to be noted that the wave-length is equal to *twice* the width of the steps (see Fig. 1). The advancing wave of sound *xy* strikes the first step and part of the wave is reflected. When *xy* reaches the second step, the sound from the first step has already traveled back a distance equal to the width of the steps. Therefore, the distance between the reflected pulses of sound—the wave-length—is equal to *twice* the width of the steps. It should be noted also that this phenomenon shows clearly the diffraction of sound. The fact that an observer can hear the separate pulses of sound at any point in front of the steps, indicates that the sound must spread out from each step as a center of disturbance.

The results of the observations follow. The observed pitch as determined by an adjustable Koenig fork was 226 vibrations a second. The pitch was calculated from the relation

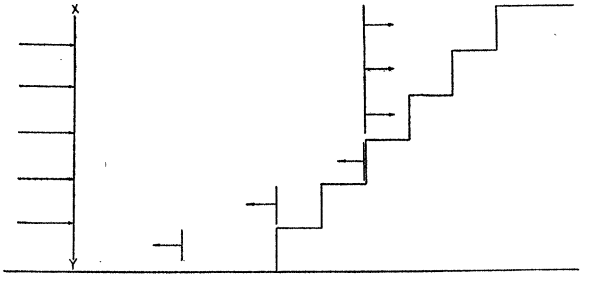

FIG. 1

$n = v \div \lambda$ from the following data. The observed temperature was 22° C., hence the velocity of sound[2] was $v = 33{,}200 + 61 \times 22 = 34{,}542$ cm./sec. The width of the steps was 76 cm., hence $\lambda = 2 \times 76 = 152$ cm. Finally $n = 34{,}542 \div 152 = 227$ vibrations per second.

The agreement between the observed and calculated values is closer than one would expect. The pitch of the fork was not corrected for temperature. Another source of error lies in the fact that the outgoing pulse of sound struck the steps at an angle rather than perpendicularly, so that the wave-length was somewhat greater than twice the width of the steps.

[2] Poynting and Thomson, "Sound," p. 21.

A second example of a musical echo was observed when a sharp sound was reflected from a set of bleachers on the athletic field at the University of Illinois. The pitch was determined, as in the former case, although the conditions were different and not so favorable. The bleachers were constructed of wood and were situated in a long straight row. If a rifle was shot off at some distance in front of the bleachers, an observer heard the reflected musical echo distinctly. The data taken follows. Temperature = 25° C., velocity of sound 34,725, width of steps = 73.5 cm., $n = 236$ vibrations per second. The pitch as observed by a tone variator was 235, although other observers nearer the bleachers obtained a value 241. The agreement between the calculated and observed pitches is as close as could be expected.

Aside from the novelty of the experiment, it is interesting to learn that the pitch of the echo is so definite. The notes given out in both cases cited is about a tone below middle C, hence where an observer expects a musical echo from steps about 30 inches wide, he can anticipate the result very nearly by first humming the expected tone.

F. R. WATSON
UNIVERSITY OF ILLINOIS,
May 17, 1911

SOCIETIES AND ACADEMIES

AMERICAN MATHEMATICAL SOCIETY

THE eighteenth summer meeting of the American Mathematical Society was held at Vassar College on Tuesday and Wednesday, September 12–13, extending through two ses-

sions on Tuesday and a morning session on Wednesday. Thirty-two members were in attendance. Ex-presidents Thomas S. Fiske and Henry S. White occupied the chair in alternation. The council announced the election of the following persons to membership in the society: Professor Frederick Anderegg, Oberlin College; Dr. C. E. Brooks, Northwestern University; Mr. G. G. Brower, Cascadilla School; Mr. W. C. Graustein, Harvard University; Dr. Dunham Jackson, Harvard University; Mr. W. V. Lovitt, University of Washington; Mr. J. C. Raysworth, Washington University; Mr. L. L. Smail, University of Washington; Dr. E. B. Stouffer, University of Illinois; Dr. S. E. Urner, University of Wisconsin; Professor J. N. Van der Vries, University of Kansas; Mr. C. W. Webster, University of Washington. Twelve applications for membership in the society were received. The total membership is now 658.

Luncheon was served by the college on both days. On Tuesday evening twenty-nine members gathered at the usual informal dinner, at the close of which brief remarks were made by Professor Birkhoff on Moore's general analysis and by Professor A. G. Webster on wider views in mathematics and physics. Wednesday afternoon was devoted to an excursion to Lake Mohonk. At the close of the meeting the hospitality of Vassar College was recognized by a vote of thanks.

The following papers were read at the summer meeting:

Edmund Landau: "Ueber eine idealtheoretische Funktion."

W. A. Hurwitz: "On the pseudo-resolvent to the kernel of an integral equation."

W. A. Hurwitz: "On mixed linear integral equations."

Elizabeth R. Bennett: "Simply transitive primitive groups whose maximal subgroup contains a transitive constituent of order p^2 or pq, or a transitive constituent of degree 5."

Florian Cajori: "On a rare book of Michel Rolle and the history of 'Rolle's theorem.'"

L. C. Karpinski: "The Algebra of Abū Kāmil Shojā ben Aslam."

F. W. Beal: "Normal congruences determined by centers of geodesic curvature."

Arnold Emch: "On the congruence of rays realizing circular transformations between two planes."

Joseph Bowden: "The two fundamental relations of the calculus."

J. E. Rowe: "Covariant curves of the R^4 and R^5."

G. A. Miller: "A third generalization of the groups of the regular polyhedra."

G. A. Miller: "Some properties of the group of isomorphisms."

L. P. Eisenhart: "Minimal surfaces in plane four-space."

Arthur Ranum: "On the projective differential geometry of spreads generated by ∞^1 flats."

E. W. Castle: "A graduation of the combined experience table of mortality to Makeham's formula by the method of moments."

S. Lefschetz: "On the existence of loci with given singularities."

S. Lefschetz: "On some topological properties of plane curves."

Virgil Snyder: "Periodic quadratic transformations in a ternary field."

A. G. Webster: "On a new mixed boundary problem in connection with the telegrapher's equation."

A. G. Webster: "On the wave potential of a circular ring of sources."

A. G. Webster: "Solid viscosity versus elastic hysteresis in the transverse vibration of an elastic bar."

G. D. Birkhoff: "New proof of the theorem concerning matrices of analytic functions."

G. D. Birkhoff: "On the simplest type of irregular singular point."

G. A. Bliss: "A generalization of the preparation theorem for a power series in several variables."

Oswald Veblen: "On the definition of multiplication of irrational numbers."

H. T. Burgess: "One-parameter groups of contact transformations defined on a fixed quadric by a bilinear form."

Joseph Bowden: "Making a recitation schedule."

The next meeting of the society will be held at Columbia University on Saturday, October 28. The San Francisco Section will meet on the same day at the University of California.

F. N. COLE,
Secretary