[CONTRIBUTION FROM THE ANATOMICAL LABORATORY OF THE UNIVERSITY OF CALIFORNIA]

A DEVICE FOR INCREASING THE EFFECTIVENESS OF FREEZING MIXTURES[1]

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The difficulty in obtaining temperatures below −15° with sodium chloride–ice mixtures in the laboratory is well known. The device pictured here was designed to overcome this difficulty. The apparatus consists of two concentric cylinders made of 8-mesh per inch (3-mesh per cm.) wire screen with a common bottom of the same material. This is made to fit easily inside of a standard one gallon wide-mouthed vacuum food jar. Crushed ice is placed in the vacuum jar and rock-salt (sodium chloride) in the annular space in the basket. The jar is then filled well up in the basket with brine or water. If water is used to start, rather than brine, the ice tends to cake together at first. If one breaks this cake after a few minutes, however, the action proceeds as if brine were used. Convection starts immediately, the dense, concentrated brine moving downward next to the walls, and the colder, more dilute, brine rising in the center.

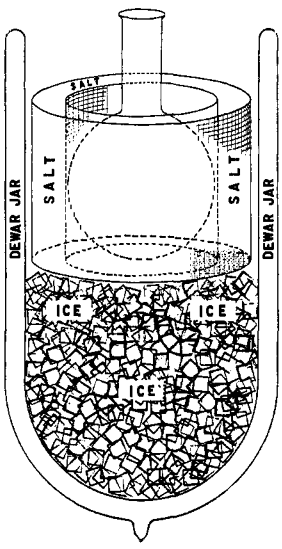

Fig. 1.—A device for obtaining temperatures close to the eutectic temperature of salt–ice mixtures. Material used is 8-mesh wire screen. A 500-cc. flask is pictured.

In tests made on this device the temperature of the brine in the center space dropped to −18° in ten minutes, and to −20.5° within thirty minutes after starting. It held this temperature approximately until practically all the ice had melted, which, starting with the vacuum jar half full of ice, was about twenty-four hours when the top was covered with a folded towel to keep out air currents. It is not necessary to have the jar covered in order to reach the low temperature obtained here.

A test was also made using an ordinary tin can of the proper size (a 5-lb. ether can) instead of the vacuum jar. In this case it cooled somewhat more slowly, reaching −13° after ten minutes, and −18° after thirty minutes. The minimum temperature, −18 to −18.5° was held for about two hours, after which time the ice was gone. If the can were insulated with sawdust, its performance would doubtless approach that of the vacuum jar.

[1] While the author has no patent or other limitation on the use of this idea, it is perhaps of interest that the Central Scientific Company, Chicago, Illinois, has agreed to make these devices in various sizes on order.

The ice used for these tests was crushed, averaging 1 or 2 centimeters in dimensions. When a single large piece of ice was used the temperature dropped very slowly, reaching −14° in one and one-half hours. A lower temperature would probably be reached if sufficient time were given. If snow or shaved ice were used the cooling would probably be rather slow also, since the packing of the snow would hinder convection.

The inside cylinder of the basket is made to take a 500-cc. flask or an 800-cc. beaker. As a test, using the vacuum jar, 500 cc. of ethyl alcohol was put in a flask at room temperature, and the flask placed in the already cold brine. At the end of half an hour the alcohol was lightly stirred for a moment and its temperature was read as −17°. At the end of the first hour the temperature was down to −20.5°. During the observations the temperature dropped as low as −20.8° and it might have approached the eutectic temperature of −21.1° even more closely.

Obviously this device may also be used with other salts and mixtures of salts. However, temperatures below −30° are difficult to obtain with calcium chloride (either alone or with the aid of sodium chloride) because of the unfavorable heat relations and because of the decreased convection due to the greatly increased viscosity.

This device is a double application of the "dissolving cone" principle.[2] A further modification has been successfully used for many years by Professor W. C. Bray of the Chemistry Department for maintaining unstirred water-baths close to 0°. Since water has a maximum density at about 4°, Professor Bray uses a screen or cage to hold the crushed ice near the bottom of the 0° bath.

[2] "The Laboratory," Fisher Scientific Co., Pittsburgh, Pa., Vol. V, No. 1, p. 10, 1932.

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[Contribution from the Department of Chemistry of Johns Hopkins University]

FURTHER STUDIES IN THE RARE GASES. I. THE PERMEABILITY OF VARIOUS GLASSES TO HELIUM[1]

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During the course of a research[3] on the computation of the age of iron meteorites by the "Helium method"—the ratio of helium to uranium and thorium—it was necessary to determine the loss of helium on heating for

[1] The following paper presents the results of experiments on the diffusion of helium and hydrogen through Pyrex glass, Jena 16''' glass, soda glass and lead glass. The results are discussed from a theoretical standpoint in formulating a theory of the mechanism of the diffusion process.

[2] Henry E. Johnston Scholar at the Johns Hopkins University.

[3] Paneth and Urry, *Z. physik. Chem.*, **A152**, 127 (1931).