a little to the south of Valparaiso, near the southern boundary of the Peru coastal current, under meteorological conditions precisely the same as those we found to accompany red water at the Cape. My colleague, the late E. R. Gunther, has described discoloration of the sea by living organisms in the Peru coastal current with references up to 1936 in great detail[4], but he also missed this point of Darwin's, and for that I am to blame, for I was trying to help him with microplankton references while he was engaged with other aspects of the work. It is interesting to note further that a second type of 'water-bloom' described by Darwin[3] near the Galapagos tallies almost equally well with Gunther's[4] observation of a yellow patch ". . . due to a swarm of a colonial radiolarian, probably Collosphaera . . . some 180–200 miles off Punta Aguja".

The peculiar conditions resulting in the formation of bottom deposits emitting hydrogen sulphide found off the south-west African coast, farther north than "Discovery Investigations" have proceeded in detail, and described by Copenhagen[5], are analogous to those observed in parts of the Peru coastal current. It will be very interesting to learn whether 'water-bloom' phenomena also extend northwards along that coast so far as the Walfisch Bay area.

Mesodinium is now known to have been a cause of red 'water-bloom' off central Chile in winter[3], in Seydis Fjord, Iceland, in summer[6], off Cape Peninsular in autumn and winter[1], and off British Columbia[7]. There may be other records that elude me under present conditions.

The influence of 'water-bloom' phenomena upon animals of economic importance is at times profound, so it is certain that more research upon them will be needed in the future. It is therefore pleasant to find the origins of scientific treatment of the subject in the work of Darwin, for he must always rank (in the minds of naturalists who ply their trade in deep waters) among the greatest field-workers of all time, whatever his later fame depended upon.

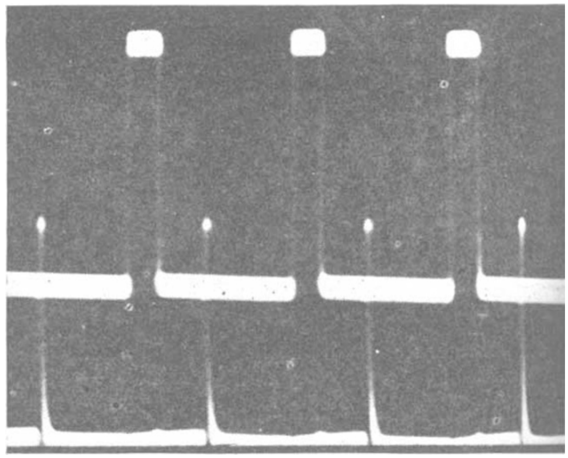
T. JOHN HART.
(Discovery Investigations.)
The Laboratory, Citadel Hill,
Plymouth.
Nov. 1.

[1] NATURE, 134, 459 (1934).
[2] NATURE, 134, 974 (1934).
[3] Darwin, Charles, "Journal . . . Voyage of H.M.S. Beagle . . ." [1845] fourth edit. (Ward Locke and Co., 1889) (pp. 15–17 in John Murray's fourth edit. of the same year).
[4] Gunther, E. R., Discovery Repts. XIII., 107–276 (1936).
[5] Copenhagen, W. J., Invest. Rept. 3, S.A. Fish. Survey Rept. No. 11 (1934).
[6] Paulsen, Ove, *Meddl. Danske Komm. Havundersögelser* Ser. Plankton, 1, No. 8 (1909).
[7] Clemens, W. A., NATURE, 135, 473 (1935).

An Oscillographic Method for the Determination of the Velocity of Sound

METHODS of measuring the velocity of sound in air, using the cathode ray oscillograph, have been described by Wold and Stephenson[1], Colwell and others[2,3,4] and by Patchett[5]. Only one precise determination by an oscillographic method has been attempted[4], and the results in this case are of doubtful value since, for example, the influence of humidity and carbon dioxide content of the air have been ignored.

The method to which this communication refers is similar in principle to that used by Colwell, but is considered to be capable of greater accuracy. Sound from a loud-speaker connected to an audio-frequency oscillator is picked up by a microphone, which moves on rails perpendicular to the plane of the speaker. The potential difference developed by the microphone is amplified and operated on by pulse-shaping circuits which change its sinusoidal waveform into a series of short rectangular pulses. The output from this arrangement is used to deflect one beam of a double-beam oscillograph. If the microphone is moved along its rails, the pulses travel across the screen and the distance between positions of the microphone at which corresponding points of successive pulses coincide with an arbitrary reference mark is equal to the wave-length of sound at the frequency employed. The reference mark is obtained by connecting the loud-speaker terminals to a separate pulsing circuit, using the output to deflect the second beam of the oscillograph. The trace then has the appearance shown in the accompanying illustration. As the microphone is moved, the upper set of pulses travels across the screen, while the lower series remains stationary. The frequency of the oscillator is checked against that of a standard electrically maintained tuning fork, by continuous observation and adjustment of a Lissajous figure on an auxiliary oscillograph. Frequencies between 4,000 c.s. and 5,000 c.s. have been used, and in this range twenty or thirty values for the wave-length may be obtained by moving the microphone through a distance of two metres.



UPPER TRACE—MICROPHONE PULSES. LOWER TRACE—LOUD-SPEAKER PULSES.

Preliminary experiments give reason to believe that this arrangement, with minor modifications, may be used for very precise determinations of the velocity of sound in various media. Further research along these lines is in progress.

J. M. A. LENIHAN.
Physics Department,
King's College,
University of Durham,
Newcastle upon Tyne.
Nov. 3.

[1] Wold, P. I., and Stephenson, E. B., *Phys. Rev.*, 21, 706 (1923).
[2] Colwell, R. C., Friend, A. W., and McGraw, D. A., *J. Franklin Inst.*, 225, 579 (1938).
[3] Colwell, R. C., Friend, A. W., and McGraw, D. A., *J. Franklin Inst.*, 227, 251 (1939).
[4] Colwell, R. C., Friend, A. W., and Gibson, L. H., *J. Franklin Inst.*, 230, 749 (1940).
[5] Patchett, G. N., *Proc. Phys. Soc.*, 55, 324 (1943).