United States. The object of the proposed organization is to afford promptly to all the hydraulic laboratories throughout the world information as to the nature of the research which each is undertaking, thus permitting a closer coordination of the work. The first step in organizing this service nationally in the United States was to compile and distribute to the hydraulic laboratories in this country a report covering the activities of these laboratories. As a result of the prompt cooperation of the individual laboratories, it was possible for the bureau to issue on April 1 its first report of this kind, a mimeographed bulletin entitled, "Current Hydraulic Laboratory Research in the United States." The second report will be issued on July 1, and succeeding numbers will appear quarterly. In addition to the above service, the bureau will compile and issue annually a description of the hydraulic laboratories in the United States, their equipment and facilities for research in so far as the heads of the laboratories will furnish the necessary information. It is planned to issue the first report of this kind on June 1.

DISCUSSION

AN ELECTRIC ANALOGUE OF VOWEL PRODUCTION

It is of interest to examine the results of the remarkable if somewhat bizarre experiment of Travis and Buchanan,[1] which relates to the production of sound frequencies in the voice, in the light of our knowledge of analogous electric circuit behavior. The mathematics of the electric circuit is remarkably well developed, and since in many cases a strict analogy may be demonstrated between sound vibrations and electric vibrations, it is hoped that in the present study a consideration of this mathematics will prove significant.

First, the possible appearance in the output of vibration frequencies that are entirely absent in the motive force should be considered, that is, the appearance of frequencies in the voice that would not appear in the vibration of vocal cords in the open. Or, in terms of this particular experiment, the change of wave-form when a pure sine wave is passed into the resonating cavities.

There is no doubt that such a change is possible. It is the result of non-linear response of some of the elements involved in the propagation of sound, and appears when a strictly sinusoidal stress does not result in a strictly sinusoidal strain in either the vibrating medium or the containing walls. The irregularity of the vocal passage and the non-homogeneity of the walls make a somewhat non-linear response certain, but the amount of the change of wave-shape is unknown. The amount of the change at any one point may be small, but if any of the chief frequencies thereby introduced should find a resonating cavity of the same natural frequency, the amplitude of such frequency will be greatly increased. It should also be noted that the vibration of the vocal cords is not entirely independent of the resonant system in which they operate, although for practical purposes it is very nearly so. It is to be expected that the distortion of loud sounds is greater than that of soft ones.

[1] SCIENCE, 77: 121, January 27, 1933.

Second, the magnification, in the output, of small irregularities in the input must be considered. An abrupt change in the input motion, a discontinuity, will produce resonance in all cavities, but in amounts varying with the natural frequency, location and size of the cavity. An irregular, or non-sinusoidal input will have a similar effect. So will a wave whose steady-state condition is sinusoidal, when it is starting or stopping. All three of these means of producing resonance will doubtless occur in the normal voice. Only the second will be appreciable in the experiment, as described, with the oscillator; but it is evident that the input can not be mathematically exact even under the most favorable experimental conditions, and there is no mention of a determination of the exact wave-form in detail.

Finally, the relative amounts of frequencies introduced by the two means should be considered. The first, the distortion due to non-linear response of the vocal passages, can produce energy of one frequency only at the expense of decreasing energy of another frequency. The more audible a frequency is, the more it is being damped by losing energy as output. From these considerations, and from the nature of the system, it is improbable that resonance in the sinusoidal steady-state condition could introduce frequencies with amplitudes of more than a few per cent. of the fundamental.

The second type of distortion, due to transient conditions or to non-sinusoidal input, will give resonant vibrations that depend for their energy on a component vibration of their own frequency in the input. Hence, as they also are damped by the output, their amplitude with an approximate sine-wave input may be of the same order of magnitude as the steady state distortion.

So both "steady-state" and "transient" production of resonant frequencies appear to be possible. In either case a small amplitude may be magnified to many times its original amount by resonance, and from the published data it seems impossible to tell which type of distortion produces the resonance detected by Travis and Buchanan.

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NOMENCLATURE OF THE VEGETABLE WEEVIL

THIS interesting weevil is one of the many insects which has recently emerged from natural obscurity and has appeared as an economic pest on three continents during the past twenty-five years, it having originated on a fourth. Its native habitat is the southern half of South America, from which area it has been carried by commerce to Australia, North America and Africa.

The first specimens were collected more than one hundred years ago on Magellan Strait and were described as *Listroderes costirostris* by the Swedish entomologist Schoenherr[1] in 1826. An aberrant form was later named *L. obliquus* by Gyllenhal[2] in 1834. There appears to be some confusion regarding the authority of *L. costirostris,* for in this latter publication, "Schoen. Gen. et Spec. Curcul.," vol. 2, p. 277, 1834, by L. Gyllenhal, and also in vol. IV, p. 189, 1842, by C. H. Boheman, the species is credited to Gyllenhal rather than to Schoenherr. L. L. Buchanan, U. S. Bureau of Entomology, very kindly looked up the original descriptions by Schoenherr and furnished the following information:

> In 1826, Schoenherr ('Curculionidium disposito methodica . . . ,' page 158) erects *Listroderes* as follows:—'Genus 82. *Listroderes* nob.—*Merionus* Dej. *Character generis*:—' (12 lines of descriptive matter). Then, '*Descriptio*:' (Remainder of page 158 and more than half of page 159 taken up with a detailed description). Then, '*Typus*: *Listrod. costirostris* Gyllenh. n. sp.
>
> Schoenherr's purpose here evidently was simply to describe a new genus, but the description, being based on one species, really amounts to a combined generic description of *Listroderes* and a specific description of *costirostris.* Under these conditions, it seems to me proper to consider *costirostris* as having been described by Schoenherr in this paper.

In 1881 Berg[3] gave some additional information regarding the weevil and listed it from the region of the Rio Colorado in central Argentina, but wrongly listed *Listroderes robustus* Waterhouse as a synonym of *L. costirostris.* Hustache[4] credited the species to Gyllenhal, and to its distribution adds Buenos Aires with the statement that the range extends northwards to meridional Brazil. His figure of *L. vicinus* Hust., pl. II, is very much like *L. costirostris.*

In 1908 this same weevil was discovered in South Australia, where it was described as a new species, *Desiantha nociva,* by Lea[5] in 1909. Along the eastern and southern coasts of that continent it soon became known as a pest of considerable economic importance to vegetable crops and to fruits and was generally called the buff-colored tomato weevil.[6] It was not until years later that the weevil was known to be of South American origin.

On the North American continent the weevil was first recognized as a newly introduced pest of truck crops at McHenry, Mississippi, on March 28, 1922, and was determined as the Australian tomato weevil and first listed as *Listroderes* (*Desiantha*) *nociva* (Lea).[7] Later it was designated scientifically simply as *Desiantha nociva* Lea.[8] Further studies and comparisons with known species convinced Chittenden that the weevil was *Listroderes obliquus,* which he credited to Fabricius.[9] It was also known as *Listronotus obliquus,* and is not to be confused with the American species by that name.[10] In 1926 the same species was discovered attacking vegetables at San Jose, California, and within a few years was known to occur in much of the San Francisco Bay region.

The very same weevil was recorded in South Africa in 1924, having been previously introduced into Port Elizabeth,[11] where it was found to be injuring turnips.

This rapid and wide distribution has no doubt been due to the transportation of infested vegetables from South American seaports used in ships' stores, and it is not unlikely that all these different foci of infestation have a more or less common origin.

Although the insect has generally been scientifically known as *Listroderes obliquus* (Gyll.),[12] Schenkling

1 C. J. Schoenherr, "Disp. Meth. Curculionidum," p. 158. 1826.

2 L. Gyllenhal, "Schoen. Gen. et Spec. Curcul.," vol. 2, pt. 1, p. 277. 1834.

3 C. Berg, "Entomologisches aus dem Indianergebeit der Pampa." *Stett. Ent. Zeit.*, 42: 62, fig. 10. 1881.

4 A. Hustache, "Curculionides de la Republique Argentine." *Ann. Museo Nacionale de Hist. Nat.*, Buenos Aires, 34: 199. 1926.

5 A. M. Lea, *Trans. and Proc. Royal Soc. So. Austr.*, 33: 174–175. 1909.

6 C. French, Jr., Handbook Destr. Ins. Victoria, pt. V, pp. 41–43, Oct., 1909; W. W. Froggatt, "The Buff-colored Tomato Weevil (*Desiantha nociva*)," *Agr. Gaz. N. S. W.*, Sydney, xxvi: 1065–1066. 1915.

7 R. W. Harned, "A New Potato Weevil in Mississippi." *Quart. Bul. State Pl. Bd. Miss.*, 2: 1–2, pp. 6–8, 11–12. 1922.

8 E. K. Bynum, "Controlling the Australian Tomato Weevil, *Desiantha nociva.*" *Ibid.*, 3: 1, pp. 22–24 (1923); F. H. Chittenden, "The Australian Tomato Weevil, Introduced in the South," U. S. Dept. Agr., Dept. Circ. 282, 8 pp., 6 fig. July 31, 1932.

9 F. H. Chittenden, "An Introduced Weevil Related to the Vegetable Weevil." *Proc. Biol. Soc. Wash.*, 39: 71–74, pl. 1. 1926.

10 An entirely different weevil, *Listronotus obliquus*, was described from Texas in 1876 by J. L. LeConte. *Proc. Am. Philos. Soc.*, 15: 128, 129. 1876.

11 *Jour. Dept. Agr., Union South Africa,* 8: 3, pp. 264–265. 1924.

12 E. O. Essig, "The Vegetable Weevil." "A History of Entomology," pp. 203–206, figs. 78–81 (Bibliography). New York: Macmillan. 1931. O. H. Lovell, "The Vegetable Weevil, *Listroderes obliquus.*" *Calif. Agr. Expt. Sta., Bull.* 546, 19 pp., 5 figs., December, 1932.