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TECHNICAL MEMORANDUMS

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 623

ELEVENTH RHÖN SOARING-FLIGHT CONTEST, 1930

By Walter Georgii

Zeitschrift für Flugtechnik und Motorluftschiffahrt
Vol. 22, No. 5, March 14, 1931
Verlag von R. Oldenbourg, München und Berlin

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Washington
June, 1931

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ELEVENTH RHON SOARING-FLIGHT CONTEST, 1930*

By Walter Georgii

In 1930 the general conditions considerably increased the difficulty of a successful conduct of the contest. The economic situation made it very hard for the various soaring-flight clubs to obtain the requisite funds for participation in the contest. It was also difficult for those in charge to collect sufficient money for the expenses of management. Despite the general economic depression and the bad weather (it being possible to fly on only ten of the sixteen contest days, while rain and clouds prevailed on the remaining days), the success of the contest was unquestionably great. Progress was manifest not only in the fact that, despite the much less favorable flight conditions, the performances of the previous year were considerably excelled, but also by the general improvement in the maximum performances. There were not only outstanding performances by the best pilots, but these met with more competition and were pushed to still greater performances during the progress of the contest, especially in the endurance flights. With distance flights of over 100 km (62 miles), Kronfeld is still ahead, but more interest was aroused in this most difficult of all soaring-flight contests by the fine performances of a number of younger contestants. It is especially gratifying that systematic soaring flight was successfully accomplished this year by the youngest contestant.

The conditions for the eleventh soaring-flight contest were essentially the same as for previous contests. The contestants were divided into three classes: primary, practice and performance. The conditions for the primary class were generally of only a formal nature. Prizes were offered for soaring flights to be made between May 15 and August 17, 1930, at the home fields of the primary gliding clubs. There were many of these local contests, the most important ones being the Borckenberg contest in Westphalia, the West Group of the D.L.V. (Deutscher Luftfahrt Verband), the second Bavarian soaring-flight contest at Hesselberg south of Ansbach and the gliding and soaring-flight contest of the Württemberg Aero Club. At Hesselberg

*"Bericht über den 11. Rhon-Segelflug-Wettbewerb," a paper read before the W.G.L., November 14, 1930. From Zeitschrift für Flugtechnik und Motorluftschiffahrt, March 14, 1931, pp. 129-140. Verlag von R. Oldenbourg, München und Berlin.

soaring flights of long duration were made. The local contests doubtless contribute much to maintaining the interest in soaring flight and thus constitute an important auxiliary of the Rhön contest. Moreover, the preliminary primary contest at the Wasserkuppe afforded the clubs considerable technical instruction aside from the practical training. The mere fact of the primary contest and the performance contest being held contemporaneously awakes in the primary contestants the desire for soaring flight and afforded them the opportunity to obtain technical information regarding the construction of high-performance gliders or soaring planes. The ambition of the primary gliders to learn soaring flight through gliding flight should be encouraged, in order to insure the continued development of unpowered flight. The main province of gliding flight should be to afford preliminary training for soaring flight. Gliding flight is an excellent means to awaken interest in flying and to inculcate the first conceptions of an airplane and of flight. It can, however, satisfy only the beginner and loses its fascination for an advanced flier, unless followed by soaring flight. Just this necessary transition from gliding to soaring flight is promoted by the preliminary Rhön gliding contests by giving the contestants the incentive to soaring flight and awakening in them the desire to build soaring planes. In this gathering of all the clubs and individuals devoted to unpowered flight, the Rhön contest is not only a sporting event, but an annual convention of the air-minded German youth, from which the unanimity of sportive thought, technical activity and aeronautic information, so characteristic of the German soaring-flight movement, can develop. To this unanimity is largely due the unexampled ascendancy of German soaring flight. It might be to the interest of German progress in soaring flight to consider from time to time this process of development and the problems arising from it.

The proclamation of the practice and performance contests in general increased the minimum requirements for the Eleventh Rhön Soaring-Flight Contest. An innovation for the practice contest was the closed-circuit flight, in which the aircraft must fly at least 5 km (3.1 miles) from the Wasserkuppe and return to the starting point without any intermediate landing. The chief results of the practice contest are given in Table I.

Before 1928 little attention was given to endurance flights in the Rhön mountains. After the wind ascending the west slope of the Wasserkuppe had been utilized to the best advantage during the previous years, no further important results were to be expected, aside from the thrill of surpassing previous performances and the practice flights of young aviators. The year 1928 brought a revival of endurance flying on the slopes of the Wasserkuppe. In that year endurance flying assumed greater importance through the utilization of up-currents under clouds in

addition to the winds up the mountain slopes. This added a greater charm to endurance flights and was of great training value, because the pilot had to accustom himself to the difficult conditions of cloud flight. Moreover, the scientific value of endurance flights was greatly enhanced by combination with cloud flying, because it often afforded an opportunity to study the upward currents in the vicinity of clouds. This year's endurance flights afforded exceptionally valuable data in this respect. Under these circumstances it is especially gratifying that the interest of the pilots in endurance flying has considerably increased during the last three Rhön contests. In connection with the results of the 1930 endurance flights, as given in Table I, it is interesting to note the unusual physical and psychical demands on a pilot participating at intervals in the contests, sometimes on two successive days, unprotected from the cold, his every motion restricted in the small fuselage, usually with an empty stomach, for six to eight hours in continuous flight over the western slope of the Wasserkuppe. In 1929 only two flights of over five hours were made. In 1930 there were twelve flights of over five hours, seven of which exceeded seven hours, the longest flight of all (8 hr. 36 min.) being made by Van Husen of the Göttingen Academic Aero Club on the "Jupp Pitter." This was an hour short of the Rhön endurance record of 9 hr. 36 min. made by Hemmer in the summer of 1930, but surpassed the best record of the 1929 Rhön contest. The considerable improvement in the results of the practice contest over previous years did not consist, however, in the single peak performance, but in the larger number of excellent performances. Starck, of the Darmstadt Academic Aero Club, made three flights exceeding five hours each over the west slope of the Wasserkuppe, and won the hard-contested Swabian prize for his club. Pätz, of the Aachen Scientific Aero Club, who piloted the "Rheinland," had to yield the endurance record by a small margin to the "Darmstadt," although he had two flights of over 7.5 hours to his credit.

In 1929 there were, for the first time, eleven gliders soaring simultaneously over the west slope of the Wasserkuppe. In 1930 the number was increased to fourteen, or nearly half of all the gliders participating in the contest. Of the seventeen gliders taking the air on that day, only one met with an accident. This formed quite a contrast with the previous year, when under similar conditions, five gliders, out of six which took off, fell victims to the weather conditions. This comparison well illustrates the progress which has been made in soaring flight.

The expectation that endurance flying would enable the attainment of higher altitudes, has also been fulfilled. Cloud flying has made it possible to reach altitudes of several thousand meters. Test flights with powered airplanes in the vicinity

of cumulus clouds have shown that the upward currents in and above the clouds sometimes reach altitudes of 4000 to 5000 m (13123 to 16404 ft.). In the 1930 contest the high altitude of the previous year, 2160 m (7087 ft.) by Kronfeld, was not reached. The weather conditions of the 1930 contest made the attainment of high altitudes very difficult, the possibility of cloud flights being limited to the last day of the contest. The brief duration of the vertical cloud currents was skillfully utilized, however, by several pilots. The highest altitudes were reached by Bedau on "Luftikus" with 1640 m (5380 ft.), Starck on "Darmstadt" with 790 m (2592 ft.) and Hemmer on "Schloss Mainberg" with 620 m (2034 ft.). Bedau, who, as a new class-C flier, had distinguished himself the previous year by an altitude flight, exhibited special skill in 1930. His flight was one of the most remarkable and instructive performances thus far accomplished. It demanded of the pilot not only a knowledge of piloting, but also exceptional nerve. During an endurance flight on the last day of the contest, Bedau's glider was suddenly seen to emerge in steep spirals from a cumulus cloud. Bedau had evidently lost the sense of balance and had fallen out of the cloud. Beneath the cloud he succeeded in levelling off and, undisturbed by this exceptional experience which would have been fatal for a weaker craft, completed an endurance flight of 7 hr. 34 min. The barogram of this flight is very remarkable. Figure 1 shows the altitude-time curve of the flight in the cloud. Bedau first soared in the upwind of the Wasserkuppe. In the 214th flight minute he entered the upwind of a cloud which gradually carried him to 1600 m (5249 ft.) absolute altitude. After the first climb, the upwind slackened until suddenly in the 226th minute an exceptionally strong upwind lifted the glider over 900 m (2953 ft.) in three minutes. The swift ascent was followed by the fall, during which the glider acquired a falling speed of about 25 m (82 ft.) per second and then went into spiral flight during which it emerged from the cloud. On the basis of a sinking speed of 0.7 m (2.3 ft.) per second for the "Luftikus," a vertical speed of 6 to 7 m (20 to 23 ft.) per second was attained in the cloud. This is very large in an ordinary cumulus cloud of about 1200 m (3937 ft.) height. It considerably exceeds previously measured vertical velocities and shows still clearer that in innocent appearing cumulus clouds vertical velocities occur which are commonly expected only in storm clouds. The sudden transition from a low vertical velocity to a very high one, as shown in Bedau's barogram in the 26th minute, warrants the assumption that the upwind in the cumulus cloud is ascribable to an eddy with either a horizontal or vertical axis. There are many possibilities for the formation of such an eddy in the flow of the air over opposing elevations. Figure 2 shows how such an eddy might be developed over a declivity by the meeting of the swifter upper currents with the slower upward currents produced

by the slope with the aid of thermal upcurrents. As represented, this eddy has a horizontal axis, but it can go over into an eddy with a vertical axis by bending downward either in or under the cloud. The flow is something like that in a waterspout. Observations made from other gliders indicated the existence of such eddies. On October 10, 1930, Chlingensperg flew from the Wasserkuppe to Mellrichstadt on a glider of the "Professor" type (Fig. 3). While still in the vicinity of the Wasserkuppe he soared to 660 m (2165 ft.) above the starting point by utilizing the upwind of a cloud. He was then about 200 m (656 ft.) under the bottom of the cumulus cloud. Here he noted a tendency of his craft to turn sidewise, even with strongly opposing rudder. This phenomenon warrants the assumption of a vortical motion in the region of the cumulus upwind, into which the craft tended to turn.

Bedau's flight showed clearly what valuable results for the kinematics of the atmosphere can be obtained by cloud flying. The investigation of the vertical motions of the air is of interest to all aviators, especially as there is yet so little reliable information regarding them. The occurrence of such swift vertical currents in normal cloud formation, as were encountered during Bedau's flight, seems quite worthy of note even for powered flight and especially for airship flight. The practice of cloud flying and of flight on the front of storms is desirable, in order to utilize the possibilities thus offered for improving the performances of soaring flight. Bedau clearly demonstrated that such flights developed unusual stresses in the aircraft. During the past year the storm flights of Hemmer and Muschick showed that high-performance gliders can generally withstand these stresses. In future construction there should be no diminution in the strength of such gliders.

The prizes for the maximum time in the air were won by Starck, Bedau and Patz on the "Darmstadt," "Luftikus" and "Rheinland" with $27\frac{1}{2}$, $24\frac{1}{2}$ and $16\frac{1}{2}$ hours, respectively. Bedau and Starck obtained, respectively, first and second prizes for the highest average maximum altitude of five flights - 734 m (2408 ft.) and 520 m (1706 ft.). Hemmer stood third with 250 m (820 ft.). From the previous statements regarding endurance flights, it is obvious that the gliders making the longest endurance flights would naturally lead in the altitudes reached. During the endurance flights, the third principal contest for the practice class, the closed-circuit flight, was won with very little effort by the "Darmstadt" and "Luftikus." For a short time in the afternoon of August 17, favorable upward cloud currents prevailed. Starck, who had already been in the air several hours reached an altitude of 760 m (2493 ft.) under a cloud and utilized this altitude to fly in the direction of Fulda 5.45 km (3.4 mi.) from the starting point and back to the Wasserkuppe. Bedau did likewise, flying directly behind the "Darmstadt," though at

at a lower altitude of only 400 m (1312 ft.) above the starting point. Bedau's turning point was 5.15 km (3.2 mi.) from the Wasserkuppe. Both gliders followed the direction of a cloud chain or "cloud street" which stretched to the westward of the Wasserkuppe in the direction of Fulda. The round flight was easily made in the upward currents of this "cloud street." After Starck and Bedau, Patz also made the closed-circuit flight on the "Rheinland," showing how favorable the flight conditions were on that day outside the up-current region of the Wasserkuppe.

In the performance class a prize was offered for a flight of at least 25 km (15.5 mi.) in the direction of Fulda. This prize was offered on the assumption that the flight would have to be made entirely with the aid of the up-current under the clouds. It was prescribed for the direction of Fulda, because it was hardly possible to utilize mountain slopes in that direction. This contest was not flown, because the favorable conditions of August 17 did not recur during the whole period of the contests.

The soaring flight of Hurrstig in the performance class supplemented and emphasized, from the scientific viewpoint, the above statements regarding storm flights. Even the distance flights of Kronfeld and Groenhoff have their scientific significance. It is characteristic of the long soaring flights of 1930 that they were made chiefly in upward currents produced by mountain slopes, in contrast with those of 1929, when the exceptionally favorable weather conditions enabled long flights with the aid of the cloud currents and with very little effort. The flight barograms, which indicated climbs to 3000 m (9842 ft.) naturally yielded important scientific data. The relatively low altitudes attained in the individual distance flights plainly indicate that the cloud currents contributed very little to their success, but that the flights from hill to hill had to be made principally with the slope currents. Since the longest flights of 1929 were excelled under such conditions, the skill of the pilots and their sensitivity to the greatly varying terrain must be held in so much greater regard. The success of the 1930 contest under these conditions must be given a still higher value than is expressed simply by the numerical results.

The 1930 performance contest plainly indicated the extraordinary difficulties encountered by an inexperienced pilot in distance flights. The decision to leave the known reliable up-wind field of the Wasserkuppe costs the novice a great effort of will. It is important in every distance flight which is to depend entirely on the up-currents produced by the slope of the ground, to determine in advance the route to be followed under the given wind conditions. The pilot must know just what elevations he is to fly over and must be careful to follow the route

corresponding to the wind. Flights, of which only the first part has been previously determined in the hope of being able to take advantage of conditions arising during the flight, are almost certain to end prematurely. It cannot be emphasized too strongly that participation in the Rhön performance contest requires a careful preliminary study of the route to be followed. It is desirable for the pilot to trace his route on a map, under the assumption of certain wind conditions, and to so fix it in mind that, in the contest with suitable weather conditions, he knows just what route to follow and what hills to fly over in order to encounter the most favorable up-currents. It never suffices to adopt a general direction, but all the details of the contemplated route must be thoroughly worked out in advance for a given direction of the wind. With the exception of Nehring and Kronfeld, hardly a pilot has hitherto made such a careful preparation for the performance contest, though the systematic planning of certain stretches in preparation for the contest constitutes the most important condition for success. To this careful planning were due the successes of Nehring and Kronfeld in distance flights. Kronfeld was no "pathologically gifted" soarer, but an unusually sensible pilot, who first thought out his flight with understanding, before executing it with skill. Especially with reference to the experiences of the 1930 contest, it appears necessary to call attention to the requirements for distance flights aside from piloting skill, since the neglect of these requirements spells failure for even the most skillful pilot. Herein lies the great charm of distance flying.

As already mentioned, the pilots who flew their first performance contest in 1930 were confronted with especially difficult tasks since, due to unfavorable weather, the low altitudes attained rendered it difficult to overcome the dangerous down-currents at certain points. Nevertheless, Mayer, one of the less experienced pilots in distance flying, after a few short practice flights, accomplished an excellent flight of 46 km (28.6 mi.) to Marisfeld near Meiningen. Hurttig, of the "Niederhessischer Verein für Luftfahrt" made three flights of 39.3, 40.2 and 51.1 km (24.4, 25.0 and 31.8 mi.), respectively, the first two being pure gliding flights and the last one a masterpiece of soaring flight. The first two followed Nehring's favorite route toward Kieselbach and Leimbach. It was this route that Nehring chose for his first long flight of 51 km (31.7 mi.) in 1927 and for his flight of 71.2 km (44.25 mi.) in 1928, because it offered an almost continuous upwind field. Kronfeld also followed this route in 1930 and, after a flight of 51.5 km (32 mi.), landed near the spot where Nehring landed in 1927.

Hurttig's soaring flight resembled the cloud flight of Kronfeld in 1929, although he did not fly so far. On August 13, several wind squalls passed over the Wasserkuppe. The first one,

which struck the Wasserkuppe at 2:30 P.M., was utilized by Kronfeld to begin his soaring flight toward Rehau. The intensity of this squall was relatively small, however, and its upwind region was not very pronounced. The second squall, which struck the Wasserkuppe toward 4 o'clock, was well developed and carried a roll of clouds on its front. The rapid progress of this squall prevented the gliders from starting at the right moment. A third squall arrived from the west at 5:30, and Hurrstig started at the right moment with his glider "Elida" and flew toward the west to meet it. It was disadvantageous that the squall was exceptionally low and enveloped the mountains with clouds. A few minutes after the start, Hurrstig reached the upward region of the squall and quickly rose to 320 m (1050 ft.) above his starting point. He remained on the front of the squall until it was retarded by the Hohe Rhön beyond the Ulstertal and was left behind the glider (Fig. 4). Over the east slope of the Hohe Rhön, Hurrstig struck a downward region and lost considerable altitude. Between the Hohe Rhön and Geba, he again made contact with the squall which was forming a new front beyond the Hohe Rhön. Here he rose to 380 m (1247 ft.) above his starting point and continued at about this altitude during a large portion of his flight. This portion of the flight, which was made about a hundred meters in front of the squall, closely resembled the storm flight of Kronfeld in 1929 (W. Georgii, "Bericht über den 10. Rhön-Segelflug-Wettbewerb," Zeitschrift für Flugtechnik und Motorluftschiffahrt, 1930, page 81). Hurrstig left the storm front beyond Meiningen and landed at Schleusingen after a long glide. Figure 4 is a diagrammatic representation of this instructive storm flight. The dotted streamlines are not intended to represent a continuous field of flow, but only the upwind region in front of the squall, in order to show its relation to the altitude curve of the "Elida" at certain points. Hurrstig thus demonstrated anew that, with proper care, it is no acrobatic stunt to fly in front of a storm, but a well-considered plan for utilizing the not inherently dangerous energy of a storm front.

The distant-goal flights, to some given point several kilometers from the Wasserkuppe and return, have been, since 1926, a regular part of the Rhön-contest program, because it requires careful planning and skillful execution and generally great tenacity and perseverance. These flights have contributed materially to the progress in soaring flight during recent years. In 1930 the requirements were raised considerably by designating Kreuzberg, 15 km (9.3 mi.) from the Wasserkuppe, as the goal, thus increasing the total distance there and back by 10 km (6.2 mi.) as compared with the preceding year. Moreover, the flight was rendered still more difficult by the nature of the terrain, since the summits of Himmeldankberg, Simmelsberg and Dammersfeld must be flown over, on the lea side of which, with a westerly wind, there is a dangerous downwind field which renders the

Kreuzberg flight exceedingly difficult. Hence it is all the more gratifying that the distant-goal prize was won by two gliders of the performance class, first by the soaring glider "Wien" piloted by Kronfeld, and a few days later by the "Fafnir" piloted by Groenhoff. Here again Kronfeld exhibited his characteristic tactics of choosing a definite goal for every flight. On the morning of August 12, 1930, the day of Kronfeld's Kreuzberg flight, the weather map forecast the passage of a storm in the afternoon. The approach of this storm was the signal for the pilots of the performance class to take off at once. Groenhoff took off first on the "Fafnir." After him came Mayer of Aachen followed by Kronfeld and lastly by Kegel on his "Kassel." Mayer succeeded in making a flight of 20.2 km (12.55 mi.) toward Gerhausen east of the Hohe Rhön. Kegel flew only 15 km (9.32 mi.) to Tann. The front of the squall apparently did not bring the expected upwind velocity.

This was particularly manifest in the case of Kronfeld, who flew along the front of the squall in the direction of Milseburg (Fig. 5). He often disappeared in the clouds, but lost considerable altitude over Milseburg. Here he showed his characteristic tactics. After deciding that further flight along the front of the squall could yield no noteworthy result, he did not await the possibility of a more favorable situation but, after the failure of his first plan, he immediately adopted Kreuzberg as his new goal. Although Kronfeld was still near Milseburg and the flight from there to Kreuzberg was more difficult than from the Wasserkuppe, he immediately undertook the attainment of the new goal with all his energy. From Milseburg he flew back toward the Wasserkuppe, crossed the Gersfeld valley and reached the Simmelsberg where he remained for a long time, now losing and now gaining altitude, until he could finally attempt the flight to the Kreuzberg. After encircling the Kreuzberg, he returned to the Simmelsberg, where he had to battle again with variations in the force of the upwind until he reached an altitude which enabled him to fly back along the Himmeldankberg and the Rotes Moor to the Wasserkuppe. During the last part of the flight, from Simmelsberg to the Wasserkuppe, he reached his highest altitude, which enabled him to land very near the starting point. Figures 5 and 6 show the course of Kronfeld's Kreuzberg flight and how it was made exclusively in upward currents produced by the mountain slopes. All the flight paths were plotted from the measurements made by W. Harth's surveying squad. The excellent work of this squad contributed greatly to the frictionless development of the contest and enabled a thoroughly scientific analysis of the flights.

On the very day of his Kreuzberg flight, Kronfeld gave another demonstration of his untiring zeal for aviation. He took off on the Kreuzberg flight at 2 P.M. and landed on the Wasser-

kuppe at 4:15. Ten minutes later he was again in the air, prepared to carry out his original plan of attempting a distance flight. On this day he made his first attempt in simple soaring flight in the slope wind to pass over the Rhön in an easterly direction and reach the Thuringian Forest. After a flight of 41 km (25.5 mi.), he landed at Fambach, only a few miles from the first heights of the Thuringian Forest. On no other occasion in the history of soaring flight have two such flights been made in a single afternoon.

Groenhoff's Kreuzberg flight of August 17, 1930 (Figs. 7 and 8), was similar to Kronfeld's flight, excepting that Groenhoff accomplished the flight to the Kreuzberg more easily. After several hours of soaring over the west slope of the Wasserkuppe, aided by the upwind under a cloud, he reached an altitude of 790 m (2592 ft.), which enabled him to reach the Kreuzberg in a flat glide and begin the return flight. The return to the Wasserkuppe proved much more difficult. In the critical downwind region between Arnsberg and Himmeldankberg, Groenhoff lost so much altitude that he could not fly over the summit of the latter. He therefore turned back toward Arnsberg and again acquired altitude by flying slowly back and forth over its brow. He then glided toward the Himmeldankberg but again in vain, as he was unable to cross the summit and reach the saving lea side of Himmeldankberg. It was with great difficulty that Groenhoff returned to the Arnsberg and acquired altitude again. The up-current at Arnsberg lifted him from 200 m (656 ft.) below the starting altitude back to that altitude. With this very slight reserve he attempted, for the third time, the passage over the Himmeldankberg, this time with success. He passed over the latter at the height of the tree tops and reached the upwind on the lea side of the mountain. Groenhoff had to tarry a long time over the Himmeldankberg and the Simmelsberg before he could finally venture to cross over Gersfeld and return to the Wasserkuppe. Every one was therefore surprised when Groenhoff's glider appeared over the Eube late in the afternoon. Groenhoff took off from the Wasserkuppe at 1:45 P.M. and, after the Kreuzberg flight, landed near the starting point at 7 P.M.

For years the chief events of the Rhön contest have been the distance flights. In them the pilots show their endurance and skill in the utilization of up-currents. The spectacular distance flights of Nehring in 1927, 1928 and 1929 were all made with the sole aid of mountain-slope winds, as likewise was Kronfeld's first 100 km (62 mi.) flight over the Teutoburg Forest. The long flights of Kronfeld from the Wasserkuppe to Thuringia and Upper Franconia in 1930 were made without regard to the nature of the terrain simply by the utilization of up-currents in proximity to storm clouds. The skillful methodical use of cloud and mountain up-currents is the secret of distance flying. Un-

fortunately, nature is seldom so generous as to provide both kinds of up-currents simultaneously. Cloud currents were almost entirely lacking at the eleventh Rhön soaring-flight contest, those which did develop being too weak to enable such flights as Kronfeld's 1929 flight to Geba in Thuringia.

Long-distance flights with the aid of mountain currents alone are only possible by flying from the Rhön to some other mountain with favorable up-currents. Flights of only 50 to 60 km (31 to 37 mi.) from the Wasserkuppe can be made by the utilization of the Rhön mountains alone. The endeavor to lengthen the flights without the aid of cloud currents led to the adoption of routes rendering it possible to pass from the Rhön to other mountains. In this connection the natural goal from the Wasserkuppe is the Thuringian Forest, which, extending from the northwest to the southeast, presents a prominent obstacle to southwesterly and westerly winds, thus producing excellent up-wind conditions. The continuation of the Thuringian Forest by the Franconian Forest and the Fichtel Mountains and further by the Bohemian and Bavarian forests in the same direction offers the possibility of flying from the Wasserkuppe to the Danube by means of mountain up-currents alone.

Attempts were made to fly from the Wasserkuppe to the Thuringian Forest, as soon as it was found possible to make 50 km (31 mi.) or more in unpowered flight. Nehring was the first to recognize the possibilities of this route and to make the first attempt, in 1927, to reach the Thuringian Forest from the Rhön Mountains. This attempt revealed the great obstacles to be overcome. With a westerly wind, the worst obstacle is the strong downwinds in the lee of the Hohe Rhön, which were very noticeable, e.g., during Hurttig's flight (Fig. 4). The stretch between the Hohe Rhön at Frankenhain and the Geba (the most easterly foothill of the Rhön), is rendered so difficult by the downwind region that, thus far most of the gliders attempting the flight have been forced to land. In his first flight in this direction in 1927, Nehring had to land at the foot of the Geba. Likewise, in the 1930 Rhön soaring-flight contest, Mayer, Krebs and Groenhoff were all forced to land in the vicinity of Geba. The flight from Geba to Dolmar (the first foothill of the Thuringian Forest) is also attended by difficulties, because the adjacent hills on both sides of the Werra Valley hardly reach an altitude of 500 m (1640 ft.) above sea level. On this stretch, Hirth had to land only a few miles from Dolmar in his fine flight from the Wasserkuppe to Metzels in 1929. On the Wasserkuppe-Geba-Dolmar route the distance between the Geba and the Dolmar is 17 km (10.6 mi.). Farther north, between the Plessberg at Salzungen and the Altenstein at Liebenstein (Thuringia), the distance between the Rhön range and the Thuringian Forest is only 14 km (8.7 mi.). The orographic conditions are more favorable for

reaching the Thuringian Forest by this northern route along the Hohe Rhön across the Baier to the Plessberg. The negotiation of the remaining 14 km (8.7 mi.) from Pless to the Thuringian Forest seems comparatively simple (Table III).

Figure 9 is a cartographic representation of these flights. Thus far only four of the attempts to fly to the Thuringian Forest have been successful. Of these, Kronfeld's 1929 flight to Lienlas in Bavaria was chiefly a cloud flight. Also in Groenhoff's flight of October 10, 1930, which reached the Dolmar, the cloud upwind aided materially during the first part (Fig. 10). The longest flights yet made on the Thuringian Forest route were the two flights of Kronfeld in the 1930 Rhön contest to Rehau near Hof and to Marktredwitz in the Fichtel Mountains. In these flights he not only accomplished the difficult passage from the Rhön to the Thuringian Forest by way of the Geba and the Dolmar without material aid from storm fronts or cloud upwinds, but also utilized to the full the mountain upwinds along the Thuringian Forest. As Kronfeld's 1929 flight demonstrated the possibility of flying over a hundred kilometers with the aid of cloud upwinds regardless of hills and valleys, so his 1930 flights to Rehau and Marktredwitz demonstrated the possibility of flying a like distance in the mountain upwinds, where the success of flight depended every moment on the correct appraisal of the wind. The representation of his 150.3 km (93.4 mi.) flight to Rehau (Fig. 11) shows very clearly the difficult and masterly performance (even aside from the distance covered) as compared with the flights of the preceding year. Just as Kronfeld was starting on the west slope of the Wasserkuppe for his long flight to Rehau, a weakly developed squall was approaching. Kronfeld flew along its right side in order to reach its rear front. This front carried him quickly to an altitude of 300 m (984 ft.), but was too weak to carry him overland. In the lee of the Hohe Rhön he lost altitude, so that he was 200 m (656 ft.) below the summit of the Wasserkuppe when he reached the Geba and was able to acquire altitude again. In the flight from Geba to Dolmar he again lost altitude, which he regained and considerably increased, however, over the Dolmar. From the Dolmar he began the long flight along the Thuringian Forest which he was able to accomplish without dangerous loss in altitude. At the foothills of the Franconian Forest his glider, the "Wien," again lost altitude. During the entire flight over the Thuringian Forest and the Franconian Forest, Kronfeld was followed by a storm front, which he left, however, at 4 P.M., between Dolmar and Hermansberg. Figure 9 shows the ground plan of the flight of the "Wien" to Rehau and also the direction of the following squall. It is seen that the storm front followed 1/4 to 1/2 hour behind the glider. At Munchberg, where the southern spurs of the Franconian Forest meet the Fichtel Mountains and where the prevailing wind was very unfavorable for further flight, Kronfeld awaited the pursuing

storm front in order to secure its support for the continuance of his flight. The upwind in front of the storm brought the "Wien" a gain of 700 m (2297 ft.), making its altitude 1650 m (5413 ft.) above sea level, the greatest of the whole flight. For the next twenty minutes Kronfeld succeeded in maintaining approximately this altitude by keeping just in front of the storm (Fig. 12). Unfortunately the continued worsening of the weather, the enveloping of the mountains with clouds and the approach of darkness soon forced Kronfeld to break away from the storm front and glide to the land. He landed at Rehau after a flight of 150.3 km (93.4 mi.). On August 24, Kronfeld again flew over the same route. This time he obtained still less support from storm winds than in the August 13 flight. With the support of the mountain winds alone, he flew over the Rhön, the Thuringian Forest and the Franconian Forest and, by deviating from his former route, also over the Fichtel Mountains. He landed at Marktredwitz, after flying 164.8 km (102.4 mi.).

These two flights represent the peak of the eleventh Rhön soaring flight contest. For the development of soaring flight they have the exceptional value of showing how long distances can be flown in the up-currents due only to mountain slopes without up-currents due to cloud formations. The exceedingly favorable weather conditions for cloud flying in 1929 and the high altitudes attained, together with the easy flight over long distances with almost the certainty of powered flight, doubtless led to the underestimation of the possibilities of mountain winds for long flights. The 1930 Rhön contest has reestablished the latter method of flying on a par with cloud flying. Moreover, the 1930 contest has clearly indicated the great goal of future contests, namely, the flight from the Wasserkuppe to the Danube. The possibilities of this route enable the confident expectation of still longer flights in future Rhön soaring-flight contests.

TABLE I. Endurance and Altitude Flights

Contestant	Name of glider	Pilot	Longest flight		Total flying time		Maximum altitude	Mean altitude (5 flights)
			hr.	min.	hr.	min.		
Akaflieg Darmstadt		Starck	7	50	27	28	790	520
			6	17				
			5	19				
Flugwiss. Vereinig. Aachen	Rheinland	Pätz	7	49	16	31	502	-
			7	39				
Berliner Segelflug-Verein	Luftikus	Bedau	7	34	24	35	1640	734
E. Dittmar	Schloss Mainberg	Hemmer	7	27	-	-	620	-
Akaflieg Dresden	B 9	Muschick	6	53	-	-	-	-
Akaflieg Stuttgart	Stadt Stuttgart	Röhm	5	54	-	-	530	-
Endurance flights in performance class								
Luftfahrtverein Aachen	Aachen	Mayer	8	28	-	-	725	-
Akaflieg Göttingen	Jupp Pitter	Van Husen	7	24	-	-	-	-
			8	36				

TABLE II. Distance Flights in Performance Class
Distance of over 25 km (15.5 mi.)

Contestant	Pilot	Glider	Distance in km.	Max. alt. m	Landed at
Groenhoff	Groenhoff	Fafnir	25.7	650	Dörrensolz on the Geba
Niederhess. Verein f. Luftf.	Hurttig	Elida	39.3	260	Kieselbach near Bad Salzungen
Kronfeld	Kronfeld	Wien	40.6	385	Fambach near Schmalkalden
Niederhess. Verein f. Luftf.	Hurttig	Elida	40.2	140	Leimbach near Salzungen
Niederhess. Verein f. Luftf.	Hurttig	Elida	51.1	538	Lengfeld near Schleusingen
Kronfeld	Kronfeld	Wien	51.5	134	Berka on the Werra
Flugtechn. Verein Frankfurt	Mayer	Franko- furtia	45.8	590	Marisfeld near Meiningen
Kronfeld	Kronfeld	Wien	150.3	640	Rehau near Hof
Kronfeld	Kronfeld	Wien	164.8	891	Marktredwitz

TABLE III. Rhön-Thuringian Forest Distance Flights

Year	Glider	Pilot	Distance km	Route	Landed
1927	Darmstadt	Nehring	32.0	Wasserkuppe- Geba	On the Geba
1929	Lore	Hirth	40.8	Wasserkuppe- Geba-Dolmar	Near Metzels at foot of Dolmar
1929	Wien	Kronfeld	150.0	Wasserkuppe- Sonneberg in Thür. (Wol- kensegelflug)	At Lienlas in Bavaria
1930	Wien	Kronfeld	51.5	Wasserkuppe- Baier-Pless	At Fambach
1930	Franco- furtia	Mayer	45.8	Wasserkuppe- Geba (Wol- kensegelflug)	At Marisfeld
1930	Fafnir	Groenhoff	25.7	Wasserkuppe- Geba	On the Geba
1930	Kakadu	Krebs	22.0	Wasserkuppe- Geba	At foot of Geba
1930	Wien	Kronfeld	150.3	Wasserkuppe- Geba-Dolmar	Near Rehau
1930	Wien	Kronfeld	164.8	Wasserkuppe- Geba-Dolmar	Near Marktred- witz
1930	Fafnir	Groenhoff	40.0	Wasserkuppe- Geba-Dolmar	On Dolmar near Rohr

Translation by Dwight M. Miner
National Advisory Committee
for Aeronautics.

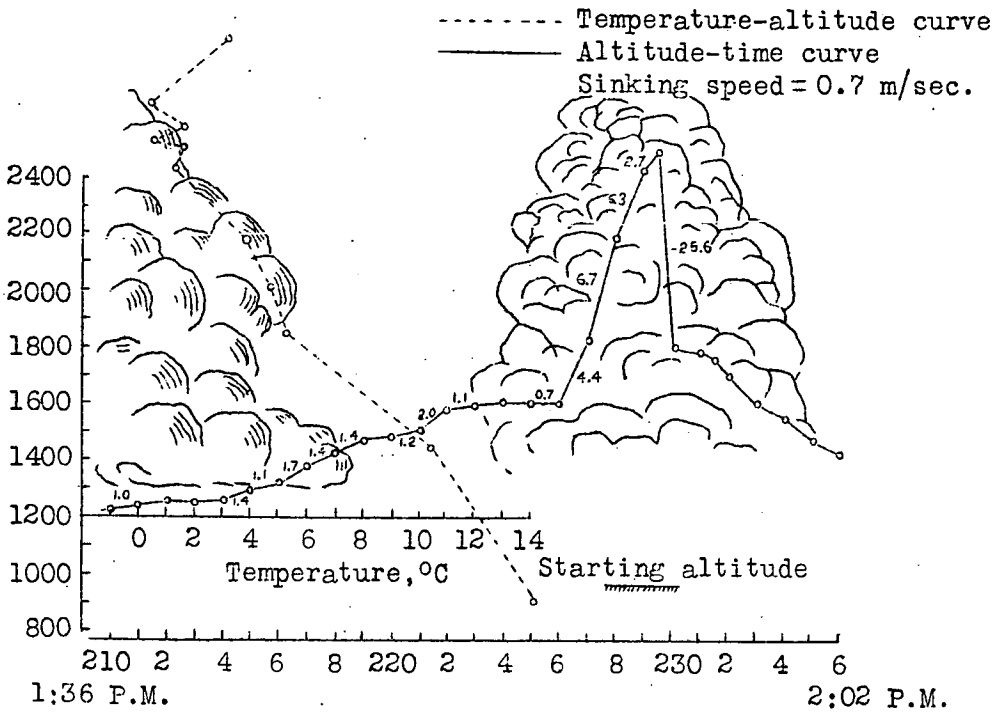


Fig.1 Altitude-time curve of Bedau's flight, Aug. 24, 1930.

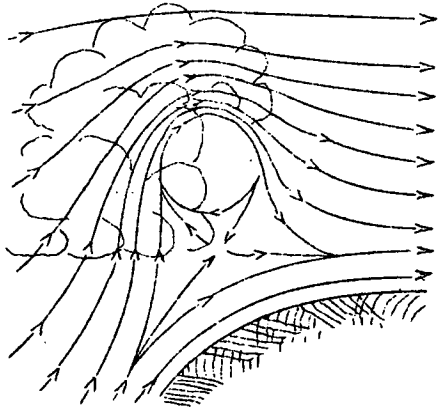


Fig.2 Formation of eddy on slope of hill.

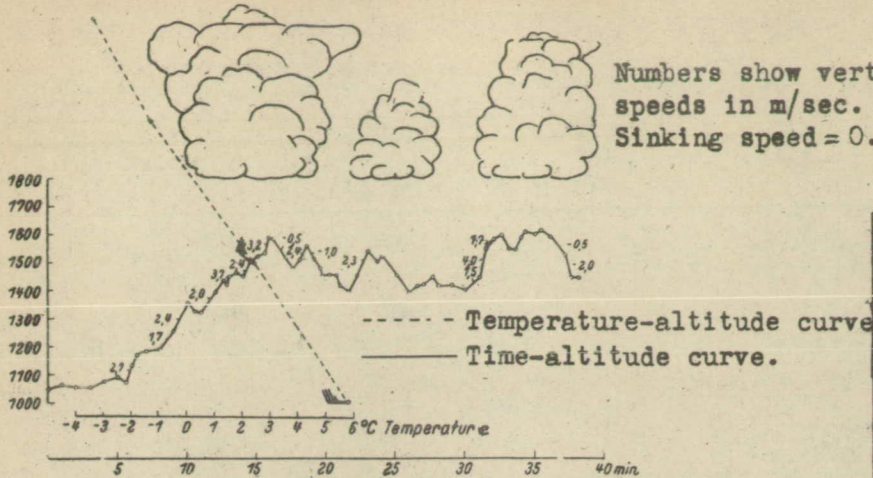


Fig.3 Altitude-time curve of Chlingensperg's flight, Oct. 10, 1930.

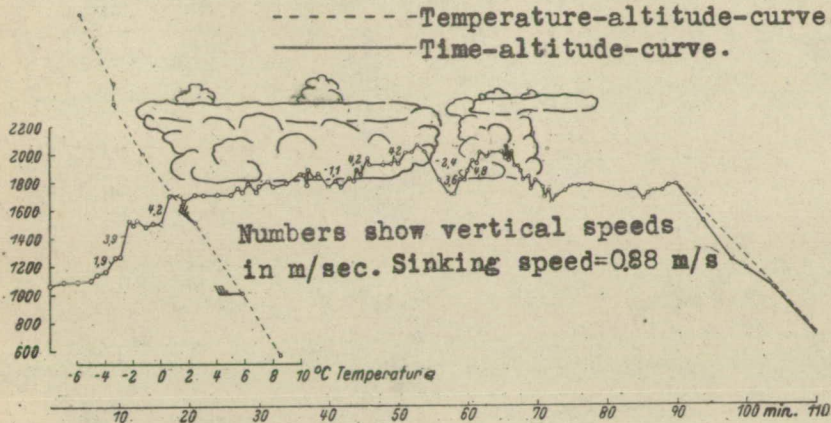


Fig.10 Altitude-time curve of Groenhoff's Rohr flight, Oct. 10, 1930.

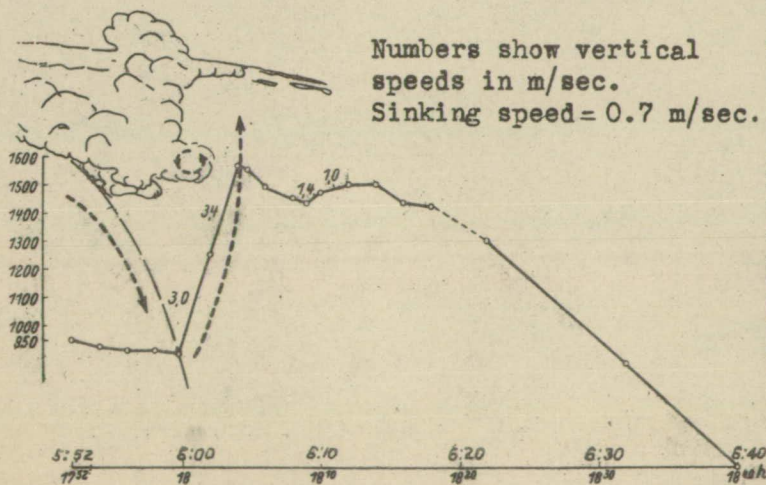


Fig.12 Altitude-time curve of "Wien" before storm cloud on flight to Rehau, Aug. 13, 1930.

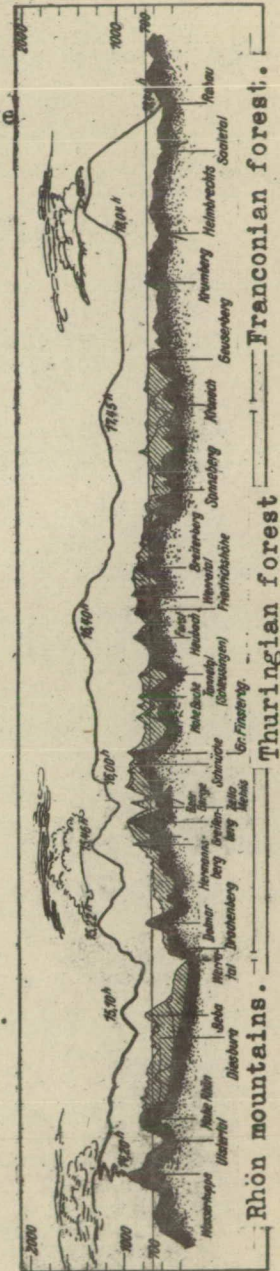


Fig.11 Path of glider "Wien" on flight to Rehau, Aug. 13, 1930.

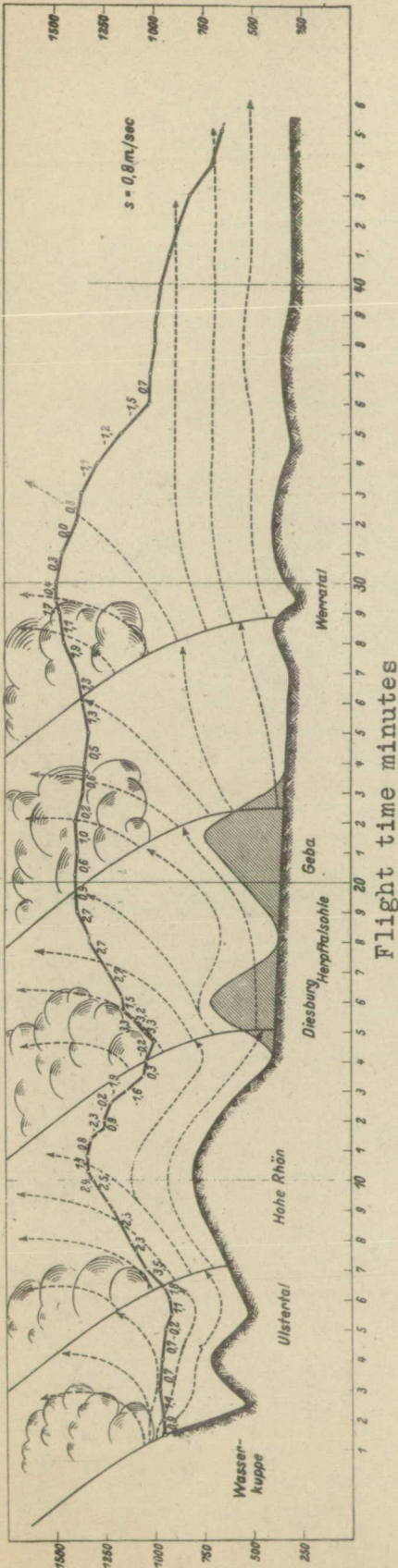


Fig. 4 Hurrting's storm flight to Lengfeld Aug. 13, 1930. Dotted lines show motion of air ahead of storm in simplified form. Terrain is not drawn to scale but with respect to flight time.

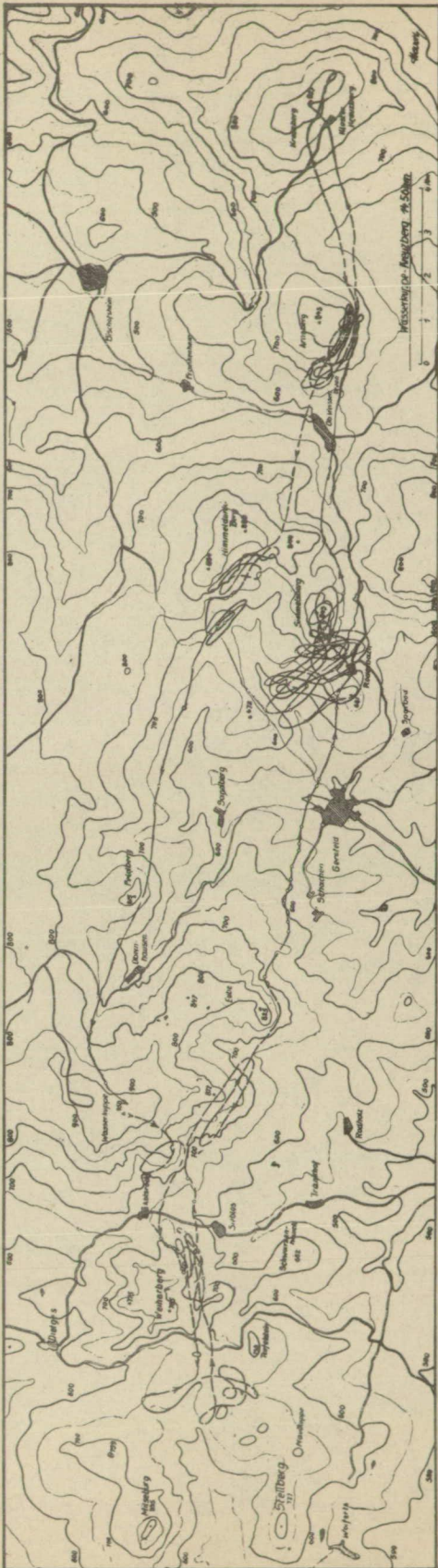
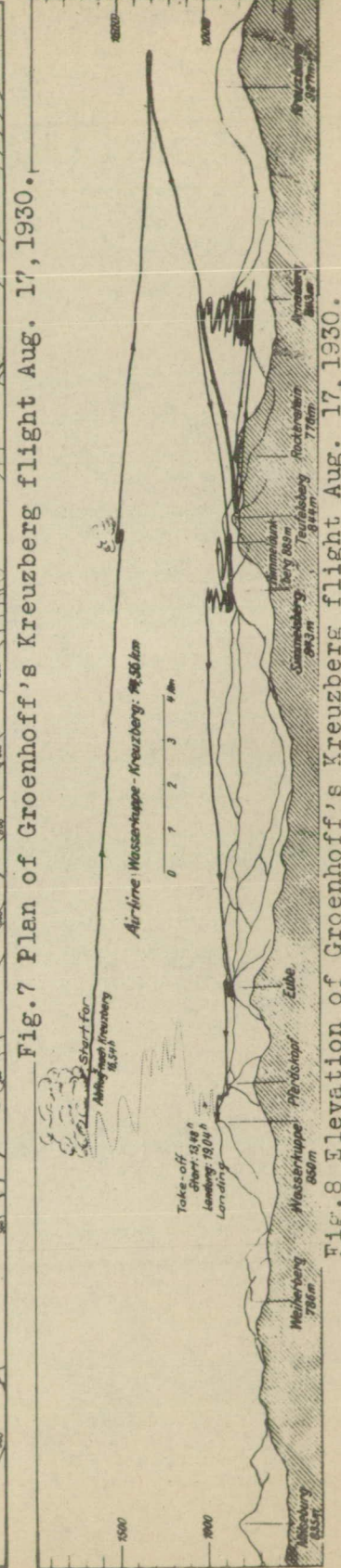
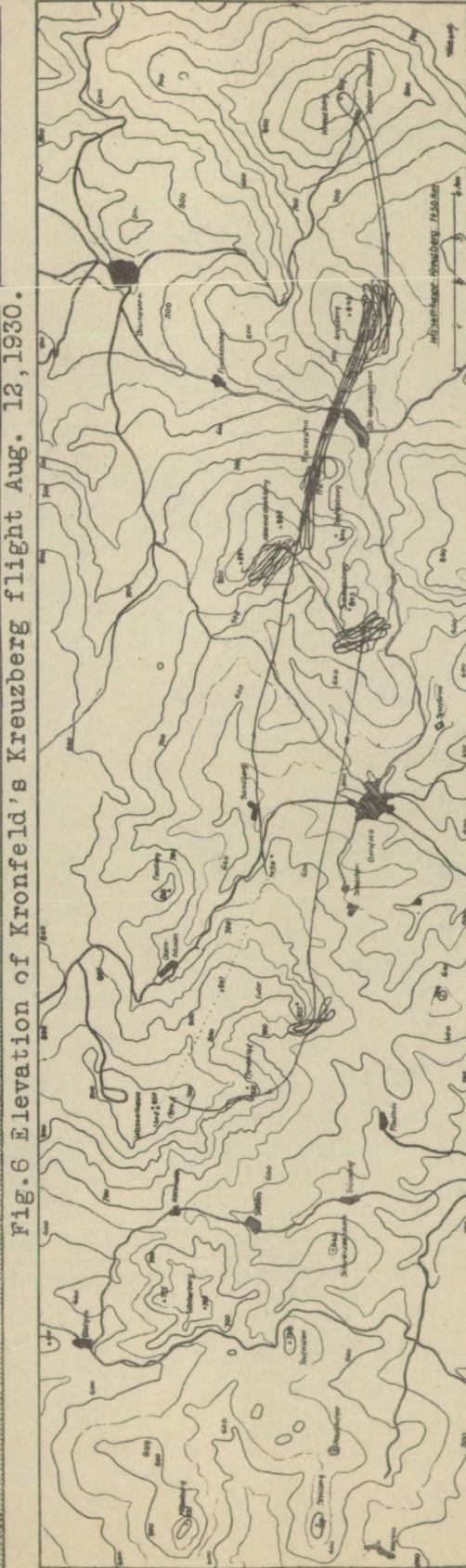
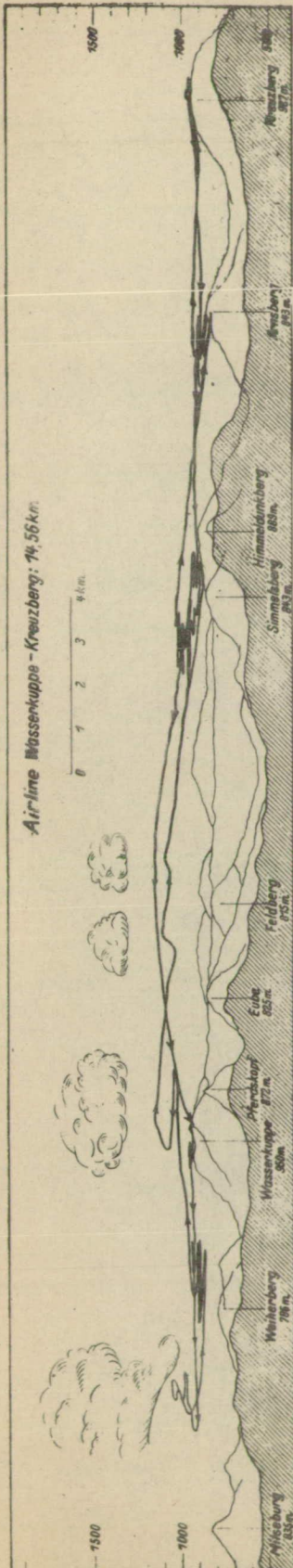


Fig. 5 Plan of Kronfeld's Kreuzberg flight Aug. 12, 1930.



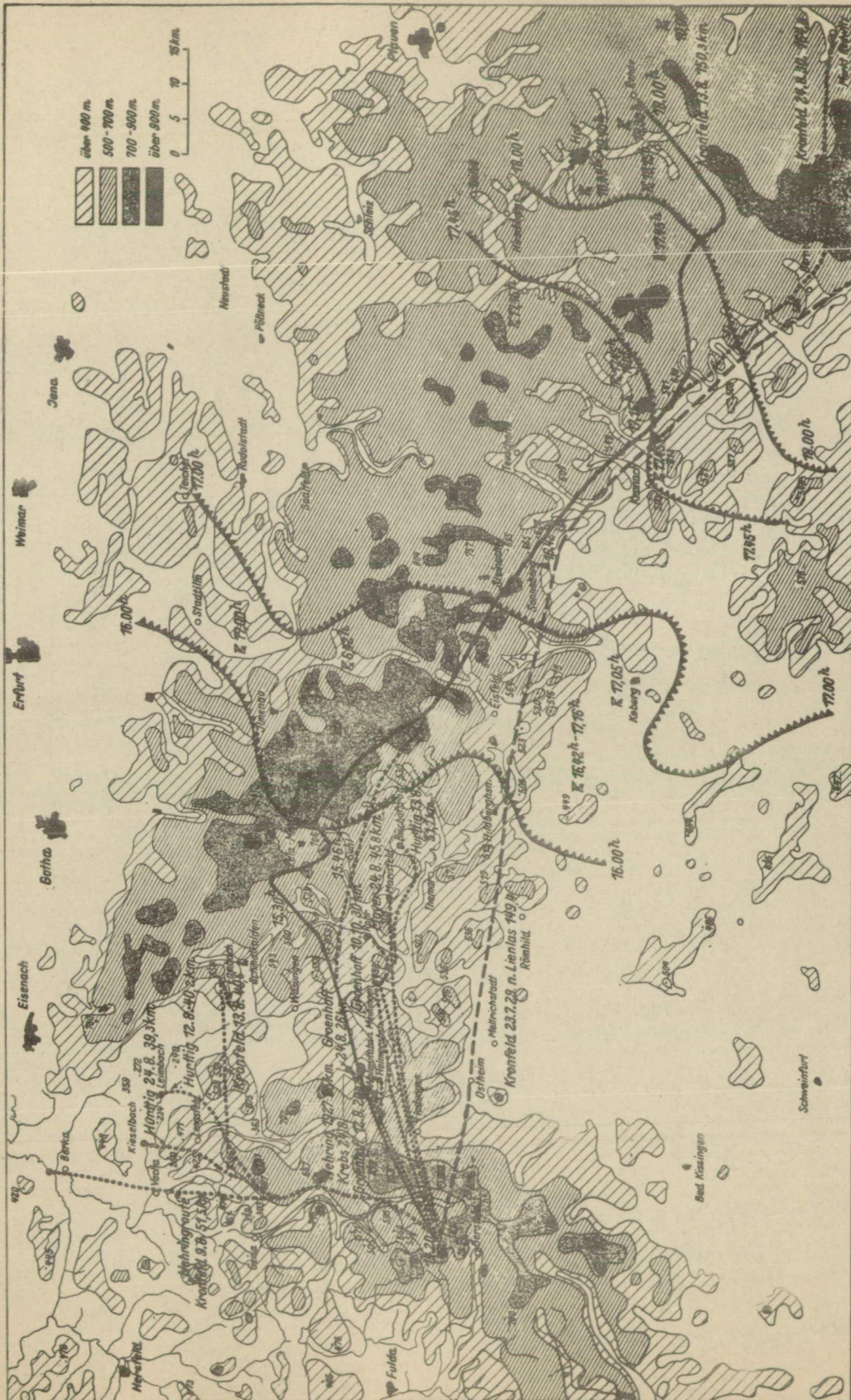


Fig.9 Rhön-Thuringian Forest flights.