the height of the spectrum, the rate of this decrease being particularly large quite near to the edge. Whether such a phenomenon exists or not is a question which our experiments as yet are not able to settle; but it is hoped to get evidence on this point in the near future.[6]

In conclusion, I wish to thank Prof. Coster and Prof. Kramers for the kind interest they have shown in this investigation.

J. A. PRINS.

Natuurkundig Laboratorium
der Ryks-Universiteit,
Groningen (Holland).

[6] From my photographs may be concluded that this effect is at any rate smaller than Kallmann and Mark's theory would lead us to expect.

A Sonic Interferometer for Liquids.

FROM thermodynamical considerations alone it should be possible to calculate the number of degrees of freedom, and consequently the association of molecules in the liquid state, if one could only determine the numerical difference between the specific heats at constant pressure and at constant volume. It is practically impossible, however, to obtain direct measurements of liquids at constant volume because of the elasticity of the walls of the containing vessel. But this difficulty can be obviated if the velocity of a compression wave in the liquid can be ascertained with sufficient precision, because the numerical difference between the specific heats can, by the aid of Newton's equation, be expressed as a function of the temperature, the coefficient of expansion, and the velocity of a compressional wave.

With these thoughts in mind, and taking advantage of the work being conducted in this laboratory by R. W. Wood and A. L. Loomis on the physical and biological effects of high-frequency high-intensity-sound waves, we have constructed a 'sonic interferometer' capable of measuring the velocity of compressional waves in small quantities of liquids with an accuracy of one part in three thousand. This instrument is in many respects the sonic analogue of the Perot-Fabry interferometer.

Corrections for the elasticity of the containing vessel can be entirely eliminated by using a sufficiently high frequency so that the wave-length is small in comparison with the diameter of the radiating source. We use, as a radiator, a piezo-electric crystal quartz disc 100 mm. in diameter and 12 mm. thick carefully ground and polished plane parallel, which we cause to oscillate at frequencies from 200,000 to 400,000 cycles per second, producing waves from 3 to 8 mm. in length. The frequency of the oscillating circuit is determined with a precision wave meter. Contrary to the usual practice with piezo-electric crystals of allowing them to oscillate at their own natural frequencies, we have found that much more precise measurements can be obtained if the crystal is driven at certain frequencies well removed from the natural frequency of the crystal, for then the crystal resonance does not partially mask the exact moment when resonance is established in the liquid. The small glass vessel containing the sample of liquid under investigation is placed on the oscillating crystal. When properly adjusted, the compressional waves pass upward through the plane parallel bottom of the vessel into the liquid and, because of the shortness of the waves compared with the dimensions of the vessel, pass upward in the liquid as strictly plane waves. They are then reflected from a plane surface immersed in the liquid and made parallel with the quartz disc. By carefully adjusting the distance of this surface with a fine micrometer screw standing waves can be produced. It is thus possible to measure 20 or more half wave-lengths with a precision of 1/100 mm. At each nodal point a small neon light loosely coupled to the circuit is extinguished, due to the reaction of the system of standing waves upon the crystal.

Characteristic results are presented in the accompanying table. These results are subject only to a revision of our wave meter calibration, and are of a self consistency one order higher than the number of places here presented. No variation in velocity with frequency can be detected within the frequency limits which we have employed, nor can any difference be detected when we vary the material and dimensions of the containing vessel.

VELOCITY OF SOUND WAVES IN LIQUIDS IN METRES/SEC.

Material.	*Temperature.*			
	5°	15°	25°	35°
Distilled Water	1439	1477	1509	1534
1·0% NaCl sol.	..	1487	1520	1542
2·5% ,, ,,	..	1510	1539	1561
5·0% ,, ,,	..	1540	1569	1589
Mercury	..	..	1469	1468
Carbon Disulphide	1215	1184	..	..
Chloroform	1066	1027	..	..

The data published on the velocity of sound in liquids are for the most part in very poor agreement, and the methods employed, with the exception of direct determination in open water, involve serious corrections, the wave-lengths in general being large in comparison with the containing vessel. It is of interest to note that careful and laborious measurements have been made of the velocity of sound in the open sea by ascertaining the time of travel of a compressional wave for a distance of 53 nautical miles (E. A. Eckhardt, *Phys. Rev.*, **24**, 452; 1924). The velocity thus obtained is 1492 metres/sec. at 13° C. As a check we found at the same temperature a velocity of 1480·5 metres/sec. for a 1·0 per cent. sodium chloride solution and 1503 metres/sec. for a 2·5 per cent. sodium chloride solution. It is of interest to compare these results with that for distilled water from which substantially all the air has been removed, which at 13° C. we found to be 1470 metres/sec. The presence of small quantities of dissolved air materially affects the velocity.

We are at present engaged upon a comprehensive study of water and of its solutions with several salts, and of a number of organic compounds and their mixtures, which we expect to publish shortly, together with a detailed description of the instrument.

JOHN C. HUBBARD.
ALFRED L. LOOMIS.

The Tower, Tuxedo Park,
New York.

The Flying Fox Pest in Australia.

THE Council for Scientific and Industrial Research is finding difficulty in devising methods for coping with the large fruit-eating bats, commonly known as "flying foxes," which are a most serious menace to fruit growers in Queensland and New South Wales. There are five species in Australia, the commonest by far being *Pteropus poliocephalus*. Nocturnal in habit, and very gregarious, these animals live in large camps of hundreds of thousands of individuals. They migrate according to season and food supply, but