



## CZYTAMY PO ANGIELSKU

### 50 cycle hum

*From Ian Jacobs textbook*

*The Physical World, New House, 1996*

Carol plays in a band and listens to music whenever she can. She decides to investigate the behaviour of a horn speaker rated at 12 watts maximum input power and 8 ohms impedance. She connects it to a 2 volt AC power supply. The speaker hums quietly.

The current in the voice coil is given by

$$I = V/R$$

$$= 0.25 \text{ amps}$$

The input power is given by...

$$P = VI$$

$$= 0.5 \text{ watts}$$

Carol calculates that she can safely turn the power supply up to 10 volts without destroying the voice coil, but at 10 volts the speaker hums wildly. She turns the voltage down to 6 volts which gives a steady 50 cycle hum.

She now puts an AC digital current meter in series with the speaker. The current at 6 volts is 0.73 amps. Measuring the voltage across the power supply gives a value of 5.94 volts which is more accurate than the dial setting. The power supplied to the coil is

$$VI = 5.94 \times 0.73$$

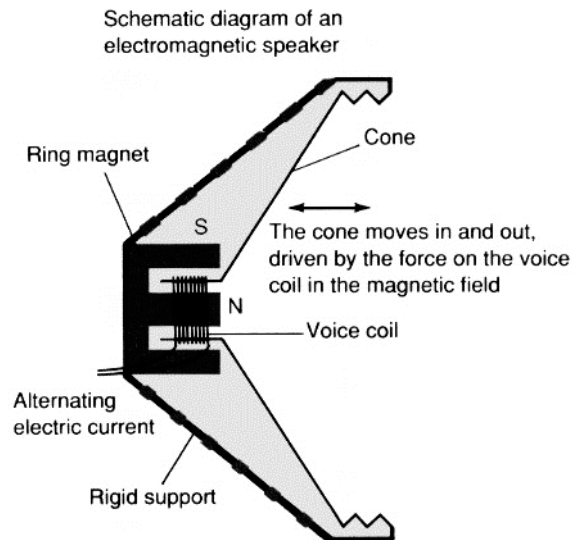
$$= 4.3 \text{ watts}$$

The hum is no louder than a person talking so she reasons that the power radiated as sound is less than one thousandth of a watt. Most of the input power must go into heating the coil!

She now has a friend turn the speaker through 180 degrees. She notices that the sound she hears is much the same at all positions because the wavelength of 50 cycle hum is 6.8 meters, much longer than the diameter of the horn.

Finally she borrows a signal generator and connects the speaker to a 12 kHz signal. It emits a nasty high-pitched whistle. The sound is much louder directly in front of the horn and drops off to the sides. She expected this because she calculated the wavelength of a 12 kHz whistle to be 2.8 cm (taking  $v$  as  $340 \text{ m s}^{-1}$ ), much smaller than the horn diameter.





• **Questions**

- 1 Show that at 10 volts the maximum recommended power input is only just exceeded.
- 2 Why is the hum distorted at this high power input?
- 3 Find the wavelengths of 50 Hz and 12 kHz sounds in air (speed  $340 \text{ m s}^{-1}$ ).
- 4 What are the two principal requirements for the material of a speaker cone?

**Dictionary:**

**hum** – brzęczeć, buczeć

**ring** – pierścień

**magnet** – magnes

**alternating electric current** – prąd zmienny

**rigid support** – sztywna podpora

**voice** – głos

**coil** – cewka

**cone** – stożek

**magnetic field** – pole magnetyczne