SCALE FORMATION AND SUPPRESSION IN HEAT EXCHANGE SYSTEMS FOR SIMULATED GEOTHERMAL BRINES

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A system to generate a 1- to 3- gallon per minute stream of 350°F (177°C) simulated geothermal brine is discussed. A 10,000-gallon tank serves as the brine holding tank. The solution is prepared by diluting 26% sodium chloride, derived from a Gulf Coast salt dome with steam condensate, deaerating, heating the brine to 350°F in a steam heat exchanger, injecting the desired cations and anions into a flowing stream with chemical injection pumps, and mixing with in-line mixers.

Non-scaling cations are normally added to the 10,000-gallon base brine solution; anions, such as bicarbonate, silicate, etc. are injected as the sodium salts. Sulfide is injected separately as sodium sulfide solution. Hydrochloric acid is injected to adjust pH to the desired 6-8 pH unit range. Composition of the resulting simulated geothermal brine may be varied over wide ranges for each component.

The system is presently in operation on a hydrogen sulfide oxidation study while heat exchangers are being constructed for the scaling studies. Two heat exchanger systems will be used. The first is large U-tube exchanger designed to receive the hot brine on the shell side with cool water circulating in the tubes. The second is a series of three smaller straight tube exchangers with the hot brine in the tube side. Both systems will be completely instrumented to measure heat transfer coefficients in each exchanger.

Proposed experiments include: addition of scale control agents, injection of carbon dioxide to prevent carbonate scaling, and exploration of the effects of electrical and magnetic fields on scaling.

It is anticipated that the generation of data will begin in approximately one month or about September 1.

DISCLAIMER

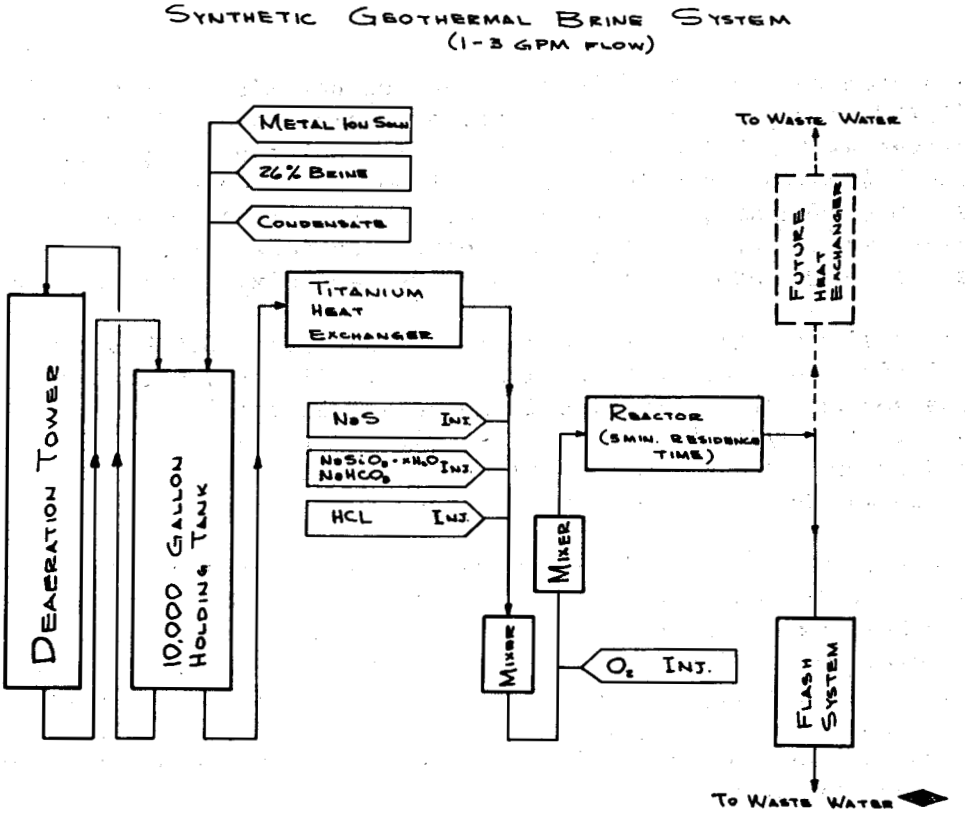

Figure 1: Flowsheet Schematic

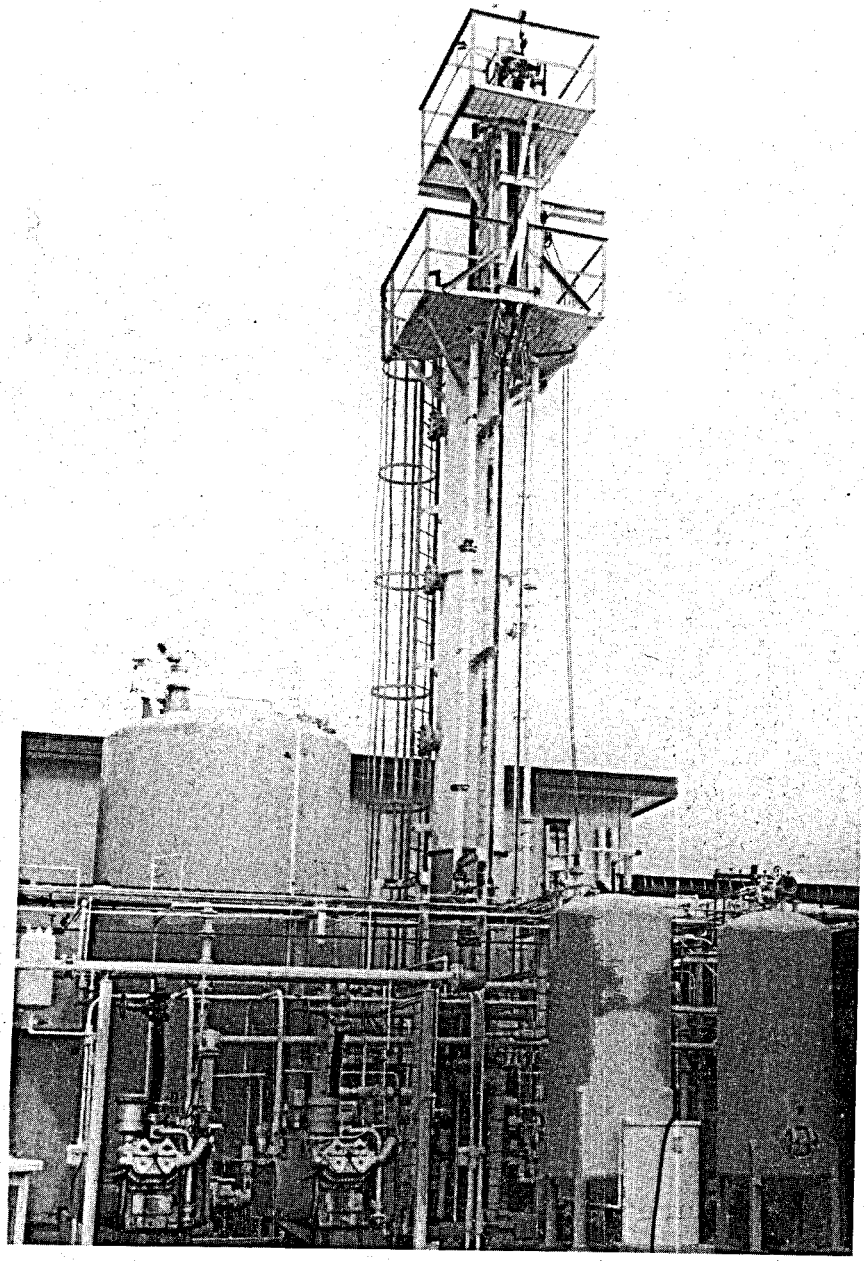

Figure 2: Deaeration Tower and 10,000 Gallon Holding Tank.

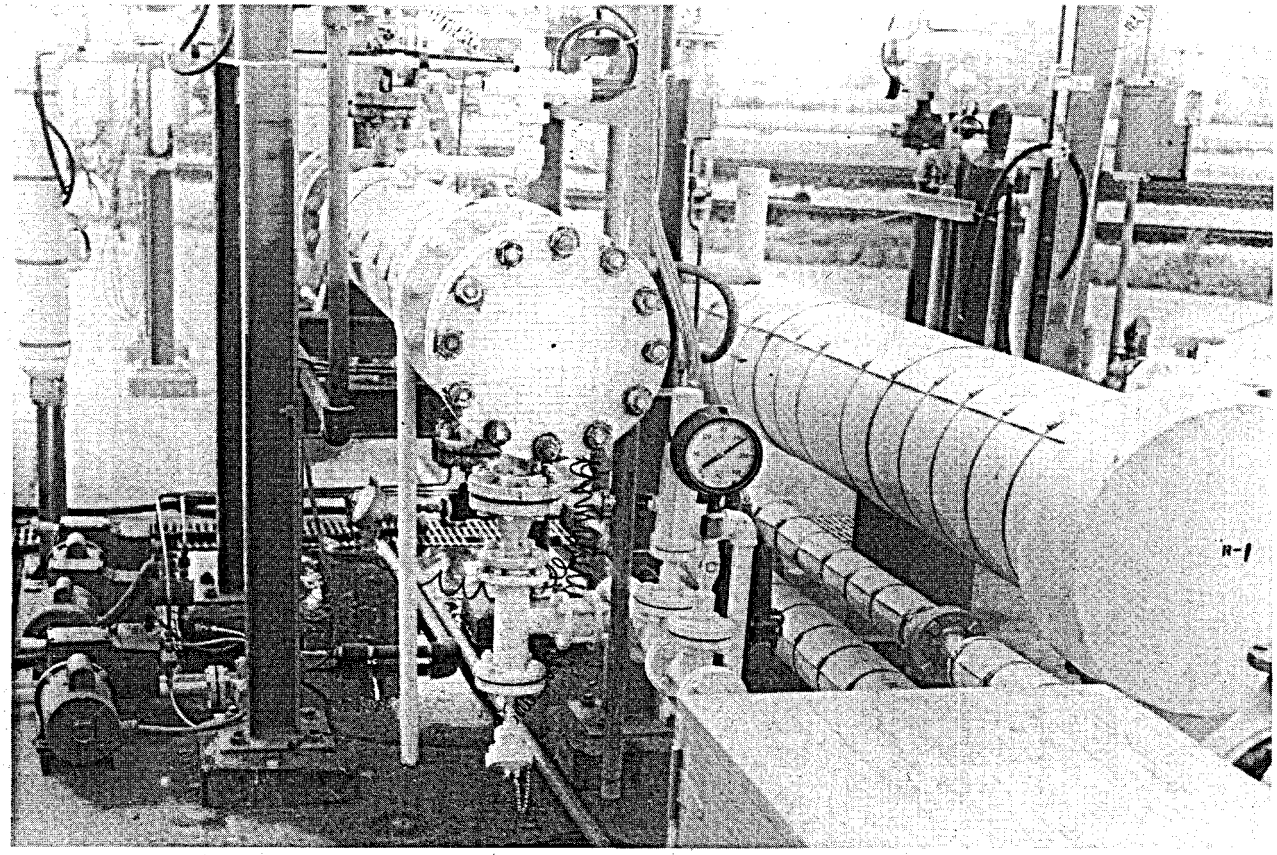

Figure 3: Titanium Heat Exchanger

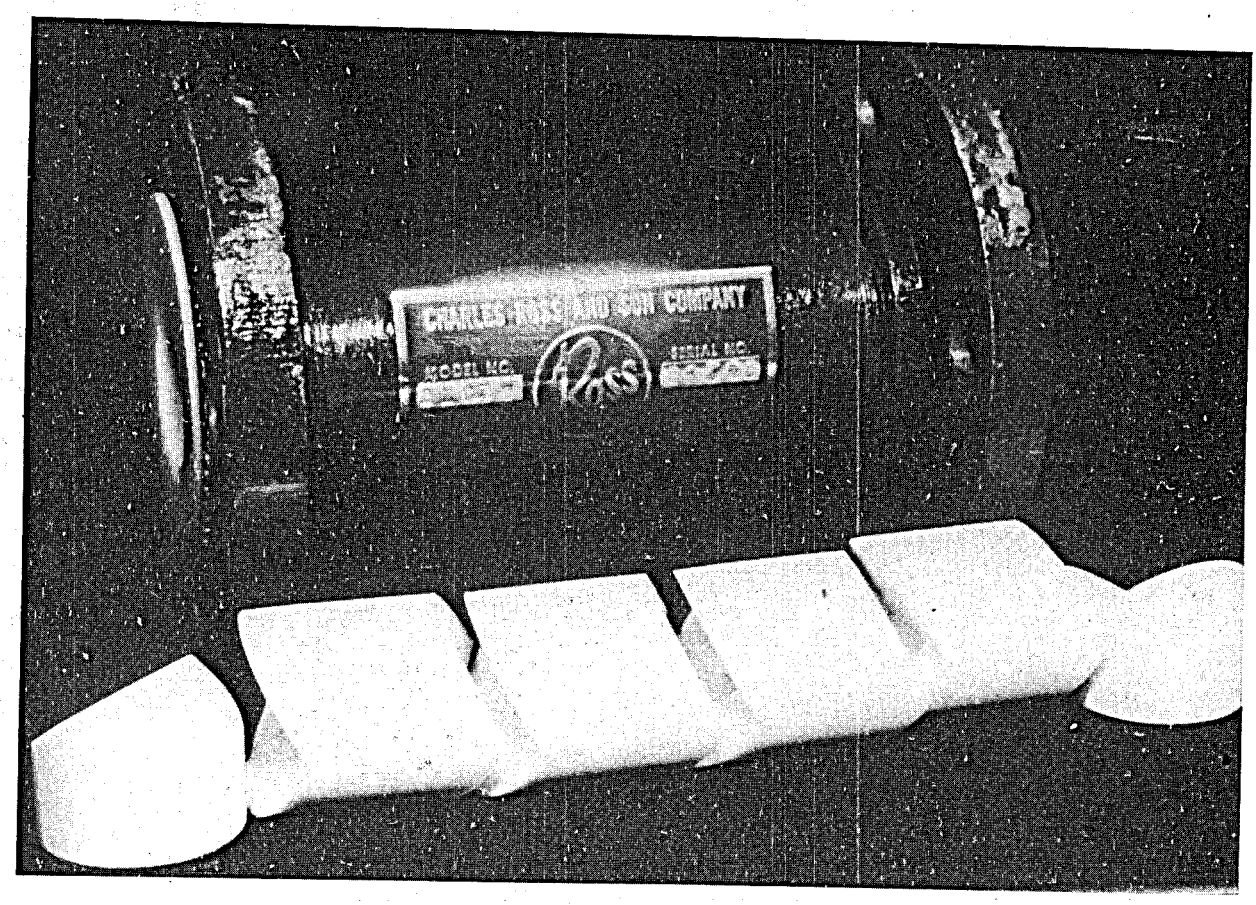

Figure 4: In Line Mixer

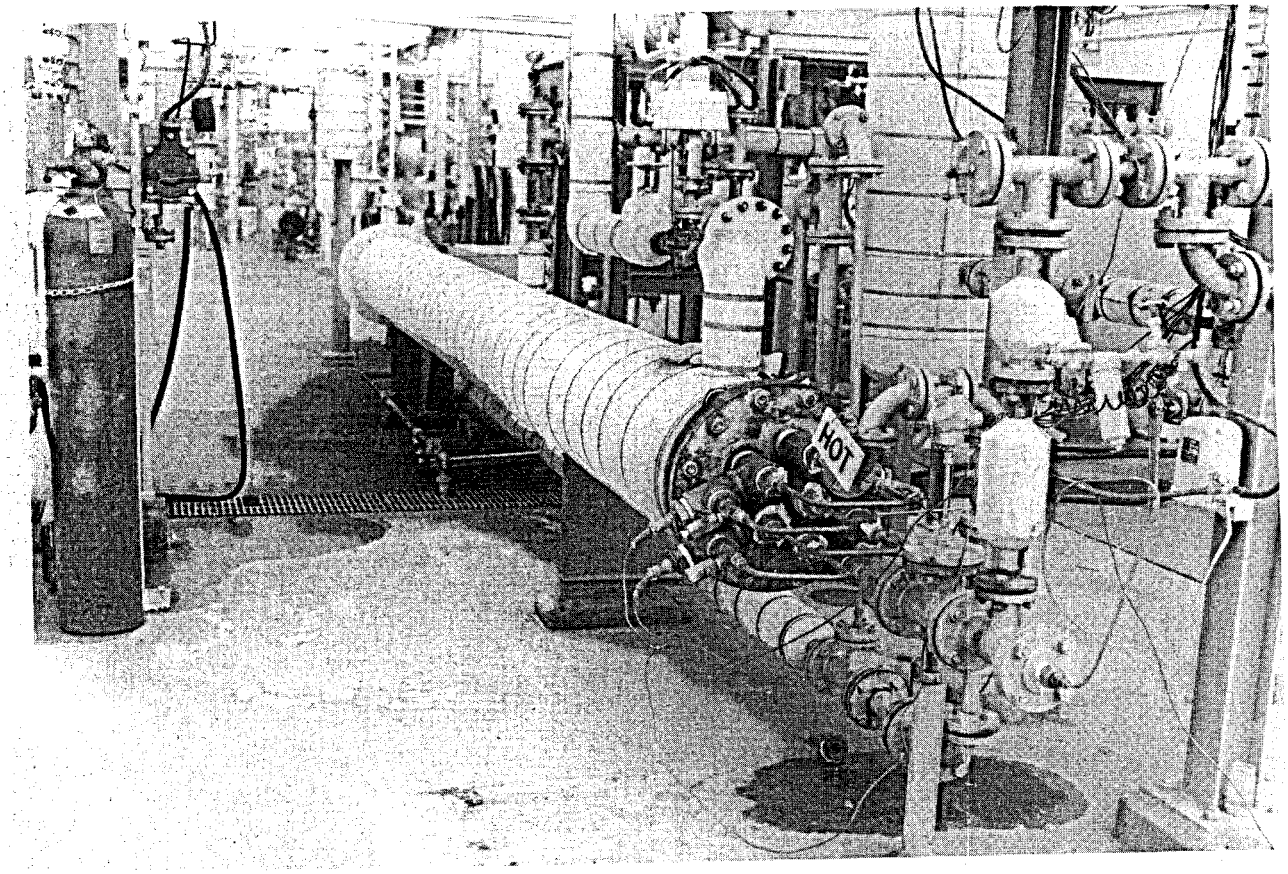

Figure 5: Five Minute Residence Time Reactor

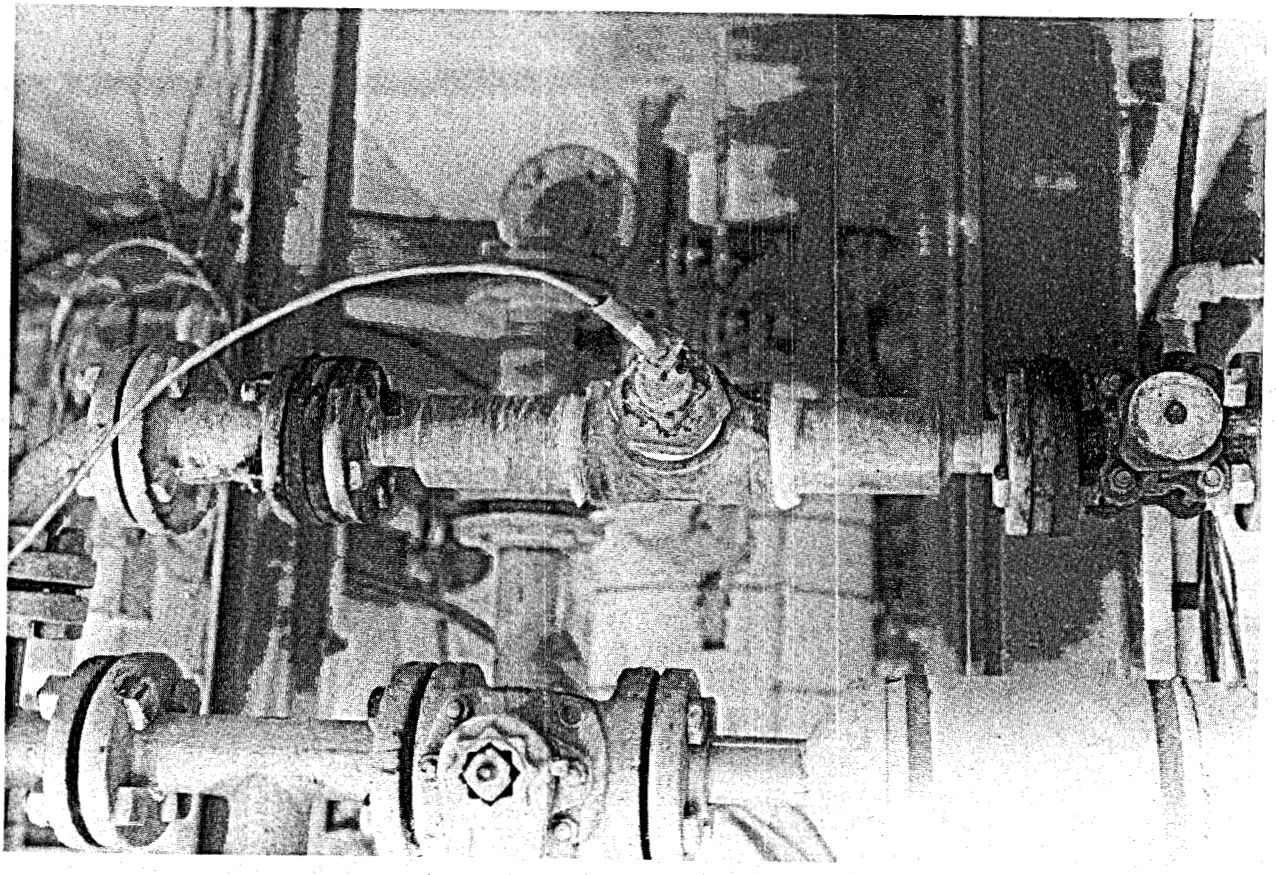

Figure 6: Petrolite Corrosion Probe

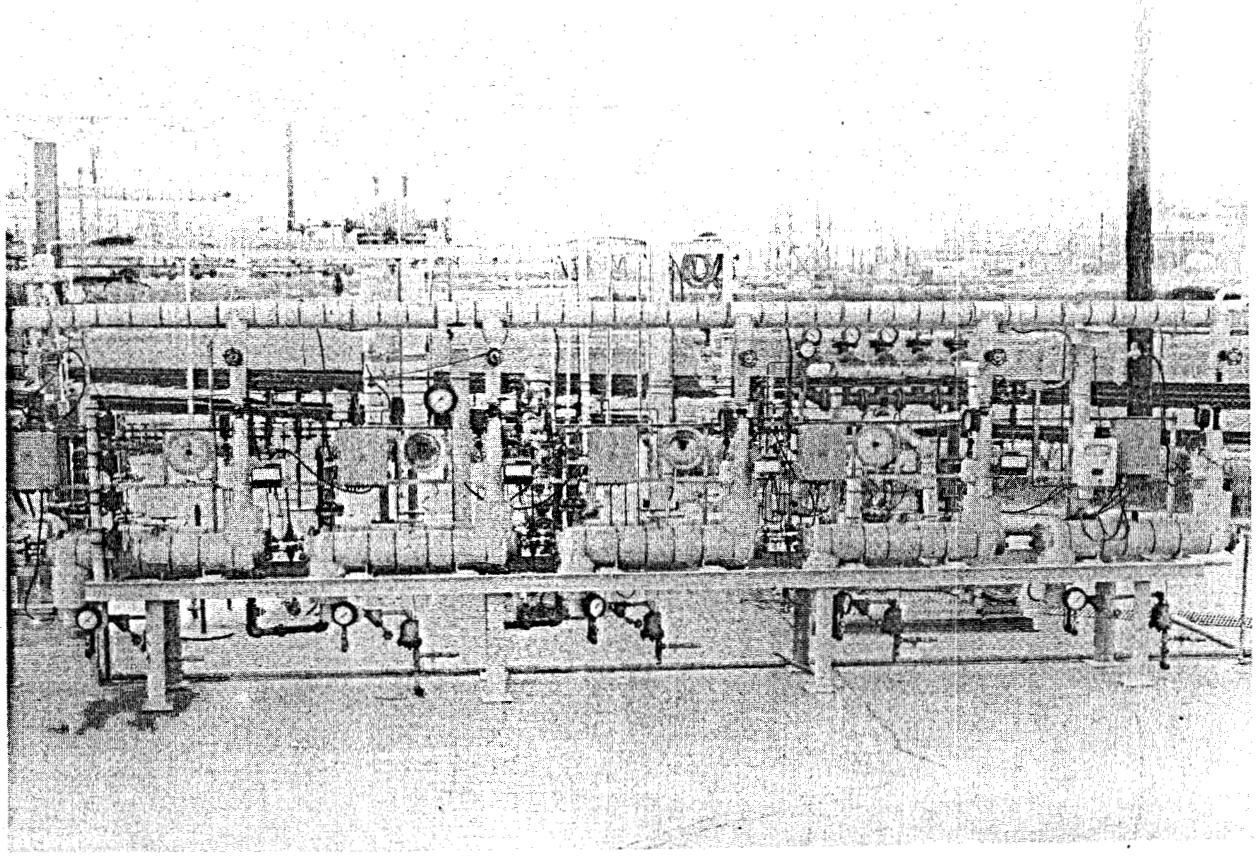

Figure 7: Mini Heat Exchangers