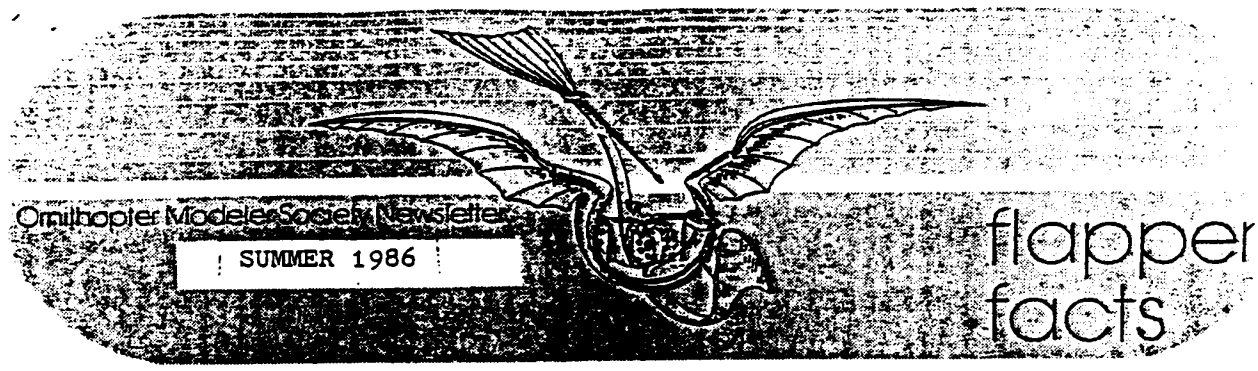


VOLUME III NUMBER III ROY & SHIRLEY WHITE, EDITORS

NEWS OF THE OMS

Membership has increased to 86 with new members from all over the U.S. and also Sweden. We welcome from the U.S. - Milton B. Galant, Michael Dodd, George Baibar, Willis Overholt, William Foshag, Donald Schults, Donald Perkins D. Joseph Parrish - from Sweden - Jonas Romblad. This issue carries a contribution from Mike Dodd who has also offered to help with any of the art work, cartoons, etc. Thanks Mike, we will put your offer to good use. Also, Jonas Romblad has submitted material that will appear in the next issue in regard to I.C. Ornithopter. A special thanks to all members who have answered our plea for material for this, our first effort as editors. Please keep the material coming. We are in the process of obtaining permission from the Smithsonian to reprint the article on Paul McCready's flying machine, and if we get it, will put it out as a special issue. Thanks to Bill Baker for sending it along to us. Walt Erbach is interpreting the German article for all for reprint in a future issue. Our contributors this month are John White, Frank Kieser, Jan Koniarek, Dick Johnson and Mike Dodd.

Hope to see a lot of you for the NFFS in Niagara Falls this June. We need to have more flyers in the official events for ornithopter to let our voice be heard for more inclusion as an official event in other contests. The NFFS is sponsoring an unofficial event at the NATS this year and hope we have some attendance there. How about some letters to Homer Smith to get Ornithopter as an official event at the '87 NATS?

The AMA has denied our application as a chartered club but we are in the process of applying for charter as a Special Interest Group. President Frank Kieser is handling this and hope to have a report from him for the Fall issue. And how about some reports from the rest of you guys. What are you doing in the way of building, flying, times, flying sites you have, come on, we want to know what's going on with all of you!!!

We will have back issues available. Send your request with a SASE and will send to you. Design Manual also available, if you haven' received yours, let us know.

A special note of appreciation to our former editor, Pat Deshaye. This is our first effort at the newsletter and a difficult job it is. Hope you are pleased with it, and if not, send your suggestions and material. Pat did a hell of a job and hopefully, when he is settled, he will be back into this again, but it's a project that needs help from all concerned,

F. KIESER
2219 Gordon Ave.
Jacksonville Bch., FL 32250

April 2, 1986

Dear Les,

Your "Simple Tandem Ornithopter" as published in the Spring '86 issue of "Flapper Facts" is certainly clever and unique and it will be interesting to compare its performance with more conventional types. One advantage I see compared to most monoplane designs that I am sure you must have found is that the crank and slider linkage eliminates the dead center - no load condition of the conventional monoplane linkage. When your crank is at top center, it appears that the wing rotational velocity is maximum and at bottom center the rotational velocity is still appreciable. At some position above horizontal, the rotational velocity goes to zero, but the translational velocity is maximum, so the system appears to be always under load which should result in a smooth motion.

There is one problem with your design as published of which you may not be aware. As I interpret the AMA rule, "Free Flight General Para. 6", your configuration does not comply. My interprtation would be that the rear wing, as driven by the crank, is the flapping surface and the forward wing, even though it rotates in flight, is the fixed stabilizer since it is rigidly fixed to the motor tube. The AMA rule limits the area of this surface to a maximum of 50% of the total wing area. In your design as shown, the stabilizer area is about 72%. I don't see any real detrimental effect in redesigning to comply with the rule.

Since there may be others who would like to compete using your design, I am sending a copy of this letter to Roy White to publish in the next newsletter. I hope this is OK with you. I'm looking forward to seeing you in June at the USIC.

Sincerely,

Frank

Frank Kieser

Some ideas on ornithopter design - John White 20·3·1986

Dear friends,

I first became interested when Parnell Schoenky published 'Flaphappy' in an English journal in October, 1949. After a brief flurry of activity, working in isolation, building ceased but my interest contin I therefore welcomed the opportunity of joining OMS and the chance to exchange ideas. As I no longer have the desire, or the capability of chas ornithopters that could reach 300 ft. and drift downwind for half a mile, I have decided to acquire the gentle art of building indoor models.

I submit for your consideration the following notes that outline my present approach.

I firmly believe in the future of the bi-plane ornithopter and hope to show mathematical support for this configuration in the first part of this article. An important aim is to design a wing system that wi operate smoothly with little vibration.

Let me start by making two assumptions

1. A crank mechanism has been designed to drive two similar set of wings such that when the angular velocity of the crank-sha is constant, they will beat sinusoidally with a phase angle o 90 degrees between each set of wings, but with no phase difference between the left and right wing of each set.
2. The load on the crank-shaft is proportional to the square of the angular velocity of the wing (c/f Frank Kieser's analysis

Let C = the angle of the crank-shaft
and a = the angle of the wing
and v = the angular velocity of the wing
and p = the load on the crank-shaft

Then considering the first pair of wings

$a_1 \propto \sin C$
$v_1 \propto \cos C$ ($v = da/dt$)
$\therefore p_1 \propto \cos^2 C$ (assumption 2)

Then considering the second pair of wings

$a_2 \propto \cos C$ ($\sin(90+C) = \cos C$)
$v_2 \propto \sin C$
$\therefore p_2 \propto \sin^2 C$

With both wings operating

Total load on the crank-shaft = $p_1 + p_2 = \cos^2 C + \sin^2 C = 1$

Therefore the load on the crank-shaft is constant which satisfies one the conditions imposed by our first assumption. All that remains is t design a crank mechanism that will satisfy, as closely as possible, t remaining conditions of that assumption.

To help me do that I programmed my computor to plot graphs of win angle v crank angle for left & right wings of a pair, having input t dimensions of the crank mechanism. I have included print-outs of the upper wings of my 1950 'DRAGONFLY' and the results from an improved crank mechanism. This gives hope for a future improvement in perform if my theories are correct.

However, the force to drive the wings is not the only factor governing the crank-shaft load. Because the wings have mass, kinetic energy is lost as they are decelerating and energy has to be provided while they are accelerating. A negative force is imposed on the crank-shaft during deceleration and a positive force during acceleration. These forces corrupt the uniform rotation of the crank-shaft we wish to achieve. These forces are in proportion to the weight of the wing, so by halving the weight the forces are halved.

When a pendulum swings, the bob is raised at the limits of each swing and so stores the kinetic energy of the bob as it decelerates. This energy is returned to the system as the bob falls and accelerates on the return swing. There is a continuous exchange from kinetic energy to potential energy and back again.- a very efficient system.

Insects overcome this problem, I read, in two ways. First they have very light-weight wings, and secondly use the elastic outer shell of their thorax as an energy store. The thorax deforms when the wings are decelerating and reform when accelerating thus returning energy to the system. I shall experiment with a springy material holding the wings at a required dihedral angle to see if the wings will oscillate if deflected and then released. Some insects beat their wings resonately, sending impulses to the muscles, not at every wing beat but at longer intervals so perhaps it is a possibility.

The problem that one wing is not supported by the weight of the opposite wing is another reason for having very lightweight wings. A model in vertical flight does not have this problem. Will a hovering model minus tailplane be built one day ?

Insects steer themselves by increasing the wing sweep angle on one side and reducing it on the other. I intend to use this method to provide a turning flight rather than using a fin.

Another avenue I intend to explore one day is to produce a mono-wing ornithopter with bird-like wings. The inner section of each wing will operate 90 degrees out of phase with the outer sections. I have already done a computor simulation of the system and the motion appears very bird-like. The parameters of the system will have to be calculated very carefully but I think it has possibilities.

I have given undogmatically my personal views and ideas. I hope to have stimulated some thought. I would welcome your views and criticisms.

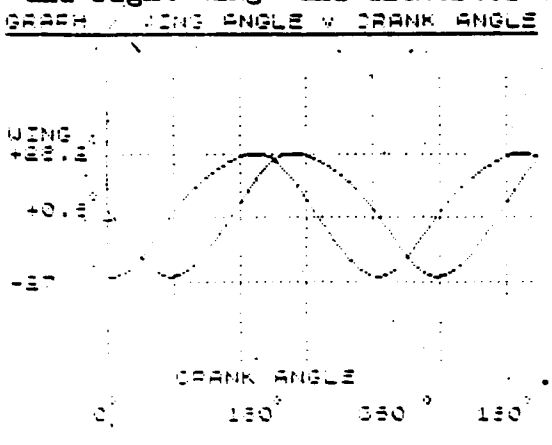
Yours.

Upper wings of

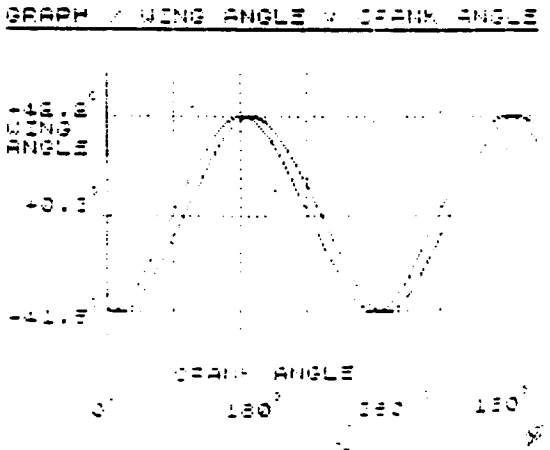
'DRAGONFLY' 1950

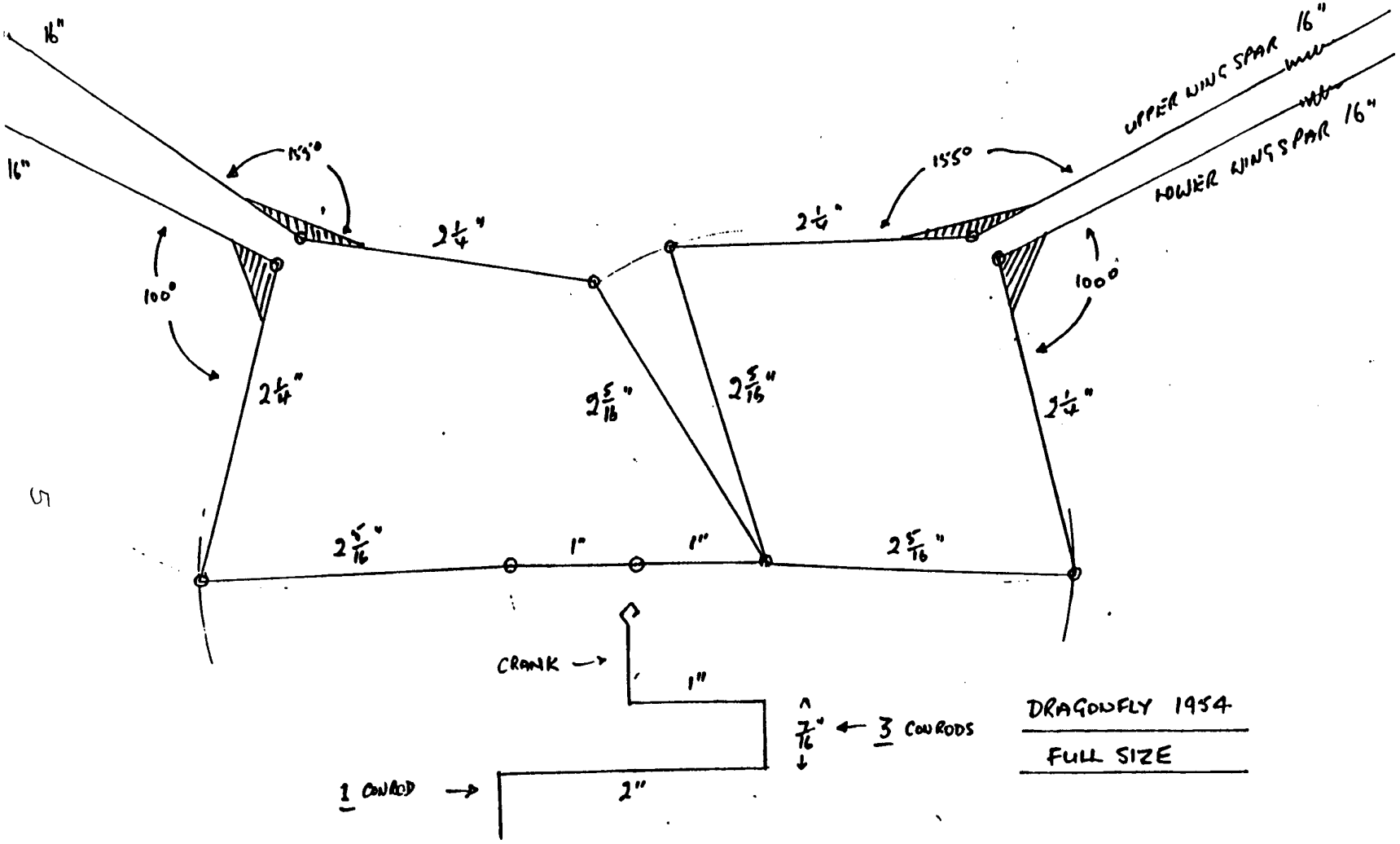
Add 25 degrees for true angle.

Notice large phase angle between left and right-wings and distorted wave-form.



An improved mechanism gives small phase angle and is closer to a sine-wave.

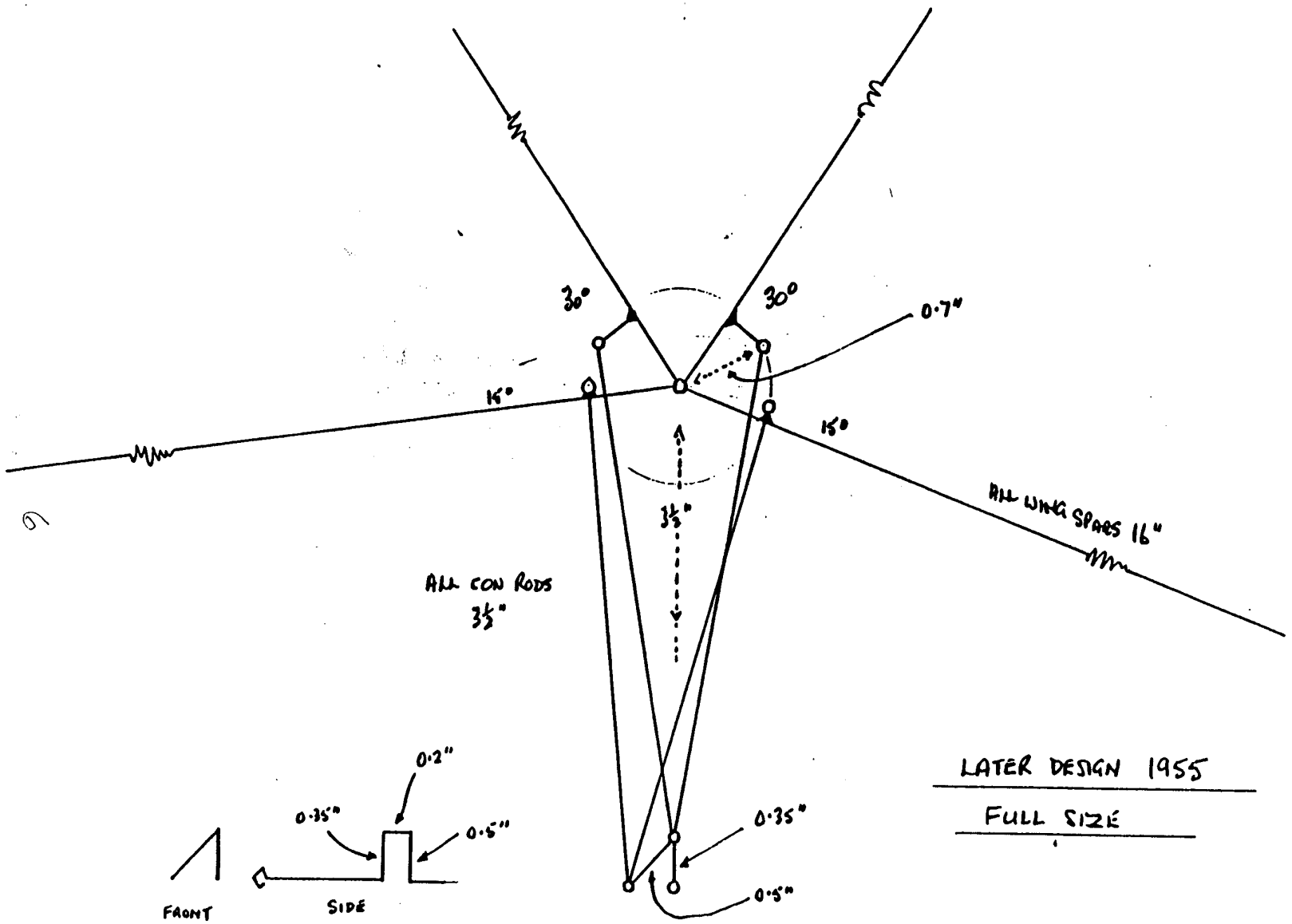




DRAGONFLY 1954

FULL SIZE

J. S. WHITE



LATER DESIGN 1955

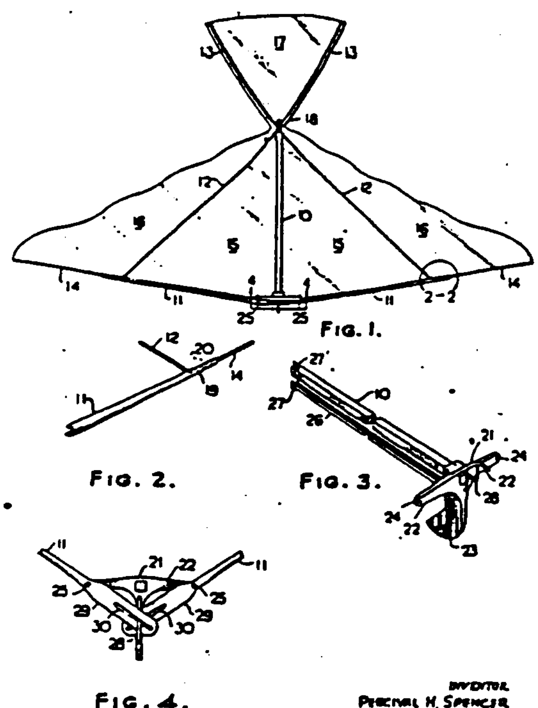
FULL SIZE

J. S. WHITE

Nov. 11, 1958 P. H. SPENCER 2,859,553

TOY AIRPLANE

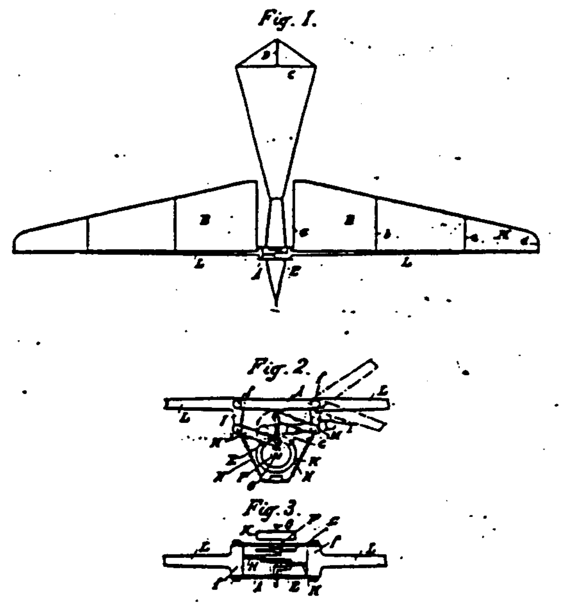
Filed Oct. 2, 1956



INVENTOR.
PERCIVAL H. SPENCER
BY Elliott & Pastoriza

R. L. LIOUT.
FLYING MACHINE WITH FLAPPING WINGS.
APPLICATION FILED AUG. 5, 1911.

1,009,692. Patented Nov. 21, 1911.



Witnesses. Inventor.

United States Patent [19] [11] 4,139,171

Harris [45] Feb. 13, 1979

[54] ARTICULATED WING ORNITHOPTER

[76] Inventor: Jeremy M. Harris, 479 Park Overlook, Worthington, Ohio 43085

[21] Appl. No.: [illegible]

[22] Filed: Aug. 29, 1977

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. [illegible], Jul. 16, 1976, abandoned.

[51] Int. Cl. B64C 33/00

[52] U.S. Cl. 244/22

[58] Field of Search 244/11, 22, 90 R, 38, 244/37; 115/31

[56] References Cited

U.S. PATENT DOCUMENTS

FOREIGN PATENT DOCUMENTS

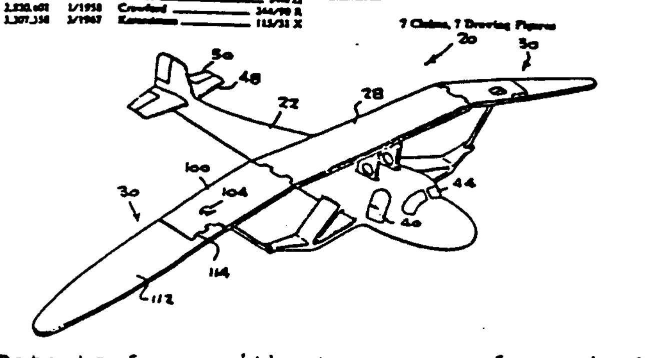
Primary Examiner—Galen L. Barefoot

Attorney, Agent, or Firm—Mason, Fenwick & Lawrence

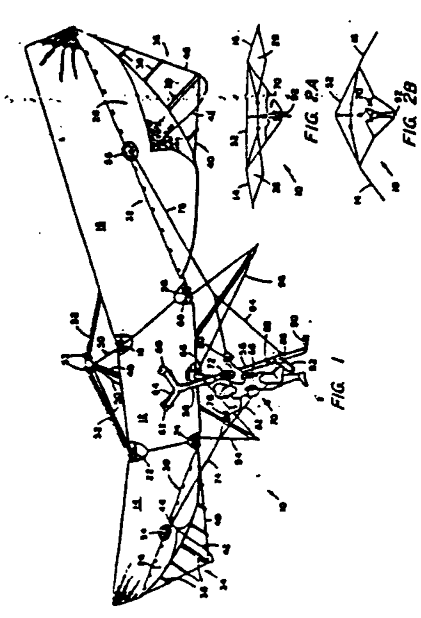
[57] ABSTRACT

An ornithopter which produces a large swept volume of the wings and essentially constant lift and includes a first and a second outer wing segment joined by an aerodynamically significant center wing segment having pivotal connections at the ends to the first and second outer wing segments, a driving mechanism for translating the center wing segment vertically with respect to the body of the ornithopter and links pivotally connected to the outer wing segments and to the body to cause the outer wing segments to rotate relative to the center wing segment as the center wing segment translates.

7 Claims, 7 Drawing Figures



U.S. Patent Nov. 29, 1983 Sheet 1 of 2 4,417,707



Patents for ornithopters range from simple (top two panels) to complex,

SAV SMALL AIRBORNE VEHICLES

.Roy & Shirley White
Rt. 1-Box 241
Catawissa, MO 63015

Dear Folks:

I guess the best I can hope for in this letter is 'conversation' by way of some random thoughts. The Ornithopter Design Manual and the two issues of Flapper Facts, both great, have served to fan the funny fires that have smoldered within for years. There is little doubt that we are talking about "Special Purpose Flying Machines" so perhaps with the incentive of the OMS I can justify some serious thinking....and even doing. Also, I see some impressive names in the roster so I look forward to what might transpire.

I am sending an article clipped from the December '72 Aero Modeler which I thought might be of interest and wanted to share it. I have a copy for my files, so do with it what you wish.

I have fond memories of a flapper kit that existed pre-WWII since I built several. It was a Bat like craft, black and tailless and hardly an ultra-light as I remember it. It did indeed thrash it's way into the air but for mere seconds. Maybe some of the more 'mature' members will remember it.

Although I look fondly at some of the modern flapper models with their light and delicate...and efficient performance, I must admit that I am more of a 1/4 square balsa builder since my eyes and fingers work better with such sizes. Peanuts are about as small as I dare undertake Therefore, the idea of the I.C. version is much more in my ballpark. No doubt, the on-going electric work being done by Paul Mac Cready will have some bearing on what might be done with the gassies and this too should serve as an incentive. Are you aware of the progress report in the Smithsonian magazine, Feb. '86 I believe? Anyway, The question raised by Bob Meuser regarding the use of the "series" inclusion of a rubber link between the power source, the engine, and the flapping mechanism, is, to my mind, a brilliant suggestion. I view it as perfectly acceptable and think of it as an accumulator or surge tank as applied to a hydraulic system. If one looks at instantaneous horsepower requirements as the wings oscillate through a cycle it can seen that there is a terrific variation on demand. As an example, when the wings are at top and bottom dead center there is no torque fed bac to the power source. By the same token, at some point through the cycl the torque becomes maximum so there is a constant variation in torque, velocity, and accelleration. The rubber link, acting as a spring, woul seem to provide some degree of energy management and would certainly seem worthy of experimentation.

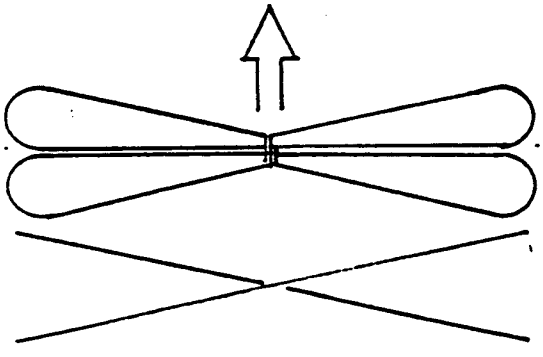
Some time ago I toyed with the idea of using action/reaction as has been demonstrated with the tandem ornithopter so well conceived by Lester Garber. Such a scheme would also seem to provide a degree of energy management and sounds like fertile fuel. Does this suggest a combination of the Mueser/Garber thinking? Might it be possible to, in effect, have the I.C. engine frame driving one wing with it's torque, while the rubber link drives the other wing via the crankshaft reaction torque? It would seem that the available energy would certainly be running around within the system. What seems exciting to me is the fact that, as Bucky Fuller once said, "I realized that there was no one around to grade my paper", so since this method of aerial locomotion has only been mastered by Mother Nature, it would seem that just about anything is worth trying. We are indeed fortunate that this model airplane habit lets us try things for little or no cost or hazard. A history of the hobby certainly proves that inspiration and perspiration can be combined to yield real innovation.....An afterthought suggests that letting the engine actually rotate sure would help the cooling problem that might exist with low forward speed.

Oh dear, might as well get the rest of it out on the table. My personal thinking has been along the paired wing concepts. Nature has not seen fit to select the canard or tandem wing approach (I don't think) but the dragonfly must be sort of a biplane. I have toyed with a mechanism that I will try to explain. Visualize the right forward wing and the left rear wing rigidly connected to one another so that as one goes up, the other goes down. By the same token, the left forward wing and the ri; rear wing are connected, one up and the other down. Viewed on end one would see an 'X' at extreme travel. In plan form, it would seem that the instantaneous center of pressure would always be at the same longitudinal position with respect to the fore and aft C.G. location. Since the dragonfly has a long fuselage but no tail feathers out back, I wonder if he (she) bends the aft portion so as to shift the C.G. with respect to the C.P. and therefore create climb or dive moments. I tried such a thing once....and it didn't work. But, in my line of work as an Inventor I look at failure as just as important a rung in the ladder to success as the things that work when trying to climb out of a problem. Since the: are not too many firm and fixed rules in this flapper game, what the heck! When time permits I will try to supply a sketch or two and maybe someone out there can accomplish something I couldn't.

And, know that your efforts are greatly appreciated by this individual since I know that it takes a lot of work to keep a newsletter under way. I am not a great 'joiner', but this looks to be a lot of fun and I hope I can at least keep things stirred up.

Sincerely,

Dick Johnson
3-20-86



ORNITHOPTERS -- A BIOLOGICAL PERSPECTIVE

Michael Dodd

Ornithopters are fascinating enough to me in their own right. However, I sometimes find myself thinking that perhaps there's more to ornithopters than the art of model-making. I suspect that they represent a concept - one that may prove more and more useful to the study of Biology and the understanding of nature.

Most children can name the three major groups that use flapping wings to fly -- Birds, Bats and Insects. Although very dissimilar in many aspects they all share the concepts of muscle, skeletal or exo-skeletal, and appenda, modifications that allow them to enter and exploit the aerial domain, of thi: planet. However, the concept does not stop here. Add Fishes to the list ..... more specifically, the "freshwater flying fish" -- the gastropelecine characins of South America, whose pectoral fins are vibrated like wings after the fish jump out of the water .... enabling short flights. (Not to confused with the "flying fish" proper..... which are first rate gliders with endurance records of thirty seconds and distances of ¼ mile.)

Also, to the list we must add the pterosaurs, pteredactyls and pteranodons of 65 million years ago.

Is out list complete now? Perhaps not....paleontologists tell us that 98% of all species that have ever existed on this planet have left us with no fossil evidence. This leaves a lot of leeway for the actual possibilites and a lot for the imagination to ponder.... what bizarre and exotic creatures just might have taken wing and flown above the surface of this 4.5 billion year old planet?

If and when man discovers another planet that is blessed with an atmosphere and precious life, he will no doubt again see the "ornithopter concept" in use by some native lifeform. Perhaps the apparently dead planet Mars hides within its shifting sands the fossils of creatures that once flew when the planet harbored life and held a much denser atmosphere.

Any ornithopter builder who has ever had to endure an unenlightened comment concering the supposed "frivolity" of their art may silently or vocally rejoice in the knowledge that both the function and science of Biology do and will continue to rely on the "Ornithopter Concept".

P.S. Write to Homer Smith, c/o AMA, 1810 Samuel Morse Dr., Reston, VA 22090

Also, check your checkbooks. If you sent your dues a year ago, its due again. Memebership is forever, subscriptions costs $7.00 a year. With the increased cost of printing and postage, dues are a necessary evil.