Relationship between sound and water

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1. Introduction

・Sound vibration means low frequency
・Water movement means water flow
→When we apply sound to the flowing water, we can observe the phenomenon shown in figure1

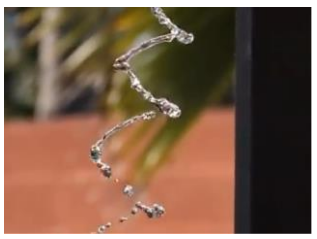

Fig.1 the picture of this phenomenon 1)

2. Purpose

The mechanism is unknown
→We want to elucidate it
・Relationship between frequency and spiral shapes

3. Materials and Methods

Materials

- Low frequency sound source
- Amplifier
- Subwoofer
- Hose(12mm×14mm made by vinyl, 4mm×6mm made by silicon)
- Vinyl tape
- Camera(24fps,30fps,60fps,120fps) (fps is frame per second)

In the movie, frame rate is the number of frames to process per unit time. Usually, expressed in units of fps (=frame per second). 2)

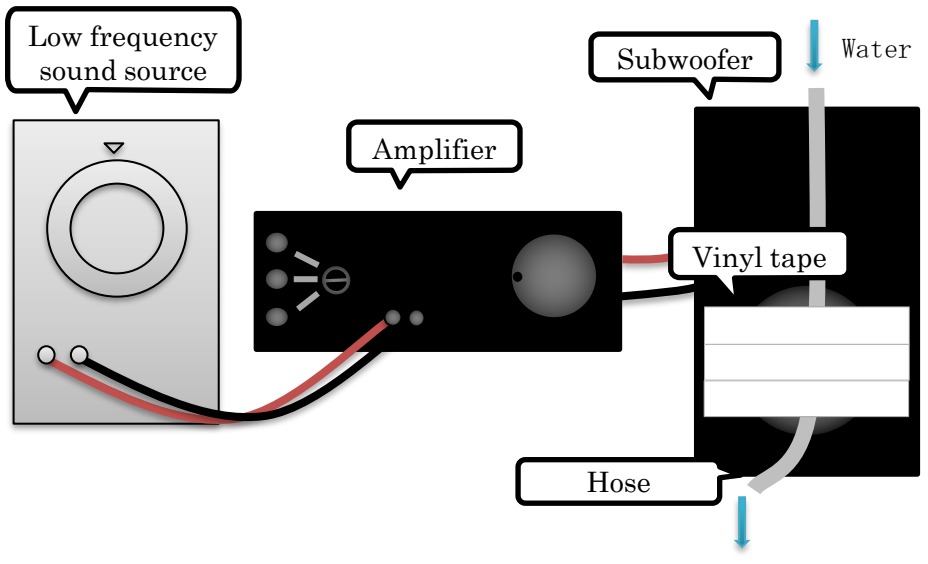

Fig.2 How to connect these equipment

Experiment methods
First, we build circuit like above illustration and affix the hose to the subwoofer. Second, we connect a hose and a PET bottle. Third, we turn on the power of these equipment and run water. Finally, we took a video from various directions and repeated the same operations with changing fps and frequency.

4. Result and Discussion

Experiment① The weight of the hose
The vinyl hose did not vibrate
→ The hose was too heavy

Change to the silicone hose

The silicone hose vibrated

Experiment② Frequency
○In case of
24Hz(24fps),30Hz(30fps),60Hz(60fps),120Hz(120fps)

Increase frequency
→Spiral length became narrowed

In case of 120Hz(120fps),the shape of the water did not change
→The hose cannot vibrate because of the vibrating speed

Experiment③ Frequency and frames Per Second

Frequency (24fps)	23Hz	24Hz	25Hz
Appearance	Rising	Stop	Falling

Fps and frequency	30Hz (30fps)	60Hz (60fps)	120Hz (120fps)
Appearance	Stop	Stop	-

Hypothesis : The shape of water changes because of the position of water drops in a frame

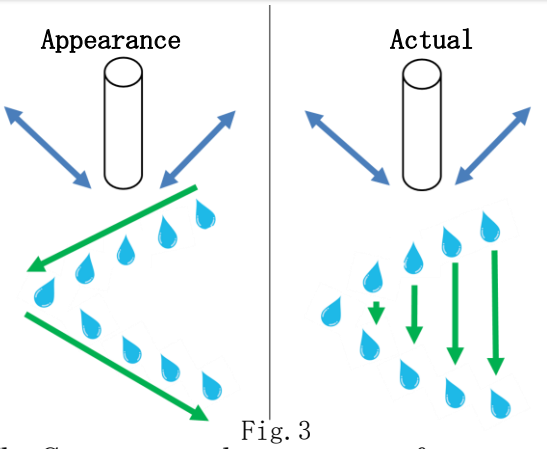

Fig. 3
＊The Green arrow shows current of water
The Blue arrow shows the vibrating way of hose

5. Conclusions

- Heavy hose didn't vibrate
- When we increase frequency, the spiral length became narrowed
- For 120Hz, we couldn't see spiral
- The spiral movement changed by difference between the frame rate and frequency
- We saw spiral only at a specific angles due to the direction of hose movement

6. Future work

We will verify hypothesis

Experiment④ (plan)
Method : Experiment with the same frame rate and frequency as in Experiment ③ using high-density liquid
Liquid example : salt water, sugar water, starch water, Glycerin, and water candy

References

1) https://www.youtube.com/watch?v=uENITui5_jU
2) https://ja.wikipedia.org/wiki/%E3%83%95%E3%83%AC%E3%83%BC%E3%83%A0%E3%83%AC%E3%83%BC%E3%83%88