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A New Tonoscope

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as vibrating chamber, with the right end of the large tube covered with a silvered mica membrane. The left end of the smaller tube served for mouthpiece. Leaning against the large tube in the foreground is seen a circular piece of silvered mica such as was used for a reflecting membrane.

SUMMARY.

1. A new and simple method has been found for producing the stroboscopic effect.

2. The method appears to employ a general means of producing periodic illumination changes at a fixed point which has not been hitherto used; viz., the periodic lateral displacement of a beam of light non-uniform in intensity over its cross section.

3. A question for further investigation is: How large a contribution to the changing light intensity on the stroboscopic screen is due to changing curvature of the mirror?

4. An additional experiment suggested by the stroboscopic effect with the vibrating mirror is a similar experiment with a vibrating convex lens, similar to that used by Bell with a selenium cell.

A NEW TONOSCOPE.

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While undergoing a series of voice pitch tests some three years ago in the Psychological Laboratory of the State University of Iowa, the author learned that in his own individual case, as in some others, there existed, according to the statement of the investigator, Mr. C. J. Knock, a consistent as well as persistent tendency to miss in a definite direction certain intervals of the musical scale. The instrument used in these tests was the Seashore tonoscope,[1] an indicator of absolute pitch developed in some of its later stages at this University. In the particular results mentioned the amount of the error was not so noticeable to the ear, as the ear has its limitations, especially when it is the ear of the one who is himself forming the intervals by voice, but in an absolute instrument like the tonoscope even very small errors can be detected. The conclusion formed by the author from these results was that the musical intervals concerned had been wrongly learned in childhood.

[1] Seashore, C. E., Psych. Monographs, University of Iowa Studies in Psychology, No. VI, June 1914, p. 1.

The sources of a child's information regarding musical intervals are his listening to a piano or other musical instrument, or his hearing the intervals sounded by almost anyone who may be at hand to do this for his benefit. The chief difficulty with the first method is that the instrument may be and generally is, to an extent at least, out of tune, and in the second case the fidelity to pitch of the older person who is sounding the intervals is more or less questionable, depending both upon how good a musician this person is and also upon his physical condition, which has a marked effect upon one's fidelity to pitch.

A child's first impression is the important impression. In the interest of making his first impressions regarding matters of pitch in singing as nearly absolutely correct as possible an instrument like the tonoscope should be made readily available to the public. In fact it should be an instrument available in the home itself. Availability includes as small size and weight as possible together with low cost.

The idea of improving the tonoscope in at least these respects has continued with the author since the series of tests to which reference has been made. In February of the present year (1916) experimental work was undertaken with a view to simplifying the instrument. This resulted in a new method of producing the stroboscopic effect which is particularly adapted to the tonoscope because it does away with the manometric flame and its necessary gas supply. It also permits the illumination to come from one end of the drum rather than directly in front of it. The new method is presented in a separate paper.

It was also found by stroboscopic tests that a mechanical clockwork meter of the phonograph type possesses a marked constancy of motion, which over an interval of about two minutes is constant to within one-tenth vibration per second. By introducing an electric wind to keep the spring automatically at the same tension very great constancy can be secured and thus the special synchronous motor for constant speed rendered unnecessary. Also it was found that the stroboscopic drum could be greatly reduced in size, and both drum and scale placed at the distance of most distinct vision from the eyes.

Thus there has resulted an improved tonoscope that has the desirable qualities of portability and reduced cost of manufacture. It is an instrument easily available to the home and the

public school, as well as to music teachers and musicians everywhere, in private studios or conservatories. Because of its wide

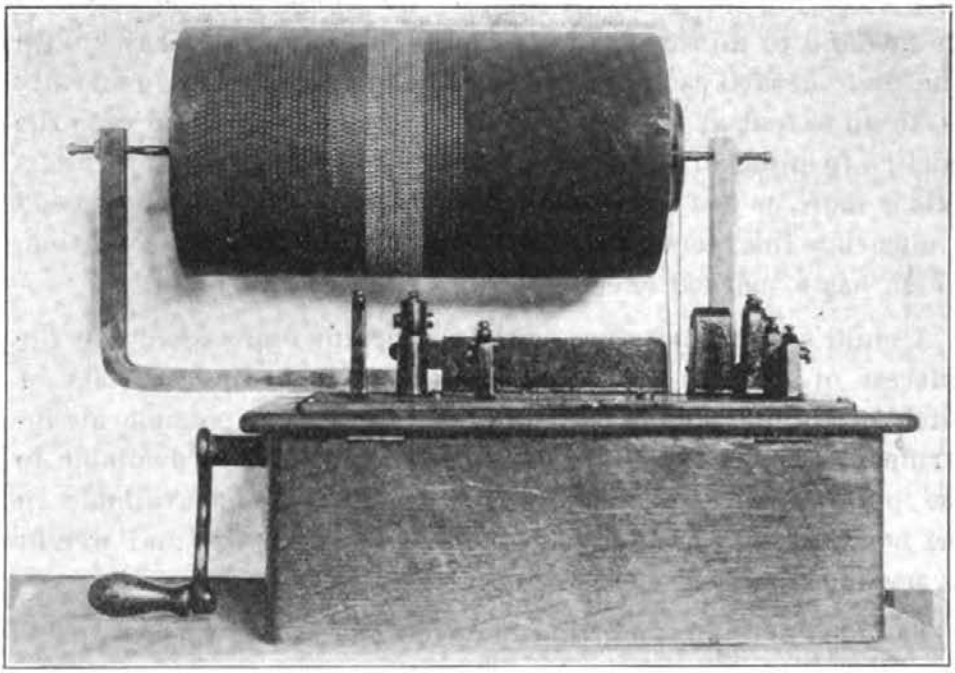

FIG. 22.

availability science will have at hand practically unlimited amounts of data to be used in drawing scientific conclusions, or formulating laws.

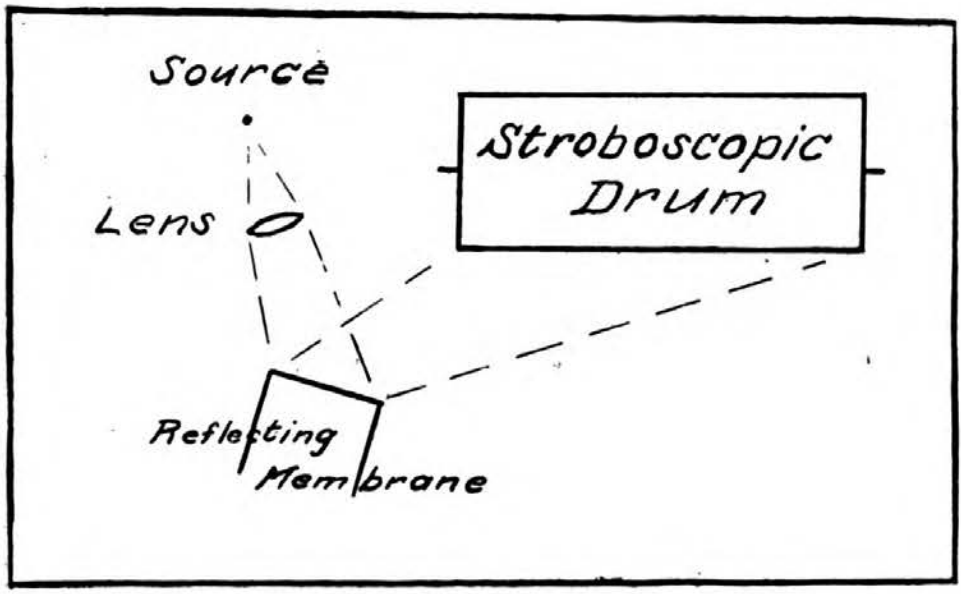

FIG. 23—Lighting Scheme in New Tonoscope.

Its uses are numerous, but none would seem to be more important than its employment in giving to children correct im-

pressions as their first impressions regarding matters of pitch. For a child to be at all musical he must learn the musical scale. The scale is fundamental although simple and usually quickly learned by the child, and a little time spent with him with the tonoscope as an aid will give him these correct impressions.

The stroboscopic drum with its phonograph motor drive used in the demonstration of the new tonoscope at Des Moines is shown in figure 22. The lighting scheme for the stroboscopic method is indicated in figure 23.

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