MELDE'S EXPERIMENT

LAB REPORT FOR ASSIGNMENT NO.1

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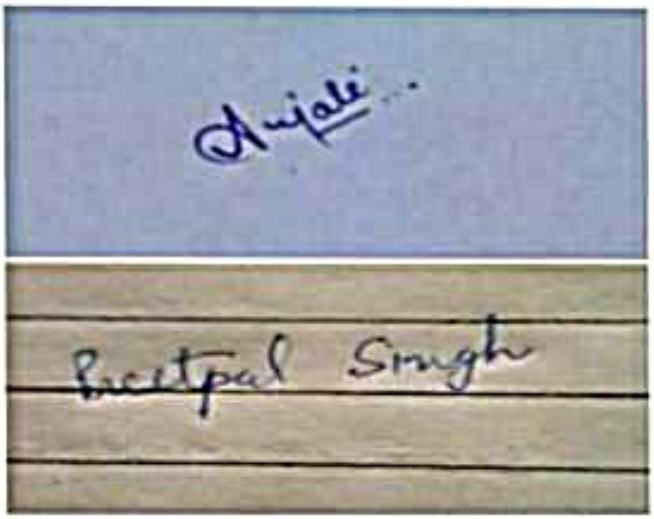

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Aim: To determine the frequency of a given tuning fork using Melde's apparatus.

Apparatus: Electrically maintained tuning fork, power supply, light weight string, light weight pan, weight box, stand with clamp and pulley, analytical balance

Theory:

→ When a string under Tension is set into vibrations, transverse harmonic waves propagate along its length.

→ The speed of wave in stretched string depends on Tension in the string and mass per unit length (linear density) of string.

$v = \sqrt{\frac{T}{m}}$; v = velocity, T = tension, m = mass per unit length

→ Frequency of wave = $n = \frac{1}{2l}\sqrt{\frac{T}{m}}$; l = length of loop

→ The string is set into vibrations by means of an electrically maintained tuning fork.

→ When other end of string is clamped to rigid support (here, pulley), reflected waves will also exist.

→ The incident and reflected waves will superimpose to produce transverse stationary waves in the string.

→ The string will vibrate in such a way that the clamped points of the string are nodes and anti-nodes exists at the middle. Nodes are the points where displacement is minimum. Anti-nodes are the points where displacement is maximum.

→ As the wave is limited to a certain region, it is a stationary wave.

→ Longitudal wave is a wave in which particles vibrate parallel to the direction of propagation of wave.

→ Transverse wave is a wave in which particles vibrate perpendicular to direction of propagation of wave.

→ In transverse mode, the string also completes one vibration when the tuning fork completes one. Hence, in this mode, frequency of tuning fork (N) is equal to the frequency of string (n):-

$$N = \frac{1}{2l}\sqrt{\frac{T}{m}}$$

→ In longitudinal mode, tuning fork is set in such a way that the vibrations of the prongs are parallel to the length of string. The string completes half of its vibration when the tuning fork completes one. Hence, in this mode, frequency of tuning fork (N) is equal to twice the frequency of the string (n):-

$$N = \frac{1}{l}\sqrt{\frac{T}{m}}$$

Procedure :

i) Connect the primary of the step down transformer to A.C. mains, while the secondary to the given point of electrically maintained tuning fork.

ii) Tight one end of thread to prong of tuning fork and tight second end to scale pan. Hang the scale pan with pulley that is fixed at end of table.

iii) Arrange tuning fork in transvere situation and load a mass of (100g) on pan. Now excite the tuning fork using screw so that vibration in tuning fork gets started.

iv) Move the tuning fork toward or away from pulley to adjust length of thread, so that clearly visible loops can be formed. Now measure the complete length of thread and count the number of clearly visible loops. Divide whole length by no. of loops to get length of single loop.

v) Now increase the mass in pan in 100 gm and repeat this (5-6) times.

vi) Now arrange tuning fork in longitudinal situation and load a mass of 100 gm on its pan. Excite the turning fork, to start vibrations in tuning fork.

vii) Move the tuning fork towards or away from pulley to adjust length of thread so that loops made are clearly visible. Measure the length of complete thread when stable loops are formed in transverse plane and count the number of clearly visible loops. Divide whole length by no. of loops to get length of single loop.
This length would be double of length in transverse case.

viii) Now increase the mass in pan in 100 gm and repeat this (5-6) times.

ix) Measure the mass of thread and mass of scale pan. Also calculate mass per unit length of thread i.e. (m).

x) Calculate frequency of tuning fork for transverse and longitudinal cases.

Precautions:

(a) The thread should be uniform and inextensible.

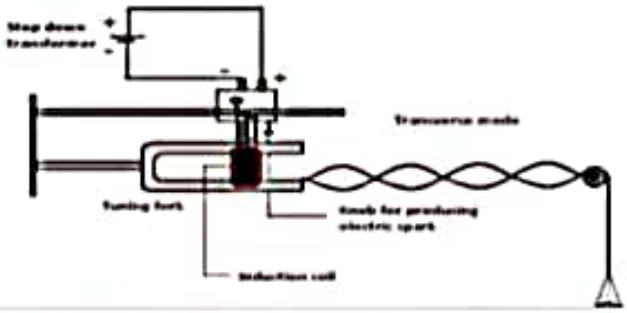
(b) Well defined loops should be obtained by adjusting the tension.

(c) Frictions in the pulley should be least possible.

(d) Longitudinal and transverse arrangements should be correct.

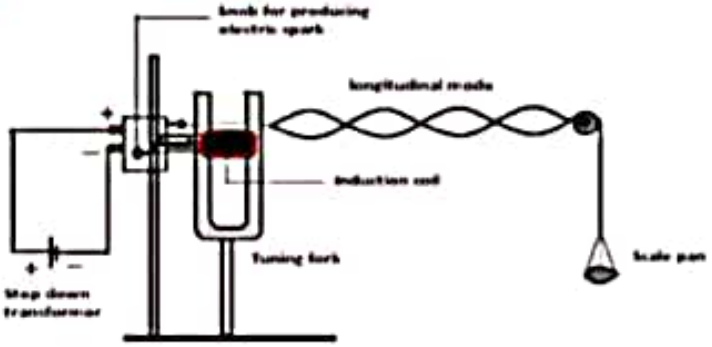
Transverse mode of vibration:

In this arrangement, the vibrations of the prongs of the tuning fork are in the direction perpendicular to the length of the string.



Longitudinal mode of vibration:

In this arrangement, the tuning fork is set in such a manner that the vibrations of the prongs are parallel to the length of the string.



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Contribution:

2020PHY1140 Preetpal Singh :-

As he is okay at coding part, he made the codes understand to his partner.
He prepared excel, csv, py files and performed the calculation part.

2020PHY1164 Anjali :-

As she is okay at writing legibly, she prepared handwritten report. Meanwhile, she corrected calculations and helped her partner to reach till correct results via a right path.

→ Sharing screens to learn codes, having discussions to proceed for calculations in straight and easy way, sharing different links to grasp more and more about this experiment remained a constant part of doing assignment.

→ It was really effective and interactive time doing this assignment.