A diffraction grating for sound waves

The following demonstration was used at the Swiss Federal Institute (ETH) in the sixties, and was written up in the book of demonstrations edited by Meiners [1] (now out of print). Since it is easy to construct and shows diffraction effects nicely, we should like to present here a version of it that we constructed recently.

Figure 1 shows the arrangement. The grating is made from 3 cm wide tin strips (plastic or wooden laths would serve just as well), nailed at 3 cm intervals on a wooden frame 60 × 60 cm. A tiny loudspeaker, serving as a 'point source', is obtained from the inside of any digital multimeter: we extend the internal leads to it by 50 cm and take it outside the meter. It is activated when the setting on the meter is ohms, range 200 Ω testing for continuity. Its frequency can be measured, and is around 4000 Hz, corresponding to a wavelength of about 8 cm. After the present use it can be replaced in the multimeter. A small loudspeaker, not more than 3 cm in diameter, driven by a signal generator, would do equally well.

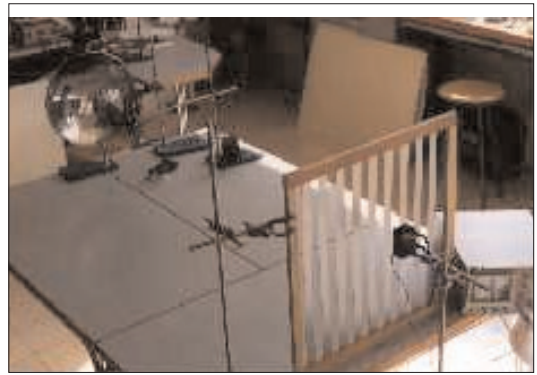

Figure 1. *Apparatus for sound wave diffraction. Left to right: reflecting surface, loudspeaker, grating, microphone and oscilloscope.*

Two more components of the set-up were salvaged from junk: a large spherical reflector from a radiant electric heater serves as a reflector of sound waves (or use a satellite TV dish), and an old-style collapsible fan-like reflecting dish of a flash unit, in the middle of which we set the loudspeaker, instead of the flashbulb, thus facing the reflector at the height of its central axis. The reflecting surface from an old car headlamp would be just as good. The loudspeaker is set at the focal point of the large reflector, from which an approximate plane wave is radiated towards the grating some 1.5 metres away.

A small microphone, the smaller the better so as not to disturb the sound field, connected to an oscilloscope picks up the diffracted sound behind the grating. As the microphone is moved across the grating some 50 cm behind, the oscilloscope trace shows diffraction peaks and minima.

Reference

[1] Meiners H F (ed) 1970 *Physics Demonstration Experiments* (New York: Ronald Press) p 522

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