Experimentelle Untersuchungen an geraden und gekrümmten Diffusoren

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Experimentelle Untersuchungen an geraden und gekrümmten Diffusoren

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15. Summary

Systematic experimental investigations were carried out to determine the influence of the frictional boundary layer on the incompressible flow in channels with pressure rise along the axis. Fourteen straight and curved diffuser models having 10 cm inlet diameter were used for the measurements. Ten of these diffusers (fig. 4, 5 and 6) have the same axial distribution of cross-sectional area; their form was obtained by curving the axis of a straight conical diffuser of circular cross-section and 8° total vertex angle (area ratio 1 : 4) and by area-preserving affine transformations of the circular cross-sections to non-circular shapes. These forms of diffuser are similar to the draught tubes of water turbines and diffuser passages in pumps and blowers.

In the region where the conversion of flow velocity into pressure begins, the flow conditions were investigated in detail with the aid of a short precision diffuser (fig. 28—30). Comparative measurements were also performed with a straight conical diffuser of 6° total vertex angle (fig. 6, upper right) and a pipe with sudden expansion of the cross-section (fig. 32, Borda-Carnot).

Special care was taken to use suitable definitions of the diffuser efficiency (chapter 10) and to obtain physically precise value for the inlet velocity distribution and the related boundary layer parameters (chapter 7). To influence the inlet boundary layer, straight pipes of various lengths were inserted between the air supply and the diffuser models. A wide range of inlet velocity profiles was thus obtained (table p. 65).

Thin inlet boundary layers give the best conversion of flow velocity into pressure with all of the diffusers tested. The "poorer" the form of the diffuser, the steeper the drop in efficiency as a function of the displacement thickness (fig. 26 and 27). Detailed investigations of the wall pressure distributions, energy distributions at the outlet, turbulence measurements, and data on the local pressure conversion are presented in addition to the overall efficiency measurements (fig. 18—25).

The knowledge gained by these experiments has indicated some possibilities for improving the conversion of the flow kinetic energy into pressure. Investigations of boundary layer suction, generation of artificial secondary flows, and the method of timewise separation of the deceleration and bending of the flow were performed (chapter 14).

Moreover, attention is drawn to the first results of a procedure for calculating straight diffusers with turbulent flow, given by Prof. *Ackeret* (p. 50). The abovementioned investigations are to be continued and completed by measurements of the turbulence inside diffusers, and expanding the work into the range of compressible flow as referred to in this report (chapter 6).