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# NASA TECH BRIEF



## Plasma-Heating by Induction

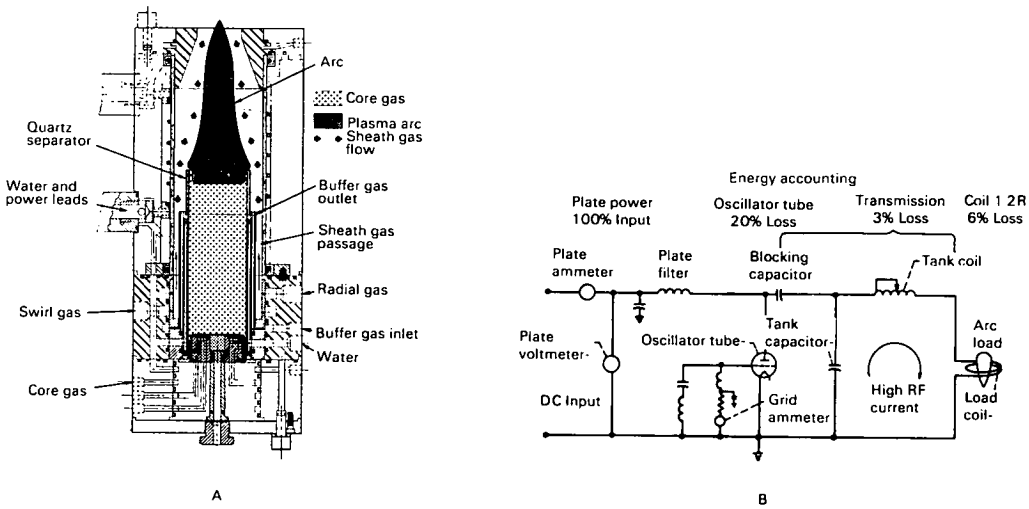


Figure 1. The Touch (A) and Sites of Losses of 29% of the Power Input (B)

An induction-heated plasma torch (Fig. 1A) has been operated with an input of 1 Mw of direct current of which 71% was transferred to the plasma; the remainder was consumed by electrical losses in the system (Fig. 1B). This power load is about ten times greater than had previously been achieved.

Heating of the plasma was induced by passage of 450-kHz alternating current through a copper coil wrapped around it. The plasma was formed in a central jet of core gas; a surrounding flow of "sheath" gas cooled the torch walls. Nitrogen, oxygen, air, and argon were used in various combinations for these two gas flows. The inside diameters of the torch were 4.5 and 6 inches. An exhaust enthalpy of 41,700 Btu/lb in air was achieved at a power level of 700 kw. No overheating problems occurred. Continuous operation of the torch should be possible for as long as 5,000 hours, as required for power-supply maintenance.

Operation of an induction-heated plasma torch, with pure hydrogen as both the core gas and sheath gas, was achieved at a frequency of 4 MHz at power levels of up to 185 kw. The torch's inside diameter was 1.1 inches. Exit-gas enthalpies were estimated to be at more than $10^6$ Btu/lb.

### Patent status:

Title to this invention has been waived, under the provisions of the National Aeronautics and Space Act [42 U.S.C. 2457(f)], to the Humphries Corporation,

(continued overleaf)

180 North Main Street, Concord, New Hampshire 03301.

Source: K. Harrington and M. L. Thorpe of
TAFA Division,
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