

Experiment VW9 Stationary sound waves

Aim

In this experiment you will investigate the formation of a stationary wave pattern in air and measure the speed of sound in free air.

Apparatus

- cathode ray oscilloscope
- signal generator
- loudspeaker
- microphone
- reflecting surface (e.g. drawing board)
- metre rule

A stationary wave pattern

1 Place the loudspeaker and the reflecting surface at opposite ends of a metre rule with the microphone between them, as shown in figure 1. Arrange the loudspeaker and reflecting surface so that the incident wave strikes the reflecting surface at normal incidence.

2 Connect the loudspeaker to the signal generator and the microphone to the Y plates of the c.r.o. Set the signal generator to a frequency of 2 kHz.

Notes: (a) If reflections from the bench surface appear to be a nuisance, place the loudspeaker and reflecting surface on separate supports (e.g. laboratory stools).

(b) Keep the apparatus away from the walls.

3 Move the microphone backwards and forwards between the screen and loudspeaker and observe the trace on the c.r.o. Observe what happens to the amplitude of the c.r.o. trace as you move the microphone. Explain your observations. Why did the points of minimum intensity not fall to zero?

Measurement of λ and calculation of c

1 Locate the positions of the microphone where the c.r.o. trace has minimum amplitude. Obtain a value for the average distance between the nodes and hence calculate the wavelength λ of sound.

2 Repeat step 1 for several other frequencies f .

3 Knowing that $c = f\lambda$, obtain an average value for the speed of sound in free air.

4 What is the main source of error in this experiment?

5 Record the temperature of the air.

6 Compare your value with the theoretical value ($3.3 \times 10^2 \text{ m s}^{-1}$ at 273 K).

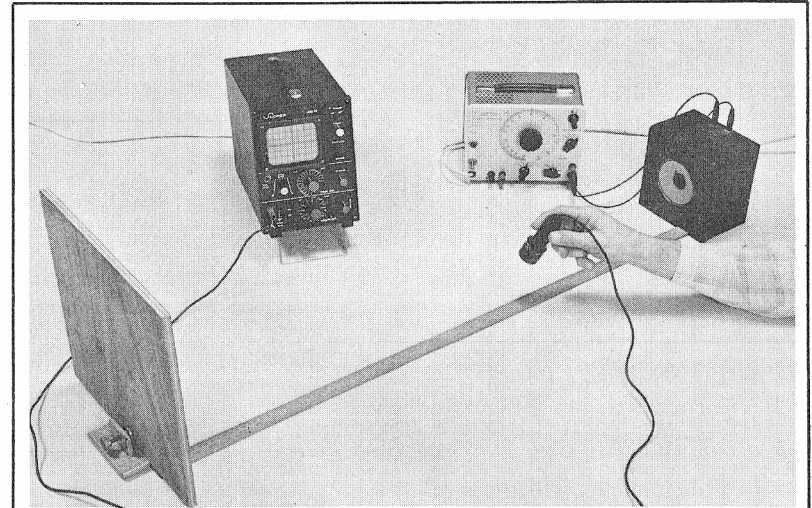


Figure 1