NOISE ATTENUATION BY THE SYSTEM CONCEPT[1]

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The project was designed to prove that noise control is basically a system problem and that in general there are many different components which may be altered to achieve a particular desired noise attenuation. The system which is the combination of all the components contains three major parts: the source, the path and the receiver. The source in the project was a noisy electric mixer. The sound energy from this source traveled over paths of solids and air. The receivers used in the project were two microphones—one attached to a tape recorder and the other operating a General Radio Corporation noise meter and an octive band analyzer also manufactured by General Radio. In the project the paths by which the noise traveled were modified by the insertion of vibration isolators beneath the noise source, and by the installation of barriers of various types and densities to provide a separation between noise and receivers.

The purposes of the project were (1) to investigate the sound pressure level and octave band analysis of a noisy rotating machine, (2) to obtain frequency spectrums of the machine noise under the various attenuating methods studied, (3) to study the theory of vibration control and its relation to noise control (4) to prepare a data book on vibration and noise control and (5) to exhibit some of the many types of vibration isolators available to the design engineer.

The test equipment consisted of an electric mixer, virbration isolators, sound barriers, a sound level meter, an octave band analyzer and a tape recorder. The test procedure consisted of (1) operating the noisy machine in the open and under or behind various types of barriers, (2) operating the noisy machine with barriers together with properly designed vibration mounts beneath the unit and (3) plotting and recording the frequency spectrums of the resulting noise under the various attenuating methods tested.

The highest degree of noise attenuation was obtained when vibration isolators, sound absorptive material and barriers of the proper mass were used. In this particular test an overall noise reduction of 33 DB was recorded when compared with the machine in the open.

In order to demonstrate the effectiveness of vibration isolators, and barriers on the noise of the mixer under the several different conditions tested, a tape recording was made of resulting noise.

[1]This project was a winner in the Southern Appalachian Science Fair in Knoxville, 1960.

My projcet this year was a continuation of the study of sound, following last year's Science Fair Project entitled "Noise Attenuation Properties of Materials" in which the actual decibel loss obtained with very light to very dense materials was measured.

THE TEMPERATURE EFFECT OF MIXING SALT AND ICE

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In making ice cream with home freezers people are frequently confronted with the problem of how much salt to add to a given quantity of ice to obtain the coldest temperature. My experiment was designed to determine the extent to which the temperature of ice could be lowered by the addition of various quantities of salt and the point at which greatest freezing could be attained.

Salt absorbs water, even from ice, and melts it, forming a salt solution or brine. The freezing point of the saturated brine is —21.3°C or —7°F. Brine has a lower freezing point and absorbs heat from ice, causing it to melt. As the brine absorbs the heat and the ice melts, the temperature of the solution is lowered.

The fact has been known for many years. In 1771 R. Watson observed that the time a salt solution takes to freeze and the lowering of the freezing point were proportionate to the concentration. The same general conclusions were reached at a later date by C. Blagden, but he was unaware of any previous work. Since priority is given to Blagden, the proportionality between the lowered freezing point and the solution concentration is known as Blagden's law.

In my experiment I used twenty-five pounds of sized ice — about one half inch in diameter — the size usually sold for freezing ice cream. Also I had eight pounds of ice cream salt, thirteen quart jars, a pair of scales, a pan for mixing the salt and ice, and two Centigrade thermometers. With one pound of ice I mixed a predtermined quantity of salt and placed it in a quart jar. Then I put a thermometer in the jar with the mercury bulb about one and one-half inches from the bottom of the brine solution and left it there until temperature equilibrium was reached. I then made a thermometer reading and recorded the results. About fifteen minutes later, as a check, I made a second reading but noted no changes.

To one pound of ice I added salt in the following quantities: for the first experiment, no salt — ¼ ounce — ½ ounce — 1 ounce — 2 ounces — 4 ounces — 8 ounces — 12 ounces — 16 ounces — 20 ounces — 24 ounces — 28 ounces — 32 ounces. The

room temperature during the experiment was 23°C. or 73.4°F.

The temperature results of mixing various quantities of salt with one pound of ice were as follows:

Quantity of salt in one pound of ice	*Temperature of Combination*	
0	0°C	32 °F
¼ ounce	— 4°C	24.8°F
½ ounce	— 7°C	19.4°F
1 ounce	— 9°C	15.8°F
2 ounces	—13°C	8.6°F
4 ounces	—17°C	1.4°F
8 ounces	—19°C	— 2.2°F
12 ounces	—20°C	— 4.0°F
16 ounces	—19°C	— 2.2°F
20 ounces	—18°C	— 0.4°F
24 ounces	—17°C	1.4°F
28 ounces	—15°C	5.0°F
32 ounces	—13°C	8.6°F

After the point of saturation had been reached and the temperature became no lower, I noticed a falling out of the salt from the solution to the bottom of the jar. At first the quantity was slight but as I added more salt the precentage increased and became very noticeable.

In this experiment I learned that the point of greatest freezing was obtained by adding twelve ounces of salt to one pound of ice. However, effective freezing can be obtained with as little as four ounces of salt per pound of ice. Considering the cost of ice and ice cream salt, four parts salt to one part ice or two parts salt to one part ice would be practical recommendation for making ice cream with home freezers. Although I was unable to reach the freezing point of brine which is 21.3°C., I did come fairly close with the 20°C of the twelve ounces of salt and one pound of ice. I intend to go on with this work and it is my hope that I will be able to learn more about the freezing process and its practical application.

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lectured before the Institute on "Chemical Protection against ionizing radiation." Lawton H. Smith also lectured before the Institute on "Effects of radiation on cell morphology and viability" and "Protection against ionizing radiation other than chemical."

Sheldon Wolff attended the Third International Congress on Photobiology in Copenhagen, Denmark, July 31-August 5, and presented a paper "On the apparent synergistic effect of far-red and X rays in the production of intergenic mutations (chromatid aberrations)." Dr. Wolff also attended the International Atomic Energy Agency Symposium on the Effect of Ionizing Radiation on Seeds and Its Significance for Crop Improvement in Karlsruhe, Germany, August 6-13, and presented an invited paper entitled

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