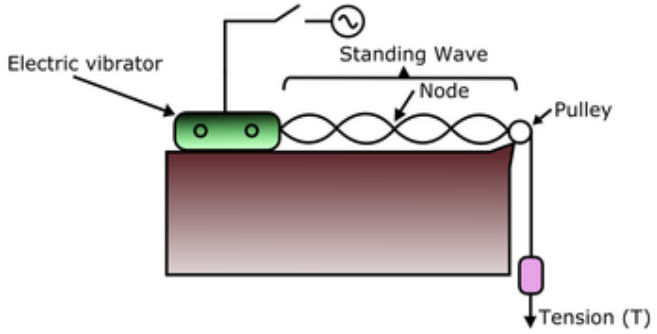
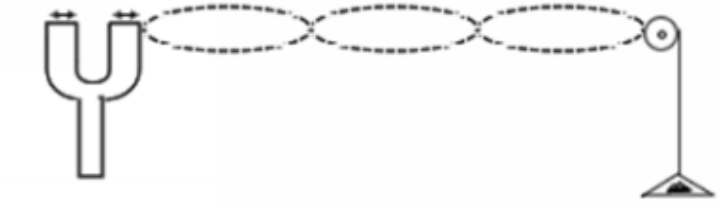
MELDE'S EXPERIMENT - DEFINITION



This is a scientific experiment carried out in 1859 by the German physicist Franz Melde on the standing waves produced in a tense cable originally set oscillating by a tuning fork, later improved with connection to an electric vibrator. This experiment, "a lecture-room standby", attempted to demonstrate that mechanical waves undergo interference phenomena. Mechanical waves traveled in opposite directions form immobile points, called nodes. These waves were called standing waves by Melde since the position of the nodes and loops (points where the cord vibrated) stayed static.

In this experiment the change in frequency produced when the tension is increased in the string similar to the change in pitch when a guitar string is tuned will be measured. From this the mass per unit length of the string / wire can be derived.

Melde's experiment in longitudinal/parallel position:

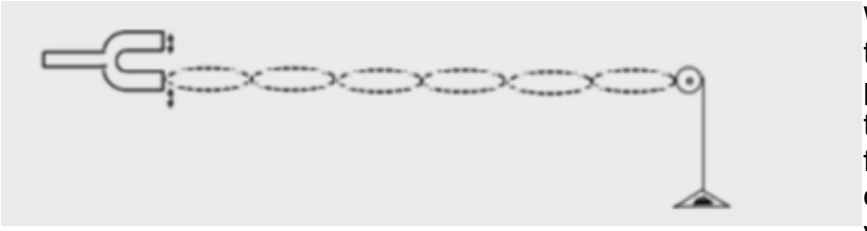


Melde's experimental set up consists of a light string tied to one of the prongs of a tuning fork which is mounting on a sounding board. The other end of the string is pased over a horizontal pulley and a light pan is suspended from the free end. The tension of the string can be adjusted by changing the weights placed in the pan while the length of the string can be adjusted by changing the position of the pulley towards or away from the fork. If the fork is adjusted so that its arms vibrate parallel to the length of the string. Through adjusting the length or the tension number of clear loops can be visible as the standing wave is formed. When the prongs vibrate parallel to the length of the string, the frequency of the fork is twice the frequency of the string. Since the string is vibrating in the fundumental mode, its frequency "n" is given by

$n = \frac{1}{2l}\sqrt{\frac{T}{m}}$, Therefore the frequency of the tuning fork will be $N = 2n = \frac{1}{l}\sqrt{\frac{T}{m}}$.

If number of loops formed is "p", then $N = \frac{p}{l}\sqrt{\frac{T}{m}}$. .

Melde's experiment in transverse/perpendicular position:



When the fork is adjusted so that its arms vibrate perpendicular to the length of the string, the frequency of the fork is same as the frequency of the string. ince the string is vibrating in the fundumental mode, its frequency "n" is given by

$n = \frac{1}{2l}\sqrt{\frac{T}{m}}$, Therefore the frequency of the tuning fork will be $N = n = \frac{1}{2l}\sqrt{\frac{T}{m}}$.

If number of loops formed is “p”, then $N = \frac{p}{2l}\sqrt{\frac{T}{m}}$.

Exercise: In Melde's experiment, it was found that the string vibrates in 5 loops. When 10 *gm.wt* is placed in a light pan. What weight must be placed to the pan to make it vibrates in 10 loops? Neglect the weight of the pan.