the best flights. A number of points in the curves indicate the speeds at which the best effective cruise has been achieved. In other words, these points indicate the optimum cruising speed.

Now, the influence of wind on effective cruising speed should be investigated, since, after all, few flights are made on absolutely calm days. It is apparent that the foregoing still applies since the movements of the sailplane in relation to the air mass are the same regardless of any motion of the latter in relation to the ground. Thus the actual cruising speed will be the vector total of the effective cruising speed and the wind velocity. This means that on an up-wind flight of effective cruising speed 70 km/hr and wind velocity 30 km/hr, the ground speed will be 40 km/hr. For a corresponding down-wind flight, the ground speed would be 100 km/hr. Thus it is seen that the values for optimum cruise remain unchanged regardless of wind direction. Also, this result disproves the fallacy of the necessity of using higher cruising speeds on up-wind flights and lower speeds for down-wind flights. (This latter method should be used only when attempting to "stretch" a glide when no lift is available.)

The effects of downdrafts on the stretches of straight flight should also be considered. Here we arrive at a familiar conclusion: speed must be increased when passing through downdrafts. This is clearly indicated by Fig. 5, as well as indirectly by the equation given.

It is difficult to say what thermal strengths or corresponding variometer indications might be expected in practice. Some values are known, however. When, for example, the Swiss pilot S. Maurer established his world speed record for a 100 kilometer triangular course he attained an effective cruising speed of 70 km/hr with an average variometer indication of 2.5 m/sec. in thermals. This may be considered a good day for Swiss conditions, because, on the other days of the International Competitions the thermals were generally much weaker. In general, it might be estimated that for a good cross-country day, the thermals would average at least 1 to 4 m/sec., in which case ground speeds of at most 70 km/hr could be attained without helping winds. Before a cross-country flight of, say, 300 km should be attempted, the average thermal strength at noon should be, in the author's opinion, at least 3 m/sec. Or, if the thermals are weaker, the wind velocity in the desired direction should be at least 30 to 50 km/hr, since the available flying time will only be 4 to 7 hours.

As for a comparison between cross-country performances of various sailplanes, Fig. 4 shows that a typical high-speed type like the WLM-1 is superior to the Weihe only at thermal strengths above 3.5 m/sec., and is decidedly inferior in weak thermals. If, in addition, the weak thermal conditions which are inevitably encountered at the beginning and end of a long cross-country flight, as well as the probability of "staying up" are taken into account, the comparison is, without doubt, advantageous to a sailplane of the Weihe type. Only in speed contests in particularly good weather is the high-speed type superior.

In practice, the following "rule-of-thumb" points should be sufficient for the sailplane pilot:

(1) Climb in a thermal at the smallest possible radius of turn and at minimum speed. Observe variometer indications.

(2) The speed used during the subsequent straight flight should be proportional to the mean variometer indication during the climb. A low rate of climb calls for the speed giving best glide angle, while a high rate of climb should be followed by as high a speed as is permissible for the sailplane. The best speed can be found more quickly and accurately if a chart (Fig. 6) or table (Fig. 7) is prepared for the particular aircraft. In the accompanying table the additional effects of downdrafts have been taken into account.

Good soaring results may be achieved only through skillful use of thermals. It is the author's hope that this study has shed some light on the problem, and may therefore be of assistance in finding the best cross-country technique.

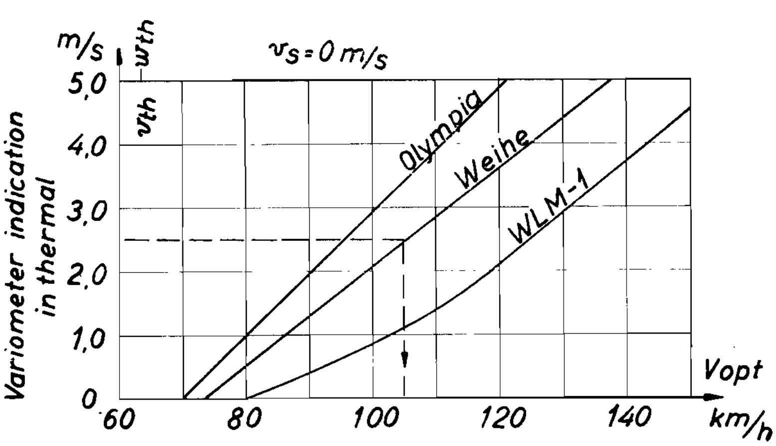

Fig. 6

"Olympia"

Thermal Variom. ind. m/s	Straight flight Variom. ind. m/s	Vopt. km/h	Veff km/h
+1,0	-1,0	~80	40
	-2,3	~90	27
+2,0	-1,3	~90	55
	-2,7	~100	42
+3,0	-1,8	~100	63
	-3,1	~110	53
+4,0	-2,2	~110	70
	-3,4	~115	62

Fig. 7