whether it suffered any alteration in amplitude. To facilitate comparison the pulse from the signal generator was always placed close to the received echo and adjusted to be of the same width. The frequency ν of the oscillator valve (Figure 4) was set to give the maximum size of echo and the frequency was afterwards measured. The optimum frequency was found to vary with the temperature of the liquid, owing to changes in its acoustic impedance and to thermal expansion of the mounting of the crystal. The frequency was therefore reset after each change in the temperature. Due allowance was made for this change in ν when calculating α/ν^2 from the results. Operation too far from the resonant frequency caused distortion of the pulse. The frequency was measured with a crystal check wavemeter which had an accuracy for c.w. signals of better than one part in 1,000. The pulse width was always set to its maximum value when measuring the frequency so that the "spread" on the wavemeter was a minimum.

As has been stated measurements are made with the reflector in both the Fresnel and the Fraunhofer diffraction regions; the mechanical adjustments required to put the crystal housing and the reflector in their correct positions differed in the two cases.

For measurements in the Fresnel region the transverse adjustments of the reflector perpendicular to the beam are not critical, since the reflector is much bigger than the source. The adjustment of the crystal mounting so that the beam travels exactly parallel to the guide rails may be made by eye. The angular adjustment of the reflector to be perpendicular to the beam is extremely critical however and must be performed with care by turning the two adjusting screws alternately. The correct adjustment may be checked in the following manner: if only one screw is turned the echo should go through one large maximum value, with smaller subsidiary maxima on either side. The occurrence of two or more maxima of nearly equal size indicates that the original setting was incorrect.

In the Fraunhofer region, as we have shown in § 3, the adjustments are more critical. It was found convenient to make the adjustments in the following sequence. The reflector is first placed at the nearest distance at which it is intended to observe. It is then moved in the two directions perpendicular to the beam until the echo reaches a maximum. Adjustment of the angle of the reflector follows, and then a further transverse adjustment. It is now necessary to ensure that the beam is travelling parallel to the guides on which the reflector is moved. This is done by placing the reflector at maximum range, and making angular adjustments to the crystal housing. On replacing the reflector at minimum range the reflector adjusting screws will probably require resetting. The process of alternate adjustment of the reflector at short range and the crystal housing at long range is carried on until no further improvement in signal strength can be obtained in either position. It is important that the last adjustment to be made should be at the nearer range since the two transverse adjustments of the reflector are by far the most critical, due to the narrowness of the central maximum of the beam at short ranges.

(ii) *Procedure for Measurement*

The temperature is brought to a steady value and measured. A series of readings of the strength of the echo at increasing ranges is taken by comparing it with a pulse on the same frequency from the signal generator. The amplitudes are measured directly in decibels of attenuation. If correction is required for divergence the absolute value of the range must be recorded; if no correction is required increments of range only need be noted. Usually between ten and fifteen readings are taken at equal range intervals and plotted on a graph (cf. Figures 1 and 2).

If for any reason the temperature changes slowly throughout an experiment, the error can be minimized by taking readings of attenuation with range increasing and then at the same points with range decreasing. Taking the average of the two readings for each point removes the error; the corresponding temperature is also taken as the average of the values before and after the experiment. This method has been used at low temperatures, where thermostatic control is inconvenient.

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ABSTRACT. This paper deals with the experimental problems involved in accurate measurement of the absorption of ultrasonic waves in liquids. Reasons are given for preferring a method employing pulses of ultrasonic energy. The errors likely to be introduced by diffraction are discussed and it is shown that reliable measurements may be made in both the Fresnel and Fraunhofer regions. An account is given of a convenient method of correcting for divergence of the beam in the Fraunhofer region. The choice of the optimum conditions for accuracy is discussed and illustrated by practical examples. A description is given of the essential features of an apparatus working on six frequencies between 7·5 and 67·5 Mc/s. using the pulse technique.