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THE SAILPLANE & GLIDER

Official Organ of the
British Gliding Association

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THE SAILPLANE & GLIDER

(Founded in September, 1930, by THURSTAN JAMES).

The only Journal in the World devoted solely to Motorless Flight.

OFFICIAL ORGAN OF THE BRITISH GLIDING ASSOCIATION.

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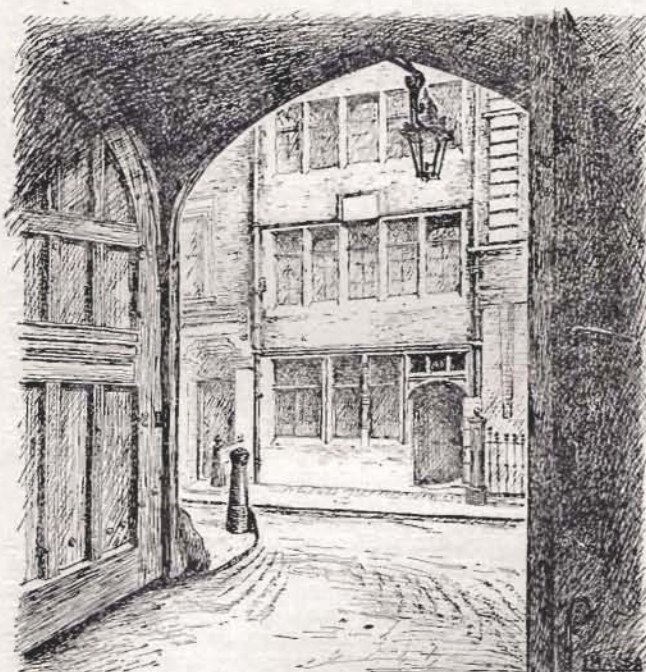
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The Offices of the SAILPLANE viewed from the historic XVIIth Century gateway of Lincoln's Inn.

THE "MOTOR-ASSISTED" GLIDER

When, some weeks ago, Mr. Lowe Wylde produced a B.A.C. VII. glider fitted with a small power unit in the form of a 600 c.c. DOUGLAS engine, publicity was given in the Daily and Aeronautical Press to the advent of what was variously described as a "motor glider" and an "ultra-light" aeroplane, as heralding the introduction of an era of cheaper flying which would bring aviation within the reach of all. The successful tests which have since been carried out at Hanworth with this type of aircraft have brought increased publicity and it is not surprising that the "motor-assisted" glider has become a keen subject for discussion within the Gliding Movement.

Whatever may be said to the contrary, the fitting of an engine to a glider, however small the power unit may be, immediately removes the aircraft from the category of motorless aircraft or gliders, and, whatever name may be employed to distinguish it from higher powered machines, it becomes an aeroplane. The question as to

whether this type of machine will prove valuable for the initial training of power pilots or whether it will be found satisfactory as a cheap form of touring aeroplane for the private owner is one which belongs to power flying and does not concern us here.

Various expressions of opinion will be found in recent issues of THE SAILPLANE regarding the possible value of the motor-assisted glider to the Gliding Movement. The two more important points of view which have been put forward in support of this possibility are as follow:—

(1) By making wider appeal than the present methods of gliding and soaring, and so embracing those who, being air-minded, are keen to "get into the air" without necessarily becoming "soaring aces," the introduction of the motor-assisted glider would provide a much-needed fillip to the Gliding Movement and would lead to increased support.

(2) It would facilitate training and would give club

members more time in the air than is permitted by present methods of instruction.

It is further suggested that, in order to render possible the introduction of the motor-assisted glider, this type of aircraft should be freed from the official restrictions governing power-driven aircraft and should be placed, with motorless aircraft, under the control of the British Gliding Association.

When, at a recent meeting of the Council of the British Gliding Association, a resolution was proposed to the effect that the policy of sponsoring the motor-assisted glider should be considered as a means of consolidating the British Gliding Movement, the Council wisely decided to defer consideration of the matter until it had been examined in all its aspects by the Technical Committee. Until this Committee produces its report it would be premature to attempt to state anything like a final view on what is not, perhaps, such a simple problem as might at first appear. New ideas, however, are attractive and there is always a danger of people being carried away by them without considering possible repercussions and weighing the pros and cons. On the other hand, there are those who make a point of turning down anything new without first giving it due consideration. Without attempting to express a final opinion we venture to draw attention to one or two aspects of the matter which may well be taken into account by those who are considering the problem.

In the first place, the motor-assisted glider is not a new idea. It was the evolution of this type of aircraft in 1923 which brought to an abrupt close the first post-war gliding era which had made such a promising beginning at Itford Hill in 1922. Is there not a danger of history repeating itself and of the experience in soaring flight which has been accumulated during the last three years being lost, just as we are on the eve of a great advance in motorless flying? It will be remembered that the ultra-light aeroplane movement which followed the 1922 Itford meeting was also short-lived and was followed by the light aeroplane movement which resulted in the formation of the present-day light aeroplane clubs and gave an impetus to private flying. It is argued that there are many who are interested in cheap flying and not in gliding as such. Would not the interests of such people be best served by the light aeroplane clubs taking over the motor-assisted glider and leaving the gliding clubs free to develop soaring flight?

There is a very real danger of even enthusiastic gliding pilots becoming diverted from the main object which is the *raison d'être* of the British Gliding Movement. In the London Club notes published in this issue, our correspondent emphasises the new perspective which has been given to the Club members as a result of Wolf Hirth's visit. This gliding pioneer's talks and demonstrations have illustrated how far we, in this country, have yet to travel. It would be a thousand pities if at this stage soaring flight proper were abandoned.

On the other hand, the idea that the motor-assisted glider has no application to the Gliding Movement must not be dismissed lightly. There may be possibilities from the point of view of training, particularly in cases where a club is precluded from the use of a suitable hill and has to carry out its flying activities over level country. Two years ago a suggestion was made to the effect that from the point of view of certain aspects of meteorological research a motor-assisted glider might be a valuable adjunct to a club's equipment.

We wish to emphasise the importance of every aspect of this question being examined impartially before a de-

cision is reached. And one thing is, even now, quite definite, that if it is decided that the British Gliding Association should sponsor the motor-assisted glider it must only be as an auxiliary to purely motorless flying; this objective must *never* be allowed to fade out of sight. There can be no question of an ultra-light aeroplane movement growing up side by side with the motorless flying movement, both being administered by the British Gliding Association. Such a procedure can have but one result—the ultimate abandonment of motorless flying.

THE 1933 COMPETITIONS.

In our correspondence columns in the present issue of THE SAILPLANE a correspondent raises the question of the 1933 Competitions. His letter is published at an opportune moment, for past experience has shown that in order to ensure a successful meeting it is necessary to get well ahead with the preliminary organisation some months in advance of the actual date. We would emphasise that unless we are to experience a repetition of the 1932 Furness Meeting it is necessary to start work, in earnest, *immediately*. So far, no announcement has been made by the British Gliding Association, although we understand that the matter is under consideration. We presume that the Contest Committee will again be charged with the duty of making the necessary arrangements. The two most important questions to be settled quickly are (a) the place, and (b) the date of the Competitions. We hope to receive the necessary information to enable us to make an announcement, on these two matters at least, at an early date.

THE EDITORSHIP OF "THE SAILPLANE."

Dr. A. E. Slater has kindly consented to become Honorary Editor of THE SAILPLANE. He will be responsible for the journal as from the next issue (Vol. IV., No. 2).

Dr. Slater needs no introduction to readers. He has been one of the keenest supporters of THE SAILPLANE since its inception, and is a frequent contributor to its columns. He holds the "C" gliding certificate and is particularly interested in the scientific and technical aspects of soaring flight.

We have no hesitation in prophesying a successful future for THE SAILPLANE under Dr. Slater's editorship, particularly as the paper is now on a firmer financial footing than it has been for some time past.

A SUGGESTION FROM SWITZERLAND.

In THE SAILPLANE of December 9th you wrote that the future of the journal is very uncertain, due to the financial crisis of the B.G.A. I believe that the paper should be saved by all means, and I am sure that you will find your way. In Switzerland we had the same trouble until the paper had been declared obligatory to the members of the different clubs. I cannot say that this was the right solution, but at the moment it was the only one to take.

OTTO FRISCH KNECHT.

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BIRD FLIGHT. V

By C. H. LATIMER-NEEDHAM, M.Sc., F.R.Ae.S.

**Analysis of Wing Forces in Flapping Flight (Contd.).
Outer Third of Wing.**

Before considering the forces acting on the outer portion of the wings, it is necessary first to investigate the exact function of the primary feathers in flapping flight. Why is the wing slotted and what effect does the slotting have on the individual feathers?

It has been stated that the wing incidence decreases towards the tips and, even allowing for the higher speed of the wing-tip and the extra height through which it descends, it is still found that the angles of attack, i.e. the angles at which the outer portion is presented to the relative air-flow, are not excessive and are not likely to reach stalling conditions. If this is correct, why should some birds retain the primary feathers in the open position during the down stroke? It was in attempting to find a solution of this perplexing question that the true value, and perhaps the absolute necessity, of the tip-slots was discovered.

It has been seen that very little forwards thrust is derived from either the inner or the middle parts of the wing, but that conversely drag forces are induced as the cost of lift, so that the outer portion has to supply, not only the thrust to compensate for the body drag, but also sufficient to overcome the drag of the inner part of the wing as well. For this reason the Primary pinions are sometimes referred to as "rowing feathers."

The analysis would undoubtedly have been greatly simplified if the bird chosen had been of a species which does not utilise the wing-tip slots for flapping, but had this been so it is very probable that the real object of emargination might have been overlooked.

The forces on the outer wing were first found in a similar manner to that employed for the two previous sections, on the assumption that the wing section retains its normal shape, that is to say, any twisting of individual feathers was neglected. It was realised that such a state of affairs could hardly exist, but it was thought to be a helpful step in the analysis. The forces thus found were in the neighbourhood of 0.9 lbs. vertically and 0.22 horizontally, and it is at once seen that the combined drags of the two inner sections amount to more than the thrust so obtained and there is still the drag of the body and the instruments, with which the bird was laden in the original experiments, to be accounted for, so clearly there is some further factor yet to be taken into consideration.

Action of Primary Feathers in Flapping Flight.

When the Buzzard's wing is in the open position there are gaps between the five primary feathers forming this part, and these gaps extend inwards for the most part of the third-span being considered. Now it is found that very nearly the whole of the web, or vane, of each feather is situated behind the quill, and therefore directly an air load falls on the feather there is bound to be some twisting.

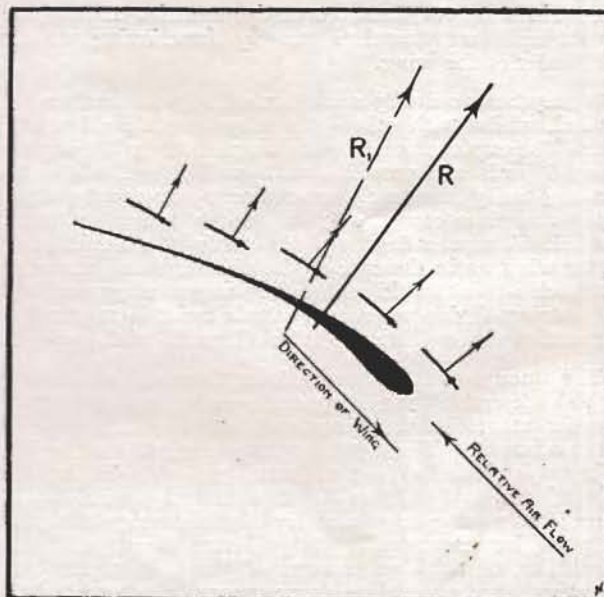


Fig. 13. Action of Primary Feathers in Flapping Flight.

The twisting will obviously be restrained to some extent by the torsional resistance of the quill, and therefore the feather will take up a new position where the torque due to the air load is just balanced by the torsional resistance.

In the new position the feather is more nearly parallel to the air-stream and thus the resulting forces will be directed more forwards.

Fig. 13 shows the wing descending along the fairly steep path followed by the tip portion. The primary feathers have taken on a certain amount of twist so that each gives its separate contribution towards the total force, R , and this latter is directed forward of the force R_1 that would have obtained if no twisting had taken place.

From this it becomes clear that the emargination of the wing-tip feathers of certain species of birds is essential for the generation of thrust in flapping flight. Graham* drew attention to a similar condition of the wings when presented at a large angle of incidence in order to show how stalling was avoided, and further explained that each feather must bend forwards under the influence of air load, but it is believed that this theory accounting for the derivation of thrust is put forward for the first time.

It may be pointed out that the action of each primary feather is almost identical with the action of the main

*"Safety Devices in Wings of Birds," Journal, R.Ae.S., January, 1932.

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wing, as outlined in Part I., where it was seen that, owing to the stiff member of the wing being located near the leading-edge, a twist is imparted to the wing during the down-stroke, and so causes a forward movement. Actually, of course, the primaries form a continuation of the main wing, or, more correctly, a series of continuations, and are therefore merely functioning as the remainder of the wing.

It may be asked why some birds flap with feathers extended, whilst with others the wings are devoid of such gaps. The explanation is quite simple. Only the shorter-winged birds are provided with well-defined slots, the slotting really being a clever artifice to increase the aspect ratio, and thus compensate for lack of span, but this is not all. A greater degree of natural twist could be given to the wing, as in the case of the pheasant and partridge, but such a twist would render the wing totally unsuitable for soaring flight, where very little twist is required on account of the uniform speed of all parts of the wing.

The amount of twist required for flapping is thus seen to be undesirable for gliding and soaring, and the ability to soar must therefore be dependent to a large extent on this feature. Hence we see that *a wing cannot be fully efficient for both flapping and soaring flight*. In the long-winged birds it is possible that flapping efficiency is sacrificed to some extent for the sake of soaring, although it must be remembered that a lesser degree of thrust would be required on account of the high aspect ratio wing and good streamline shape generally, whereas at the same time the greater velocity of the wing-tips would enable the requisite thrust to be developed with smaller wing angles.

Reverting now to the analysis of the wing forces on the outer third of the span, a set of revised calculations was made in which the feathers were given an estimated degree of twist, the effect being assumed to be the same as would be obtained by giving the same twist to the wing as one piece. The new figures were 0.8 lbs. vertically and 0.35 lbs. in a forward horizontal direction.

The total lift for the three portions is therefore $1.37 + 1.18 + 0.8 = 3.35$ lbs., and this agrees fairly well with the assumed loaded weight of 3 lbs.

Figures for the drag of the bird's body and the air tubes connected to it must be calculated. Assuming a frontal area of one-sixth sq. ft. for the tubes (i.e., two 4 ft. lengths of $\frac{1}{4}$ in tube) and a resistance coefficient of 0.2, a resistance of 0.071 lbs. is found at 30 ft./sec. Similarly for the body, a frontal area of 0.125 sq. ft., and a coefficient of 0.025 gives a drag of 0.0067 lbs., or a total of 0.0778 lbs. The net horizontal force on the wings has been found to be $0.35 - 0.113 - 0.15 = 0.087$ lbs., and this seems also to agree quite well with the estimated drag figure just found.

The results of the wing force calculations were next drawn out in the shape of curves, Fig. 14, separate diagrams being made for the vertical and horizontal forces and the total resultant curves added. The close resemblance of the lift curve to the body path curve of Fig. 5 immediately became apparent, and this would appear to act as a check to the proceeding work. The path traced by the body would vary very slightly from the curve of the bird's centre of gravity on account of the moving wings, but the lightness of the wings, coupled with the fact that the little weight there is is concentrated quite near the shoulder cannot displace the C.G. to any appreciable extent.

Too many assumptions have been made throughout the whole of this work for any great degree of accuracy to be claimed, but it is believed, nevertheless, that a good general picture of the phenomenon of flapping flight has been obtained.

SAILPLANE PHOTOGRAPHIC COMPETITION.

The winners of the Competition for October, November and December, 1932, will be announced in the next issue of THE SAILPLANE.

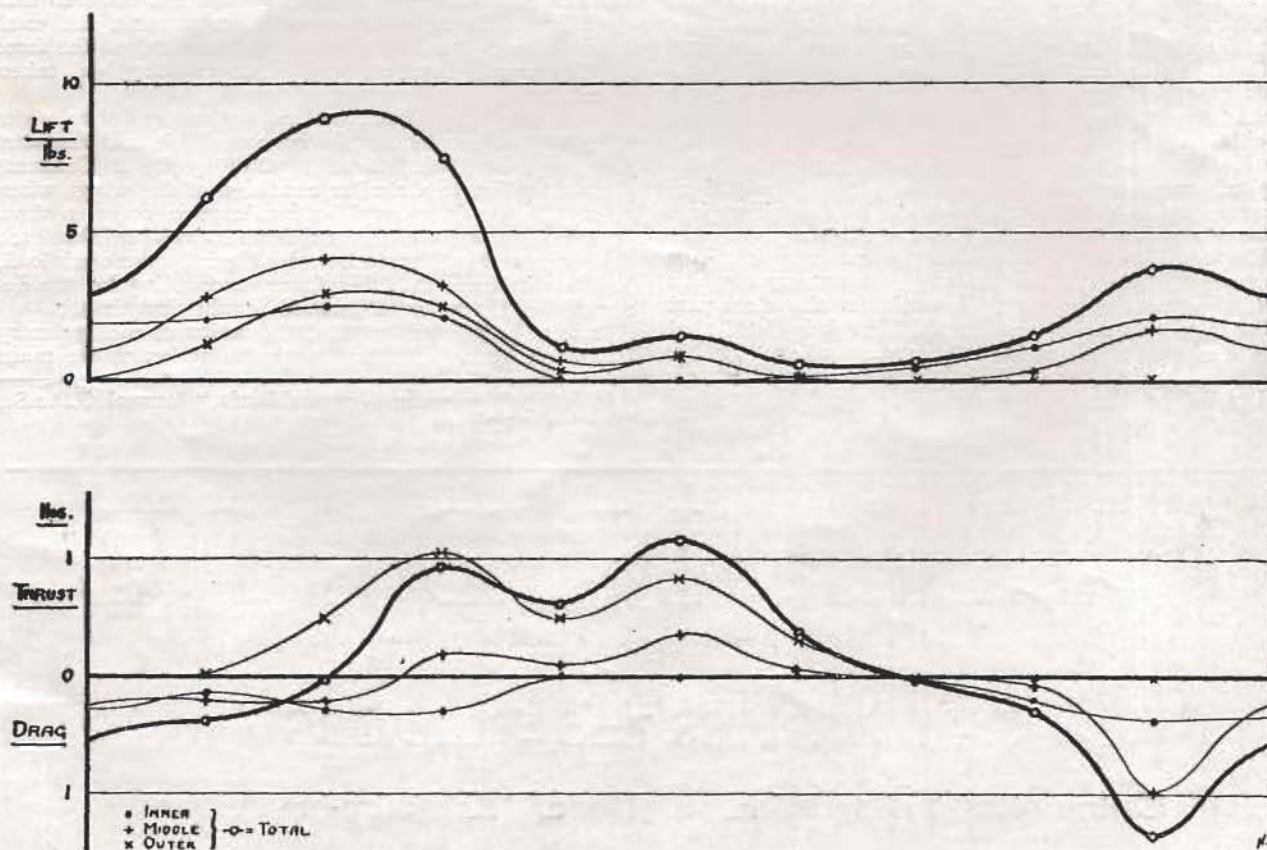


Fig. 14. Vertical and Horizontal Wing Forces.

WOLF HIRTH ON THERMAL AND CROSS-COUNTRY SOARING

By H. L. RICHARDSON.

At the London Gliding Club's Christmas Camp, Wolf Hirth, who is a pioneer in thermal soaring and whose mastery in this new and almost magical art is supreme, gave a series of most instructive talks. Without attempting to reproduce them in full, his talks deserve some form of permanent record, both because of their helpful character and because a definite meteorological discovery seems to be involved in his theory of rising "bubbles" of warm air.

In his first talk Hirth discussed "Thunderstorm flights," those made in advance of cold fronts which were so vigorous as to be accompanied by thunderstorms. While this type of cross-country soaring is by now well known, for the benefit of those unfamiliar with the literature of soaring flight it may be mentioned that in principle soaring above a cold front resembles slope-soaring, only instead of air as wind moving against a hill, one has what is in effect a hill of cold air moving, usually from the West, against stiller air. As a result the stiller, warm, air is deflected upwards, supplying rising currents on which soaring is possible; and as the cold front travels rapidly forwards long cross-country flights are possible if one can keep just ahead of it in the rising warm air. Theoretically it should be possible to leave the top of the launching-hill just before the cold front arrives and be carried up directly in the rising air; but because of the difficulty of judging the right moment it is usual to wait until the first puff of cold air comes and then take off immediately. A few minutes' delay now will spoil the chances of soaring. The pilot gains height in the slope-currents set up by the cold wind, and tries to rise high enough to reach the rising warm air in advance of the front. Hirth told how in one of his flights he soared over two high ridges in succession without managing this, and it was only at the third attempt that he was successful. It was no use continuing to attempt to gain further height over a ridge once the rain-shower accompanying the cold front arrived: then one must glide down-wind to the next ridge, if one was available, and try to gain height again there. Once successful in gaining the rising warm air, however, the pilot found his work easy; the rise of the air here was exceedingly rapid, and—which was not previously anticipated—the rising air was very steady so that the sailplane could almost be left to fly itself. One might be carried into the cloud that formed a long line above the cold front, but in this part of the front the air continued its steady rise through the cloud, so that following a compass course one would soon emerge on its upper slope. Then one could continue to soar in figure-of-eight along this slope, or if losing too much height make a quick curve into the cloud and out again, emerging much higher. If the cloud front appeared to be splitting, that which proceeded East or South-East rather than northwards was more likely to endure. The fronts tended to break up after a while, the regular cloud formation dispersing and the "lift" disappearing; a vigorous front travelled rapidly, and if the pilot noticed that his forward progress relative to some landmark was slowing down he could take this as a sign that the front was beginning to break up.

Another type of thunderstorm has been used for soaring: the "heat" or "summer thunderstorm" characterised by the development of enormous cumulo-nimbus clouds. Inside these clouds, however, the air is excessively turbulent, with rapid up- and down-currents in close proximity; flying even with instruments is most difficult, and the sailplane might be broken up by the stresses experienced. Apart from anything else, it could easily get into a dive and gather such speed (because of its low drag) that the wings would break on flattening out. Instru-

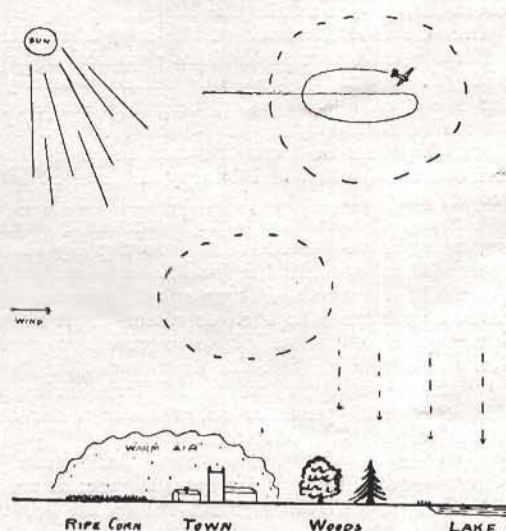


Fig. 1. Thermal Soaring—diagrammatic.
Subsequent positions of "bubble" dotted. Sailing circles approximately in horizontal plane.

ments, if carried, might become iced up and useless even at moderate heights. Nevertheless, provision was being made for soaring in clouds of this type, particularly by building sailplanes that would be stable in all directions, so as to fly themselves, and by pilots receiving training in blind flying both in aeroplane and in sailplane.

In his other talks, Hirth dealt with various aspects of thermal soaring. He pointed out that thermal effects played a part in other types of soaring, so that the technique of "pure" thermal soaring was important in all soaring or cross-country sailing. Describing the structure of thermal currents, he said that occasionally—as on a sunny day over Berlin, where the city was surrounded by pine forests and lakes—there might be a complete column of rising air, but his experience showed that in temperate climates sooner or later most rising air currents disappeared, and search how he might he could not get into them again. This suggested that they were discontinuous; that the warm air rose through the cold air like a hot-air balloon, or like a bubble of a less viscous in a more viscous fluid. The air over a dry surface, such as a field of ripe grain, or a stony river-bed, or a town with its brick or stone buildings and their roofs, became heated when the sun shone and gradually a flat "cushion" of warm air was built up (see Fig. 1). When this became large enough it formed into a "bubble," detached itself, and floated away, drifting in the wind if this was not too strong. A strong wind, by setting up turbulence and diluting the warm air over a hot surface, hindered the formation of such thermals. If there was an inversion at a certain height (a layer of air warmer than that immediately below), the bubbles of warm air would vanish and a soaring pilot would find the lift mysteriously disappearing at this height. If the air in the bubbles was moist, when it rose high enough to pass the "condensation base" the vapour would condense out into clouds, forming the ordinary small cumulus clouds of a summer day. Each of these clouds corresponded to a bubble of warm air. The liberation of latent heat when the vapour condensed warmed the air again, so that it rose more rapidly. The bubbles were smallest when they left the ground and expanded as they rose; at first, as the difference in temperature between bubble and surround-

ing, cooler air increased, the rate of lift in the bubble increased; later, as the bubble expanded more and cooled, the rate of lift decreased; still later, if a cloud was formed, the rate of lift increased once more. Hirth gave many instances that confirmed the "bubble" theory; when already high, he had glided towards a hawk that he observed soaring; at first he had found no lift above it, but he manoeuvred so as to remain in the same place, and shortly he found rising air, while just afterwards the hawk rose level with him. Again, he had been able to calculate the height, or depth, of a bubble which he entered about at the top, from a knowledge of the height it carried him, his own sinking speed, and the length of time he was in it before it finally rose past him: one such bubble had a height of some 500 m. (1,600 ft.). The boundary of the bubble was irregular, though probably less so than the outline of a cumulus cloud, and one could often feel bumpy air as one flew into or out of it, whereas in its interior the air was quite steady. Around the bubble were descending currents, but these, being more diffuse, sank less rapidly than the bubble rose. Thus outside the bubble one might have 1-2 ft./sec. added to one's sinking speed, whereas within it one rose at perhaps 6 ft./sec., to which must be added the sinking speed of the sailplane to give a measure of the rate of rise of the bubble. The diameter of the bubbles naturally varied greatly; those useful for soaring must have a diameter of 100 yards or so, while at a fair height the diameter might be much more.

The properties of the thermal "bubbles" have been brought together in this way for convenience; at an early stage in his account Hirth described the method of using them for gaining height. The first essential, in this as in all except slope soaring, was a reliable variometer for registering rising or sinking speed. Without this one could do nothing, since one's senses would record accelerations but would not indicate steady rising or sinking speeds of the magnitude of those used in thermal soaring. The pilot must have enough experience to be able to fly his machine automatically, so as to have all his attention available for making observations; he would be watching his variometer perhaps 90 per cent. of the time. He must also know the length, in seconds, of the smallest circle his machine would make without unduly increasing its sinking speed, and he should have practised these circles in slope upwinds. Then the pilot, soaring on a sunny day above a slope, or gliding down from an auto- or aero-tow, would find that his variometer showed various decreases in sinking speed or some places of actual rising speed. These should be disregarded unless the lift amounted to 6 ft./sec. or more since less vigorous bubbles were unlikely to be useful. When a sufficiently strong lift occurred, the pilot must at once begin to count seconds (by saying, in German, *Ein-und-zwanzig*, *Zwei-und-zwanzig*, etc., or in English, *One-hundred-and-one*, *One-hundred-and-two*, etc.), and after a number of seconds, equal to one-third of the known circling time of his sailplane, if the lift still continued, he should turn sharply at right angles and begin circling, continuing so long as the variometer continued to record lift. If at one point of the circle the lift was less, he should move a little in the opposite direction for subsequent circles. Since the quick circles were tiring, slower circles might be used as the sailplane rose. With MUSTERLE, Hirth's own sailplane, he could circle in 20 seconds, so that after being in the area of lift for 6-7 secs. he turned sharply left (this being more convenient) and circled continuously, the time for a complete circle gradually rising to 25, 30, or even 45 or 50 secs. if the bubble was large enough. MUSTERLE had a high speed—some 40 m.p.h.—and travelled about 100 yards in the 6-7 secs.; with a slower machine smaller circles could be made, and perhaps 4-5 secs. would be enough for the diameter of the first circle.

In this way 15 or 20 circles might be made in a single "bubble," and up to 4,000 ft. of height be gained. Lifts up to 12 ft./sec. had been observed in these thermal currents, so that one onlooker seeing Hirth making a series of small circles had remarked: "He is doing an upward spin!"

(To be concluded)

PERFORMANCE of the NYBORG GLIDER

Several readers of THE SAILPLANE appear to have been led astray by the somewhat unorthodox dimensioning of my glider and, consequently, have wrong ideas as to its flying speed. In the hope that a discussion of some interest may result, I propose to give its performance curves, calculated both by my own methods and by the methods so clearly explained by "Kentigern" in THE SAILPLANE of August 26th, 1932. As I cannot agree fully with his theory, the different types of resistance are considered in detail.

(1) Skin Friction.

According to Professor Fahm, the skin friction due to the surface contact with the air is

$$R_{S.F.} = k S b^{0.95} V^{1.85}$$

where:— k is a constant depending on the nature of the surface,

S is the span,

b is the chord of the surface,

and V is the velocity.

As this expression is inconvenient, it is sufficient to assume

$$R_{S.F.} = k A V^2$$

where A is the total surface.

For A in sq. metres, V in metres per second and $R_{S.F.}$ in Kg.

k is 1.84×10^{-4}

For A in sq. feet, V in feet per second and R in lbs.

k is 3.56×10^{-6}

(2) Losses due to Streamline Body.

While agreeing that a streamline body does not produce eddies, I cannot accept the statement that it produces no resistance to motion. Such a body moving through air compresses the air in front of it, thereby imparting energy to the air which is given off again behind the thickest part of the body as the air expands. The energy expended in compression work must, obviously, be supplied by the body, but the expansion work is not all performed on the body. There is, therefore, a loss of energy dependent on the axial section and fineness of the body, which shows itself as a resistance to motion.

This streamline resistance can be taken as

$$R_{St.} = k \frac{2\gamma}{g} A \left(\frac{a}{b}\right)^n V^2$$

where:— k is a constant depending upon the degree of streamlining,

γ is the mass per unit volume,

A is the maximum axial section area,

b is the fineness,

n is a constant depending upon whether the body is streamlined in two or three dimensions,

and V is the velocity.

For my own calculation I have assumed $k = \frac{1}{2}$ and $n = 2$.

The streamline resistance of the wings is naturally dependent on the angle of incidence and must be calculated accordingly, though "Kentigern" simplifies matters considerably by neglecting it. However, from my calculations, I find that the streamline resistance for the wings of my glider varies very nearly in inverse proportion to the square of the velocity (similar to induced drag).

$$R_{ST.W} = \frac{k}{V^2}$$

When R is in Kg. and V is in m./s. $k = 350$ for my glider.

Thus for a flying speed of 40 m.p.h. the streamline resistance for the wings is 1 kg. or 2.25 lbs., and as the total resistance at the gliding angle of 1 in 25 is approximately 15 lbs., it obviously cannot be neglected.

These constants are not the result of experiment, but are deduced from information obtained either from writings on, or from personal observation of, birds.

I would welcome any remarks from readers on the separation of the different resistances of gliders.

(3) Induced Drag or Aerodynamic Resistance.

Unfortunately, I am in complete disagreement with the assumptions made by both "Kentigern" and Mr. Lancaster regarding the manner in which the lifting force is produced by an aerofoil. "Kentigern" regards it as being similar to the reaction on the jet of a fire-hose and states that an efficient wing imparts a constant downward velocity to the air across the space, effecting a cylinder of air having a diameter equal to the span and the distance travelled.

Without going further into the point, may I ask how, if that is so, it is possible to explain the proven fact that the last bird of a large flock experiences no more, if not actually less, difficulty in flying than the first.

I have calculated the resistance, sinking speed, and gliding angle for my glider both by "Kentigern's" and my own method, allowing for body and wing streamline losses so that a comparison may be drawn between the performance curves thus obtained.

The following data were used:—

W=170 Kg.=375 lbs.

A=4.3 sq. m.=46.5 sq. ft.

S=9.75 m.=32 ft.

A Body=9 sq. m.=98.0 sq. ft. (including elevator and rudder).

Maximum section of Body=0.42 sq. m.=4.6 sq. ft.

Total length of body, including elevator=3.7 m.=12 ft.

The resistance of the skid and streamlined wind-screen is assumed to be approximately one-half the body resistance.

The streamline resistance of the wings is taken as $\frac{350}{V^2}$

in kg. for V in m./s. This is a very close approximation to the streamline losses of the wings obtained from my calculations.

In the appended tables and curves are given the resistance, gliding angle and sinking speed, in addition to the required kL for the wings at different flying speeds, though apart from providing a good basis for comparison of the stalling speeds of different gliders, as the higher the kL the better the wing design, I confess I cannot see the use for this constant. In using "Kentigern's" method of calculation I have taken:—

$$k_L = \frac{g}{\gamma} \times \frac{W}{A} \times \frac{1}{V^2} = \frac{300}{V^2} \text{ for } V \text{ in m/s.}$$

Profile Drag = $k V^2 = .006 \cdot V^2$ for V in m/s and Drag in kg.

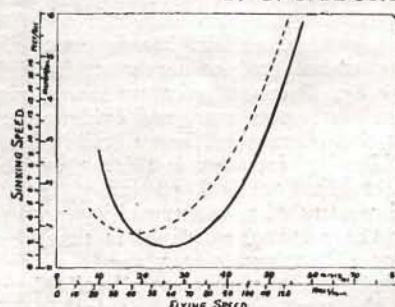
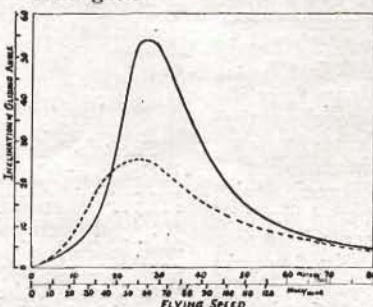
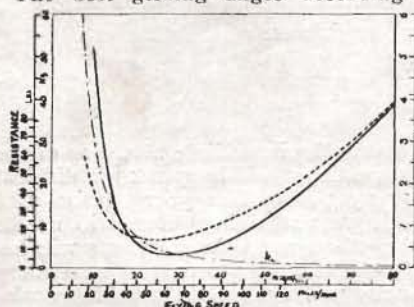
Induced Drag = $\frac{2}{\pi} \frac{g}{S} \frac{W^2}{V^2} = \frac{1480}{V^2}$ for V in m/s and Drag in kg.

Streamline Drag for Wings $\frac{350}{V^2}$ for V in m/s and Drag in kg.

From the total Drag Curves we see that at 42 m.p.h. the two curves have the same value, but for less speed my curve gives a bigger resistance and for greater speed a smaller resistance than "Kentigern's."

Comparing the sinking speed curves we find that according to "Kentigern" the smallest sinking speed is at about 40 m.p.h., while my curve shows its smallest sinking speed at about 60 m.p.h. As these differences are so large it should be easily possible to confirm one or other from actual tests on the glider.

The best gliding angle according to "Kentigern's"



Resistance, Gliding Angle and Sinking Speed for different Flying Speeds.

curve should be 1 in 26 at a speed of 56 m.p.h., while my curve shows an optimum angle of 1 in 54 at 62 m.p.h.

FLYING SPEED			K.L.	TOTAL DRAG				$\frac{W}{R} = \frac{L}{D}$ KEN TGN	SINKING SPEED				
				KENTIGERN		T.G.N.			KENTIGERN		T.G.N.		
M/SEC	M/NOZ	FT/SEC		K	LBS	K	LBS		M/SEC	FT/SEC	M/SEC	FT/SEC	
10	223	33	3	18.9	42	47	105	9	3.6	1.1	3.75	2.8	9.2
12.5	28	41	1.9	12.5	28	25	56	13.6	6.8	.93	3.05	1.84	6
15	33.5	49	1.34	9.5	21.3	14	31.5	18	12.1	.63	2.73	1.24	4.2
20	44.6	65	.75	6.7	15	6	13.4	25.3	28.4	.73	2.4	.71	2.3
25	56	82	.48	6.8	15.2	3.5	7.8	25	48.5	.99	3.25	.52	1.7
30	67	98	.33	7.4	16.8	3.2	7.2	23	53	1.3	4.3	.56	1.85
35	78	115	.24	8.7	19.7	4	9	19.7	42.5	1.77	5.8	.82	2.8
40	89	131	.19	11	24.5	6	13.4	15.5	28.5	2.55	8.4	1.4	4.6
50	111	164	.12	16	35.7	11.5	26	10.6	14.8	4.7	15.4	3.3	11

Regarding the stalling speed, I can say nothing definite, but as "Kentigern" had no hesitation in assuming $kL=2$ for his performance calculation of the VULTURE, I see no reason why this figure should not be taken here until such time as it may be disproved.

Making this assumption, the stalling speed works out at 12.5 m./s. or 28 m.p.h.

In actual practice it appears that the glider will rise from level ground at an air speed less than 40 m.p.h. when towed by a car in practically still air and, after releasing the tow rope at a height of about 3 ft., will glide 30-50 yards, though on several occasions this distance was exceeded. Unfortunately, the directional control is not sufficiently stable, and the glide generally ends in a side slip, though occasionally a flight is made with the machine apparently under perfect control. The fitting of a large rudder fin did not make any appreciable difference, and I suspect that the instability was mainly due to the absence of the cockpit cover, which had to be left off as it did not allow sufficient room for the pilot's head. This fault is now being rectified, and I am hoping that improved control will result during future trials.

From our experience up to the present it appears that the required lift of 8 lbs. per sq. ft. is developed at an air speed of well under 40 m.p.h., and that the stalling speed (minimum speed for horizontal flight) is about 30 m.p.h.

The minimum gliding angle has not yet been verified, as it is our practice always to put the glider down to the ground at the end of a glide by pulling the elevator down. In fact, the machine is sometimes brought down so hard that an orthodox glider would have little chance, as side skids of 30 to 40 yards on the ground are not unknown. So far, however, the only damage sustained due to bad landing was the bending of the elevator trailing edge, on two occasions, when the machine swung so far round that it went tail first along the ground and the pilot did not lift the elevator. Even then the damage was slight, and the repaired elevator is still in use.

In a flight made on August 13th, 1932, with a maximum air speed of 40 m.p.h., the distance travelled after the rope was released was 50 to 60 yards, and the landing spot was 5-6 feet above the point of release, as is shown in the diagram. The actual wind speed was under 3 m.p.h.

T. G. NYBORG.

CORRESPONDENCE

THE TAILLESS SAILPLANE.

Sir,—May I, as one who has had experience in the design of tailless aircraft over a period of some years, add one or two observations to the very interesting case for the tailless sailplane, as put forward by Mr. L. P. Moore in the last issue of *THE SAILPLANE*, although my views may be at variance with his in several respects of fundamental importance.

Dealing with the tailless machine with a rectangular wing, it is stated that when the ailerons, or flaps, are moved up simultaneously, the angle of attack of the wing is increased, due presumably to the effect of the assumed down load on the flaps. The reverse is, I believe, actually the case, since raising the flaps decreases the incidence and sectional curvature, which causes a backward movement of the C.P. accompanied by a loss of lift, and thereby results in a dive. This is the method of control adopted for the Lippisch gliders, and it is interesting to recall that actual machines, somewhat similar to the *STORCH*, but with rectangular wings were built and flown, which, incidentally, disproves the suggestion that sweepback is essential for this type of machine.

Originally, ailerons only, i.e., one pair of flaps, were fitted, but they were not found to be sufficiently effective for the dual purpose required, and hence subsequent machines employed both elevators, over the inner parts of the wing and ailerons.

Some sweepback was then incorporated by both Herr Lippisch and Dr. Koppers (the designer of the *AUSTRIA*), but this was obtained by tapering the wing, with the trailing edge still retained at right angles to the nacelle.

Then, surely, the C.G. is placed vertically below the C.P. when in the position for normal gliding flight, and not behind. This ensures maximum efficiency and safety. And again, is the tail end of a fuselage the end that matters most from a streamline point of view?

Although there undoubtedly are future possibilities for the tailless sailplane, I am not sure that the characteristics peculiar to this type of machine are entirely beneficial. Weight and drag of tail and fuselage are admittedly reduced to a considerable extent, but the most efficient aerofoil shapes do not have fixed positions for the C.P. (or Nature would surely have discovered this long ago!). Hence we are forced to use inefficient wing sections, or alternatively to decrease the efficiency of the wing by employing twist. The best stable sections have been developed by Munk in America during recent years, but they still fall behind the best Gottingen sections, I think.

The next snag is that we find there is nowhere to fix the rudder, and in consequence two are used, one on each wing-tip, but only one can be used at the time so that the net effect is an increase in parasite drag. This defect, however, probably constitutes one of the most valuable features of the tailless machine, since the rudders act as end-caps to the wing and thus produce a higher aspect ratio effect. But this need not be limited to tailless craft. (In one tailless aeroplane, with the design of which I was associated, the nacelle was actually extended backwards to support the rudder, and this machine proved itself to be very efficient!)

I cannot refrain from turning for guidance to the birds, whose flying abilities have developed over many, many centuries, for, as Mr. Moore contrarily states, "Surely Nature's feathered soarsers must be right!" What do we find? In all cases "tails are worn" right down from the extinct *Archæopteryx*, and evidence exists to show that even the *Pterodactyl* had a tail! But this needs some qualification, for there is a large variation in the sizes of tails, so that we find, generally, that those species with good powers of manoeuvrability possess large tails, and only those for whom flight is needed almost solely as a means of getting from place to place, usually flown in a straight line, possess small tails, large enough only to give the small amount of control required at the initial

rise and at the descent. Such birds are generally heavily loaded and clumsy fliers.

And so time will probably show that tails form a necessary adjunct to all but heavy commercial aircraft, where tailless machines would be of most use, and even here a small tail may be found preferable.

The statement that "Herr Lippisch has already proved the superiority of the (tailless) type" cannot be accepted. I do not for one minute wish to decry his most valuable contributions to aircraft design, as there are probably few who have surpassed him in this respect, but I doubt whether even he, in the flush of his enthusiasm for tailless craft, would support this claim.

The *SCHWANZLOSE* certainly proved very successful when powered with an engine of low power, but I was informed on good authority, when at the *Wasserkuppe* this summer, that the results were disappointing; in fact, very little better when a more powerful engine was fitted. And we have yet to see such splendid performances set up with tailless sailplanes as have been achieved with those of orthodox lay-out.

C. H. LATIMER-NEEDHAM.

THE 1933 COMPETITIONS.

Sir,—I write on what I myself feel to be the MOST important item in the coming Gliding year, 1933, viz., the B.G.A. Competitions.

Last year, owing to lack of early organisation, and in the end a very hurried decision to hold a competition at Barrow, very few pilots other than from the London Club were able to go up to Barrow for the whole week.

I was one of those unfortunates who, during the whole summer, had been waiting to make arrangements to attend the competitions with a sailplane and a group of the more advanced pilots from our club. When the date was at length pronounced, it left me no time to make arrangements to get away from work, and this applied also to nearly all the other members of my club.

The Competitions, which we wish to hold annually, are really for the exclusive use and enjoyment of the "gliding members" of the various clubs, as opposed to the many other members who seem to think that though they do not glide themselves they should have their say in matters.

I would suggest, therefore, that any or all soaring pilots who are sufficiently keen for a Competition should, after an official announcement by the B.G.A., subscribe a definite amount to the Competition, which would of course cover their entrance subscriptions (say, £1 10s. or £2 each). With this money, if it were enough, they should hire the rights to soar in competition over the site chosen, and there should be no thought of collecting any monies from the public. In fact, I seriously suggest that the public should be left severely alone. It is a soaring competition we want, not a demonstration.

When I refer to these soaring pilots who should subscribe, I do this with the intention of making certain that there will be a soaring competition, on a given date at a given place, and that the date may be announced as soon as possible.

Finally, I would like to suggest that Barrow be again chosen, and that the B.G.A. get into touch with the persons responsible for the land and find how much they would require for one week's use of their land at the top of the hill, when no thought is going to be given to making money out of the public. I suggest Barrow because the lands people are known, and the site has already been proved.

The whole matter wants the immediate attention of the B.G.A., or else the same thing will happen as it did last year, and a great many people like yours truly, who MUST be planning the year's holidays now, will not be able to be there, and so the annual Competitions will become merely a yearly meeting of a few men who every year through their lucky position in life are able to take a week's holiday at a moment's notice.

My suggestions may be useless, but at least let the B.G.A. announce as soon as possible the date of this year's Competitions so that as many enthusiasts as possible will be able to turn up.

"SEGELFLIEGER."

THE MOTOR-ASSISTED GLIDER

Sir,—There are several points in the correspondence in your columns lately which interest me considerably.

I am afraid my knowledge of British gliding is very limited—mainly culled from the pages of *THE SAILPLANE*—and therefore I would beg of you to excuse any of my criticisms that badly "miss the mark," and ascribe them to my ignorance.

The letters throughout contain the atmosphere that "crashery" in primary instruction is unavoidable—indeed the dual-instruction protagonists claim that as an advantage to their system. But surely crashes in primary instruction should be the exception and not the rule. Of course, one must allow that not all sites have billiard-table surfaces on which to land, but a crash by direct mismanagement in the air should be exceptional. My contention is borne out by the example of the Fliegerschule am Dörnberg, where an average of over 20 primary launches a day was maintained for eight months last year without a single bad crash—and they certainly have not got billiard-table surfaces. Undoubtedly the primary machines used were responsible for the greater part of this result. The machines used were German "trainers" (E.S.G.) which are not only cheaper to build, but almost "uncrashable," which is more than can be said of the ZÖGLING and improved ZÖGLING types.

This machine has a further advantage in that the step up from primary to secondary can be most easily made by fixing the wings to the enclosed body—the R.S.G. type.

Still, a good deal of this result can be ascribed to the instructor, an *ab initio* glider pilot himself. Caution is his watchword, and he insists on a definite standard being reached by a pupil before he may attempt something new. "Black out," or sudden launches from high slopes unnerving the pilot are quite unknown under this system of instruction.

Personally, I feel that the B.G.A. would be justified in sinking its principles a little and saving motor-assisted gliders—the term "Planettes" sounds better—from the Air Ministry by taking over their control. Planettes are one development of gliding—though I consider British glider design nothing like sufficiently advanced to venture into these new fields.

I am astonished that the amazingly good sense and advice contained in Air Commodore Chamier's letter, published in the issue of September 9th, has never been carried any further. With him, I am convinced that the resuscitation of gliding rests with our youth; and now, when our very existence is being threatened, is the time to go out and try and persuade youth to come into the sport. Lectures and demonstrations should be made to interest some of the great youth movements, such as the Boy Scouts, etc., and also in our schools. These are the material with which to build up our movement. Not only,

in many cases, have they the workshops, but they have the enthusiasm and numbers—and often the time—which is not possible among our present type of member.

P. S. FOSS.

Sir,—Assuming that the Air Ministry can be persuaded to legalise motor-assisted gliders, there appear to be two possibilities:—

(1) Power-gliders may be subject to the same regulations as other aeroplanes, or

(2) They may be as free from control as motorless machines are at present.

In the first case, flying costs would presumably be comparable with those of the Aero Clubs—that is to say, far beyond the average gliding club member's resources. (I speak for my own club, knowing no other.)

In the second place, I apprehend that many people without experience or knowledge will become intrigued with the idea of building a "flying motor-cycle," with the result (probably) that there will be crashing and breaking of necks, followed by Air Ministry regulations forbidding amateur construction (except, perhaps, under supervision). The importance of this is that the said regulations would almost certainly include the motorless craft, which would be a great pity.

Perhaps some partial form of control could be devised which would allow of cheap running costs while ensuring the safety of machines.

It may be said that if there had been any danger of accidents due to home-made machines, it would have shown itself at the initiation of the Gliding Movement.

Well, I think that anyone who is keen enough to build a glider, knowing the extreme difficulties of operation and the apparently dull nature of the flying, is usually keen enough to acquire some knowledge of the subject. Anyway, he has to join a club to get a launching crew, and he cannot fail to learn something of airworthiness from repair work.

ANOTHER NORTHERNER.

"AIR RANGER'S" VIEWS

"Air Ranger" writes as follows in the *Glasgow Daily Record*:

"The motor-assisted glider recently produced by Mr. Lowe Wyld is causing much discussion not only in gliding circles proper, but in those more directly associated with power flight.

"I am quite willing to admit that there is a big, even virgin, field for this type of craft, but I imagine that the gliding movement is the one most advantageously placed to take full advantage of its development.

"It is admitted that the more rigid, or shall we say idealistic, spirits in the gliding movement are against the introduction of the power factor, but the interest and probably the greatest benefit to the majority of gliding club members lies in the production of just this very type of craft.

"We have already discussed the use of this type of machine for primary training purposes, and while endeavoring to make it a success, we must not lose sight of the fact that it is a machine for the future."

(Continued on p. 12, col. 1)



The "E.S.G." Trainer.

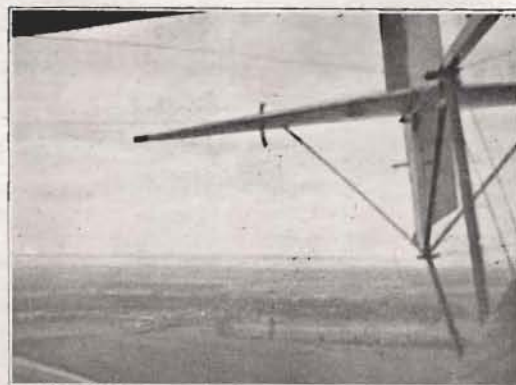


The "R.S.G." Secondary.

(See letter from Mr. P. S. Foss above)

NEWS FROM THE CLUBS.

An unusual photograph.
Passenger's view tailwards from the "Poppenhauser" at Dunstable.



BRADFORD AND COUNTY GLIDING CLUB.

Sunday, Dec. 18th. Wind S.S.W.; variable strength.

With a gusty wind running almost parallel to the ridge DICKSON Intermediate accomplished flights averaging 75 seconds, Stedman heading the list with 85 secs. As no soaring practice was possible, Cox and Robertson were given their initial flights in the nacelled machine, the latter astonishing everyone with a flight of 52 seconds from a 40 ft. slope on the plateau.

Tuesday, Dec. 27th. Wind S.S.W.; 5 m.p.h.

Again the wind was not very helpful, so the day was spent bringing on the novices with REYNARD primary. Jowett again showed the most notable progress by graduating from the "flat" to the hill, eventually performing a fine steady flight of 21 secs. and landing with excellent control. Hather and Watson, also, showed steady improvement.

It was learnt during the day that Santa Claus had made us a surprise offer. We are all waiting anxiously to see how this "present" turns out, and we may be able to say more about it in our next report.

KENT GLIDING CLUB.

Sunday, December 18th.

Cheers! a favourable wind at last, after weeks of indifferent conditions. The bright sun and blue sky produced an enthusiastic bunch of "early birds," and old Columbus flew merrily all day. Dugdale, who has had very bad luck in his attempts at his "B," determined to make the most of the "gale" with another attack on the minute. His best flight had three nice turns, but as he was nobly trying to keep Columbus inside our field he just failed on time. After lunch more members turned up, and with the certainty of a large crew for handling he made another flight, finishing beyond the double hedge and gaining his "B" with 67 seconds.

Wood, an early "A" pilot who has not been much in the air lately, made a hair-raising flight with zooms and dives ad lib., the final dive being at?—into?—over?—YES, thank goodness!—the two hedges. (Doesn't the tail make a nasty noise crashing through the brushwood at 30 m.p.h.?) However, all's well that lands well, and Weekes brought us once more to a calm state of mind with one of those long, slow flights of his that make gliding look so easy. Silhouetted against the sunset sky he made a sort of tour round the site, and as there were already two or three stars shining we remembered with a sigh of relief that he can always be relied upon to put Columbus down inside our field.

Sunday, January 1st.

Attendance was none too good, and gliding was confined to a few flights in the late afternoon.

Nightingale, our newest member and a power-pilot, got his "A" with a nice flight over some low trees and the double hedge. In spite of a difficult launch he flew very steadily and made an excellent landing. This is only his second flight since joining the Club and his third on a glider, so it should not be long before he has his "B."

It is surprising what progress can be made with Primary machines. In 1930 it was supposed to be only just possible to get an "A" on our site. In 1931 "A's" were

fairly frequent, and in 1932 we were getting "B's." Can we get "C's" in 1933? Opinions are divided! Anyway, we intend to make a visit to another site in the near future, and we are also looking forward to getting delivery of the B.A.C. IX. soon.

LONDON GLIDING CLUB.

On Saturday, December 3rd, the KASSEL 20 was given a trial-hop, after the completion of enormous repairs by Collins. The Watson R.F.D. was flown off the hill-top, descending into sticky ploughed land downwind. She turned quietly without damage, leaving the pilot suspended by the safety-belt of which he had previously never seen the point. The HOLS was soared in the dusk, with an electric torch illuminating the air-speed indicator. But the pilot suddenly realised that he had not done up his belt and descended promptly on the hill-top. Another pilot took over and flew as he had never flown before, for the simple reason that for the first time he could not see the indicator.

On Sunday, the sun blazed all day, though the air was cold. A gentle wind blew up the hill till late in the afternoon. An accredited expert deposited the PROFESSOR on top of the Bowl (causing amiable giggles), whence Hamilton (*ab initio*) made an exquisite (N.B. no exaggeration) flight of 35 minutes. Meanwhile the KASSEL 20 and CRESTED WREN had been launched, also carrying *ab initio*, and the three machines played together indefinitely until the KASSEL pushed off to Whipsnade and the PROFESSOR landed. The WREN later joined the KASSEL. Then the KASSEL landed and the HOLS took off. HOLS intensely resented the passage of the WREN within a few yards of her wing-tip and threw an Immelman turn downwind, toward the hill. The WREN, already forced off her course, had no choice but to land. HOLS's triumph was short; the wind was already failing and soon dropped altogether. The flights of the four machines totalled about 4½ hours.

Five machines in all were flown down from the hill-top, one by a French commercial pilot. Herr Eisenstädter, from Vienna, made a start on elementary ground-hops and did well. Monsieur Claudel is nearly ready for his "A."

The Imperial College have so completely renovated their R.F.D. that one man actually flew her off the hill-top, coming to no harm. It was over a year ago since the last completely open machine used the hill, and it certainly looked queer—quite the old witch-on-a-broomstick.

On Sunday, December 11th, a dreadful easterly gale with hail and freezing rain. We sank a car-axle verti-

TUITION.

LIVE AND LEARN AT PHILLIPS & POWIS SCHOOL OF FLYING, Reading Aerodrome. Comfortable residential accommodation at economical rates. The very highest standard of instruction by late instructors of the R.A.F. Take a 15s. trial lesson at the country's most up-to-date school. Reading Aerodrome.

Sonning 114.



N. H. Sharpe soaring the Bradford and County Gliding Club's "Dickson" Intermediate on the west slope of the Club's flying ground.

cally in the hill-top so that the rim of the tyre-less wheel can be used in place of the top pulley in the haulage gear. It will save any amount of power and wear and tear in the rope.

On Sunday, December 18th, a strong southerly wind. Dewsbery and Collins flew the CRESTED WREN and KASSEL 20 from the top of the hill, but met nothing except violent down-draughts. The machines were down in less than a minute and were then put away. The Watson R.F.D. was hand launched from a low foot-hill and was heaved about pretty violently. The worst misgivings were justified finally by a smashed landing-wire fitting and a torn-out wing-root, caused by an ugly double-bounce landing. But many odd jobs were done round and about the premises.

The Club closed down during the Christmas week-end, all except Mr. Walker, the steward-cum-engineer. Being apparently a lineal descendant from a member of the Light Brigade, he spent his Christmas Day working voluntarily until after dark on a damaged machine.

On the Monday Herr Hirth arrived in his HIRTH-KLEMM, accompanied by a young German pilot who has done an almost incredible amount of flying with and without engines. The mere thought of the achievements of this pair makes one blush bright pink all over. What we dream of doing, they do. They tie a PRÜFLING on to a KLEMM tail-skid and then go for a nice ride. The apparently casual way in which the Germans do feats which, done in this country, would (a) give the B.G.A. forty fits,

(b) explode the Air Ministry, (c) fill THE SAILPLANE for several issues, is so utterly attractive that a large number of British pilots are enquiring about the methods for taking out German naturalisation papers.

At this moment the Camp is still in progress. The weather has been fairly vile, but not bad enough to prevent elementary instruction. But in any case the real attraction of the Camp has been Herr Hirth, who has been successfully badgered night and day. His readiness to divulge all his trade-secrets is amazing and delightful, and rather novel. It is impossible to make a start, here and now, to retail his information, seeing that he lectured and answered questions all day and half the night for days on end. Actually, he has given us a *new perspective*, and only time will tell what the results of it are going to be. His absence from the New Year's honours list is inexplicable.

What piffle this ridge-soaring now seems to be! One can only fight for the day when, having learnt to *FLY* after a fashion by about fifty hours of ridge-soaring, one can push off with a variometer and evermore ignore the nursery-hill except for its proper purpose—a spring-board.

On Sunday, January 8th, a gusty wind, about 25-35 m.p.h., blew from the S.W. diagonally up the hill, with a continuous sheet of clouds at about 400 ft. above the lip of the ridge. Depression N. of Scotland.

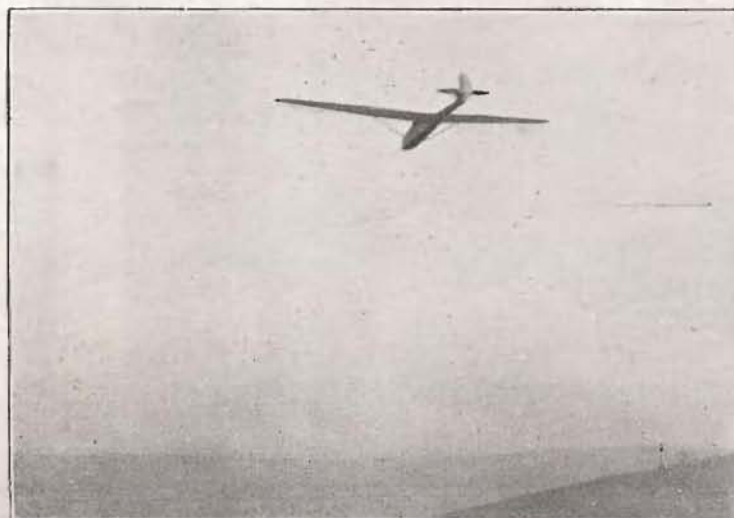
Collins went up the hill with the KASSEL 20 and launched with the sole aid of a solitary spectator, who jerked him into motion while the machine was balanced by the ailerons. Ten minutes later Collins was out of sight of the ground in the clouds over the Zoo. He circled inside the clouds and barely managed to regain the up-currents by means of a steep dive. He remained in and out of the clouds for about an hour, then landing at the launching-point. Later he repeated the performance for another long spell. This *ab initio* pilot is near enough to brilliance now. While Wolf Hirth was here, Collins made an extraordinary soaring flight over the Bowl and thereby seems to have revised Hirth's opinion of this particular make of machine.

Cornell took a couple of short trips in the KASSEL 20, landing on the hill-top. Robertson flew the Watson R.F.D. down to the hangars. Major Petre and Humphries aired the CRESTED WREN for an hour and a half. On the ground the rebuilt PRÜFLING did many trial hops. Slingsby took a hop as some kind of a reward for a 500-mile round trip from Scarborough in the day (and night).

The conditions above the hill were about as queer as any we have felt. The air was abominably rough at times.

Soaring at Dunstable.

On the left: Humphreys taking off in the "Crested Wren"



The roughness came in bursts and seemed to be in no way connected with turbulence caused by the hill-side. Occasionally there would be a steadier patch with big lift, allowing the WREN to hover quietly upward until the first flecks of cloud were scouting by below the machine. Then the air would return to its general state of daftness and the stick would be hard at work again. To an average pilot a flight was rather too much like a war—lots of hard work sprinkled with moments of acute fright! But it all helps.

One of the most interesting aeronautical features was the struggle up-wind to round the Zoo Corner. Collins made fairly easy work of it in spite of many definite down-draughts. The WREN in less abnormal hands squeezed round and then worked up a safe height over the buffalo paddock and Lion. Mole in the KASSEL two-seater, with a passenger, met his Waterloo, tried to struggle home, and landed on the wrong side of the hedge. Perhaps there is more in this ridge-soaring than there seems to be at first sight.

'Air Ranger's' Views. *Continued from page 9.*

avouring to keep a perfectly open mind on the subject I am still of the opinion that the dual control auto-towed glider, similar to the BAC VII. machine, has some distinct and attractive advantages to offer.

"With regard to the 'classification' of the motor-assisted 'glider,' it is claimed, and with justice, to be the offspring at any rate, of the gliding movement.

"It is also asserted that by reason of its construction, design, performance, etc., it is much more closely related to the motorless plane than to the light aeroplane.

"There is, however, no bilking of the position which this machine occupies under our existing laws so that until the Air Ministry regulations are altered glider clubs as such will be unable to make use of this new and undoubtedly wonderful little machine.

"Assuming, at any rate for the moment, that the

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DIARY OF FORTHCOMING EVENTS.

Monday, January 23rd, 1933, at 6.30 p.m., in the Library of the Royal Aeronautical Society, Albemarle Street, W.1.—Council meeting, British Gliding Association.

machine will be of great value to the gliding movement, we are immediately faced with the problem of its introduction into general use.

"The first step, obviously, is to persuade the Air Ministry to alter prevailing regulations and to remove the great barrier which exists between the gliding movement and its progressive offspring.

"It is also imperative that the inevitable expenses incurred in obtaining certificate, etc., be kept down to a minimum.

"When these two great steps have been taken I sincerely believe that the whole movement will go forward very rapidly and that there will be a great revival in the whole British gliding movement."

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