NASA TECH BRIEF
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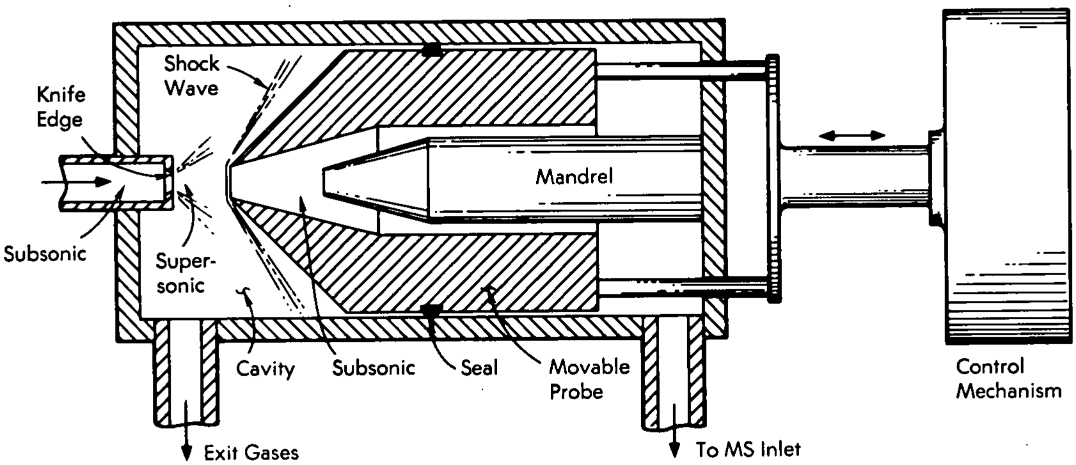
Transonic Divider for Gas Chromatograph Effluents

Reduction of the rate of flow of the gas chromatograph effluent which is introduced directly into a mass spectrometer (MS) is generally accomplished by means of valving systems. However, when rates of effluent flow are varied, the change is transmitted upstream, and the performance of the gas chromatograph (GC) is altered.



A transonic effluent-divider system has been developed which permits varying the mass input of a GC effluent into the MS without affecting the performance of the GC. The novel system consists of a supersonic orifice communicating with a cavity and an adjustable sampling probe. The effluent-divider system is interposed between the GC and the MS; as indicated in the diagram, the sample probe is moved longitudinally by a sensitive control mechanism (micrometer) so that any desired fraction of the effluent can be extracted. The orifice is defined by knife edges to transform the entering subsonic GC flow of gas into supersonic flow, so that perturbations downstream cannot affect the GC system. The assembly is not large (about 2 by 18 cm) and is much simpler in design than a valve network. By adjusting the position of the movable sample probe, from zero to nearly 100 percent of the GC effluent can be extracted for MS analysis. At least two adjustments would be required in valve-controlled systems, but any adjustment would be reflected as a shift of operating parameters for the GC.

As shown in the diagram, the movable probe is a hollow cylinder with one end shaped as a hollow cone, and it moves along the mandrel. Effluent gases from the GC pass over the knife edges of the orifice, causing a supercritical drop at nominal gas flow rates and converting the subsonic flow of incoming gases to supersonic flow within the cavity. The circular edge at the tip of the hollow cone combines with the outer conical surface of the probe to produce a stable shock wave in the free jet-stream. Gases downstream from

(continued overleaf)

the shock wave, now subsonic again, enter the probe to flow through the annulus between the probe and the mandrel and into the line leading to the MS. Excess gas leaves the device via the other exit; the seal prevents seepage between the two gas flows.

Notes:

1. A bellows-type seal is used to prevent leakage at the juncture of the control mechanism and the case of the transonic divider.
2. Requests for further information may be directed to:

Technology Utilization Officer
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103
Reference: TSP 72-10706

Patent status:

NASA has decided not to apply for a patent.

Source: John B. Wellman of
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