In Table I, the data for surfaces 2, 3, and 4 are taken from Poulter, while the data for the smooth surface have been computed using standard correlations; the diameter of the smooth surface is identical with the tip diameter of the transverse fins. From Table I, we see that the longitudinal fins are worse than useless, because the fins are too long. The performance of the spiral polyzonal fins, which are used in the Magnox Reactors of the British Central Electric Generating Board, is quite outstanding. If these reactors had had to use smooth cans, the total cost of electricity from them might well have been twice as high as it actually is.

The comparable figure of merit for an advanced gas-cooled reactor (AGR) fuel element is $\sim 0.05\ \mathrm{ft}^{1/2}$. Thus, the roughened surfaces used in these later reactors are not as good as the spiral polyzonal fins of the Magnox Reactors. Such fins could not be used in AGR. This reactor has stainless-steel cans, and the neutron absorption in high fins would be excessive. In addition, the fins would be relatively ineffective, because the thermal conductivity of stainless steel is so much less than that of magnox. The merit figure of a stainless-steel duplicate of the spiral polyzonal can is only $0.038\ \mathrm{ft}^{1/2}$, so that the roughened can is preferable on purely heat transfer grounds.

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Reply to "Comments on 'Merit Index for Gas-Cooled Reactor Heat Transfer' "

We certainly agree with D. C. Leslie that various figures of merit have and should be considered for heat transfer in gas-cooled reactors. For instance, in our own Note we mention the index $(N_S/f)^{1/2}$ for given flow area, and $(N_S^3/f)^{1/2}$ for given heat transfer area. Those two values correspond to maximum power for a given ratio of pumping power to thermal power. We also state in our conclusions that one would find a "different choice of optimal heat transfer improvement, where overall costs should be minimized rather than thermal output maximized." The criterion derived by D. C. Leslie, $(N_S^3/f)^{1/4}$, corresponds to a simple type of economic optimization, which, by the way, does not include extra costs incurred for enhancing heat transfer, or parasitic pressure losses. His criterion, just like ours, is only a first approximation to try to compare various types of heat transfer improvements. Our criterion has been found to be useful for a number of preliminary designs, but we have no quarrel with anyone else using other powers of the ratio (N_S^3/f), or even other combinations of the ratio of Stanton number to friction factor.

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