AMERICAN INTERNATIONAL UNIVERSITY–BANGLADESH (AIUB)

FACULTY OF SCIENCE & TECHNOLOGY

DEPARTMENT OF PHYSICS

PHYSICS LAB 2

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Section: L, Group: 8

LAB REPORT ON

To determine the frequency of electrically maintained tuning fork by means of Melde's apparatus in longitudinal and transverse mode of vibration

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TABLE OF CONTENTS

Theory:

A. Longitudinal mode of vibration: The frequency of electrically maintained tuning fork in longitudinal mode of vibration is determined by following formula.

$$n = p/l \sqrt{(T/m)} \qquad (1)$$

B. Transverse mode of vibration: The frequency of electrically maintained tuning fork in transverse mode of vibration is determined by following formula.

$$n = p/(2l) \sqrt{(Mg/m)} \qquad (2)$$

Where l = loop length of the thread

T = tension applied to the wire = Mg,

M = total mass loaded on thread

m = mass per unit length of the thread,

Figure and circuit:

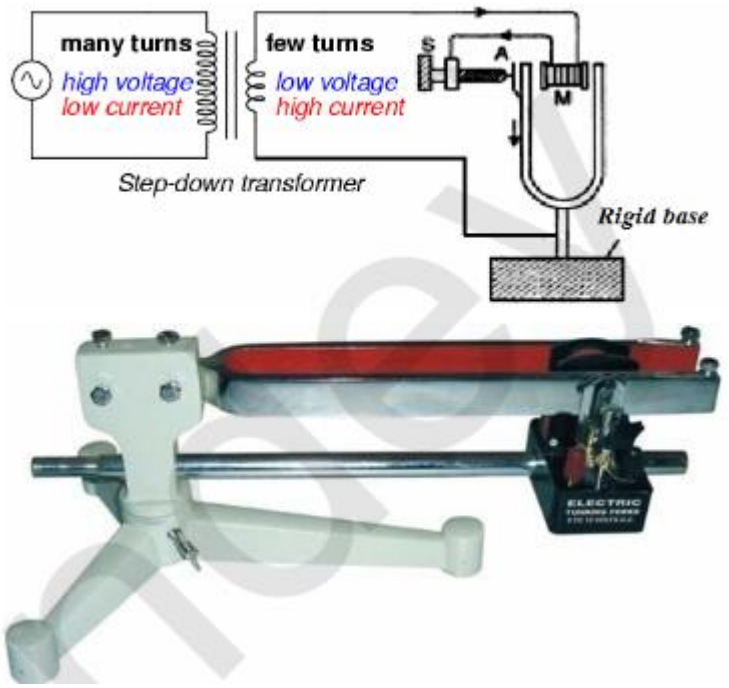

Fig.1: Electrically maintained tuning fork

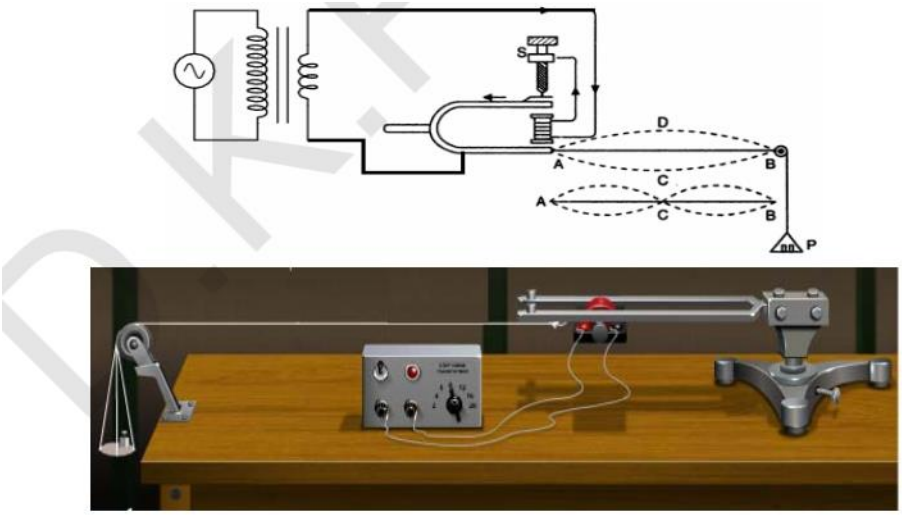

Fig.2: Arrangement for transverse mode of vibration

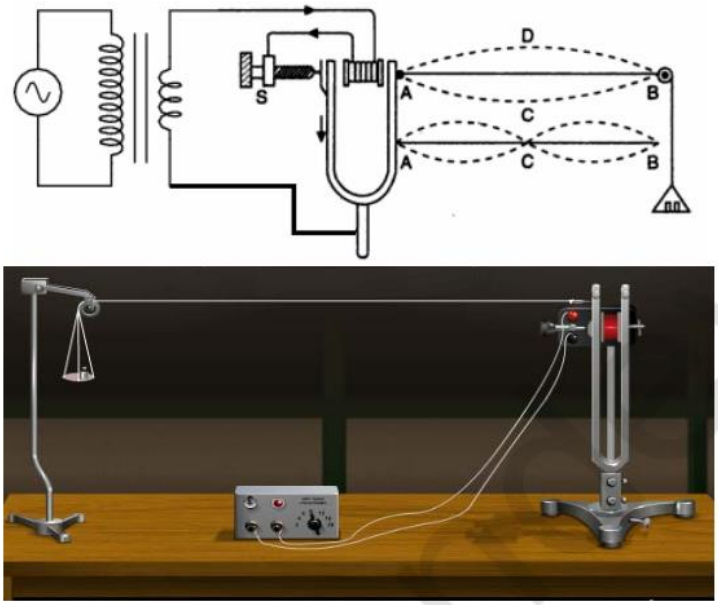

Fig.3: Arrangement for longitudinal mode of vibration

Apparatus: electrically maintained tuning fork, hanger/pan and weights (5, 10, 20gm) and thread

Procedure:

1. At first, the primary of the step down transformer were connected to A.C mains, while the secondary to the given point of electrically maintained tuning fork.

2. Then, the one end of thread was tighted to the prong of tuning fork and other end to a scale pan.the scale pan was hunged with pulley that is fixed at end of table by us.

3. After that, the electrically maintained tuning fork was arranged in transverse situation by us and loaded a mass of 5gm on its pan. then the screw S were rotated , then vibration in tuning fork gets started.

4. Then the tuning fork was moved toward or away from pulley to adjust the length of thread, so that loops could be formed. After that, the length thread for one and two loop was measured when stable loops are formed in horizontal plane. This has given the value l for one and two loops.

5. After that the mass on scale pan (m=10, 20 gm) was increased and repeated the step 4.

6. After it the electrically was arranged maintained tuning fork in longitudinal situation (Fig.3) (i.e. arrange in such a way that length of string is perpendicular to the prong of tuning fork) and loaded a mass of 5gm on its pan. Excite the tuning fork, so that vibrations get started in tuning fork.

7. Then, the tuning fork was moved toward or away from pulley to adjusted the length of thread, so that loops could be formed. Now we measured the length thread for one and two loop when stable loops are formed in transverse plane. This has given the value l for one and two loops. The observed length came double length of transverse case.

8. Then, the mass on scale pan (m=10, 20 gm)was increased and repeated the step 7 for this arrangement.

9. Finally , length of thread per loop (l/p) for each case of load was found out .

10.Then the mass (mT) of 10m length of thread and mass of scale pan (mP) was measured. Value of mT/10 gives mass per unit length of thread.

11. Lastly, frequency of tuning fork for transverse and longitudinal case using M, m and l/p we calculated by us.

Experimental Data

(A) Mass of the scale pan, w = 23.4gm

(B) Length of the sample thread, L = 204 cm

Mass of the thread, M = 0.8gm

Mass per unit length of the thread, m = M/L = $3.92*10^{-3}$gm/cm

Table for transverse mode of vibration

No. of observation	Total no. of loops between the fixed ends	Load on the scale pan (w_l) gm	Tension T=Wg =$(w+w_l)$g dynes	Distance between the pins (G)	N0. of loops between pins (N)
1	5	0	22932	116	5
2	4	5	27832	98.5	4
3	3	10	32732	80	3
4	2	15	37632	63	2

Analysis and Calculation

Length of a segment, l = $\frac{G}{N}$

Length of a segment l = $\frac{G}{N}$	T/l^2 = const	Frequency of the string = $\sqrt{\frac{1}{m} * \frac{T}{4l^2}}$
23.2	42.6	52.126
24.625	45.9	54.103
26.67	46.02	54.174
31.5	37.926	49.180

Mean frequency in transverse arrangement = (52.126 + 54.103 + 54.174 + 49.18) /4 = 52.395 Hz

Result:

Frequency of electrically maintained tuning fork in transverse arrangement = 52.395 Hz

Discussions:

(1) It was made sure that the thread was uniform and stretched.

(2) Care was taken so that friction on the pulley was not too high.

(3) Measurement of the loops was taken from the central part of the thread

(4) The transverse arrangement was done with proper care