NASA TECH BRIEF

Ames Research Center

Improved Aircraft Reaction Nozzles

The problem:

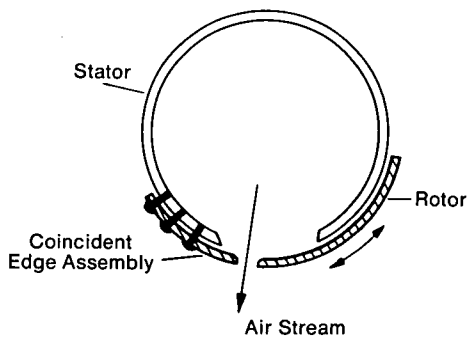
To design for jet aircraft, reaction control nozzles that require low operating forces and have a linear and predictable jet thrust vs nozzle exit area and position. In addition to low weight and low inertia, other desirable features would include a constant exit area so that total thrust remains constant throughout the nozzle position range, and the nozzle thrust vector is controllable by a single rotary motion.

The solution:

An outside cylindrical rotor with coincident nozzle exit edges.

How it's done:

The primary components of the improved reaction control nozzle are an outside rotor can, an inside stator can, a thrust bearing, and a radial bearing (frictionless spacer). The diameter and length of the assembly can be proportioned to meet the thrust area requirements. Constant area vs position is achieved by nozzles designed with a double exit or by twin nozzles designed with a single exit. It is important that the radial clearances between stator and rotor do not exceed 0.25 mm (0.15 mm preferable) and that the coincident edges have a radius equal to the material thickness (avoid sharp edges). The coincident edge feature of the nozzle is shown in the diagram. The inside cavity is smooth to reduce flow losses; with proper machining tolerances, the nozzle operates with minimum torque. The rotor can be driven either by adapting a shaft to the rotor thrust bearing end or by adding a gear to the outer diameter of the stator, which would make it a part of the gear reducer.



The improved nozzles have been used for hot (177°C) air at 414 kN (60 psig) pressure. Higher pressures are possible with provision for structural integrity.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
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Moffett Field, California 94035
Reference: TSP 75-10284

Patent status:

NASA has decided not to apply for a patent.

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(ARC-10906)

Category 06