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Discussion

Walton Forstall.[3] This is a valuable summary of present knowledge concerning the Pitot tube. It is most helpful to have so much information brought together in one place, a service for which the author will have the sincere, though often unspoken, thanks of many workers in fluid mechanics. The paper, in addition, is suggestive of further work that should be done.

The writer is curious about some of the implications of Fig. 14. If the velocity profile is symmetrical, one would expect a symmetrical curve from the transverse tube and, indeed, the "A Impact" curve seems reasonably symmetrical. One would now expect that the "B Impact" readings would be slightly less than the A Impact values due to the difference in velocities which should result from the difference in areas blocked. However, the maximum pressure difference that can be attributed to blocking is only about 9 per cent (when the B tube is barely inserted) and decreases rapidly. The B curve should approach the A curve more and more closely as the cantilevered probe approaches the far side of the pipe. Since it does not, some essential difference in the behavior of the measuring device is indicated, perhaps attributable to the presence or absence of a free end.

The author states that the shape of the static-pressure curve illustrates the difficulties in the interpretation of such measurements. Indeed it does, but perhaps there is an opportunity here for someone to explore the matter further. It may be that by some additional work the mystery could be uncovered.

T. W. Head.[4] My comments consist of two questions. First, how much straight pipe is required ahead of an instrument station to assure uniform flow? Are the correction data in the paper applicable to air flow at low Reynolds numbers?

Author's Closure

Mr. Forstall has been most generous in his general comments on the paper. His discussion points out the apparent difference in mutual interference between the flow about the transverse tube and pipe walls and the cantilevered tube and the pipe walls as shown by Fig. 14, impact pressure curves. Due to the difference in free end conditions, the author does not agree that curves A and B should necessarily approach each other as the pressure holes approach the far side of the pipe. No satisfactory explanation can be made for the experimental static-pressure curves at this time.

Mr. Head raises a very practical question which is most difficult to answer briefly since the velocity distribution at the instrument station is a function of the upstream pipe as well as the geometry of the piping system upstream of the straight section if insufficient straight pipe is used. Some idea of the order of magnitude of required straight lengths is presented in reference (76) for various upstream pipe fittings, a typical example being about 40 diameters for a single 90-degree elbow. The author has seen measurable changes in velocity distributions as far downstream from a single elbow as 125 diameters.

With regard to Mr. Head's second question, it should be noted that usually the compressibility of air may be neglected at low Reynolds numbers. Experiments at low Reynolds numbers reported in Fig. 9 include data for air and liquids indicating that correction data are applicable to both fluids.

A recent article of interest is:

130 "Investigation of the Time Response and Outgassing Effects of Pressure Probes in Free Molecule Flow," by E. L. Harris, Univ. of Toronto, UTIA TN-6, 1955, 14 p.

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