A disadvantage with this planform is obviously the greater bending moment in the region of the wing root. However it is not necessary to keep very strictly to the planforms under review here. The influence of small changes will be clear enough from the data supplied.

## SELECTION OF WING SECTIONS

Even more so than with wing planforms one is guided by two aerodynamic factors in selecting wing sections for sailplanes. The sections should provide, if possible, a high cross-country speed, and also guarantee docility in slow flight. The influence of the section on the cross-country speed is not easy to perceive when bearing in mind circling flight, and requires separate examination (see Ref. 1). Even with very different sections one can sometimes achieve equally high cross-country speeds. If, for example, one chooses a section with very low drag at the high-speed range, this advantage is generally removed through large drag in slow flight, or vice versa.

If one examines the currently available section polars it will be seen that none of them gives optimum cross-country speeds. It would seem to be much better to use sections with extra-wide laminar buckets, those which equally favour both high-speed and slow flight. A detailed reason (not taking into account meteorological details) is given in Ref. 2.

Apart from such arguments, which consider only the cross-country speed, a section with a wide laminar bucket is recommended also for other reasons. In weak lift conditions it is easier to stay up, and if lift increases with height, the critical height before one must land lies lower than with the narrow bucket.

If one assumes conditions with strong, but widely spaced thermals one can obviously put forward a case for sections with favor high speed. It seems however, that such conditions are rather the exception than the rule.

To use the same section throughout the span is from the aerodynamic point of view not the optimum, since apart from a high cross-country speed the section should fulfill further requirements at the outer wing.

* * *

To obtain docile performance in slow flight the spanwise distribution of angle of attack for all lift coefficients between zero and the maximum should, if possible, be greater over the inner wing than over the outer wing. Above the maximum the lift coefficient should fall off as gradually as possible. Finally, the outer wing section should not have a sharply defined laminar bucket.

At high speed, owing to the elasticity of the wing, it could be that the outer wing could reach such a low $C_L$ value that it falls out of the laminar bucket and becomes a very active brake. When circling tightly the same sort of danger threatens the outer portion of the inner wing, this time by reaching too high a lift coefficient. Above all, however, the aileron efficiency should not be lost through an unlucky choice of sections.

Such opposing demands are not easily resolved without some penalty to the cross-country speed, especially as the Reynolds numbers of $0.5-1.0 \times 10^6$ in the outer wing are already rather small. A comparison of a few wing sections, whose measured polars give high cross-country speeds, and which seem to satisfy a few of the above requirements, has been given in Ref. 2.

**References**—Ref. 1, Summary of the influence of the airfoil polar on the performance of sailplanes by Dr. F. X. Wortmann and K. Schwoerer. Ref. 2. Some laminar profiles for sailplanes by Dr. F. X. Wortmann. English translations of both articles appeared in *Soaring*, January, 1964 pages 6 and 14. (See also OSTIV Publ. VII.)

*(To be continued and concluded in the July issue)*

## WARNING!

As a result of a recent accident to a Standard Austria, Model S, in which the pilot was unable to recover from a spin and parachuted, the safety of the aircraft has come under question. Motorless Flight Enterprises feels it prudent to issue this warning.

As of this date the accident and facts relating to it, and the spinning characteristics of the S, SH and SHK are under review. It must be determined, if at all possible, just what happened to cause the accident and if any deficiency exists in the aircraft design which has not been brought to light heretofore.

All sailplanes produced by Schempp-Hirth KG. are fully Type Certificated and as such have withstood a thorough flight-test program by the company and the government including spin tests in accordance with the regulations. The Standard Austria S not only passed the tests but recovered without corrective pilot action on some spins. No reports of spin recovery difficulties or accidents resulting from spins have come to the attention of Schempp-Hirth KG. although 45 of this model have been produced and flown over the past five years.

In the accident the pilot thought that he may have been in a condition where the tail became stalled with the stick full forward. Such might have been the case. Normally the spin will have stopped before the pilot moves the stick forward of neutral.

Until facts can be studied and recommendations or conclusions released, it is felt that the following precautions should be observed:

**Do not engage in intentional spins**

**Check center of gravity position and ballast as necessary to the forward 50% of the range if possible.**

**Check elevator rigging.**

As with other very clean aircraft, the Standard Austria loses altitude quickly in a spin and this should be considered when flying near the ground.

The Austria SH and SHK have superior stalling behavior to the S and no spin-recovery difficulties with these aircraft have been reported. However since the subject accident could involve a possible although unlikely set of conditions caution should be observed in spins and neutral-stick recoveries are advised.

MOTORLESS FLIGHT ENTERPRISES