CORRESPONDENCE

Flow between Rotating and Stationary Discs

From Mr. P. Polak (*University of Sheffield*)

I wish to contribute to the paper by Professor Bayley and Dr. Owen in Vol. XX, Part 4 (November 1969) on flow between rotating and stationary discs. In view of possible practical applications in this field it may be useful to draw attention to the benefits which can be gained from directing the flow near a rotating disc by means of a stationary spiral groove with narrow lands. My results from such an arrangement were reported in *The Engineer*, Vol. 225, pp. 155-7 (Jan. 1968). I found that when the flow pattern was restrained in this way the disc drag was significantly lower than with a smooth stationary wall, particularly if a self-generated net outward flow was permitted. There was a substantial velocity difference between the fluid and the rotating disc except near the centre to make heat transfer possible. The difficulty near the centre of the disc could be overcome, if required, by varying the width or depth of the groove as is done in the devices known to physicists as molecular vacuum pumps.

Reply from Professor Bayley and Dr. Owen (*University of Sussex*)

The authors are aware of Mr. Polak's contributions in the field of rotating flows and his comments upon our recent paper are welcome. We agree with his findings that directing the flow near a rotating disc by means of a stationary spiral groove can reduce the drag by a significant amount. The superimposed radial flows studied in our paper, however, are primarily intended for cooling, and the reduced drag in Mr. Polak's proposal, as our more recent work[1] has shown, will reduce the heat transfer between the rotor and the air flowing over it, although the lower drag will lead to less kinetic heating, which in certain conditions can be significant.

It is difficult to make a direct comparison between the results in Mr. Polak's original paper and our own data because of the difficulty of defining the equivalent geometric parameters for his system. We would also make the point that his experimental technique for determining the moment coefficient through measurements of the efflux of momentum are susceptible to large experimental errors and this again may vitiate the comparison between our respective experimental investigations. Mr. Polak's comments on our paper give one example of the many variations which are possible upon the basic geometry we have studied in our paper, all of which, it seems from our recent experience, have a significant effect on both the drag and the heat transfer over a rotating disc.

1. BAYLEY, F. J. and OWEN, J. M. The fluid dynamics of a shrouded disc system with a radial outflow of coolant. American Society of Mechanical Engineers, Gas Turbine Conference, Brussels, 1970.