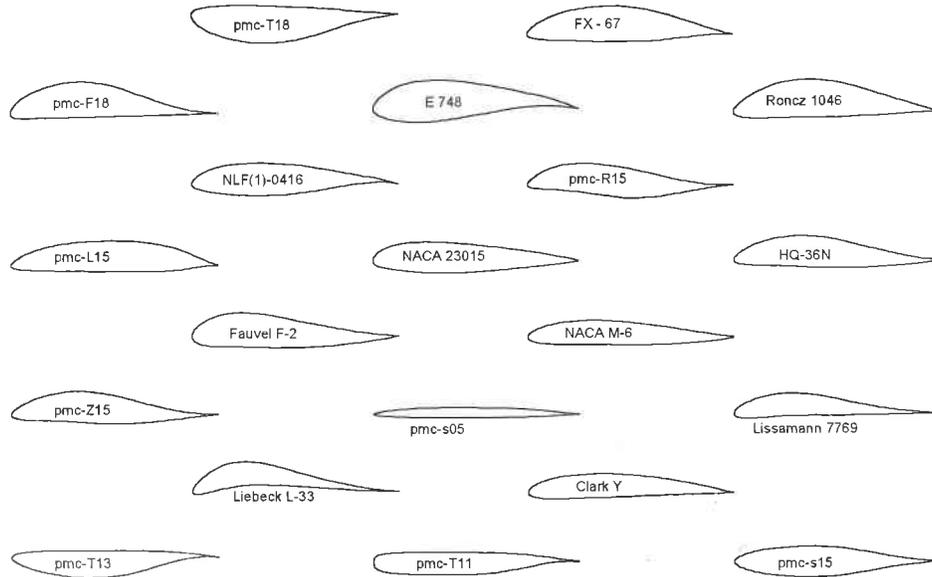


# T.W.I.T.T. NEWSLETTER

## MATH-MODELED AIRFOILS



Slides SAE 961317 J Philip Barnes

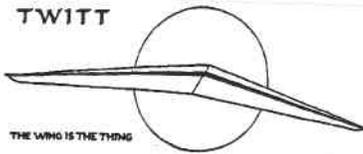
### T.W.I.T.T.

The Wing Is The Thing  
P.O. Box 20430  
El Cajon, CA 92021



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**Next TWITT meeting: Saturday, May 18, 1996, beginning at 1330 hrs at hanger A-4, Gillespie Field, El Cajon, CA (first hanger row on Joe Crosson Drive - East side of Gillespie).**



**THE WING IS  
THE THING  
(T.W.I.T.T.)**

T.W.I.T.T. is a non-profit organization whose membership seeks to promote the research and development of flying wings and other tailless aircraft by providing a forum for the exchange of ideas and experiences on an international basis. T.W.I.T.T. is affiliated with The Hunsaker Foundation which is dedicated to furthering education and research in a variety of disciplines.

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Meetings are held on the third Saturday of every other month (beginning with January), at 1:30 PM, at Hanger A-4, Gillespie Field, El Cajon, California (first row of hangers on the south end of Joe Crosson Drive, east side of Gillespie).

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**PRESIDENT'S CORNER**

**W**ell, as you have seen the April newsletter didn't come out all that bad. I did notice a couple of small glitches that will be taken care of this month, and I must apologize to Dominigue Veillard for misspelling his name over the picture on page 8 (I didn't have a roster handy at the time and took my best shot).

This month there wasn't very much in the mail so I spent some time going through the library to come up with material to fill the pages. In some cases I have included a little of the test that accompanied the article or diagram, and in other I simply inserted a drawing that I do not believe has appeared in a past issue of the newsletter. Unfortunately, there was usually no mention of who contributed the item to TWITT so I was not able to give the proper acknowledgments.

I hope that some of these things will create a little interest among you and generate some mail we can use to fill the pages of our newsletter.

The items on pages 7 & 8 represent some of the early theories that helped create TWITT as a means of reaching the goal of having an aircraft flying with this type of control system.

We can thank Phil Barnes for providing the program announcement and the associated cover material (who better than the speaker himself). I know everyone will enjoy it since he always generates questions in our minds that just need to be answered.

Even with the help of Phil's camera ready input, this was actually one of the harder issues to put together. First it took more time to find the various pieces of material in the library, and then there is the added lay-up time to get this much cut and paste to fit on the pages. I find that re-typing member input takes less total time and the newsletter sort of takes on its own shape based on the amount of space taken up by the printing.

So, please put pen or typewriter to paper and let us know what you are doing out there. It would sure help me late at night at the publishing deadline is rapidly approaching.

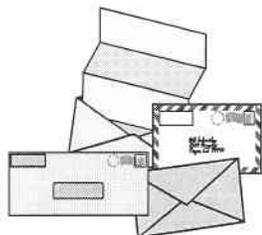
MAY 18, 1996 PROGRAM

The announcement for this month's program can be seen on page 3. It seemed better to let Phil cover his presentation, which he mentioned is going to be given again the week after the meeting in a more formal setting.



The July meeting is shaping up already. We can expect **Bruce Hinds**, one of the Northrop B-2 test pilots, who has agreed to come down from Palmdale and give us some insight on the Air Force's newest flying wing. I will be confirming the final arrangements with him before the June newsletter, so should have more definitive word by then.

LETTERS TO THE EDITOR



April 17, 1996

TWITT:

As you can see by this letter, I lack e-mail and computer capabilities. Thanks to you and Serge Krauss for the wonderful material on the Snyder-Arup's, Milt Hatfield's "Little Bird", Hoffman's All Wing Airplanes and the famous Vought V-173 Flying Pancake.

Dr. Snyder's son, if still living, would be pleased to know that his father is listed amongst TWITT's legendary aircraft designers. I hope that Richard Snyder can be located and if available can make his valuable views an insights known to TWITT for aviation's historical record and archives.

Also, the late, great George Worthington, till his death in the early 1980's, made San Diego his home.

I can see by the number to the right of my name my subscription is about up for the year, so my renewal check is enclosed.

Thanks for all the great TWITT reading material.

Yours truly,

Edwin Sward

*(ed. - Thanks for the comments on last month's newsletter. As you can see, we still take all kinds of "snail mail" since it will probably always be around no matter how much the computer revolution invades our world.*

We will try to find Mr. Snyder, but since it is a relatively common name it may take some time and leg work to narrow down the right one, if he is still in San Diego.

I included your short note about dues being due as a reminder to others that the number next to their name is where their subscription runs out. June usually circles it in red as it comes due, or is over due, as an additional reminder. We appreciate everyone who manages to get their renewal in before expiration, since it makes bookkeeping so much easier, and means no issues will be missed.)

LIBRARY CONTRIBUTION

A **A**lain MIROUZE sent in the following article which is all in French. It includes photos of the AV-45 in flight and on the ground, Charles Fauvel in 1977 & 1979, and the AV 221 in ground operation. We will add it to the library for anyone who would thinks their French is good enough to get something out of it.

"LES 90 ANS DE CHARLES FAVUEL", by Christian Ravel, Les Cahiers DV R.S.A., 1995, No. 205, 46 rue SAUFFROY, 75017, Paris, France. Header line reads: Ingénieur-pilote, Charles Fauvel a été LE pionnier de la formule aile-volante. Quoique handicapé à l'époque par une puissance de calcul limitée (entre les deux guerres et dans l'immédiat après-guerre), ce précurseur témoigna d'un véritable génie créatif.

AVAILABLE PLANS & REFERENCE MATERIAL

Tailless Aircraft Bibliography

by Serge Krauss

4th Edition: An extensive collection of about 2600 tailless and over 750 related-interest listings. Over 15 pages of tailless design dates, listing works of over 250 creators of tailless aircraft, and the location of thousands of works and technical drawings for the Ho 229 (IX), Me 163, & Me 262.

Cost: \$23 (Domestic)  
\$32 (European destinations)  
\$35 (Asia/Australia destinations)

Order from: Serge Krauss  
3114 Edgehill Road  
Cleveland Hts., OH 44118

(Continued on page 10)

May Speaker

The airfoils on the front cover should give you some idea about our May 18 TWITT presentation by **Phil Barnes**, who will do a 30-minute dry run of his SAE paper, to be presented at Aerospace Atlantic, Dayton Ohio, later in the week. Those who attended Phil's Sept '95 presentation will find that "**Math Modeling of Airfoil Geometry**" has been completely revamped and has significant new material.

Although Phil's slides will be largely technical, TWITT members will find something for everyone. Airfoil selection criteria are covered for conventional, tailless, and canard aircraft. Numerous airfoils and aircraft are illustrated, including the SB-13 tailless sailplane and Douglas blended wing-body transport. Time permitting, topics include:

- Historical coverage of airfoil math modeling
- New math models for thickness and camber
- Upper / Lower surface modeling
  - Flat-bottom airfoils
  - Transonic airfoils
  - Closely matching existing airfoils
- Application of Theodorsen's method
  - Calculating surface velocity
  - Zero lift incidence
  - Locating the stagnation point
- Phil's presentation of vortex density for surface velocity
- Liebeck's clockwise integration of vortex density for lift
- Phil's vector integration of pitching moment coefficient
- Locating the aerodynamic center and cmac

Figure 6.1 pmc-L15 Airfoil

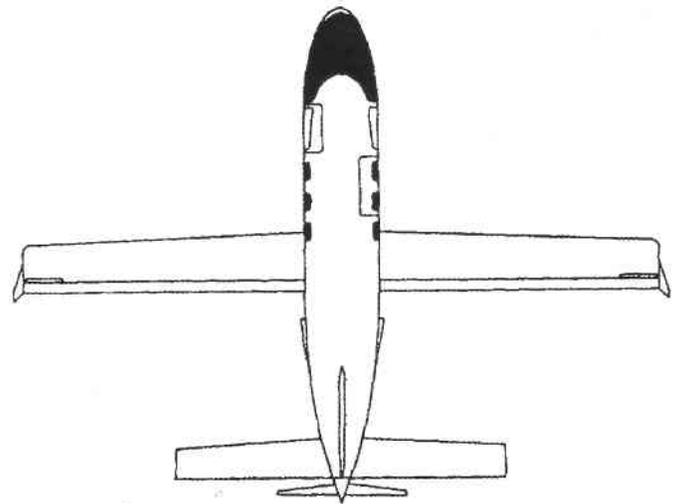
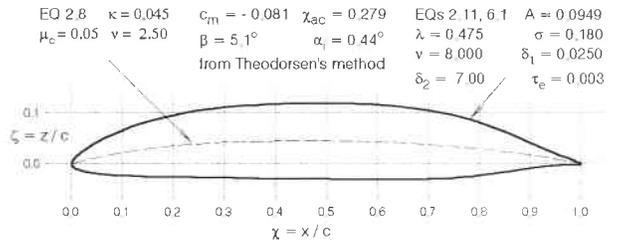


Figure 6.6 pmc-T11 Airfoil

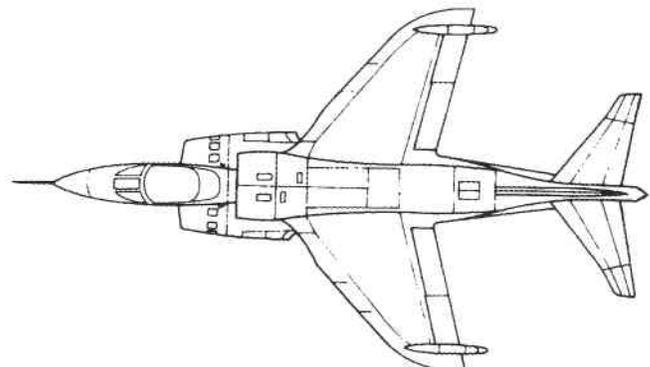
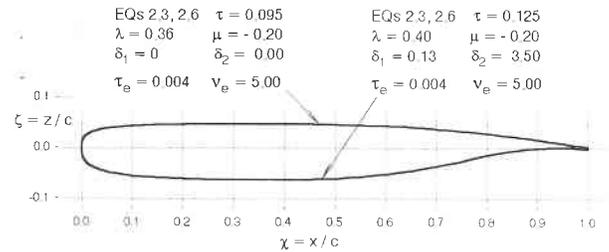
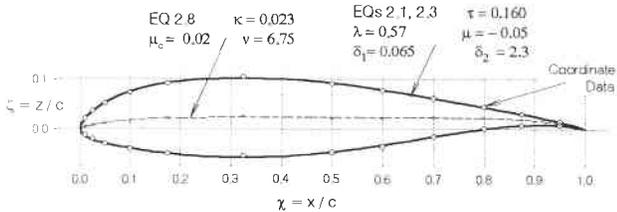
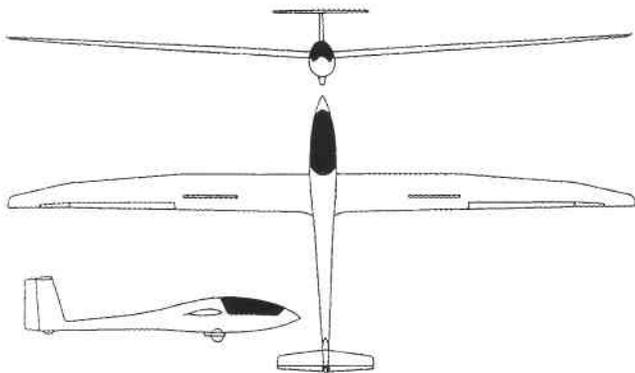


Figure 5.1 -- Somers NLF(1)-0416 Airfoil



Discus Sailplane



Since Phil has had to concentrate on preparing his paper, software is not yet available. However, hardcopies of the slides will be on hand for those attending. A copy of the paper (SAE 961317) can be obtained from SAE by telephone at 412-776-4970 or by FAX at 412-776-0790. The price is \$5 for SAE members, \$10 for non-SAE-members.

The items on this page came from the December 1944 edition of *Aircraft Engineering*, pp. 340-352, in a piece titled "Tailless Aircraft and Flying Wings - A Study of Their evolution and Their Problems", by A.R. Weyl, A.F.R.Ae.S. Mr. Weyl covers a lot of ground in this article moving from 1870 and Richard Harte's petition for a patent for improvements in an apparatus for effecting aerial locomotion, to the works of Alexander Lippisch in the 1930s.

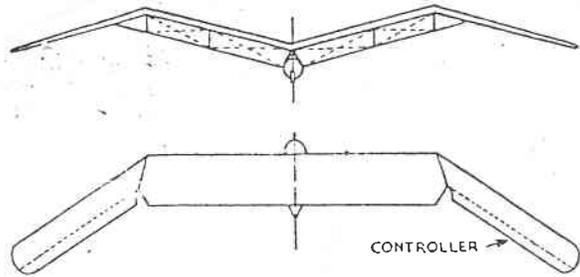
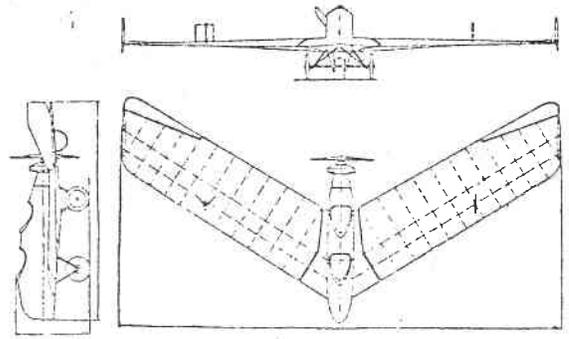


FIG. 20.—Wenk-Peschkes "Weltensegler" sailplane—1921 type

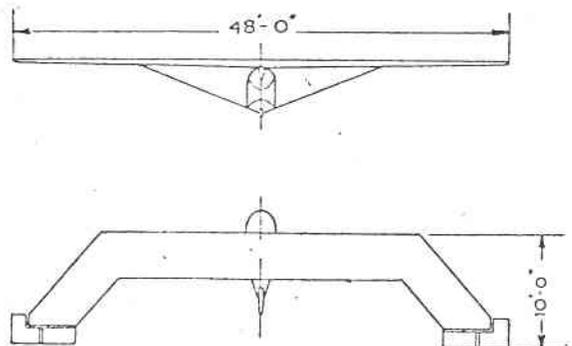
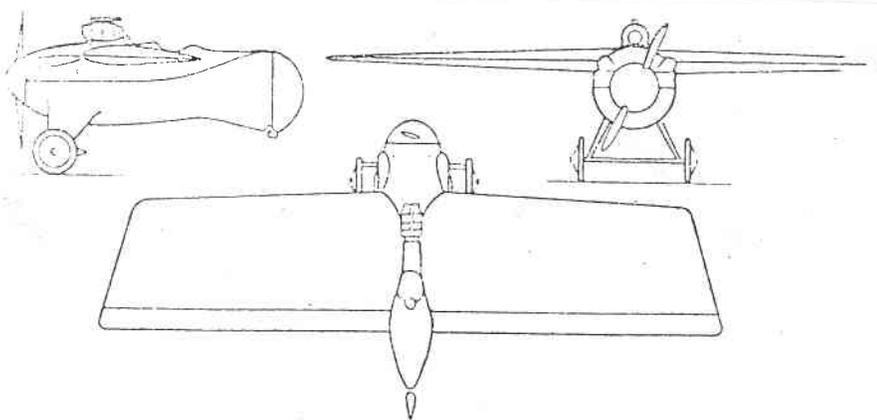


FIG. 23.—"Charlotte" sailplane of Von Parseval, Winter and Pfister

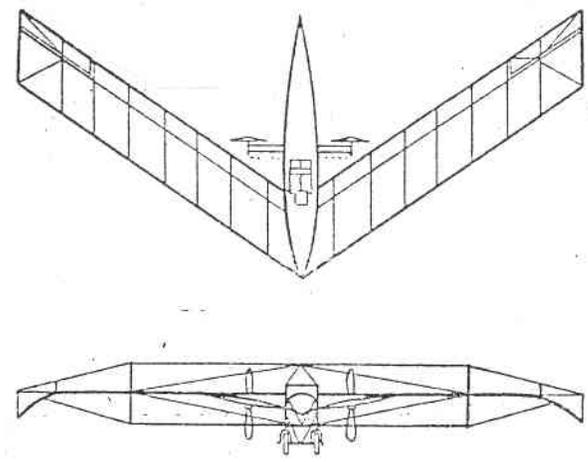
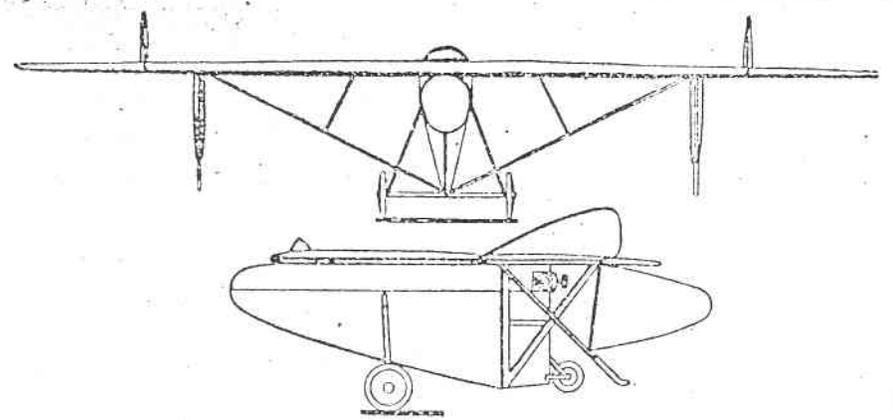


FIG. 9.—Dunne monoplane—from a 1909 patent

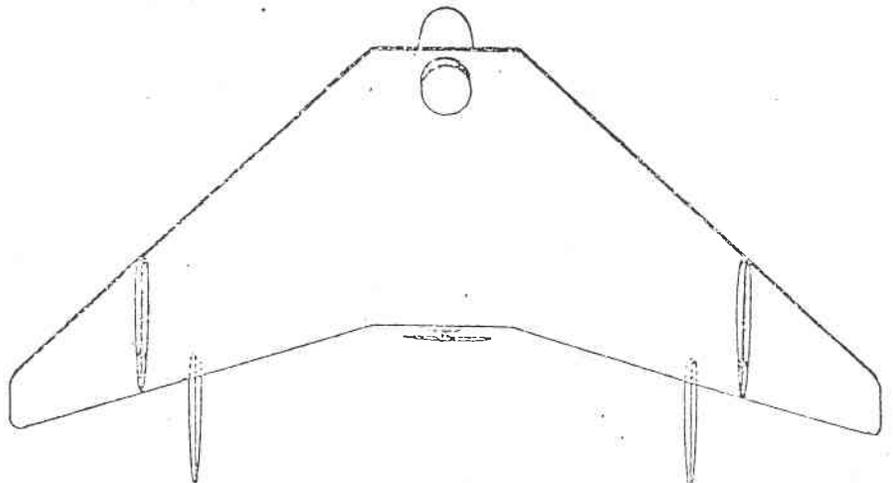


FIG. 38.—The first "Plevoductyl" of Professor G. T. R. Hill

The material on the top half of the page is from A.R. Weyl's article "Wing Tips for Tailless Aeroplanes", published in the September 1945 edition of *Aircraft Engineering*, pp. 259-266. He covers slotted wing tips, diffuser tips, rams-horn vortex and related phenomena, and the oblique-attack effect

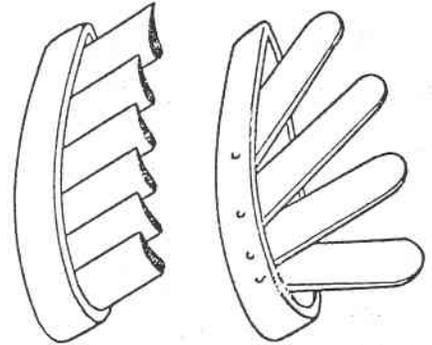


FIG. 2.—Principle of slotted wing tip

FIG. 3.—Principle of Schmidt wing tip

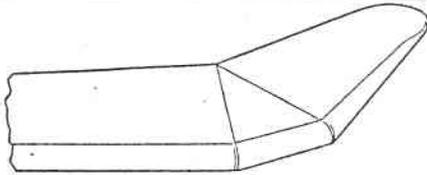


FIG. 1.—Hocke wing tip, 1927

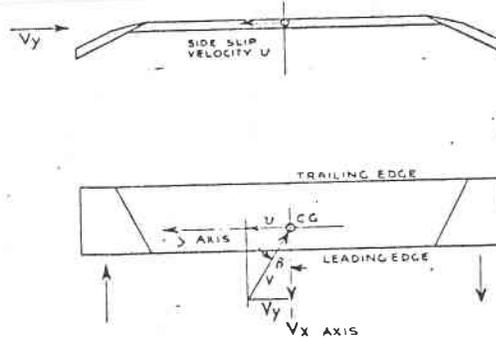


FIG. 4.—Elementary diffuser wing tip

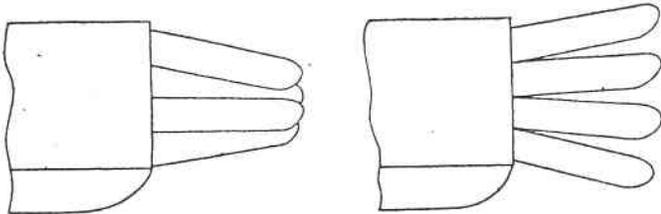
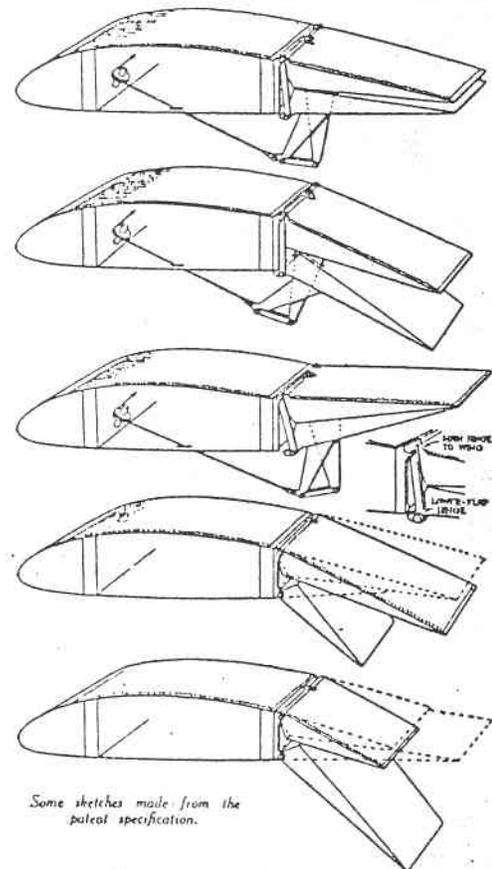


FIG. 3(a).—Slotted wing tip of A. P. Thurston and the Bristol Aeroplane Co. according to a 1921 patent. When the elements are fanned out (as shown on the right), their incidence is greater than that of the fixed wing

The items on the bottom half of the page are from A.R. Weyl's article "High-Lift Devices and Tailless Aeroplanes", as published in the October & November 1945 editions of *Aircraft Engineering*, pp. 292-297 & 325-330, respectively. As you can see, he covers a wide range of lifting devices, some simple and others much more complex.



Some sketches made from the patent specification.

{Courtesy "The Aeroplane"  
FIG. 8.—Flaps suggested by C. R. Fairey in 1921

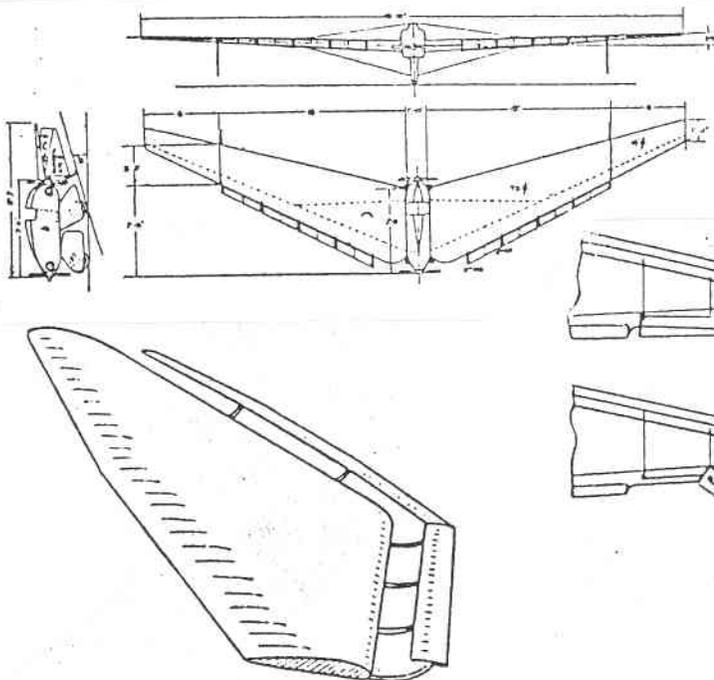


FIG. 5.—N.A.C.A. tailless model with fixed slat (1933)

FIG. 1. (left)—Halton Meteor tailless twin-engined monoplane with slotted wing. The slots are of the automatic Handle Page variety

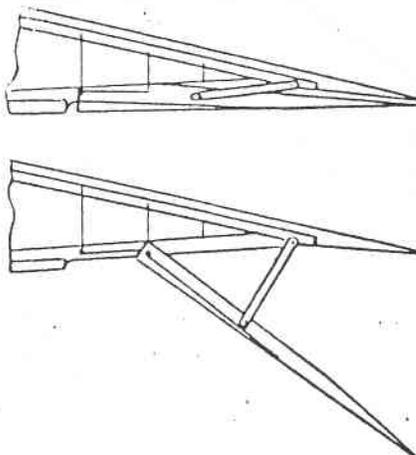
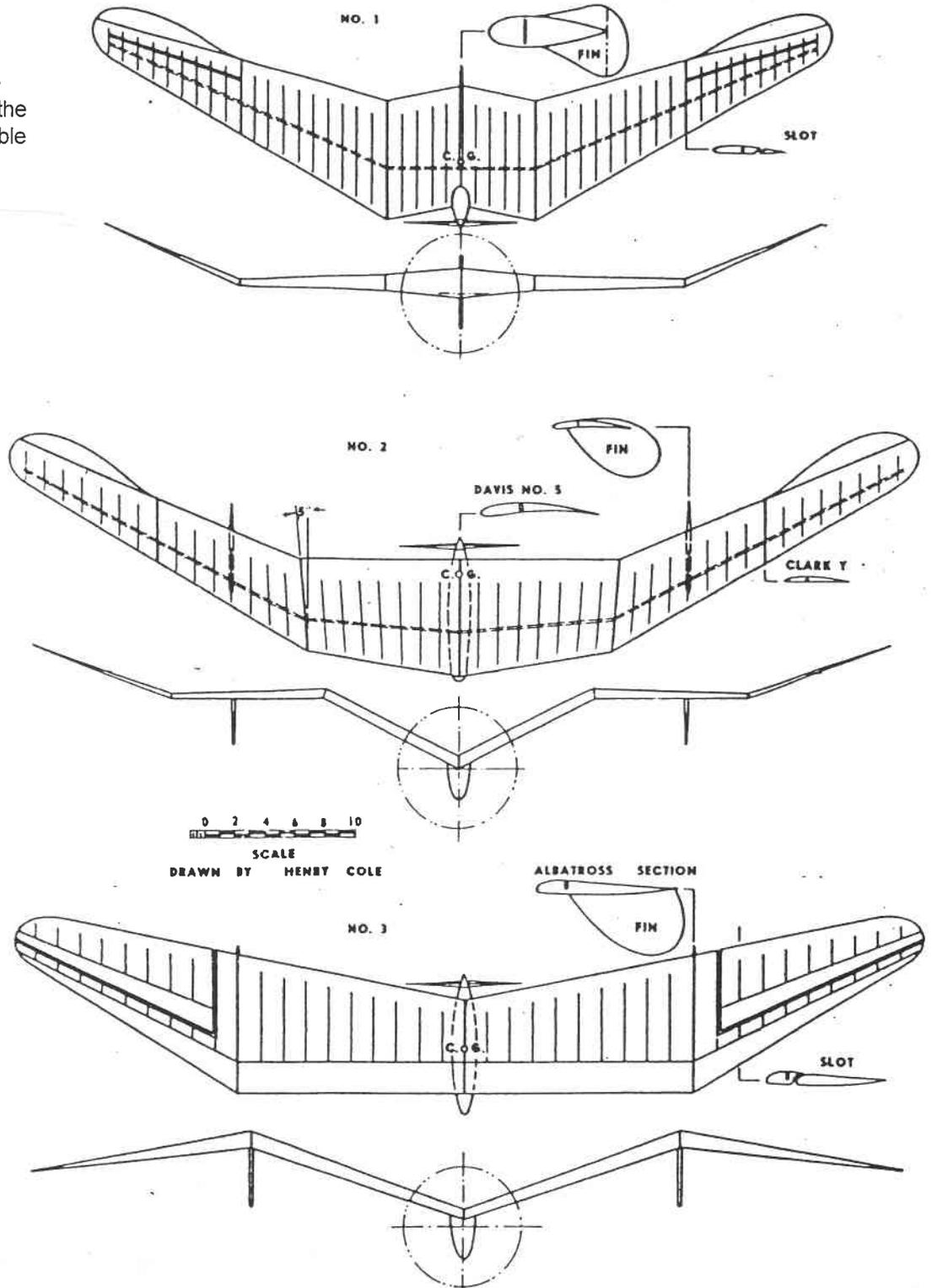
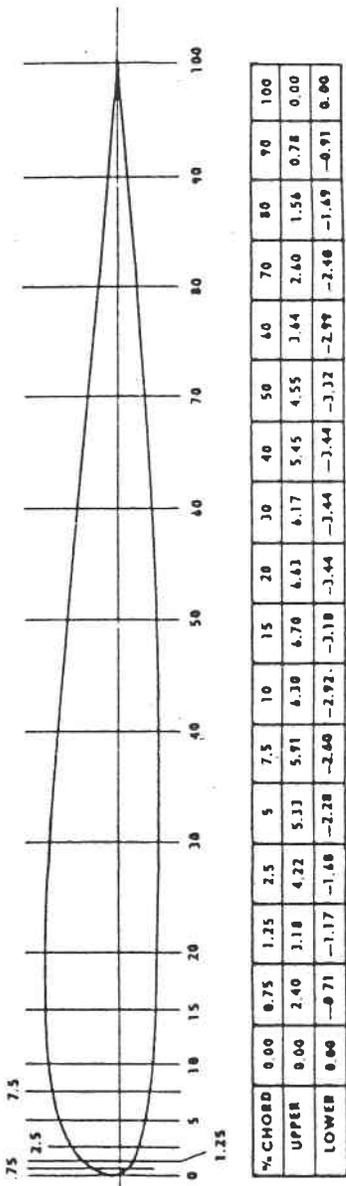


FIG. 12.—Zap split flap of E. Zaparku

The material on this page came from a reprint in the Tailless News No. 14 of an article originally published in the June 1943 edition of Air Trails and in the Air Trails Annual 1944, titled "Flying Wings" by Henry Cole. The subtitle stated, "Flying wings represent the theoretical ultimate in aircraft design. Use these ideas, available after a year of research, to develop practical models.

Design No. 3 is a perfect example of keeping the C.L.A. low and yet incorporating sufficient lateral stability. The dihedral-chord relationship builds up a high pressure at the peak and the gull tips keep the the C.L.A. low. The result is a stable model with smooth flying characteristics.



The next two pages are copies of the original diagrams developed by Hernan Posnansky as a way of achieving the highest possible performance from a flying wing aircraft. The plan was to build an unstable glider and use the electro-mechanical system to allow the pilot to control it in flight. As can be seen, the system is rather complex, requires a consistent power source, and most importantly adds a lot of weight to the airframe.

A set of wing molds were made from a Diamant wing which were supposed to provide the basis for the actual wing. However, the lack of time and money finally overcame the project and TWITT decided to move on into new areas of tailless design.

The various technologies developed in the ensuing years have probably made the concept a little more feasible, but time and money are still the constants that keep it from blooming.

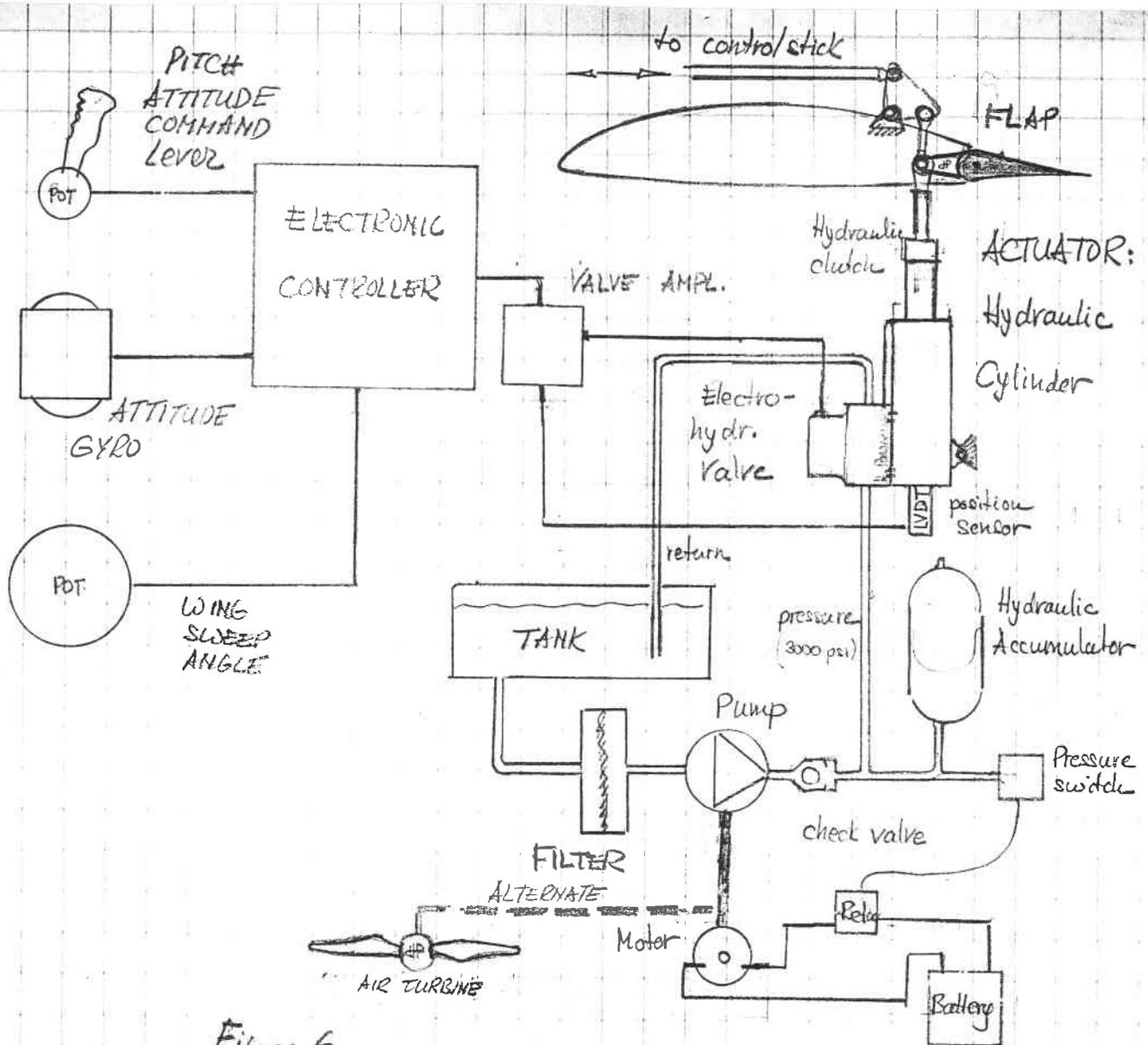


Figure 6  
SIMPLIFIED SCHEMATIC  
FOR AN ELECTRO HYDRAULIC STABILIZATION SYSTEM

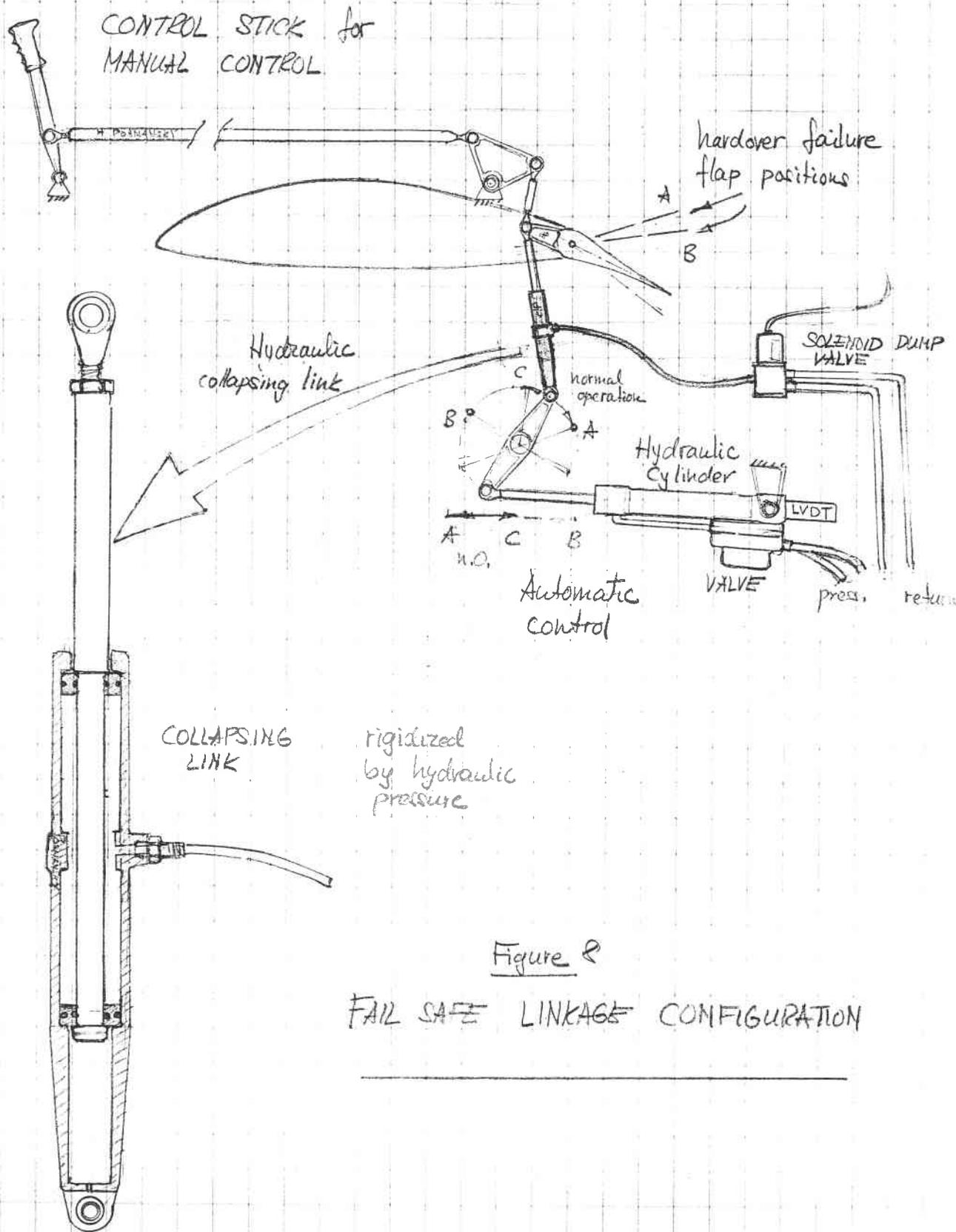
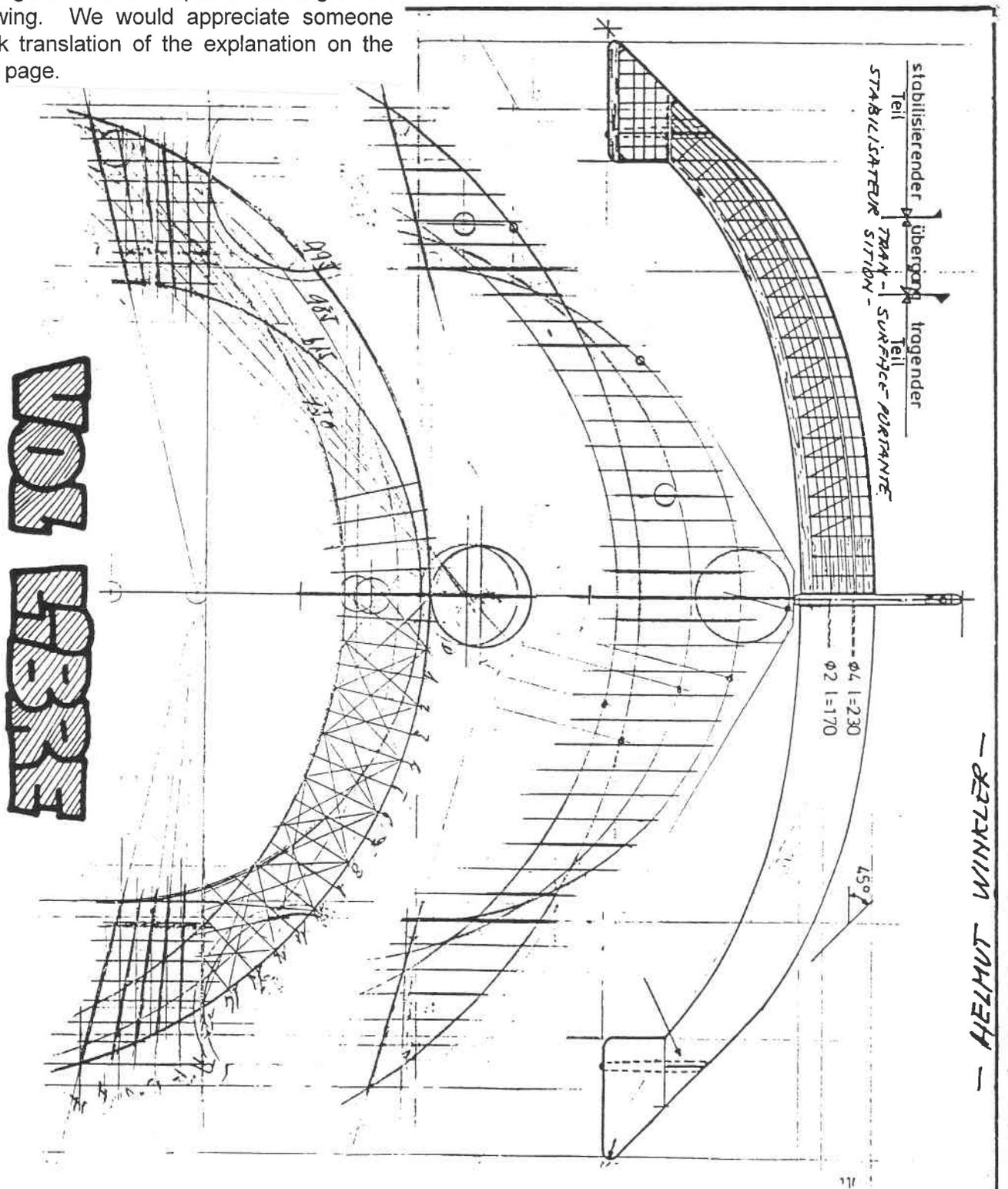


Figure 2

FAIL SAFE LINKAGE CONFIGURATION

We are not sure where this drawing came from, but it is an interesting series of concepts for building a free flight flying wing. We would appreciate someone doing a quick translation of the explanation on the bottom of the page.



**RADIENREINRASSIGES N1  
AUF BASIS VON 5 RADIIEN  
AUSGEHEND VON DER "FLIGENDEN SICHEL"  
des HOLLÄNDERS AUS ARNHEIM  
DES FLIEGENDEN HOLLÄNDERS IN SICHELFORM**