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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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CONTENTS.

MOTORLESS AND POWER FLYING

In the last issue of THE SAILPLANE an instructor of the Brooklands School of Flying reported the results of a test in which a pupil who had recently obtained his "C" Gliding Certificate, but had never previously flown a power-driven aircraft, was given a short period of dual instruction in a Gipsy Moth. The conclusion reached by the instructor was that the gliding pilot attained in ten minutes a standard which would have required from two-and-a-half to three hours in the case of the average ab initio pupil.

This example of the value of gliding as preliminary training for power-flying may well be taken to heart by those responsible for running Schools of Flying. The shortening of the period of instruction on a power machine must mean, inevitably, a reduction in the cost of training a pupil and, if properly handled, this would result in the addition to the clientele of the Schools of many people who are keen but who cannot afford the high charges which flying training involves at the present time.

It is significant that in the February number of "Motor Sport" the Aviation Correspondent ("Rudderbar"), discussing the subject of cheaper aviation, suggests that a solution to the problem may be found through the gliding clubs. The ideal club for this purpose would be one specialising in auto-towing. An efficient two-seater auto-tow sailplane, fitted with dual control, would enable a pupil to be taken up and, from the beginning, have the benefit of an instructor with him in the air. Tuition would be given in exactly the same way as when a power-driven aircraft is being used.

Having passed his tests on the engineless machines, the pupil would then pass on to instruction on the club's low-power two-seater 'plane. An hour should be sufficient to bring him to the solo stage and, ultimately, to his becoming a certified aviator.

Elaborating the scheme the writer goes on to suggest that a "motor-glider" of 10 h.p. would form part of the equipment of the club and that this machine would be available for qualified soloists for building up flying hours.

Discussing the probability of the revival of the motor-assisted glider, "Rudderbar" points out that there is very little prospect of this development at present. As soon as a power unit is added, the machine becomes an aeroplane and, as such, its design, construction, operation and maintenance become hedged about by laws and regulations. It is suggested that the necessary supervision and approval of such machines could well be left in the hands of the British Gliding Association in the same way as gliders and sailplanes, and that if the Air Ministry were prepared to take this step the development of the "motor glider" would quickly follow.

It is by no means certain that a really low-powered aircraft is as remote as "Rudderbar" suggests. We understand that a well-known firm of aircraft constructors, which already has a light aeroplane on the market, is considering the production of a high-efficiency machine of not more than 20 h.p. which would fulfil the requirements of the aircraft visualised in "Motor Sport." Delay is being caused owing to the difficulty in obtaining a suitable engine, but, if this difficulty can be overcome successfully, the aircraft will soon be available.

The term "motor glider," incidentally, is unpleasantly reminiscent of 1923 when it was used freely by the Press to describe the low-powered light aircraft which were then being developed from gliders. At that time people's thoughts were turning from gliders to power machines. Now, nine years later, there is a tendency for those responsible for power-flying to revert to gliders, but only as a means to power-flying. We must emphasize that **all this is not motorless flying** and when discussing any relationship between gliding and power-flying we must not lost sight of the fact that **the main object of the Gliding Movement is to develop motorless flying for motorless flying's sake.** We see the achievements to which the steady pursuit of this objective has already led in Germany. And we can see the beginnings of real achievement in this country. To what developments motorless flying will ultimately lead nobody would be foolish enough to attempt to predict. But one thing is certain, that unless the main object is kept steadily and definitely before us, there will always be a danger of our becoming side-tracked.

What is wanted in the Gliding Movement above all else is a sense of perspective. The Movement is big enough to carry through successfully its main programme and produce big achievements in soaring flight, and at the same time to foster those developments in gliding which are going to be of practical help to aviation. If the latter are kept in their proper perspective in relation to the main objective, nothing but good can result both for the Gliding Movement and for aviation generally. It is with this in mind that we welcome any signs of a linking-up of motorless and power flying.

CLOUD FORMATIONS IN RELATION TO SOARING FLIGHT

(Impressions of a lecture on "Clouds" by Capt. C. J. P. Cave, written by Dr. A. E. Slater)

Fig. 1.

Fig. 2.

The public lecture on "Clouds" given at the Science Museum on Jan. 28 by Capt. C. J. P. Cave, past-President of the Royal Meteorological Society and a foremost authority on the subject, was attended nearly to capacity, but not, one regrets to say, by members of the Gliding Movement, which was hardly represented at all. We were treated for over an hour to slide after slide of magnificent cloud photographs, most of them quite unfamiliar, though a certain number have appeared in the lecturer's book "Clouds and Weather Phenomena."

Beginning with cumulus, Capt. Cave soared up by stages through the various other types to the cirrus level; it was therefore the early part of his lecture which was of more direct concern to those interested in motorless flight. Particularly was this the case with several pictures showing cumulus arranged in long lines; in some instances the individual clouds were separate, but more often they had joined up to form a continuous belt, usually running more or less parallel to the wind direction.

There was no "question time" after the lecture, but in reply to an enquiry Capt. Cave has very kindly written amplifying some of the points he raised; not only so, but he has sent for reproduction in THE SAILPLANE three photographs which were among those exhibited, and which should be of special interest from the point of view of cloud soaring.

Fig. 1 shows a continuous line of cumulus, photographed on the morning of Aug. 29, 1928, from the island of North Uist in the Outer Hebrides, looking about East. The line was of great length—only part of it is shown in the photograph—and Capt. Cave estimated that he could see at least 40 miles of it at a time. The motion of the cloud was approximately along the line; quite different, therefore, from that of a "line squall," in which the whole line moves transversely across country.

This line of cloud persisted all day, and Fig. 2 shows it in the afternoon, still going strong; this photograph was taken looking in a different direction, the right hand of the picture being approximately South. The lecturer described this example as a perfect cloud for gliders; the pilot, he said, could start at one end and fly along the line getting lift all the way. He did not explain how the glider was to get up there in the first place, but a glance at Fig. 2 will reveal a distant pair of mountains with apparently good soaring slopes; these are about 25 miles away in the island of South Uist. They are Hekla (1,988 ft.) and Ben More (2,035 ft.), so their tops are in all probability already half-way to the clouds.

Following these two photographs, Capt. Cave projected on the screen a map of the Outer Hebrides showing the wind conditions at various points in the islands on that particular day. This was of extraordinary interest. The islands of this group form a chain running approximately SSW to NNE; the line of cloud was similarly placed and lay directly above the island chain; while the general run of the wind was also in the same direction. But reports from observing stations on the East side of the islands showed a slight deflection of this wind towards the West, and those on the West side a deflection towards the East; in other words, superposed on the general wind flow there was a drift of air in from the sea on both sides, as if it was being sucked in by powerful rising currents within and below the cloud; thus the influence of the cloud extended right down to ground level for some miles on either side.

The reader who cares to examine these pictures more closely (there was hardly time to do so at the lecture) may notice that, in Fig. 2, there projects from the southern end of the cloud line an extension of cumulus towards the West; referring to a map the southern end of South Uist is also found to curl round to the West in the same way; it is as if cumulus cannot help forming as soon as air from the sea strikes land. Further, at the other end of the island chain, the Western side of North Uist juts out into the Atlantic, so that over this portion of land, from which the photograph is taken, the wind blows directly in from the sea, not from over the other islands. Consequently one would expect fresh cumulus formation to be taking place in the neighbourhood of the photographer.

A glance at Fig. 1 shows that this is so. A little below the upper border of the picture (i.e., nearer the camera than the main cloud line) are a few wisps of newly-forming cumulus, one patch near the centre and a few scraps near the right corner; they can be distinguished by their texture from the streaky background of cirro-stratus which is, of course, immensely higher up and need not concern us. A more fully developed lump is seen just below the centre of the picture; it appears to be projecting up out of the thick cloud line, but this is not so; it is not higher, merely nearer. Its comparative nearness is evident from the lack of sharpness in its outline. The rounded tops characteristic of cumulus are just taking shape.

Low down near the horizon more lines of cumulus may be discerned in the far distance; these are most likely over the Isle of Skye, 35 miles away.

"These straight lines of cumulus" writes Capt. Cave,

"do not seem to have been recognised by the cloud writers . . . one does not get them much in this part of England (Hampshire), but during the month I was in the Hebrides in 1928 I noticed many occasions when these lines were evident." It may be recalled that the first and only recorded cloud flight by a British sailplane pilot (Aug. 15, 1931, near Ivinghoe) was achieved by flying upwind below just such a cloud line.

Other photographs of lines of cumulus followed ("cloud streets" the Germans call them), some formed in the Trade Winds of Barbados, and one, most astonishingly of all, in mid-Atlantic! The latter was a fine specimen; it must, in the lecturer's estimation, have been at least 100 miles long, for his ship steamed along parallel to it for a great part of the day.

There is a widespread belief in the gliding movement, particularly among aspirants for the Cellon cross-Channel prize, that thermal currents are not to be expected over the sea. Such people may now take heart, for Capt. Cave proceeded to show us pictures of cumulus over the English Channel. A rather unusual example of this is shown in Fig. 3; this was taken quite recently, on the morning of Jan. 7. The cloud was far away in the South-East as seen from Petersfield, and must, so the lecturer said, have been over the Channel. Down on the right, where it hides the sun, the cloud still preserves its rounded cumulus character; elsewhere it has grown out into an almost perfect "anvil" which shows dark against the sky owing to the light being behind it. To see such a cloud on a Winter's morning is uncommon; cumulus, it is true, usually forms in the morning if at all, but it takes time to build itself up into large masses, and even longer to produce an outgrowth of "false cirrus" ("hybrid cirrus" Capt. Cave prefers to call it) of which the "anvil" is composed.

At this point one was taken aback by the lecturer remarking that he thought that in Winter there was more cumulus over the Channel than ever the land. Capt. Cave confirms this in his letter; he states that such is certainly his impression: "I am judging from perhaps rather casual observations of my own; but I have noticed cumulus in Winter over the sea at Lyme Regis and at Bognor Regis; and I have noticed that here (at Petersfield) there is often cumulus visible far away to the South, which must be over the sea, the sea being only 18 miles distant as the crow flies. But I have no statistical evidence."

Is it possible, in an off-shore wind, for a sailplane to fly out over the sea by keeping company with a cumulus cloud? One of Capt. Cave's photographs showed a good healthy pile of cumulus just arrived at the coast from inland, full of uplift, sprouting a mass of "hybrid cirrus" from its top and all ready to embark upon the Channel crossing. Yet what happened? Capt. Cave told us that no sooner had this particular cloud got over the sea than the lower, or cumulus, part of it rapidly melted away, and in a short time nothing was left but the upper section consisting of hybrid cirrus. The latter went floating gaily out across the sea all by itself, looking much like a lump of ordinary cirrus, and with not a trace of the up-currents of cumulus which had originally given it birth.

Clouds of cumulus type may be a great deal further off than they look; one of the lecturer's photographs showed a thunderstorm over Essex, yet the photo was taken in Hampshire. On this occasion there was a sharp boundary to the thunderstorm area crossing half England.

Once Capt. Cave saw a darkish band crossing the sky just after sunset. On climbing to the top of the Farnborough Airship shed, he found it to be the shadow of a cumulus cloud far off on the western horizon; subsequent inquiries proved that the cloud was over Plynlimmon in Wales.

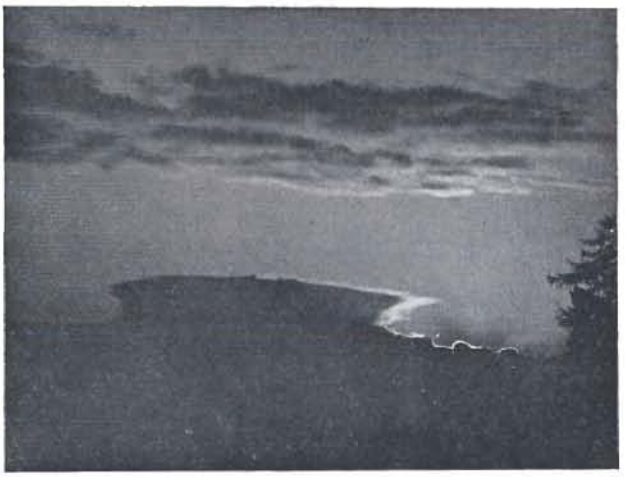


Fig. 3.

An interesting photograph taken from above Lyme Regis showed a sharply limited patch of fog which, having formed in the valley above Lyme Regis, had flowed down it and out over the sea, for all the world like dirty water discharged from a drainpipe into a clear pool. An even more remarkable case of a severely localised flow of air was mentioned by the lecturer, who told us that once, on an otherwise perfectly calm day, he observed a cold wind current of force 4 (13 to 18 m.p.h.) blowing down the narrow valley which emerges at Lynmouth in Devon. Evidently these local wind effects are by no means to be sneezed at by those who glide.

So much for the lecture as far as it concerned motorless flight; the lecturer said much else besides, and said it all with pictures, and once he pulled our legs by palming off as alto-cumulus the upside-down negative of a photograph of sand ripples.

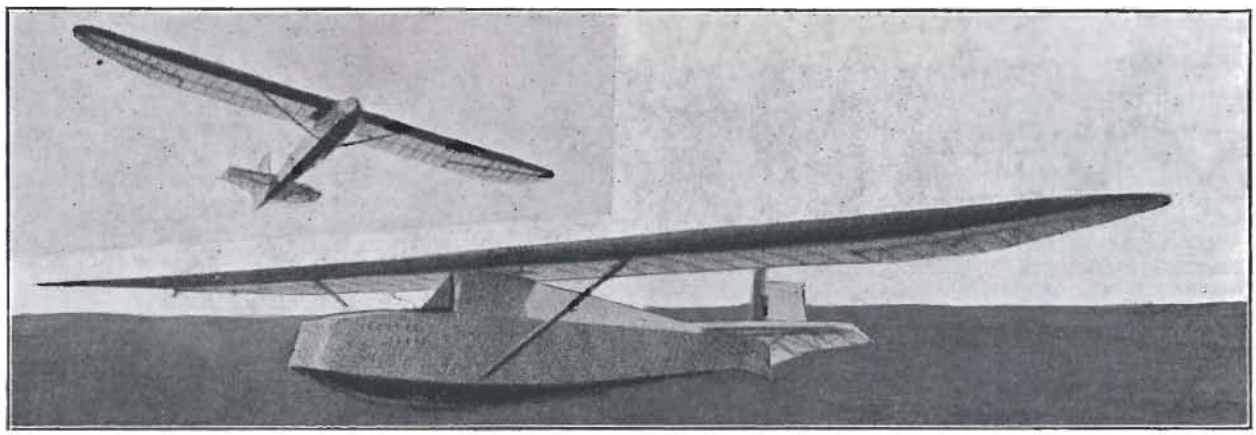
A "SAILPLANE" COMPETITION

Until further notice a year's subscription to THE SAILPLANE will be presented for the best photograph received during any one month, illustrating any feature of the Gliding Movement such as the activities of Clubs, etc.

Photographs, which must be original, should be addressed, "The Editor of THE SAILPLANE, British Gliding Association, 44a Dover Street, London, W.1." Envelopes should be marked "Competition" in the top left-hand corner. The competitor's name and address, and Club (if any) should be written on the back of the photograph. Descriptive matter, which should be brief, should be written on the back of the photograph or on a separate sheet of paper.

The Editor reserves the right to publish any photograph submitted whether a winning photograph or otherwise. The Editor's decision on all matters will be final.

MORE ABOUT THE SCHNEIDER "BABY"



The "Grunau Baby."

So much interest was aroused by the information given on page 16 of the issue of THE SAILPLANE of Jan. 15 regarding the E.S.G. 31—"Baby," one of the latest German sailplanes, that we are reproducing further details for the benefit of readers, taken from an article by Hugo Kromer, who, with Wolf Hirth, assisted Edmund Schneider, its constructor, in designing the machine.

There has been developing in Germany of late a definite school of thought which is breaking away from the idea of indefinitely increasing the span of sailplanes in order to secure a better gliding angle, an idea of which Kronfeld's "Austria" is an extreme case. This new trend is fostered especially by the "Darmstadt School," which carried out a programme of thermic soaring in the Berlin district last year) see THE SAILPLANE, Sept. 25, 1931, page 66). It was Dr. Schrenk, of Darmstadt, who set the ball rolling in a paper he had read before the first International Gliding Congress nearly two years ago. His thesis was that, for thermic soaring, manœuvrability and reduction of the machine's inertia about the longtitudinal and vertical axes were of more importance than a good gliding angle and low sinking speed.

The "Grunau Baby," as this machine is called, is built partly as an expression of these views, as are also the "Alexander der Kleine" of Rossitten and the new Darmstadt machine described in THE SAILPLANE for Sept. 11, 1931 (page 51). The object of the designers has been to reduce the span without spoiling the performance, and in this connection the design of the wing is of special interest. The inner 14 ribs of each wing (i.e., up to the aileron) are shaped to Gottingen 535 wing section, but, further out, the section is gradually changed till at the last rib (the 22nd) it is bi-convex and symmetrical, with a slight reduction in the angle of incidence. The additional drawings which are now given show, with dimensions, the detailed lay-out of the "Baby" including the graduated wing ribs.

For his claim to have reduced the span without a reduction in performance, the writer is taken to task by the Editor of FLUGSPORT, in which journal the article appears. The latter points out that, other things being equal, a larger span is bound to give a better performance as re-

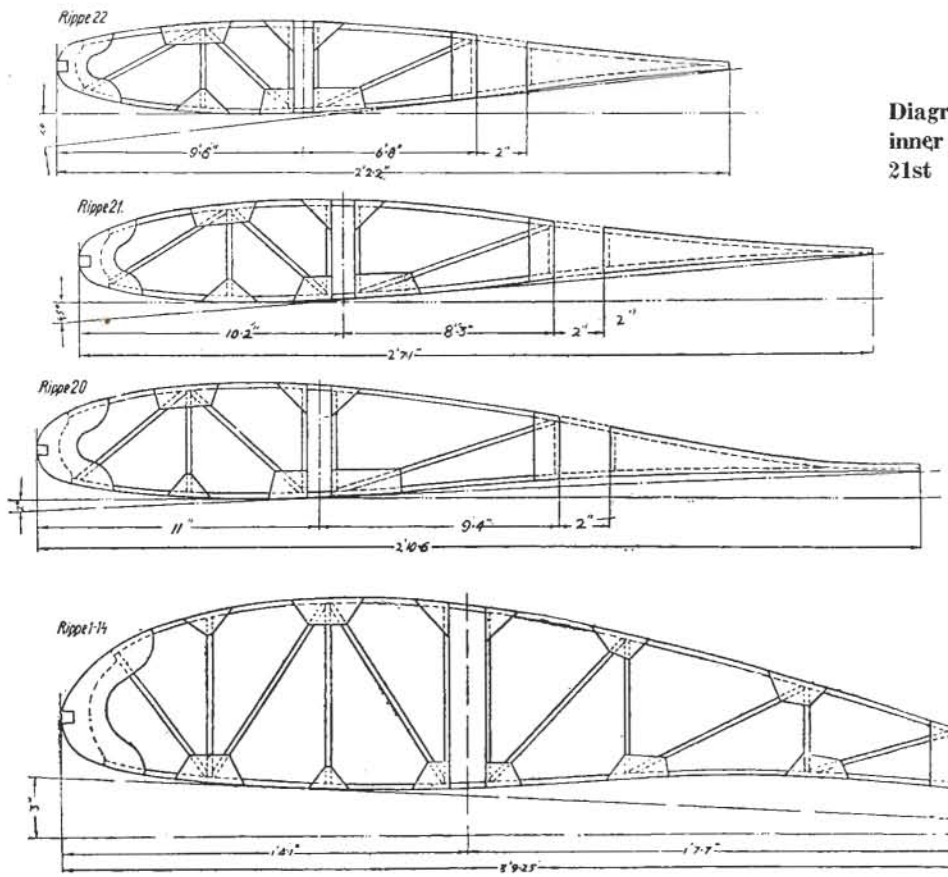
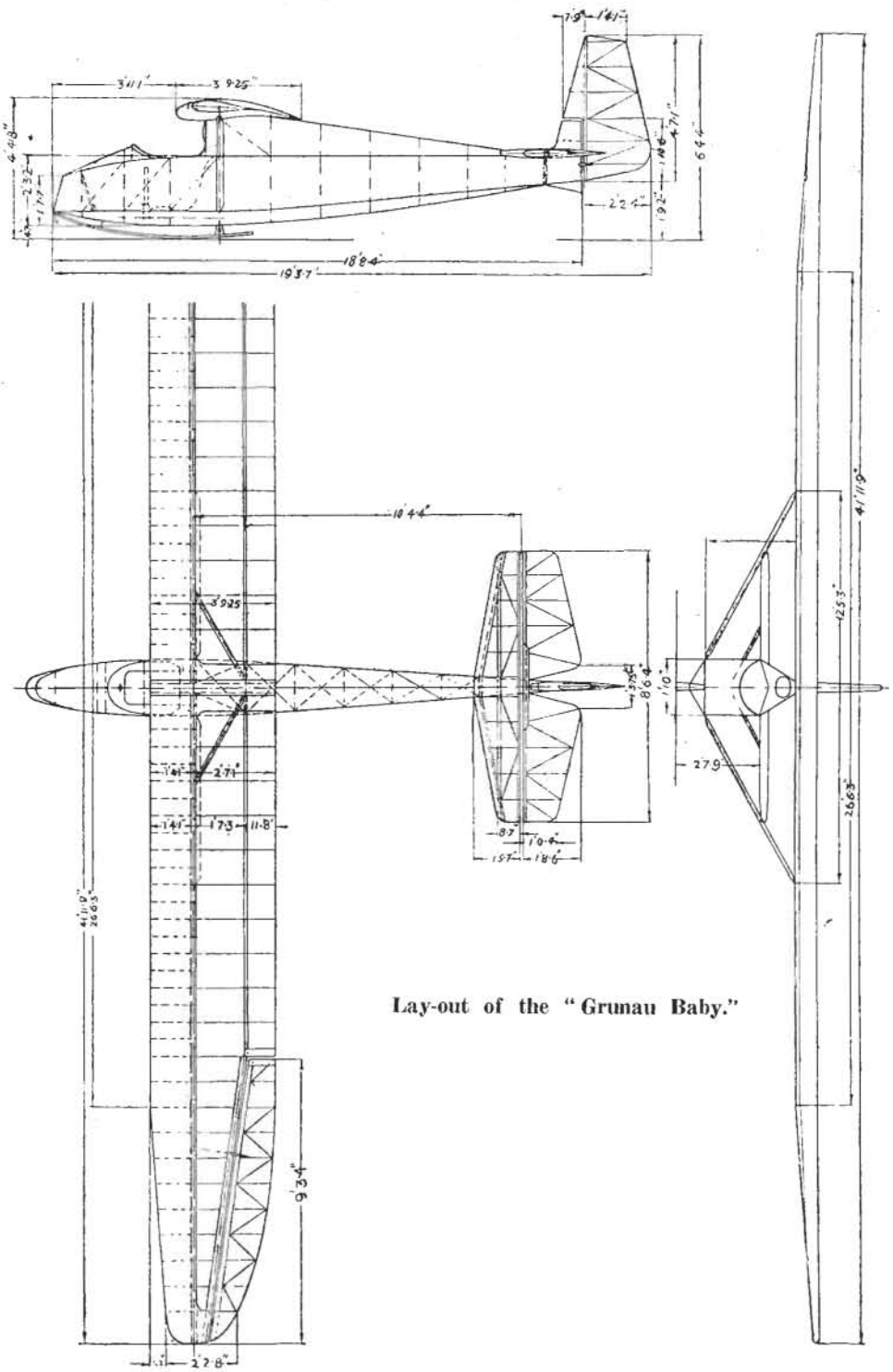


Diagram illustrating the inner 14 ribs and the 20th, 21st and 22nd ribs of the "Grunau Baby."



Lay-out of the "Grunau Baby."

gards gliding angle and sinking speed; he recalls that Kronfeld with his large-span "Wien," on the occasion when he flew 96 miles on thermal currents last August, was the only pilot to get away at all from the ridge over which he and his competitors were soaring.

According to our latest information the price of this machine ex works, ready for flying, is in the neighbourhood of RM1,000. We are endeavouring to ascertain from Germany the cost of the machine delivered, say, in London.

SOARING OVER PARIS

According to a report in the "Daily Telegraph," M. Georges Abrial has recently carried out a soaring flight over Paris. Taking off from Etampes aerodrome, Abrial was towed by an aeroplane to a height of over 4,000 ft., and when on the outskirts of Paris, he cast off and made a soaring flight over the capital. Making a wide circle he flew to Versailles and shortly afterwards made a successful landing at Villacoublay.

M. Abrial was impressed at the clearness with which the noises of the city could be heard at his high altitude. The hum of motor-cars, the whistles of trains and river boats, the barking of dogs and even human voices were discernible.

It will be recalled that in June last, Herr Kronfeld carried out a soaring flight from Hanworth to Chatham in the WIEN, passing over the centre of London. Casting off at 800 ft. from the aeroplane which towed him from Hanworth, Kronfeld reached a height of 4,500 ft. when over London.

THE DESIGN OF MOTORLESS AIRCRAFT

By E. H. LEWITT, B.Sc., A.M.I.Mech.E.

(Vice-President of the Imperial College Gliding Club. Member of Technical Committee of the British Gliding Association).

TYPES OF MOTORLESS AIRCRAFT.

Motorless aircraft may be divided into three distinct classes, each of which has its purpose.

(1) **Primary Machine (or "Zogling")**

This is the simplest type of glider and is used for instructing beginners. These machines weigh about 170 lbs. and have a wing span of 32 ft. to 35 ft.; the pilot is completely exposed to the air-stream. The primary machine is used for short hops only.

(2) **Intermediate Machine (or "Prufling")**

This type of machine is used for longer flights. It has a wing span of 35 ft. to 40 ft. and is similar in construction to the primary machine except that a fairing, known as the **nacelle,** is built round the pilot; this reduces the resistance of the machine.

(3) **Sailplane**

This is the most advanced type of motorless aircraft and is used for soaring. It is a high performance machine and has a wing span of 50 ft. to 55 ft. The controls are more sensitive than those of the preceding types, and the weight may be as much as 400 lbs.

FUNCTIONS OF PARTS.

The whole weight of the machine and pilot is supported by the air pressure on the wings, which must be made strong enough for this purpose. Parts of the rear portion of the wings are made movable, turning on hinges; these are known as **ailerons.** A lateral movement of the control lever will cause these ailerons to be raised or depressed; this movement has a tendency to bank the machine. The stabilising surface of the machine is known as the **tail plane;** this is connected to the wings by a supporting beam known as the **fuselage** or tail **girder.** The tail plane also acts as a support for the elevators and rudder.

The pilot's feet rest on a horizontal lever, known as the **rudder bar,** which operates the rudder. Owing to the centrifugal force, a machine on the turn will tend to side-slip; this is prevented by banking the machine by use of the ailerons.

The raising and depressing of the elevators will raise or lower the nose of the machine; this movement of the elevators is brought about by the backward and forward movement of the control lever.

Under the pilot's seat is the landing skid and, towards the front, the launching hook.

The wings are sometimes braced to the fuselage, or tail plane girder, by means of wires known as **flying wires.** The lower flying wires are connected to the landing skid; the upper flying wires are connected to a kingpost above the wing, known as a **cabane.** Sometimes a streamline strut is substituted for the flying wires.

THE AEROFOIL.

The machine obtains its lifts by the action of the air current on an aerofoil. A view of an aerofoil is shown in Fig. 1; the section is so shaped that an upward lift can be obtained from a horizontal air current. The wings of a glider are made this shape in section.

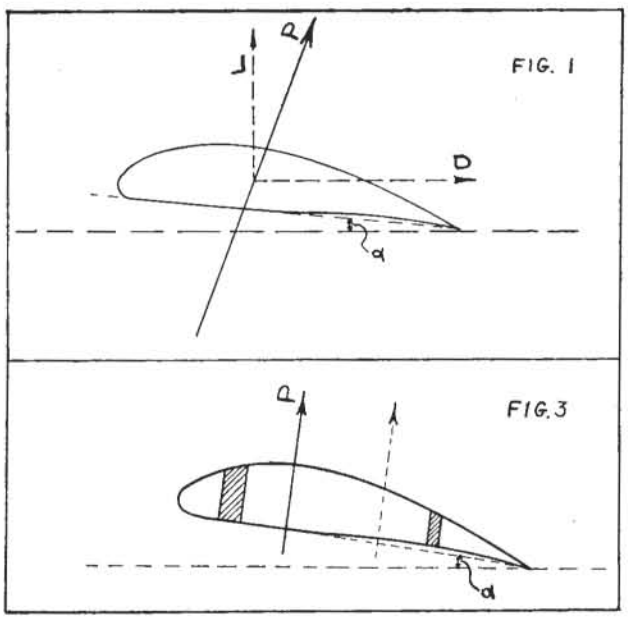
The shape of the aerofoil will depend on the purpose for which it is required; the most efficient shape can only be obtained by testing various shapes in a wind channel. The particulars and results of such tests are to be found in various official publications of the British Air Ministry and in similar publications of other governments. From these results the designer can choose his aerofoil to suit his particular purpose.

The action of the air current on the aerofoil will produce a resultant force P; this is due to the fact that the air current causes a negative pressure on the upper surface of the aerofoil and a positive pressure on the lower surface. The resultant force P will have a vertical component L, which produces the **lift** of the aerofoil, and a horizontal component, D, which is the **drag** or **resistance** of the aerofoil. The dotted line, from tip to tail, is known as the chord; and the inclination a of this dotted line to the wind direction is the angle of inclination or angle of attack.

The front edge of the aerofoil is called the **leading edge,** the back edge the **trailing edge.** The point through which the resultant force P acts is known as the **centre of pressure.**

The position of the centre of pressure will depend on the angle of attack. With a glider, this varies from about one-third of chord from leading edge to about three-quarters of chord from leading edge, during normal flight. This movement of the centre of pressure is an important factor in the design.

The various important properties of an aerofoil, obtained from wind channel tests, are known as the characteristics of the aerofoil. The most important of these are the left coefficient, the drag coefficient, the ratio of lift to drag, and the movement of the centre of pressure. The variation of these characteristics with the angle of attack is shown plotted on a base representing the angle of attack. These results are to be found in the official publications previously mentioned; they are given for hundreds of standard types of aerofoils. A set of characteristic curves for the R.A.F. No. 31 aerofoil is shown in Fig. 2. A view of the aerofoil is also shown in this figure.



The Lift Coefficient

The lift of an aerofoil is proportional to the area of surface, measured in the plane of the chord, to the density of the air, to the square of the velocity of the air current, and to a coefficient depending on the type of aerofoil. This coefficient is known as the **lift coefficient,** and for a given aerofoil it will vary with the angle of attack.

Let

K_L = lift coefficient in lb. units
d = density of air in lbs. per cubic ft.
A = area of wing surface in sq. ft.
V = air speed of machine in ft. per sec.

Then lift of wings = K_L d A V^2 lbs.

It will be seen from Fig. 2 that the value of K_L varies considerably with the angle of attack; for this particular aerofoil the maximum value of K_L occurs at an angle of attack of 9°.

The Drag Coefficient

The drag, or horizontal resistance, of an aerofoil will also depend on the density of the air, the wing area, the square of the air speed, and on a coefficient which will vary with the angle of attack. This coefficient is known as the **drag coefficient** and applies only to the particular aerofoil under consideration.

Let K_D=drag coefficient in lb. units.

Then, drag of wings=K_D d A V^2 lbs.

A curve showing the variation of the drag coefficient with the angle of attack is also plotted in Fig. 2. It will he noticed that this aerofoil will have its least resistance at an angle of attack of x-6°.

The Lift-Drag Ratio

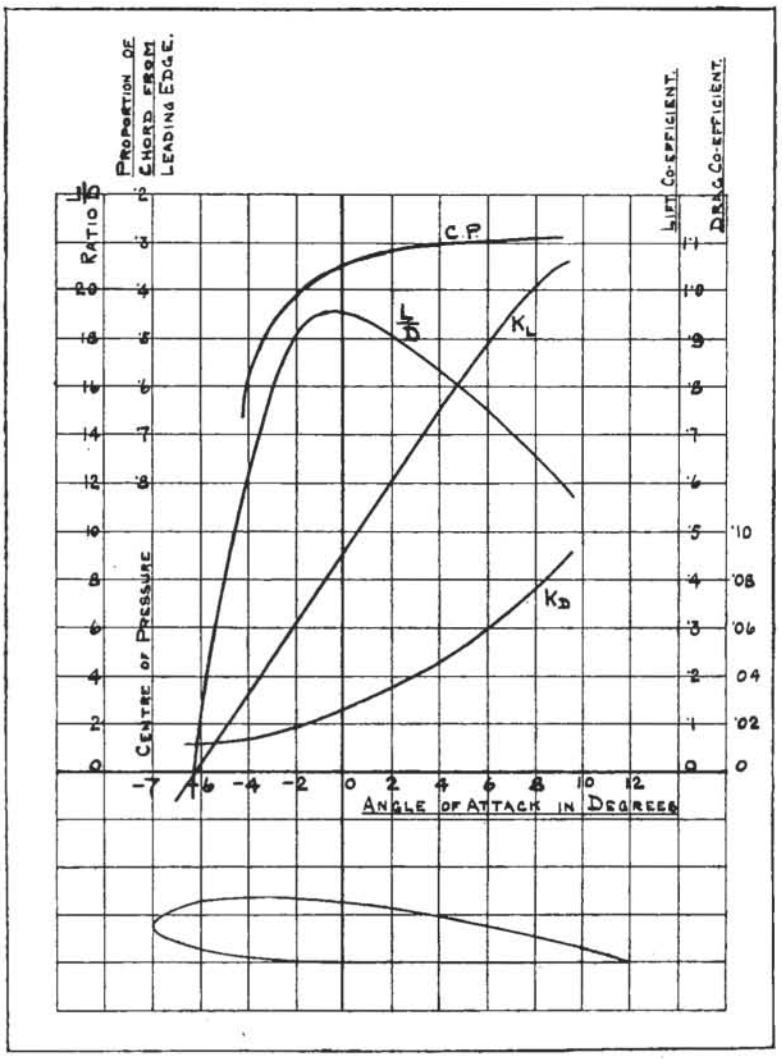
Another useful characteristic curve of an aerofoil is the **lift-drag ratio,** which is shown plotted in Fig. 2. The ratio of lift to drag will be the same as the ratio of lift coefficient to drag coefficient, and may be obtained from the curves representing K_L and K_D. The lift-drag ratio is usually represented by L/D. The variation of L/D with the angle of attack is shown plotted in Fig. 2. The aerofoil for a glider should have a high maximum value for L/D.

It will be noticed from Fig. 2 that the maximum of L/D for the aerofoil under consideration is 19, and this occurs at an angle of attack of v-1°. At this angle of attack the drag is one-nineteenth of the lift of the machine. In other words, the horizontal resistance of the wings is one-nineteenth of the total weight of the machine and pilot.

The Movement of Centre of Pressure

The position of the centre of pressure for a given angle of attack is another important factor in the design. As the angle of attack increases, the centre of pressure moves forward towards the leading edge. The position of the centre of pressure, as a percentage of the chord from the leading edge, is shown plotted against the angle of attack (Fig. 2). This is another characteristic curve for a particular aerofoil.

The wing of a glider is usually constructed of two spars as shown in figure 3. These are known as the **front spar** and the **rear spar.** The resultant force P will act on both of these spars; the amount of P taken by each will depend upon the position of the centre of pressure. The nearer the centre of pressure approaches the front spar, the greater proportion of P will act on that spar. Hnce, before these spars can be designed, the limiting positions of the centre of pressure must be known.



CONDITIONS PRODUCING CRITICAL LOADING.

The glider is designed of sufficient strength to satisfy the requirements of the British Gliding Association on whom the Air Ministry has conferred the powers of awarding the Airworthiness Certificate. Certain critical conditions of loading have been decided on by this Association and all designs must satisfy these conditions. The following are the most important of these critical conditions.

(a) **Centre of Pressure Forward**

The wings are designed on this condition with a factor of safety of 5. The extreme forward position of the centre of pressure is assumed to be at one-third of chord from leading edge. From the centre of pressure curve of Fig. 2, it will be noticed that this corresponds to an angle of attack of 1°. The corresponding value of L/D for this position may be read off from the L/D curve; in this case it is 18.5. Referring to Fig. 3, the amount of the total pressure acting on each spar will be inversely proportional to their distance from the centre of pressure. By dividing the total lift in this proportion, the amount of load on each spar is obtained.

(b) **Centre of Pressure Back**

The wings are designed on this condition with a factor of safety of 3.75. In this case, the extreme back position of the centre of pressure is assumed to be three-quarters of chord from leading-edge. From Fig. 2, it will be noticed that this corresponds to an angle of attack of—4½°, and the corresponding value of L/D is found to be 11. This means that the drag of the wings is one-eleventh of the weight of machine and pilot; this is the worst condition for drag forces.

The centre of pressure will now be at the position of P shown dotted in Fig. 3, and the amount of load taken by each spar will be inversely proportional to their distance from P.

(c) **Nose Dive**

A load of 5 lbs. per sq. ft. is assumed to be acting on the tail plane. The corresponding load on the wings may be found by taking moments about the centre of gravity of the machine with pilot. The machine should stand to this condition with a factor of safety of 1.

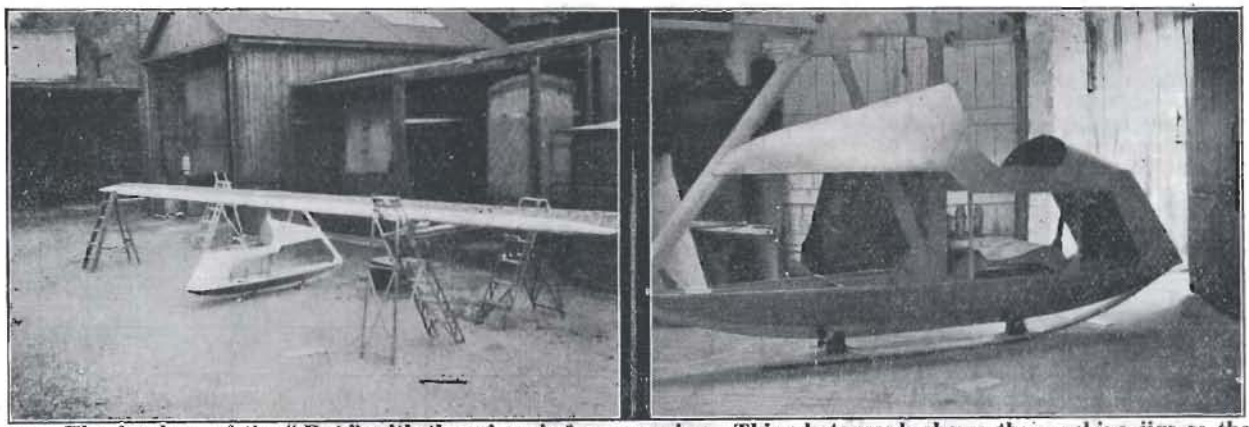
(d) **Inverted Flight**

Certain members of the structure will come into action during inverted flight. A factor of safety of 3 is stipulated.

(e) **Flattening out after Steep Nose Dive**

There is no satisfactory analytical solution to this problem. In Germany a loading of 30 lbs. per sq. ft. on the tail-plane is assumed.

(To be continued)



Left.—**The fuselage of the "Bat" with the wings before covering. This photograph shows the machine jigs so that the strut lengths can be measured and the struts fixed.** Right.—**The "Bat" fuselage complete with controls, etc., ready for covering.**

CLUB CONSTRUCTED MACHINES

"By SEGELFLIEGER"

VI.—British Enterprise: THE BAT.

The Bat Sailplane, built by the Ilkley Gliding Club, under the direction of Messrs. Hartley and Crabtree is, with a few minor modifications, a Hols.

The Club decided to build an intermediate machine, after it had already built a primary machine, and had had plenty of experience in both methods of construction, as described in earlier articles. The practical experience gained by the Club, made them decide to adopt the Continental method, as being both quicker and more satisfactory.

The machine was built in three parts: the planes, the fuselage, and the struts and tail unit. The construction of all these parts was straightforward, and no serious difficulty was experienced.

Although a set of metal fittings could have been imported, it was felt that the whole of the construction of the machine ought to be British, and the metal parts were made by a local metal worker. Financially this was found to be a mistake, as the total cost of the fittings was nearly five times as much as the cost of a complete set made on the Continent, although the standard of the work was very much higher and more satisfactory. For a machine of this type it was felt that, in future, ready made fittings should be bought if obtainable.

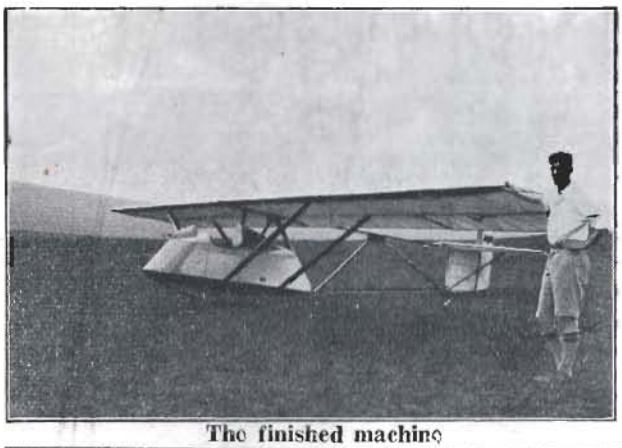
During construction the machine was constantly under the eye of the Club's ground engineer, and the work was kept up to a definite standard, with the result that when the machine was inspected finally by the B.G.A. officials, there was no complaint made at all, and the standard of the work was found to be very sound.

The whole of the machine, with the exception of the rudder and fin, was finished complete with controls and all working parts, before covering was started.

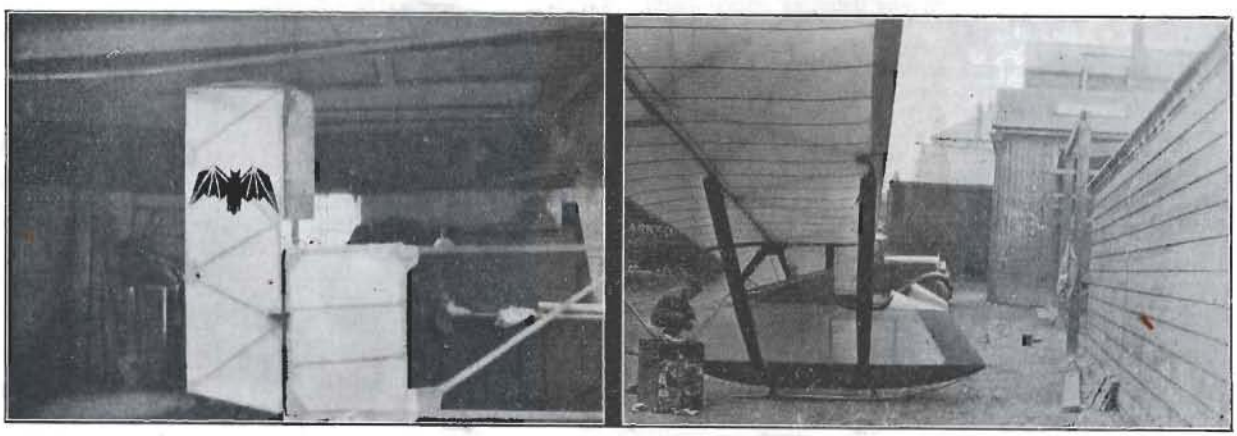
The fitting of the struts was found to be the most difficult part of the construction, and for this purpose the wings and the front section of the fuselage were rigged in a yard, and the struts fixed in position (see illustration). During this step great care was taken to ensure the fuselage being at right angles to the wing, and that the wings themselves were level. The machine was finished as described in article No. 4 of this series, the final coat of varnish being applied in the open air, on a quiet day, to ensure a good finish. A black Bat was painted on the rudder, and though a minor point, this gave the machine a finished appearance.

An addition was made in the shape of a fairing for the wind speed indicator, on the front of the fuselage, this being considered the most advantageous point to mount it.

The machine finally obtained its C. of A., and was afterwards flown a little in the late months of last year. It is now ready for the use of members who wish to obtain their "C" licence, and for practice until the Club obtains a further advanced machine.



The finished machine



Left.—**The tail unit of the "Bat."** Right.—**The machine drying after its last coat of clear varnish. The extra fairing on the nose houses the air-speed indicator.**

CORRESPONDENCE

Should Glider Wings be Sprung?

Sir,—Captain Needham is to be congratulated on digesting for THE SAILPLANE Lt.-Com. Graham's valuable paper on "Satety Devices in the Wings of Birds." At the conclusion of his article he draws attention to the advantages which might be gained by hinging the wings of a sailplane. This is already done in one type of powered aircraft and the autogiro with its flapping wings is regarded by some as opening a new era in commercial aviation. Senor de la Cierva, however, uses centrifugal force to keep his wings spread and as those forces are some ten times those of lift he anticipates no trouble.

The designer of sailplanes has no centrifugal force to help him but there seems to be no reason, unless that of excessive weight, which prevents him using silk torses. These silk torses are simply twisted skeins of silk and the idea, if not as old as the hills, is of great antiquity for medieval and Roman catapults often made use of twisted thongs.

A lot of data about these torses has been obtained by Mr. J. D. Batten for another purpose and his experiments are recounted in the Journal of The Royal Aeronautical Society for Oct., 1930 and Dec., 1931, under the heading of "Wing Beats."

Exactly how "wing flutter" could be prevented would require caretul investigation—perhaps Captain Needham could make some experiments with the ALBATROS.

THURSTAN JAMES.

An Appeal for Assistance in the Study of the Flight of Soaring Birds.

Sir,—I would like, through your coloumns, to make an appeal, and at the same time to thank Captain Latimer Needham for the pleasant things he said about my work on the slotted wings of birds. His extremely able article puts the matter in a nutshell in masterly fashion.

The appeal is due to the fact that the specimens required for the study of the flight of soaring birds are hard to come by, and I would very much like to carry on with that study. It is possible that from time to time, members of the Gliding Association may come across dead birds of the type required. Of the soarers which are likely to be found in this country, Ravens, Buzzards and other soaring birds of prey, also the larger gulls, Gannets, Shearwaters, Swifts, etc., would be of particular interest. Fresh specimens travel quite well enough if stuffed into a small sack or fish-bag, wrapped lightly.

I should be very grateful to any of your readers sending such to me at this address, and they may be assured that the progress in research which usually comes of even one new specimen is well worth the trouble taken to procure it.—R. R. GRAHAM, H.M.S. Ganges, Harwich.

Ground Training Devices.

Sir,—We note with interest the remarks in the news from the Croft Gliding Club (No. 3, Vol. 3 of THE SAILPLANE), that they contemplate constructing a ground training device which they believe will be the first in the country.

We should be pleased if you will draw their attention to the particulars and report of results of our ground training device—the first of its kind—published in THE SAILPLANE, Vol. 2, No. 3 (Aug. 14, 1931), and reported at the first Conference of Gliding Clubs at Ilkley last July.

We shall be pleased to be of any assistance to the Croft Club, who may make free use of our experience on such a machine.—ALFRED P. MILLER (Hon. Sec., The Newcastle Gliding Club).

Sir,—I have read with interest the Newcastle Club's comments on my letter and I am indeed pleased to learn that the same method of training has already been adopted by this Club.

It seems to us that prevention of damage to gliders during the initial instructional stages can only be achieved by the use of some such device to "acclimatize" pupils to the acceleration of the elastic rope.

We propose continuing training on an auto-towed machine with a **two** wheeled undercarriage which again seems the only logical method of minimising the minor crashes which usually prove so harmful to a Club's membership and finance.

We thank the Newcastle Club for their offer of assistance and hope to learn something further as to their advanced training methods. We have duly absorbed the contents of their report in THE SAILPLANE.

P. H. BALL (Chairman, Croft Gliding Club).

Motorless and Power Flying

Sir,—In the last issue of THE SAILPLANE you have a complete page given over to the experiences of a glider pilot's first trip in an aeroplane. I have had an even more interesting experience. When I had made my "A" at the Wasserkuppe and the course had finished, Herr Stamer, the "flugleiter" advised me to take a short course of aeroplane flying to try and acquire some "feel." My flying was that bad. Herr Groenhoff arranged for me to go to Giessen (Upper Hesse) for a course with the club there. I found that the instructor could speak no English and I certainly could speak very little German, furthermore, I had only been up in an aeroplane once before and that on a 5s. "joy flip.'

I flew with this instrucor entirely by signs since telephones were of no use, and made 39 landings in 2 hours and 26 minutes, some of the later ones entirely without the instructor's aid. He told me, when I left him, that he would have allowed me another hour's dual before letting me go solo. When I returned to the Wasserkuppe again I made my "C" within a fortnight.

This is adequate proof, were it required, that even a bad glider pilot who had only had 36 flights on a ZOGLING to his credit at least has a reasonable idea of how to fly, to turn, and even to land when warned of the slight differences between an aeroplane and a glider.—P. S. FOSS.

"SAILPLANE" PHOTOGRAPHIC COMPETITION

The Competition for January was won by Mr. G. M. Buxton, of the London Gliding Club for the photograph entitled "D. Dent flying the KASSEL 20." which was reproduced in THE SAILPLANE of Jan. 15. Mr. BUXTON thus receives a year's free subscription to THE SAILPLANE.

The Competition for February promises to be keener than during the previous month as several excellent photographs have already been received.

Particulars of the Competition are given on page 39.

NEWS FROM THE CLUBS

(Club News will always be welcome, but owing to the limited space available, contributions should be confined to items of outstanding interest and irrelevant matter should be excluded. News items should reach the Editor not later than the first post on the Monday preceding the date of publication.)

THE FURNESS GLIDING CLUB.

Sunday, Jan. 24.

Certificate qualifying flights were made by Messrs. V. Foster and W. A. Stevens. The former carried out a flight of 62 4-5 secs. duration, including turns, and made a good landing. Mr. Steven's time was 64 3-5 secs. including turns. Both members had previously made several flights of over 45 secs. duration.

LONDON GLIDING CLUB.

Sunday, Jan. 31.

A flat calm until mid-day; then a trickle of air creeping obliquely down the hill. Repeated flights were made from the top in four machines.

KASSEL 20 was flown twice by Doctor Slater; a tortuous landing was forced upon him but he pulled it off perfectly.

In PRUFLING, Alan Goodfellow finished his "B" with 70 secs. All applicants flew. Hedges curbed his enthusiasm for turns. Brame managed his first flight from the top without incident. Another pilot, looking for experience or other form of trouble, waded through the hill-side down-draughts at speed, emerging intact. There were four or five other flights and also a few ground-hops.

D. C. Smith delicately flew PROFESSOR, essentially a machine that responds to politeness. Scott-Hall was nearly deceived by her long float before landing, but by means of a side-slip cured the trouble and came to rest in the corner at the foot of the rope-railway. The machine was given a colossal homeward ground-hop at night-fall, landing about 500 yards away on a ridge-top as high as the launching point. The upper wing-surface was then found to be covered by a film of ice.

During the day DAGLING was flown repeatedly from the top, Dewsbery obtaining his "A" with 51 secs. A power-pilot stalled her, dead cold, soon after his launch, and banged down on to the tip of the bastion without damaging the machine; he narrowly missed an ugly slither down the face of the hill. So much for power? Many conflicting morals emerge.

Eight beginners in a ZOGLING class received five hops each, putting up a stout show. They had been instructed on Saturday afternoon also.

Easter Camp entries roll in. Attention is being given to accelerated hill-haulage, increased hangar-space, club-house fitments, and an adequate supply of machines and other gear.

Sunday, Feb. 7.

Bright sunshine melted the surface of the ground into a slime upon which cars could scarcely get a grip sufficient to tow machines. A gentle breeze varied between north and north-west.

A ZOGLING squad of thirteen were given an average of five hops each; on Saturday a smaller squad were also given five each. DAGLING on Saturday was auto-launched; to-day it was occasionally flown from the hill-top. Dewsbery and Miss Churchill doing a qualifying flight toward their "B."

PRUFLING was also auto-launched on Saturday, and to-day was launched from the hill. G. O. Smith's flight was really pretty and well-judged. Our turning expert now refused to use his rudder at all, and slid round his corners on bank alone. Early in the day PRUFLING found good lift on the north side of the bastion, which was enough for a return trip two-thirds of the way to the bowl.

KASSEL 20 was flown by Doctor Slater, and PROFESSOR by Major Petre. PROFESSOR has been fitted up with an optimistic altimeter (it goes up to 7,000 ft.), and with a home-made but effective statoscope.

HOLS DER TEUFEL was repeatedly auto-towed.

Still more new members. And they said they liked it. Everybody had a good day out and all energetic people sat in the mud more than once.

The Club's annual general meeting will be held in the Library of the Royal Aeronautical Society, 7 Albermarle Street, W.1., on Wednesday, Feb. 17, at 7 p.m.

MANCHESTER GLIDING CLUB.

At a meeting of the Royal Aeronautical Society, Manchester Branch, held in the Grand Hotel, Manchester, on Friday, Jan. 29., under the chairmanship of R. H. Dobson, Esq., M.I.Ae.E., the final plans were carried through for the amalgamation of the Stockport Gliding Club with the Gliding Section of the Royal Aeronautical Society. The Club to be known in future as the Manchester Gliding Club.

It was pointed out by the Chairman that this step had not been taken because of any lack of enthusiasm, or any falling off in the membership of either club; but purely as a measure which would ensure in the future the economical working and efficient development of the Movement locally.

The Committee of the new Club are preparing a very ambitious and comprehensive programme for the coming season, the salient points of which are the acquisition of an Auto-towed Machine, and a centrally-situated permanent lecture room and workshop.

In a short speech after his election as Chairman of the Royal Aeronautical Society, for the ensuing year, Mr. R. Cladwick said it was quickly apparent that the splendid enthusiasm and eager determination displayed by the Manchester Gliding Club would, he felt sure, ensure for them a season of successful flights and thrilling achievements.

NORTH KENT GLIDING CLUB.

The Club activities have been rather limited during the past few weeks, owing to counter attractions over the Christmas period and the inclemency of the weather, but we have now commenced operations seriously again.

On Sunday, January 24, thanks to the kindness of Mr. Yorke Bramble and the Southern Soarers, a party from this Club was able to proceed to Balsdean and put in some hours of very useful training. By the end of the day every member had had at least one "flip," whilst Messrs. Hills, Liddington, Owen, Pass and Richardson, and our first lady member, Miss Rodeveril, succeeded in qualifying for their "A" certificate; Mr. Richardson distinguishing himself by a smooth straight flight of 45 secs., making a perfect landing.

It is a justification of our Club policy of training members by auto-launches on the flat, when one realises that in three Balsdean visits we have managed to secure 13 "A's"—the majority by members who have never been shot off a real slope in their lives before—without a mishap to our veteran B.A.C. II.

The Annual General Meeting of the Club was held at the Bexley Heath Constitutional Club on the evening of Monday, January 25, and it is most satisfactory to be able to report that the balance sheet displayed a pleasant balance on the year's working.

The progress of the model section may be of some interest to other Clubs. Starting in a very modest way, it has now a membership of over sixty, and a financial balance well on the right side, while some of the constructional work shows signs of being in the first rank.

In order to cater for the needs of some of the "A" members, we recently acquired a B.A.C. III fuselage—by way of interest this fuselage is that in which Mr. Turner recently flew the Channel—and which we can use with the wings and tail unit of the B.A.C. II, for rigging a secondary machine.

It is hoped later to make a pair of tapering wings, thus turning our new acquisition into a sailplane, when the Club will be equipped to train members for a "C" certificate.

It is with some satisfaction that we can make a final passing remark upon the condition of our B.A.C. II machine. During 1931, this machine was used for some 750 launches, and in spite of minor alterations which have slightly altered its weight, it continues to fly well.

PORTSMOUTH AND SOUTHSEA GLIDING CLUB.

Sunday, Jan. 24.

Moderate breeze, Southerly.
Conditions were very good. Many good flights were performed, notable amongst which was Robinson's 75 secs. We were very glad to welcome a visitor from the London Club and hope to see more of him and his confreres later.

Sunday, Jan. 31.

Gentle breeze, North.
No hill flights possible but some instructive ground

P. Michelson flying the "Cloudcraft Phantom" at Dunstable.

flights were carried out by auto-elastic launching and Lympane put up a good "circuit."

Sunday, Jan. 7.

Six members spent a most enjoyable day at Maidstone with Mr. Lowe Wylde and it was worth the 90 odd miles each way!

SOUTHDOWN SKYSAILING CLUB.

Certificates Qualified for to date:—

"A"—18, 12 of these were "ab initio."
"B"—6, 3 of these were "ab initio."
"C"—3.

Several other members are now ready for qualifying flights in all grades.

In December the fleet was further increased by the purchase of a B.A.C. VII Two-Seater Dual Control and Soaring Machine. This machine will be used for Dual Control Training and advance soaring work, and also for passenger flights.

Plans are now being prepared for the erection of a large hangar and for the design and construction of a high performance sailplane.

During the past year many labour-saving devices have been utilised in the Club and at the present time practically all of the manual labour formerly associated with this Sport has been done away with, and the number of flights possible in a given time have been more than doubled. This is due to the improved methods of launching and retrieving machines.

STAINES AND DISTRICT GLIDING CLUB.

A few local enthusiasts got together last August and founded this Club. From the outset we have been severely handicapped by utter lack of experience and suitable flying ground; to say nothing of finance. However a machine was purchased and we commenced operations on a large field. Since then, we have slowly but surely made progress and will be shifting to a better site as soon as the weather improves. This progress has not been accomplished without accident but we are lucky in having several members who are expert craftsmen, some in fact belonging to a large aircraft firm and, thanks to them, we are able to execute first-class repairs without draining too much on Club funds.

A very successful opening Dance was held in November last and we are running another on Friday, Feb. 26, at the Town Hall, Staines, 8.30 p.m. to 2 a.m., the band being Stan Ducksbury's Syncopators whose name is a household word in the north. We should be very glad to see some fellow members of the Movement and can promise them a most enjoyable evening. Tickets, price 5/- single, 9/6 double, may be obtained from the Club Headquarters, Pack-Horse Hotel, Staines. Incidentally, there is a large car-park.

The first Annual General Meeting will be held at Headquarters, Tuesday, February 23, at 8.30 p.m., and we are glad to announce that Major Barlow, Chief Engineer of the Fairey Aviation Co., has consented to be President of the Club.

The subscription for membership, including entrance fee, is two guineas and the Secretary is C. Redman, 42 Wendover Road, Staines, Middlesex.

THE ULSTER GLIDING CLUB.

The Ulster Gliding and Aviation Club will resume active participation in the sport from Easter week-end onwards when, weather permitting, we hope to have a good turnout after our two months sojourn from activities on the field.

Our Club being the only one in Ulster has been prevented from getting assistance from other Clubs, therefore we have had to instruct ourselves, and we think we have

News from the Clubs (continued).

done very well under these circumstances. We purchased a Reynard machine at the beginning of last year, since when our own members have greatly improved it, and have completely rebuilt it after a bad crash. We have also, an R.F.D. machine, having purchased the parts and assembled it ourselves. We have found, like most Clubs, that we have great difficulty in getting launching crews, and have, since August 1, 1931, been working with an auto-launch conceived by one of our members, which has given every satisfaction. We may mention here that we have had no accidents whatever caused by auto-launching. Five of our members, including one lady, have obtained their "A" certificate, and we have several more ready for their "A's" as soon as we re-commence flying this year. Our greatest difficulty has been the absence of suitable gliding grounds, as the fields in this district are very small. However, we have been able to obtain a 42 second flight on our present field at Doagh, Co. Antrim. We have now in view a good site on the side of the Slemish Mountains, where we hope this year to be able to quality for "B's" and "C's."

Through the generosity of two of our members we shall shortly have a sailplane at the disposal of the Club members.

We are holding our Annual General Meeting at Head Line Buildings, Belfast, on February 17, 1932, at 7.30 p.m., when members from other Clubs would be welcomed.

News from Overseas

Writing from **Nairobi,** Mr. E. V. Stobbs informs us that a group of about thirty pople has become interested in Gliding and that a meeting has been arranged with the Aero Club of East Africa, which is also interested in the Movement, with a view to forming a glider section.

From **Ottawa, Ont.,** comes the news that a gliding club is being re-started there. Unfortunately there is little or no co-operation on the part of the public, who appear to be anything but air-minded, and this has added to the difficulty of getting the Club going. There are, however, excellent gliding facilities close to the City and it is hoped to begin operations before long.

OFFICIAL NOTICES

DIARY OF FORTHCOMING EVENTS.

Monday, Feb. 23, at 6 p.m.—Council Meeting, British Gliding Association.

Monday, Feb. 22, at 6 p.m.—Council Meeting, British Aeronautical Society, Albemarle Street, W.1.—Annual General Meeting, British Gliding Association.

THE IMPERIAL COLLEGE GLIDING CLUB.

On Monday, Feb. 29.—A lecture by Mr. C. H. Jackson on "Flying Boats on Commercial Air Routes," will be held jointly with The British Gliding Association, in Room 15, The City and Guilds (Eng.) College, Exhibition Road, South Kensington, at 6 o'clock. Chairman—Capt. G. T. R. Hill. Visitors will be welcome.

On **Wednesday, February 24, at 8 p.m.,** the **IMPERIAL COLLEGE GLIDING CLUB** and **CITY AND GUILDS MOTOR-CYCLING CLUB** will hold a joint show of flying (including gliding) and motor-cycling films at the Imperial College Union, Prince Consort Road, S.W.7. Tickets 1/- (including light refreshments).

HOW TO GET YOUR "SAILPLANE" FREE.

It has been decided that in order to encourage Members of the Association and subscribers in obtaining new subscribers to THE SAILPLANE, free issue of the journal will be awarded as follows until further notice:—

To Members of the Association.

Free issue for 6 months to a member obtaining 1 new yearly subscriber;

Free issue for 1 year to a member obtaining 2 new yearly subscribers;

Free issue for 1 year and renewal of Membership of the Association on obtaining 4 new subscribers for 1 year.

To Subscribers.

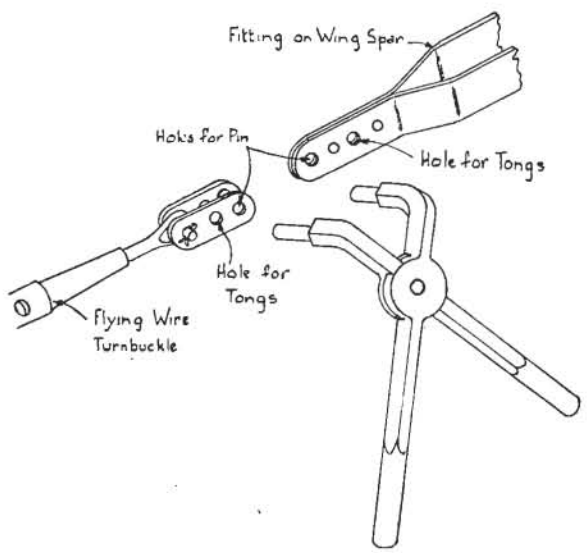
Free issue for 1 year on obtaining 2 new yearly subscribers.

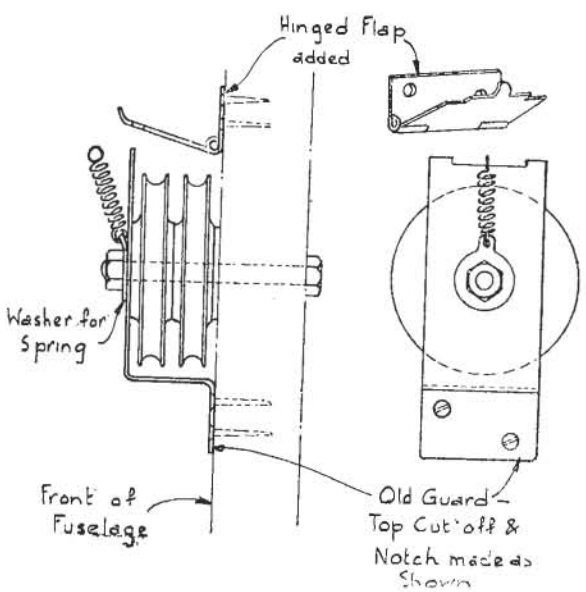
A Labour Saving Device

Sir,—As a great deal of time has been wasted in the past by groups owning the Dickson primary type some of your readers may like to know of the various devices we have introduced to cut down the rigging and de-rigging time to a fraction of what we used to spend.

To obviate the necessity of interfering with the adjustment of the flying wires we have introduced a tool rather like blacksmith's tongs. By the aid of this tool we are able to strain the wires into position with the turn-buckles done up to their normal tension (see explanatory sketch). No doubt a pair of very large pliers would be satisfactory if studs were fitted at right angles to the jaws. Holes in the fittings have to be made to take the tongs. This also allows more accurate rigging, as it can be set in the workshop.

It was previously necessary to dismantle the aileron control wires to pass them through the pulley guide behind the pilot's head. This we have overcome by cutting away the top of the guide and fitting a spring-retained hingedflap.—J. CECIL RICE, Skipton, Yorks.





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BOOKS TO READ

Gliding and Sailplaning By F. Stamer and A. Lippisch.	An excellent handbook for the beginner. It represents the collective results of the writers' experiences since 1921, related in a clear and simple manner, and is admirably illustrated. 5/6 post free
Gliding and Motorless Flight By L. Howard-Flanders and C. F. Carr.	A practical, up-to-date handbook giving expert information regarding training of pilots, organisation of gliding clubs, construction and repairs, meteorology, etc.; with interesting facts regarding past achievements and pilots and official information regarding Certificates. 8/- post free.
Henley's A.B.C. of Gliding and Sailflying By Major Victor W. Page.	A simple and practical treatise on modern Gliding. It describes the construction, launching and control of the leading types of gliders and sailplanes and gives instructions for building a strong, yet simple, primary glider, including working drawings. 11/- post free.
Gliding and Soaring By Percival White and Mat White.	Especially adapted for those with no previous knowledge of the subject, this book gives a complete review of Gliding and Soaring flight and is distinctly above the average. 13/- post free.
"Gliding" (The Year Book published by The Dorset Gliding Club)	A valuable handbook full of useful information and one that must make a wide appeal, both to those merely interested in Gliding and to the advanced pilot who requires more technical information. 1/9 post free.
Handbook of the British Gliding Association	A useful reference book for all persons and organisations interested in gliding. It includes a diary, Rules and Regulations issued by the Association, a Glossary, and authorative articles on a number of interesting subjects. 1/- post free.

Obtainable from the British Gliding Association, 44a Dover Street, London, W.1.

(Photograph taken on Mr. Hinkler's arrival in England after his epic flight)

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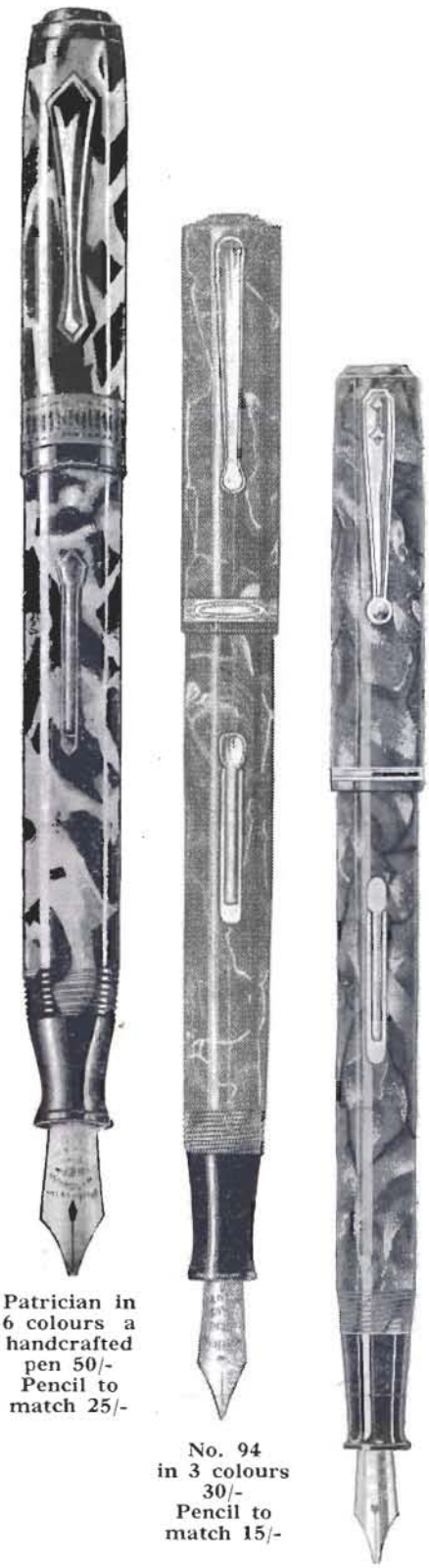

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