

THE VARIATION OF PITCH OF THE NEW  
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That the pitch of the new singing tube depends upon several factors, including the difference of temperature between the closed end and the remainder of the tube, the absolute temperature, and the linear dimensions of the tube has been known for several years. The relation between absolute temperature and pitch has been investigated,<sup>1</sup> and so also has the relation between pitch and density<sup>2</sup>; however, an exact and quantitative mathematical statement of the relations involved in the production of sound by heat by means of the new singing tube has not been offered. The object of the present investigation was to indicate in an experimental manner the variation of pitch with the external length of the tube.

With this aim in view, a tube was constructed of pyrex glass, of the form shown in Fig. 1. The dimensions of both the inner and outer tubes are given in Table I.

TABLE I

Tube No. 1.

Inner tube:	length	= 65.0 mm
	inside diameter	= 7.0 mm
	wall thickness	= 0.75 mm
Outer tube:	inside diameter	= 10.6 mm
	wall thickness	= 1.0 mm

The tube was then water-jacketed over its entire length to within 2 cm of the closed end, which was heated by means of a ring burner. The pitch of the tone emitted by the tube was measured by comparison with a tone variator. The tube was then removed from the jacket, and a portion of it (2 to 5 cm) cut off at the open end. The water jacket was shortened and replaced and the pitch again measured as before. This procedure was repeated until the outer tube was but a little longer than

<sup>1</sup> Phys. Rev., N. S., Vol. XV, p. 336.<sup>2</sup> Phys. Rev., N. S., Vol. XXIII, p. 115.

the inner tube. The data taken for tube No. 1 are given in Table II.

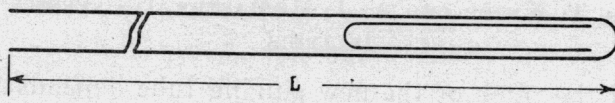


Fig. 1

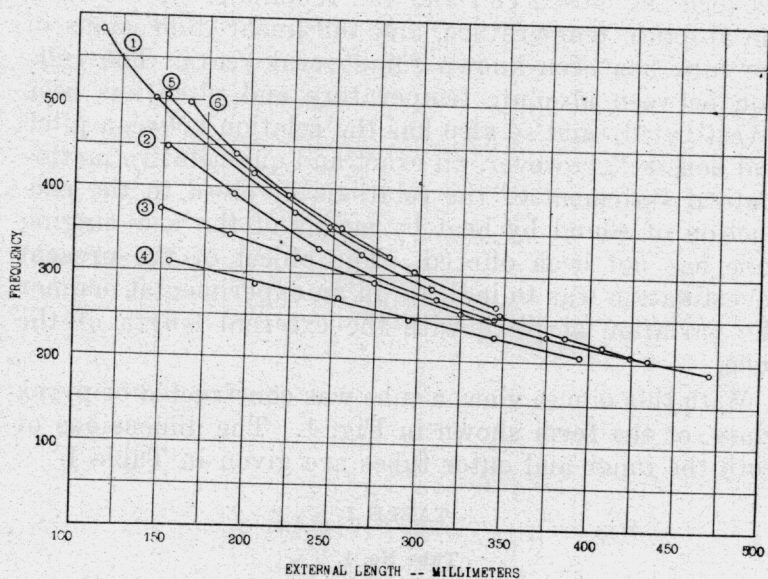


Fig. 2

TABLE II

Tube No. 1

External Length L	Frequency
434 mm	203
408	217
384	229
348	253
308	284
267	323
228	370
147	500
115	582

The variation of the pitch with the length of tube No. 1 is shown graphically by Curve 1, Fig. 2.

Other tubes were constructed in which the diameters of the inner and outer tubes, and the lengths of the inner

tubes were different. These tubes were jacketed and the pitch for various external lengths measured in the manner described. The results of these observations are also shown in Fig. 2. It is not possible to draw definite quantitative conclusions from the results obtained. The curves shown, however, indicate that the pitch not only depends upon the *absolute temperature*, but also that it varies according to a *definite law* involving the external length, and the other dimensions of the tube. The observed data all fall on smooth curves, which fact favors the possibility of such a law.