Int. J. Heat Mass Transfer. Vol. 10, p. 109. Pergamon Press 1967. Printed in Great Britain

BOOK REVIEW

HANS BÖRNER: **On the heat and mass transfer at single bodies in fluids with superimposed free and forced flow.** (In German). 39 pp. VDI-Forschungsheft 512, VDI-Verlag Düsseldorf (1965).

THIS IS a volume of a series published by the Verein Deutscher Ingenieure (VDI) in which outstanding research is reported. Heat transfer under conditions of colinear, laminar, mixed flow external to a body has been investigated, primarily theoretically, in recent years. Although laminar boundary-layer theory provides information on velocity and temperature distribution, it cannot predict the limits of applicability. The definition of these limits must be determined by experiment. Therefore H. Börner's extensive experimental work is timely. It is presented in three parts:

(1) General considerations on the laws of heat and mass transfer at free, forced and mixed convection.
(2) Experimental investigation of heat transfer to single bodies in air with superimposed free and forced flow.
(3) Experimental investigation of boundary-layer flow along a plate, around a sphere and a horizontal cylinder.

In part 1, a comparison between O. Krischer's correlation and that of A. Acrivos is shown to give deviations of less than 10 per cent for codirected flow. For this correlation Krischer used the sum of the forced convection Reynolds number and a free convection equivalent Reynolds number, which can be considered a function of the fundamental parameter Gr/Re^2. Acrivos formulated his correlation in terms of the parameter Gr/Re^2 and allowed for the mixed flow in a superposition of the assumed velocity profiles. For opposed flow, the deviations increase with increasing value of the fundamental parameter. The author obtains in part 2 a very good correlation for all bodies and flow directions under consideration by employing the square root of the sum of the squares of forced convection Reynolds number and a free convection equivalent Reynolds number. He deduces that superposition of forced flow in any direction yields increased heat transfer.

For the visual studies in part 3, the smoke method is used. The series of photographs show quite well the boundary layers around the free bodies for various Reynolds numbers and temperature differences in both codirected and opposed flow. Transition to turbulence and boundary-layer separation are visible and mark the limits of the assumptions underlying the boundary layer equations.

Experimental technique is extensively described. The bibliography lists 70 references. The magnitude of the indices would have made a list of notations desirable.

This work should prove useful for both application and further theoretical or experimental research in this field.

E. HAHNE