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22 "An Investigation of Losses of Flow Stream Mechanical Energy at Abrupt Changes in Flow Cross Section," by W. M. Kays, Technical Report No. 1, Navy Contract N6-onr-251 T.O. 6, Stanford University, Stanford, Calif., September 15, 1948.

23 "Basic Heat Transfer and Flow Friction Design Data for Gas Flow in Circular and Rectangular Cylindrical Tube Heat Exchangers," by W. M. Kays, Technical Report No. 14, Navy Contract N6-onr-251 T.O. 6, Stanford University, Stanford, Calif., June, 1951.

Discussion

C. F. KAYAN.[4] This and its companion paper (1) present results which appear to rely for homogeneity in the laminar and turbulent regions on an assumption of a characteristic dimension for the computation of the Reynolds number. This characteristic length is $4r_h$, where r_h is the hydraulic radius, as defined by the authors. Whereas they recognize lack of agreement of the heat-transfer data, primarily, for the narrow rectangular flow passages as compared with circular flow passages for which the laminar-turbulent pattern is more or less accepted, their attention is invited to the nonhomogeneity of the heat-transfer mechanism for the two types of flow, i.e., laminar versus turbulent.

With heat transfer in laminar fluid flow more directly associated with conduction, it is suggested that the smallest dimension of the flow stream might be more apt to control, rather than the "hydraulic" dimension used.

The authors venture that the aspect ratio of the rectangular channels might have some effect on the Reynolds number of transition. The suggestion is made, herewith, that perhaps some other characteristic dimension than the hydraulic one used in the Reynolds number would facilitate the general correlation of the excellent data, both thermal and friction, produced in the authors' programs.

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AUTHORS' CLOSURE

In reply to Professor Kayan's remarks concerning the use of a hydraulic diameter $4r_h$ it is possible that a single more suitable length dimension might be chosen to correlate laminar-flow data. The hydraulic diameter was selected in this paper for design convenience, so as to have a single type of presentation for both turbulent and laminar flow, and for the purpose of maintaining a consistent presentation of all of the design data obtained on this research project. At the present time additional work, both analytical and experimental, is being done on laminar flow in rectangular tubes, and when this is completed the possibility of a single generalized treatment of rectangular tubes will be greatly enhanced.