2" ahead of the right side (see Fig. 3.) and the difficulty disappeared. (This correction for excessive banking will be found especially apt for rubber models using too much right rudder.)

<u>Rubber Hints</u>

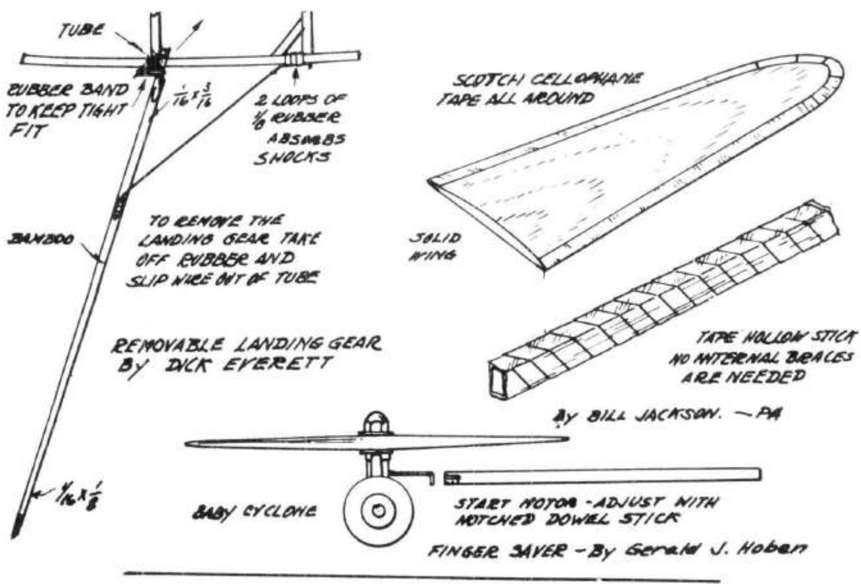
I went through the whole summer without breaking one rubber motor. (Ed.: New record for active flyers-- I wonder who will get one whole year?). I have found that rubber that is not aged properly will break very suddenly, especially if a poor lubricant is used. I use the following ageing procedure: I keep the rubber in a cardboard container in a dark, cool corner for about 3 weeks, and then I take it out and put it in airtight jars, and leave it for about 3 weeks. The rubber is now ready for use. I prepare and lube all my motors the night before the contest so that the lubricant can penetrate into the rubber pores. The lubricant should be as slippery as possible. By using these precautions, I can get 1100 to 1180 turns on 18 strands of 1/8th, 24" long.


60"
18
24
12
SPACED 3"
1/2"
4 3/4
9 1/4
4
1 1/8
RIBS SPACED 3"
FUSELAGE LONGERONS
3/8 x 3/8 BALSA
3/8 x 1/2 SOLID BALSA
5/16
1 3/8 x 1 HOLLOW SPAR
CUT OUTS
4 Ft. 6 in
4 Ft.
6 Ft. 8 in.
4 Ft.
8 3/4 SQ.
18
RIBS SPACED 4"
1/2"
16
WING IN THREE SECTIONS
POWERED BY "BABY CYCLONE
COMPLETE WEIGHT 6 lbs.
F. Zaic
66
14 Ft. 8 in GAS MODEL
"THE GIANT"
TIME — 24 m
DESIGNED BY
VERNON BOEHLE
INDIANAPOLIS IND.

My winding procedure is as follows: I stretch the motor to about three times its length, and then wind about 75 turns with a 4-1. At this point there is a slight "give" in the rubber and I stretch it about 12" more and keep on winding. I start to come in at about 195 to 200 crank winds so that when I am close to the model I have about 280. I then pack in another 5 or 10 for the first burst of power. It is advisable to get accustomed to this method before using it for a contest so that you can get the feel of the rubber tension when it is just about to break.

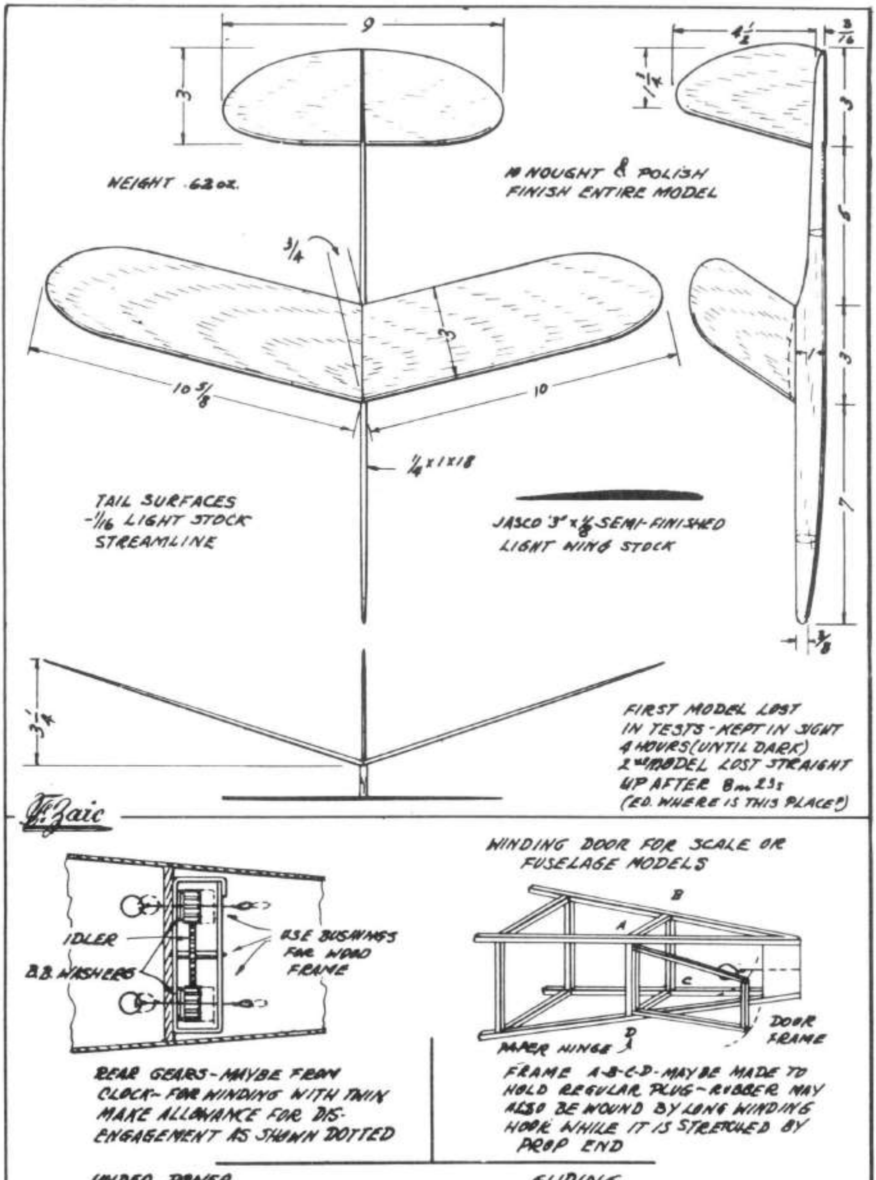
Some Notes Concerning Gliders

The wings and tail seem to have the unpleasant habit of parting company with the fuselage whenever the glider plows into the ground. To minimize this tendency I use four coats of cement with long enough intervals between them to allow the cement to set real hard. When this is all done I prepare "plastic balsa" by mixing fine balsa dust with thick dope in about half and half proportion. I spread this mixture over the top of the wing joint, as well as on the bottom portion. I let it set for about 20 minutes, and then I work the fillet into smooth flowing lines with lubed fingers. This will break the surface crust so I let it dry for about 20 minutes more, and then again form the fillet, this time with more pressure. After letting it dry overnight, I finish the fillet with sandpaper using coarse at the beginning and ten-nought to finish. The glider is then finished all over with the regular four coats of finishing dope, and a final coat of good grade floor wax. I have built five gliders in this manner and have already lost four of them. The last one is still in active service after six months of hard usage. For indoor gliders I found that light quarter-grained balsa for wings and tails and hard 1/8" balsa for fuselages are best. I learned later that Wally Simmers uses nothing but these grades for his indoor glider work.



Editor's Note: Approximate vertical velocities in feet per second, of rising air are as follows:

	Thunderstorms	Deflections (Hills)	Convection (Heat)
Rate	44-110 ft./sec.	10-27 ft./sec.	7-24 ft./sec.
Max. Ht.	20,000 ft.	depends upon hills	4,000 ft.



9
3
4 1/2
3/16
1 1/4
WEIGHT .62 oz.
NOUGHT & POLISH
FINISH ENTIRE MODEL
3/4
3
10 5/8
10
1/4 x 1 x 18
TAIL SURFACES
-1/16 LIGHT STOCK
STREAMLINE
JASCO 3" x 1/8 SEMI-FINISHED
LIGHT WING STOCK
3/8
3 1/4
FIRST MODEL LOST
IN TESTS - KEPT IN SIGHT
4 HOURS (UNTIL DARK)
2nd MODEL LOST STRAIGHT
UP AFTER 8m 23s
(ED. WHERE IS THIS PLACE?)
W. Zaic
IDLER
B.B. WASHERS
USE BUSHINGS
FOR WOOD
FRAME
REAR GEARS - MAYBE FROM
CLOCK - FOR WINDING WITH THIN
MAKE ALLOWANCE FOR DIS-
ENGAGEMENT AS SHOWN DOTTED
WINDING DOOR FOR SCALE OR
FUSELAGE MODELS
A
B
C
D
PAPER HINGE
DOOR
FRAME
FRAME A-B-C-D - MAYBE MADE TO
HOLD REGULAR PLUG - RUBBER MAY
ALSO BE WOUND BY LONG WINDING
HOOK WHILE IT IS STRETCHED BY
PROP END
UNDER POWER
GLIDING
HINGE
WIRE
STOP
HINGE
UNDER POWER RUBBER MOTOR
HOLDS ELEVATOR DOWN
POWER OUT ALLOWS ELEV. UP
AND FLATTENS GLIDE
AUTOMATIC ADJUSTER FOR PUSHER ELEVATORS
TO OBTAIN GOOD CLIMB AND GLIDE
BEND DETER-
MINES MOVEMENT
A SPRING OR RUBBER
MAYBE USED FOR
POSITIVE CONTROL
BY ALBON COWLES
ATLANTA GA.

Thermals

by Dick Everett

Thermals utilized by models are mostly of the convection type. Such currents are developed by the differences of air temperature. As you all know, heated air expands and increases in volume and so tends to rise above the colder air. Such phenomena occur whenever there are ground spots that have different rates of heat absorption. For example, bodies of water require a large amount of heat to raise their temperature, while concrete requires a relatively short exposure to the sun before becoming heated and acting as a mirror to the sun's heat.

The following types of terrain have a quick heat-saturation period, after which the air in immediate contact with the ground is warmed: concrete, asphalt, sand, hard ground, plowed fields with a hard-crusted surface, ripened grain fields, and the like. Bodies of water, green fields, trees, and objects which keep on absorbing the heat, do not heat the surrounding air.

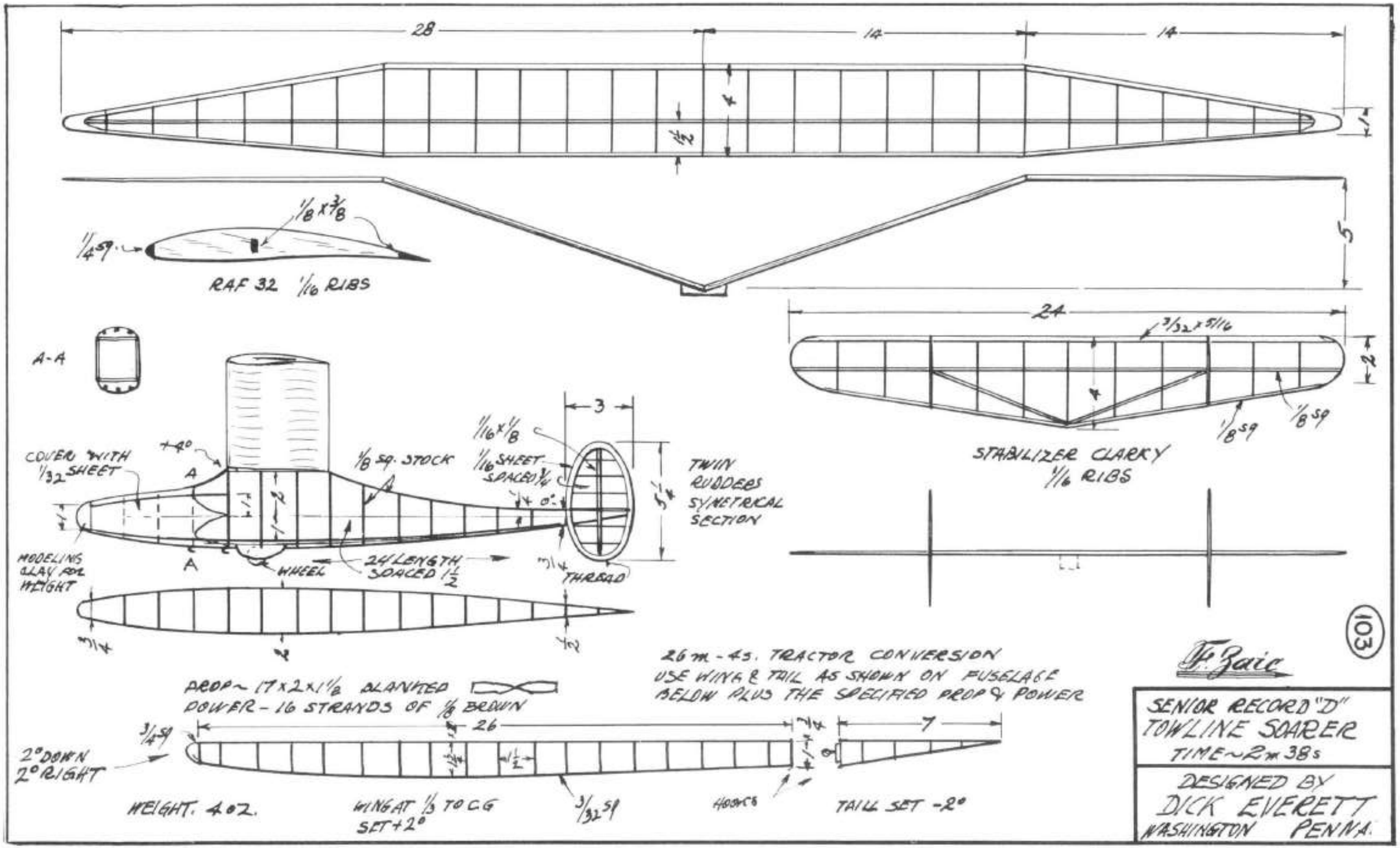
From the above explanation we can see that for best results we should fly the model in such thermal-producing areas. On the airport, the best spot is in the center of the runway or the large circle of concrete or asphalt. The tops of administration buildings and the concrete aprons in front of the hangars also give up hot risers. However, these risers have a limited altitude and it is best to wait for cumulus clouds if there are any in the sky. These cumulus clouds are the peaks of upward convection currents formed somewhere and carried over the countryside by the wind. Therefore our objective is to have the model raised high enough by the local thermals to have it contact the cloud thermals. The rest is up to your eyesight and possible horizontal velocity.

If the clouds are high, release the model just when the clouds are approaching the field, to enable the model to rise to its highest point just when the cloud is passing over it. For low clouds, release the model when they are about across the field. In this manner the model will not be drawn up into the clouds too fast, as it will more or less be on the outskirts of the thermal. Thermals can be found as late as 6 o'clock in the afternoon, and on many occasions we have clocked over 12 minutes on risers over Pittsburgh Airport at this time.

On windy days there are few ground thermals as the wind cools the ground and at the same time sweeps them away in case they are forming. On such days we should also be careful where we launch the model. The behaviour of the wind is such that it provides an upcurrent in front of an obstacle and a down current behind it. (This current is utilized by soarers to glide in front of a hill.) Therefore we should launch the model away from such obstacles unless the model is a powerful climber, in which case the upcurrent would be rather helpful. This upward deflection of wind can be used advantageously for tow-line or hand launched gliders.

General Hints

Place clay on the bottom of your glider wings at the C. G. to get the gliders up higher, outdoors. This increases the speed which in turn flattens the glide considerably. For best result have the glider highly polished. Dope propellers silver for visibility. The shining propeller reflects the light. Also cover the fuselage silver or yellow. Cover the wing red and the stabilizer yellow, and dope three times to obtain a colored transparency.



28
14
14
1/2
4
1
5
1/8 x 3/8
1/4 sq.
RAF 32 1/16 RIBS
24
3/32 x 5/16
2
4
1/8 sq
1/8 sq
STABILIZER CLARKY
1/16 RIBS
A-A
+2°
COVER WITH
1/32 SHEET
A
A
1/8 sq. STOCK
1/16 x 1/8
1/16 SHEET
SPACED 3/4
0°
3
5 1/4
TWIN
RUDDERS
SYMETRICAL
SECTION
MODELING
CLAY FOR
WEIGHT
WHEEL
24 LENGTH
SPACED 1 1/2
THREAD
103
26 m - 4 s. TRACTOR CONVERSION
USE WING & TAIL AS SHOWN ON FUSELAGE
BELOW PLUS THE SPECIFIED PROP & POWER
PROP ~ 17 x 2 x 1 1/8 BLANKED
POWER - 16 STRANDS OF 1/8 BROWN
3/4 sq
26
1 1/2
7
2° DOWN
2° RIGHT
WEIGHT. 4 oz.
WING AT 1/3 TO C.G
SET +2°
3/32 sq
HOOKS
TAIL SET -2°
F. Zaic
SENIOR RECORD "D"
TOWLINE SOARER
TIME ~ 2 m 38 s
DESIGNED BY
DICK EVERETT
WASHINGTON PENNA.

From Experience

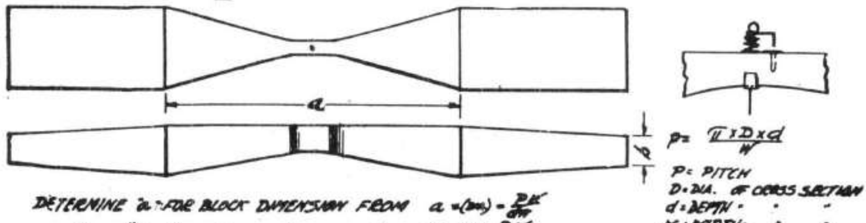
by Henry Stiglmeier
President of the Centinela M. A. C.

Airfoils

I have tried all types of airfoils and I find that the undercambered type, especially the Eiffel 431, is best for duration models. I used that airfoil on a 150 sq. in. cabin job which did not fly less than 20 minutes for three Sundays in a row. It did 46, 32, and 20 minutes and eventually flew out of sight. I find that the Clark Y is not so good for weight rule models.

Power and Propellers

In general I use two less strands of 1/8" flat rubber than the diameter of the propeller in inches. Large diameter, low pitch props seem to work best for me. A pitch-diameter ratio of $1\frac{1}{4}$:1 is good. (Example: 16" diameter, 20" pitch.) My props range in diameter from 42 to 45% of the wing span. I find that a $1\frac{1}{4}$" x 2" block is very good for 16", 17", and 18" props. I cup the back side of a two inch blade from 1/16" to 3/32". The prop layout that I use is as shown:.



Pusher v. Tractor

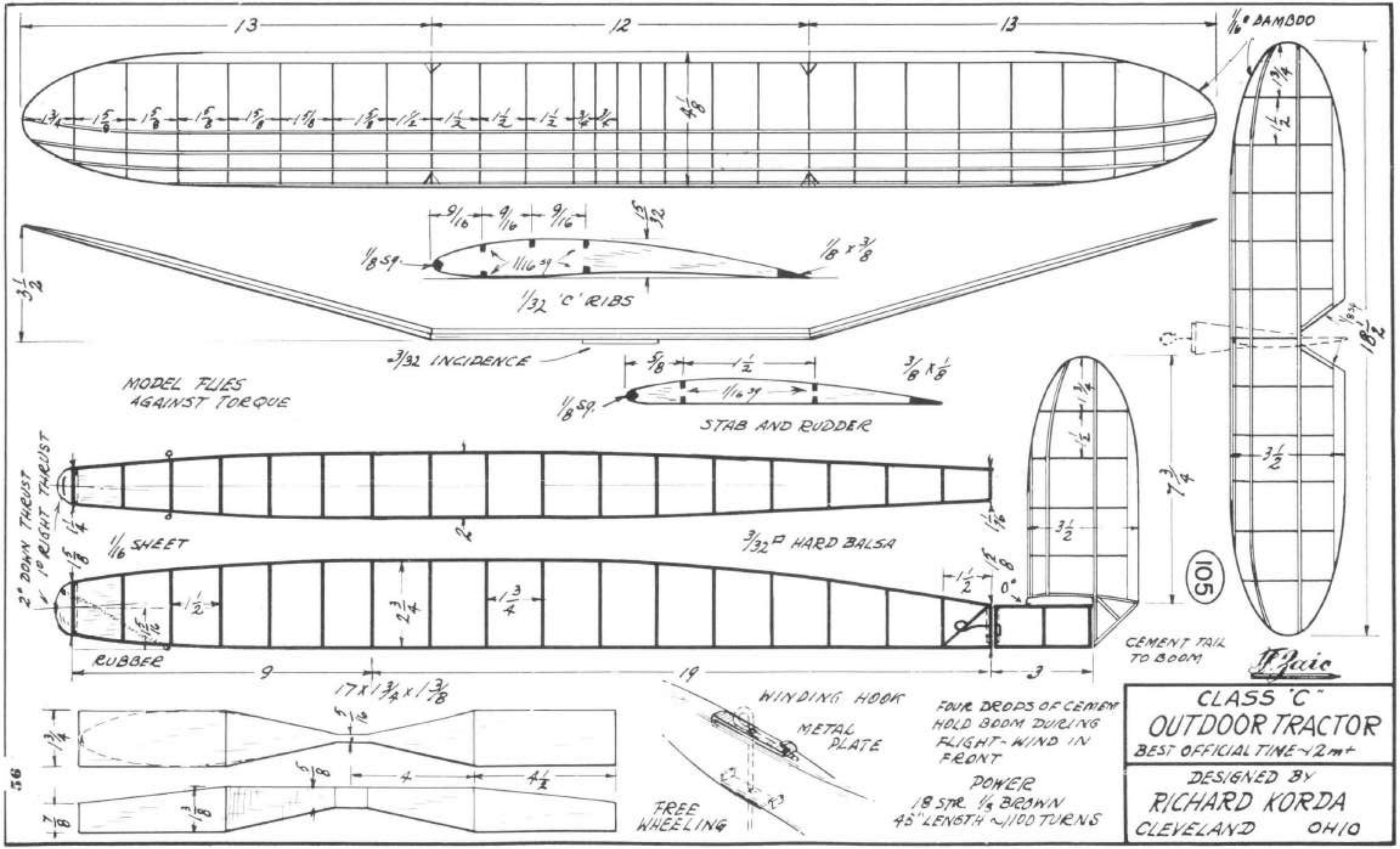
I have made many pushers and almost as many tractors. I find that tractors are easier to adjust, and I am sure that they climb as well as pushers. I dislike pushers for three reasons:-- first, it is difficult to make them circle satisfactorily throughout the entire flight; second, it is hard to determine the correct amount of elevator dihedral to prevent the model from swinging; third, since the leading airfoil in either a pusher or a tractor should be of higher camber than the following airfoil, the main wing of a pusher cannot have as high a camber as is desirable without overcambering the elevator section. In all, I believe the tractor to be just as stable as the pusher, and that it rides the thermals better.

Rudder and Stabilizer

For the average cabin or stick model, I found that rudders having an area of about 14% of the wing area are very satisfactory. A small rudder will allow the model to spin when side thrust is used. The area of a lifting tail should be about 40% of the wing area, when the model balances at the trailing edge of the wing.

Aspect Ratio

The aspect ratio of lifting tails may be as high as 7 with good results. High aspect ratio rudders are not good. I have tried several high aspect ratio wings and I believe that 12-1 is about as high as one should use. It seems to me that the model will not soar or fly very well when using wings of more than 12-1 aspect ratio. For all-around performance, I prefer an aspect ratio of 10-1 or 11-1.



1/16" BAMBOO
1/32 'C' RIBS
1/8 SQ.
1/16 SQ
1/8 x 3/8
3/32 INCIDENCE
MODEL FLIES AGAINST TORQUE
3/8 x 1/8
STAB AND RUDDER
2° DOWN THRUST
1° RIGHT THRUST
1/16 SHEET
3/32 □ HARD BALSA
RUBBER
CEMENT TAIL TO BOOM
17 x 1 3/4 x 1 3/8
WINDING HOOK
METAL PLATE
FREE WHEELING
FOUR DROPS OF CEMENT HOLD BOOM DURING FLIGHT - WIND IN FRONT
POWER
18 STR. 1/8 BROWN
45" LENGTH ~1100 TURNS
105
CLASS "C"
OUTDOOR TRACTOR
BEST OFFICIAL TIME ~12 m+
DESIGNED BY
RICHARD KORDA
CLEVELAND OHIO

Tapered Wings and Sweepback

I have built many tapered wings and have not as yet been able to see any aerodynamical advantage over straight wings of medium and high aspect ratio. The sweepback design seems to make the models bank and circle excessively.

Incidence

I once had the idea that if I increased the angle of incidence of the wing and tail, keeping the difference in angle the same, I would need less down thrust. However, after much experimenting, I found the opposite to be true. It is best to use about 2^o to 3^o incidence on the main wing.

Nose Plug and Freewheeling

The use of dress-snaps for fastening noseplugs cannot be overemphasized. Besides having the nose readily removable, the props will not break, nor will the shafts bend (as they tend to do if pins are used), because the nose merely snaps off. Be sure to use a little judgment in using the right strength snap.

The freewheeler shown has been in use for a long time, and failures have been rare. The most important factor is to make it work freely before the model has been flown. I wind all my models from the front, hooking the winder on to the freewheeler.

Visibility

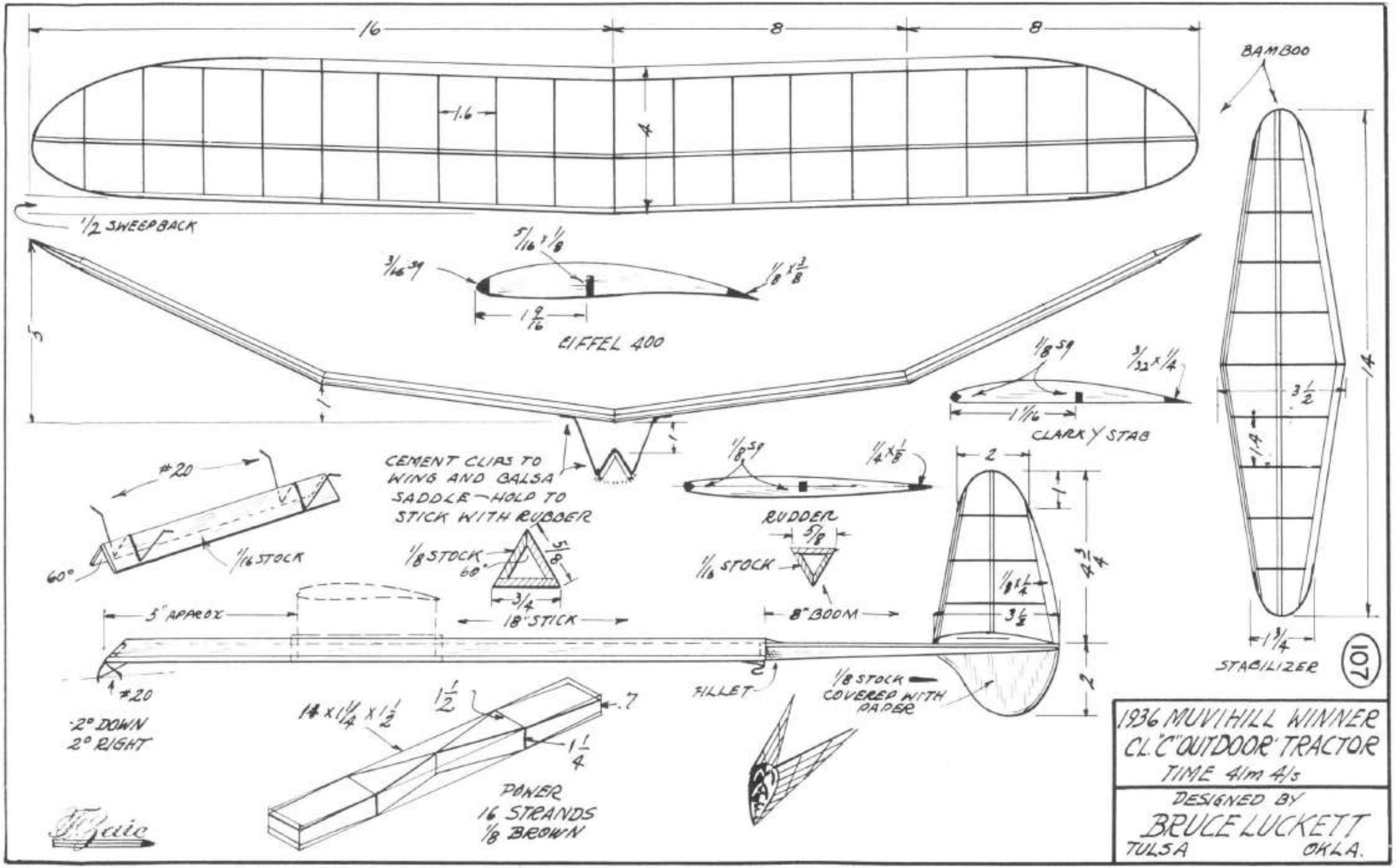
I believe that I have done about as much chasing of models that were almost in the clouds as anyone, and I find that the use of colored tissue is very satisfactory. Red, yellow, and white combined can be seen in any weather. The thing that makes models covered with colored tissue so visible is that the sun shines right through the paper. Colored tissues are strong enough if the grain runs spanwise. The specific color combination that I use is a red wing and rudder, a yellow stabilizer, and a white fuselage. Use two coats of three to one dope. More dope makes the paper brittle and warps the surfaces.

Balance

One thing that is missing in the majority of plans, is the exact position of the wing and the C. G. I contend that if any two similar models balance at the same point, they will have the same difference in angle between the wing and tail surfaces when each model is properly adjusted. Therefore, please give the balancing point whenever you have occasion to draw plans. Then, regardless of whether or not the surfaces are warped, when the ship is finally adjusted, it must have the same effective differences in angle between the surfaces.

Flying Scale Models

Since I build flying scale models primarily for duration, I attempt only those that have flying possibilities, and I also modify the model to suit this purpose. Scale models with cowlings (radial engines) and round or oval fuselages make good flyers (45 s. to 1 m. 10 s. average without thermals). The best size for biplanes seems to be from 20" to 24" wing span, and for monoplanes, 24" to 30" wing span. The construction is strong to be on the safe side, so that I can fly the model in any afternoon breeze. Quite often I come up to the weight rule requirements.



1936 MUVIHILL WINNER
CL. "C" "OUTDOOR" TRACTOR
TIME 4 m 4/s

DESIGNED BY
BRUCE LUCKETT
TULSA OKLA.

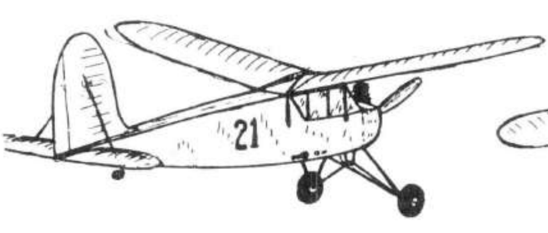
The main deviations from scale are the sizes of the stabilizer, the rudder, and the prop. The stabilizer area is about 30% of the wing area and the rudder is about 10% to 12% of the wing area. The dihedral is also slightly increased; about ½" for every foot of span. The wings are fixed normally and the model is balanced at 50% of the chord. If weight is needed for balancing, most of it should be in the form of heavy wheels and a little extra in the nose. The wing sections used were mainly the M-6 and Clark Y, but I recently tried the Eiffel 431 on a Fairchild "24" with good results.

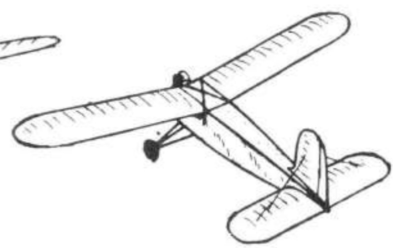
The propellers are slightly larger than 1/3 of the wing span, and are made to freewheel. I wind all of my models from the front by use of the loop on the freewheeler. In case of rubber breakage; much less damage is done if the rubber goes through the front part of the fuselage. I use enough rubber to fly the model well. If a scale model needs so much rubber in order to fly, that an excessive amount of weight is required to balance the model, it is wise to reduce the pitch of the propeller.

My best scale monoplane is a Fairchild "24" with an in-line engine. The fuselage was lengthened slightly in all directions. The rubber increase required enough balancing weight to bring the model up to weight rule. The span was 30" and the prop 11". I used 12 strands of 1/8" flat brown rubber. The wing had 1½" of dihedral, and the weight of the wheels was 1/4 oz. each. The stabilizer was 30% and the rudder 10% of the wing area. A Clark Y was used with many full and false ribs. The model had a fast and steep climb and picked up thermals best when gliding in fast right circles. I believe that a fast circle is one way of getting the model up high. My best times with this model are: 17 m., 10 m. out of sight in a haze, and 14 minutes. My best time with a 27" Udet Flamingo biplane using an airfoil similar to the M-6 is 17 minutes out of sight.

Gas Models

My second and best gas model has the following specifications:





WING
Area 530 sq. in.
Span 60 in.
Chord 9 in.
Dihedral 5 in.
Airfoil Gott. 398
(¼" under camber)

Weight 3¾ lbs.

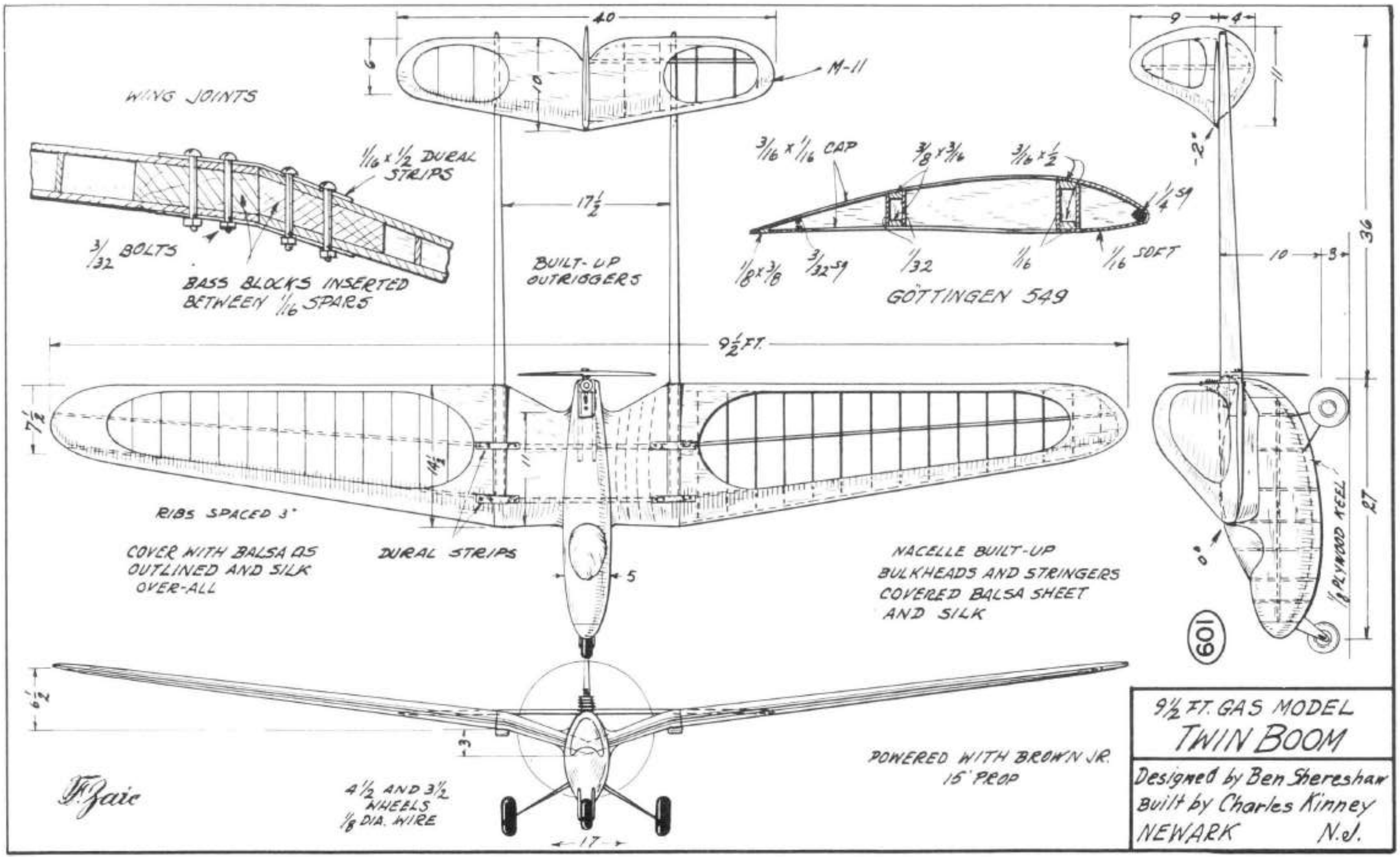
STABILIZER
Area 160 (30%)
Span 25 in.
Chord 7 in.
Airfoil Clark

ENGINE
Brown Jr.
Neg. 2° - Right ½°

RUDDER
Area 53 (10%)

FUSELAGE
Length 43 in.
Tail M.A. 28 in.
D.C. 17½% Fuselage behind the C.G.
Climb 650 ft/min

GOOD WING CONSTRUCTION



WING JOINTS
1/16 x 1/2 DURAL STRIPS
3/32 BOLTS
BASS BLOCKS INSERTED BETWEEN 1/16 SPARS
M-11
BUILT-UP OUTRIGGERS
3/16 x 1/16 CAP
3/8 x 3/16
3/16 x 1/2
1/4 SQ
1/8 x 3/8
3/32 SQ
1/32
1/16
1/16 SOFT
GÖTTINGEN 549
9 1/2 FT.
RIBS SPACED 3"
COVER WITH BALSA AS OUTLINED AND SILK OVER-ALL
DURAL STRIPS
NACELLE BUILT-UP BULKHEADS AND STRINGERS COVERED BALSA SHEET AND SILK
1/8 PLYWOOD KEEL
109
POWERED WITH BROWN JR. 15" PROP
4 1/2 AND 3 1/2 WHEELS
1/8 DIA. WIRE
9 1/2 FT. GAS MODEL
TWIN BOOM
Designed by Ben Shereshaw
Built by Charles Kinney
NEWARK N.J.
F. Zaic

Performance: Almost perfect stability in the glide, and under power the longitudinal stability is excellent. If the engine stops with the nose up, the galloping oscillations (Very appropriate--Ed.) are reduced to nothing very quickly. Climbed to 5,000 feet in 9 minutes (checked from a following plane), with the spark adjuster in the center. Glides from three to five times the motor run. Can fly well in 18 m. p. h. wind as well as take off in a cross wind. The only weakness is that it won't circle in circles of less than approximately 75 feet, without slowly spiral diving. But in spite of this, it has spiraled only once, when the rudder was warped, and that was the first broken prop in 136 flights. To date I have had 150 flights with only three broken props. The most flights that I've had in any one day is 27.

General Gas Model Hints

Airfoils: I have found the Gott. 398 with undercamber to be very good. The Eiffel 431 gives a good glide.

Dihedral: In general, one inch on each side for every foot of span is sufficient.

Stabilizer and Rudder: A lift-section stabilizer is excellent in my opinion. It is very effective and strong. An adjustable rudder is good, but the tabs must not be too big, or they will be supersensitive. Use small screws for setting the tabs. A moment-arm length of from 40 to 50% of the wing span is good.

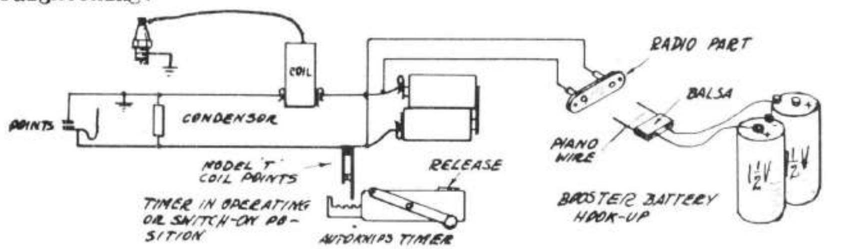
Covering: Bamboo paper is strong enough and takes paint well.

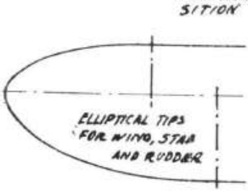
Time Switch: Almost all models in Southern California are equipped with them. For hookup, see the diagram. The flashlight cells are connected when the switch is set, which should be done before the boosters are disconnected. Allow about 7 seconds for launching time.

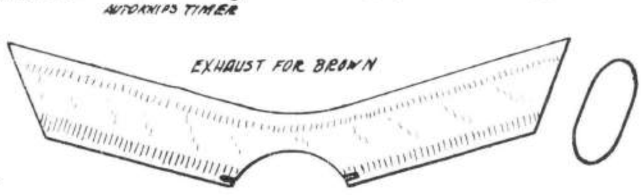
Tail Wheel or Skid: I prefer a small doughnut wheel. The tail supports should be soldered to a sheet of metal before wrapping and cementing to the fuselage.

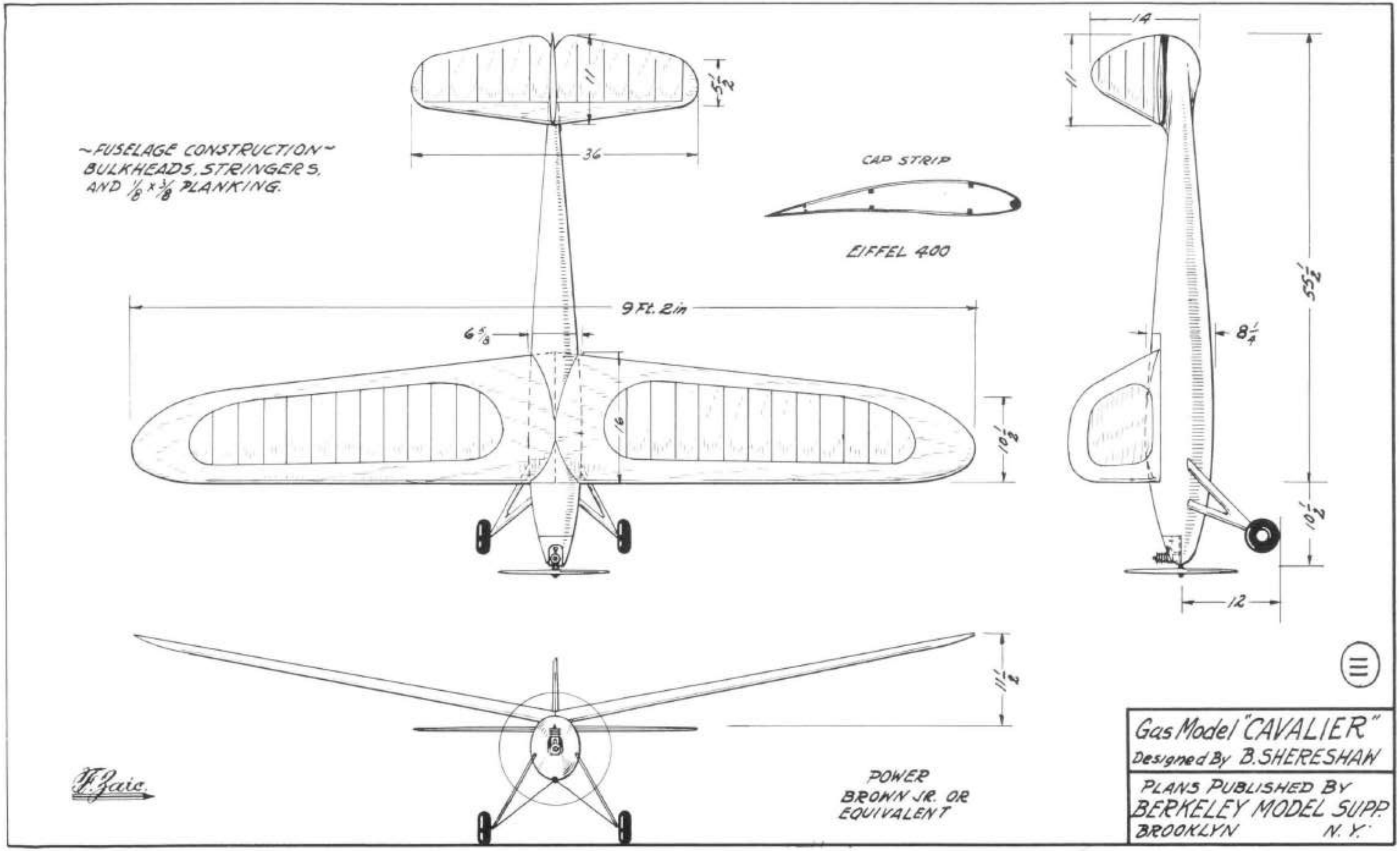
Exhaust for Brown: A piece of $\frac{1}{2}$" aluminum tubing makes an excellent exhaust. Just bend a radius in the middle of the tube, flatten, and file to fit the cylinder. Cut two small slots for the first fin. The exhaust fits over the bottom fin.

Motor Mounts: I recommend wood for mounts. Dural or 24SO will stand up for a short while, if not in too many smashes which require some straightening.









~FUSELAGE CONSTRUCTION~
BULKHEADS, STRINGERS,
AND 1/8 x 3/8 PLANKING.
36
11
5 1/2
CAP STRIP
EIFFEL 400
9 Ft. 2 in
6 5/8
16
10 1/2
14
55 1/2
8 1/4
10 1/2
12
11 1/2
POWER
BROWN JR. OR
EQUIVALENT
F. Zaic.
III
Gas Model "CAVALIER"
Designed By B. SHERESHAW
PLANS PUBLISHED BY
BERKELEY MODEL SUPP.
BROOKLYN N.Y.

How to Operate a Brown Motor

I always leave the spark lever in the vertical position. Why advance it unless you have a 10 ft. job? I adjust the needle valve and forget about it. All I use for adjustment is the choke nut. When it is wide open the engine is running full speed for that particular spark setting, and closing the air intake slows the engine down until it just chugs over. It runs at any speed between maximum and minimum depending upon the choke setting. With this arrangement I can get 23 minutes on the ground with a full tank of fuel and the choke nut open.

Testing and Adjusting

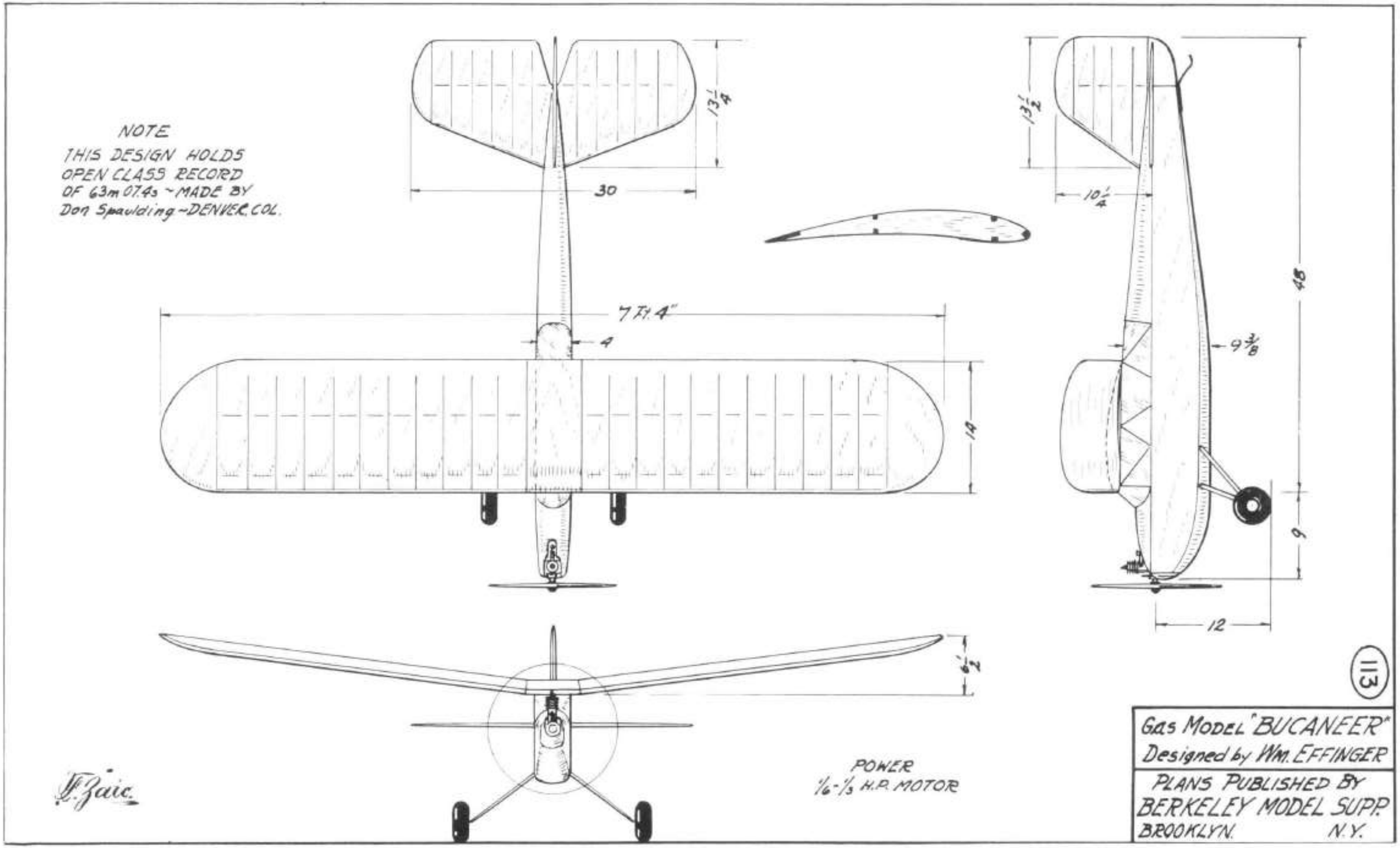
Be sure you have your plane completely finished, especially in regard to paint or dope. Surfaces are apt to warp after painting, putting your ship out of adjustment. The C. G. should be somewhere between 30% and 50% of the mean chord of the wing. If the tail surfaces are non-lifting or less than 25% of the wing area, the C. G. should be at 30%. After a final check on fastenings and line-up you are all set for testing.

The first step is to shove the model on the ground to determine if you have made any bad mistakes in adjustments. The shove should be hard enough to just about lift the model. The model should be stable in that it does not stall or bank sharply. If it does, make the necessary corrections before attempting the next step. The next step is to glide the model. If you cannot glide it, get someone who can. Run with the ship and then throw it straight at a point on the ground about 50 feet in front of you. It must not swoop or stall but should glide slightly under-elevated. The corrective adjustments are made by changing the wing or stabilizer settings or by changing the balance slightly. Do not give the wing less than 1° nor more than 3° incidence. Sharp banking should be corrected before attempting power flight.

Start the engine and get it running perfectly before attempting any flights. Set the timer for a 20 second motor run. With the engine running slowly and the model adjusted for what you think will give a straight flight, shove the ship moderately into the breeze. In all probability, it won't fly straight. Immediately adjust the ship for a circle and an even glide. Make all test flights short and run the engine slow. If the plane stalls under power it is because of the thrust line setting. By all means, don't allow you ship to fly under power to the right. Adjust the rudder for a left turn and set the thrust line right or left until the ship flies to the left. I have tested and flown five gas models ranging in size from 4 ft. 8 in. to 8 ft., all with 1/5th H. P. motors, by this method. All tests were successful.

Editor's Note: Henry has been building models since 1928. He has made over 192 models, of all types, to date. He has been a consistent contest winner. His best durations are as follows:

	Less than Wt. Rules	Wt. Rules
Cabin Model	36 min.	46 min.
Stick Model	27 "	19 "
H. L. Glider	15 "	
Flying Scale	17 "	18 "



NOTE
THIS DESIGN HOLDS
OPEN CLASS RECORD
OF 63m 07.4s ~ MADE BY
Don Spaulding ~ DENVER, COL.
30
13 1/4
7 Ft. 4"
4
14
13 1/2
10 1/4
48
9 3/8
9
12
6 1/2
POWER
1/6 - 1/3 H.P. MOTOR
113
Gas Model "BUCANEER"
Designed by Wm. EFFINGER
PLANS PUBLISHED BY
BERKELEY MODEL SUPP.
BROOKLYN. N.Y.

Petrol Model Hints

by Captain C. E. Bowden

General

The testing period is the most dangerous period of the life of the petrol model. It is therefore worthwhile thinking out a system that ensures the maximum amount of success that can be achieved.

The method I have adopted for several years now has proved itself very satisfactory and has been also used by a number of my friends, with very little damage to their models.

Before describing the actual method itself, I would like to describe certain features that I incorporate into all my gas models, whether they are high wing, low wing, or biplane. These features I consider a help toward testing and subsequent flying without damage.

Firstly, all of my models have a detachable nosepiece upon which the engine is mounted. This nosepiece is held into the nose of the fuselage by rubber bands to wire hooks, in the same way that the nosepiece of many rubber models is attached. The engine on striking any object can therefore be knocked out and the rubber bands give to the blow instead of the crankshaft. Again, this method allows slight alteration of the thrust line and offset of the thrust to counteract engine torque, by the simple method of inserting slips of packing wood between the detachable mounting and the fuselage. Fig. 1. is a sketch of the method.

All of my models have their cantilever wings and tailplanes attached by rubber bands to wire hooks that protrude from the fuselage. Thus the rubber bands hardly show, and yet allow the wings, etc. to be knocked off in the event of a crackup.

Thirdly, I always fit a type of undercarriage that assures a backward movement twist followed by an upward movement. This takes up the blow of gliding into the ground, for a gas model is naturally not "flattened off" and stalled to a three point landing by a pilot. It glides into the ground. The undercarriage must therefore be well forward and give backwards first.

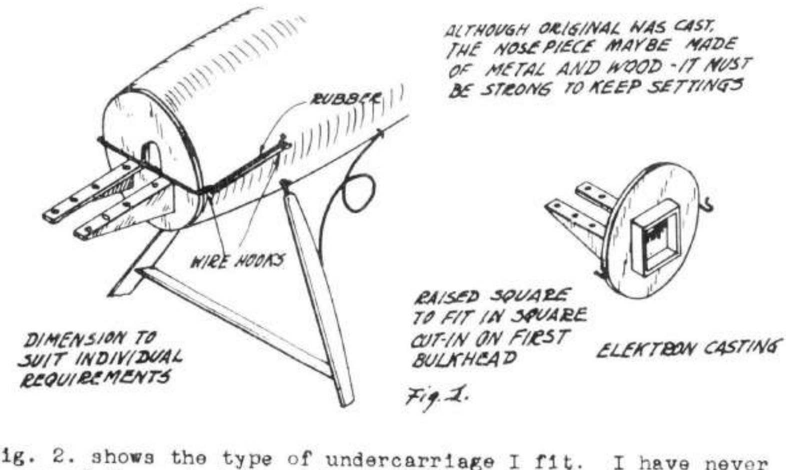
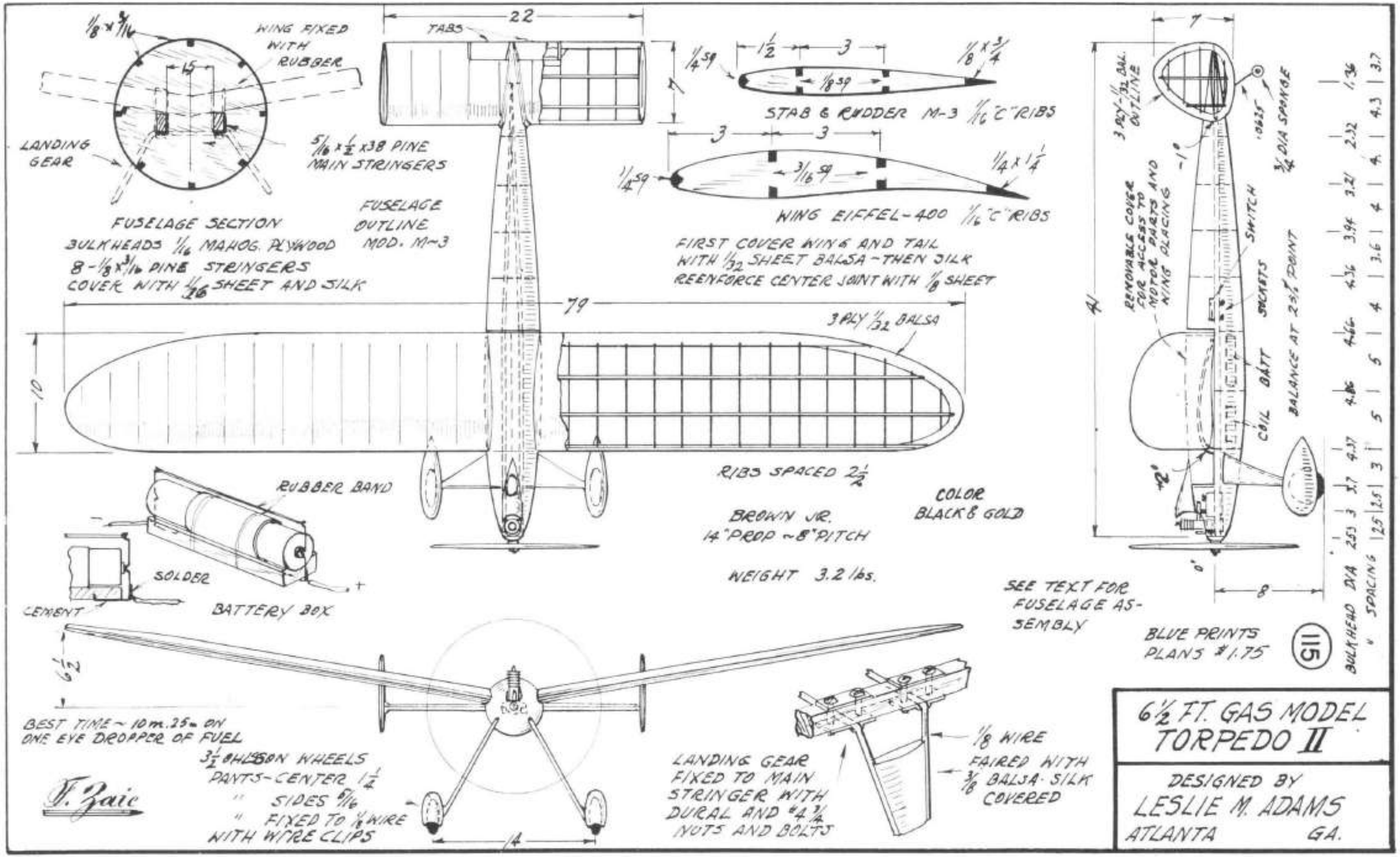


Fig. 1.

Fig. 2. shows the type of undercarriage I fit. I have never known one of these to become damaged and seldom do they allow any damage to a fuselage, owing to their large range of travel in the right direction.



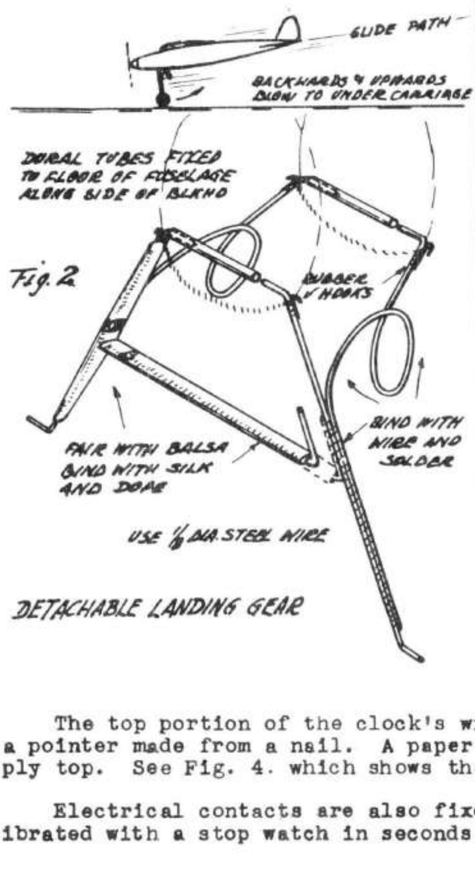
WING FIXED WITH RUBBER
LANDING GEAR
5/16 x 1/2 x 38 PINE MAIN STRINGERS
FUSELAGE SECTION
BULKHEADS 1/16 MAHOG. PLYWOOD
8 - 1/8 x 3/16 PINE STRINGERS
COVER WITH 1/16 SHEET AND SILK
FUSELAGE OUTLINE MOD. M-3
TABS
22
STAB & RUDDER M-3 1/16 "C" RIBS
WING EIFFEL-400 1/16 "C" RIBS
FIRST COVER WING AND TAIL WITH 1/32 SHEET BALSA - THEN SILK
REENFORCE CENTER JOINT WITH 1/8 SHEET
79
3 PLY 1/32 BALSA
RIBS SPACED 2 1/2
RUBBER BAND
SOLDER
CEMENT
BATTERY BOX
BROWN JR.
14" PROP ~ 8" PITCH
WEIGHT 3.2 lbs.
COLOR BLACK & GOLD
3 PLY - 1/32 BAL. OUTLINE
REMOVABLE COVER FOR ACCESS TO MOTOR PARTS AND WING PLACING
SWITCH
SOCKETS
BATT
COIL
BALANCE AT 25% POINT
3/4 DIA SPONGE
SEE TEXT FOR FUSELAGE ASSEMBLY
BULKHEAD DIA
SPACING
BLUE PRINTS PLANS $1.75
115
BEST TIME ~ 10 m. 25 s. ON ONE EYE DROPPER OF FUEL
3 1/2 OHLSSON WHEELS
PANTS - CENTER 1 1/4
" SIDES 5/16
" FIXED TO 1/8 WIRE WITH WIRE CLIPS
LANDING GEAR FIXED TO MAIN STRINGER WITH DURAL AND #4 3/4 NUTS AND BOLTS
1/8 WIRE FAIRED WITH 3/8 BALSA - SILK COVERED
F. Zaic
6 1/2 FT. GAS MODEL
TORPEDO II
DESIGNED BY
LESLIE M. ADAMS
ATLANTA GA.

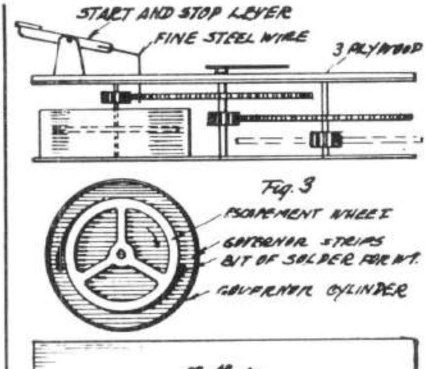
Fourthly, I consider it essential to fit a model with a device that will definitely control the duration of flight to within seconds. This is both a safety device and a great help in test work as the reader will shortly see.

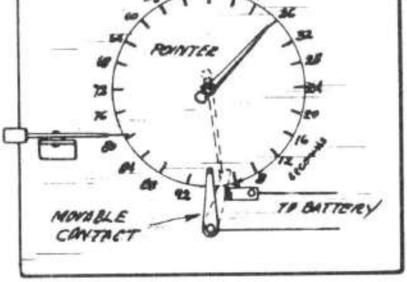
The best control device I know of is made from the "works" of a half-dollar small clock. The mechanism operates an ignition switch and cuts the current from one of the battery leads after any predetermined time.

The mechanism is extracted from the case of a cheap clock, and the case, the hands, and the dial are scrapped. The escapement movement is next removed and discarded with the exception of the escapement wheel which is converted into a governor. Little metal strips are attached at one end to the escapement wheel opposite each other and the other ends of the strips are left free but have blobs of solder attached. A small tin cylinder is then made for the escapement wheel to revolve inside with its weights on the ends of their strips of sheet metal, but not touching the tin cylinder which is soldered into position in the works of the clock. The above is a governor which at a certain speed whirls the strips with their weights out into a light frictional contact with the walls of the cylinder.

A small starting and stopping device is next fitted to a three ply top to the clock. See Fig. 3., which is a side elevation of the clock timer.



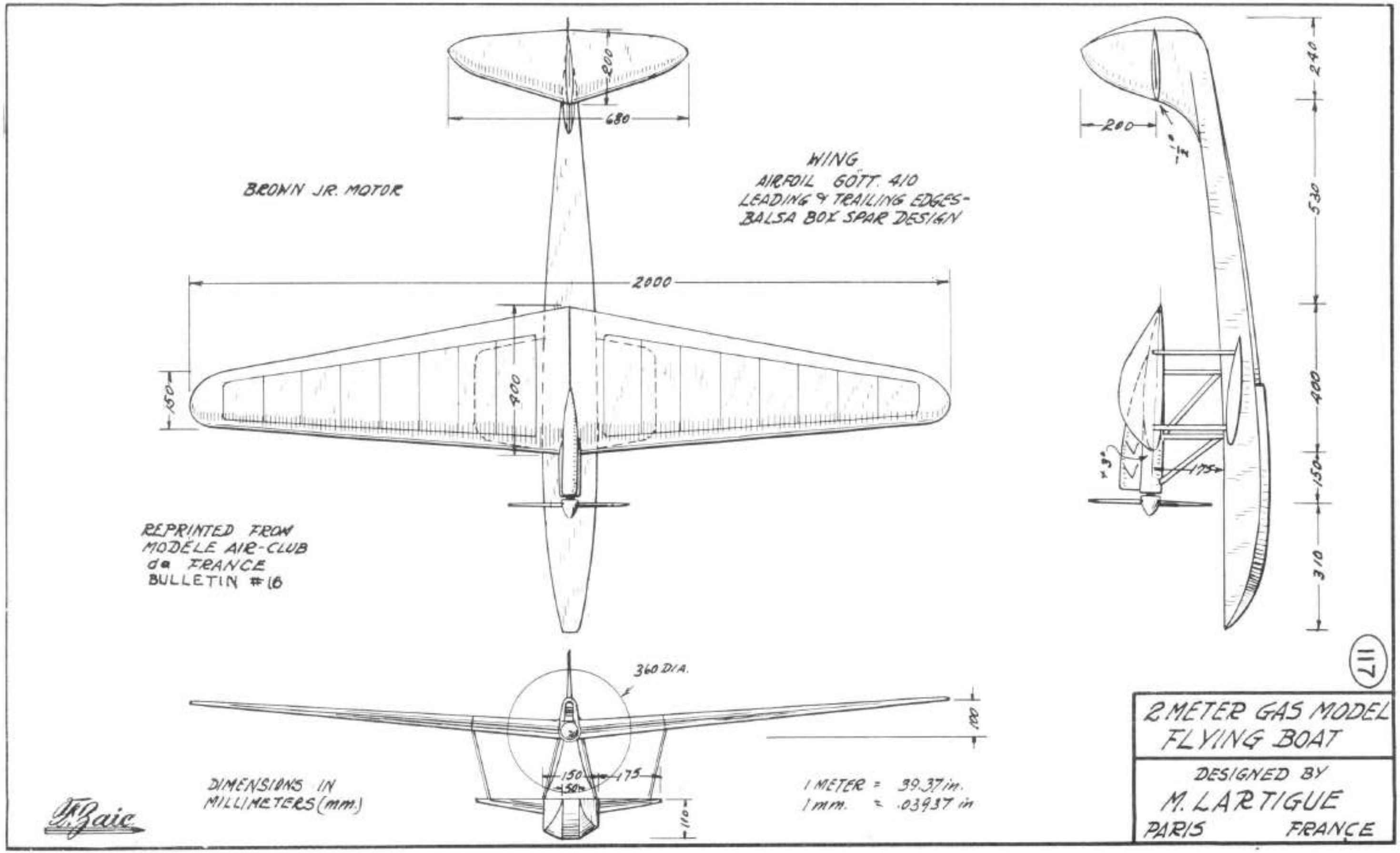




SET WITH POINTER

The top portion of the clock's winding key is now replaced with a pointer made from a nail. A paper dial is next fitted to the three ply top. See Fig. 4. which shows the top of the device.

Electrical contacts are also fixed as shown, and the dial is calibrated with a stop watch in seconds.



117
2 METER GAS MODEL
FLYING BOAT
DESIGNED BY
M. LARTIGUE
PARIS FRANCE
BROWN JR. MOTOR
WING
AIRFOIL GÖTT. 410
LEADING & TRAILING EDGES-
BALSA BOX SPAR DESIGN
REPRINTED FROM
MODÈLE AIR-CLUB
de FRANCE
BULLETIN #16
DIMENSIONS IN
MILLIMETERS (mm.)
1 METER = 39.37 in.
1 mm. = .03937 in
360 DIA.
2000
680
200
400
150
100
110
175
240
530
310

To operate the time switch, the top and start lever is raised and the pointer wound up to the required number of seconds as shown on the dial. The switch is connected and the engine is started up. Just before releasing the model, the clock starting lever is pressed and the time switch will stop the engine after the correct time as set on the dial.

With this device it is possible to test out a model with complete safety, starting with a short hop of, let us say, five seconds, and gradually increasing the duration until perfect trim is obtained.

It is also possible to fly a model in a small field. Mr. Allman, a former winner of the Wakefield Cup, designed this device. This clock device can be made detachable and fitted into various models.

Testing a Gas Model

I invariably carry out the following procedure when trying out my new models, and as a result of this procedure and the methods of design already described, I very seldom indeed do any damage during this critical period.

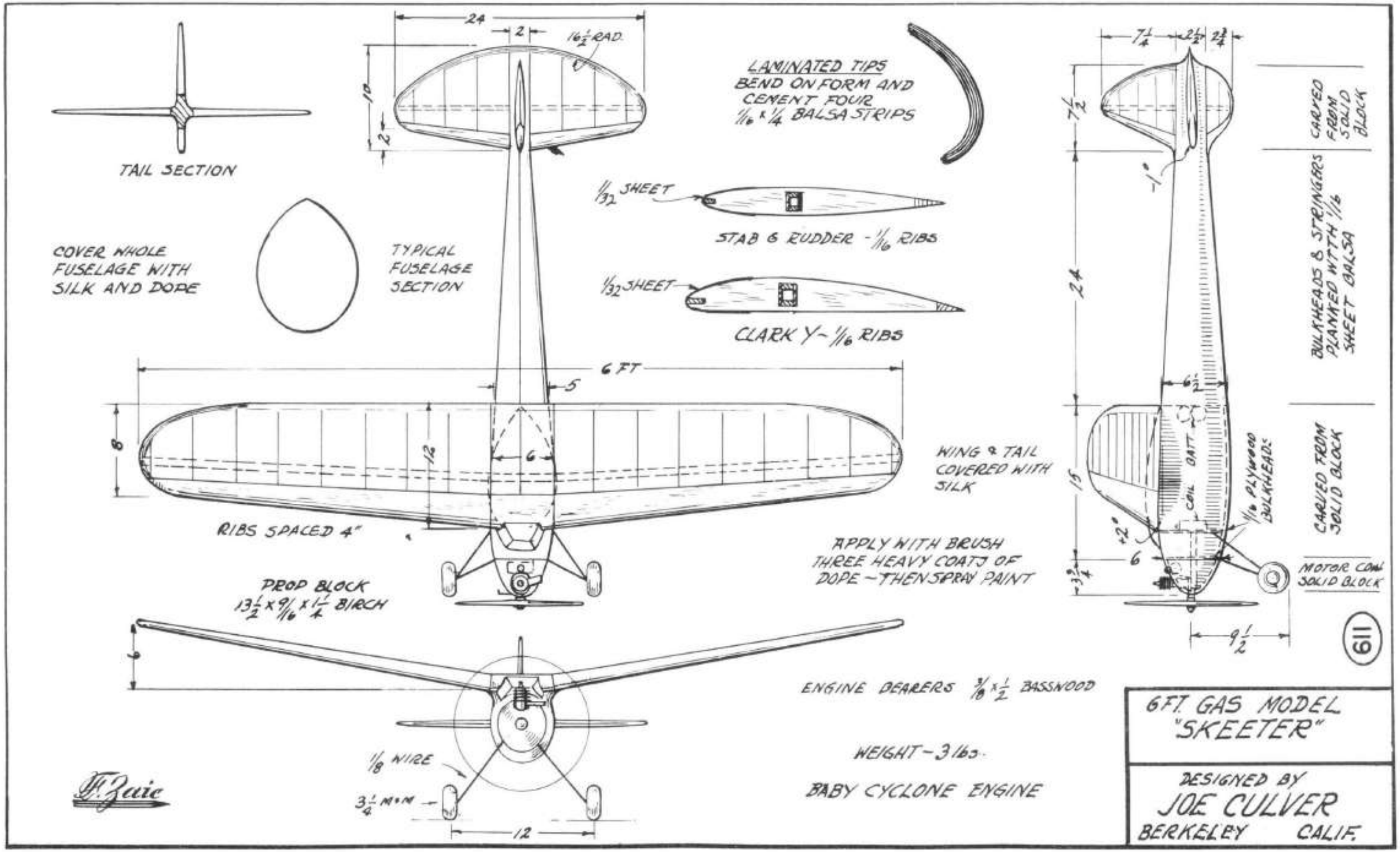
Having obtained the correct wing position in relation to the Centre of Gravity of the model, i. e. the C. G. at about 1/3 from the leading edge of the wing, and having also allowed for the correct angles of incidence of the wing and tailplane in the design, the model should be glided carefully by hand into a slight wind, and any small adjustments made so that the model makes good flat glides. The model must be a good glider if good landings after power flight is completed, are to be obtained.

Now a five second hop can be tried under power, controlled by the clock mechanism. But before this is tried, the detachable nosepiece must be tilted downward (i. e. "downthrust") by packing wood slips between the detachable engine mount and the fuselage nose. The nosepiece must also have a slight offset to counteract the engine torque. Release the model, and if it will not rise during its five second run, reduce the downthrust a little at a time until the model just starts to get off the ground. Now try a longer flight and if all is well and a good landing is obtained, as it should be after a good glide, the wood packings between the detachable nosepiece and fuselage can be permanently glued into position and covered over with silk and doped to keep into position.

If you have never tried the above method, just give it a trial and give up crackups!

As the reader will probably know, if the wing is placed very high in relation to the engine thrust line (as in a parasol or high wing model), then there will be a tendency for the engine to pull the nose up around the very high centre of pressure of the wing and so cause a stall. Many people first test their models under power and in order to stop stalling under these circumstances they move the wing back a little. When the power ceases the model becomes nose heavy and dives to a crackup.

The correct method is to give the right amount of downthrust to counteract the stalling tendency and to leave the wing in its correct gliding position over the C. G. Good landings and glides will then be obtained. The detachable nosepiece allows this to be obtained very easily.



TAIL SECTION
COVER WHOLE FUSELAGE WITH SILK AND DOPE
TYPICAL FUSELAGE SECTION
LAMINATED TIPS
BEND ON FORM AND CEMENT FOUR 1/16 x 1/4 BALSA STRIPS
16 1/2 RAD.
1/32 SHEET
STAB & RUDDER - 1/16 RIBS
1/32 SHEET
CLARK Y - 1/16 RIBS
6 FT
RIBS SPACED 4"
WING & TAIL COVERED WITH SILK
APPLY WITH BRUSH THREE HEAVY COATS OF DOPE - THEN SPRAY PAINT
PROP BLOCK
13 1/2 x 9/16 x 1 1/4 BIRCH
CARVED FROM SOLID BLOCK
BULKHEADS & STRINGERS PLANKED WITH 1/16 SHEET BALSA
CARVED FROM SOLID BLOCK
1/16 PLYWOOD BULKHEADS
COIL
BATT
MOTOR COWL SOLID BLOCK
611
ENGINE BEARERS 3/8 x 1/2 BASSWOOD
WEIGHT - 3 lbs.
BABY CYCLONE ENGINE
1/8 WIRE
3 1/4 M+M
6 FT. GAS MODEL
"SKEETER"
DESIGNED BY
JOE CULVER
BERKELEY CALIF.

Building a Gas Job

by Rod Doyle

The boys out here on the West Coast build smaller models than the Eastern fellows. The smaller ships have proved to be not as good for N. A. A. contest flying when in competition with the regular eight footers and larger models. However, the smaller jobs give more soul-satisfying flights. A snappy take-off and a steep climb are something that is fun to watch. Smaller models also require less material, and can be carried to and from the airport in an ordinary sedan (not a box car).

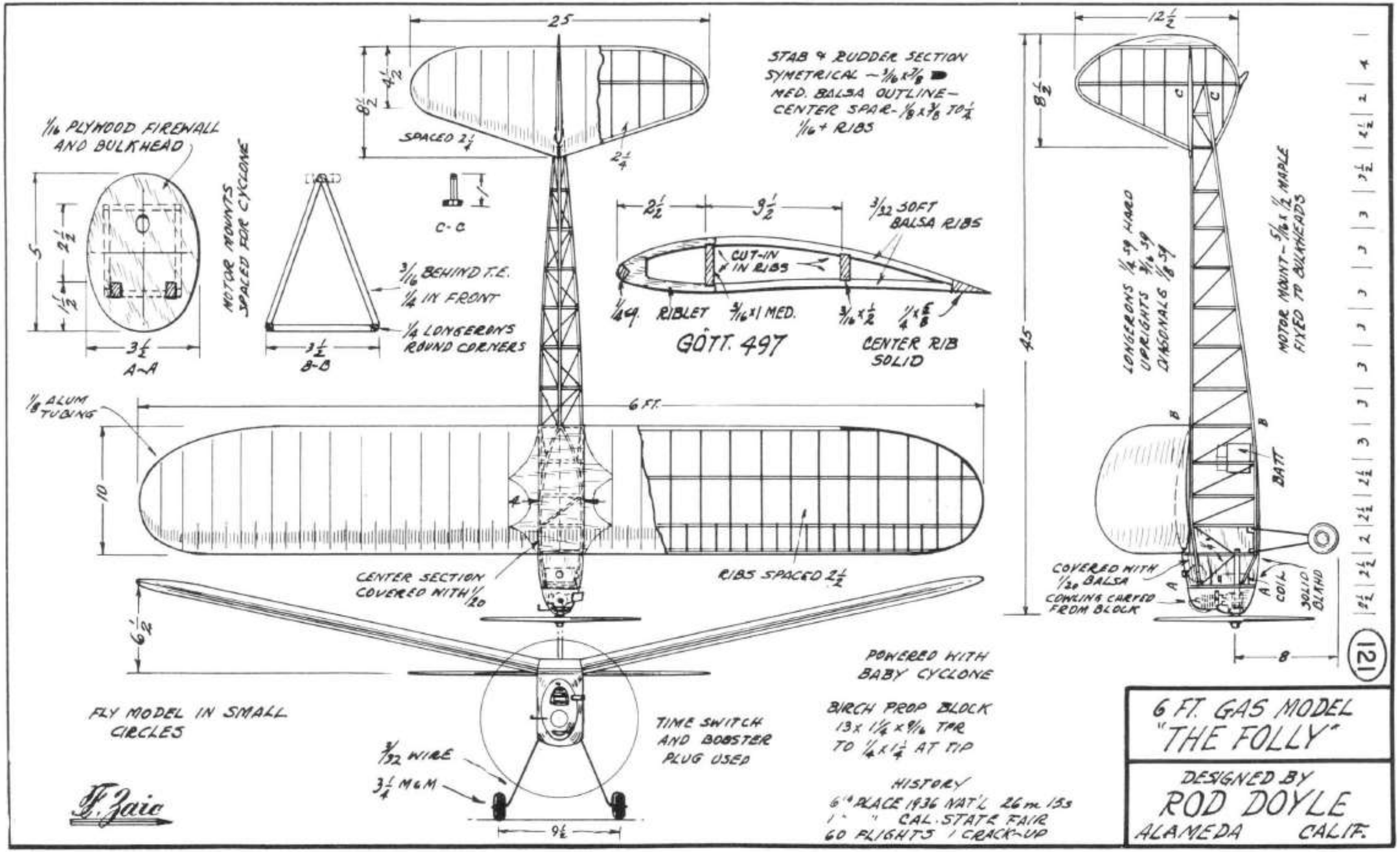
The factor that had quite a bit to do with the designing of the relatively small size West Coast gas job is the type of contest held out here. The contests are for performance, and not endurance alone. The performance rating takes into consideration the take-off, climb, glide, precision landing, and the construction and finish of the model. For example, our last State Fair gas event was judged according to the following rules: The engine run was limited to 30 seconds; the construction rating was fixed at a total of 125 points for neatness, originality, and color and finish; the flying rating was set as follows-- 75 points were given for take-off, climb and glide. The total rating thus obtained was added to the flying time in seconds in order to obtain the final point standing. These rules produced an exceedingly interesting event.

Following are a few general points concerning gas models, that I have found quite satisfactory: Keep the motor mount as short as possible to eliminate vibration. Maple engine bearers are very good. A simple steel wire landing gear is the best. I prefer using under-cambered airfoils of the Gottingen type, as they have high lift at the gliding angle and also have a high stalling point. Fastening the wing to the fuselage with rubber bands is good in preventing breakage in crackups.

My procedure when covering with silk is as follows: I get No. 2¾ Japan silk from coffin manufacturers. It costs about 25 cents a yard. (Ordinary silk costs about 60 cents a yard.) This silk is strong enough to work with and it also takes a good finish. I apply it with aircraft dope like tissue, attaching it to the center section, then the tips, and then to the sides. Wrinkles can be removed by applying dope over the attaching points, one section at a time, and when the previous dope has loosened, by pulling the silk loose and drawing out the wrinkles. The silk is flexible enough to cover compound curves well. The best colors to use in my opinion are either aluminum or silver for light weight, and lacquer trimmings for decoration.

Engine and Hook-up Suggestions

Have all the connections well soldered to eliminate loss through fittings, such as bolts and twisted wires. Use a plug for the outside batteries for easy starting. Try to get a two-way phone jack which cuts out the inside batteries when the plug is in, and switches on the inside batteries when the plug is removed. Keep the condenser as close to the contact points as possible. Use exactly the fuel mixture specified by the engine manufacturers. Keep the fuel clean and free from grit; strain it if in doubt. Don't take the engine apart unless it is absolutely necessary, and then use care. Do not use a prop that is too light, or one with a pitch that is too high, as the engine will not rev. full and will not cool properly. We have found that birch is a very good wood for props. It is a bit harder to carve but it is worth the extra trouble. Keep the engine adjustments a little rich (very little) as the mixture leans out in the air and the



STAB & RUDDER SECTION SYMETRICAL — 3/16 x 3/8 MED. BALSA OUTLINE— CENTER SPAR— 1/8 x 3/8 TO 1/4 1/16 + RIBS
1/16 PLYWOOD FIREWALL AND BULKHEAD
MOTOR MOUNTS SPACED FOR CYCLONE
A-A
B-B
C-C
3/16 BEHIND T.E.
1/4 IN FRONT
1/4 LONGERONS ROUND CORNERS
SPACED 2 1/4
3/32 SOFT BALSA RIBS
CUT-IN IN RIBS
RIBLET
3/16 x 1 MED.
CENTER RIB SOLID
GÖTT. 497
LONGERONS 1/4 SQ. HARD
UPRIGHTS 3/16 SQ.
DIAGONALS 1/8 SQ.
MOTOR MOUNT— 5/16 x 1/2 MAPLE FIXED TO BULKHEADS
1/8 ALUM TUBING
6 FT.
CENTER SECTION COVERED WITH 1/20
RIBS SPACED 2 1/2
BATT
COVERED WITH 1/20 BALSA
COWLING CARVED FROM BLOCK
COIL
SOLID BLKHD
121
POWERED WITH BABY CYCLONE
BIRCH PROP BLOCK 13 x 1 1/4 x 9/16 TPR TO 1/4 x 1 1/4 AT TIP
FLY MODEL IN SMALL CIRCLES
TIME SWITCH AND BOOSTER PLUG USED
3/32 WIRE
3 1/4 M & M
HISTORY
6th PLACE 1936 NAT'L 26 m. 15 s.
1st " " CAL. STATE FAIR
60 FLIGHTS 1 CRACK-UP
6 FT. GAS MODEL "THE FOLLY"
DESIGNED BY ROD DOYLE ALAMEDA CALIF.
F. Zaic

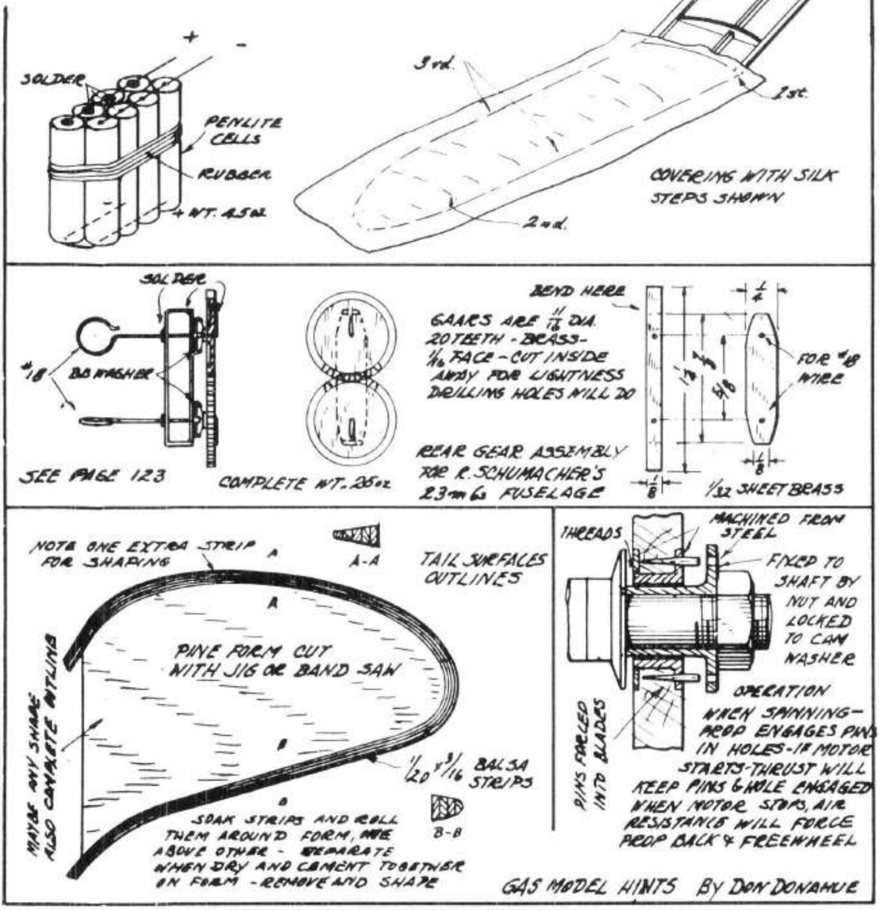
engine is liable to quit if it is started lean. A nice set of batteries can be made from PenLite cells. Eight of them hooked up in parallel series will provide a good hot spark and will have quite a long life, providing that you get fresh cells. The weight of the setup is about $4\frac{1}{2}$ ounces.

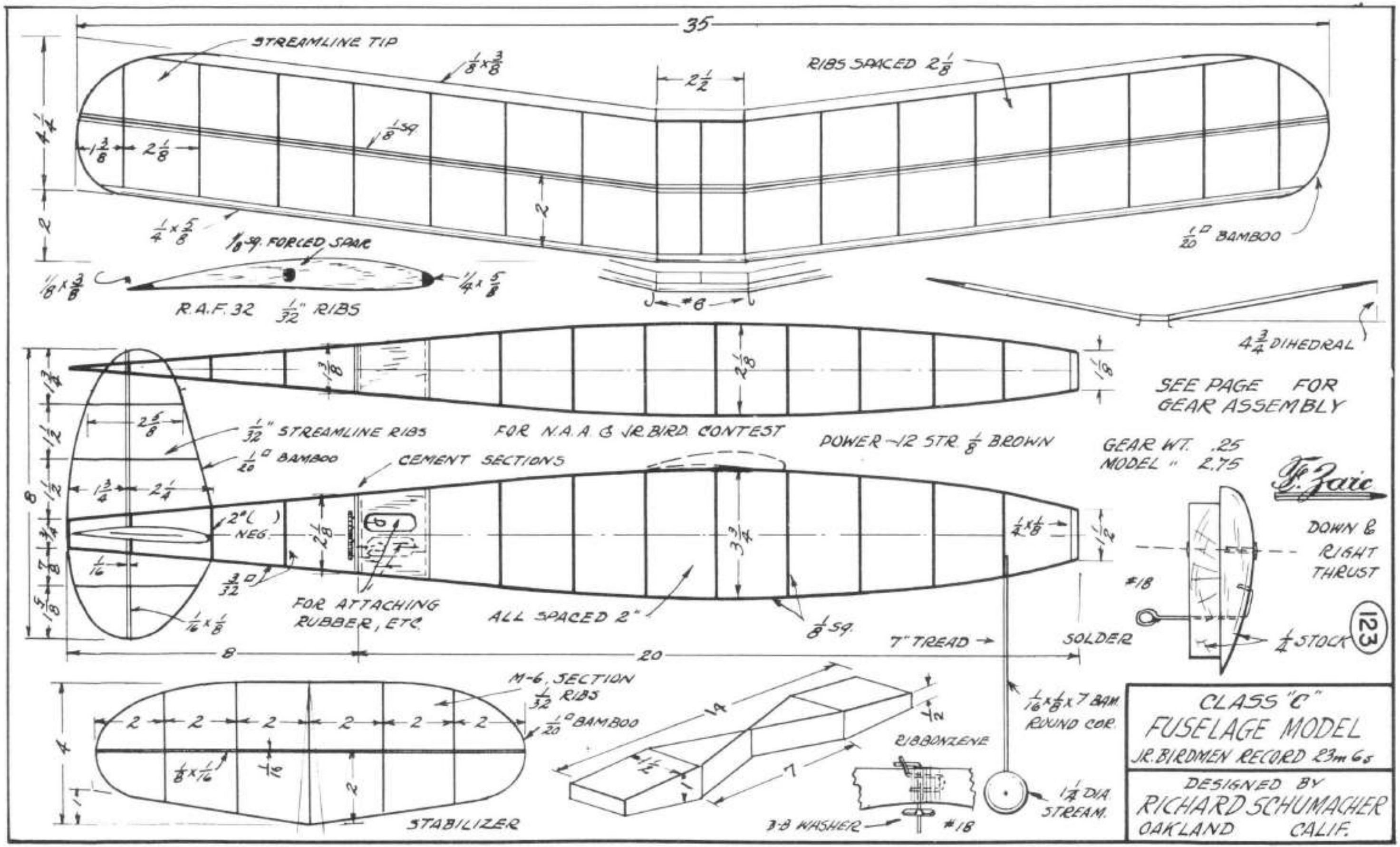
Concerning Flying

I cannot say very much about flying, but from my own experience I have found that by flying with the torque, the model is a bit more controllable. That is, if the ship gets into a tight circle it does not have such a spinning tendency. A ship can be rigged for a very steep climb providing it can be flown in small circles.

In conclusion

The longer I build and fly models, the more I hate to see a lucky flight win. I think that the gas model rules should be modified for the Nationals, because the luck element is quite large under the present rules. An average of three flights might help, but here again the retrieving troubles set in. The logical and simplest solution seems to be to limit the fuel allowance to a lower percentage than heretofore. What do you think?




35
STREAMLINE TIP
1/8 x 3/8
RIBS SPACED 2 1/8
2 1/2
4 1/4
1/8 SQ.
1 3/8
2 1/8
2
1/4 x 5/8
1/8 SQ. FORCED SPAR
1/20 □ BAMBOO
1/8 x 3/8
1/4 x 5/8
R.A.F. 32 1/32" RIBS
#6
4 3/4 DIHEDRAL
1 3/4
3/8
2 1/8
1/8
SEE PAGE FOR
GEAR ASSEMBLY
2 5/8
1 1/2
1/32" STREAMLINE RIBS
FOR N.A.A. & JR. BIRD. CONTEST
POWER – 12 STR. 1/8 BROWN
GEAR WT. .25
MODEL " 2.75
1/20 □ BAMBOO
CEMENT SECTIONS
8
1 3/4
2 1/4
2° ( ) NEG.
2 1/8
3 3/4
1/4 x 1/8
1/2
DOWN & RIGHT THRUST
7/8
1/16
3/32 □
#18
5/8
FOR ATTACHING RUBBER, ETC.
ALL SPACED 2"
1/8 SQ.
1/16 x 1/8
7" TREAD
SOLDER
1/4 STOCK
123
8
20
M-6 SECTION
1/32 RIBS
1/20 □ BAMBOO
14
1/2
2
4
1/8 x 1/16
1/16
1/2
1
7
1/16 x 1/8 x 7 BAM.
ROUND COR.
RIBBONZENE
1 1/4 DIA.
STREAM.
STABILIZER
3-8 WASHER
#18
CLASS "C"
FUSELAGE MODEL
JR. BIRDMEN RECORD 23m 6s
DESIGNED BY
RICHARD SCHUMACHER
OAKLAND CALIF.

CONTRIBUTIONS

by the
Chicago Aeronuts

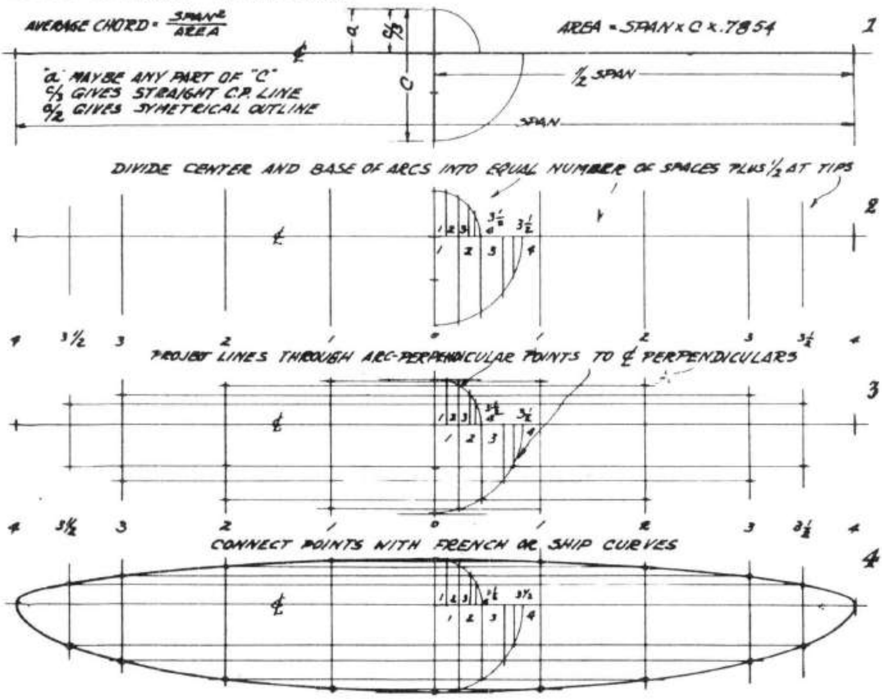
Historical Note; The club was formed in November of 1935. From the original seven members, the group now has 26 active members at present, with many boys on the waiting list. Within a year they have become very formidable in the local contests by placing high in the prize winning end, especially indoors. The 1936 Nationals found them a bit rusty outdoors, but a good hard, active summer makes them feel capable of out-Tulsa-ing the Tulsanians. The club is sponsoring many projects of a sensible nature. Some of them are disclosed here while others are kept for that contest surprise. The Aeronuts definitely have proved again that in unity there is strength, and that cooperation helps both you and me.

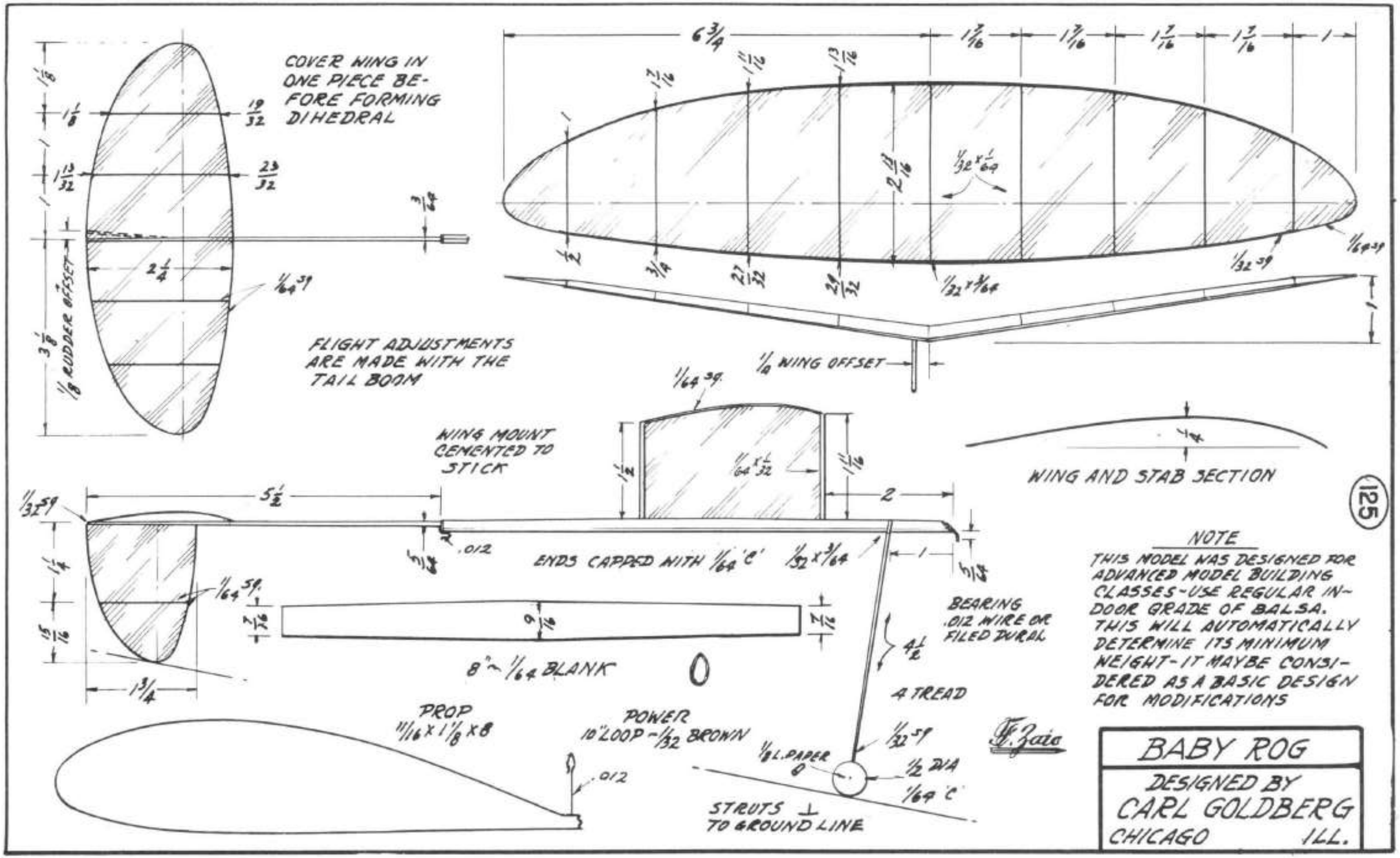
DOUBLE ELLIPSE

by Carl Goldberg

The "double ellipse" wing shape was apparently developed simultaneously by Carl Goldberg, Jack Jenkins, and Lawrence Smithline, early in 1935. Various arguments can be presented to show that it is the most efficient shape yet developed. It should be employed on the wing and tail surfaces of all model airplanes which seek the highest possible efficiency. A distinct trend towards this design can be noted in the British Supermarine-Spitfire and the Heinkel transport HE-70, both very fast and efficient.

The speediest method of laying out the ellipse is to use the method shown by J. P. Glass in the 1935-36 Year Book. Just consider the final double ellipse as being a combination of two halves of the same length but of different widths. It is from this fact that the name "double ellipse" is derived.




125
COVER WING IN ONE PIECE BEFORE FORMING DIHEDRAL
FLIGHT ADJUSTMENTS ARE MADE WITH THE TAIL BOOM
1/8 RUDDER OFFSET
1/4 WING OFFSET
WING MOUNT CEMENTED TO STICK
ENDS CAPPED WITH 1/64 'C'
WING AND STAB SECTION
BEARING .012 WIRE OR FILED DURAL
4 TREAD
8" ~ 1/64 BLANK
PROP 11/16 x 1 1/8 x 8
POWER 10" LOOP - 1/32 BROWN
1/8 L. PAPER
1/2 DIA 1/64 'C'
STRUTS ⊥ TO GROUND LINE
NOTE
THIS MODEL WAS DESIGNED FOR ADVANCED MODEL BUILDING CLASSES-USE REGULAR INDOOR GRADE OF BALSA. THIS WILL AUTOMATICALLY DETERMINE ITS MINIMUM WEIGHT-IT MAYBE CONSIDERED AS A BASIC DESIGN FOR MODIFICATIONS
BABY ROG
DESIGNED BY CARL GOLDBERG
CHICAGO ILL.

Double-Surfaced Monospar Microfilm Prop

Developed by Sidney Axlerod
Suggested by Carl Goldberg

The propeller design as shown is the sixth of the experimental series. It is 16½" in diameter and weighs only .007 oz.; with a variable pitch device it weighs .015 oz., which is still below the average of the wooden propeller. It has had numerous flight tests and it has proved to be superior to the ordinary microfilm prop. The center spar and the double surfacing remove all the disadvantages formerly attributed to the microfilm prop.

The construction procedure is similar to wing construction, and is comparatively simple if directions are followed faithfully. The result will be a perfectly true and sturdy prop.

1. Make the form from a block of wood with the desired pitch and diameter dimensions. Cut the helix perfectly flat from the leading to the trailing edge. This is important and should be done carefully.

2. Draw the prop outline and cut the pattern in the wood.

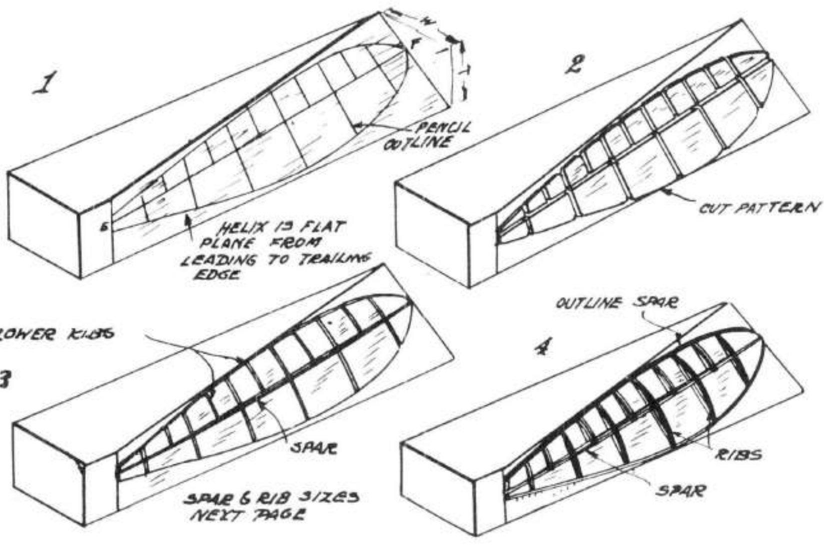
3. Cut the spars and ribs to specification. Note the curve of the center spar to accomodate the undercamber variations. Also note that the ribs are of quarter-grain stock, and that the curve given will fit all points on the diameter.

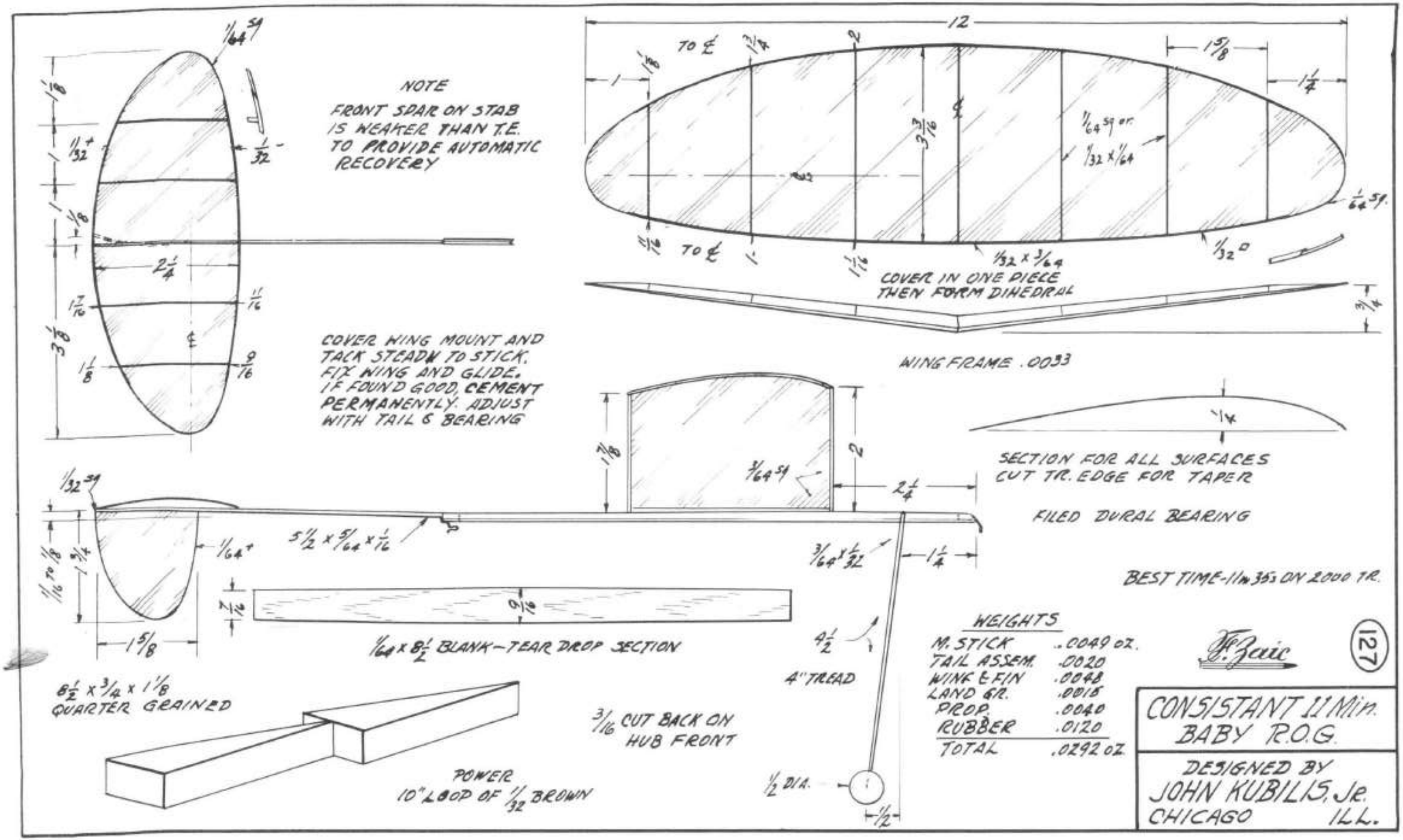
4. Position the spars on the E-F line, and begin to cement the lower ribs into place. After the lower ribs are set, the upper ones can be cemented. Trim the ends to the outline line.

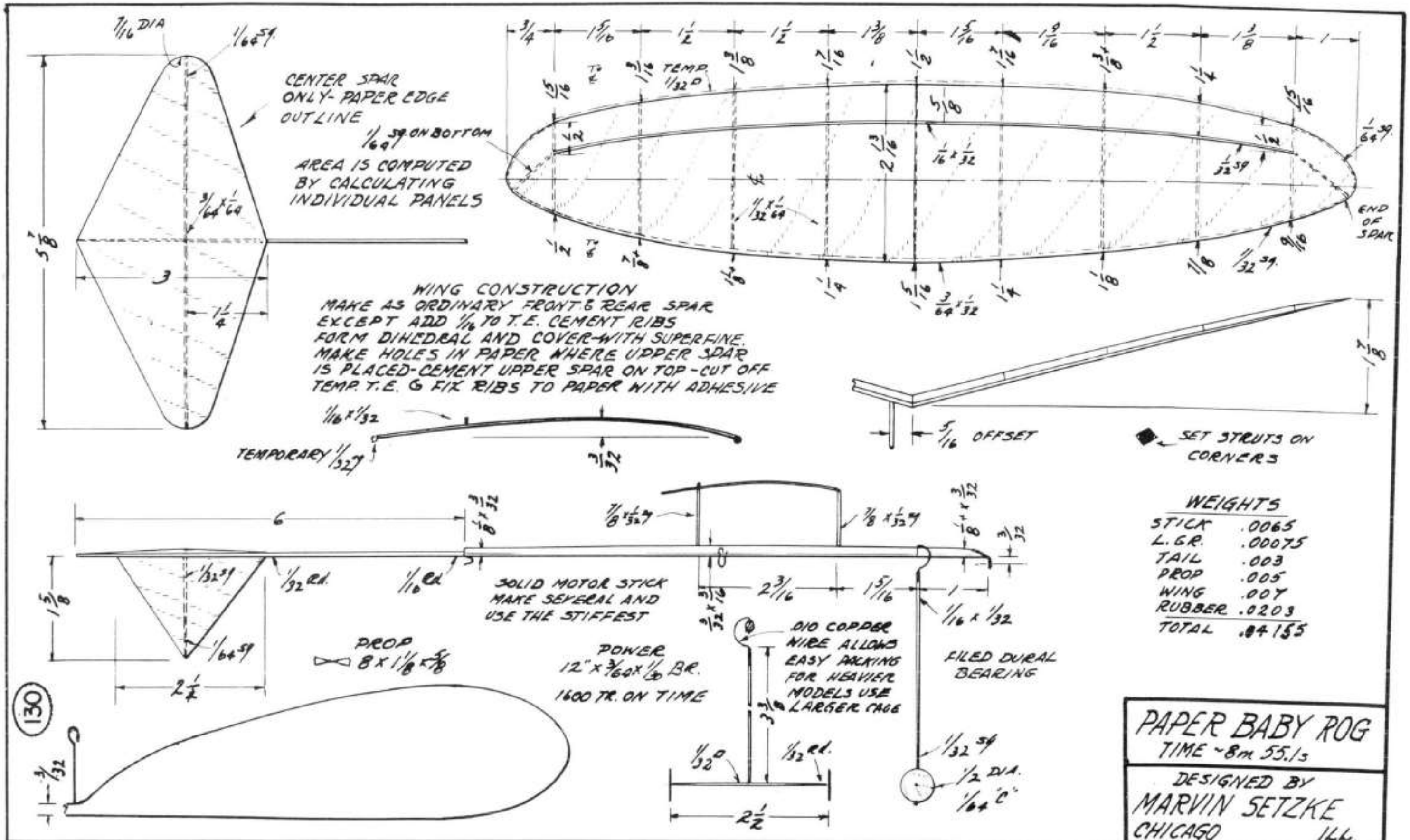
5. The leading and trailing edges are made of one piece, which is cemented onto the center and leading edge ribs first and then rolled around the form and cemented to the trailing edge ribs.

6. Reenforce the hub with 1/32" balsa as shown, and also cement tungsten to the top and bottom of the ribs to keep the film from sticking together. The prop half is now ready to be removed from the form.

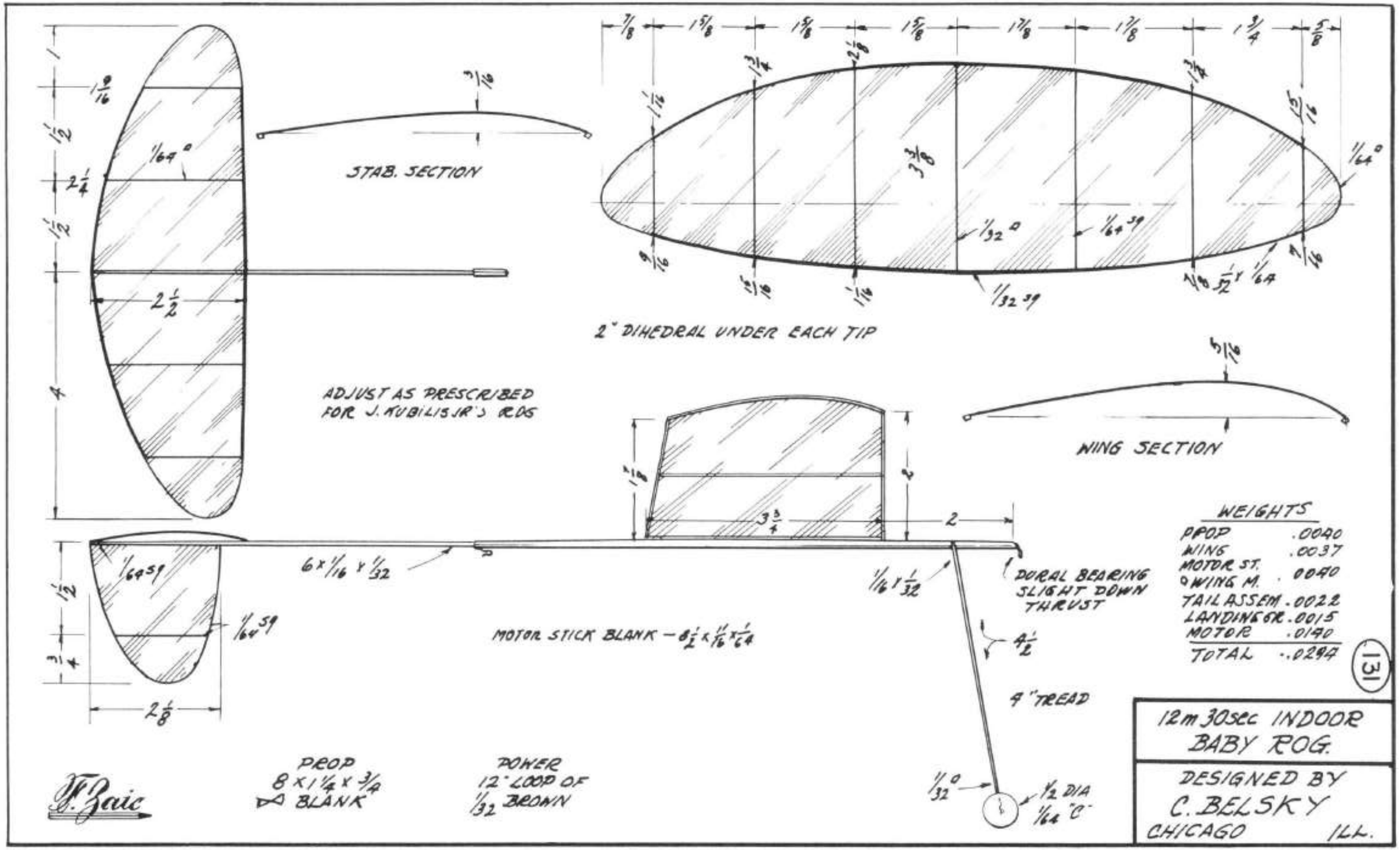
7. Make the other half. Assemble by lapping the hubs for extra strength. Insert the prop shaft and cover with film. After covering let the water adhesive set and dry before trying the prop out. The construction time is about 4 hours, in comparison to the 5-6 hours required for the carving of a wooden propeller.




NOTE
FRONT SPAR ON STAB IS WEAKER THAN T.E. TO PROVIDE AUTOMATIC RECOVERY
COVER WING MOUNT AND TACK STEADY TO STICK. FIX WING AND GLIDE. IF FOUND GOOD, CEMENT PERMANENTLY. ADJUST WITH TAIL & BEARING
COVER IN ONE PIECE THEN FORM DIHEDRAL
WING FRAME .0033
SECTION FOR ALL SURFACES
CUT TR. EDGE FOR TAPER
FILED DURAL BEARING
BEST TIME-11m 35s ON 2000 TR.
1/64 x 8 1/2 BLANK—TEAR DROP SECTION
5 1/2 x 5/64 x 1/16
8 1/2 x 3/4 x 1 1/8
QUARTER GRAINED
3/16 CUT BACK ON HUB FRONT
POWER
10" LOOP OF 1/32 BROWN
4" TREAD
1/2 DIA.
WEIGHTS
M. STICK .0049 OZ.
TAIL ASSEM. .0020
WING & FIN .0048
LAND GR. .0015
PROP. .0040
RUBBER .0120
TOTAL .0292 OZ.
F. Zaic
127
CONSISTANT 11 Min.
BABY R.O.G.
DESIGNED BY
JOHN KUBILIS, Jr.
CHICAGO ILL.



CENTER SPAR ONLY- PAPER EDGE OUTLINE
1/64 SQ. ON BOTTOM
AREA IS COMPUTED BY CALCULATING INDIVIDUAL PANELS
TEMP. 1/32 □
END OF SPAR
WING CONSTRUCTION
MAKE AS ORDINARY FRONT & REAR SPAR EXCEPT ADD 1/16 TO T.E. CEMENT RIBS FORM DIHEDRAL AND COVER-WITH SUPERFINE. MAKE HOLES IN PAPER WHERE UPPER SPAR IS PLACED-CEMENT UPPER SPAR ON TOP-CUT OFF TEMP. T.E. & FIX RIBS TO PAPER WITH ADHESIVE
TEMPORARY 1/32 SQ.
5/16 OFFSET
SET STRUTS ON CORNERS
SOLID MOTOR STICK MAKE SEVERAL AND USE THE STIFFEST
PROP 8 x 1 1/8 x 5/8
POWER 12" x 3/64 x 1/30 BR.
1600 TR. ON TIME
.010 COPPER WIRE ALLOWS EASY PACKING FOR HEAVIER MODELS USE LARGER CAGE
FILED DURAL BEARING
1/2 DIA.
1/64 "C"
WEIGHTS
STICK .0065
L.GR. .00075
TAIL .003
PROP .005
WING .007
RUBBER .0203
TOTAL .04155
130
PAPER BABY ROG
TIME ~ 8m 55.1s
DESIGNED BY MARVIN SETZKE
CHICAGO ILL.



STAB. SECTION
2" DIHEDRAL UNDER EACH TIP
ADJUST AS PRESCRIBED
FOR J. KUBILIS JR'S RDS
WING SECTION
DURAL BEARING
SLIGHT DOWN
THRUST
4" TREAD
MOTOR STICK BLANK
WEIGHTS
PROP .0040
WING .0037
MOTOR ST. .0040
WING M. .0040
TAIL ASSEM .0022
LANDING GR. .0015
MOTOR .0140
TOTAL .0294
131
12m 30sec INDOOR
BABY ROG.
DESIGNED BY
C. BELSKY
CHICAGO ILL.
PROP
BLANK
POWER
12" LOOP OF
1/32 BROWN
F. Zaic

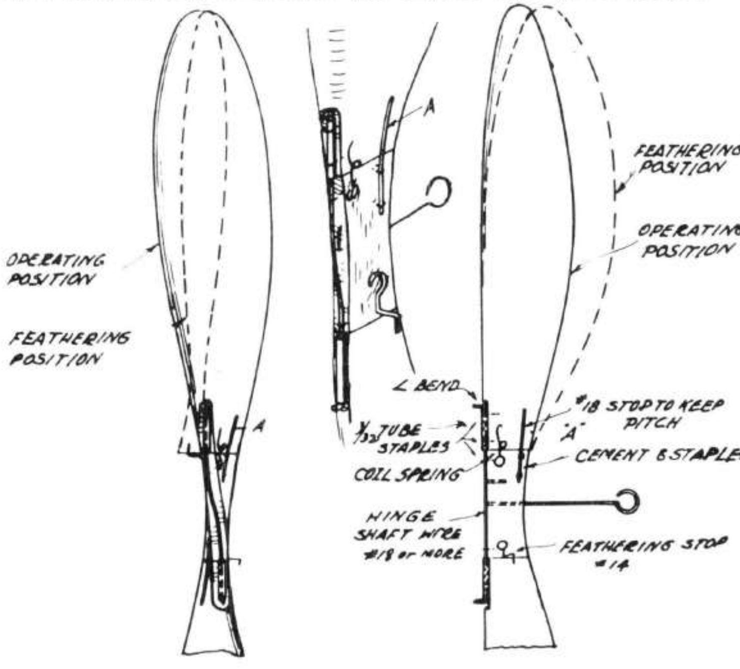
Feathering Propeller

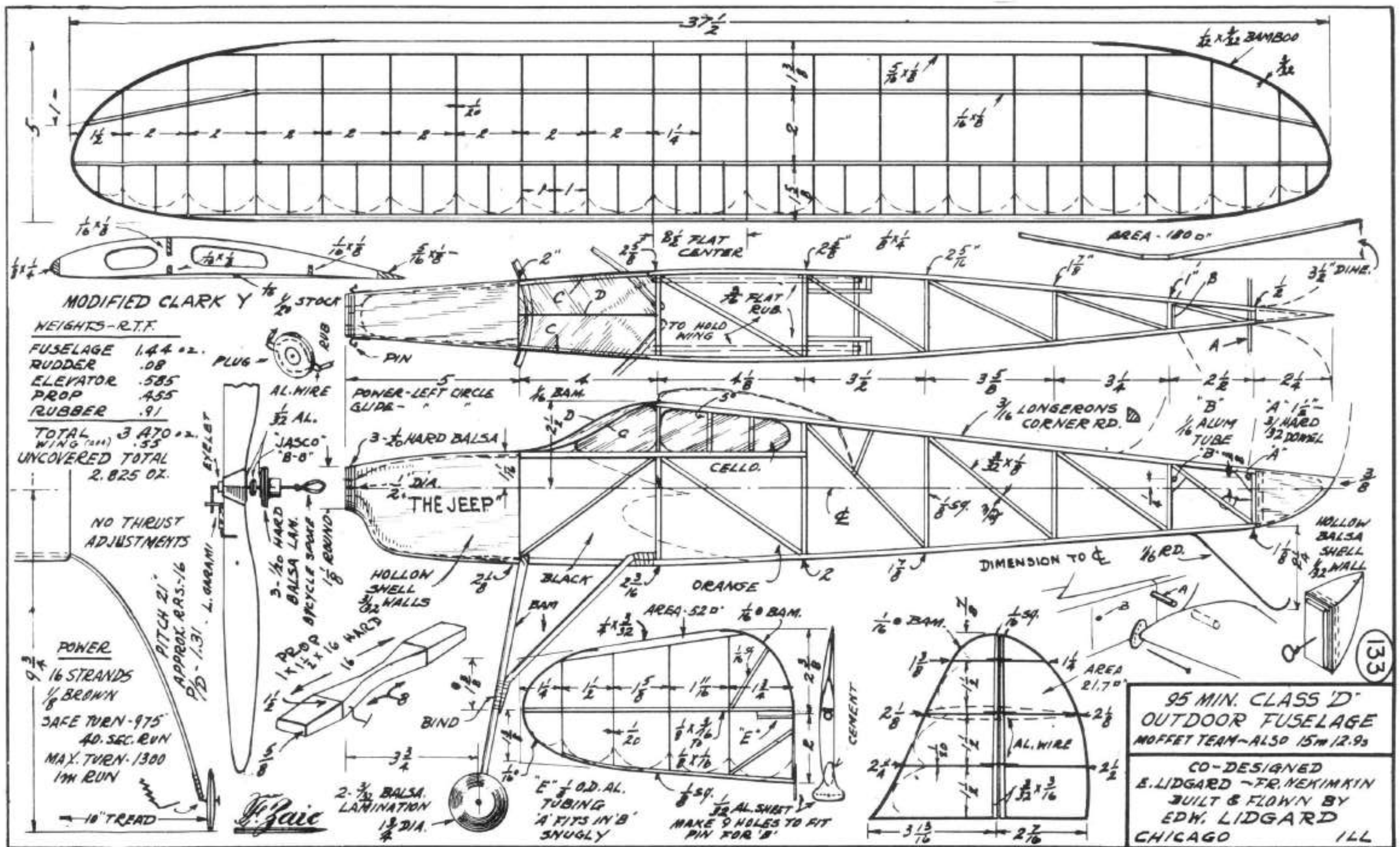
Developed by Marvin Setzke
Suggested by Carl Goldberg

"Feathering: the ability of a pivoted or free surface to automatically assume its best L/D position or present minimum frontal area."

The propeller as shown in the plans is the third of the experimental project to determine the value of feathering props. The first one, hinged but without a spring and with only the main stop, fluttered but it nevertheless improved the glide beyond my expectations. Since then, I have made numerous excellent flights when using the feathering prop. One evening at about 7 o'clock with the temperature close to 60°, I wound up the rubber about 340 turns for a test flight. The model rose to approximately 250 feet with a 30 second prop run. The glide lasted for 3 minutes, turning in a flight of 3m. 30s. under still air conditions. The prop may be used in conjunction with freewheeling to facilitate removal as well as to take care of any possible accidental failures. It may be stopped in any desired position by using the rubber tensioner and any appropriately placed stop. The exact combination can best be determined by individual requirements. The best duration obtained to date with a feathering prop is 2 hours and 30 minutes, with an 18" prop with 18 strands on a 2.8 oz. N. A. A. Cabin Fuselage job.

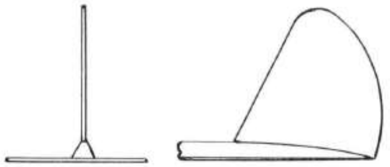
1. Carve the prop in usual manner. Determine and mark the hinge point. Cut in 3/32" for the wire and tube parts. Cut and shape the needed hardware. Be sure to slip the aluminum tubing into the hinge wire before bending the ends as shown.
2. Cement the tube to blades and wire to the hub. Reenforce with staples and tissue or silk covering.
3. Cement the wire stop "A" and reenforce it with staples and silk.
4. Cut the blades at the pivot points. Cement the coil spring to assure positive action.
5. Face the prop and equalize the upper and lower areas. Fix them in position temporarily with pins and cement .014 wire stops.



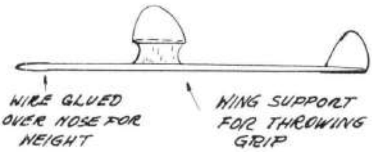


133
95 MIN. CLASS 'D'
OUTDOOR FUSELAGE
MOFFET TEAM–ALSO 15m 12.9s
CO-DESIGNED
E. LIDGARD ~ FR. NEKIMKIN
BUILT & FLOWN BY
EDW. LIDGARD
CHICAGO ILL
MODIFIED CLARK Y
WEIGHTS-R.T.F.
FUSELAGE 1.44 oz.
RUDDER .08
ELEVATOR .585
PROP .455
RUBBER .91
TOTAL 3.470 oz.
WING .55
UNCOVERED TOTAL 2.825 OZ.
NO THRUST ADJUSTMENTS
PITCH 21"
APPROX. R.R.S.-16
P/D - 1.31
L. GARAMI
POWER
16 STRANDS
1/8 BROWN
SAFE TURN-975
40. SEC. RUN
MAX. TURN-1300
1 1/4 M RUN
10" TREAD
THE JEEP
HOLLOW SHELL 3/32 WALLS
3-1/20 HARD BALSA
POWER-LEFT CIRCLE
GLIDE- " "
3/16 LONGERONS CORNER RD.
CELLO.
BLACK
ORANGE
DIMENSION TO ℄
HOLLOW BALSA SHELL 1/32 WALL
1/16 RD.
1/16 ALUM TUBE
3/32 HARD DOWEL
8 1/2 FLAT CENTER
3/8 FLAT RUB.
TO HOLD WING
AREA-180 □"
3 1/2" DIHE.
1/32 x 3/32 BAMBOO
37 1/2
AREA-52 □"
AREA 21.7 □"
AL. WIRE
1/16 ⌀ BAM.
"E" 1/8 O.D. AL. TUBING
'A' FITS IN 'B' SNUGLY
1/32 AL. SHEET
MAKE 9 HOLES TO FIT PIN FOR 'B'
CEMENT
2-3/32 BALSA LAMINATION
1 3/4 DIA.
BIND
BAM
1 PROP 1 x 1 1/2 x 16 HARD
3-1/20 HARD BALSA LAM.
BICYCLE SPOKE
1/8 ROUND
"JASCO" "B-8"
1/32 AL.
AL. WIRE
PLUG
RUB
EYELET
PIN
1/20 STOCK
F. Zaic

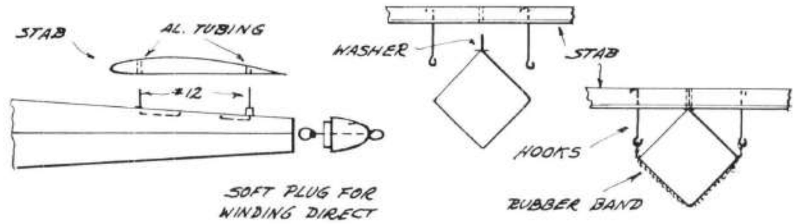
BY EDMOND B. SWORT



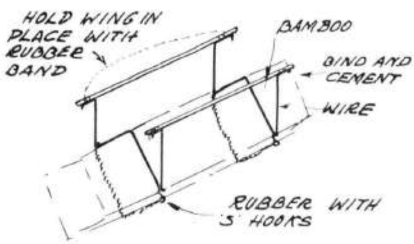
LESS TURBULANCE BY MOUNTING STAB BELOW FUSELAGE ON GLIDER



USE PINE OR OTHER HARD WOOD FOR FUSELAGE -MAYBE MADE SMALLER FOR LESS DRAG

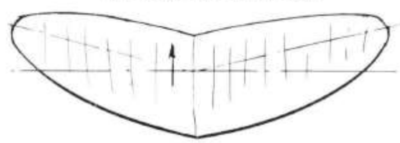


ATTACHING TAIL ON DIAMOND FUSELAGES

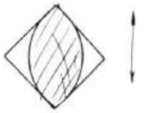


REMOVABLE WING MOUNT FOR ON-EDGE FUSELAGE

SWEPT FORWARD INDOOR STABILIZER



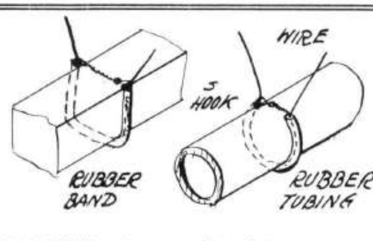
A DIVE WILL WASHOUT THE STAB AND SO PRODUCE CORRECTIVE FORCE – LESS DRAG THAN SETTING TIPS NEG.



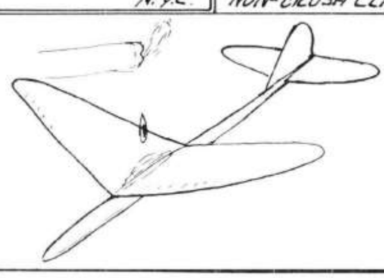
SIMPLE STREAMLINING FOR INDOOR STRUTS

DOUBLE PAPER COVERING ON OUTDOOR MODELS GIVES SUPER-STRENGTH. BE SURE TO CROSS GRAIN

DITTO BY D.B.HECHT N.Y.C.

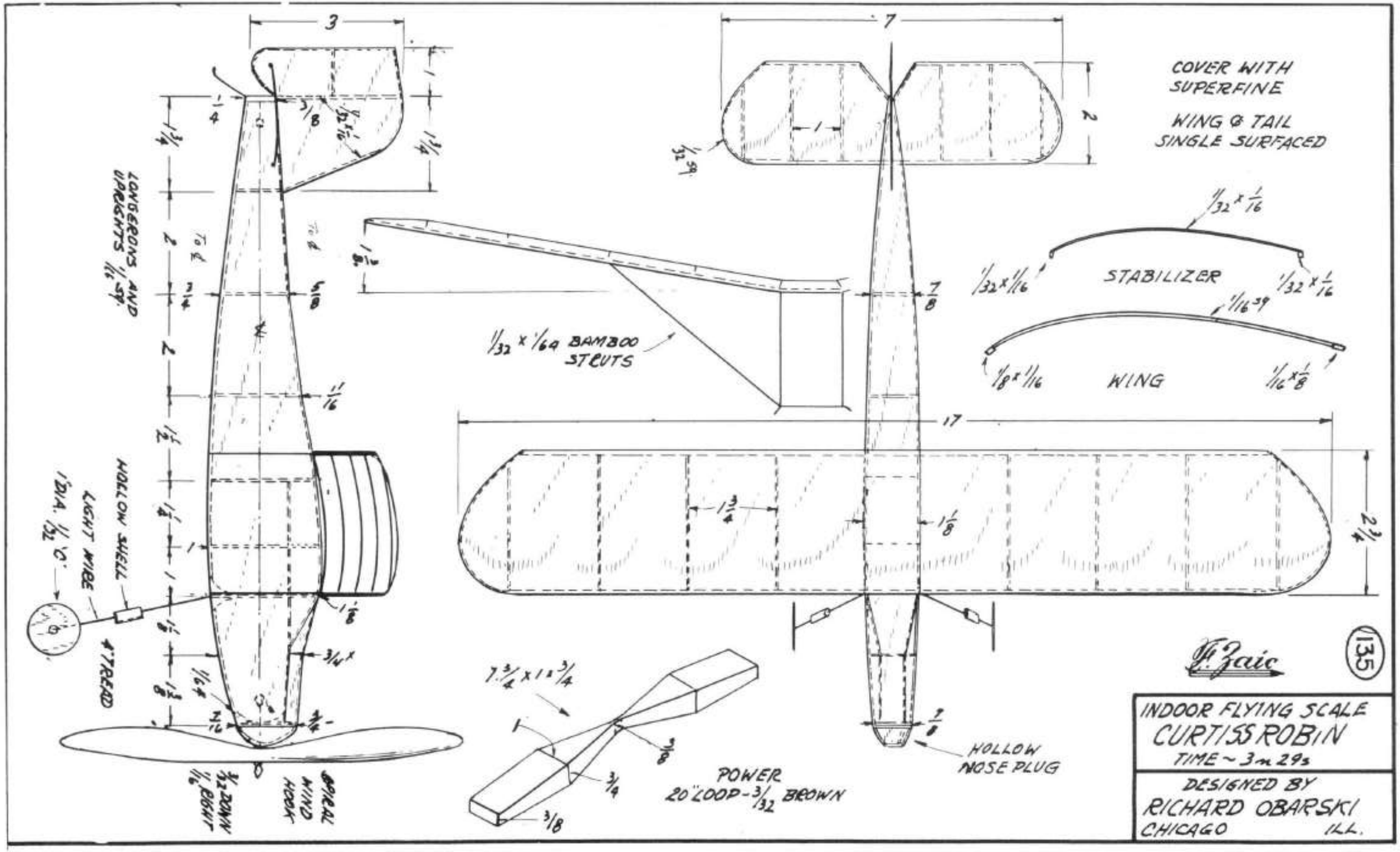


NON-CRUSH CLIPS BY J.KUBILIS

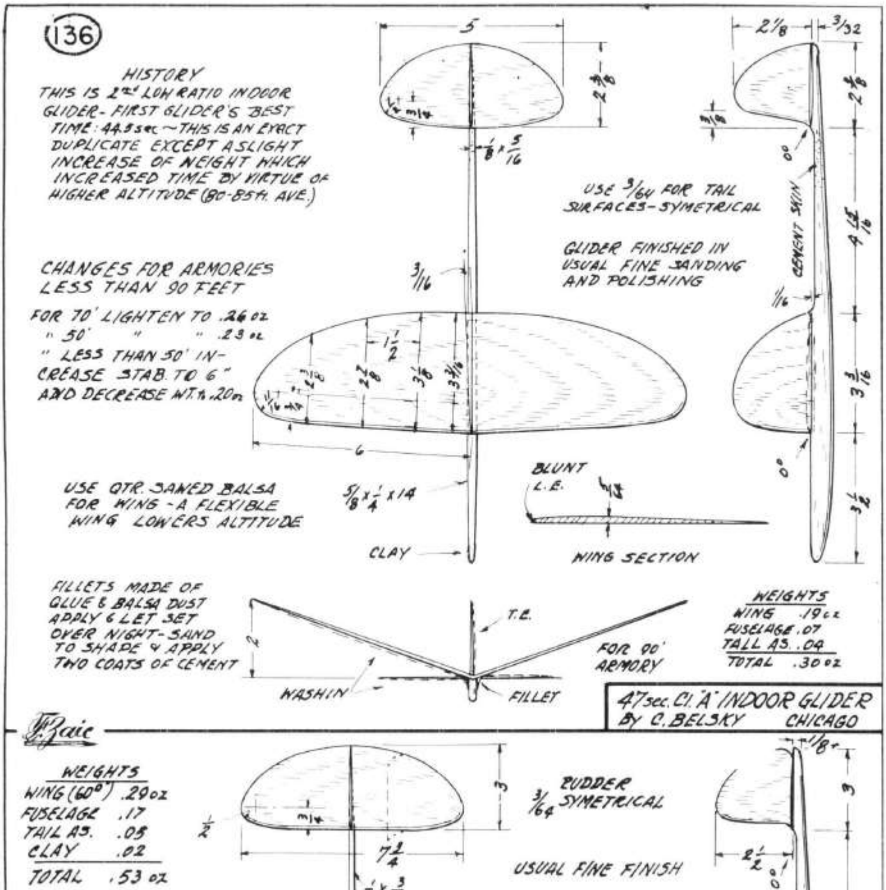


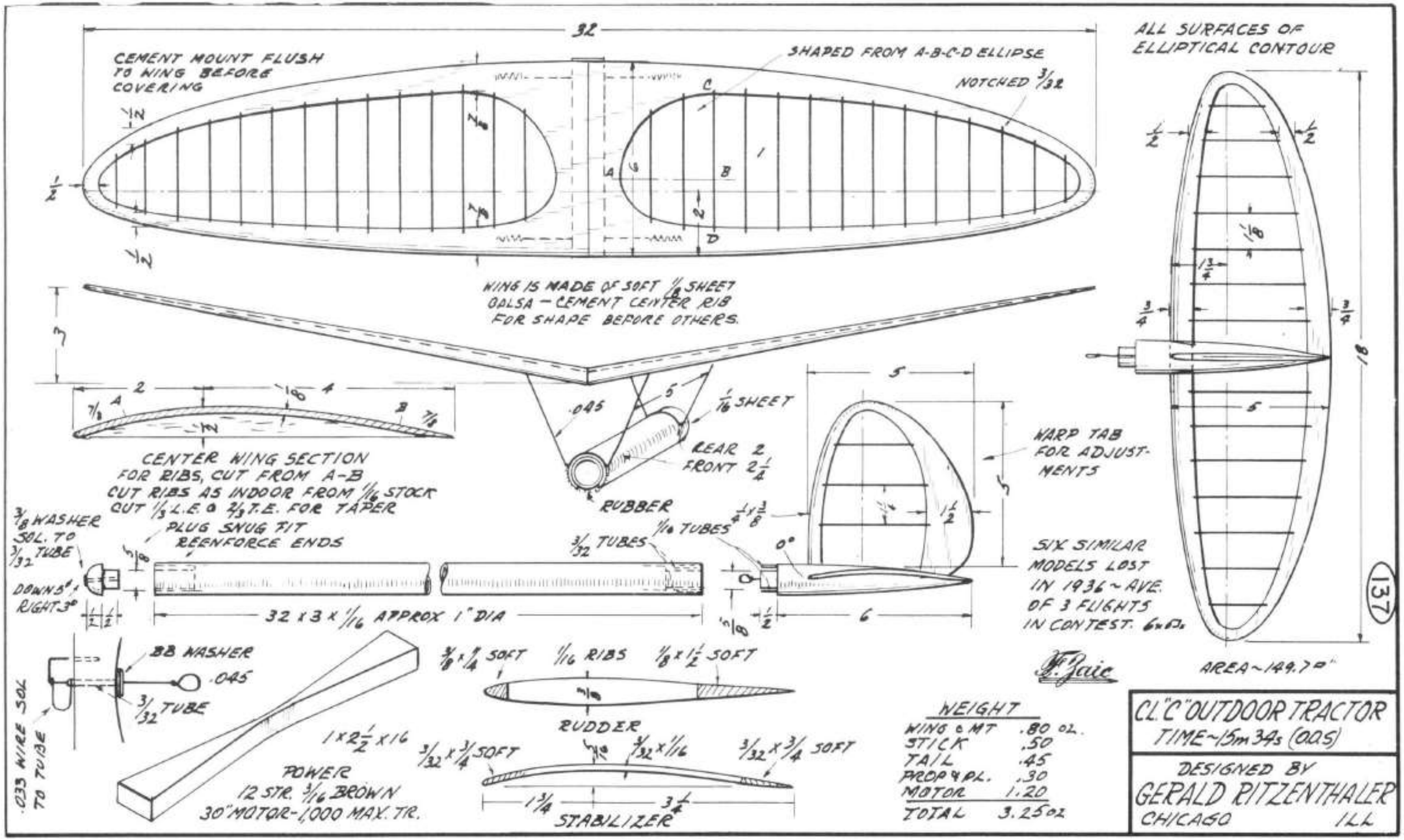
FILLETING WITH WAX By M. Huguelet

DROP MELTED WAX ON PLACE TO BE FILLETED AND SMOOTH OVER WITH FINGER

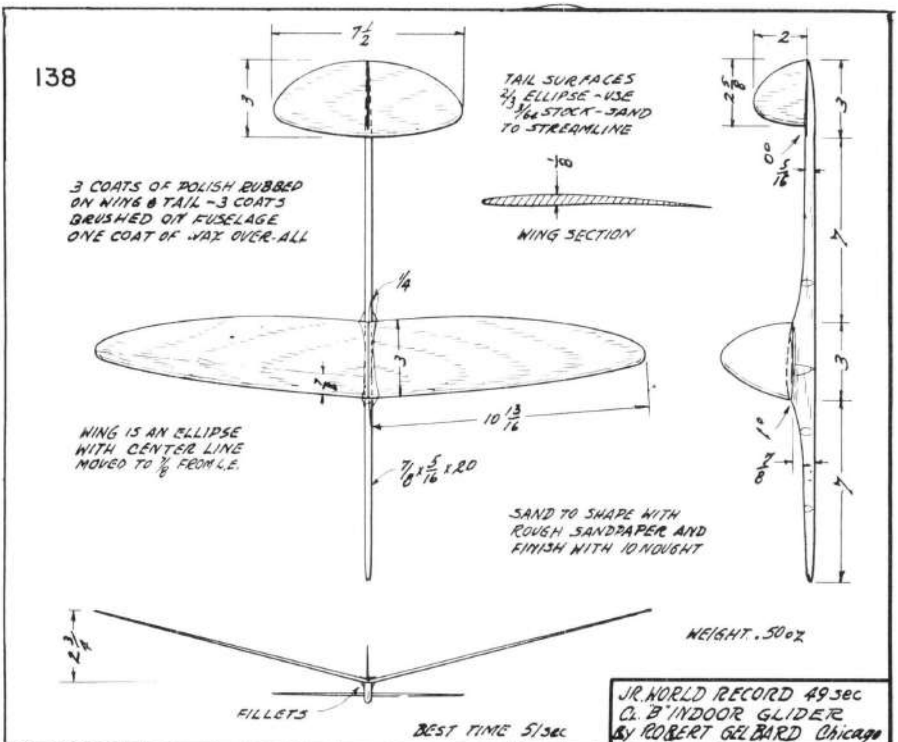


COVER WITH SUPERFINE
WING & TAIL SINGLE SURFACED
STABILIZER
WING
1/32 x 1/64 BAMBOO STRUTS
LONGERONS AND UPRIGHTS 1/16 SQ.
HOLLOW SHELL
LIGHT WIRE
1" DIA. 1/32 'C'
4" TREAD
SPIRAL WIND HOOK
3/32 DOWN 1/16 RIGHT
HOLLOW NOSE PLUG
POWER 20" LOOP - 3/32 BROWN
7 3/4 x 1 x 3/4
INDOOR FLYING SCALE
CURTISS ROBIN
TIME ~ 3m 29s
DESIGNED BY
RICHARD OBARSKI
CHICAGO ILL.
135

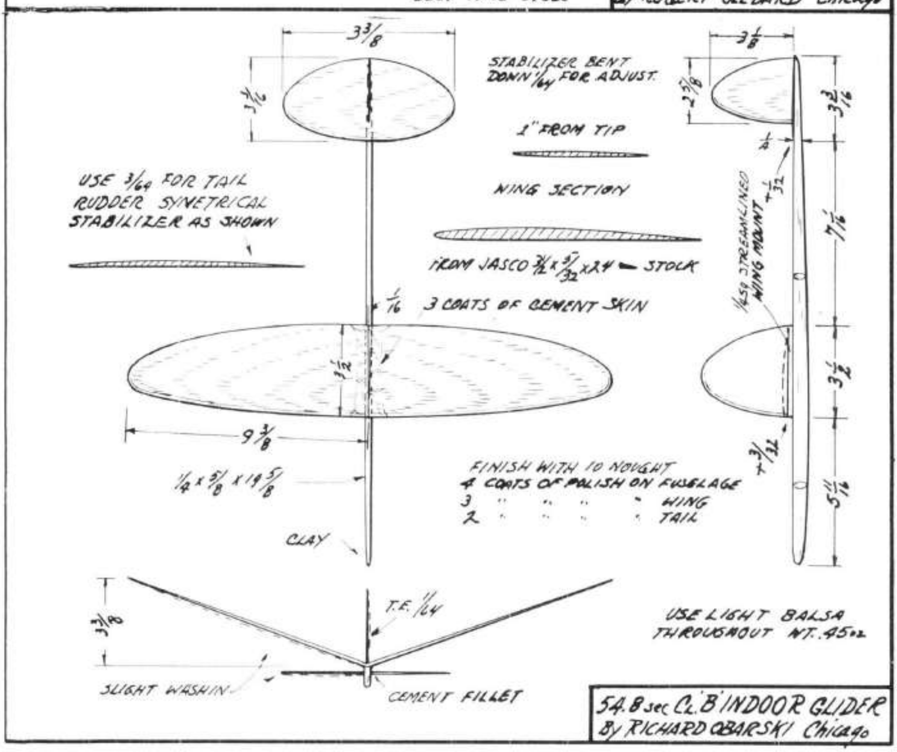

136
HISTORY
THIS IS 2nd LOW RATIO INDOOR GLIDER - FIRST GLIDER'S BEST TIME: 44.5 sec ~ THIS IS AN EXACT DUPLICATE EXCEPT A SLIGHT INCREASE OF WEIGHT WHICH INCREASED TIME BY VIRTUE OF HIGHER ALTITUDE (80-85 ft. AVE.)
CHANGES FOR ARMORIES LESS THAN 90 FEET
FOR 70' LIGHTEN TO .26 OZ
" 50' " " .23 OZ
" LESS THAN 50' INCREASE STAB. TO 6" AND DECREASE WT. to .20 oz
USE QTR. SAWED BALSA FOR WING - A FLEXIBLE WING LOWERS ALTITUDE
USE 3/64 FOR TAIL SURFACES - SYMETRICAL
GLIDER FINISHED IN USUAL FINE SANDING AND POLISHING
CEMENT SKIN
BLUNT L.E.
WING SECTION
CLAY
FILLETS MADE OF GLUE & BALSA DUST APPLY & LET SET OVER NIGHT - SAND TO SHAPE & APPLY TWO COATS OF CEMENT
T.E.
WASHIN
FILLET
FOR 90' ARMORY
WEIGHTS
WING .19 oz
FUSELAGE .07
TAIL AS. .04
TOTAL .30 oz
47 sec. Cl. "A" INDOOR GLIDER
BY C. BELSKY CHICAGO
WEIGHTS
WING (60°) .29 oz
FUSELAGE .17
TAIL AS. .05
CLAY .02
TOTAL .53 oz
3/64 RUDDER SYMETRICAL
USUAL FINE FINISH
TIME CAN BE INCREASED FOR LARGER ARMORY (90 ft up) BY INCREASING WT. & RIGIDITY OF THE WING (.35 oz)
STAB. SECTION
ADJUSTMENTS ARE FOR SHOULDER HIGH SIDE THROW. BE SURE IT DOES NOT PULL OUT BEFORE MOMENTUM IS EXPENDED
WING SECTION
T.E.
WASHIN
FILLET
CLASS 'A' NOTES APPLICABLE TO 'B'
54.8 sec Cl. B INDOOR GLIDER
by C. BELSKY CHICAGO



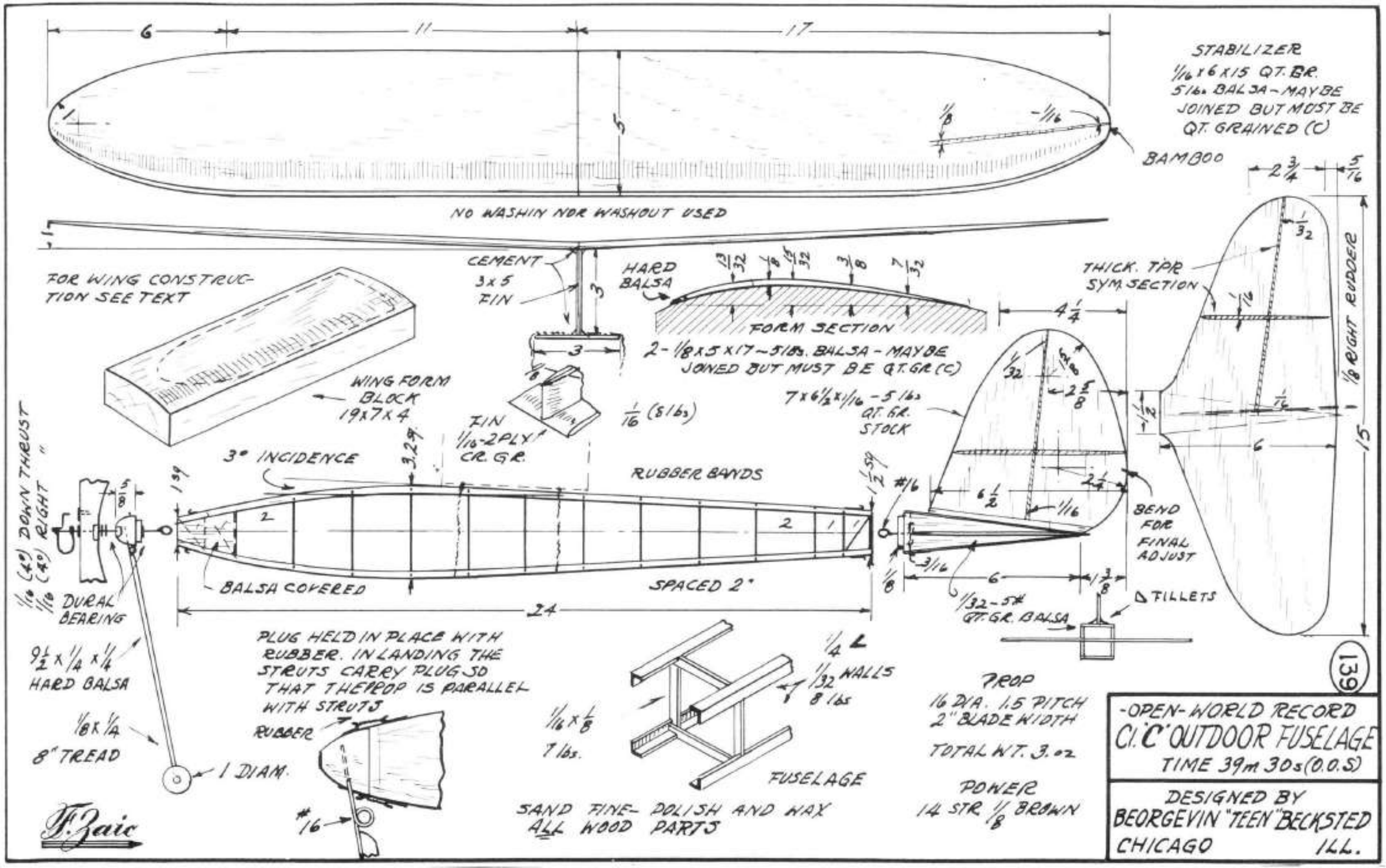
32
CEMENT MOUNT FLUSH TO WING BEFORE COVERING
SHAPED FROM A-B-C-D ELLIPSE
NOTCHED 3/32
ALL SURFACES OF ELLIPTICAL CONTOUR
WING IS MADE OF SOFT 1/8 SHEET BALSA — CEMENT CENTER RIB FOR SHAPE BEFORE OTHERS.
CENTER WING SECTION
FOR RIBS, CUT FROM A-B
CUT RIBS AS INDOOR FROM 1/16 STOCK
CUT 1/3 L.E. & 2/3 T.E. FOR TAPER
.045
1/16 SHEET
REAR 2
FRONT 2 1/4
RUBBER
WARP TAB FOR ADJUSTMENTS
3/8 WASHER SOL. TO 3/32 TUBE
PLUG SNUG FIT
REENFORCE ENDS
3/32 TUBES
1/16 TUBES
DOWN 5° RIGHT 3°
32 x 3 x 1/16 APPROX 1" DIA
SIX SIMILAR MODELS LOST IN 1936 ~ AVE. OF 3 FLIGHTS IN CONTEST. 6m 53s
BB WASHER
.045
3/32 TUBE
.033 WIRE SOL TO TUBE
1 x 2 1/2 x 16
POWER
12 STR. 3/16 BROWN
30" MOTOR - 1,000 MAX. TR.
3/8 x 1/4 SOFT
1/16 RIBS
1/8 x 1 1/2 SOFT
RUDDER
3/32 x 3/4 SOFT
3/32 x 1/16
3/32 x 3/4 SOFT
STABILIZER
AREA ~ 149.7 □"
WEIGHT
WING & MT .80 oz.
STICK .50
TAIL .45
PROP & PL. .30
MOTOR 1.20
TOTAL 3.25 oz
CL. "C" OUTDOOR TRACTOR
TIME ~ 15m 34s (O.A.S.)
DESIGNED BY
GERALD RITZENTHALER
CHICAGO ILL
137



TAIL SURFACES 2/3 ELLIPSE - USE 3/64 STOCK - SAND TO STREAMLINE
3 COATS OF POLISH RUBBED ON WING & TAIL - 3 COATS BRUSHED ON FUSELAGE ONE COAT OF WAX OVER-ALL
WING SECTION
WING IS AN ELLIPSE WITH CENTER LINE MOVED TO 7/8 FROM L.E.
7/8 x 5/16 x 20
10 13/16
SAND TO SHAPE WITH ROUGH SANDPAPER AND FINISH WITH 10 NOUGHT
WEIGHT .50 oz
FILLETS
BEST TIME 51 sec
JR. WORLD RECORD 49 sec
CL. 'B' INDOOR GLIDER
By ROBERT GELBARD Chicago

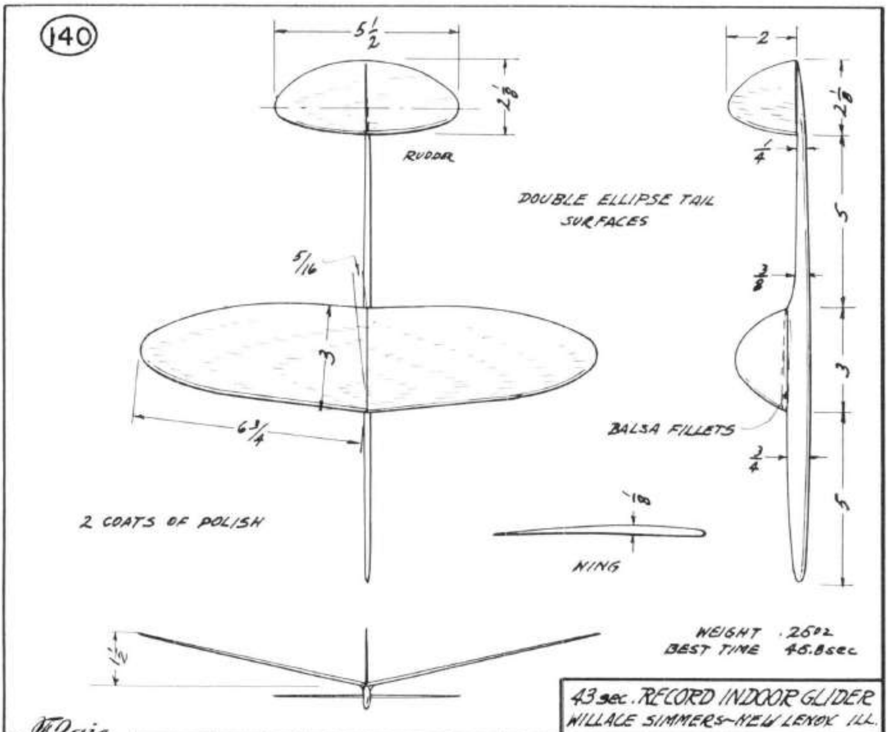


STABILIZER BENT DOWN 1/64 FOR ADJUST.
1" FROM TIP
WING SECTION
USE 3/64 FOR TAIL RUDDER SYMETRICAL STABILIZER AS SHOWN
FROM JASCO 3/32 x 5/32 x 24 - STOCK
3 COATS OF CEMENT SKIN
1/64 STREAMLINED WING MOUNT
9 3/8
1/4 x 5/8 x 19 5/8
FINISH WITH 10 NOUGHT
4 COATS OF POLISH ON FUSELAGE
3 " " " WING
2 " " " TAIL
CLAY
T.E. 1/64
USE LIGHT BALSA THROUGHOUT WT. .45 oz
SLIGHT WASHIN
CEMENT FILLET
54.8 sec CL. 'B' INDOOR GLIDER
By RICHARD OBARSKI Chicago

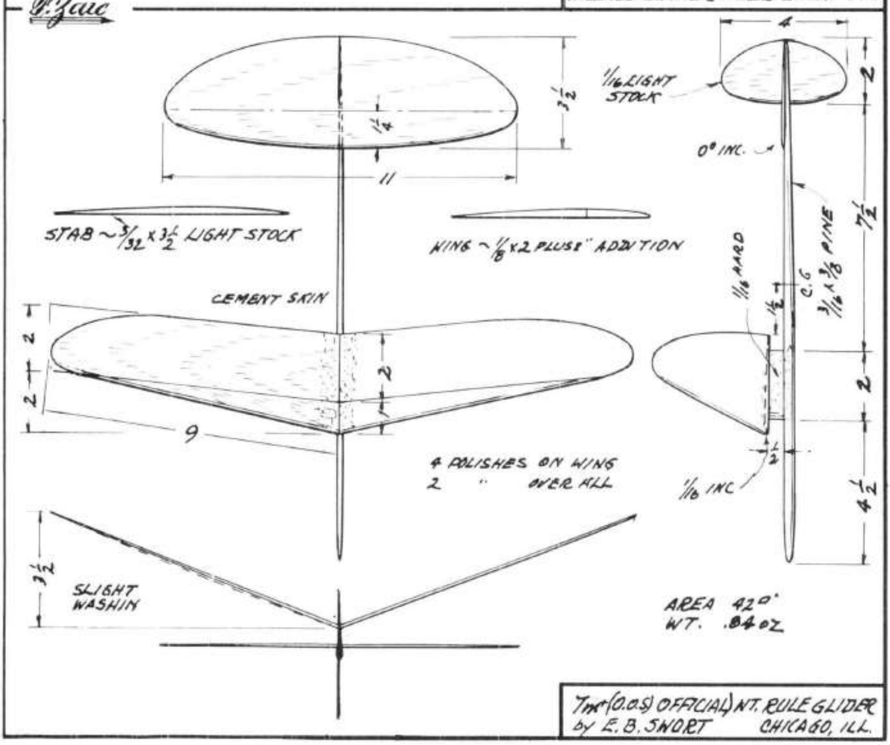


STABILIZER
1/16 x 6 x 15 QT. GR.
5 lb. BALSA - MAYBE
JOINED BUT MUST BE
QT. GRAINED (C)
BAMBOO
NO WASHIN NOR WASHOUT USED
FOR WING CONSTRUCTION SEE TEXT
CEMENT
3 x 5 FIN
HARD BALSA
FORM SECTION
2 - 1/8 x 5 x 17 ~ 5 lbs. BALSA - MAYBE
JOINED BUT MUST BE QT. GR (C)
THICK. TPR
SYM. SECTION
1/8 RIGHT RUDDER
WING FORM
BLOCK
19 x 7 x 4
1/16 (8 lbs)
7 x 6 1/2 x 1/16 - 5 lbs
QT. GR.
STOCK
FIN
1/16 - 2 PLY
CR. GR.
3° INCIDENCE
RUBBER BANDS
1/16 (4°) DOWN THRUST
1/16 (4°) RIGHT "
DURAL
BEARING
BALSA COVERED
SPACED 2"
BEND
FOR
FINAL
ADJUST
1/32 - 5#
QT. GR. BALSA
FILLETS
9 1/2 x 1/4 x 1/4
HARD BALSA
1/8 x 1/4
8" TREAD
1 DIAM.
PLUG HELD IN PLACE WITH
RUBBER. IN LANDING THE
STRUTS CARRY PLUG SO
THAT THE PROP IS PARALLEL
WITH STRUTS
RUBBER
1/4 L
1/32 WALLS
8 lbs
1/16 x 1/8
7 lbs.
FUSELAGE
PROP
16 DIA. 1.5 PITCH
2" BLADE WIDTH
TOTAL WT. 3. oz
POWER
14 STR. 1/8 BROWN
SAND FINE - POLISH AND WAX
ALL WOOD PARTS
139
-OPEN- WORLD RECORD
Cl. "C" OUTDOOR FUSELAGE
TIME 39m 30s (O.O.S)
DESIGNED BY
BEORGEVIN "TEEN" BECKSTED
CHICAGO ILL.
F. Zaic

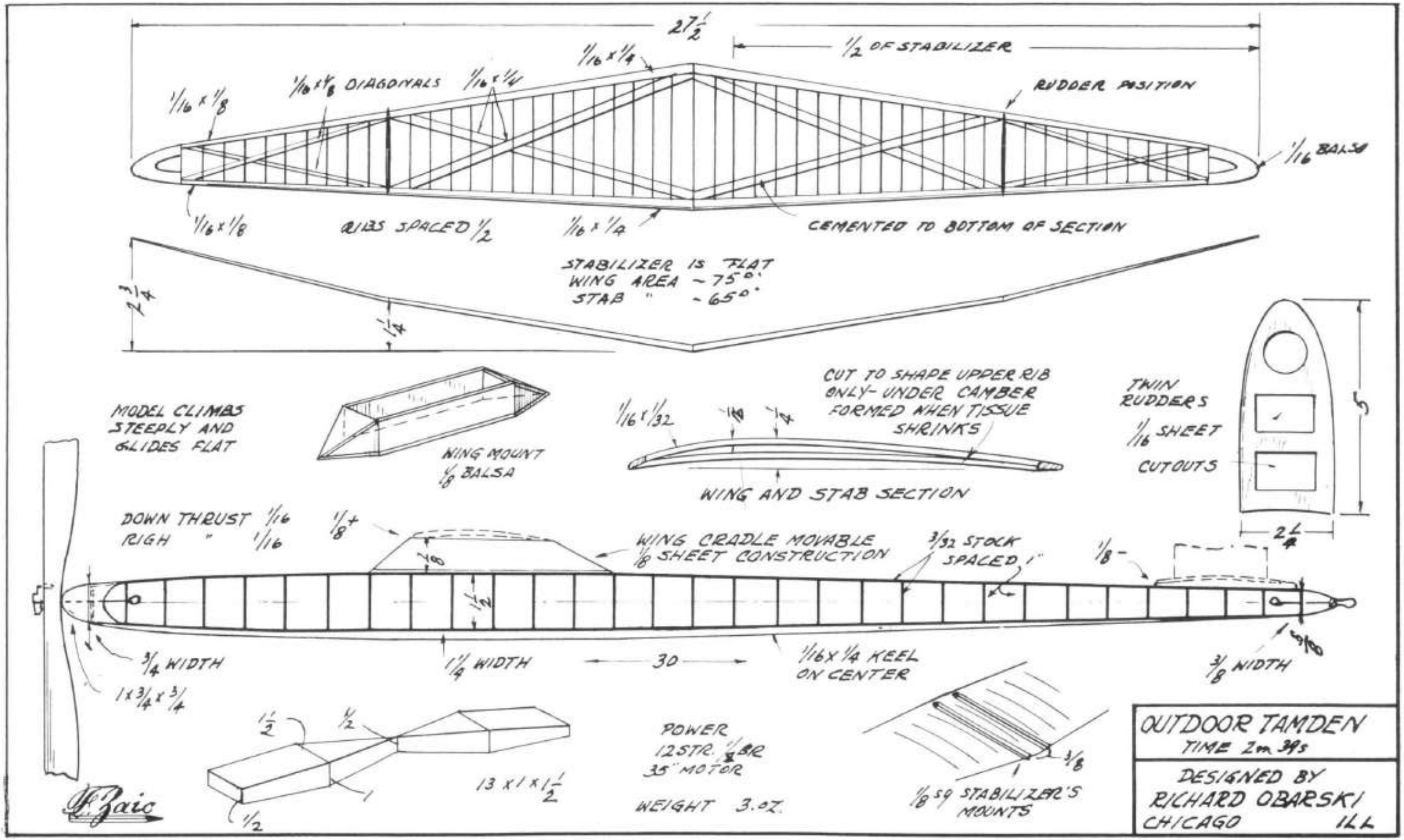
140

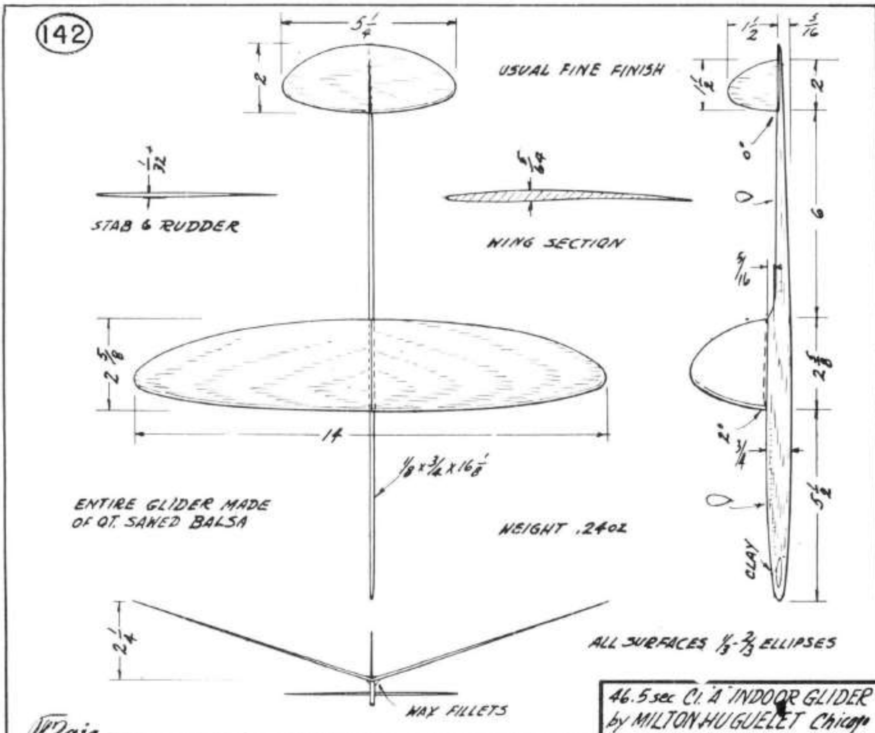


RUDDER
DOUBLE ELLIPSE TAIL SURFACES
BALSA FILLETS
2 COATS OF POLISH
WING
WEIGHT .26 OZ
BEST TIME 46.8 sec
43 sec. RECORD INDOOR GLIDER
WALLACE SIMMERS~NEW LENOX ILL.
F. Zaic



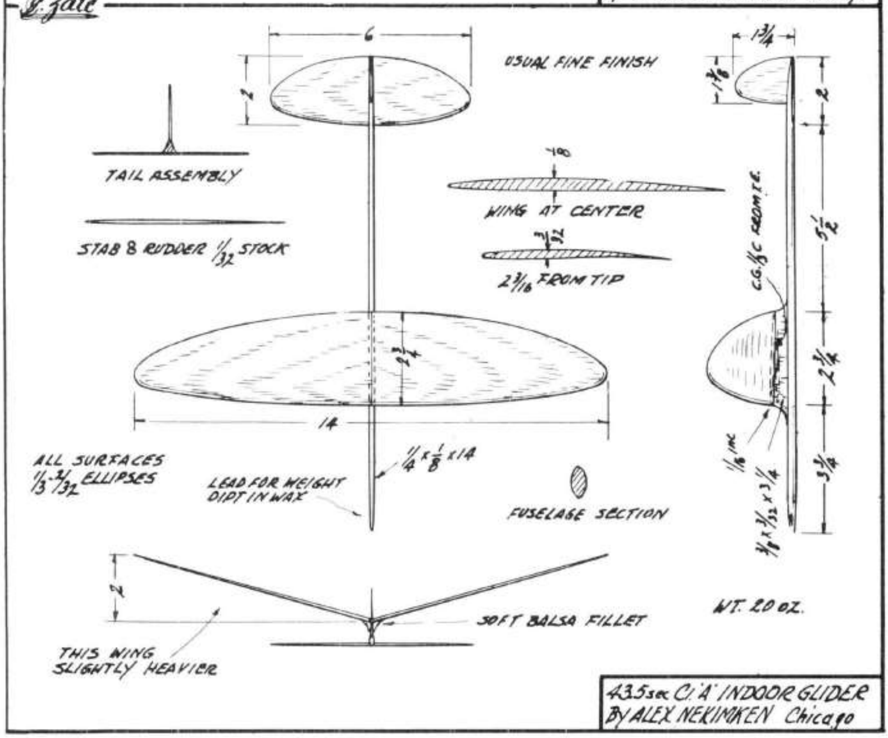
1/16 LIGHT STOCK
0° INC.
STAB ~ 3/32 x 3 1/2 LIGHT STOCK
WING ~ 1/8 x 2 PLUS 1" ADDITION
CEMENT SKIN
1/16 HARD
C.G.
3/16 x 3/8 PINE
4 POLISHES ON WING
2 " OVER ALL
1/16 INC
SLIGHT WASHIN
AREA 42□"
WT. .84 OZ
Tmt (O.O.S) OFFICIAL WT. RULE GLIDER
by E. B. SHORT CHICAGO, ILL.


27 1/2
1/2 OF STABILIZER
1/16 x 1/4
1/16 x 1/8 DIAGONALS
1/16 x 1/4
1/16 x 1/8
RUDDER POSITION
1/16 BALSA
1/16 x 1/8
RIBS SPACED 1/2
1/16 x 1/4
CEMENTED TO BOTTOM OF SECTION
STABILIZER IS FLAT
WING AREA ~ 75□"
STAB " ~ 65□"
2 3/4
1 1/4
CUT TO SHAPE UPPER RIB
ONLY- UNDER CAMBER
FORMED WHEN TISSUE
SHRINKS
TWIN
RUDDERS
1/16 SHEET
CUTOUTS
5
2 1/4
MODEL CLIMBS
STEEPLY AND
GLIDES FLAT
WING MOUNT
1/8 BALSA
1/16 x 1/32
WING AND STAB SECTION
DOWN THRUST 1/16
RIGH " 1/16
1/8 +
WING CRADLE MOVABLE
1/8 SHEET CONSTRUCTION
3/32 STOCK
SPACED 1"
1/8 -
3/4 WIDTH
1 x 3/4 x 3/4
1 1/4 WIDTH
30
1/16 x 1/4 KEEL
ON CENTER
3/8 WIDTH
1/2
1/2
1
1/2
13 x 1 x 1 1/2
POWER
12 STR. 1/8 BR
35" MOTOR
WEIGHT 3.OZ.
3/8
1
1/8 SQ STABILIZER'S
MOUNTS
OUTDOOR TAMDEN
TIME 2m 39s
DESIGNED BY
RICHARD OBARSKI
CHICAGO ILL



USUAL FINE FINISH
STAB & RUDDER
WING SECTION
ENTIRE GLIDER MADE OF QT. SAWED BALSA
WEIGHT .24 OZ
CLAY
ALL SURFACES 1/3-2/3 ELLIPSES
WAX FILLETS
46.5 sec Cl. "A" INDOOR GLIDER
by MILTON HUGUELET Chicago

V. Zaic



USUAL FINE FINISH
TAIL ASSEMBLY
WING AT CENTER
STAB & RUDDER 1/32 STOCK
2 3/16 FROM TIP
C.G. 1/3 C FROM T.E.
ALL SURFACES 1/3-3/32 ELLIPSES
LEAD FOR WEIGHT DIPT IN WAX
FUSELAGE SECTION
WT. .20 OZ.
SOFT BALSA FILLET
THIS WING SLIGHTLY HEAVIER
43.5 sec Cl. "A" INDOOR GLIDER
BY ALEX NEKIMKEN Chicago

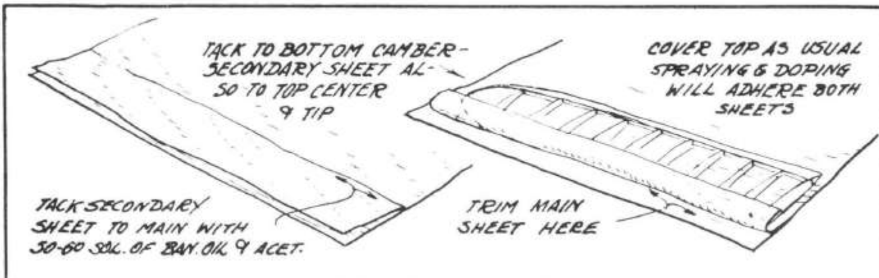
All-Balsa Wings — by Teen Becksted

A sheet of quarter-sawed, 5 lb./cu. ft., 1/8" thick balsa is needed for the wing. (If the exactly specified wood in unobtainable, use the best you can get. The width may be built up by cementing two or more sheets.) Cut to outline and sand the bottom free from saw marks. Next, sand the upper camber to the desired wing section. In the case of a tapered wing, be sure to taper the thickness evenly from the center to the tip. A hard balsa leading edge, and a bamboo tip are advisable in order to save the efficiency of these highly important edges. They should be cemented in place before the top surfaces are worked down. It is an easy job to finish balsa wings if three grades of sandpaper are used, finishing with ten nought.

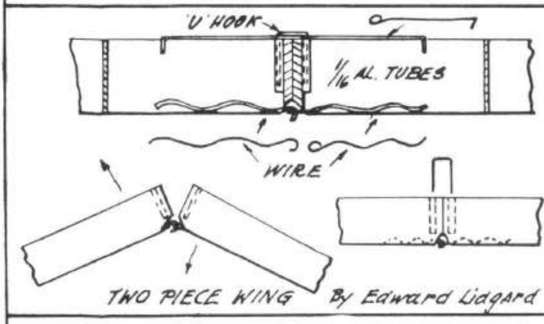
The wing is made in two halves, and the halves are bent on the same form, one after the other. To bend for the lower camber, moisten the top only, and bind the half on the form with 1/2" gauze. It may be left to dry overnight, or it may be baked in an oven. When dry, carefully sand the raised grain on the top surface, while the wing is still on the form. Dope twice with thin shrinkless dope, sanding between coats, and wax with Simoniz or a similar wax, except in the center where a cement skin of about 1" is applied. Make the other half in the same manner.

Before cementing the two halves together, set them at the desired angle and carefully sand the edges for a perfect joint. Cement them together and hold in place with pins. When the unit is dry, coat the joint well with two or three coats of cement. Be sure that the initial joint does not lossen with the fresh cement.

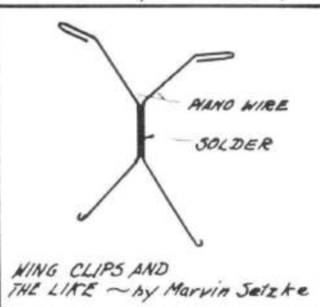
If the work is done carefully, the balsa wing will be more efficient and will also stand up better than any paper covered wing of the same size. The method has been used on several ships, and has been thoroughly tested.



DOUBLE COVERED LEADING EDGE by Edward Lidgard



TWO PIECE WING By Edward Lidgard



WING CLIPS AND THE LIKE ~ by Marvin Setzke

——— Thank you. Boys ———

THE MOVEMENT IN ENGLAND

by C.S.Rushbrooke-- Lancashire Model Aircraft Soc.

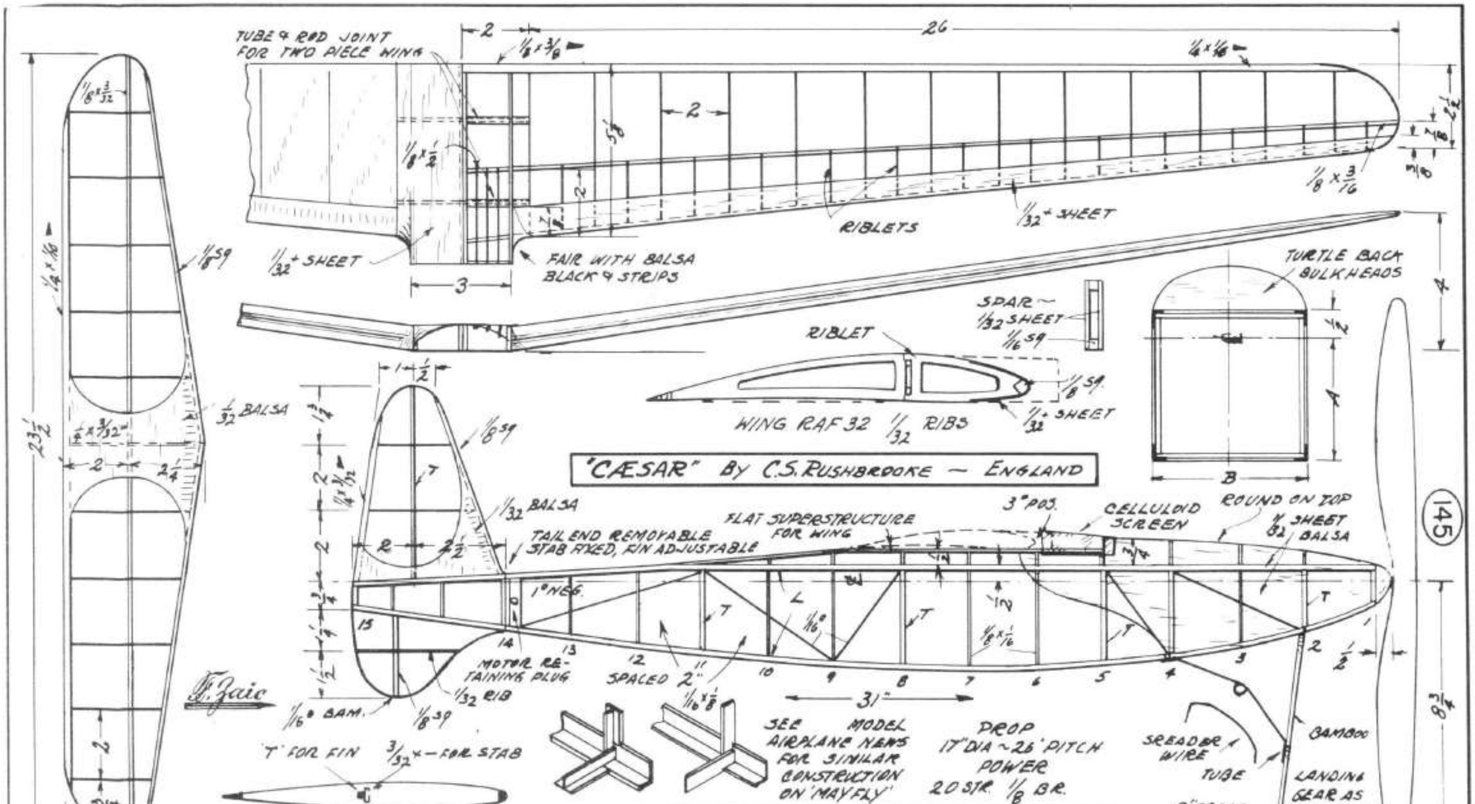
The most striking factor noticeable in English model aeronautics at the present is the enormous increase in interest and activity shown in recent months. Perhaps the greatest demonstration of this was the huge entry for the Wakefield trials held at Fairèy's Aerodrome early in this year, the actual number of competitors alone constituting a record for an English competition.

As always, the Wakefield Cup takes first place in the topic, and the decision to send a complete team to the United States in an effort to regain the Trophy for Great Britain has had far reaching effects. Firstly, an unprecedented interest was created by the decision to get down to things seriously, and through the efforts of the various clubs and individuals, a fund was raised that enabled the S.M.A.E. to realise their ambition. The success of the scheme is past history by now, and it is a matter of congratulation that the English team that went to Detroit made such a good showing. The main objective was accomplished, and the successes gained in other competitions showed that the initial success was no flash in the pan. I think I can say, without giving offence, that the American enthusiasts had a bit of a shock at the showing put up by the Britishers, and this fact is going to make for better and keener clashes in the future.

It is a matter of great satisfaction to hear that a team from the States will be coming over the water for next year's Wakefield, and if only for that development, the original scheme can be regarded as having brought the sport into greater prominence than ever. Close contact has been made, friendships cemented, and the whole movement given a "kick in the pants" that will be felt for years. I have chatted with a number of the men who went to Detroit, and it is good to know that this hobby of ours brings such a crowd of good fellows together-- the general opinion of the folk met being "Oke". The only complaint I heard was "no time to sleep", but who'd mind losing a month's sleep for the chance to have a smack at the Wakefield?

Big changes have taken place in the movement in England this year. Owing to the increased interest and growth, the S.M.A.E. has ceased to be a competitive body, and is now the governing factor to the whole movement. A system has been evolved whereby individual societies become affiliated to the main body, and a representative from such clubs have a vote on all matters that come up for consideration. Certain competitions that were until now held only in London are held simultaneously on the home grounds of the various societies, results being forwarded to the S.M.A.E. and the final placings worked out by them. This has naturally lead to a greater interest in competitive matters, and has had a far-reaching effect on the whole movement.

One other big development that has taken place this year is the initiating of indoor flying on an organized basis. At the moment this is only true of the London area, where the obtaining of the Albert Hall has given a big fillip to the sport. A series of special meetings are running during the winter, and it is hoped that we shall shortly have a batch or records on a par with the American figures. Actually we start under a handicap in this respect, owing to the scarcity of suitable buildings, there being none of those big airship sheds one reads so much about in American books. The general climatic conditions will most likely play a big part also, as it is generally realized that the average weather on this side of the water is not conducive to record work. However, it is to be hoped that by the time the team crosses the Atlantic next year, there will be enough good indoor models to give the old hands a run for their money!!



FUSELAGE DIMENSIONS

POSITION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	3/4	1 1/2	2	2 1/4	2 9/16	2 5/8	2 5/8	2 5/8	2 1/2	2 3/4	2 3/16	2	1 7/8	1 3/8	3/4
B	1 1/4	1 7/8	2 3/8	2 3/4	3	3	3	3	2 7/8	2 1/2	2 1/4	1 3/4	1 3/8	7/8	0

From my own point of view, I can only report at all thoroughly the events that have taken place in the North of England. I paid two visits to the South earlier in the season, once to the Wakefield Trials, and again to the Annual National contest. The weather for this latter contest was vile, and most of the day was spent in my caravan having a chat with the lads who had just returned from the States. Still, I could think of a lot worse things to do than that, and our spirits were sustained with suitable refreshment!! It says a lot for Bob Copland and his machine that they pulled off the contest, and is one more success to a chap who has done remarkably well this year.

My remarks on happenings in my part of the country naturally deal mainly with my own club. A successful series of competitions have been carried through, and personally I have nothing to grumble at, having finished the season with three "pots" on the sideboard-- with explicit instructions from the better half that I have to clean them myself.

Early in the season we ran an Open Day programme, to which various clubs were invited, all competing in an attractive series of contests. The proceeds from this were presented to the S.M.A.E. Wakefield fund together with other monies collected in various ways, the sum being quite a nice total, and showed that the Lancashire had at least upheld its reputation. We had our repayment when one of our junior members-- Alwyn Greenhalgh-- was lucky enough to be one of the chosen six.

Perhaps our most successful meeting this year was the Northern Rally. This is an annual affair with us, and with the help of the Liverpool Club, was run off to the satisfaction of all-- even including ourselves, who have big ideas on what an affair should be!! We have found that these "get-togethers" are a big factor in the furthering of the sport, and it is our wish to make these annual meetings bigger and brighter in the future.

Taking things all round, things have been pretty good this year apart from the weather, which has been anything but kind. On looking through my competition reports for the year, it is very striking that on only one day were the conditions at all conducive to good flying. High winds have been our chief difficulty, and the damage to models this year has been very heavy. Still, the weather is something we cannot control, and the only thing to do is make the best of it. There is some talk of an alteration in the wing loading for next year's Wakefield, and this suggestion will I think be well accepted everywhere, as it is getting past a joke to chase a model over miles of country-- in a flight which after all is not a true indication of the model's capabilities, for if that particular "riser" wasn't there, we know darn well the model would have come down minutes before!

Well, I only hope that this ramble on matters over here has been of some interest to the reader, and trust that there will be more and more opportunities for the meeting of the two great model building fraternities. I should like to see an Annual convention of the English and American aero-nuts, but I'm afraid that until we can do the journey on about a week's spending money, that is out of the question! However, let the technical papers further the cause, and remember there is always the medium of the post to get in touch with other enthusiasts overseas-- and believe me, there is a practise I have found most instructive and enjoyable.

RUBBER

The turn tables given were first calculated from the par and coefficient formula and then checked with actual winding. The number of turns given will prove to be a bit on the safe side and can be achieved on a day of normal temperature providing that the rubber is stretched as much as possible. An excessively hot or cold temperature will materially decrease the possible number of turns. The number of turns can be brought close to the normal if the rubber is kept under shade, wrapped in moist paper on hot days, or in a pocket or near a radiator on cold days.

Straight green soap slightly thinned with glycerine will serve as a good lubricant. Be sure to spread and rub it in evenly. After every wind up check for cracks and grit, and relube the motor. Since lube messes up the handkerchief considerably, it is much better to wear white athletic cotton socks for cleaning your hands whenever they get dirty.

The actual number of turns that can be obtained from a motor depends upon your strength and will power. After a prewind of 75% and 90% of the maximum, the wind-up should be made by stretching the rubber at least five times its length (17 feet for a 40" motor). Wind about one half of the maximum at this length and then slowly come in so that there is at least 2" or 3" of elasticity left. The best way of knowing just when the motor has enough is to practise so that you will get the feel of the rubber just before it is about to break.

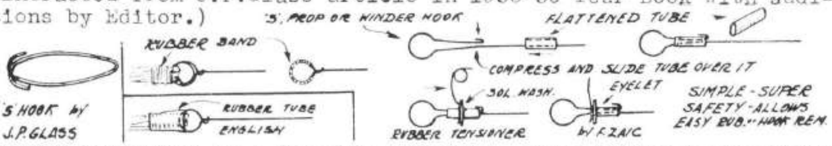
Turns per inch on Two Strands--Weight per inch of Single Strand

Size	1/32	3/64	1/16	5/64	3/32	7/64	1/8	5/32	3/16	1/4
Turn	225	189	163	145	130	124	115	108	94	80
Wt. oz.	.0005644	.0008466	.0011288	.0011411	.0016932	.0019756	.0021576	.0028220	.0033864	.0043152

Turns per inch on Multiple Strands

No.Str.	4	6	8	10	12	14	16	18	20
1/8	80	64	55	50	44	40	36	34	32
5/32	68	59	50	46	41	38	34	29	24
3/16	60	54	46	42	38	35	32	27	24
1/4	56	44	37	33	29	27	25	23	21

The tables are for 1/30 Gage Special Brown Rubber (MRL, T56). A complete table of all numbers of strands and lengths of motors would require too much space. Make your own chart for the motors which you usually use most, and paste it in your model box. The 1/4 motors of over 14 strands are hard to handle. It is advisable to wind the motors before begining a design using this size. (Extracted from J.P.Glass article in 1935-36 Year Book with additions by Editor.)



RUBBER TENSIONER is a British invention. Its purpose is to prevent a long motor from unwinding completely and so prevent shifting.

OFFICIAL LIST OF UNITED STATES MODEL AIRCRAFT RECORDS
Approved by Contest Board of the N.A.A. Sept. 30, 1936.

INDOORS (No weight restriction)

STICK — CLASS A (30 sq. in. or under)

Rise off Ground

Junior: William Wert	Philadelphia, Pa.	10m 26.4s
Senior: Ervin Leshner	Philadelphia, Pa.	15m 47.4s
Open : Joseph Matulis	Chicago, Illinois	9m 59.0s

Rise off Water

Junior: William Wert	Philadelphia, Pa.	7m 19.4s
Senior: Colman Zola	Brooklyn, N. Y.	7m 41.1s
Open : Beorgevin Becksted	Chicago, Illinois	5m 38.2s

CLASS B (30-100 sq. in.)

Hand Launched

Junior: John S. Stokes Jr.	Huntington Valley, Pa.	18m 12.2s
Senior: Wilbur F. Tyler	Boston, Mass.	20m 50.1s
Open : Ernest A. Walen	Springfield, Mass.	18m 46.5s

Rise off Ground

Junior: John S. Stokes, Jr.	Huntington Valley, Pa.	17m 19.3s
Senior: Hyman Oslick	Philadelphia, Pa.	17m 03.8s
Open : Ernest A. Walen	Springfield, Mass.	17m 42.8s

Rise off Water

Junior: William Wert	Philadelphia, Pa.	9m 27.6s
Senior: Mayhew Webster	Philadelphia, Pa.	11m 55.0s
Open : William Latour	Philadelphia, Pa.	13m 15.0s

CLASS C (100-150 sq. in.)

Hand Launched

Junior: John S. Stokes, Jr.	Huntington Valley, Pa.	20m 53.0s
Senior: Robert Jacobsen	Philadelphia, Pa.	25m 29.0s
Open : Carl Goldberg	Chicago, Illinois	23m 29.3s

CABIN FUSELAGE — CLASS B

Rise off Ground

Junior: John S. Stokes, Jr.	Huntington Valley, Pa.	14m 15.3s
Senior: Charles Heintz	Philadelphia, Pa.	13m 12.2s
Open : Beorgevin Becksted	Chicago, Illinois	11m 26.0s

Rise off Water

Junior: John S. Stokes, Jr.	Huntington Valley, Pa.	3m 23.0s
Senior: Sidney Axelrod	Chicago, Illinois	6m 32.2s
Open : William Latour	Philadelphia, Pa.	5m 42.0s

CLASS C

Rise off Ground

Junior: John S. Stokes, Jr.	Huntington Valley, Pa.	15m 05.6s
Senior: John Haw	Philadelphia, Pa.	17m 14.8s
Open : William Latour	Philadelphia, Pa.	12m 31.8s

GLIDERS — CLASS A

Hand Launched

Junior: M. Hugelot	Chicago, Illinois	34.6s
Senior: Wallace Simmers	New Lenox, Illinois	43.6s
Open : Joseph Matulis	Chicago, Illinois	38.8s

CLASS B

Hand Launched

Junior: Robert Gelbard	Chicago, Illinois	49.2s
Senior: Wallace Simmers	New Lenox, Illinois	58.4s
Open : Carl Goldberg	Chicago, Illinois	47.5s

AUTOGIRO

Junior: Raymond Steinbacher	Ridgefield, N. J.	57.2s
Senior: Alton H. DuFlon, Jr.	Ridgefield. N. J.	2m 01.2s

(Min. Fuselage Section $\left(\frac{\text{Length}}{10}\right)^2$

OUTDOORS (Min. Wing Load. 50 sq. in./ 1 oz.

STICK — CLASS C (100-150 sq. in.

Hand Launched

Junior: Junior Dague	Tulsa, Oklahoma	21m 04.0s
Senior: Harry Cornish	Denver, Colorado	61m 09.0s
Open : Joseph Frady	Tulsa, Oklahoma	27m 07.0s

Rise off Water

Senior: Larry Low	New York, N. Y.	2m 00.0s

CLASS D (150-300 sq. in.)

Hand Launched

Junior: Fred Skafec	Akron, Ohio	8m 21.6s
Senior: Daniel Clini	Springfield, Mass.	38m 50.0s
Open : Chester Lanzo	Cleveland, Ohio	18m 10.0s

Rise off Water

Senior: Larry Low	New York, N. Y. (tie)	1m 12.0s
Senior: Malcom Abzug	New York, N. Y.	1m 12.0s

CABIN FUSELAGE — CLASS C

Rise off Ground

Junior: Fred Smith	Denver, Colorado	27m 40.0s
Senior: Robert Cahill	Indianapolis, Ind.	33m 00.0s
Open : Beorgevin Becksted	Chicago, Illinois	39m 30.0s

Rise off Water

Senior: Alan Orthoff	New York, N. Y.	1m 07.0s

CLASS D

Rise off Ground

Junior: Arthur Koslow	Philadelphia, Pa.	9m 47.0s
Senior: William Ying	Rosebank, S.I., N. Y.	41m 19.0s
Open : Chester Lanzo	Cleveland, Ohio	48m 45.0s

Rise off Water

Senior: Louis Milowitz	New York, N. Y.	1m 14.3s

CLASS E (300 sq. in. and over)

Gasoline Engine

Senior: Joseph Kovel	Brooklyn, N. Y.	64m 40.0s
Open : Don Spaulding	Denver, Colorado	63m 07.4s

GLIDERS — CLASS B

Hand Launched

Junior: Walter Weitner	New York, N. Y.	46.5s
Senior: Harry D. Soper, Jr.	Rockford, Illinois	2m 52.0s
Open : Willis C. Brown	Arlington, Mass.	33.1s

CLASS C

Hand Launched

Junior: Horace Smith	Jacksonville, Fla.	36.0s
Senior: Colin Edwards	Oswego, New York	6m 30.4s
Open : James McPheat, Jr.	New York, N. Y.	31.5s

Tow Launched

Junior: Ralph Brown	Arlington, Mass.	9m 32.0s
Senior: Bob File	Columbus, Ohio.	23m 13.0s
Open : Everett Tasker	Boston, Mass.	4m 25.0s

CLASS D

Hand Launched

Senior: Edward L. Smith	Jacksonville, Fla.	38.0s

Tow Launched

Junior: Paul Durup	Boston, Mass.	57.8s
Senior: Dick Everett	Elm Grove, W. Va.	2m 38.0s
Open : Roland Buhrig	Canastota, New York	1m 18.0s

CLASS E

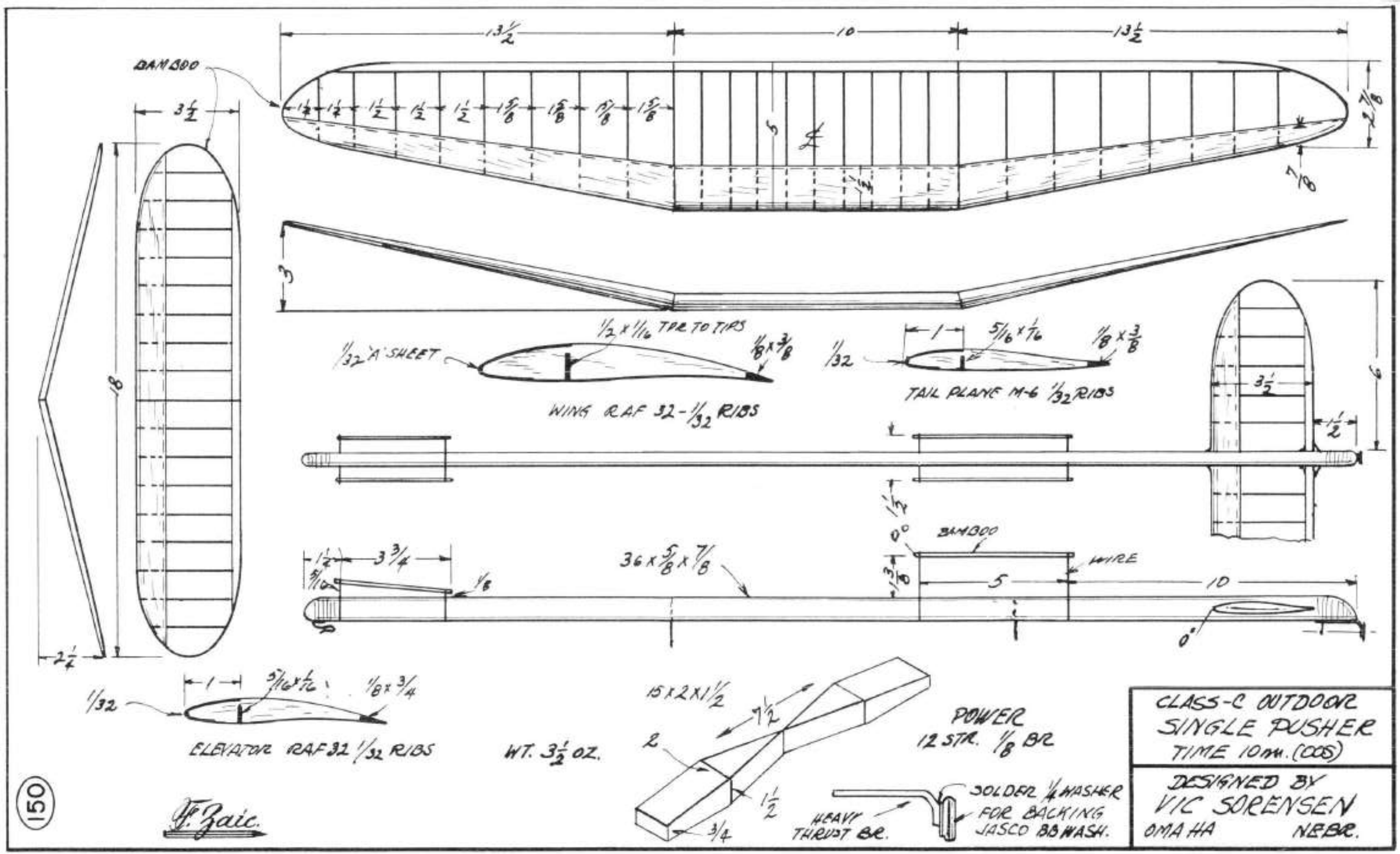
Tow Launched

Senior: Jack Smith	Dayton, Ohio	1m 23.4s

AUTOGIRO

Senior: Ralph Kummer	Saint Louis, Mo.	2m 06.0s

(Min. Fuselage Section $\left(\frac{\text{Length}}{10}\right)^2$



150
BAMBOO
13 1/2
10
13 1/2
3 1/2
18
2 1/4
2 7/8
7/8
3
1/32 'A' SHEET
1/2 x 1/16 TPR TO TIPS
1/8 x 3/8
WING RAF 32 - 1/32 RIBS
1/32
5/16 x 1/16
TAIL PLANE M-6 1/32 RIBS
3 1/2
6
1 1/2
36 x 5/8 x 7/8
3 3/4
WIRE
1/32
5/16 x 1/16
1/8 x 3/4
ELEVATOR RAF 32 1/32 RIBS
WT. 3 1/2 OZ.
15 x 2 x 1 1/2
7 1/2
POWER
12 STR. 1/8 BR
HEAVY THRUST BR.
SOLDER 1/4 WASHER FOR BACKING JASCO BB WASH.
CLASS-C OUTDOOR
SINGLE PUSHER
TIME 10 m. (OOS)
DESIGNED BY
VIC SORENSEN
OMAHA NEBR.
F. Zaic.

OFFICIAL LIST OF 1936 NEW ZEALAND RECORDS

Accepted by the Auckland Aero Club

INDOOR

STICK				
H.L.	Junior:	R. E. Clarkson	A.M.A.C.	6m 47.8s
	Senior:	V. B. Gray	A.M.A.C.	8m 38.0s
R.O.G.	Junior:	R. E. Clarkson	A.M.A.C.	7m 04.0s
	Senior:	V. B. Gray	A.M.A.C.	5m 30.0s
R.O.W.	Junior:	A. Sykes	A.M.A.C.	1m 45.0s
	Senior:	W. B. Mackley	A.M.A.C.	1m 35.0s
FUSELAGE				
H.L.	Junior:	L. R. Mayn	A.M.A.C.	4m 43.0s
	Senior:	L. R. Mayn	A.M.A.C.	6m 05.2s
R.O.G.	Junior:	L. R. Mayn	A.M.A.C.	4m 12.0s
	Senior:	V. B. Gray	A.M.A.C.	7m 07.0s
R.O.W.	Junior:	A. Sykes	A.M.A.C.	1m 31.4s
	Senior:	W. B. Mackley	A.M.A.C.	3m 26.8s
SCALE				
H.L.	Junior:	L. R. Mayn	A.M.A.C.	55.8s
	Senior:	W. G. Alexander	Wi. M.A.C.	46.0s
R.O.G.	Junior:	L. R. Mayn	A.M.A.C.	43.2s
	Senior:	W. G. Alexander	Wi. M.A.C.	47.0s

OUTDOOR

STICK				
H.L.	Junior:	J. Curtis	TA.M.A.C.	14m 40.0s
	Senior:	L. R. Mayn	A.M.A.C.	14m 08.2s
R.O.G.	Junior:	R. E. Allen	A.M.A.C.	5m 30.4s
	Senior:	H. G. Parker	H.M.A.C.	14m 00.0s
R.O.W.	Junior:	A. Sykes	A.M.A.C.	2m 45.0s
	Senior:	W. B. Mackley	A.M.A.C.	1m 45.0s
FUSELAGE				
H.L.	Junior:	G. M. Perkins	A.M.A.C.	18m 37.0s
	Senior:	N. Gray	C.M.A.C.	10m 00.0s
R.O.G.	Junior:	B. E. Loftus	A.G.S.A.S.	9m 00.0s
	Senior:	W. Dawson	N.M.A.C.	11m 55.4s
R.O.W.	Junior:	W. J. Finlayson	Ti.M.A.C.	30.0s
	Senior:	A. J. Dacombe	C.M.A.C.	1m 30.0s
SCALE				
H.L.	Junior:	W. Dawson	N.M.A.C.	1m 25.4s
	Senior:	A. E. Vause	W.M.A.C.	1m 11.0s
R.O.G.	Junior:	J. McGuire	W.M.A.C.	59.0s
	Senior:	W. B. Mackley	A.M.A.C.	1m 01.2s
WAKEFIELD FUSELAGE				
R.O.G.	Open :	W. Dawson	N.M.A.C.	11m 55.4s
PETROL DRIVEN				
R.O.G.	Open :	G. Bolt	Ne.M.A.C.	2m 38.4s

Auckland Grammar School Air Squadron, Auckland	A.G.S.A.S.
Auckland Model Aeroplane Club, Auckland	A.M.A.C.
Christchurch Model Aeroplane Club, Christchurch	C.M.A.C.
Hornet Model Aeroplane Club, Palmerston North	H.M.A.C.
Napier Model Aeroplane Club, Napier	N.M.A.C.
Nelson Model Aeroplane Club, Nelson	Ne.M.A.C.
Te Aroha Model Aeroplane Club, Te Aroha	TA.M.A.C.
Tinakori Model Aeroplane Club, Wellington	Ti.M.A.C.
Wellington Model Aeroplane Club, Wellington	W.M.A.C.
Wisemans Model Aeroplane Club, Auckland	Wi.M.A.C.

OFFICIAL LIST OF RUSSIAN RECORDS, 1936

STICK MODELS			
Duration H.L.	I	Shahnazarian	10m 04s
" " "	II	Nesterenko	4h. 23m 00s
" " "	III	Gerasimova	19m 00s
Distance H.L.	I	Shilov	1,431 meters
" " "	II	Kravchenko	12,000 "
" " "	III	Efimova	940 "
Dropping Rubber:			
Duration H.L	II	Nesterenko	1h. 15m 00s
Distance H.L.	II	Ivanov	15,000 meters
R.O.W.	I	Gaiduk	28s
	II	Kravchenko	3m 00s
	IIII	Gaponenko	27m 20s
FUSELAGE MODELS			
H.L.	IIII	Ziurin	27m 20s
R.O.G.	II	Boikov	9m 48s
Tailless	II	Trunchenkov	1m 40s
R.O.W.	--	Ziurin	1m 26s
Speed	--	Semashko	14.3 meters/sec. (32 mph)
GLIDERS			
Launched on Slope:			
Fuselage	II	Popelko	8m 51s
" "	IIII	Korkhunov	1h. 00m 05s
Tailless	II	Kamkin	3m 01s
" "	III	Gruhul	1m 00s
" "	IIII	Petrov	3m 30s
Launched from Kite:			
Tailless	II	Shvetz	9m 29s
" "	IIII	Zinchenko	15m 10s
Fuselage	IIII	Melnikow	16m 00s
GAS MODELS			
Duration	--	Minagevim	23m 00s
Distance	--	Malikom	3,150 meters
GLIDERS (Recd. Oct. 1936)			
Tailless	--	Sheverdiavim	19m 06s
" "	--	Shvetz	2,630 meters

CLASSES

I Children under 12
II Pioneers (under 16 years)
III Girls
IIII Technical Students (over 16)

Prepared By Andrew Borysko

LIST OF OFFICIAL GERMAN RECORDS, April,1936

Klasse Rumpfmodelle: (Fuselage Models)

Bo.-Str.: Lippmann sen., Flieger-Ortsgr. Dresden, 795,5 m
Bo.-Dau: Neelmeyer, Flieger-Ortsgr. Dresden, 13 Min. 7 Sek.
Ha.-Str.: K. Lippert, Flieger-Ortsgr. Dresden, 22 400 m
Ha.-Dau: Lippmann sen., Flieger-Ortsgr. Dresden, 1 Std. 8 Min.

Klasse Stabmodelle: (Stick Models)

Bo.-Str.: H. Mundlos, Flieger-Ortsgr. Magdeburg, 730 m
Bo.-Dau: E. Warmbier, Flieger-Ortsgr. Magdeburg, 1 Min. 57,6 Sek.
Ha.-Str.: E. Warmbier, Flieger-Ortsgr. Magdeburg, 3900 m
Ha.-Dau: E. Warmbier, Flieger-Ortsgr. Magdeburg, 25 Min. 38 Sek.

Klasse Rumpf-Segelmodelle: (Fuselage Gliders)

Ha.-Str.: A. Besser, Flieger-Ortsgr. Dresden, 13 500 m
Ha.-Dau: E. Bellaire, Flieger-Ortsgr. Mannheim, 20 Min. 13 Sek.
Ho.-Str.: Patalas, Flieger-Ortsgr. Quakenbrück, 35 000 m
Ho.-Dau: H. Kummer, Flieger-Ortsgr. Düben, 55 Min.

Klasse Segelmodelle, schwanzlos: (Tailless Gliders)

Ha.-Str.: A. Herrmann, Flieger-Ortsgr. Nordhausen, 2375 m
Ha.-Dau: K. Schmidtberg, Flieger-Ortsgr. Frankfurt a. M., 37 Min. 41 Sek
Ho.-Str.: E. Klose, Flieger-Ortsgr. Dresden, 8800 m
Ho.-Dau: E. Klose, Flieger-Ortsgr. Dresden, 8 Min. 14 Sek.

Klasse Rekordmodelle mit abwerfbarem Antrieb:

Ha.-Str.: E. Warmbier, Flieger-Ortsgr. Magdeburg, 4200 m.
Ha.-Dau: E. Warmbier, Flieger-Ortsgr. Magdeburg, 28 Min.

Klasse Rekordmodelle ohne abwerfbaren Antrieb:

Ha.-Str.: F. Hoffmann, Flieger-Ortsgr. Schönebeck, 429 m
Ha.-Dau: E. Warmbier, Flieger-Ortsgr. Magdeburg, 2 Min. 40,5 Sek.

Klasse Wassermodelle: (Hydroplane)

Wa.-Dau: H. Mundlos, Flieger-Ortsgr. Magdeburg, 53,4 Sek.

Bo.- Rise off Ground
Ha.- Hand Launched
Ho.- Launched from Altitude
Str. Distance
Dau. Duration
Wa.- Rise off Water

GERMAN MAGAZINES
FEATURING MODEL NEWS

"FLUGSPORT" BiWeek.
Hinderburgplatz 8
Frankfurt a.M. Ger.
16 Marks per Year

DER DEUTCHE SPORT-
FLIEGER. Monthly
Leipzig, Germany
50 Pfennig --Issue

LUFT & KRAFTFAHRT Mon.
Alte Jakob Strasse 148
Berlin SW 68, Ger.
4.40 Marks per Year

1936 LIST OF AUSTRALIAN RECORDS, as Accepted by Aero Club of Australia. Rep. FAI.

		OUTDOOR	
FUSELAGE	R.O.G.	Archie Brown	12m 41s
"	R.O.G.	M. Davis	2m 34s
"	H.L.	S. Wigzell	20m 49s
WAKEFIELD	R.O.G.	J. Fullarton	15m 28s
"	R.O.W.	G. Hopkins	1m 46s
STICK	R.O.G.	J. Finneran	4m 00s
"	R.O.W.	A. Robson	4m 37s
"	H.L.	Archie Brown	13m 01s
SCALE	R.O.G.	J. Fullarton	1m 07s
"	R.O.W.	C. Tuxford	1m 27s
"	H.L.	J. C. Luke	1m 39s
GLIDERS	Tow Line	H. E. Hervey	6m 00s
		INDOOR	
STICK	H.L.	J. Jago	7m 45s

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, October 12, 1936

FUSELAGE MACHINES

Rising off Ground	G. M. Merrifield	9m 50.0s
Rising off Water	G. J. Liggett	2m 33.8s
Hand Launched	A. D. Paine	23m 10.0s
SPEED (R.O.G.)	C. H. Debenham	33.25 m.p.h.
BIPLANE (H. L.)	H. E. White	1m 33.0s
" (R.O.G.)	S. R. Crow	1m 32.1s
PETROL (R.O.G.)	C. E. Bowden	12m 48.0s
COMP. (Fuselage R.O.G.)	D. A. Pavely	1m 46.0s
AIR (Stick R.O.G.)	D. A. Pavely	1m 10.0s
SCALE (H. L.)	H. L. Henery	29.0s
AUTO- (H. L.)	S. R. Crow	49.4s
GYRO (R.O.G.)	S. R. Crow	29.3s
FARMAN TYPE (H. L.)	C. A. Rippon	51.0s
TAILLESS (H. L.)	F. B. Baggs	1m 30.0s
ORNITHOPTER (H. L.)	J. C. Smith	16.7s
GLIDER (H. L.)	W. E. Evans	3m 10.0s

BRITISH MODEL AEROPLANE MAGAZINES

The AERO MODELLER
24-26 Dean St. Fetter Lane
London, E.C.4, England
6d per Issue--7/6 Yearly
(Both are monthlies)

The MODEL AEROPLANE CONSTRUCTOR
129 South East Wing
Bush House, Kingsway
London, W.C.2, England
6d per Issue-- / Yearly

OFFICIAL LIST OF BELGIUM RECORDS, August, 1936

Rubber Powered	M. Alfred Van Wymersch	2m 35s
Gliders	M. Andre Cartigney	2m 02.9s

Aviation magazine featuring model airplane news

L'Aviation Belge, Weekly
18, Place De La Vaillance
Anderlecht, Bruxelles, Bel.
Sub. 75 Francs per Year

MODEL AIRCRAFT LEAGUE OF CANADA

Junior Branch, Aviation League of Canada

309 Journal Bldg.
OTTAWA, Ont., Canada

October 14, 1936

Mr. Frank Zaic
83 East 10th St.
New York, N.Y.

Dear Frank:-

During the 1936 Nationals at Detroit, you observed somewhat pensively that "our greatest fault in this game is that we take ourselves too seriously". Ira Hassad even went so far as to suggest that we "put an end to Percy Pierce, or whoever started this thing called model aviation". Both thoughts are, perhaps, worthy of consideration (or are they?), but I won't commit myself beyond advising that we all do what we can to make the best of what appears to be an unhappy involvement (or is it?).

Model builders are, of course, an unusual crowd - a unique brotherhood of diverse individuals. How, for instance, would you reply to one who in all apparent seriousness asks you, "What is the difference between an air screw and a tail spin?", or, more distracting yet, "I am making a microfilm propeller and intend covering both sides of the blades; is it okay to use wax paper to keep the two surfaces from sticking together?" Do you wonder that my opinion is divided as to whether I should agree with the statement you made at Detroit? At any rate, in accepting your invitation to write some notes on Canadian Progress for your Year Book, I would ask your pardon if what I say appears to be of more serious nature than it might have been.

The year 1936 has been one of marked progress, both nationally and internationally, in the world of model aviation. A turning point has been reached in two distinct respects: firstly, governing bodies in the various countries have become aware of the necessity of mutual co-operation with the object of standardizing contest rules and procedure, which will probably result in the formation of an organization composed of representatives from each nation; secondly, after it has become increasingly evident that a major revision of rules is necessary, particularly with regard to eliminating the element of luck from outdoor competition, definite steps in that direction now seem assured. Our personal preference in the latter would be, in short, a weight ruling of one ounce per 25 square inches of wing area, with the average time of three flights to be counted in all events, both indoor and outdoor.

A comparison of the latest Canadian records with last year's will serve as an indication of the extent to which model aircraft activity has advanced in this country during the past year. The first list of Canadian records was prepared just two years ago, and of those appearing on the present list, all but three were established in the course of the past twelve months - fourteen of them in the 1936 Canadian National Contest. All were, of course, made in this country, where average weather conditions are notably poor, compared with those generally encountered by contestants in United States meets.

The highlight of the year's activity was the National Contest, held at Toronto, Ontario, from August 31st to September 2nd, under the joint auspices of the Model Aircraft League of Canada and the Canadian National Exhibition. This was the Dominion's sixth annual contest, previous ones having been held at Ottawa (1930 and 1931), Winnipeg (1932), and Toronto (1934 and 1935). The number of participants this year was the largest ever, with 160 entries in all being recorded, and more out-of-town contestants took part than ever before. Bruno Marchi, Joe Matulis, and Jimmie Bohash made up a strong group of invaders, the first two each leaving a pair of new records for the books.

Probably the most unusual feature of the contest was the fine weather which prevailed on the day of the outdoor contest. After so many years of windy weather at the Nationals, the light breeze and multitude of thermals came as an unexpected and pleasant surprise to most of the contestants. The most keenly contested event proved to be, as might be expected, the Wakefield. This event is held annually under rules similar to those of the International Contest, with the Canadian Wakefield Trophy going to each year's winner. Paul Verdier, of Ottawa, Ontario, placed first with an average time of 4 minutes 53 seconds for three flights, his last attempt being an out-of-sight flight of 11 minutes 13 seconds. The fact that so many models flew out of sight substantiates the widely felt belief that the present minimum wing loading is inadequate. If a heavier wing loading were coupled with an average time ruling, it seems to me that skill would replace the element of luck, which is so undesirable, in outdoor competition.

There isn't much more to be said on Canadian Progress, Frank. Our best suggestion is that you and other builders from other countries see things at first hand by participating in the 1937 Canadian National Contest. Conversely, we hope our fellows will be very much in evidence at foreign meets next year.

Yours sincerely,

Edward S. Booth

National Secretary

MODEL AIRCRAFT LEAGUE OF CANADA

Junior Branch, Aviation League of Canada

OFFICIAL CANADIAN MODEL AIRCRAFT RECORDS
Adopted by the Model Aircraft League of Canada, October 1, 1936

INDOOR

BABY R.O.G. (30 sq. in. or under)			
Junior:	Don McIntyre	Guelph, Ont.	7m 05s
Senior:	Ernest Houslander	Hamilton, Ont.	8m 34s
Adult :	Melvin Bardsley	St. Catherines, Ont.	6m 47s
STICK H.L. (30-150 sq. in.)			
Junior:	Bert Norman	Vancouver, B. C.	10m 15s
Senior:	Fred Hollingsworth	Vancouver, B. C.	11m 59s
Adult :	Joseph P. Matulis Jr.	Chicago, Ill.	12m 29s
FUSELAGE R.O.G. (30-150 sq. in.)			
Junior:	Clarence Dunn	Hamilton, Ont.	7m 07s
Senior:	James J. Haffey	Toronto, Ont.	9m 59s
Adult :	Joseph P. Matulis Jr.	Chicago, Ill.	8m 55s
FLYING SEMI-SCALE R.O.G.			
Junior:	Clarence Dunn	Hamilton, Ont.	2m 29s
Senior:	Paul Verdier	Ottawa, Ont.	4m 58s
Adult :	Albert Levy	Toronto, Ont.	4m 14s
GLIDER H.L. (30-100 sq. in.)			
Junior:	Bob McLellan	Vancouver, B. C.	21s
Senior:	Ernest Barrie	Galt, Ont.	33s

OUTDOOR

STICK H.L. (100-200 sq. in.)			
Junior:	Leonard Fisher	Winnipeg, Man.	4m 13s
Senior:	George Lord	Winnipeg, Man.	15m 00s
Adult :	James M. Jensen	Unity, Sask.	4m 10s
WAKEFIELD R.O.G (190-200 sq. in. -- Average of 3 flights)			
Junior:	Clarence Dunn	Hamilton, Ont.	2m 15s
Senior:	Paul Verdier	Ottawa, Ont.	4m 43s
Adult :	Bruno Marchi	Medford, Mass.	3m 09s
GASOLINE ENGINE R.O.G.			
Senior:	Tom Smith	Winnipeg, Man.	13m 44s
Adult :	Bruno Marchi	Medford, Mass.	7m 45s

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This book is a reprint and its contents should be viewed from a historical viewpoint. Some of its technical and theoretical text may be outdated and misleading. — Consult current books for information on model aerodynamics. — Also, because of the long time interval between the original publication and reprint, please do not use any of the addresses shown in the book.

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