Memo Report C-54-29

CHEMISTRY RESEARCH DEPARTMENT

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PRESSURES GENERATED BY HEATING LIQUIDS AT CONSTANT VOLUMES

H. Tracy Hall

Mechanical Investigations Section

Abstract: Pressures developed by heating liquids at constant volume are discussed.

I have often been asked, “What pressures can be obtained by heating a liquid confined to a fixed volume?” the answer is shown in the figure. Solid curve (1) gives the pressure of carbon disulfide as a function of temperature if the liquid is confined to the volume it normally occupies at -100° C and 1 atmosphere. Curve (2) is for the same substance confined to the volume it normally occupies at 20° C. All organic liquids (for which data are available), under the same conditions give curves lying close to these. The dashed curve gives the pressure generated by confining carbon disulfide in a thick-walled steel cylinder. Allowance has been made for increase of initial volume due to thermal expansion of the steel and also it “stretch” under the pressure.

Curve (3) is for mercury confined to its natural volume at -30° C and 1 atmosphere. Clearly, mercury is in a different class than the organic liquids. It is conceivable that pressures near 20,000 atmospheres could be generated by heating mercury to 1000° C in some kind of confining vessel. However, pressures of this order are easily generated in simple apparatus so we are not tempted to dabble in red hot mercury.

The graphs were constructed from compressibility data of P. W. Bridgman.

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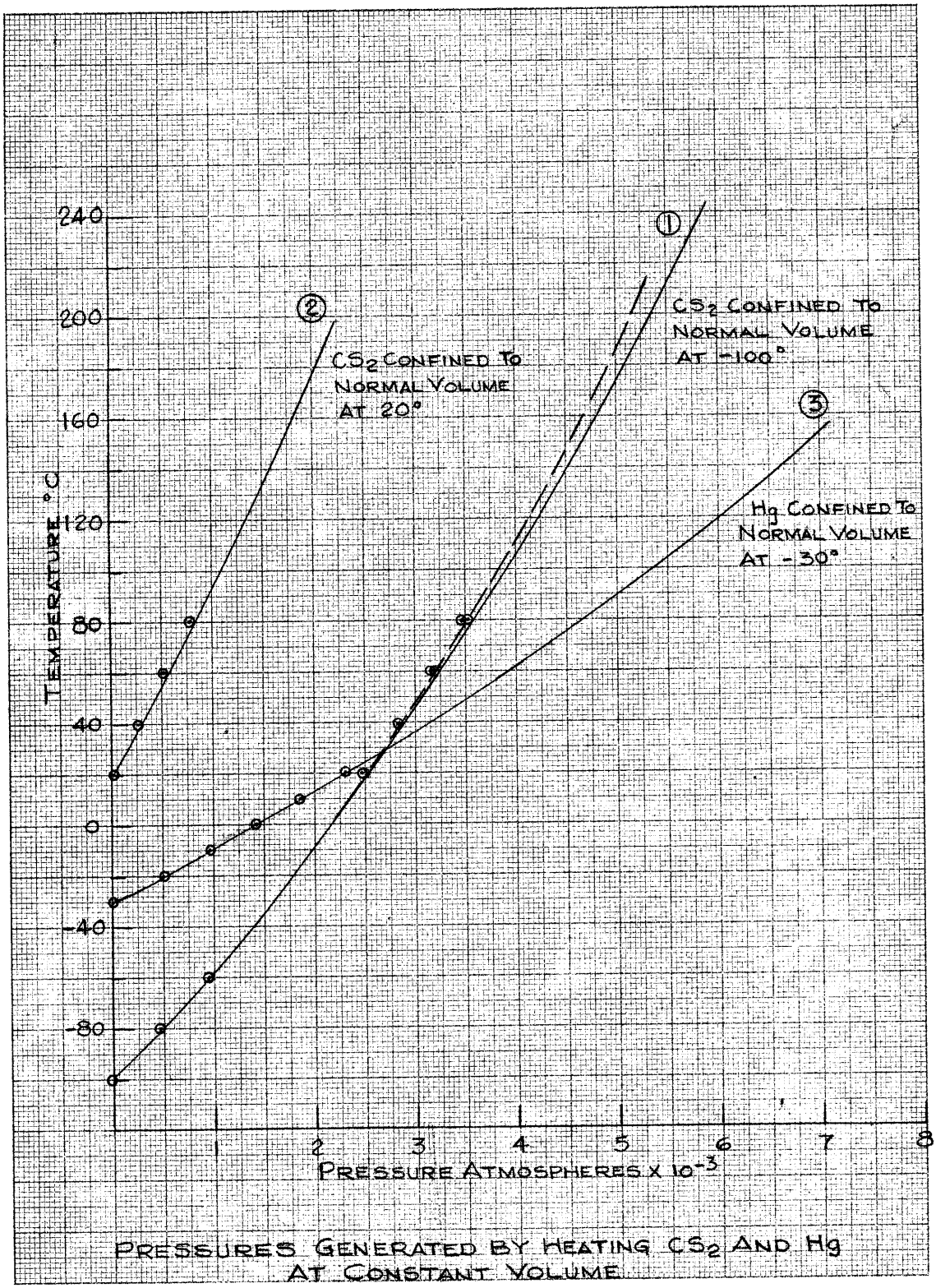

PRESSURES GENERATED BY HEATING CS_2 AND Hg AT CONSTANT VOLUME