Flapper Facts

Newsletter of the Ornithopter Modelers' Society

Issue #10 Spring 1995

Editor/Publisher: Nathan Chronister, Box C-3815, Bucknell University, Lewisburg, PA 17837.

How to Join OMS: If you are reading someone else's copy of Flapper Facts and want your own membership, you can join now by sending $9 ($14 outside the US) to the address above. Payment should be made to "Nathan Chronister."

Folding Wing Contest Entries

This issue of *Flapper Facts* contains each of the twelve entries in the 1994 Ornithopter Modelers' Society Postal Contest, reproduced in the order in which they were received. Each has been given a letter for identification purposes, and the identity of each contestant will be revealed in the next issue.

The prizes, provided by Indoor Model Supply, OMS, and Roy Clough, will be awarded to two contestants in the design category based on your votes. To encourage participation, a reply card has been provided with this issue. After you have read the newsletter, please take a moment to review the designs and decide which one you like best. To avoid biasing your decisions, I will suggest no judgment criteria other than recommending that only the design itself, rather than style of presentation, etc., should be considered.

The winner of the documented flight category will be announced along with the other winners.

OMS Member Survey

The enclosed card, in addition to providing a space for contest voting, asks several questions which will help insure that OMS represents the interests of its members. The first question addresses the suggestion by some members that the newsletter should include certain unusual topics other than ornithopters. Do you agree?

The next question is intended to guide policy concerning the AMA rules issue. Your votes will determine which type of rules change proposal we submit and hopefully will help get the proposal approved by the AMA.

The first option is for those of you who don't think fixed wings should be allowed to provide most of an ornithopter's lift. The current rule was an attempt at this which failed due to several loopholes, but Dick Quermann and I have found a better way. If it is decided that fixed wing lift should be limited in the AMA contest, we can do so with the following requirement:

"...The center of gravity shall be less than 1/3 (2/5 for pushers) the distance from the point on the wing(s) farthest from the stabilizer, to the point on the stabilizer nearest the wing(s)."

Notice that having the CG nearer to the wing than it is to the stabilizer is the only way to prevent the fixed stabilizer from carrying most of the weight, even if it is small.

If, on the other hand, you would like to see models with large fixed wing area and small flapping propellers in the contest, pick option B. This type of model may outcompete true ornithopters under these rules.

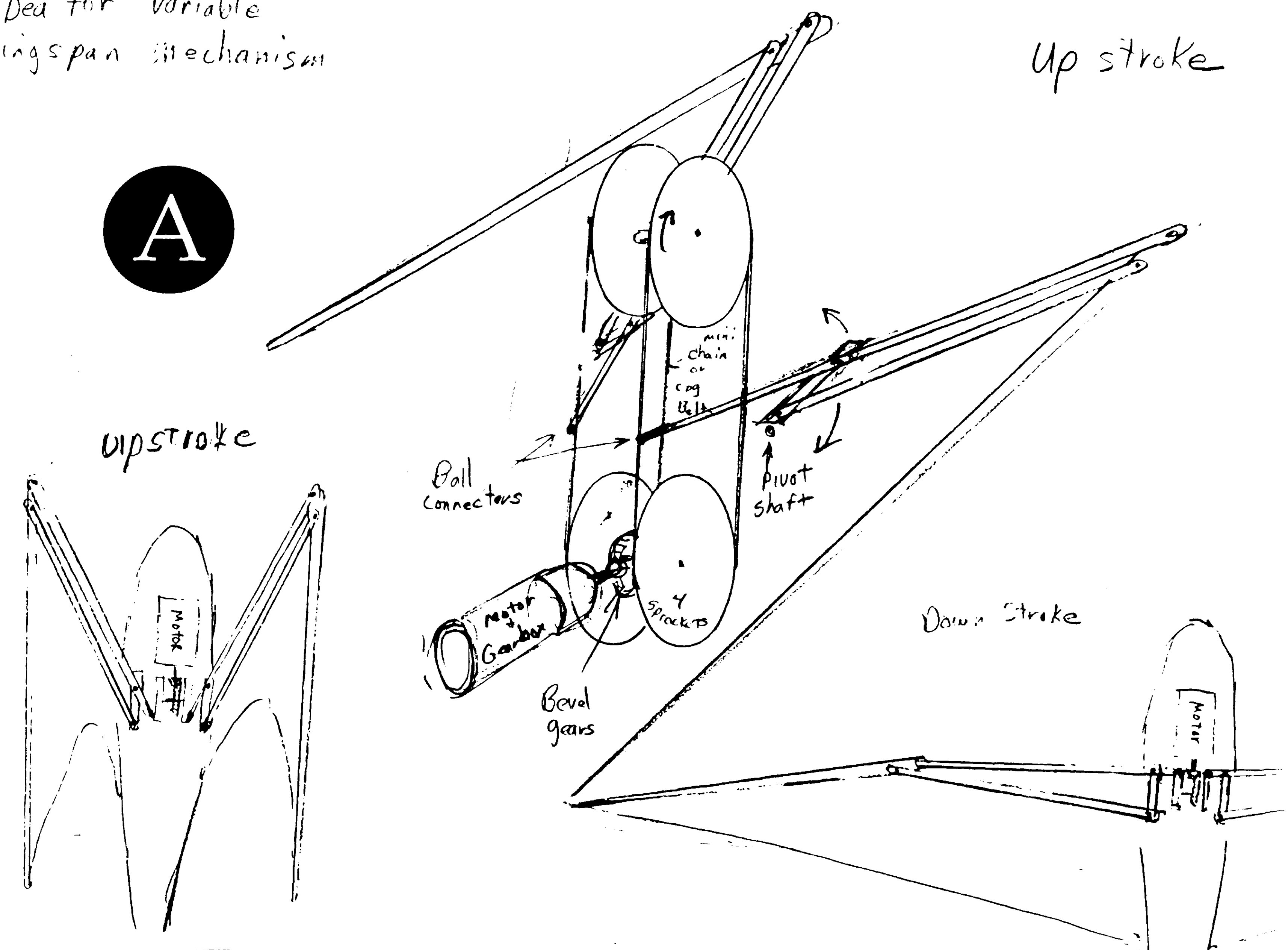
The third choice also allows most of the lift to be produced by fixed surfaces, but the area of these is limited for aesthetic reasons. These models are supported mainly by stabilizer lift, and are fundamentally similar to those in B.

Finally, I would like to revise the Design Manual soon, and any suggestions you may have concerning this would be helpful. Tell me what you think is missing, which parts should be left as they are, and suggest any changes or additions you feel could be made. Use the back of the post card for this purpose and for anything else you wish to convey. News about projects is especially welcome.

Backissues

The ever-lengthening backissues set is now more expensive. Locally they are charging $.07 a page for copying, so the price is up to $25 now, $33 overseas. New, expanded *Flapping Flight Bibliography*, members send SASE.

Idea for variable wingspan mechanism



Not to scale (not even close)

B

MOUETTE PROJECT

The flight of birds relay mainly on 9 motions:

1 An up/down flapping
2/ A down/up -
3/ A fore/aft movement
4/ A aft/fore -
5/ A pitch change next to the body
6/ - at the tips
7/ "Hand" folding at the wrist
8/ Surface change by feather overlapping
9/ Variable speed, the down/up flapping is quicker than the up/down.

The Mouette is expected to fill 8 of these 9 conditions.

The tip path of the bird's wings being approximately an elliptic one, with the long axis front/up - aft down, it has be found that a circular one for a model would be convenient. A simple gear with a rubber motor, or an electric one does not need the crankshaft system of the classic ornithopters.

Wings are fitted to a shaft which is curved on three points (for one wing). On point A is the "main elbow" which indeed describes a circle. It allows the leading edge to move according to an up/down and fore/aft motion. This provides a change of the pitch next to the body. A small steel shaft running inside a ring maintains level the trailing adge. This shaft is fitted to the wind's l.e. by a small axis perpendicular to the wing's surface.

Between B and C, the shaft runs (or better said turns) inside a tube which may constitute the leading edge.

At C, the shaft is bent It is used to pilot the wing tip, and provides the folding of this tip along an hinge witch offers a delta angle to the main wing. This device is somewhat copied on the autogyro blade flapping system invented by La Cierva. This means that when the wing is rising, for instance, the incidence of the tip is less than the one of the inside part. Such pitch change is conform to the different pitches found on a propeller.

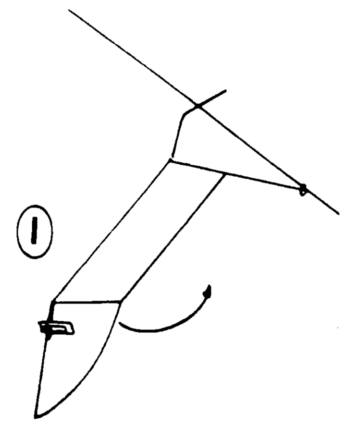
The tip of the shaft, after C point, is sliding in a slot which may be fitted more or less high over the wing tip. This allows to contol the angle of folding.

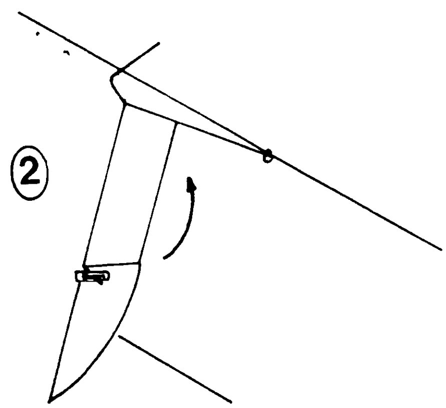
The layout has not been tested on a model in flight. Only on one wing made of carton, with a hand-actuated crankshaft. The movement of the wing is very next to the one of a living bird.

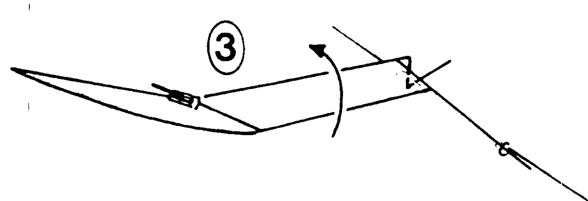
Surface changing has not been envisaged (at least until now),because it woulfl add complexity. But a kind of Karman surface could slide under the wing (or the wing slide over it, between the wing and the fuselage side.)

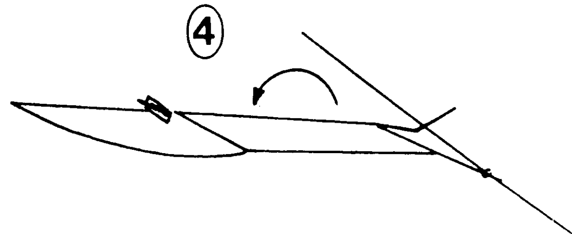
The speed change is automatic (like on classic ornithopter). As more power is needed to flap the wings down, it is noticeable that the motion is slower than when the wings are riding upwards.

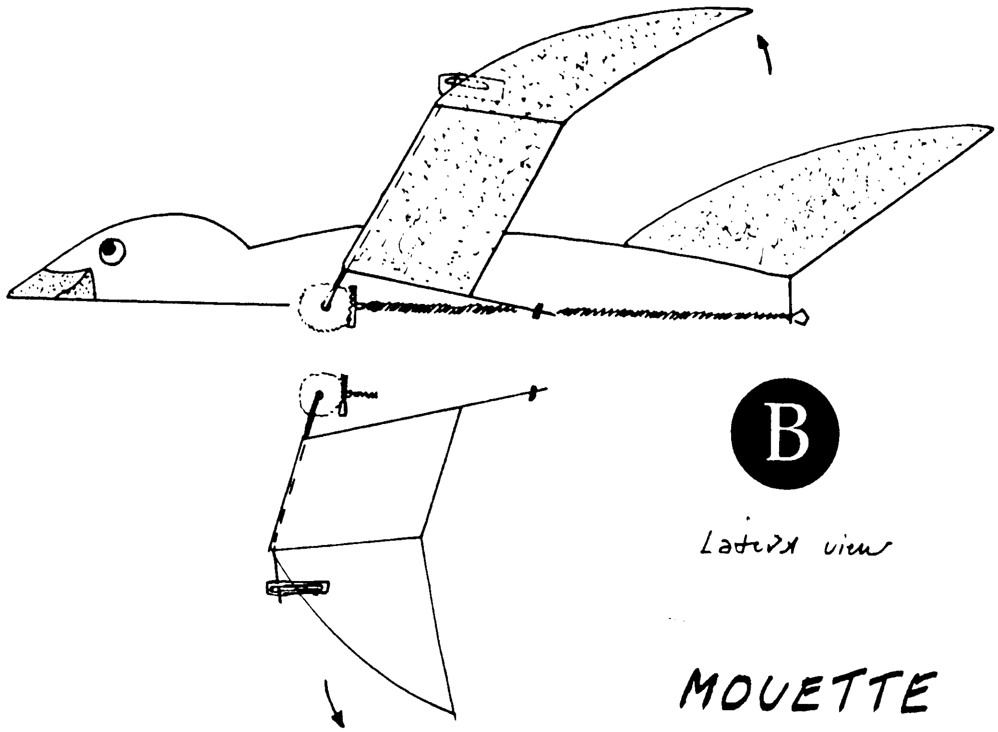
The rotating motion of the wings is likely to develop a torque tending to a pitch up of the bird's head.







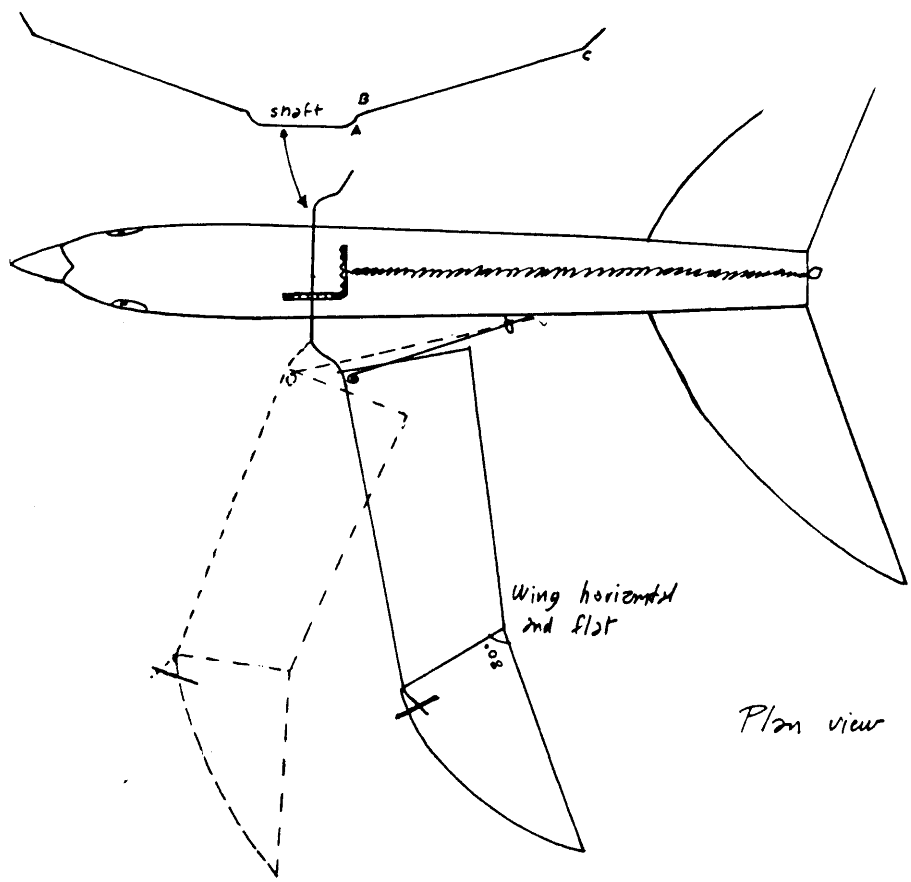




Lateral view

B

MOUETTE
gull



Plan view

June 28, 94

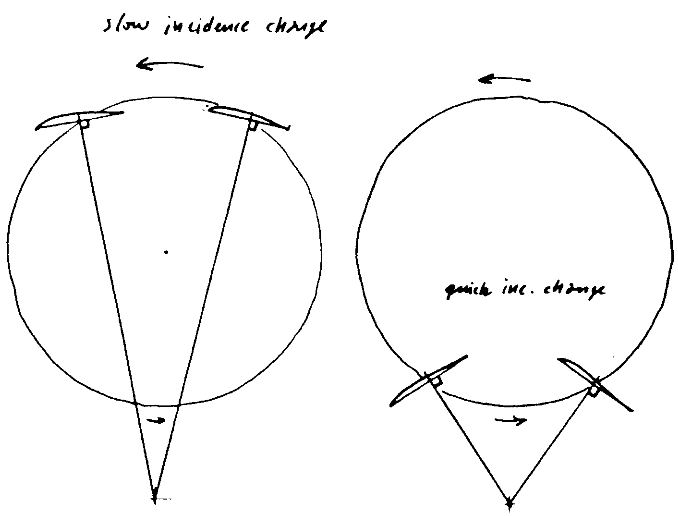
Dear Nathan,

thanks for your mail. The CO2 bird made by Joss seems to be quite remarkable. And what a fine writing ! . A very fine calligraphy which surely deserved to be reproduced.

I send a quick sketch including an improvement which should produce a slow motion of the wing in the upper part of the circle, and a quicker one in the low part. The invention is not mine, but may be found in the booklet written by Louis Kahn in 1929. He made a very complete project for an engine driven full-size dragonfly. You probably heared about it, because it is quite a classical project in the ornithopter field.

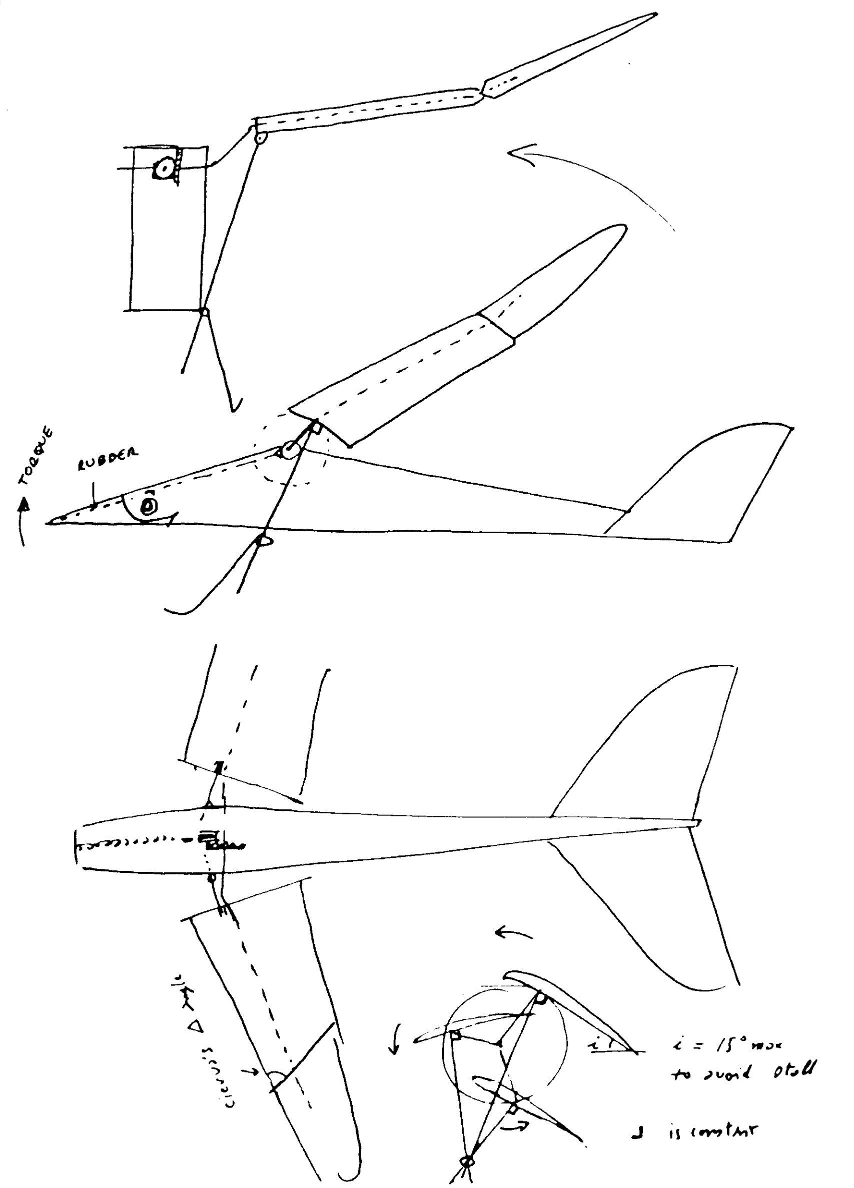
Will PERHAPS build my Mouette, but this is not sure at all !
(Time flies better than model onithos !)

. Yours rotorfully,



PROJET MOUETTE

20 JUIN 94



D

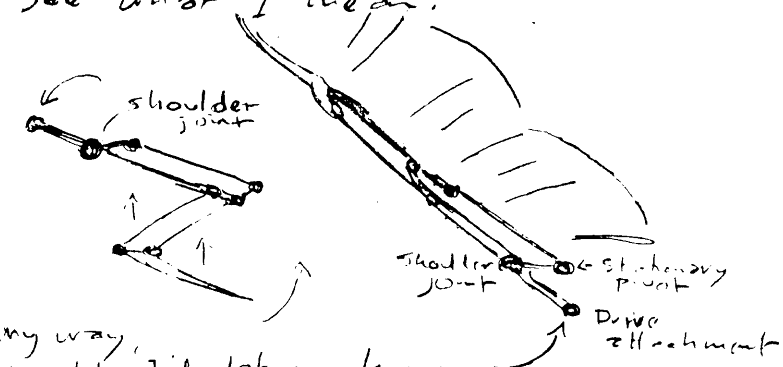
Dear Nathan,

That model contest sounds real innovative. It is a dream come true for where I was at last summer. I was dreaming of making a mechanical goose, radio controlled, to fly over goose gunners. My concept was to make the thing about 2X actual goose size, and therefore the craft would appear close enough to shoot, yet actually be far out of range. A rather expensive practical joke. But the concept still intrigues.

Unfortunately I have alot of other crazy ideas, which means I've spent very little time on the ornithopter idea.

The problem of making actual bird-like jointed wings is still keeps me dreaming once in awhile. I don't have enough time to spend on it now as I'm taking math classes preparing for mechanical engineering.

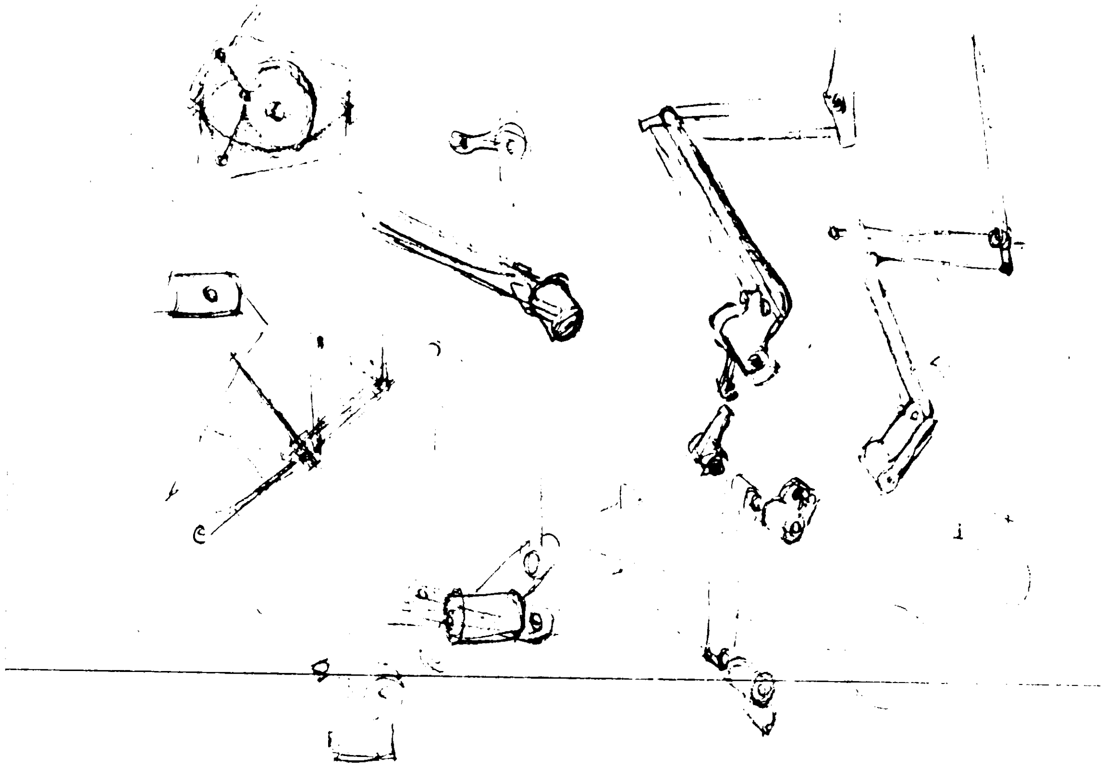
But from the few doodles I've sketched, I think the damn thing could be rather simple. The problem might be making a gismo that pulls forward and back like rowing a boat, on the wing butts inside the pivot points. And the 3 joints of the wings would take care of themselves by the way they are linked. If you look at my sketch you'll see what I mean.

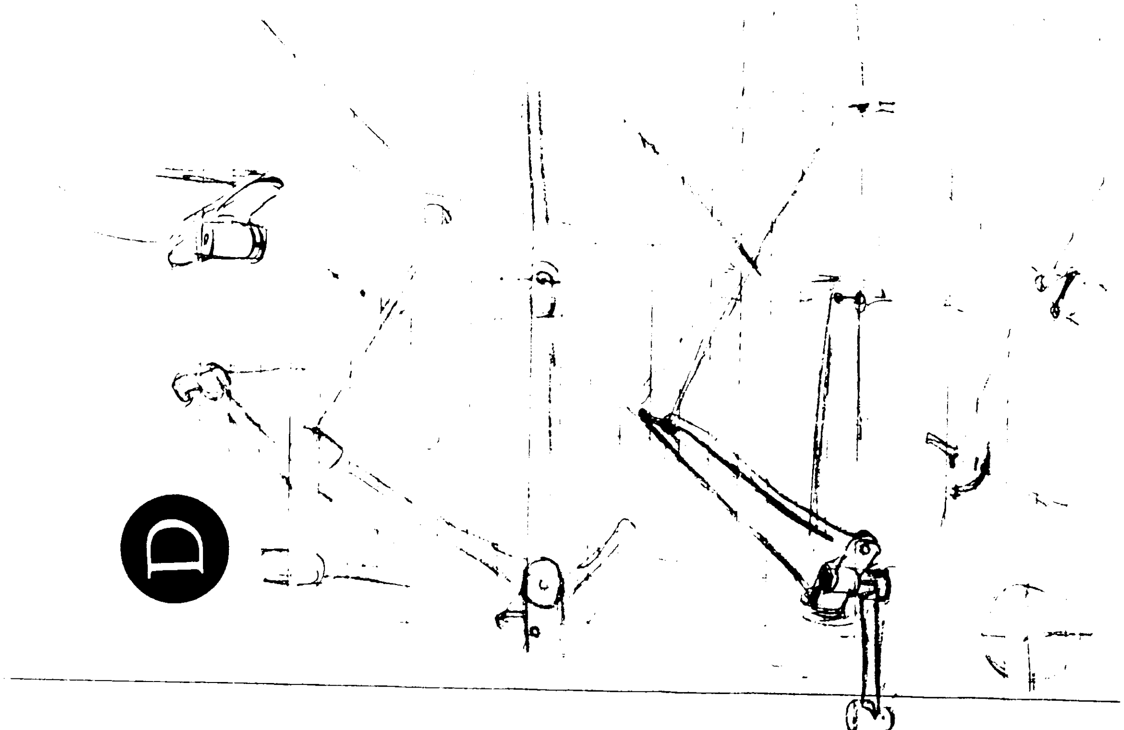


Anyway, thought I'd let ya know I'm still around and occasionally thinking of ornithopters. I can't wait to see what the real devotees came up with.

Oh yeah, my plan for the Lipchitz orni came out of Frank Zaic's "Handbook of Glider design". It was the only one there, and they claim it glides well.

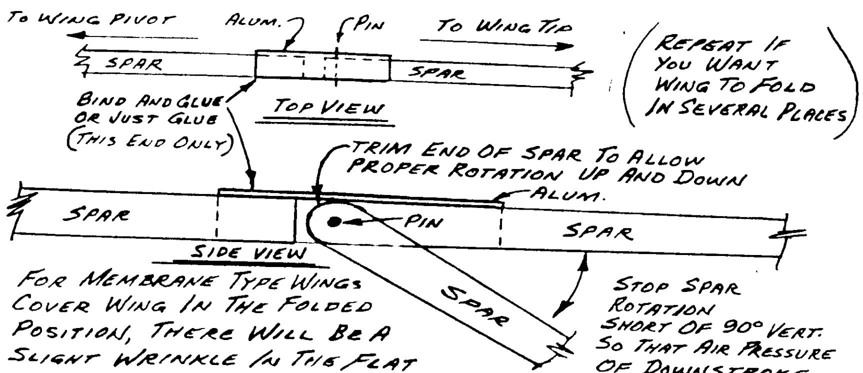
[redacted]



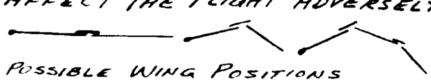


E

Here Is An Idea For A Simple, Easy To Make Hinge That Will Allow For The Folding Of Wings On Ornithopters, With As Many Folding Joints As One Likes, In Each Wing.
It Can Be Used On Wing Leading Edges Or On Wing Spars, Or Both.
May Also Be Used On Biplane Ornithopters, But Be Careful That Wings Do Not Meet.
Air Pressure Of Upstroke Causes Wing To Fold And Downstroke Causes Wing To Open To Flat.

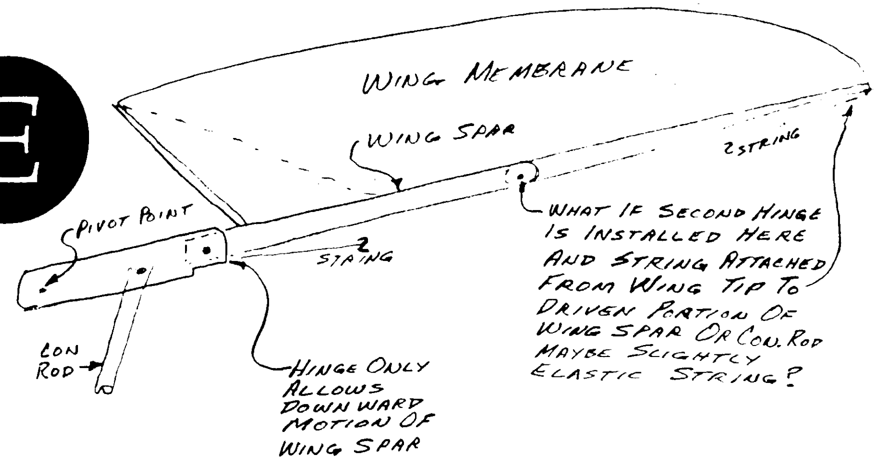


For Membrane Type Wings Cover Wing In The Folded Position, There Will Be A Slight Wrinkle In The Flat Position, But It Should Not Affect The Flight Adversely.

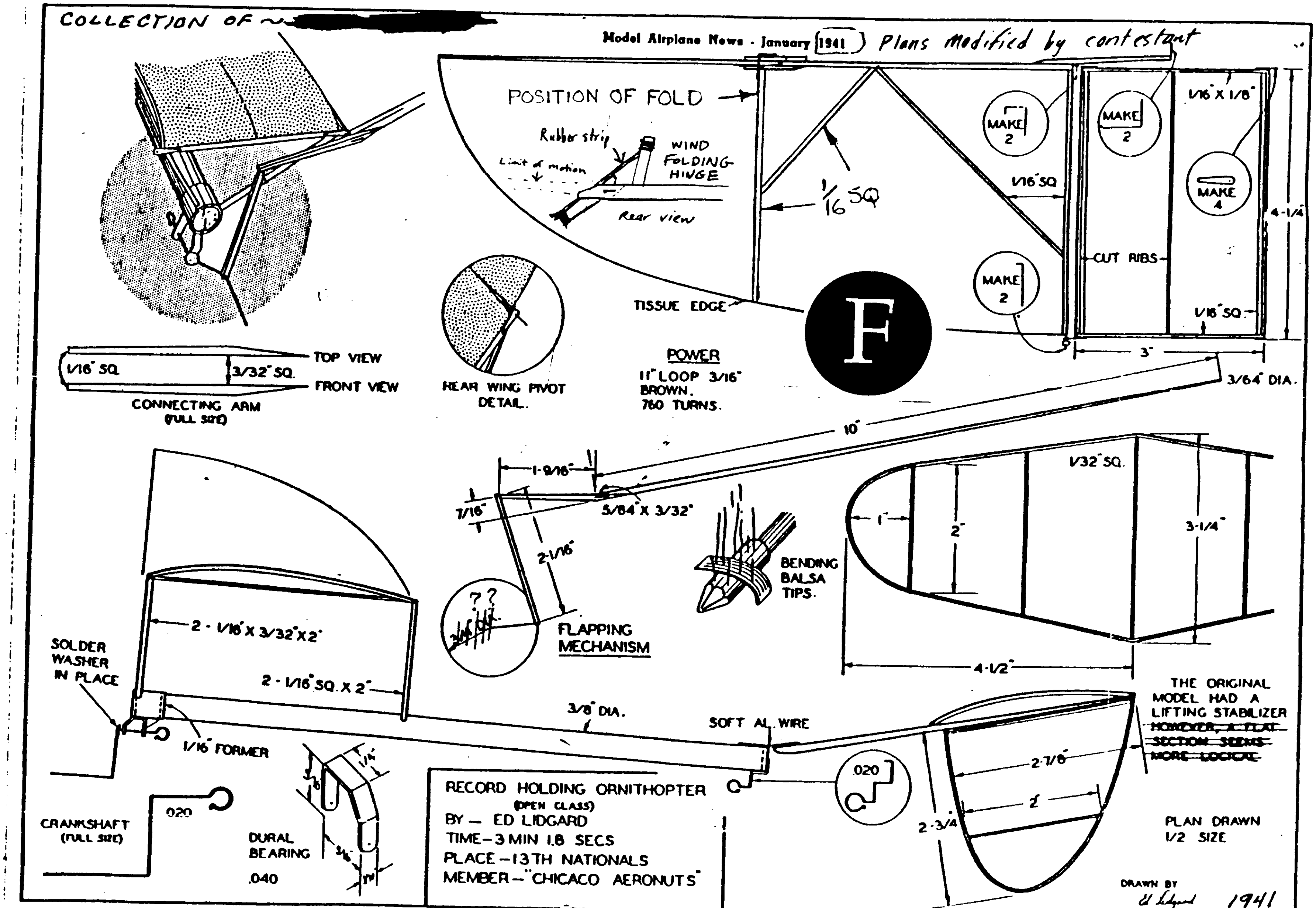


Possible Wing Positions And There Are Many More Use Your Imagination

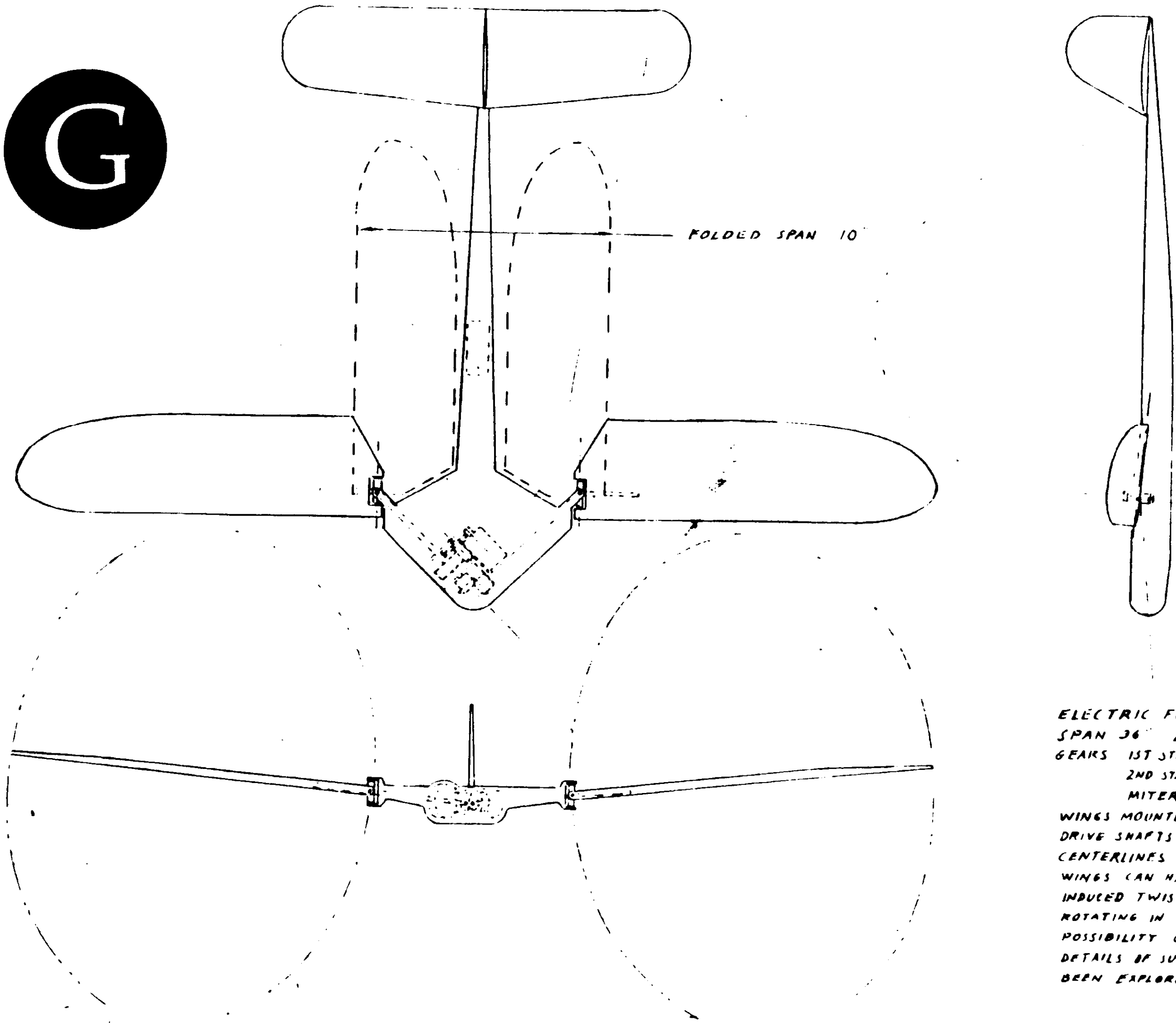
I Will Be Glad To Respond To Any Questions About This Or Any Other Of My Designs.



Another Thought: If Hinge Were Skewed Such As With A Folding Prop On A Rubber Model. It Would Be A Complex Skew (Ref. F.F. Old Timers Model Aviation Nov. 94 Pg. 101)
But Perhaps The Wing Could Be Made To Fold In & Backwards On The Up Stroke.
Those Of You Who Have The Ability & Time To Tinker Try It Out.
I Will Gladly Correspond And Discuss With Anyone - Any Of The Features Of Ornithopters


COLLECTION OF ~[redacted]
Model Airplane News · January 1941
Plans modified by contestant
POSITION OF FOLD
Rubber strip
Limit of motion
WIND FOLDING HINGE
Rear view
1/16 SQ
1/16" SQ.
1/16" X 1/8"
MAKE 2
MAKE 2
MAKE 2
MAKE 4
CUT RIBS
4-1/4
3"
3/64" DIA.
TISSUE EDGE
REAR WING PIVOT DETAIL.
POWER
11" LOOP 3/16" BROWN. 760 TURNS.
1/16" SQ.
3/32" SQ.
TOP VIEW
FRONT VIEW
CONNECTING ARM (FULL SIZE)
10"
1-9/16"
7/16"
5/64" X 3/32"
2-1/16"
FLAPPING MECHANISM
BENDING BALSA TIPS.
1/32" SQ.
1"
2"
3-1/4"
4-1/2"
2 - 1/16" X 3/32" X 2"
2 - 1/16" SQ. X 2"
SOLDER WASHER IN PLACE
1/16" FORMER
3/8" DIA.
SOFT AL. WIRE
.020
CRANKSHAFT (FULL SIZE)
DURAL BEARING
.040
1/4
3/16
RECORD HOLDING ORNITHOPTER
(OPEN CLASS)
BY — ED LIDGARD
TIME — 3 MIN 1.8 SECS
PLACE — 13TH NATIONALS
MEMBER — "CHICAGO AERONUTS"
THE ORIGINAL MODEL HAD A LIFTING STABILIZER ~~HOWEVER, A FLAT SECTION SEEMS MORE LOGICAL~~
2-7/8"
2"
2-3/4
PLAN DRAWN 1/2 SIZE
DRAWN BY
1941

G

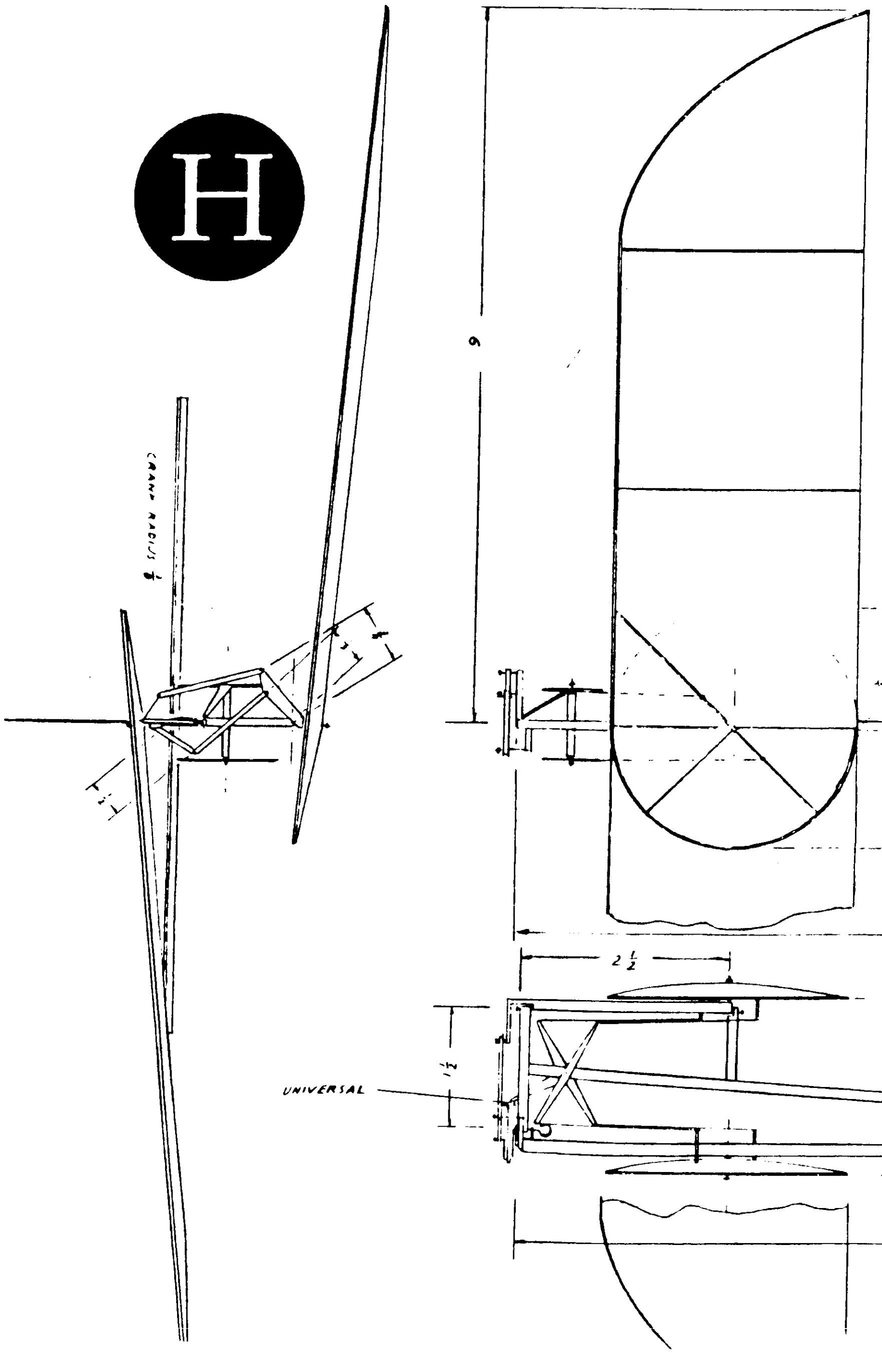


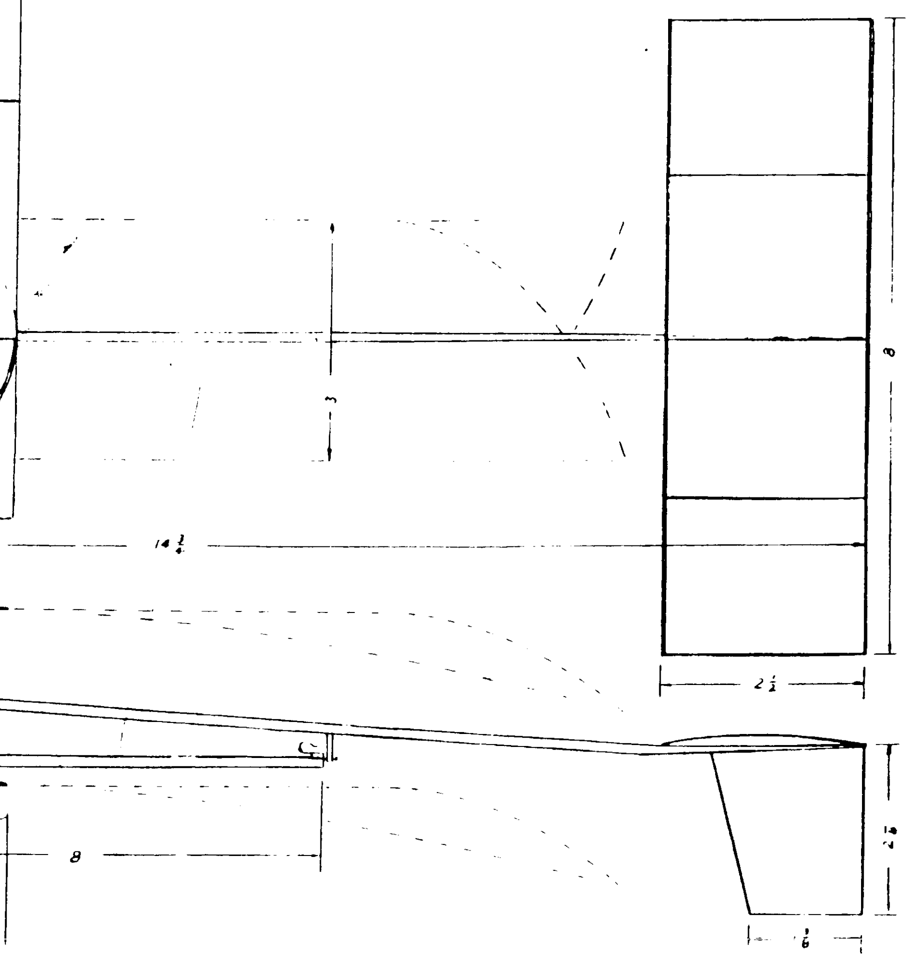
ELECTRIC FOLDING WING ORNITHOPTER
SPAN 36" LENGTH 24" WT ESTIMATE 6 OZ
GEARS 1ST STAGE 64P 10T PINION 80 T GEAR
2ND STAGE 32P 10T PINION 40 T GEAR
MITER 32 P $\frac{1}{4}$ DIA
WINGS MOUNTED TO FUSELAGE WITH GIMBAL.
DRIVE SHAFTS HAVE 45° BEND AT GIMBAL
CENTERLINES AND PIVOT FREELY IN WINGS
WINGS CAN HAVE THE USUAL AERODYNAMICALLY
INDUCED TWIST HOWEVER THE DRIVE SHAFT
ROTATING IN THE WINGS SUGGESTS THE
POSSIBILITY OF CAM DRIVEN TWIST. THE
DETAILS OF SUCH A MECHANISM HAVE NOT
BEEN EXPLORED.

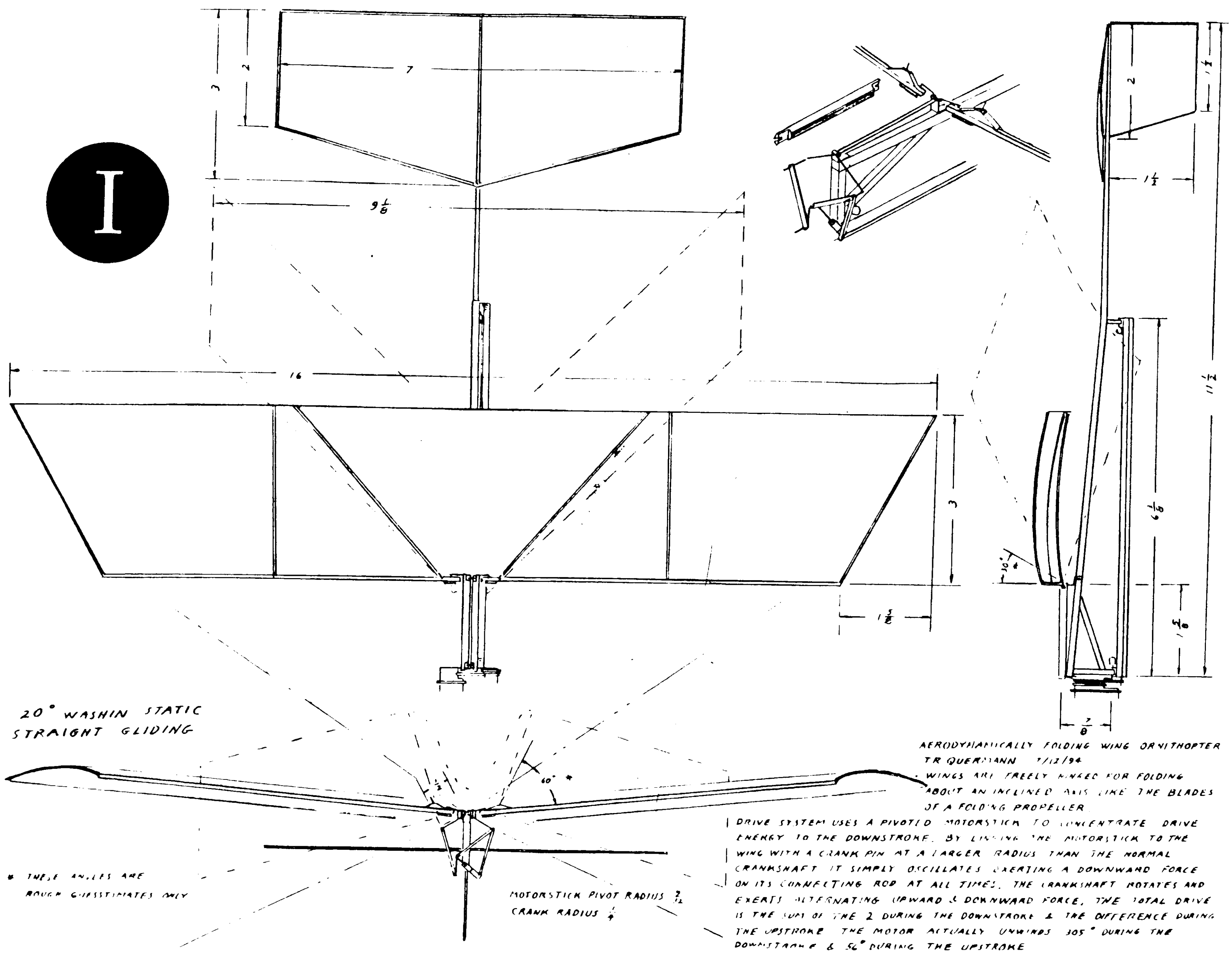
[redacted] 1/13/95

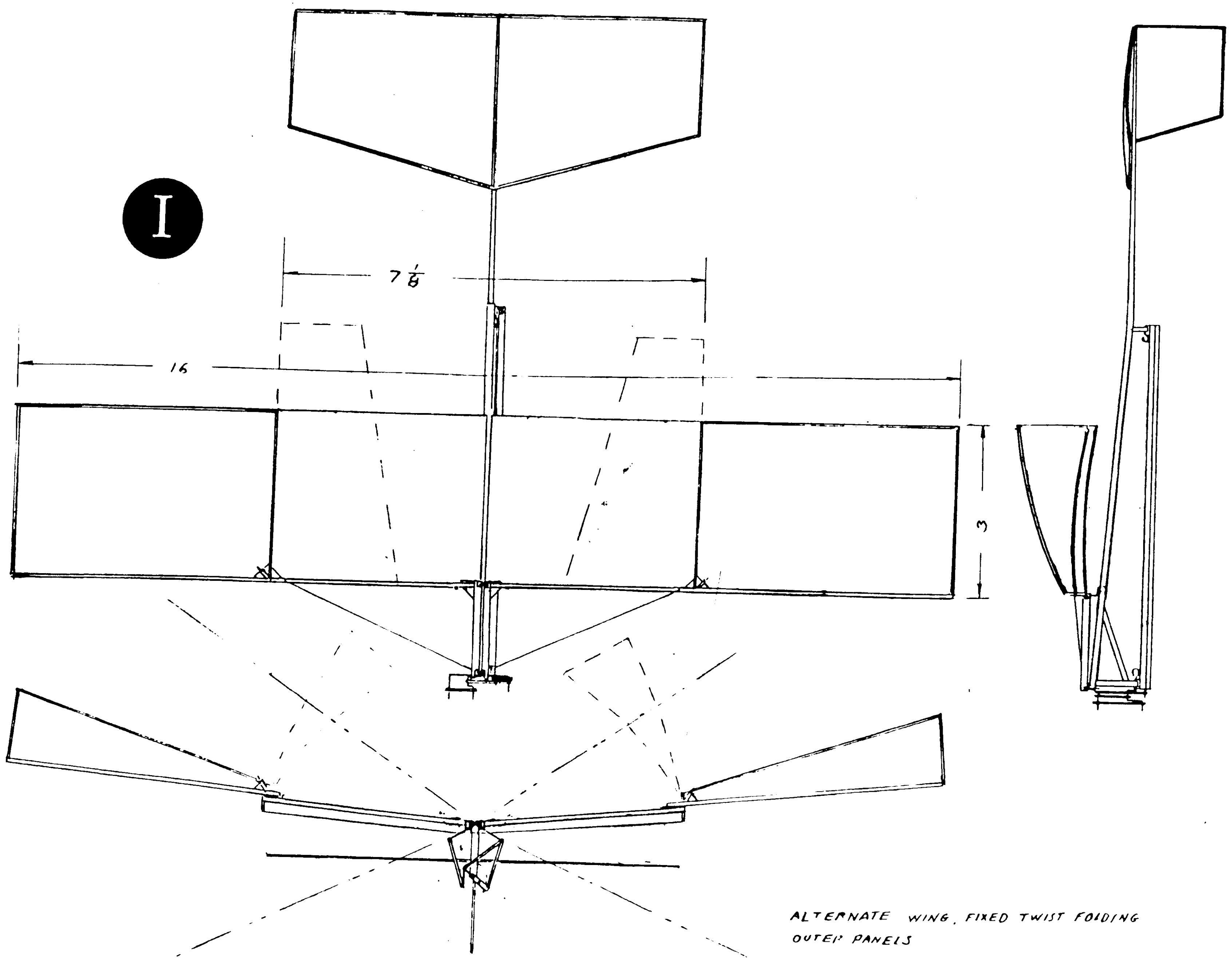
FOLDING WING ORNITHOPTER [redacted] 4/1/94

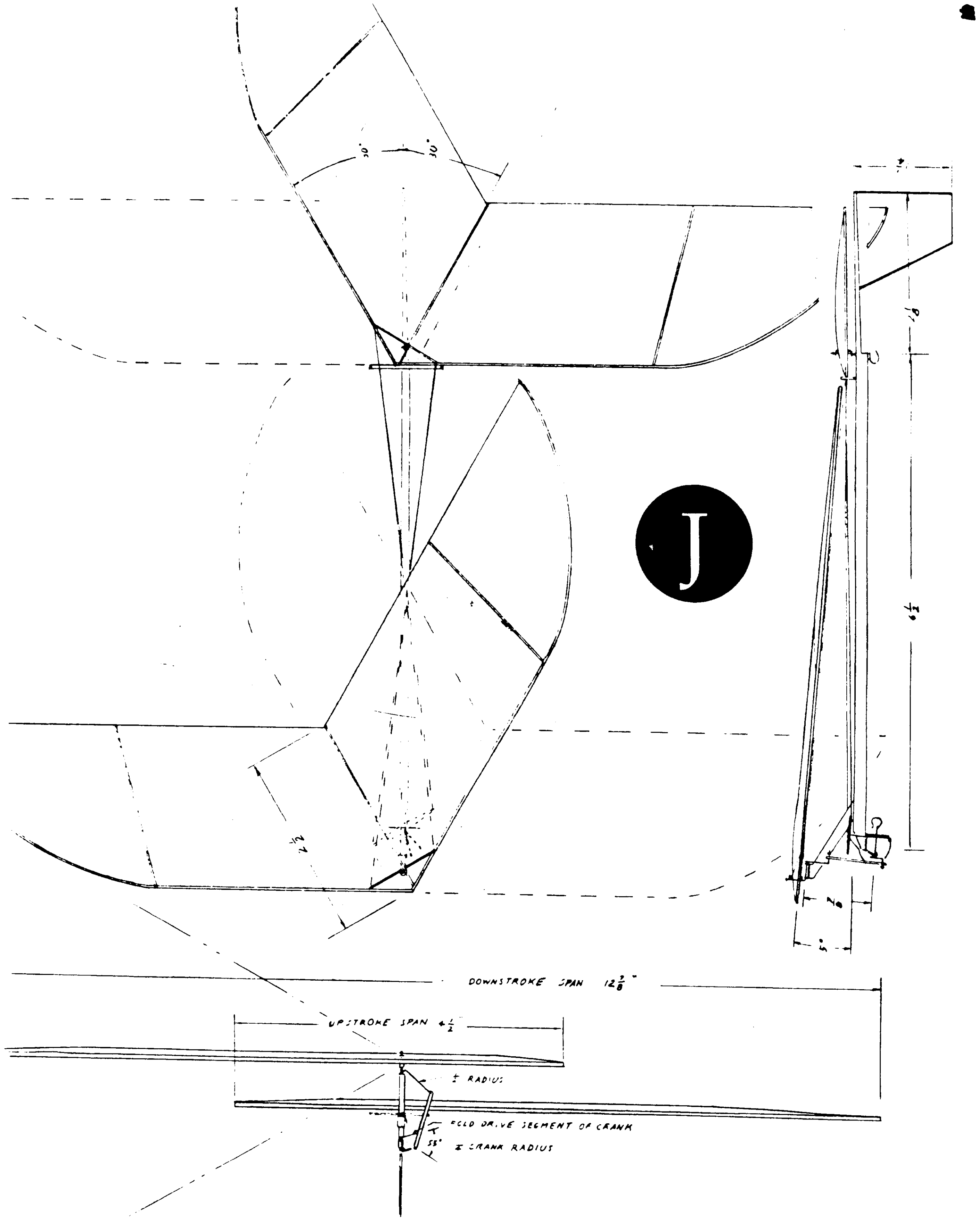
- DESIGN SEEKS TO MAXIMIZE THE DIFFERENCE BETWEEN DOWNSTROKE SPAN & UPSTROKE SPAN
- PIVOTED MOTOR STICK LINKED TO UPPER WING FLAPPING DRIVE ARM PROVIDES MOUNTING FOR LOWER WING AND CONCENTRATES DRIVE ENERGY TO THE DOWNSTROKE. AS SHOWN IN THE FRONT VIEW DURING THE DOWNSTROKE THE CCW ROTATION OF THE CRANKSHAFT AND THE CW ROTATION OF THE MOTORSTICK BOTH PRODUCE DOWNWARD MOTION OF THE CONNECTING RODS. DURING THE UPSTROKE THE CCW ROTATION OF THE CRANKSHAFT DRIVES THE CONNECTING RODS UPWARD CAUSING THE MOTORSTICK TO MOVE CCW IN OPPOSITION TO THE TORQUE EXERTED ON IT BY THE MOTOR. SINCE THE MOTOR STICK ROTATES ONLY 60° WHILE THE CRANKSHAFT ROTATES 180° THE RESULT IS THAT THE MOTOR UNWINDS 240° DURING THE DOWNSTROKE AND 120° DURING THE UPSTROKE.
- FOLDING IS DRIVEN BY THREADS ATTACHED TO TWO INDEPENDANT WALKING BEAMS ONE OF WHICH IS CONNECTED TO A CRANKSHAFT DRIVEN CONNECTING ROD WITH A UNIVERSAL JOINT
- WING SHOULD BE BUILT WITH APPROX 30° WASHIN & TORSIONAL ELASTICITY SUCH THAT AERODYNAMIC FORCES WILL STRAIGHTEN THEM IN GLIDING FLIGHT WITH THE WINGS IN MID DOWNSTROKE POSITION.






I
7
2
3
9 1/8
16
3
1 5/8
1 1/4
2
1 1/2
11 1/2
6 1/8
10° *
1 5/8
7/8
20° WASHIN STATIC
STRAIGHT GLIDING
60° *
* THESE ANGLES ARE
ROUGH GUESSTIMATES ONLY
MOTORSTICK PIVOT RADIUS 7/32
CRANK RADIUS 1/4
AERODYNAMICALLY FOLDING WING ORNITHOPTER
TR QUERMANN 7/12/94
WINGS ARE FREELY HINGED FOR FOLDING ABOUT AN INCLINED AXIS LIKE THE BLADES OF A FOLDING PROPELLER
DRIVE SYSTEM USES A PIVOTED MOTORSTICK TO CONCENTRATE DRIVE ENERGY TO THE DOWNSTROKE. BY LINKING THE MOTORSTICK TO THE WING WITH A CRANK PIN AT A LARGER RADIUS THAN THE NORMAL CRANKSHAFT IT SIMPLY OSCILLATES EXERTING A DOWNWARD FORCE ON ITS CONNECTING ROD AT ALL TIMES. THE CRANKSHAFT ROTATES AND EXERTS ALTERNATING UPWARD & DOWNWARD FORCE, THE TOTAL DRIVE IS THE SUM OF THE 2 DURING THE DOWNSTROKE & THE DIFFERENCE DURING THE UPSTROKE THE MOTOR ACTUALLY UNWINDS 305° DURING THE DOWNSTROKE & 56° DURING THE UPSTROKE


I
7 1/8
16
3
ALTERNATE WING, FIXED TWIST FOLDING
OUTEP PANELS

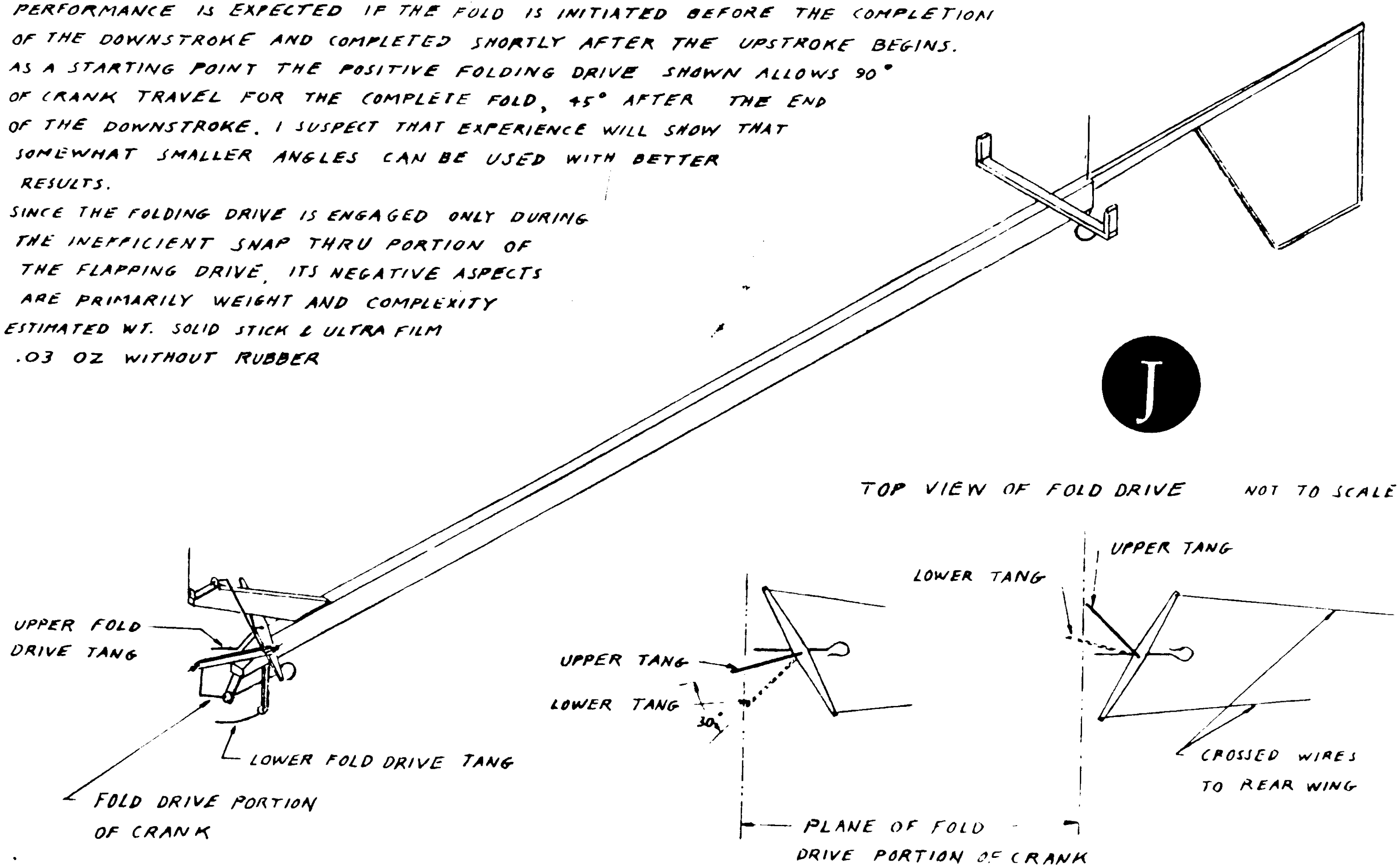


DOWNSTROKE SPAN
UPSTROKE SPAN
RADIUS
FOLD DRIVE SEGMENT OF CRANK
CRANK RADIUS

FOLDING WING TANDEM ORNITHOPTER [redacted] 1/30/95

- BY USING SWEPT BACK WINGS IN A TEETER TOTTER MODE, THE FLAPPING AND FOLDING OF THE 4 WING HALVES IS ACCOMPLISHED WITH ONLY ONE FLAPPING HINGE AND TWO FOLDING HINGES.
- SWEPT BACK WINGS NEED NO DIHEDRAL - THIS & NEED FOR RUDDER VERIFIED BY SMALL GLIDER
- CROSSED WIRE WING INTERCONNECTION SYNCHRONIZES FOLDING & ELIMINATES NEED FOR STOPS ON FORWARD WING
- WING SHOULD BE BUILT WITH 20° WASHIN AND TORSIONAL SPRING RATE TO GIVE O TWIST GLIDING.
- AERODYNAMIC FORCES SHOULD CAUSE FOLDING DURING THE UPSTROKE DUE TO THE POWERFULL THRUST OF THE DOWNWARD MOVING PANELS. HOWEVER BETTER PERFORMANCE IS EXPECTED IF THE FOLD IS INITIATED BEFORE THE COMPLETION OF THE DOWNSTROKE AND COMPLETED SHORTLY AFTER THE UPSTROKE BEGINS.
- AS A STARTING POINT THE POSITIVE FOLDING DRIVE SHOWN ALLOWS 90° OF CRANK TRAVEL FOR THE COMPLETE FOLD, 45° AFTER THE END OF THE DOWNSTROKE. I SUSPECT THAT EXPERIENCE WILL SHOW THAT SOMEWHAT SMALLER ANGLES CAN BE USED WITH BETTER RESULTS.
- SINCE THE FOLDING DRIVE IS ENGAGED ONLY DURING THE INEFFICIENT SNAP THRU PORTION OF THE FLAPPING DRIVE, ITS NEGATIVE ASPECTS ARE PRIMARILY WEIGHT AND COMPLEXITY

ESTIMATED WT. SOLID STICK & ULTRA FILM .03 OZ WITHOUT RUBBER



TOP VIEW OF FOLD DRIVE NOT TO SCALE

22/2/95

Dear Natham,

I was interested to read of your Postal Contest and the idea that is behind it. For some time I have thought about this kind of development. It may interest your readers that some flying insects (many hymenoptera) fold their fore-wings on the upstroke. They have a one-way hinge in a thickened area called the 'sigma'. This hinge allows downward flexing of the wing tip - but not upward. [Ref: P100: 'Insects in Flight' by John Brackenbury]

I have tried to copy this in one of my models without much success. I think it will require a tandem-wing model to make full use of this method. I used a simple hinge joint in the leading edge.

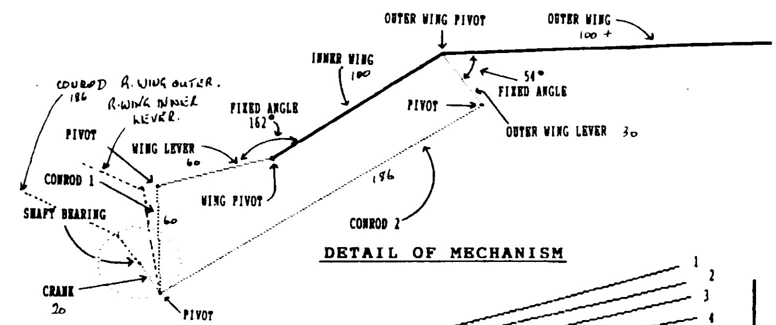
I have also attempted to design a crank system to achieve a similar action. I used my computor to display the wing movement. I printed the wing positions for every 10 degree rotation of the crank but found the print-out difficult to interpret. I split the print-out in to four quadrants. As you may see from the enclosed copy the movement has some of the characteristics of a bird's wing.

I haven't yet built a model using this system, but I hope to do so - I hope before the 31st March 1995.

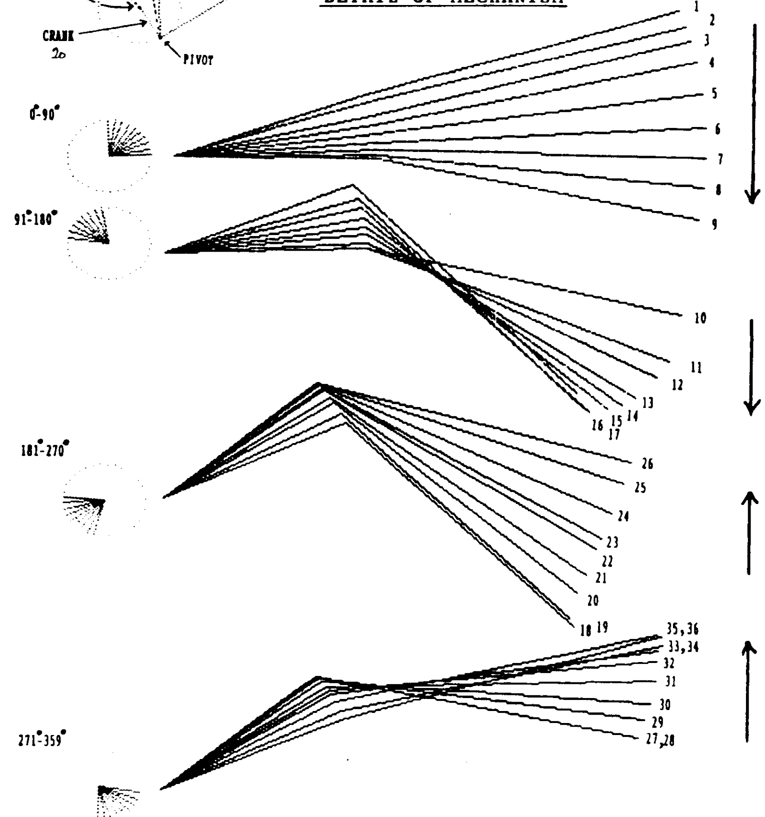
I have given the dimensions I used in the simulation in the diagram at the end of this letter.

Kind regards,

P.S. I have recently built an indoor model using a single pair of wings with a moving tailplane that beats 90 degrees out of phase with the wings. It serves three useful purposes - first it damps the vibration of the wings when the crank is at top and at bottom dead centre - secondly it provides thrust - and thirdly it acts as an elevator. I have flown it at two indoor meetings. The model reached the ceiling on both occasions and fluttered around for some time but I cannot imagine it as a duration model. My wife thought it looked like a mosquito and so named it. It provoked quite a lot of interest. I will send you photographs and drawings at a later date.

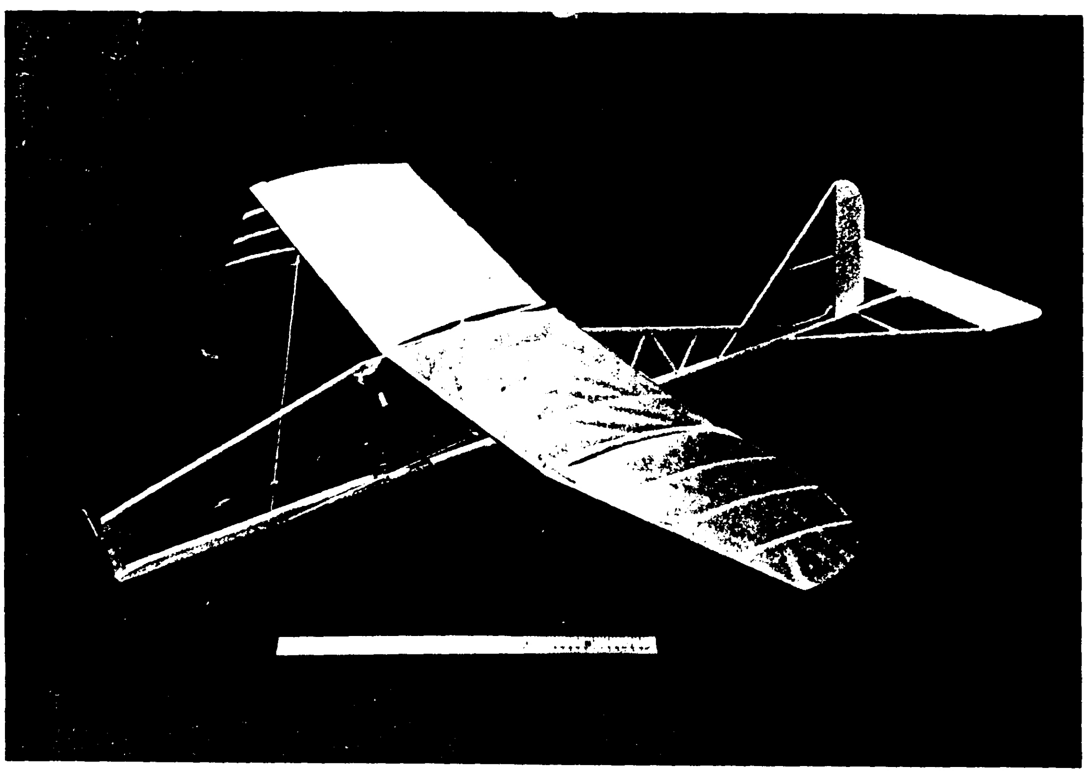


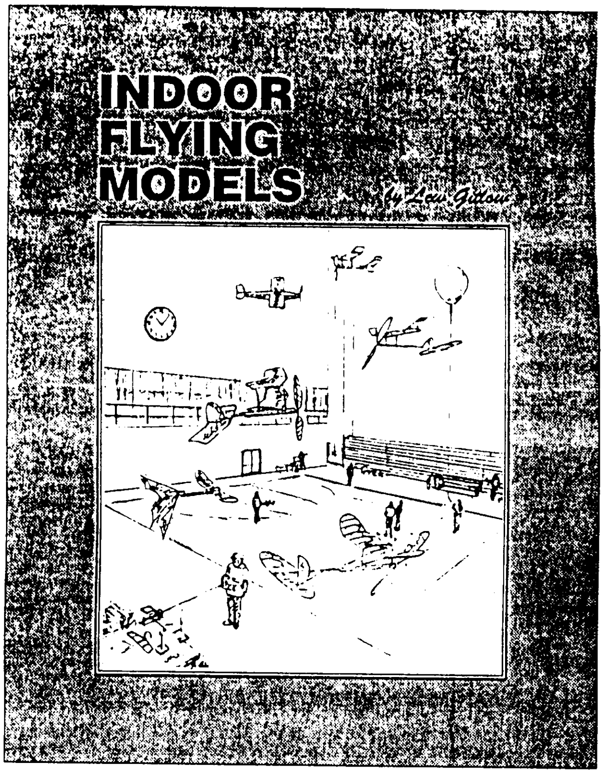
DETAIL OF MECHANISM



L

I would like to share my brief excursion into mechanically implementing variable-span flapping. In 1993 I built the small rubber-powered ornithopter shown in the enclosed photos. There was absolutely no analysis behind this. My idea was to construct a wing whose behavior intuitively modelled the variable-span flapping performed by birds. I figured that if I replicated the mechanical essence of such a wing (stiff front spar followed by a light torsionally-compliant structure; one-way hinge with elastic return spring), the physics of the problem would drive it to perform in such a way that the basic elements of animal variable-span flight would be elucidated. That is, my hypothesis was that the dynamic twisting and folding of the animal's wing is passive, aeroelastically driven from the imposed flapping at the root.





INDOOR FLYING MODELS

by Lew Gitlow

CONTENTS

Cover art by Mark Allison

Indoor Flying Models is approximately 160 pages, 8.5" x 11", with loads of plans. Many of the plans are full size and include I.M.S. Kits in addition to the original designs of famous contest winners like Banks, Coslick, Brown, Hunt, and dozens of others. The scope covers gliders to the F.1.D. international microfilm class models. With all the illustrations, technical data, building and experimenting with his own models, it comprises years of work.

You will find a development that starts with a theme of man's first dream of flying and how with imagination and the use of experimental models he actualized this dream. Then with a strong message for instructors he presents material that can be used to stimulate interest before the instructor adds his own experience. The basics of tools, materials, and "the right moves" lead you from the most simple to the most complex models and techniques, including "How to brew your own microfilm solution" and the secrets of the experts are revealed including "What your best flying buddy won't tell you."

By Lew Gitlow

☐ VISA
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