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EXPERIMENT NO. 7

NAME OF EXPERIMENT: TO COMPARE THE FREQUENCY OF TWO TUNING FORK BY USING A RESONANCE TUBE

APPARATUS REQUIRED

1. Two tuning fork of different frequency
2. Rubber pad
3. Resonance apparatus

THEORY

Resonance is the specific response of a system which is capable to vibrate with a certain frequency to an external source force acting with the same frequency. In a resonance tube, intensity of sound will be maximum at resonating length. The sound is produced due to formation of stationary wave having node at closed end and antinode at open end. The length of first maximum intensity of sound is 1st resonating length of 1st resonance. Similarly, 2nd resonating length and 3rd resonating length is for 2nd and 3rd resonance.

So, velocity of sound, $v = 2f_1(l_2 - l_1)$ — (i)

Where, f_1 = frequency of 1st tuning fork

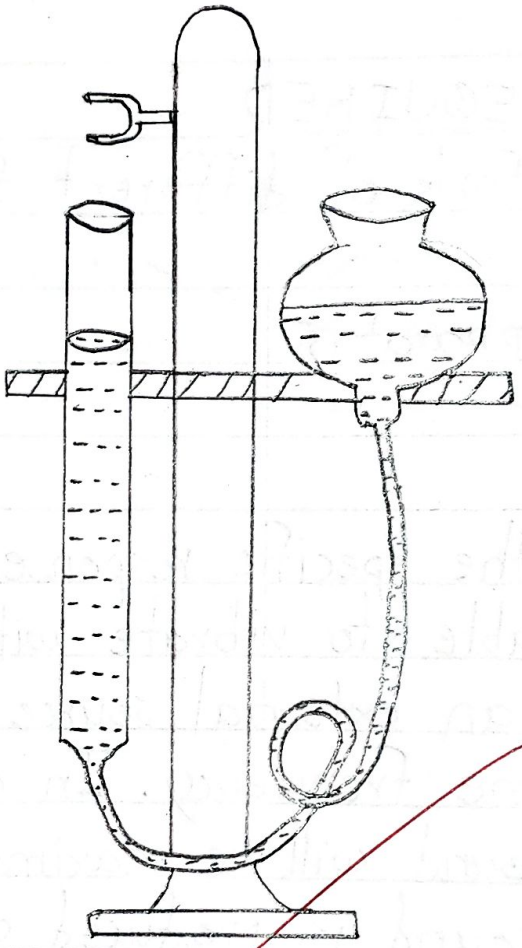

fig. Resonance tube

l_2 = 2nd resonating length using 1st tuning fork.

l_1 = 1st resonating length using 1st tuning fork.

Again,

Velocity of sound, $V = 2f_2(l_2' - l_1')$ — (ii)

Where,

f_2 = frequency of 2nd tuning fork

l_2' = 2nd resonating length

l_1' = 1st resonating length

Then, from (i) and (ii)

$$\frac{V}{V} = \frac{2f_1(l_2 - l_1)}{2f_2(l_2' - l_1')}$$

or,
$$\frac{f_1}{f_2} = \frac{l_2' - l_1'}{l_2 - l_1} \quad \text{— (iii)}$$

PROCEDURE

The first tuning fork was set into vibration and kept above the tube horizontally. At first, the intensity of sound heard was small but adjusting the length of the tube decreasing the water level by adjusting reservoir. Hence the length of the water level was measured from the top at maximum intensity of sound which is called first resonating length. Similarly, the resonating length for same resonance was

measured and mean was calculated. Again, reservoir was moved to adjust the length of resonance at another maximum intensity of sound called second resonating length. Likewise, the mean of second resonating length was taken.

Same process was done to calculate the first and second resonating length for the second tuning fork.

OBSERVATION TABLE

No. of Obs.	Frequency of tuning fork	Resonance	Resonating length	Mean resonating length
1.	384 Hz	1st Resonance	1) 22.5 cm	$l_1 = 22.4$ cm
			2) 22.1 cm	
			3) 22.6 cm	
		2nd Resonance	1) 68 cm	$l_2 = 67.9$ cm
			2) 67.8 cm	
			3) 67.9 cm	
2.	426 Hz	1st Resonance	1) 19.3 cm	$l_1' = 19.3$ cm
			2) 19.6 cm	
			3) 19.1 cm	
		2nd Resonance	1) 59.5 cm	$l_2' = 59.5$ cm
			2) 59.7 cm	
			3) 59.3 cm	

CALCULATION

$l_1 = 22.4$ cm $l_2 = 67.9$ cm

$l_1' = 19.3$ cm $l_2' = 59.5$ cm

$$\therefore \left(\frac{f_1}{f_2}\right)_{cal.} = \frac{l_2' - l_1'}{l_2 - l_1} = \frac{59.5 - 19.3}{67.9 - 22.4} = 0.88$$

$$\left(\frac{f_1}{f_2}\right)_{observed} = \frac{384}{426} = 0.90$$

$$\% \text{ Error} = \frac{\left(\frac{f_1}{f_2}\right)_{obs.} - \left(\frac{f_1}{f_2}\right)_{calc}}{\left(\frac{f_1}{f_2}\right)_{obs.}} \times 100\%$$

$$= \frac{0.90 - 0.88}{0.90} \times 100\%$$

$$= 2.22\%$$

RESULT

Hence, the frequency of first tuning fork was found to be 0.88 times the frequency of 2nd tuning fork.

PRECAUTION

1. Resonating length should be noted carefully.
2. Calculation should be done accurately.
3. Sound should be listened carefully.