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The Variation of Sound Intensity with Distance from the Source; An Interesting Case of Deviation from the Inverse Square Law

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THE VARIATION OF SOUND INTENSITY WITH DISTANCE FROM THE SOURCE; AN INTERESTING CASE OF DEVIATION FROM THE INVERSE SQUARE LAW.

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The phenomena of sound present many interesting features and diffraction is not the least. The writers have been able, by an extension of Rayleigh's theory, to determine the effect in the neighborhood of a rigid sphere produced by a source of sound located on that sphere. One of the results of this theoretical investigation is the establishment of the variation of the intensity of sound with the distance from the center of the sphere. The computations necessary for approximate numerical results are tediously long, and those given herewith are merely those that were readily available in other investigations of the writers.

The results are shown in Tables I and II. r is the distance from the center of the sphere, and the angle given is that between the two lines, one drawn through the source of sound and the center of the sphere, and the other from the center to the point for which computation is desired. The variable shown is the number which must be multiplied into the inverse square of the distance from the center to give the correct relation between the various intensities.

TABLE I.

Wave Length, Approximately Middle C. Circumference of Sphere, 60 cm.

r	0°	30°	60°	90°	120°	150°	180°
19.1 cm.	6.28	3.54	1.28	.652	.655	.756	.777
477.0 cm.	1.04	1.03	1.02	1.00	.978	.968	.957
1910.0 cm.	1.00	1.00	1.00	1.00	1.00	1.00	1.00

TABLE II.

Wave Length, Approximately an Octave Above Middle C. Circumference of Sphere, 60 cm.

r	0°	30°	60°	90°	120°	150°	180°
19.1 cm.	4.24	2.58	1.14	.622	.396	.329	.270
28.6 cm.	2.26	1.81	1.18	.728	.564	.446	.420
76.4 cm.	1.75	1.53	1.15	.862	.661	.544	.520
477.0 cm.	1.00	1.00	1.00	1.00	1.00	1.00	1.00

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Aside from the theoretical interest in the results obtained, there is a practical significance to be found in the subject of architectural acoustics, where the variation of the sound from the speaker is desired. Of course in this case there are assumed to be no reflecting surfaces excepting the rigid sphere.

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