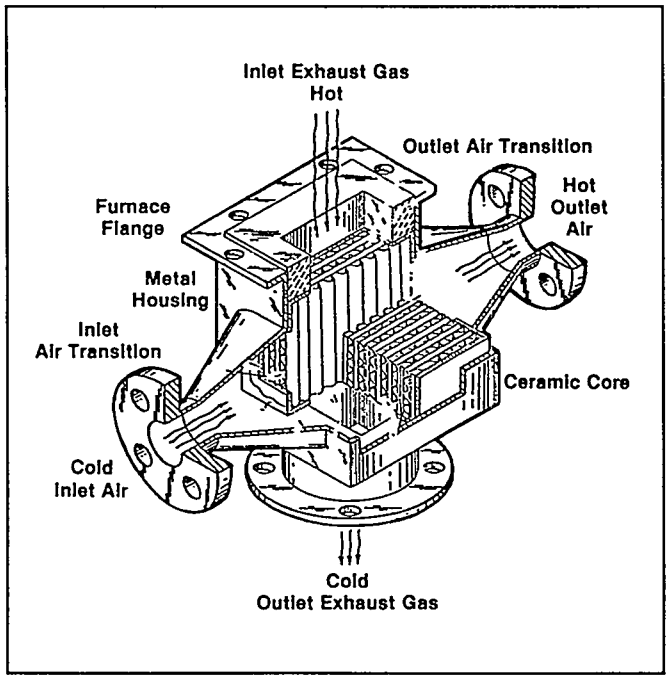

Cut-away drawing of the GTE ceramic recuperator. Ceramic recuperators can produce 40%-50% energy savings in furnaces by using hot exhaust gases to preheat incoming combustion air.

Cruciform Ceramic Tube Recuperator - The cruciform ceramic tube recuperator, developed by DOE in conjunction with Garrett AiResearch, uses a unique design to recover heat in the harsh environments of combustion exhaust where conventional heat exchangers fail. By preheating combustion air to 2000 F, the recuperator can save up to 50 percent of the fuel consumed in the combustion process. The first production unit of the cruciform ceramic tube recuperator was tested in a rotary forging furnace at Cameron Iron Works in Houston, Texas. Potential energy savings by the year 2010 are estimated at 43 trillion Btu per year.

Ceramic Recuperator - A new cross-flow, ceramic recuperator for use in high-temperature (1600-2600 F) relatively clean exhaust environments was developed and tested by GTE with DOE cost-sharing support. The "heart" of the recuperator is a ceramic (magnesium aluminum silicate) core composed of alternate layers of ceramic passages oriented at right angles to each other. Development and acceleration efforts have shown the recuperator to be applicable to a wide variety of industrial furnaces in several industries with resultant energy savings of 26 to 50 percent versus unrecuperated furnaces. As a result of DOE's technology acceleration program and the developer's marketing efforts, the recuperator is achieving widespread industrial acceptance and implementation. Some 694 operating recuperators of this type are currently saving an estimated 1.04 trillion Btu per year. By the year 2010, annual energy savings could be as much as 15.7 trillion Btu.

Metallic Recuperators - A metallic plate-fin recuperator to overcome exhaust temperature limitations and thus promote waste energy recovery was developed and tested by Garrett AiResearch with DOE support. This compact, stainless-steel plate-fin recuperator is designed to maximize the driving forces for heat exchange and to limit thermal stress. The plate-fin matrix consists of layers of corrugated sheet stock (fins) separated by plates. Tests show the recuperator able to perform satisfactorily with clean exhausts at temperatures up to 1500 F and to sustain a recuperator effectiveness of 85 percent for over one year while requiring no maintenance. Success of the recuperator prompted an acceleration program to expand knowledge of the operational characteristics of the device. Fifty-seven of these recuperators were operating in 1987 and saved an estimated 0.49 trillion Btu. It is anticipated that in the year 2010 this type of recuperator could be saving over 15 trillion Btu annually.

Plating Wastes Concentrator

The rinse water discharges from electroplating processes contain high concentrations of pollutant chemicals such as chromic acid, nickel sulfate, and zinc cyanide. Excessive pollutant discharge is presently avoided by high-temperature evaporation or chemical precipitation to produce a concentrate for disposal or recycling. These processes consume substantial amounts of energy and have high operating costs. An alternative way to concentrate large volumes of aqueous wastes is to boil the liquid at