

A PRELIMINARY STUDY OF AMORPHOUS SILICA DEPOSITION
IN A BENCH-SCALE LIQUID FLUIDIZED BED HEAT EXCHANGER

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Deposition of silica scale on heat transfer surfaces is a problem which must be solved before economic power generation from many high temperature geothermal brines will be possible. As a part of the liquid fluidized bed heat exchanger development project, a preliminary silica deposition study was conducted using a laboratory bench scale unit. The purpose of this study was to establish an experimental technique for a series of more extensive silica deposition rate tests and to determine the feasibility of using a liquid fluidized bed heat exchanger for power generation in geothermal brines which contain high concentrations of dissolved silica.

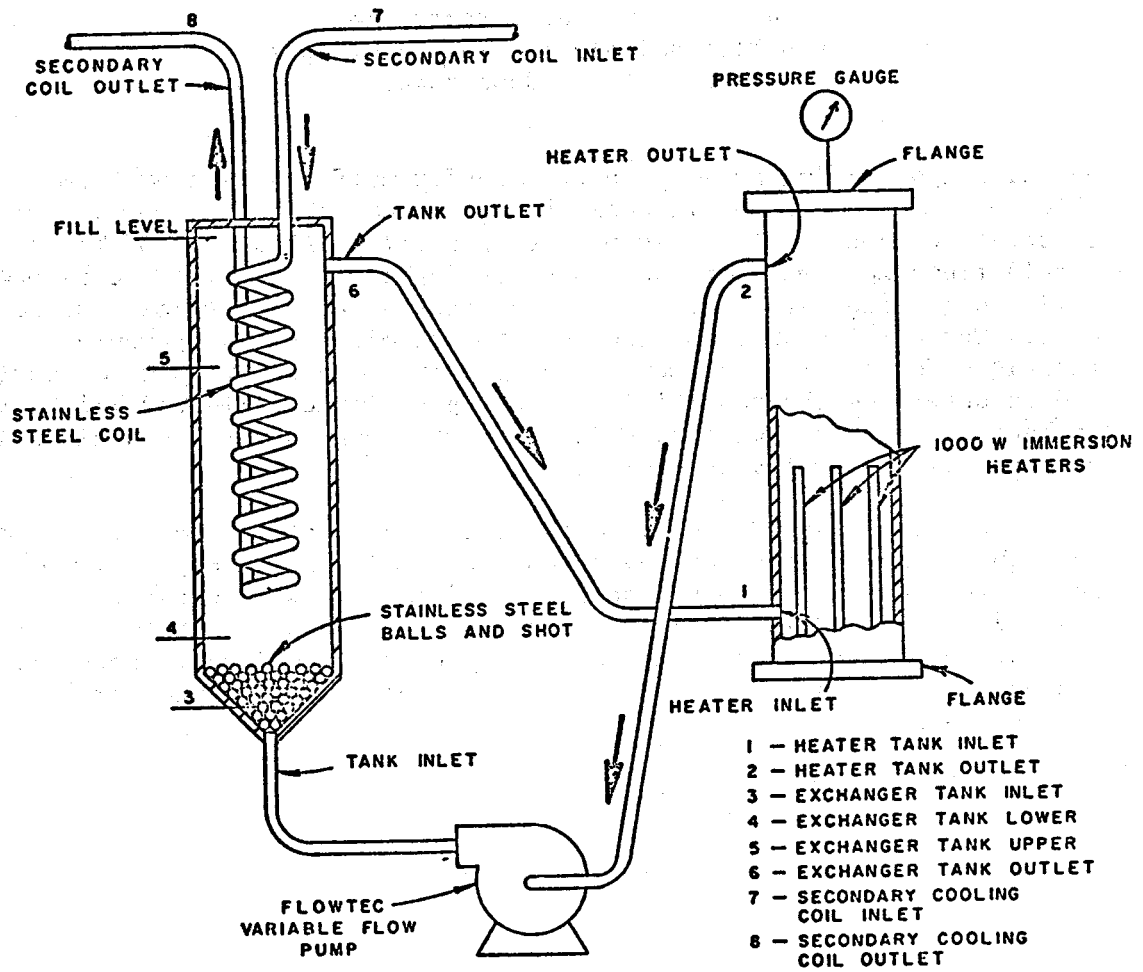
After twenty-two days of circulating a synthetic silica-calcite brine through the heat exchanger apparatus, no significant changes were observed in the outside heat transfer coefficient and no scale had deposited on the cooling coil or the glass heat exchanger tank where they were exposed to the scrubbing action of the fluidized bed. However, amorphous silica and calcite deposited on the non-fluidized portions of the apparatus.

DISCLAIMER

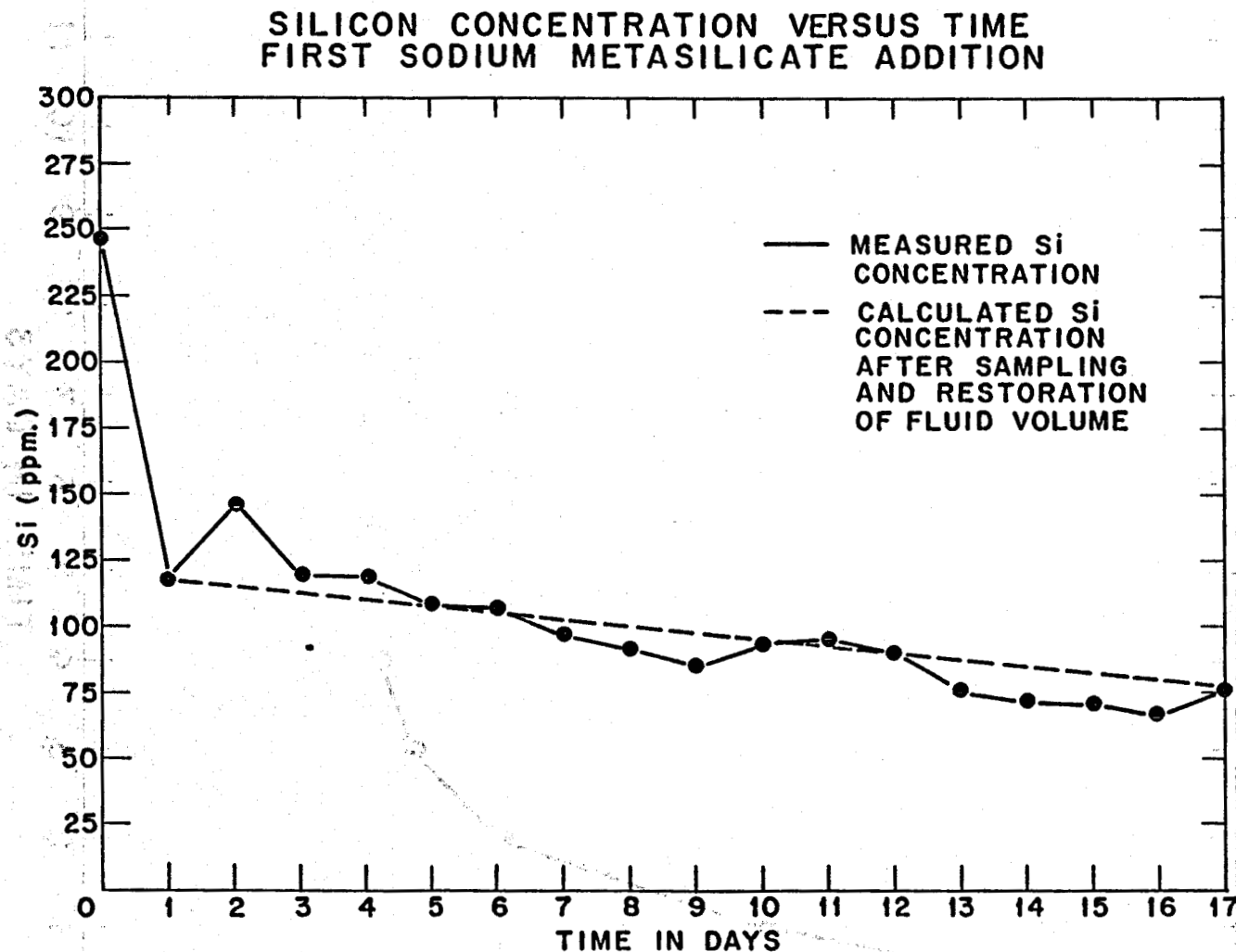
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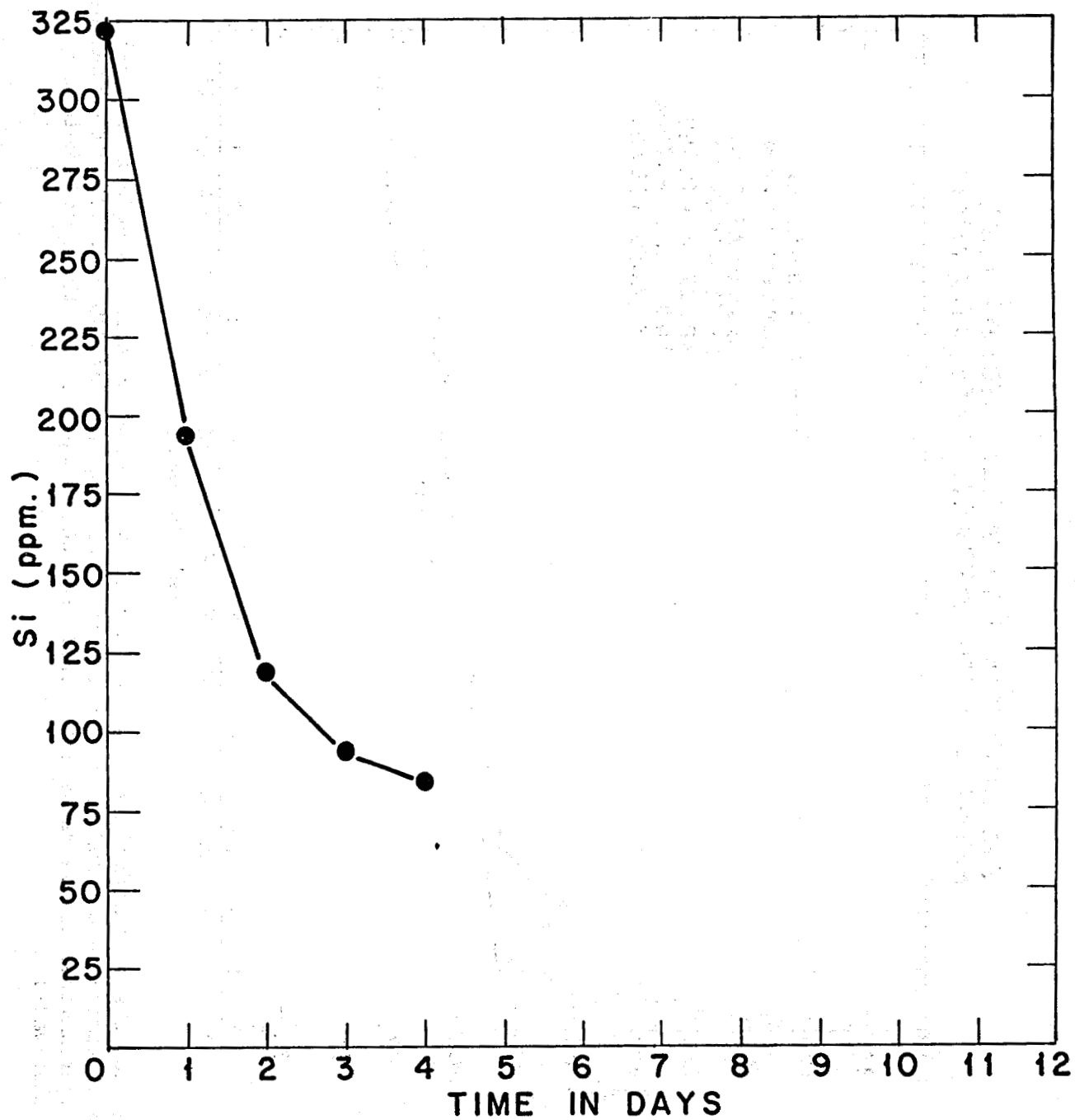


Model liquid fluidized-bed heat exchanger apparatus for scale deposition from synthetic geothermal brines. Thermocouple locations are shown.

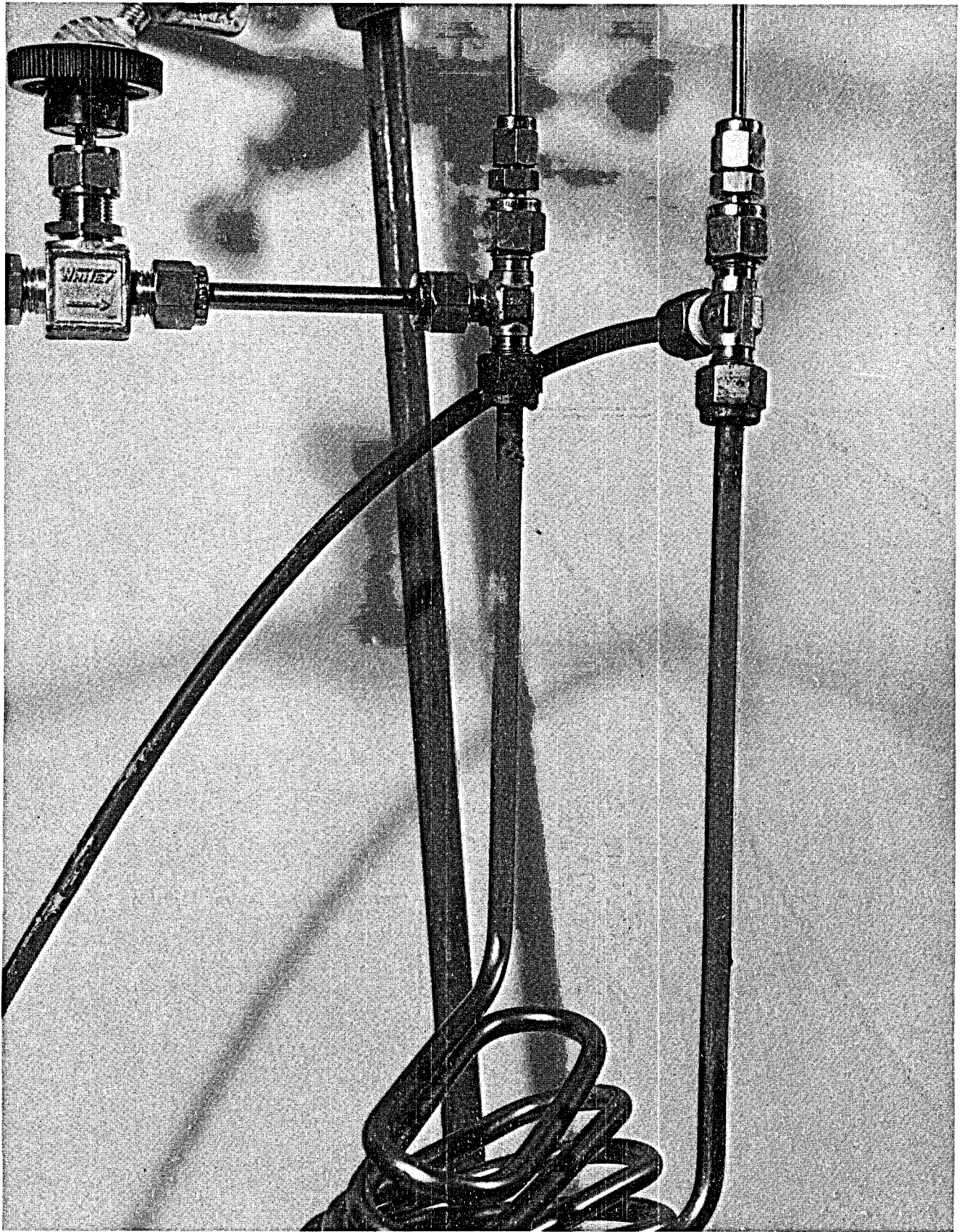


Daily analyses of filtered samples showed that the silicon in solution quickly reached a steady state at approximately 50% of the theoretical concentration of 248 ppm. The Si concentration then approximated the decrease calculated from the replacement of the sample volume by distilled water.

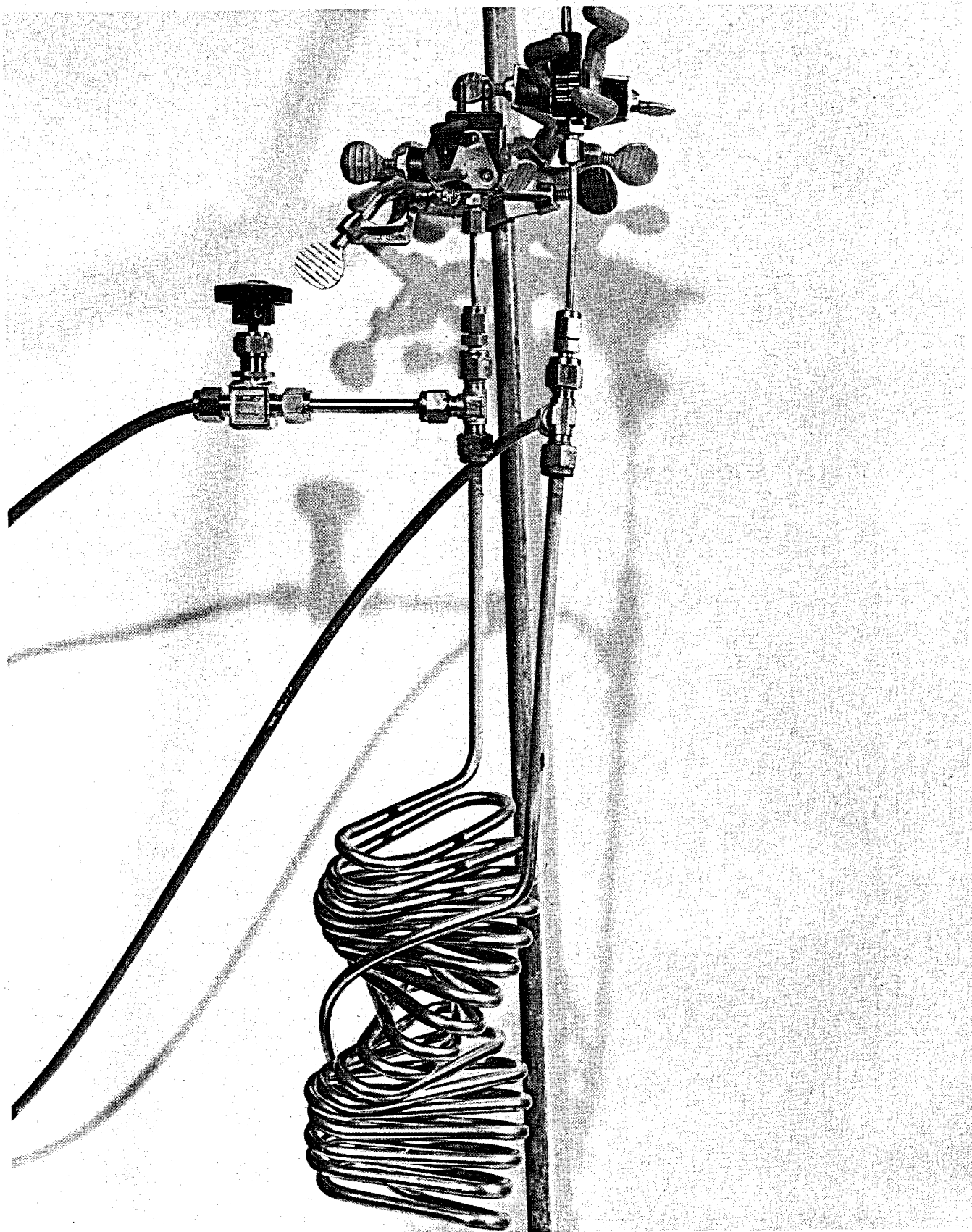
SILICON CONCENTRATION VERSUS TIME SECOND SODIUM METASILICATE ADDITION



Analyses of the second sodium metasilicate addition showed similar results.



Stainless steel cooling coil showing scale deposition above the level of the liquid fluidized-bed.



Stainless steel cooling coil showing scale deposition only on the portions not exposed to the scrubbing action of the liquid fluidized-bed.

LIQUID FLUIDIZED BED HEAT TRANSFER FROM SUPERSATURATED BRINES

