

A Review on Ruben's Tube as Acoustic Propagator

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ABSTRACT

In 1905, Ruben's Tube was invented by German physicists Heinrich Ruben and Otto Krigar-Menzel. The tube is closed at one end and the other end is attached with a loudspeaker, then filled with flammable gas. With the help of the Ruben's Tube, the standing waves were represented physically by fire. There are no specific standards in which Ruben's Tube is constructed. At certain resonance frequency, the flame produced visual standing wave that varies in height. It has been used in the teaching of acoustical resonance behavior. This article provides review on Ruben's Tube and its operation, as well as some commentaries and drawbacks for each subtopic. Each of the journals that have similar setup have been reviewed to further explain the phenomena.

Keywords: Ruben's Tube; standing wave behaviours; nodes and antinodes.

INTRODUCTION

What is Ruben's Tube?

Sound propagates through air in the form of pressure waves. However, it is difficult to watch a standing wave with the naked eye. Therefore, it can be visualized using the Ruben's Tube. By passing flammable gas through a long metal tube with a small hole drilled in the top, it is possible to create a line of individual flames. The height of each flame is related to the gas flow rate through the hole beneath it, which can be altered by modifying the gas pressure inside the tube. If this is done by a suitable choice of sound waves, standing waves can be established inside the tube, resulting in a flame pattern. This can then be examined to establish relationships between the sound waves and the gas in which they travel. Figure 1 shows the experiment setup for Ruben's Tube.

Fundamental Theory of Ruben's Tube

In this experiment, the tube is closed at one end. The number of nodes and antinodes produced are the same. The experiment starts with nodes, ends with antinodes, and the maxima could occur at nodes or antinodes [1].

Many years later, myriad of experiments have been done to prove the above statement. Reference [3] shows that the maxima of flame would occur at antinodes. Then, another experiment had been conducted to show that the maxima of flame would be at antinodes [4], [12]. All of these experiments have raised doubts from many people who had asked for more information from the 'The Physics Teacher' for further clarification