the effective cruising speed depends upon various factors, we arrive at the following equation:

$$V_{eff} = \frac{V_{th} - W_{th}}{W_s \pm v_s - (V_{th} - W_{th})} \cdot V_s$$

V_{eff} = effective, average cruising speed (km/h)
V_s = air speed between thermals (km/h)
V_{th} = vertical velocity of the thermal (m/sec)
W_{th} = sinking speed in a thermal (m/sec)
W_s = sinking speed at speed V_s (m/sec)
v_s = rising (+) or descending (-) current between thermals (m/sec)

It is apparent that the speed at which the sailplane is flown between thermals is decisive in this study, and that its value may be chosen by the pilot. The sinking speed while spiraling depends, when properly flown, mainly upon the lowest sinking speed of the aircraft, and will be 1.5 times the minimum sink. The sink at cruise is connected with the air speed through the performance curve (Fig. 2) of the sailplane, and depends upon the aerodynamic layout of the aircraft.

If we now study, on the foregoing basis (wind = 0), the dependence of the effective cruising speed upon the only value which may be selected by the pilot, i.e. the air speed in straight flight, we may draw, according to the performance curve and equation given above, the chart in Fig. 3. In this case the Weihe sailplane is used for an example. This chart indicates that:

(1) In weak thermal conditions, low effective cruising speeds are attained (about 20 km/hr for thermal strengths of 1.4 m/sec.), and it makes little difference what speed is used in straight flight. The best speed, however, would be at 90 km/hr.

(2) In strong thermal conditions, high effective speeds are reached (up to 70 km/hr for 5 m. thermals), and the speed achieved depends essentially upon the speed used between thermals. There is a clear maximum at 120 km/hr. If in this case the speed for the best glide angle (70 km/hr) is used instead of 120 km/hr, there is an 18 km/hr or 25 per cent loss in effective cruising speed.

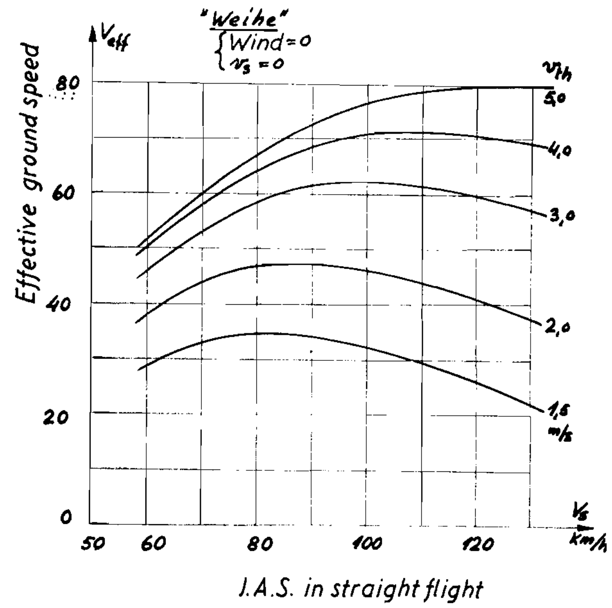

Fig. 3

On the basis of this chart, therefore, the cruising speeds giving the best cross-country flight results may be determined. This speed henceforth will be referred to as the optimum cruising speed. In the same manner, the corresponding maximum value of the effective cruising speed may be estimated. Fig. 4 illustrates their relation to thermal strength. In addition, the curves in this chart compare the corresponding values for the Olympia, Weihe, and WLM-1 sailpalnes.

The comparison of the cross-country flying performances of different sailplanes leads to two important conclusions:

(1) In weak thermal conditions the minimum sinking speed and minimum radius of turn of the sailplane decide its effective cruising speed. On poor soaring days an inferior sailplane may easily be grounded while a high performance type attains an average cruising speed of 20 to 30 km/hr on a cross-country flight.

(2) In strong thermal conditions the differences between various types are reduced, and the high-speed part of the performance curve becomes decisive. All sailplanes are able to soar and the high-speed types are capable of

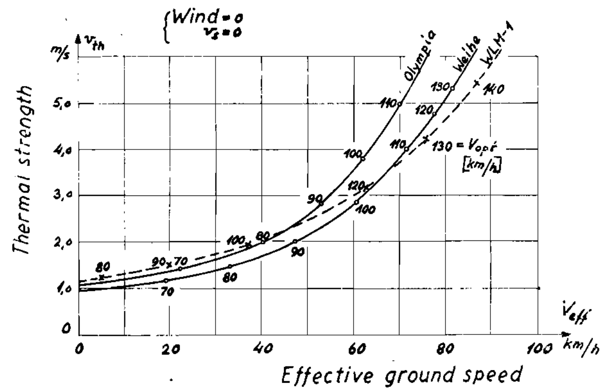

Fig. 4

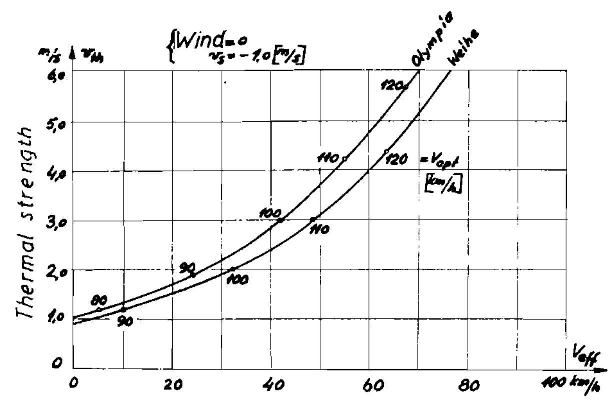

Fig. 5