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Sailplane and Glider

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THE FIRST JOURNAL DEVOTED TO SOARING AND GLIDING

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CONTENTS

Front Cover: *"Soaring an open Primary" Photo by Wolf Hirth.*

We regret that owing to lack of space a number of features and photographs have been held over until next month.

THE KEMSLEY FUND

THERE is a great lightening of the heart in Gliding circles since the announcement by Press and Radio of the fact that Lord Kemsley is making available to the Gliding and Soaring Movement as well as to those who wish to fly light aircraft, a sum equal to £100,000 spread over the next seven years. It is to be a loan, at a nominal rate of interest, repayable in twenty-five years. Its object is to stimulate private flying.

Its administration is left to representatives of the Kemsley interests, of the B.G.A., and the Royal Aero Club.

This isn't, on the face of it, a subsidy, and it is to be hoped that the Government won't take it in that light either. But, on the other hand, in view of the economic crisis, it is difficult to imagine a Government Subsidy. Nevertheless, since the money is to be advanced in the form of loans, it is to be expected that it will be advanced against some form of security. The most durable security is land and buildings, which in terms of gliding means gliding sites and hangars, bunk-houses and kitchens, and after that equipment and machines. In short, the loans are a form of capital, and the effect may be to make gliding cheaper, in addition to enabling gliding to be practised in more places because of more clubs and facilities. In this it differs from a subsidy which is meant to cover the difference between cost and what is paid. We devoutly hope that a subsidy will, therefore, not be required, since we are of the opinion that a subsidy would mean more State Control, which we are profoundly convinced is harmful. But the need for a subsidy can only disappear if the new stimulus enables the Movement to grow, and grow quickly, to several times its present size. It's the old story, the more people engage in it, the cheaper it will become, but at present it is too dear to make it possible for large numbers to enjoy it.

The number of "A" Certificates now in existence is about five times what it was before the war, yet—apart from the Services Clubs—the number of devotees in the Clubs is considerably less than the 1939 figure. This may to some extent be due to a shortage of machines and equipment. In 1939 there were nearly 400 sailplanes of all types in this country. To-day, there are only about 100. If the Kemsley money can be used to re-equip the Clubs and enable them to build up to their pre-war establishment of machines (if not more), that will be a great boon.

But the number of "A" Certificates gained is no real guide to the health of the Movement. Most of them were gained by members of the A.T.C. at no cost to themselves. The daily fifty hours' soaring achieved in some Service Clubs can only be equalled occasionally in the civilian Clubs at a Meeting and Congress, where machines and pilots come from everywhere to take advantage of special facilities. Present experience shows, too, that half of them are private owners.

It seems, therefore, that the new holders of the "A", most of whom seem to have taken their "B" if they got the chance, need not so much encouragement to go further, but the *opportunity* of going further.

The present chief barrier is cost. The average Club entrance fee to-day is 6 guineas. Before the war Club members were able to compound their flying fees for £5 a year. Now the average is £10 a year, making £16 6s. a year without taking into account fares and food. The cost cannot be much less than 12/- a week—far more than the average youth or girl gets as pocket-money to-day, or can spare from tax depleted earnings.

One wonders, therefore, some scheme of assisted Club Membership could not be evolved. Could not selected juniors who show keenness, say, for four week-ends, be admitted at a special junior entrance fee of, say, 30/-, and after a few ground slides be accepted or rejected by the Chief Instructor for a "scholarship" admitting them to full membership and a compounded year's flying fee of, say, half the normal amount?

The result to the Movement would be to increase the number of "C's" and Silver "C's" and to the Clubs more members and machines. To the country it would mean that stimulus for which we believe the Kemsley Fund was created.

CONVECTION AND THE SOARING PILOT

By F/Lt. H. NEUBROCH

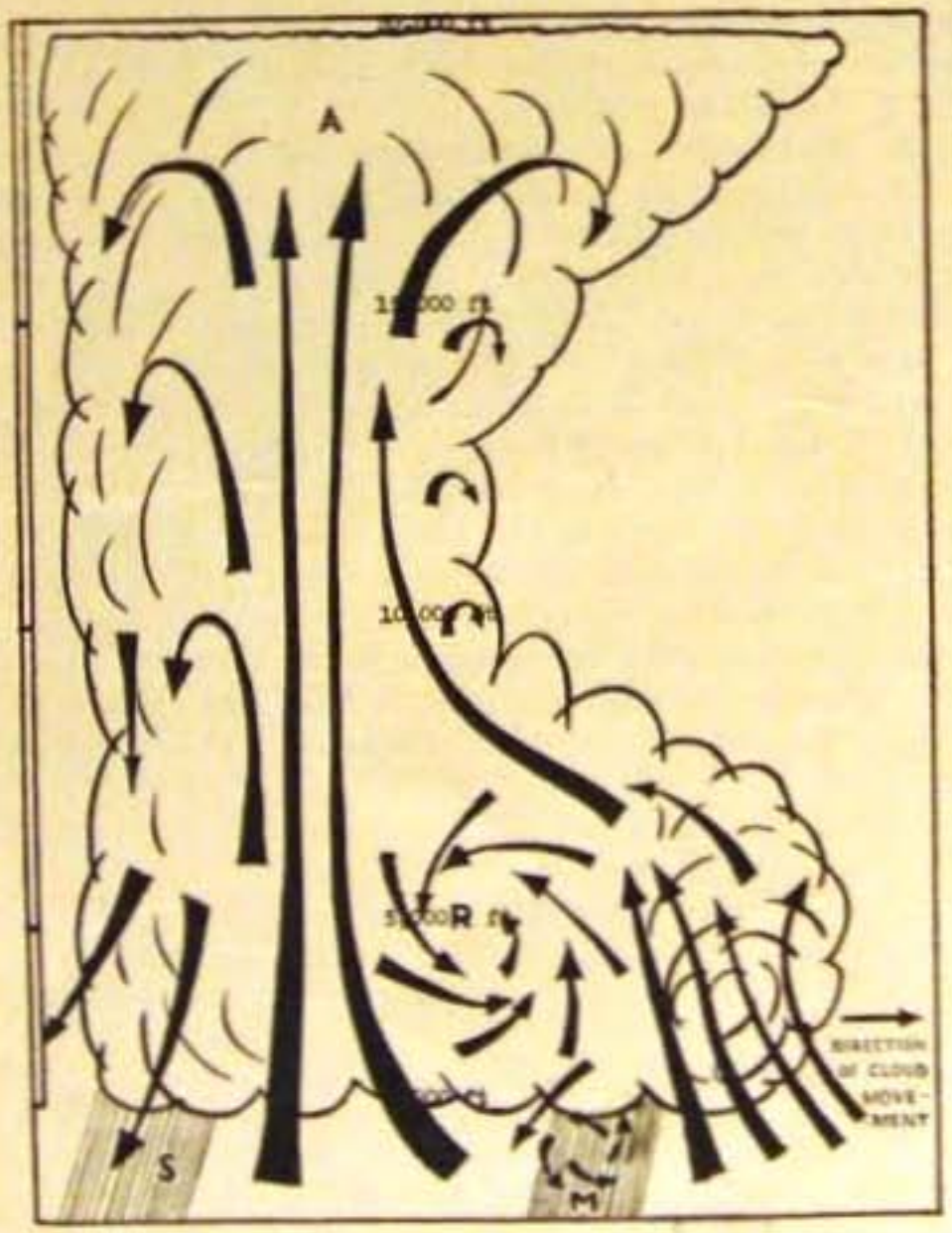
Continued from April Issue.

II

THUNDERSTORMS.

FOR many years now altitude records to the glider pilot have been associated with cumulonimbus clouds, and these again, with their powerful rising currents, cause thunderstorms. Few readers will have forgotten Mr. Philip Wills' description of his brilliant flight of June 23rd, 1946, when he established a new British altitude record of 15,207 ft. above the point of release. He wrote of one memorable minute when he rose by 2,000 ft., a rate of climb which compares favourably with that of quite a number of quite powerful service aircraft. Under favourable conditions, thunderclouds may extend to well above 30,000 ft., so that, for a long time to come, all new altitude records will be set up by pilots venturing into the still somewhat mysterious dark of cumulonimbus clouds.

What, then, are the atmospheric conditions which give rise to the largest of convection clouds? First, an adequate supply of moisture for cloud development; secondly, a sufficiently steep lapse rate over a range of not less than 10,000 ft. (In this country, Cb cloud base will usually be found between 6,000 and 10,000 ft.) These conditions are most frequently found in the summer in a shallow depression or a col. Unless the storm is stationary or moving very slightly, it will usually be associated with a cold front sweeping across the country, in which case it may move over the surface at speeds up to 50 m.p.h.



A—Anvil *R—Roll cloud*

M—Main rain area *S—Secondary rain area*

(*Fig. 1. Section through typical fully developed cumulonimbus cloud*).

Ever since Mac Kegel's flight in 1926, glider pilots have used the vigorous upcurrents in front of the roll to soar up and down a cold front, using a figure of eight technique similar to the one used in ridge-soaring, and advancing across country at the speed of the front. This method of cross-country flying, though it will often yield the distance necessary for the Silver Gliding badge, is not without disadvantage. As has already been mentioned, the cross-country speed will be no greater than the speed of the advancing front, rarely over 40 m.p.h., and soaring pilots have long learnt to use cloud streets to attain ground speeds sometimes twice as high. Secondly, unless the sailplane pilot has a towing aircraft at his disposal to take him to the front, launching requires careful timing: if the few seconds of calm just ahead of the storm are missed, there is not likely to be another chance of contacting the roll. And lastly, there is quite some danger that the pilot may find himself inadvertently inside the roll, virtually unable to control the flight—or to end it if he should so desire. On June 9th, 1946, Signalman Huntley, a member of the Air Division Gliding Club, covered the necessary distance for his Silver "C" by starting ahead of a cold front; later he found himself inside the roll and seems to have described manoeuvres which, on reconstruction, could have been none other than a whole series of loops!

But to return to altitude soaring in cumulonimbus. Several excellent descriptions of flying in cumulonimbus have been published in this journal; they all emphasise the necessity of having a sailplane in first-class condition in which the pilot is thoroughly experienced; a complete blind-flying panel and the ability to use it under the most trying conditions is absolutely essential and, if thunderclouds are to be fully explored, so are oxygen and heating equipment. Some form of de-icer will perhaps also be developed. Even so, a word of warning with regard to venturing into cumulonimbus is not out of place.

Mr. Phillip Wills would divide cumulonimbus clouds into two classes: those extending vertically up to about 17,000 ft., which should be treated with the utmost respect, and those of about twice that height which should be approached with a degree of awe. When it is remembered that the larger hail pellets, which are sometimes found in this cloud, require vertical currents with the speed of express trains moving in opposite direction, and that the

transition from up to down currents is liable to be very sudden, it is not surprising that even the largest service aircraft have been known to break up, in cumulonimbus, and that it is, therefore, considered an offence to enter a thundercloud unless there is absolutely no other course open to the pilot; sailplane pilots must face the possibility of a parachute descent and a lost sailplane, before deciding to enter the purple darkness of this the most violent of convection clouds.

Sailplane enthusiasts who wish to study cumulonimbes clouds with a view to altitude flights will be interested in the following observations based on experiences of a large number of pilots who took part in the Rhoen contest of 1938. An unusually large number of ascents above 3,000 metres—seventy-two in all—were made during the two weeks of the competition, by far the larger number in thunderclouds. Barograph traces for 52 flights show that 34 pilots reached 13,000 ft., 14 reached 16,500 ft., 3 reached 20,000 ft., and one pilot, Drechsel, reached more than 25,000 ft.

The synoptic situation during the second half of the period was particularly favourable to such developments. The chart of August 4th, typical of this period, showed a well-developed stationary High with its centre over Sweden, with a trough over Northern Russia and shallow depressions over Brittany and Southern France. The pressure gradient was negligible and the Rhoen was in an area of little or no wind.

Upper air ascents every morning and the early development of some altocumulus castellatus showed that instability was present. Around noon, there were light and variable winds associated with the formation of cumulus, some of which developed in the late afternoon into real giants of cumulonimbus, with thunderstorms, hail, anvil tops and all.

All pilots concurred in the following observations:

1. Vertical currents commenced sometimes several hundreds of feet below cloudbase with relatively low rates of climb of 3 to 5 ft./sec. The air seemed to move up quite smoothly in a sort of tube. This smoothness was always stressed, and it was claimed to be most noticeable where lift was greatest, i.e., in the centre of the tube. Inside the cloud, lift increased rapidly but the smoothness persisted.

2. The horizontal extent of these areas of lift was usually great enough for the pilots to gain height by circling; this was also shown by the barographs which recorded uniform rates of ascent through a range of several thousand feet. Even when flying straight and level, it was not usual to find the limit of lift immediately.

3. When, however, the limit of areas of lift was reached, extremely violent turbulence set in abruptly. The fact that several sailplanes disintegrated in cumulonimbus was put down to this.

4. The following were given as average variometer readings:—

below cloud base	3 to 10 ft./sec.
in cloud	15 to 25 ft./sec.,

rapidly increasing to maximum reading. Barograph traces gave rates of lift in excess of 75 ft./sec. on a day when the environment curve (actual temperature) was 6° C below the adiabatic from cloudbase to a considerable height. Maximum lift (50 to 75 ft./sec.) was usually found between 15,000 and 25,000 ft. It was due to such terrific upcurrents as this on August 6th that the pilot Spaete reached 24,000 ft. in 24 minutes. Downcurrents immediately outside the tube of rising air were in the nature of 12 to 20 ft./sec.

Pilot: FICK
Date: 3.8.38.
Height: 6,500 *metres.*

Pilot: LEMM
Date: 6.8.38.
Height: 6,200 *metres at top of trace.*

Pilot: DRECHSEL
Date: 5.8.38.
Height: 8,100 *metres.*

Different scale used for each trace.

(*Fig. 2*).

5. It was thought that the area of lift decreased with height rather in the manner of a cone, so that it was necessary to fly in ever-decreasing circles to remain in it. Near the ice crystal "anvil" top, the air seemed to gush outwards and down like the top of a fountain, and turbulence would become extreme.

6. ICING. This was usually not encountered frequently, and Drechsel gave 15,000 to 25,000 as the worst layer. The effect of hail was sometimes disastrous, damaging both wings and fuselage. A well-designed cockpit hood was important to protect the pilot. It was, however, claimed, that hail constituted a danger only when it combined with extreme bumpiness.

7. LOW TEMPERATURES. A cockpit to all intents and purposes sealed off from the outside was claimed to give sufficient protection against the low temperatures met at height. This had, however, the disadvantage of getting the hood frosted over early in flight. Provision of some kind of cockpit heating was stressed. It was also thought that low temperatures constituted one of the main dangers to a pilot abandoning aircraft. One of the pilots, Scheidhauer, was badly frozen after a parachute descent.

(*To be continued*).

THE TREND OF SAILPLANE DESIGN

By Group-Captain L. P. MOORE

Continued from April Issue.

Rudder and aileron control are interconnected so that left stick gives both bank and yaw to port in correct proportion to one another. As correction to powered take-off swings is not a problem and as air brakes obviate the need to resort to side-slip, I see no real snag in the two-control method advocated, leaving the feet free for stamping to get warm.

The air brake control operates like a motor throttle. "Throttle" forward takes off brake and extends the glide during the approach to land as does a burst of motor on a powered aircraft. Likewise "throttle" is opened for take off and cruising and closed for landing.

A landing/handling wheel is not required for real lightweights and hence is not incorporated. A tail grip is provided for catapult launching as well as for hand towing on a trolley.

their effectiveness in reducing the tendency for the wing tips to stall before the roots has never been accorded proper priority. The Germans claimed before the war as a result of their intensive research into tailless sailplane design, a much greater improvement of aspect ratio than I have taken.

The outcome of my prescription is accordingly a 45-footer with a wing loading of approximately 5 lbs. per square foot, as for the single-seater.

It is customary nowadays to take side-by-side seating for granted, but I can see no case for such an arrangement and the best reasons for having tandem seating. Whether the motive for side-by-side seating is an urge to keep warm or arises from affection for one's passenger, I have never been able to ascertain but for the drastic price that has to be paid for these doubtful facilities in the form of over-

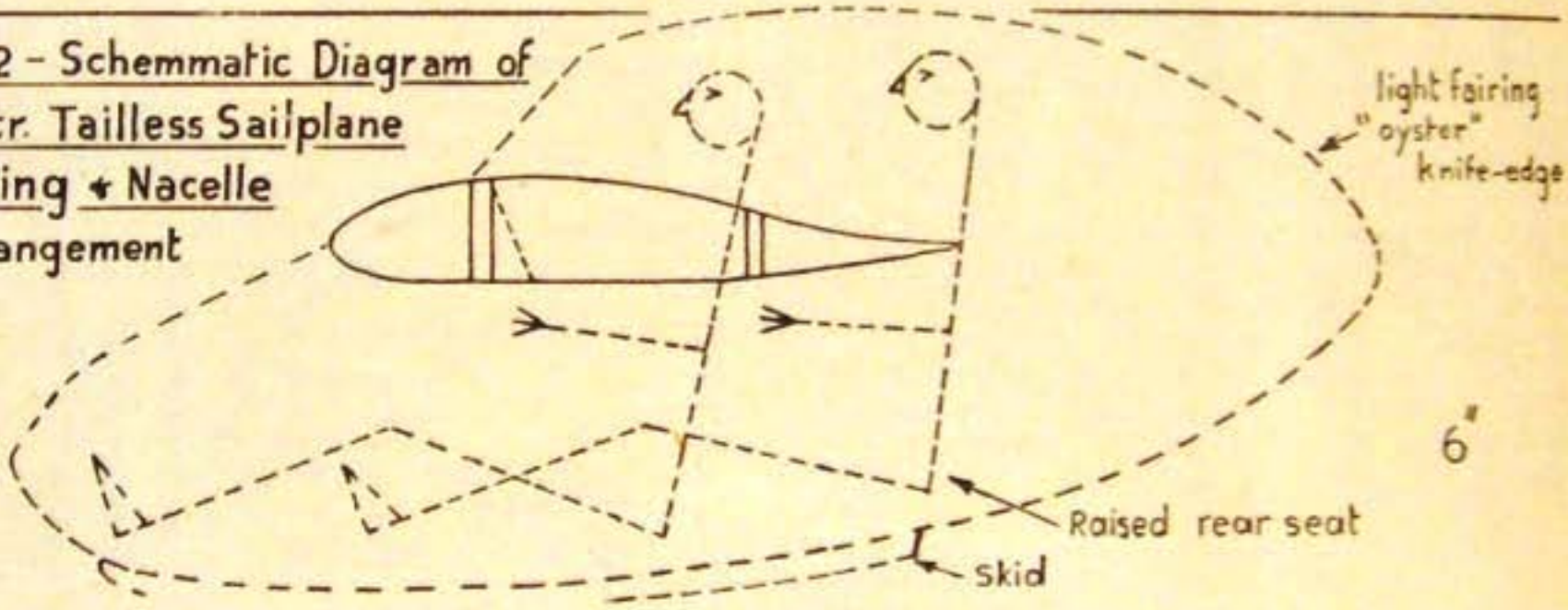


Fig. 2 - Schemmatic Diagram of 2-Str. Tailless Sailplane Seating + Nacelle Arrangement

The Two-Seater.

For the two-seater I envisage quite a different approach: it will be tailless. For the type of single-seater just described, the weight of the fuselage aft of the pilot is inconsiderable but for the two-seater, that portion of the total weight will inevitably be large if the design be orthodox. The two-seater being much heavier than the single-seater in the fully-loaded condition, will have extra inertia fore and aft to prevent over-sensitiveness in that plane for the tailless type without having to employ a large amount of wash-out towards the wing tips.

There is not need for a weight in excess of 200 lbs. for such a sailplane nor for a wing span of more than 45 feet. The centre section of the wings forms a chassis for taking most of the loads of pilot, passenger and controls and the remainder of the nacelle is little more than a super-light fairing.

Again we assume an aspect ratio of 18, but in this case, because the rudders are placed at the wing tips in the form of vertical "en-caps," the effective aspect ratio will be considerably more than the geometrical one which can therefore be about 16. I feel that this point in favour of wing tip rudders, together with crowding and elbow-digging in rough air conditions, the psychological effect of assymetrical seating upon accurate flying and the relatively poor field of view resulting from "sitting on the side" of the nose, but above all, for the formidable increase of drag induced by the broader fuselage, no claim is strong enough to justify it.

There are, nevertheless, important advantages inherent in side-by-side seating and some explanation as to how it is proposed to compensate for them is therefore required. They are as follows:—

(i) Trim is not altered when flying solo.
The tandem seats will be much closer together than usual, with the rear seat occupant sitting legs astride the front seat—as on a toboggan. The leg stretch need not be uncomfortable. Trim can then readily be made good by elevan trimmers.

(ii) Fuselage liable to be longer and heavier. There is no fuselage in the ordinary sense, in this tailless design and the closer seating fore-and-aft will help here in reducing the size of the chassis.

(iii) Two instrument panels required.
The rear seat occupant will sit higher than the front seat occupant, over whose left shoulder he will have an adequate view of the instruments used by his companion, and situated in the top left corner of the panel.

(iv) The pupil can watch "how his instructor does it."
An advantage of negligible importance. Far better that he should feel his instructor's reactions by lightly holding his own set of controls.

Both occupants will get a wide field of view. Soaring flight involves almost continuous weaving so that the view towards the inside of the turn is the criterion (n.b. the fallacy of "the good view to be had by virtue of a parasol arrangement"). The backward sweep of the wings enhances the view even for the rear seat passenger.

Rocket Launching.

I believe in an illustrious future for liquid-rocket launching—in fact to the ultimate exclusion of the much more unwieldy and uneconomical aero-tow method and even the high winch launch method. The enormous amount of wartime research on rocket launch and motor techniques has provided us with enough information to enable this possibility to be exploited safely almost at once. Hence provision has been made in both types being discussed for fitment of rockets. The exhaust problem is easy for both types, but the effect on centre of gravity of the variable fuel weight is not easy to allow for.

The weight saving advocated for future sailplane design is, of course, all in favour of rocket launching. I hope that the B.G.A. will drive like anything through the medium of its admirable newly-constituted technical groups, in this direction. Miniaturisation and tail lopping should go hand in hand with development of liquid rocket launching methods and devices.

Angle of Attack Meter.

There is a good future also, it seems, for the angle of attack meter to augment if not even to replace the air-speed indicator and to take the place of present-day fore and aft indicators. I believe, too, that this new interesting indicator may even replace the gyro-horizon if used differentially on either wing tip. Its immunity from icing trouble and its independence of high cruising speed or the alternative electric motor are strong points in its favour.

Speed Contests.

I am no speed fiend and hold the purest views on the sport of sailplaning, but I make no apology for appealing for speed contests at sailplane meetings in order to improve the breed insofar as qualities of penetration are concerned. I envisage a long beat to and fro across the face of the soaring ridge, turning at both ends around a marker and with a rigid "rule of the road" for opposite beats. The sailplane to complete the maximum number of beats within a given time would be the winner. Staggered starts and limitation of numbers would make for safety. A long beat and a steady wind would be further requirements; indeed there are usually low-cloud windy days during a meeting when other forms of competition other than, perhaps, duration, are not possible. Skill would certainly be a factor in such a contest, but the predominant one would be the penetration qualities of the competing sailplanes; and we should go full out to encourage the latter.

Conclusion.

Of all the points which I have suggested for emphasis in sailplane design of the near future, I would give prominence to much reduction in size, especially for the two-seater, tailless fashion for all two-seaters and liquid rocket launching facilities for all types. I hope that the B.G.A. will be really bold in this respect when the time comes for them to judge the two-seater design competition shortly to be before them.

FORMATION AND OPERATION OF A GLIDING CLUB

A Lecture read before Aerotech F.C. No 1 on Dec. 19th by Ann Douglas.

Continued from February issue.

Aircraft.

The first necessity, therefore, is a machine for ground slides. It is preferable that this machine should be kept for the sole purpose of dragging its wings and bounding from ridge to ridge, and it can be a very cheap machine in first cost. It need not be strictly airworthy (provided it cannot be flown) and can often be made up from bits.

The pupil should be transferred from this vehicle at the earliest possible moment, and do his last few ground slides on the machine in which he will hop.

From this stage through to circuits, only one machine class is required. Two types come to mind which fill this period of the pupil's life adequately. They are:—

(1) The German "S.G. 38 Primary," and although this is an open (cockpitless machine) it has excellent flying and handling characteristics, and is to my mind ideal.

(2) The "Kirby Cadet." This is an orthodox secondary, and has been developed by the A.T.C. It is a good little trainer, but requires more care to fly than the "S.G." An advantage of the "Cadet" is that "Tutor" wings can be fitted to the same fuselage, and the machine given a better performance for the benefit of the more advanced pupils.

For elementary soaring on a hill, both the "Cadet" and "Tutor" are suitable, although the better the performance of the latter allows the machine to be soared at a greater height, and therefore with added safety.

If, however, "C" flights have to be made on thermals from a flat site, then a machine of "GB II"