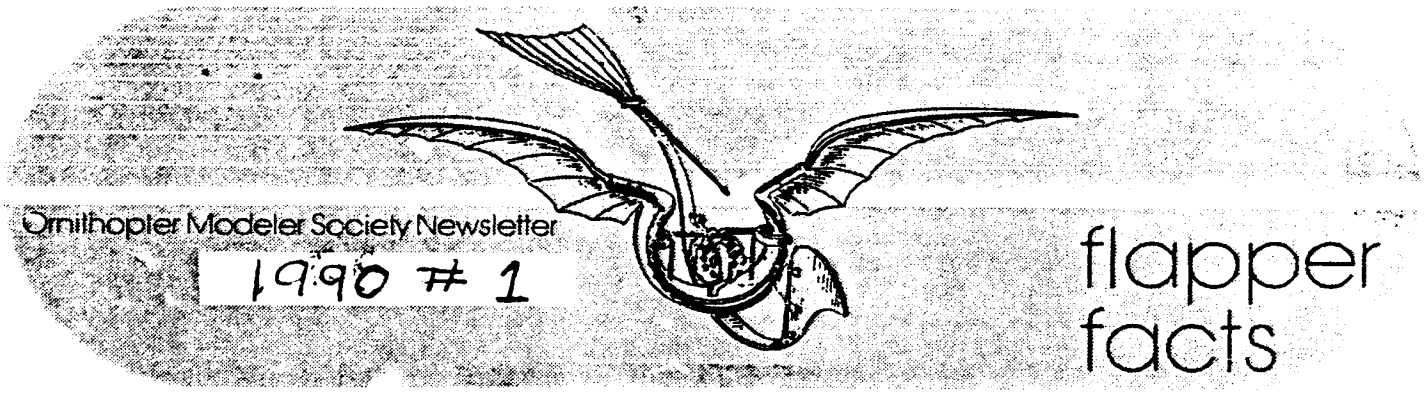


Well it's been some time since our last issue of Flapper Facts so some explanation is in order. I had quite a siege of illness last summer and fall and to further complicate things, we moved from Philadelphia back to Florida at the end of the year. So now I am just getting back to model building and other things such as this newsletter. I hope we will be able to get it out in between working on models for the big Johnson City meet. Roy and I have agreed that I will do the writing and editing and he will take care of publishing as well as membership. One thing that has been lacking is inputs from you members so please let me know of any items that would be of interest. In general, there has not been any startling flights that we know of since Roy White's magnificent 15+ minute flight at Akron. Likewise, we haven't seen any new designs. Dan Garfinkel has been working on his gas powered ornithopter, his letter appears below. Most of this issue will be devoted to that kind of work. My new Florida address is below and I would be delighted to hear from any of you.

Frank

Frank Kieser
2595 Whippoorwill Ln.
Vero Beach, FL 32960

LETTER FROM DAN GARFINKEL

PO Box 835
La Porte, TX 77571

I wish we could somehow get more correspondence going between all those who are interested in ornithopters, and especially those interested in gas powered ones. I hate to admit it but I haven't been doing much myself in the way of ornithopters, except in my mind and on scraps of paper.

My biggest problem is that I don't have a machine shop, and I am not into using these new miracle materials and I probably never will be. I have looked at some helicopter type clutches, but I do not think that they are suitable for ornithopters, at least not the ones that I am presently considering. So I am still going with the friction type drive idea that I started out with. I still think that my first one would fly if I were to strip off lots of excess weight, such as the tricycle landing gear, heavy tail boom etc..

About 3/16 or 1/4 inch diameter tubing (plastic or rubber) on the shaft of the engine, pressing against a larger wheel which in turn turns some kind of gears, seems to work fine for flapping the wings. A flywheel with some kind of small fan should keep the engine cool enough. I am considering eliminating the gears, I think that the 1/4 inch tubing turning a 2 to 3 inch wheel should work. It could not flap the wings too fast, so there would be lots of slippage. I have yet to try this, so maybe using the gears is better, only time and testing will tell. Another idea is to use square tubing to drive the larger wheel, this would allow the larger wheel to be free when the engine quit.

Sometimes I think the whole idea is unfair, mine is the only gas powered ornithopter I have seen, and I have sent pictures and sketches to all who have asked, but I have never seen any others,pictures, drawings, sketches, nothing. I have at least a million questions to ask myself. Is any one out there trying to fly a gas powered ornithopter? or are some people already successful? FF, RC, UC?? You once mentioned trying UC, did you ever do it? I would love to see any one's models, pictures, sketches, anything. The only successful ornithopters I have seen have been indoor rubber powered ones, and my own outdoor rubber powered one, which is not much but it does fly.

GAS POWERED ORNITHOPTER
by DAN GARFINKEL

I have been sticking with a 36 inch wing span for a 1/2A engine that seems to be enough power to flap the wings, although being a biplane I guess that's quite a bit of area for an .049 engine. The push rods on the next one will be dowels in alum. tubing with brass ends, they seem to take a very substantial load and I have some trouble with breakage using just dowels with brass and alum. ends.

One thing I would really like to know is what do you think is a good flapping angle, up and down? How about flapping rate?? Are we building Hummingbirds or Eagles???

Sincerely, Dan

GAS POWERED ORNITHOPTER

As you can see, Dan is somewhat frustrated by the lack of information on gas powered ornithopters but as far as I know, he and I are the only two people in the world working on the problem. However, if by chance there is someone out there who is also working on the problem or has some bright ideas, please get in touch with Dan or myself. As Dan has told us, his efforts have been mainly on hardware fabrication and testing. I am still in the design evaluation stage and I will try to describe my approach to the problem in hope that it will stimulate interest by others.

First, it is apparent that a practical gas powered ornithopter is not an easy task. There is little basis for selecting design parameters such as size, weight and configuration as well as gear reduction, cooling and linkage design.

Since the biplane design has revolutionized the indoor rubber powered ornithopter, it might seem logical to use this configuration. However, if we look at Hewitt Phillips' article "The Fuselage Motion of Ornithopters" in the 1986 Free Flight Symposium Report, some of the disadvantages of the monoplane disappear as the mass to wing area ratio increases. The weight of a monoplane should be less than that of a biplane and the aerodynamic cleanliness should be better. However, the biplane may still be the best design because of the smoothness of the drive torque required so the choice is not obvious.

To me it seems that before tackling all the problems of the gas powered ornithopter, which will be expensive and time consuming, we should first bridge the tremendous gap between

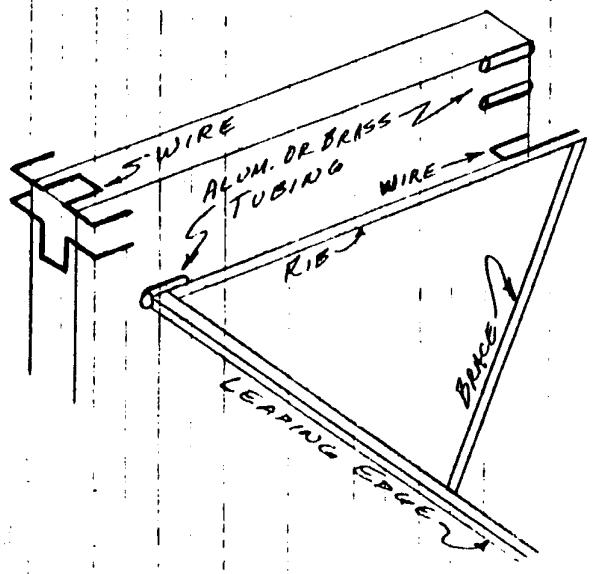
it and the existing indoor designs with intermediate sizes. This would best be done with heavier outdoor rubber powered models. Rubber is the ideal power for ornithopters because of the ability to generate large torques at low speed thus obviating the large gear reductions of one form or another between the motor and crank. A first attempt might be a model in the order of two foot span weighing about four or five ounces and then proceed on to heavier and larger designs. In this way, experimental models could be built with relatively little expense and time and much could be learned about opimum configuration, stability and power requirements.

I have done some studies on the gas powered version and here are my thoughts for what they are worth. First, I would not risk such an expensive model to free flight so I have included in the weight provision for radio control. Possibly U-control could be used as an intermediate step. I visualize using a small helicopter engine, probably .40 displacement. This would include the centrifugal cooling and ducting and a helicopter centrifugal clutch. I estimate a gear reduction of 50 to 100:1 with the first stages being gears and the last stage being a belt or chain driving the crank. With this large reduction, the output torque to the crank and wings will be very high necessitating a very strong crank and linkage design. This high torque (probably in the order of several foot pounds) will be necessary to drive the large wings whether they be monoplane or biplane configuration. I estimate a model of about 4 to 5 foot span weighing about 6 to 7 pounds. It would fly at about 20 to 30 miles/hr.. Machine shop facilities will be required for fabrication of the drive train, crank and linkage and as yet how to get this work done is a problem.

In addition to the thinking, I have gathered some parts for possible use in the clutch and gearbox. I intend to start on the rubber powered models described above after the Johnson City bash. I may also start to put together an experimental motor and drive train and do some low powered wing flapping tests.

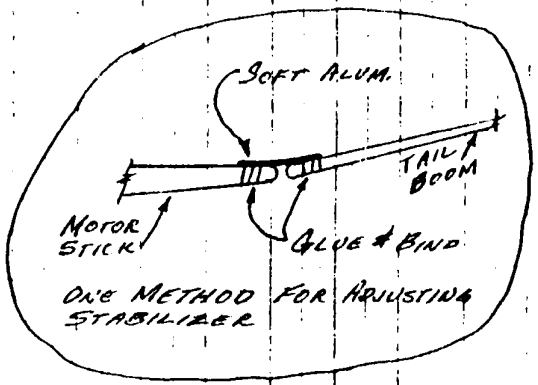
So you see it will be some time at best before I have any results. If anyone has an easier or faster way, I am sure Dan and I would be glad to hear about it. Roy and I plan to get together and finalize this newsletter at Johnson City so that you should receive it shortly after that.

SUGGESTED SIMPLE WAYS OF HINGING WINGS

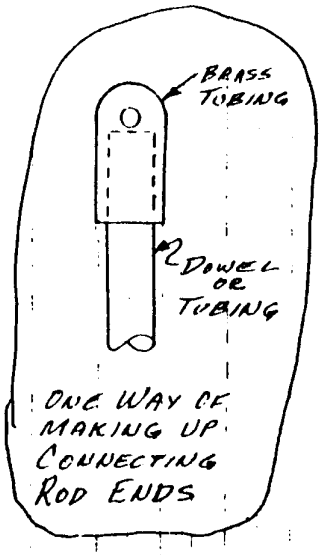


TUBING & WIRE

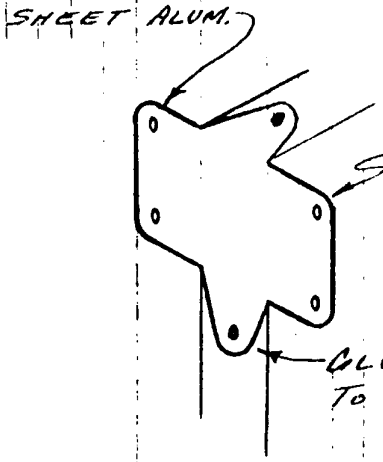
GLUE & BIND W/THREAD TO WING OR FUSELAGE



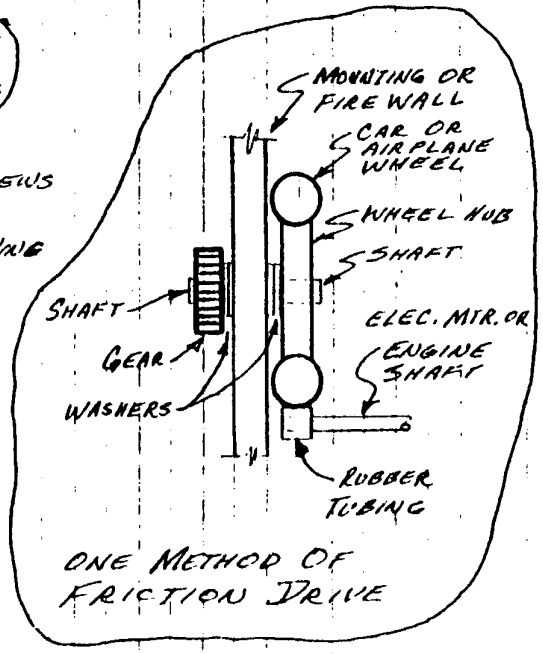
ONE METHOD FOR ADJUSTING STABILIZER



ONE WAY OF MAKING UP CONNECTING ROD ENDS



SOME PEOPLE USE THREAD FOR HINGES USE FIG. 8 STITCH



ONE METHOD OF FRICTION DRIVE

JUST A FEW LITTLE IDEAS I WISH SOMEONE WOULD SEND ME SOME WE CAN LEARN FROM EACH OTHER

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