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# TEN YEARS' GLIDING AND SOARING IN GERMANY

BY

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MR. CHAIRMAN, LADIES AND GENTLEMEN :—

Before passing to the subject of the paper may I ask your indulgence for my limited knowledge of English, which prevents my giving a free discourse, and constrains me to a set lecture. This I view with regret since it makes it difficult to impart to my words the lively and vivid feeling which a more formal picture of the importance and attractiveness of gliding flight may not give.

We are looking back on ten years of development and on an unbroken series of ten gliding competitions held at the Wasserkuppe in the Rhön, since 1920.

The organisation has not only maintained its range of activities all these years but has largely extended it, and in this way has given the best proof of its vitality and purpose.

In the first decade, now completed, successes have been achieved such as few foresaw, and the cause may be sought in the spirit of close co-operation with which the sportsman strove to avail himself of the flying possibilities opened up by the scientist.

This union of sport and science is in the true tradition of German gliding since its revival in 1920. At Frankfort in that year, Oskar Ursinus directed the "air-minded" members of the younger generation towards gliding as a substitute for power flight of which they were perforce deprived; but he had the progress of aeronautical science at least as much at heart as the interest of the sport. He desired to direct aeronautical investigation along a new path, and to free it from the restricted view that progress was bound up with power flight. Were it possible to develop gliders carrying appreciable loads, they would serve as prototypes for

FIG. 1.
*Klemperer's sailing aircraft*, 1920.

light aeroplanes, without losing sight of more general sporting possibilities. The evolution of the light sporting aeroplane from the glider was his technical objective. His sporting aim was to offer keen youngsters a chance of flying at no great financial outlay by giving their time freely to constructing gliders. In the course of their purely sporting activities they would develop a sound team spirit and would find a stimulus to technical and scientific work.

On his initiative the first gliding competition at the Wasserkuppe in the Rhön was held in August, 1920. In spite of initial difficulties a new gliding record of 2 minutes 22 seconds and 1,830 metres, was made by W. Klemperer, whose design first settled the type of construction suitable for gliders. It was a cantilever low-wing monoplane, in which great care was given to keep down resistance with its adverse effect on performance (Fig. 1).

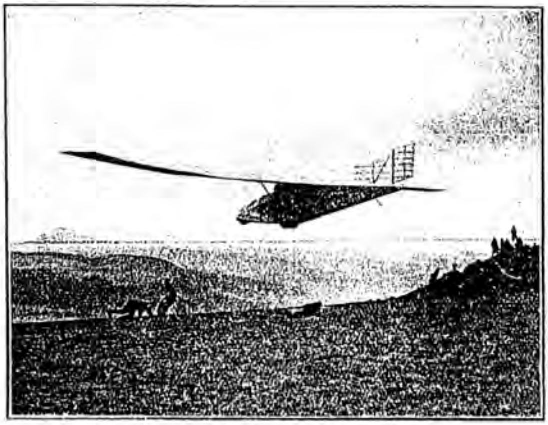


FIG. 2.
*Vampyr gliding*, 1921.

In the following year the same principle of keeping down body resistance was more fully applied by G. Madelung to his glider "Vampyr." The "Vampyr" type prevails at the present time, and this is a measure of Madelung's contribution to glider design.

Since gliding flight depends on the use of slowly rising currents in the air, a practicable glider is chiefly characterised by a small vertical component of velocity, or rate of descent.

A small rate of descent may be obtained either by reducing the sum of the resistances or by reducing the wing loading. These two methods have been applied, and lead to two special types of glider, both of which find application for special purposes. A large span and good aspect ratio are favourable to a small (induced) resistance, and further reduction of resistance is gained by a closed body, cantilever construction (no external bracing) and by dropping the starting carriage.

From the "Vampyr," the prototype of German high performance gliders, onwards, all these methods of reducing resistance have been so carefully studied and carried out that further fundamental improvements are scarcely to be expected.

The photographs, Figs. 2, 3, 4 and 5, show the best known German high performance gliders from the " Vampyr " of 1921 to the " Wien " of 1929.

" Vampyr "—Academical Flying Club of Hanover, 1921.
" Consul "—Academical Flying Club of Darmstadt, 1923.
" München "—Academical Flying Club of Munich, 1928.
" Wien "—R. Kronfeld. Built by A. Lippisch, 1929.

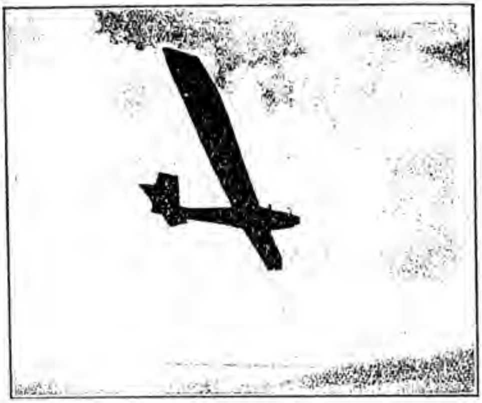


Fig. 3.
*Sailing aircraft " Consul " of the Darmstadt Academic Flying Group, 1923.*

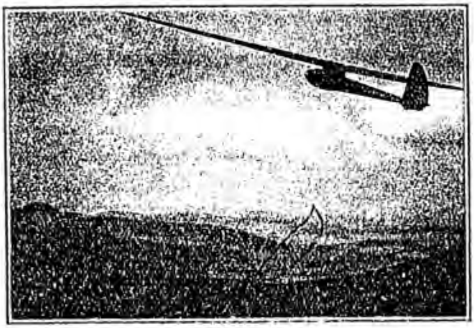


Fig. 4.
*Sailing aircraft " München " of the Munich University Flying Group, 1928.*

On the " Wien," Kronfeld carried out his great duration flights, covering distances up to 150 km.

In designing for low head resistance the structural weight is increased to a restricted degree, and the structural methods, illustrated above, produce medium heavy gliders with a margin of strength for high performance and for flying in gusty weather. The additional weight gives the greater air speed required for progress against strong winds and for passing rapidly through unfavourable belts of down wind.

The glider of low resistance and considerable structural weight is the best all round for long cross-country glides by virtue of its slow descent and high air speed.

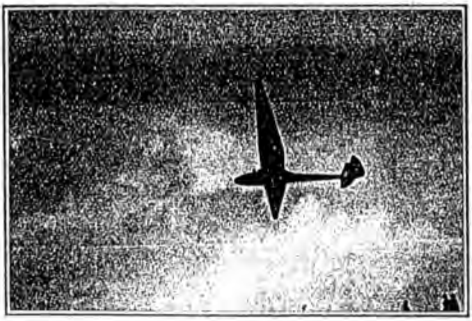


FIG. 5.
*Sailing aircraft "Wien," R. Kronfeld's aircraft, constructed by A. Lippisch, 1929.*

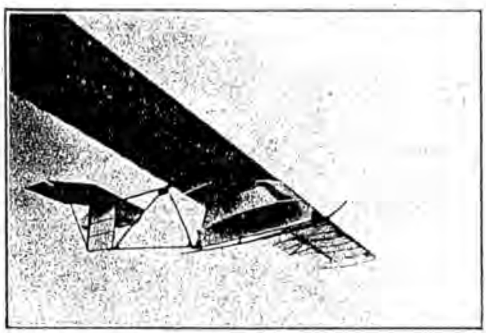


FIG. 6.
*Anamma.*

Another method of reducing the rate of descent, by reducing the wing loading, is widely applied to glider design but is quite unsuitable for high performance. It produces a very special type of low air speed, poor gliding angle, light structural weight and simple form.

The Djalvar—" Anamma " (" Devil take it ") is of this type and its main characteristics are: braced monoplane wings, single girder, tail boom, and boat-shaped cockpit below the wings. Fig. 6 shows a standard glider of this type.

It has a good duration performance in light winds but a restricted range on account of its slow air speed. In the school type the aerodynamical qualities are sacrificed to more robust construction, simplified for ease of repair; the cockpit is not covered so that the pilot may fall clear in a smash, and restricted gliding and soaring powers are desirable for training purposes. The best known of this derived type is the Zögling " (Fig. 7).

Once the principles of successful soaring were recognised results soon followed.

In 1922, Hentzen and Martens, both students, carried out the first soaring flights, lasting over an hour, on the "Vampyr." Hentzen's record flight of three hours ten minutes, attaining an altitude of 350m., made the activities at the Wasserkuppe world-famous. It elucidated the problem of soaring flight by using the energy in the air's motion.

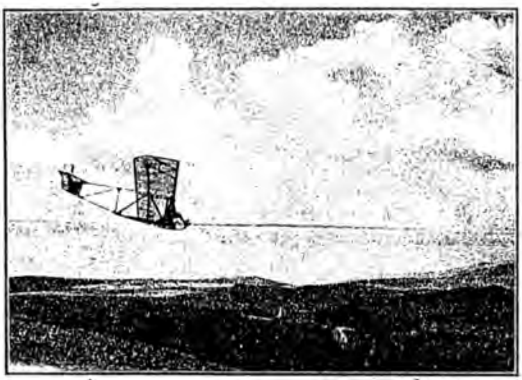


Fig. 7.
*Instructional glider "Zögling" of the Rhön-Rossitten Co.,* 1926.

In accordance with the laws of motion soaring is possible in an ascending current of air, and in a horizontal air current of variable velocity. When the rate of ascent of the air current equals or exceeds the rate of descent of the slides "static soaring" is possible.

When the horizontal wind is variable, the pilot gains height as the velocity increases and loses height as the velocity decreases. As the air forces are proportional to the square of the air speed, it is possible in principle to obtain a net gain. If the net rate of gain equals or exceeds the rate of descent, "dynamic flight" becomes possible. It is quite probable that some dynamic gain was obtained in the earlier flights, but not by any systematic use of the wind fluctuations.

The extensive efforts made from 1921 to 1923 to connect pulsating dynamical effects with the performance of man-carrying gliders did more harm than good to the development and reputation of soaring, the possibilities of which, apart from any such effects, have been fully shown by the subsequent years.

To revert to static soaring, local rising currents are produced by every irregularity of the earth's surface—knolls, dunes, woods, the waves of the sea—and may be utilised for soaring flight.

The photographs, Figs. 8-11, show well-known soaring grounds:—

The Wasserkuppe in the Rhön (Figs. 1 and 9).
The French soaring grounds at Vauville (Fig. 13).
The soaring grounds at Rossitten on the Kurisch lagoon (at the mouth of the Memel in East Prussia) (Fig. 10).

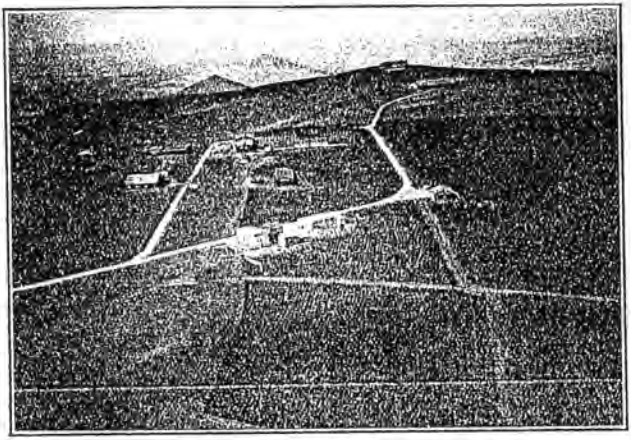


FIG. 8.
*Soaring grounds and flying station on the Wasserkuppe in the Rhön.*

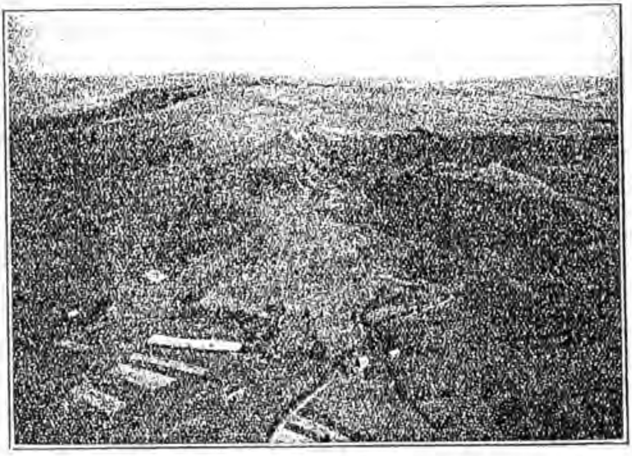


FIG. 9.
*Western declivity of the Wasserkuppe, Rhön.*
*(Main sailing-flight declivity.)*

FIG. 10.
*French soaring grounds near Vauville.*

FIG. 11.
*Gliding ground at Rossitten from the Nehrung.*

The following table shows a number of duration records.

| | Wasserkuppe | | | Rossitten. | | |
|---|---|---|---|---|---|---|
| Year | 1922. | 1928. | 1929. | 1924. | 1925. | 1929. |
| Pilot | Heutzen. | Kronfeld. | Neininger. | Schulz. | Schulz. | Dinort. |
| Duration | 3h. 10m. | 7h. 24m. | 8h. 24m. | 8h. 24m. | 14h. 7m. | 14h. 43m. |

It is seen that the records at the Wasserkuppe have dropped far behind those at Rossitten. Such flights are a useful stimulus to the sport but do not much help further developments of soaring. For this reason cross-country flights have been preferred at the Wasserkuppe as eminently serviceable for research work, and by this means alone new regions of favourable rising winds have been delimited, and the practice of soaring has been made less dependent on time and place. The performance has been steadily improved and a high aeronautical and scientific standard of instruction in the methods of soaring has been attained. The following table shows the progress made since 1922.

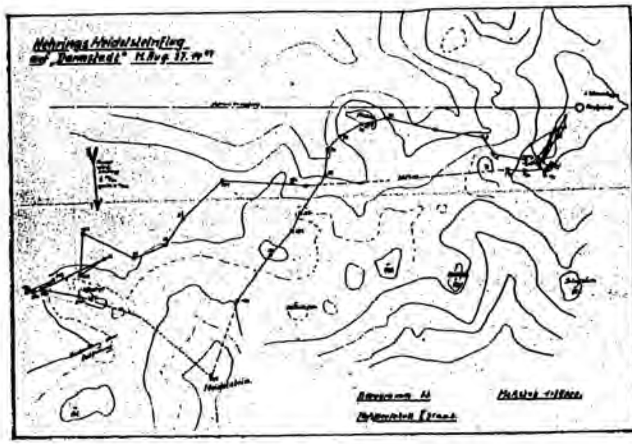


Fig. 12.

*Heidelstein flight by Nehring on the sailing aircraft "Darmstadt," August 11th, 1927.*

*Cross Country Soaring Flights*

| Year | Pilot | Distance in km. | District |
|---|---|---|---|
| 1922 | Martens | 9.5 | Wasserkuppe |
| 1923 | Botsch | 19 | ,, |
| 1925 | Nehring | 21 | ,, |
| 1927 | Nehring | 52 | ,, |
| 1928 | Schulz | 62 | Rossitten |
| 1929 | Nehring | 72.3 | Odenwald |
| 1929 | Kronfeld | 100 | Teutoburger Wald |

The technique of cross-country soaring flights is best shown by plotting the course on a contour map, with barogram readings of the heights attained, and other information supplied by the pilot. The two examples selected are the masterly flights of Nehring on the Darmstadt and Hirth on the Lore, from the starting point round a fixed mark and back.

In the flight round the Heidelstein (Figs. 12-14), Nehring first soared over the south slope of the Wasserkuppe until he had gained 150m. height above the starting point. He then flew parallel to the ridge and at right angles to the

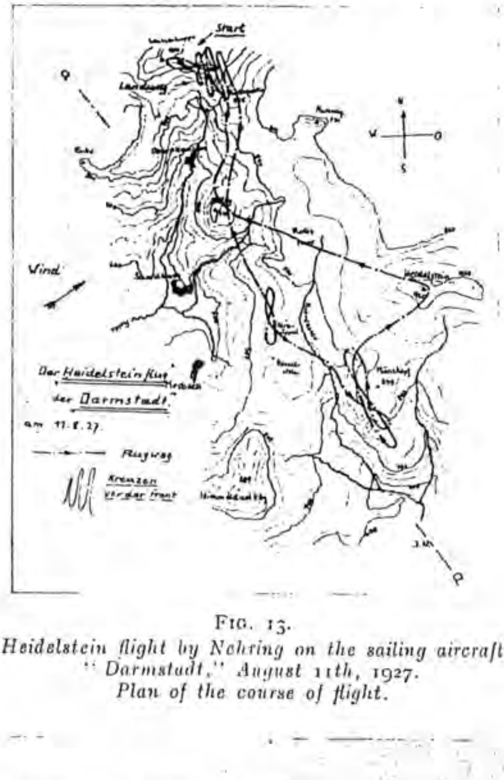



FIG. 13.
*Heidelstein flight by Nehring on the sailing aircraft "Darmstadt," August 11th, 1927. Plan of the course of flight.*

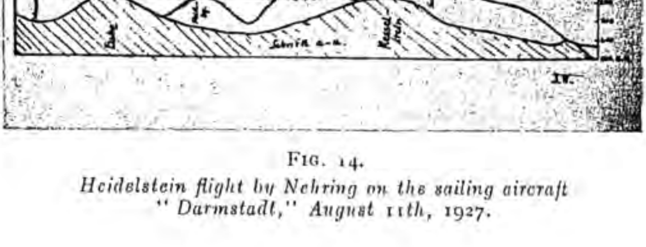


FIG. 14.
*Heidelstein flight by Nehring on the sailing aircraft "Darmstadt," August 11th, 1927.*

prevailing wind to Münzkopf, where he used the strong up-current to reach his maximum height at 260m., which was sufficient to reach the Heidelstein and return to the starting point.

Hirth's flight was more difficult and more instructive (Fig. 15). He started from the west slope of the Wasserkuppe, and maintained himself there until he had gained 400m. in height, and then carried out his cross-country flight to the immediate neighbourhood of the Schweinsberg without serious difficulty. On

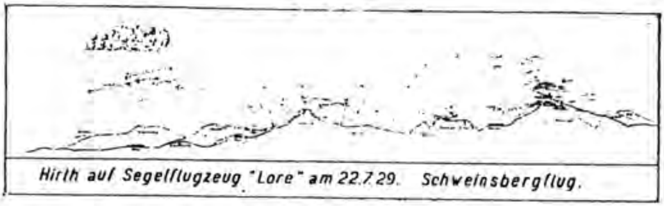



FIG. 15.
*Schweinsberg flight by Hirth on the sailing aircraft "Lore," July, 1929.*

the return flight he found that he had lost height badly and was 200m. below the starting point. He was twice forced to turn back and soar over valleys with up-winds in order to regain sufficient height to regain the western slope, over which he cruised until he was high enough to land on the plateau of the Wasserkuppe at the prescribed point.

In this admirable exhibition of the methods of cross-country work, it is seen that the pilot leaves the original region and seeks new areas of rising wind, leaving nothing to chance, but laying his course beforehand, according to the wind prevailing and to the lie of the land. It is characteristic of such flights that


FIG. 16A.
*Barogram of the flight from Nehring to Berka, August 9th, 1927.*

the best course is not in general the shortest distance, but may involve long detours in reaching up-wind areas, and lengthy soaring over a particular point in gaining sufficient height. Briefly, the pilot must fly on sound topographical and meteorological information, if he is to reach his goal. Cross-country flights will be achieved over wide regions by flying from slope to slope, from hill to hill, and finally, from range to range. The satisfaction of skilfully adapting soaring flight to the configuration of wind currents and landscape is enhanced if need be by the sporting excitement and by the real value to flying.

Nehring's flight of August 9th, 1927, is another instructive example of cross-country work in which a whole range was transversed by passing from hill to hill. There was no straightforward continuous region of upwinds available. Local areas of rising wind had to be sought out on slopes facing the general direction of the wind, and wide belts of downwind lying between them had to be crossed. The masterly fashion in which Nehring carried out these successive stages is shown by the next two slides.

A barogram of Nehring's 53 km. flight to Berka, August, 1927, is shown in Fig. 16 and a plan and height contour of the same flight in Fig. 17.

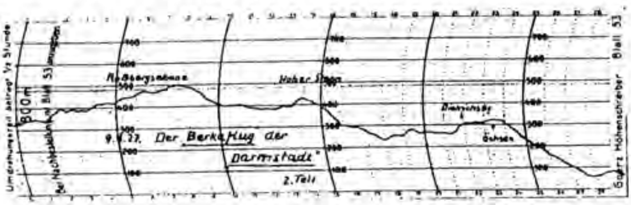



FIG. 16B.

*Barogram of the flight from Nehring to Berka, August, 1927.*

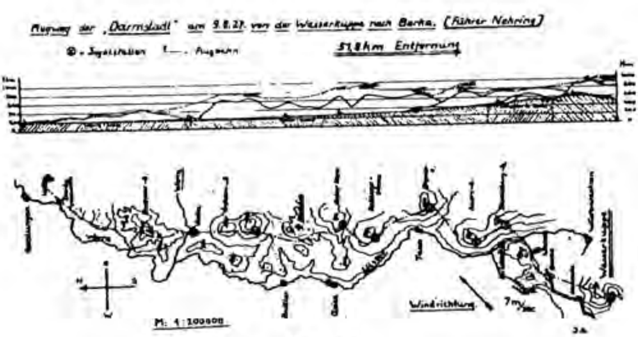



FIG. 17.

*Vertical section and plan of the course of the flight by Nehring to Buka. Distance flown 53 kilos., August, 1927.*

The ups and downs of the barogram correspond to the up and down wind regions which were met. The plan of the course shows very well the flying tactics adopted in circling over hills which produced rising winds, long enough to gain extra height for the next stage of the flight.

Kronfeld's 100 km. flight in Spring, 1929, over the Teutoburgerwald was achieved by these same tactics, and supports the view that a sound knowledge of the flow of the wind round hill ranges, hills, knolls and dunes enables a soaring pilot, competent in his art, to achieve remarkable cross-country performances, over hill and dale.

We cannot remain content to restrict soaring to hilly country but must strive to bring within its scope the regions of the air above flat lands. The sailing flight of birds, indeed, shows that upwinds exist over plains, and are probably adaptable to soaring man-flight.

Research on soaring was initiated just at the beginning of the serious crisis of 1924 and 1925.

Soaring gliders had not been involved in the restrictions imposed on power aircraft, but were adversely affected by the revival of interest in the sporting possibilities left open to light aeroplanes, when the worst restrictions were removed.

After the record duration soaring flights of 1922 England, France, Italy and Russia had held soaring competitions, but interest had soon passed back to the light aeroplane. Even in Germany soaring came to be regarded as a mere makeshift for power gliding. Only when this erroneous view had been disproved, and soaring shown to have its own individual scope, did the crisis pass.

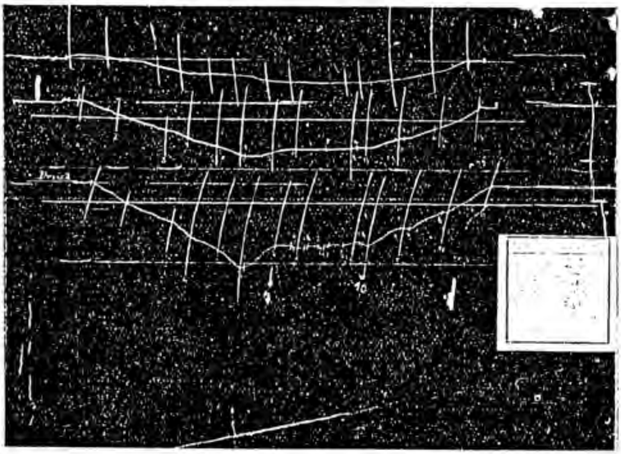


FIG. 18.

*Barogram of the exploration flight of 30th April, 1928.*

The Rhön Rossitten Gesellschaft was founded in these difficult times, with the purpose of supporting gliding schools, of holding competitions to give publicity, of improving performance, and of stimulating gliding activities generally. A special research department was established at the Wasserkuppe for advancing technical and scientific knowledge of the problems involved, and the management was placed in the hands of the present author in 1926.

The Rhön Rossitten Gesellschaft may be regarded as the centre of the gliding movement in Germany and in other countries. Teams were sent to the meetings in the Crimea at Asiago and at Vauville. Instructors were sent to the United States on the formation of the American gliding school at Cape Cod. A French educational commission has received full training, and this has stimulated the sport in France. Technical advice has been given to Hungary, Holland and Belgium. In these ways the Society has made its contribution to the common problem of soaring flight to which in turn all other nations can contribute their activities. Since 1926, having overcome the crisis of 1924-25, the practice of soaring and gliding has made vigorous and continuous progress. Glider schools have been established, and standard gliders have been distributed along with working drawings and instructions for building them. These include the "Zögling," "Prüfling" and "Professor" types. The number of airminded youngsters and their interest in gliding have been increased by these measures, and, above all, research has opened out new possibilities and has contradicted the prevailing belief that soaring depends entirely on the use of rising current over hill slopes.

The investigations of rising currents in the free atmosphere carried out in the last few years at Darmstadt and at the Wasserkuppe have shown that soaring under cumulus clouds and near cold fronts is practicable, both entirely new conditions.

It has long been known that cumulus clouds are associated with rising currents of air, but few measurements were available. Research was directed to the determination of these currents in the Spring of 1928 from measurements of the vertical rate of a power plane gliding beneath a cumulus cloud with its airscrew stopped. Repeated glides of as long as 10 minutes without loss of height were obtained.

Fig. 18 shows a barogram of an exploration flight, April 30th, 1928, and it is seen that there was no loss of height from point 7 to point 10 of the barogram, which implies a rising current of 2 m./sec.

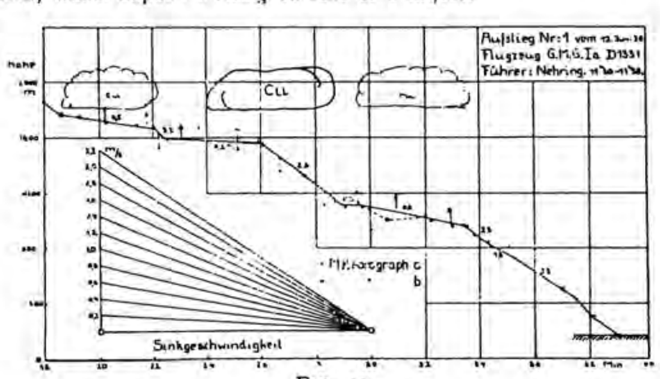



FIG. 19.

*Exploration flight of the 12th June*, 1928.

Fig. 19 shows a reduction of experimental flight measurements in a rising current, June 12th, 1928, giving the observed descent in a glide. From this is subtracted the known rate of descent in still air, about 1.9 m./sec. The difference measures the vertical motion of the air.

From time 20 min. to time 28 min. there is a rising current of from 1 m./sec. to 2 m./sec., and from 28 min. to 30 min. of 2 m./sec. to 5 m./sec. These are hign values and give excellent conditions for soaring in gliders, which have rates of descent as low as 0.7 m./sec.

A reduction of rising current measurements before a line squall, June 26th, 1928, is shown in Fig. 20.

A "cold front" produced a line squall of moderate intensity, and the aeroplane, with airscrew stopped, maintained itself without loss of height for 15 min. From these results it was inferred that a soaring glider starting from the Wasserkuppe could reach the region of rising currents under a cumulus cloud or the front of an approaching squall, and this was successfully accomplished.

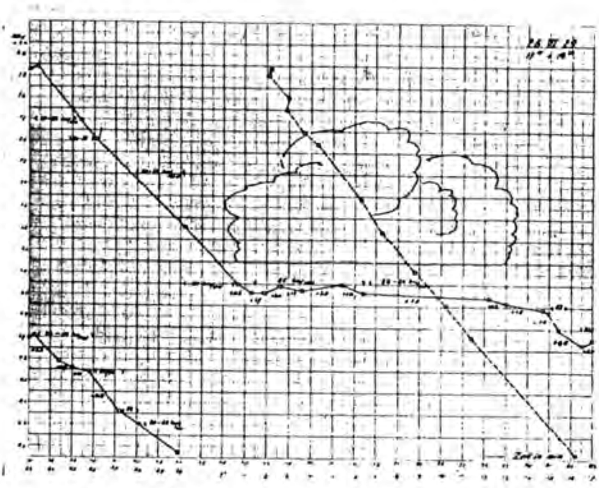


FIG. 20.

*Reduction of measurements in front of a line squall.*

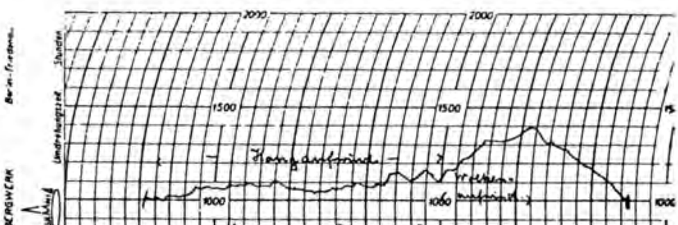



FIG. 21.

*Barogram of the "Darmstadt" of the 10th August, 1928.*

A barogram of soaring flight by the "Darmstadt," August 10th, 1928 (Fig. 21), shows clearly the vigorous effect of the rising current under a cloud in comparison with that produced by a hill barrier.

The "Darmstadt" maintained itself over the west slope of the Wasserkuppe at 100 m. above the starting point. In 20 min. the boundary of the up current below an approaching cloud was reached, and the glider was quickly carried up to a height of 400 m.

Fig. 22 shows a record of Kronfeld's flight at the Himmeldankberg, August, 1928.

The plan of the course is shown in full line under the cloud, in dotted line outside their influence.

Kronfeld started from the western slope of the Wasserkuppe, and flew at once towards an approaching cumulus cloud, which he followed towards the east with continual gain of height, reaching finally 470 m. above the starting point. The cloud began to dissipate and the up current became ineffective, so that Kronfeld left it and flew with considerable loss of height to the Himmeldankberg

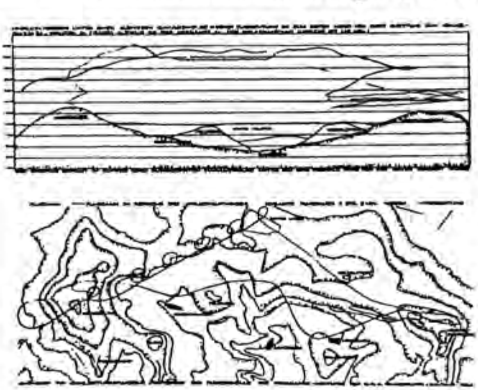


FIG. 22.
*The Himmeldankberg flight by R. Kronfeld.*

as pre-arranged, and there soared for some time in the up currents. On the approach of another cumulus cloud Kronfeld used it to gain considerable height, and then flying always from cloud to cloud he reached the Wasserkuppe at his maximum height of 540 m. above the starting point.

These details illustrate the difference between hill and cloud flying, between flying from hill to hill over a course, which must be adjusted to the contours of the ground, and flying from cloud to cloud over hill and plain, when the ground is ignored and the pilot scans the cloud formations and adjusts his course to their motion.

Fig. 23 gives a barogram of Groenhoff's flight with a passenger on the two-seater "Rhonadler," July 30th, 1929, and shows the extended performance obtained by flying into the cloud instead of soaring below it. Groenhoff started from the west slope of the Wasserkuppe and soared over it for a short time, then flew under a cumulus cloud and rose through it almost to its summit, reaching a maximum height of 1,250 m. above the starting point, and covering a course of 33.3 km., both figures being records for soaring flight with a passenger.

The rate of descent of the glider in still air was 1.1 m./sec., from which the vigour of the up winds may be inferred.

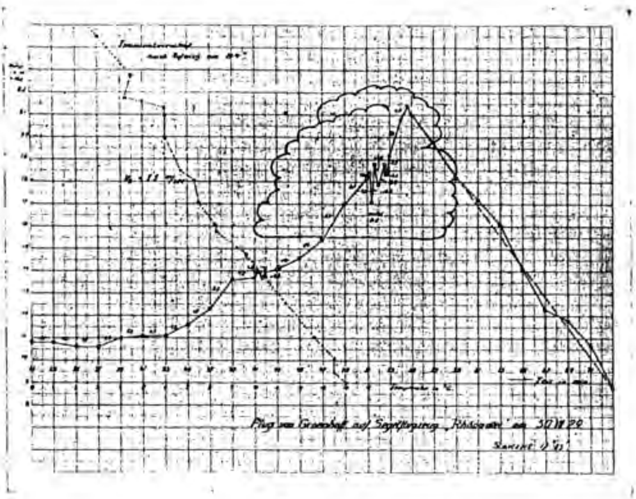


FIG. 23.
*Barogram curve of the flight by Groenhoff with a passenger on the 30th July, 1929.*


FIG. 24.
*The 150 kilometre flight by Kronfeld from the Wasserkuppe to Bayreuth, August, 1929.*

Severe vertical gusts were met with in the cloud. At 1,800 m. the glider was driven down 140 m. in a few seconds and immediately after it was carried up 170 m. Two more such gusts followed after. The chart shows a down current of 9 m./sec. and an up current of 10 m./sec.

On the same day and under the same weather conditions Kronfeld made his great cross-country flight of 150 km. from the Wasserkuppe to Bayreuth (150 km.) (Fig. 24).

Immediately after the start Kronfeld flew under a cumulus cloud and was carried up continuously to a height 2,150 m. above the starting point.

The up current given by the measurements was 5 m./sec.

After leaving the cloud height was slowly lost in passing over flat country. In two hours the Thuringenwald was reached, and the flight was continued for 4 hours in the rising currents from the ridges. Finally a landing was made at the Fichtelgebirge 150 km. from the Wasserkuppe.

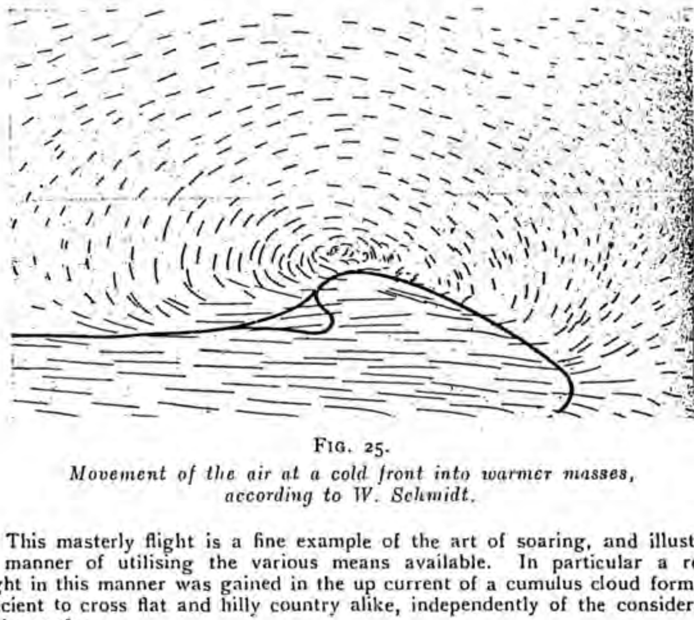


FIG. 25.

*Movement of the air at a cold front into warmer masses, according to W. Schmidt.*

This masterly flight is a fine example of the art of soaring, and illustrates the manner of utilising the various means available. In particular a record height in this manner was gained in the up current of a cumulus cloud formation sufficient to cross flat and hilly country alike, independently of the consideration of the surface.

The most important result is the ease with which great heights can be reached in the up currents of cumulus cloud formations. The second part of the flight gives fresh evidence of the value of the older established method of flying in the up currents from hills.

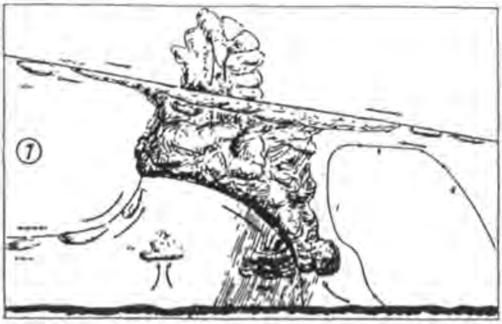
A more recent development of cloud flying is the use of up currents at the cold air fronts of line squalls, of which measurements with an engined aeroplane have been referred to. In this type of atmospheric disturbance masses of warm air are pushed up by the inrush of cold air along the surface of the earth.

Fig. 25 shows motion of the air caused by cold air flowing in under warm air (W. Schmidt), the lines of flow giving the local direction of the wind. In front of the line squall the air rises almost vertically and offers the best soaring region.

Fig. 26 shows Kronfeld's flight in front of a line squall (143 km.) and the time changes in the line squall along the course.


FIG. 26.

*Kronfeld's flight of 143 kilometres showing the advance of the storm front.*

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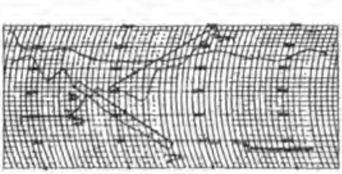

FIG. 27.

*Flight by Kronfeld of 143 kilometres before a line squall.*

(1) *Squall front and path of flight.*

(2) *Barogram.*

Fig. 27 (1) shows the region of up-currents before the cold front and Fig. 27 (2) the barogram of the flight.

Kronfeld started at the moment when the wind was freshening, just before the passage of the line squall, and by utilising the rising currents before the cold front rose 2,000 m. above the starting point. The middle part of the barogram shows that he then maintained steady flight.

The meteorological records determine the motion of the storm accurately, and in conjunction with the pilot's account lead to the conclusion that he flew about 2 km. before the front of the squall, rising or falling slightly as he was nearer or farther.

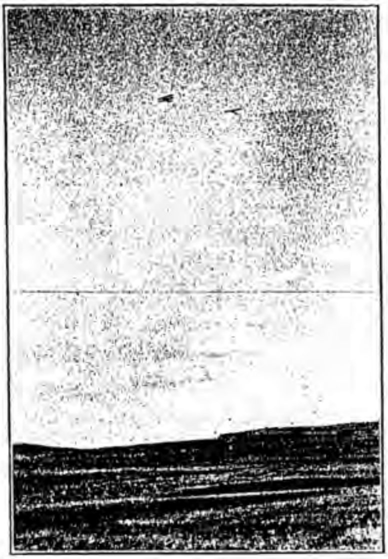

FIG. 28.
*Towed-flight on the Wasserkuppe.*

After turning away from the front the glider rapidly lost height and landed 143 km. from the Wasserkuppe after 4½ hours flight.

The knowledge gained as to the configuration of line squalls, leads to the conclusion that there is no danger if the pilot keep some distance before the advancing front.

It appears from recent investigations at the Research Institute of the Rhön-Rossitten Gesellschaft that heights of 4,000 m. to 4,500 m. above the starting point may well be attained, in comparison with the existing record of 2150, and that the cross-country record of 150 km. may be increased in like proportion.

Fig. 28 shows a flight with towed glider at the Wasserkuppe and Fig. 29 shows a flight with towed glider at Darmstadt.

Systematic experiments have been carried out by the Society with gliders towed by power aeroplanes and released at a sufficient height to reach regions of up-currents and to continue independent cloud flying.

The performances recorded above show that flying without engine power, by using the energy of rising currents in the atmosphere, is an established technique. We cannot, indeed, expect it to meet the requirements of air transport, but its value as a sport cannot be questioned, and as such it is on a high level in its demands for physical fitness, skill, quick decision and courage, and in addition for a serious study of the scientific and technical problems involved.

Especially, soaring flight has had a beneficial effect on the design of light aeroplanes which now give performances with low engine power which were possible formerly only with powerful engines. The soaring glider with an auxiliary engine is unsatisfactory both as a glider and as a power aeroplane, and this line of development has been given up in Germany except for special research work.

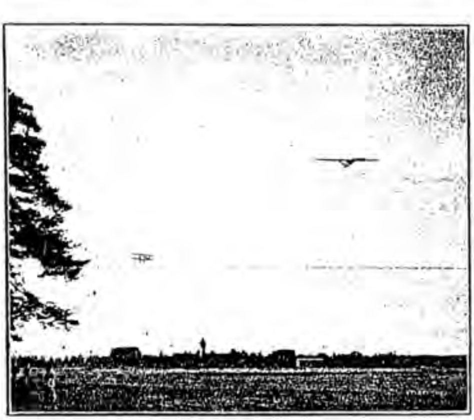

FIG. 29.
*Towed flight at Darmstadt.*

## THE PROSPECTS OF SOARING FLYING

The Research Institute of the Society has recently established a new and important system of aerodynamical tests of new aircraft types. In the first place free flights by large models of three to four metres span are carried out at small cost. When all that can be learned from the models has been recorded, gliders of similar aerodynamical form are built and tested by a pilot in different flying altitudes. Finally, an engine is fitted and ordinary flying tests are carried out. In this way the successive steps in the development of a new type are carried, with minimum of cost and danger, to a point where the design of the full-sized aeroplane offers no serious uncertainties.

The tailless "Storch" (Stork) was developed on these lines.

Fig. 30 shows the "Stork" in model size.
Fig. 31 ,, ,, in glider size.
Fig. 32 ,, ,, as a light aeroplane.

Fitted with an 8 h.p. engine it attained a speed of 125 km./hr., and attracted much attention at the Tempelhof Flying Ground by its speed, manœuvring and great stability, and gave impressive evidence in favour of this type of design. The question remains whether gliding is a sound basis

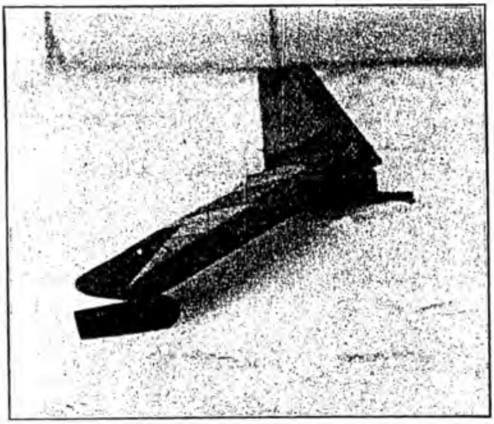

FIG. 30.
*Tailless aeroplane "Storch" as a model.*

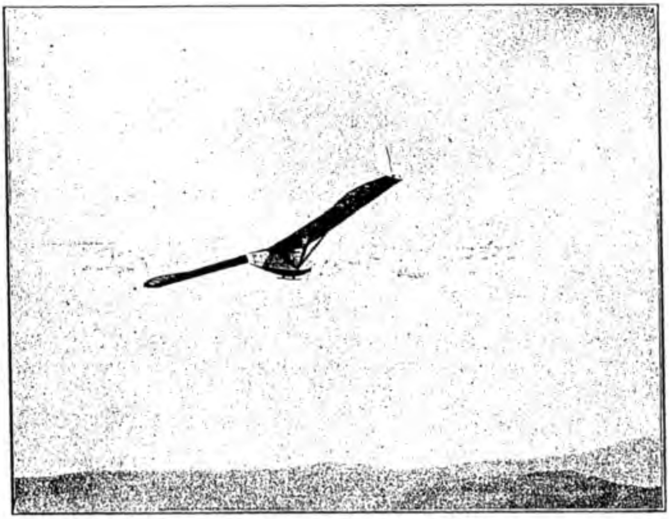

FIG. 31.
*The tailless aeroplane "Storch" as a sailing aircraft.*

for piloting a power aeroplane. Opinion is divided, but it may be taken that gliding is a sound basis for further training, and soon tests the balance, touch and eye. But a pupil who has mastered every branch of gliding still requires comprehensive further training when he goes on to power aeroplane piloting. Of far more importance than the preliminary training in hand and eye, is the extension of piloting experience to the special lore of the currents of the air, gathered in far richer measure during a flight of a hundred kilometres from hill to hill and from cloud to cloud, than in year-long flying on power aircraft. Such experiences will give a new generation of flying men a body of weather wisdom by which they may safely meet and even turn to useful purpose the atmospheric disturbances so frequently met with in air transport to-day. Pilots of this school will imitate the exploits of Kronfeld, and so far from fearing wind and weather will master them and ride the storm front in their flights across the land. The true meaning of "air sense" lies in this conquest of the variable

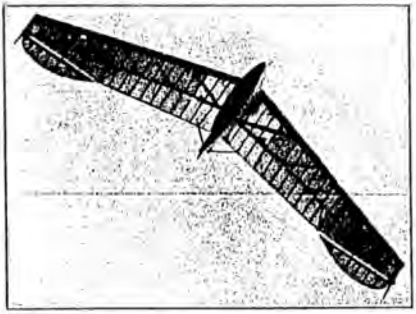

FIG. 32.

*Tailless aeroplane "Storch" with 8 h.p. D.K.W. engine.*

atmosphere by the soaring pilot. Just as the master of a great liner must serve an apprenticeship in sail craft to learn the secret of sea and wind, so should the air transport pilot practise soaring flights to gain wider knowledge of air currents, to avoid their dangers and adapt them to his service.

In confirmation of this view, pilots with soaring experience have shown their special worth in the difficult Lufthansa service across the Alps.

It has not been possible within the limits of this paper to describe more fully the growth of soaring flight, its present activities, its new problems and its future scope. I would call in aid all civilised nations, and particularly your own, in advancing its achievements to a higher level and opening to its activities all regions of the earth, temperate and tropical.

May I conclude with the hope that the unusual combination of scientific and sporting interest will bring you to join us, in friendly rivalry, in opening the regions of the air to man by means of soaring flight.

# THE FLYING SCHOOL AT THE WASSERKUPPE

BY

## FRITZ STAMER

The site of the Flying School was selected on a gentle eastward slope about midway between the southern slope of the "Wasserkuppe" and the western slope of the "Weltensegler," a ridge running at right angles to the former, the slopes of which are most used for training glides. The hangar, 60m. by 12m., was built of timber, with a cantilever roof requiring few supports and with drop doors at each end. The pupils are boarded at the school for convenience and for better supervision and direction of their spare time activities. It was also necessary to provide workshops and offices, and quarters for the mechanics and instructors and for the head of the school. A single building, also 60m. by 12m., adjacent to the hangar contains living quarters below, and a workshop above; a long central passage leads to a hall, on the south side, off which are the quarters of the Director of Research and of the Head of the School, and the kitchen premises; on the north side a woodworking shop equipped with a combined plane and shaping machine, a combined circular saw milling and slotting machine, and a hand saw. On both sides of the passage are pupils' rooms, each equipped with four beds and four cupboards, etc., and accommodating four pupils. From 25 to 30 pupils can be boarded normally, but in recent years the average has been 40 to 45, the additional pupils being boarded in an annexe not far from the school buildings. Off the passage there are also reading and writing rooms and a wind channel room for experiment and instruction. On the south side are a few guest rooms, and instructors' and mechanics' quarters. Two covered passages connect quarters and hangar, and off these passages are sick bay, bath room, large washing room and laundry. Above the machinery is a materials store. The rest of the upper floor is occupied by the school workshop lit by a long skylight. It has benches for 12 to 15 mechanics, a lathe, drill, and welding plant for metal working, and wood working equipment. Electric lighting and power is installed. This building, like the hangar, is entirely built of timber, with double boards and sandstone filling, and with untarred papier maché roof. The central heating plant and coal store are in the cellar under part of the residential building. Water is pumped electrically from a small well, sunk in the hillside, into tanks in the school building. Common meals are taken in the dining hall, and instruction is given in the large lecture hall, both in Ursinus House. Lectures are given by the instructors and by Heads of Sections in the Research Department. The sheds in the neighbouring "flying camp" have also been taken over.

The beginners' course includes pupils holding only the A certificate for glider pilots. Pupils who have passed the B glider test or who hold full pilots' certificates are classed as advanced.

In a session of seven months from 200 to 250 pupils pass through the course, and fifteen gliders of five different types are in constant use :—

6 of Zögling type for beginners.
3 of Prüfling type for soaring practice.
2 of Hangwind for soaring in light winds.
2 of Canossa two-seaters for soaring.
2 of Professor type for high performance soaring flights.
—
15 total.