



How to make a Ruben's Tube

by [manishk1994](#) on September 10, 2011

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I am an A-Levels Student at Karachi Grammar School, Pakistan. My passion is physics and mechanics and I want to be a Mechanical Engineer in the future.

Intro: How to make a Ruben's Tube

The Ruben's Tube is a physics experiment demonstrating a standing wave. It demonstrates the link between sound pressure and sound waves.

A length of pipe is perforated along the top and sealed at both ends - one seal is attached to a small speaker or frequency generator, the other to a supply of a flammable gas (propane tank). The pipe is filled with the gas, and the gas leaking from the perforations is lit. If a suitable constant frequency is used, a standing wave can form within the tube. When the speaker is turned on, the standing wave will create points with oscillating (higher and lower) pressure and points with constant pressure (pressure nodes) along the tube. Where there is oscillating pressure due to the sound waves, less gas will escape from the perforations in the tube, and the flames will be lower at those points. At the pressure nodes, the flames are higher. At the end of the tube gas molecule velocity is zero and oscillating pressure is maximal, thus low flames are observed. It is possible to determine the wavelength from the flame minima and maxima by simply measuring with a ruler.

Since the time averaged pressure is equal at all points of the tube, it is not straightforward to explain the different flame heights. The flame height is proportional to the gas flow as shown in the figure. Based on Bernoulli's principle, the gas flow is proportional to the square root of the pressure difference between the inside and outside of the tube. This is shown in the figure for a tube without standing sound wave. Based on this argument, the flame height depends non-linearly on the local, time-dependent pressure. The time average of the flow is reduced at the points with oscillating pressure and thus flames are lower.

Please Rate My Instructable and vote for me in the Epilogs Challenge. Thank you :)

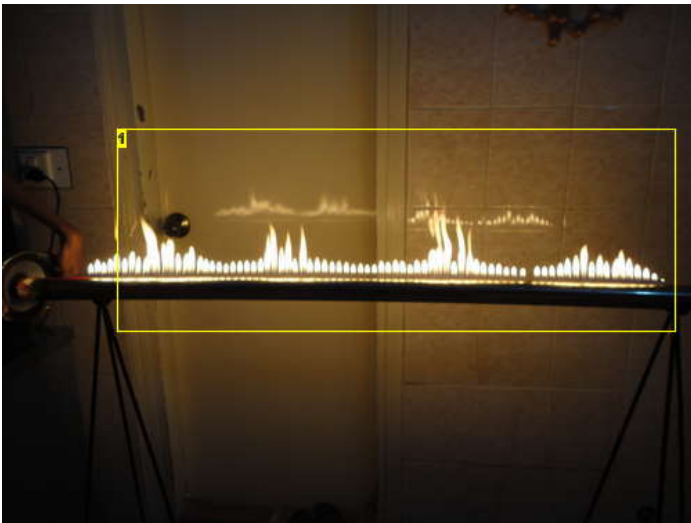


Image Notes

1. Sine Curve

Step 1: What You Need

Materials:

- Drilling Machine
- A Long Metal Tube
- Gas Pipe
- Gas Cylinder
- Speaker Wire
- Guitar Amplifier
- Crocodile Clips
- Stands for the Ruben's Tube
- Wire Strippers
- Screw Drivers
- Scissors
- Amplifier Wire (PC to Amplifier)
- Lighter



Image Notes

1. 31 in 1 screw driver set
2. Wire Strippers
3. scissors
4. Paper Cutter
5. Long Slot Screw Driver
6. Cross Screw Driver

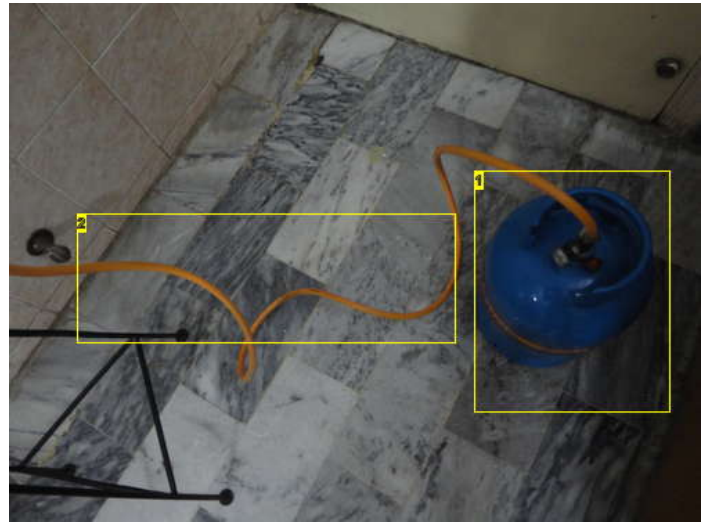


Image Notes

1. Gas Cylinder
2. Gas Pipe



Image Notes

1. Amplifier



Image Notes

1. Stand for the Ruben's Tube

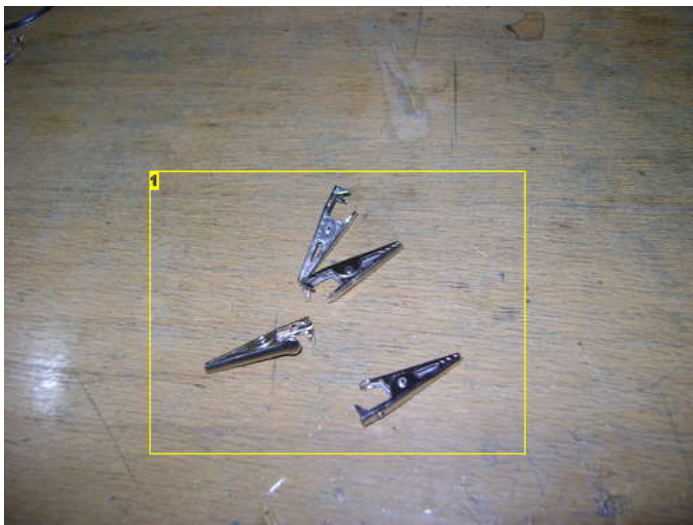


Image Notes
1. Crocodile Clips

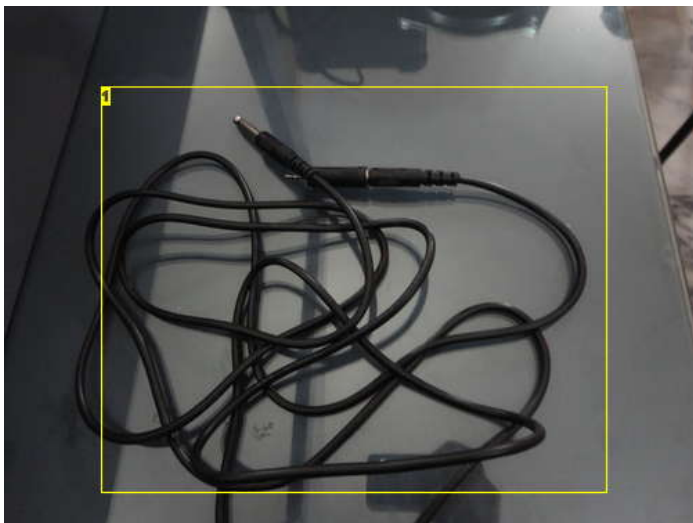
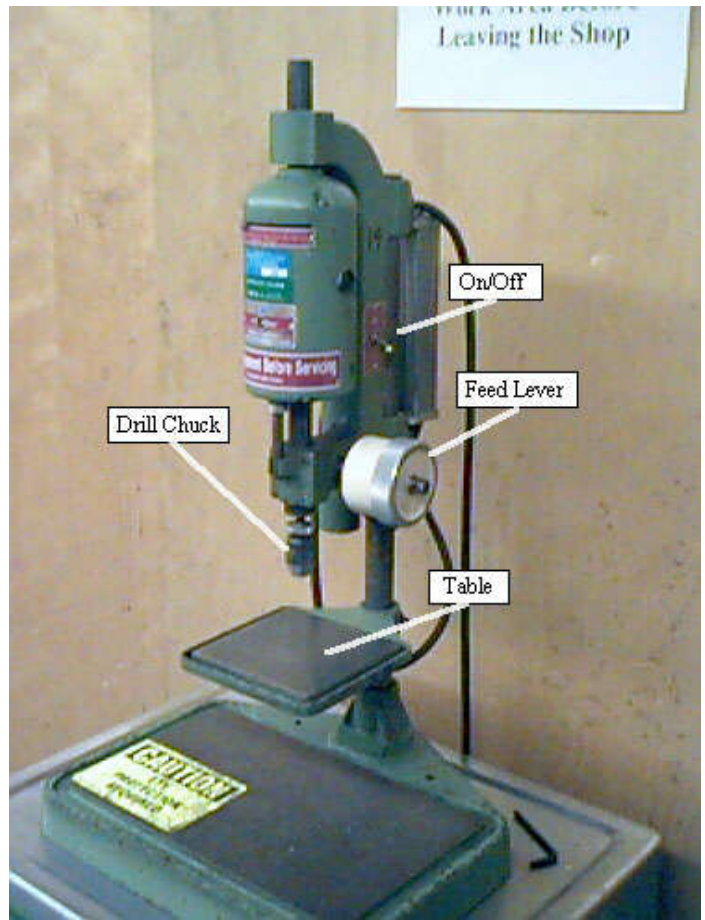


Image Notes
1. Guitar Cable (PC to amplifier)



Image Notes
1. Speaker Wire



Image Notes
1. Metal Tube

Step 2: Dismantling the Amplifier

Disconnect the wire connected to the speaker. Next Unscrew the back lid and the speaker itself from the amplifier.



Step 3: Drilling holes into the tube

Purchase a hollow metal tube from a scrap yard. Use the drill machine to drill holes in the tube approximately 1 inch apart. From one side attach a gas pipe and cover the other side by using a balloon or cardboard. My metal tube was approximately 5 ft long and consisted of 50 holes. This way the tube will act as a closed system except for the holes on the top.



Step 4: Creating Crocodile Clip Wires

Cut approximately a foot of speaker wire and strip the insulation off from each end. Solder the crocodile clip to the speaker wire. Make two of these wires. Strip off some insulation from the wire attached to amplifier. Use the crocodile clip wire to now attach the wire to the speaker itself.

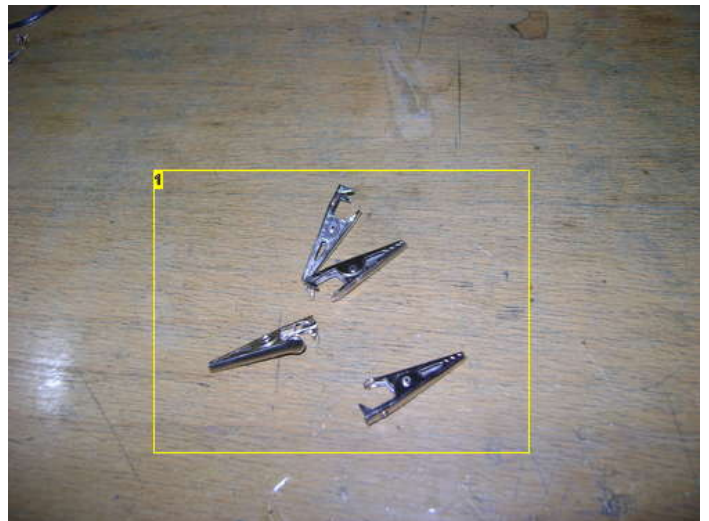


Image Notes

<http://www.instructables.com/id/How-to-make-a-Rubens-Tube/>

Image Notes

1. Speaker Wire



1. Crocodile Clips



Step 5: Closing the Tube

Cut a hole of the same diameter as the tube in cardboard using the paper cutter and stick it to the end with the balloon on it using super glue.





Step 6: Stands

Place the tube on the stands. I got them made separately from a factory.

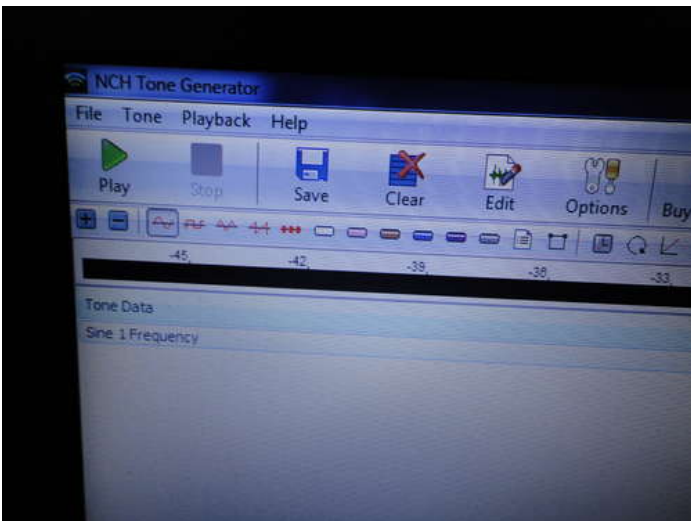


Image Notes

1. Stand for the Ruben's Tube

Step 7: NCH Tone Generator

Download a tone generator of the internet. I downloaded NCH Tone Generator. It was a 14 day free trial but it was worth it. :)



Step 8: Attaching the Gas Cylinder

Attach the Gas Cylinder to the Gas Pipe. Make sure it is fastened tightly.

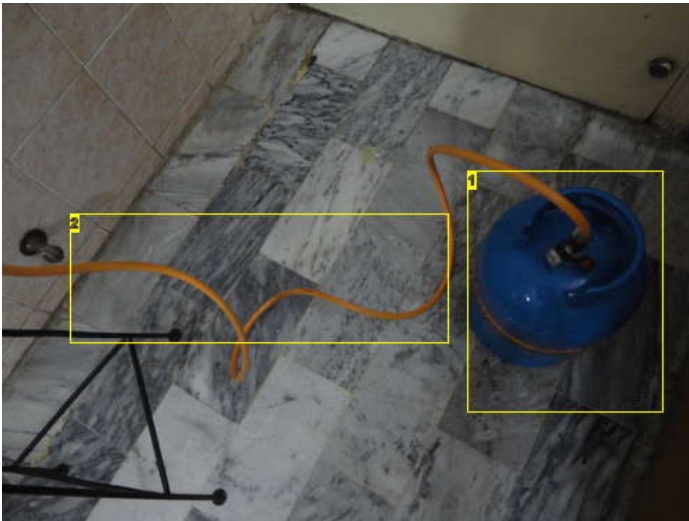


Image Notes

1. Gas Cylinder
2. Gas Pipe

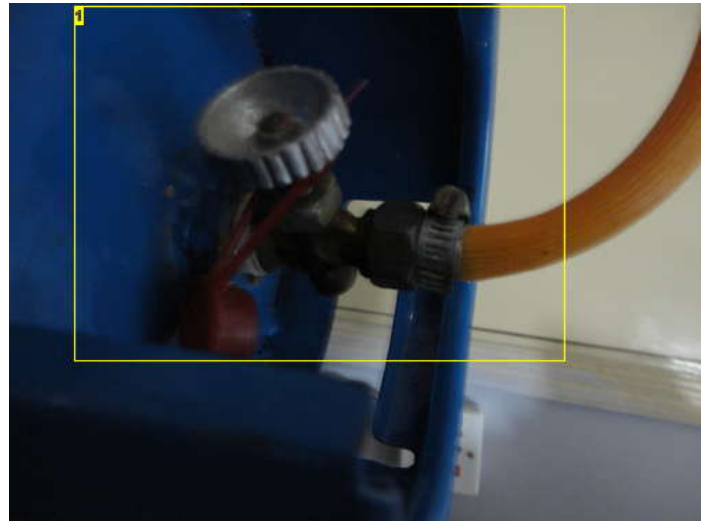


Image Notes

1. Gas Pipe to Gas Cylinder



Image Notes

1. Gas Pipe to Tube

Step 9: Attaching the Speaker

Super Glue the speaker to the cardboard piece attached to the Ruben's Tube. I Didn't do this step, instead I simply held the speaker near the cardboard during the experiment. It works perfectly fine both ways.



Step 10: Last Minute Adjustments

Plug in the amplifier wire into the PC and the amplifier. You can see the settings I used for the experiment.

Drive Gain : 10
Drive Volume: 10
Clean Volume: 10
Treble: 0.5
Middle: 1
Bass 1:

PS: The higher the frequency, the greater the amplitude needed.



Step 11:

Switch on the gas supply, plug in the amplifier in a power supply, light the gas and enjoy :) I used a 480 Hz frequency to generate a sine wave as seen in the pictures. Enjoy watching the Ruben's Tube with music too. :) Fire dancing to music can be an amazing scene.

Credits

Murtaza Mubin
Amin Mohommadi
Manish Kumar

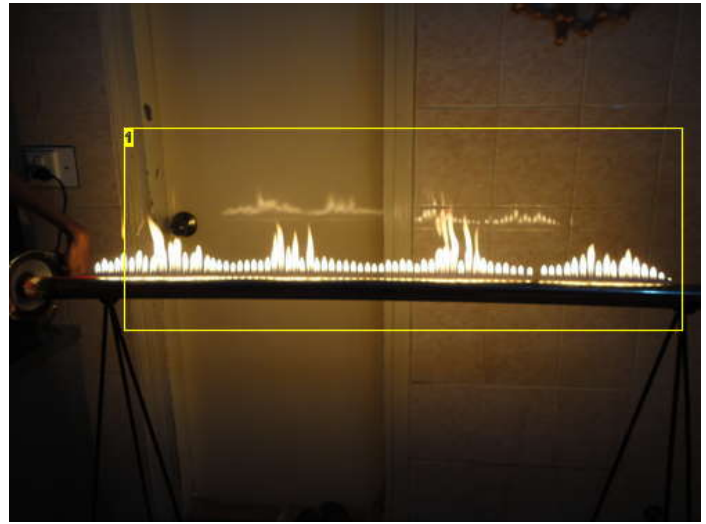
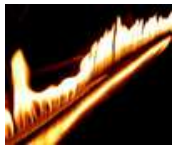


Image Notes
1. Sine Curve

Related Instructables



The Rubens' Tube: Soundwaves in Fire! by yourtvlies



Wiimote Rubens Tube: Control Fire With Sound! (And a Nintendo Wiimote!) by ScaryBunnyMan



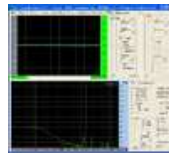
Rubens Tube Yule Log by bofthem



How Sound Works by thegeeke



Rubens Tube 8 foot long AMAZING by namit



More Sound Science With Free Software by falconphysics

Comments

11 comments

[Add Comment](#)



mopod says:

Hi Mani, great job man! Keep up with your passion and make all Pakistanis proud. Good job on the combat robot too.

Sep 15, 2011. 7:59 AM [REPLY](#)



manishk1994 says:

Thank you :) do you live in Pakistan too?

Sep 15, 2011. 8:42 AM [REPLY](#)



ilpug says:

great job. i really need to make one of these, seeing as i have ll the parts.

Sep 11, 2011. 9:29 AM [REPLY](#)



JarredsInstructions says:

My jealousy is immanent.

Sep 13, 2011. 5:29 AM [REPLY](#)



manishk1994 says:

Haha and why is that?

Sep 13, 2011. 6:53 AM [REPLY](#)



JarredsInstructions says:

Because I wish I could have all these tools, I mostly just have a Dremel and a soldering iron.

Sep 13, 2011. 3:08 PM [REPLY](#)



Kinnishian says:

I dont see any more tools than a dremel and soldering iron and knife needed in this instruct able. I think the only challenge will be attaching the pipe to the gas. This is awesome though, I'm hoping to eventually get the materials.

Sep 15, 2011. 7:39 AM [REPLY](#)



FreddE says:

a video would of it going would be pretty sweet

Sep 15, 2011. 6:33 AM [REPLY](#)



manishk1994 says:

I made a video using a 14.1 mega-pixel camera but the quality wasn't that amazing, so i bought a cam corder and will start working with that. Thank you :)

Sep 15, 2011. 7:34 AM [REPLY](#)



cloud_bam says:

Dude... Pretty freakin cool. Slightly dangerous but what fun would an i'bble be without that?

Sep 10, 2011. 7:45 PM [REPLY](#)



ponyballs1 says:

Gonna try this and I my this.

Sep 10, 2011. 1:25 PM [REPLY](#)