Noise Reduction System for Commercial Blender

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BACKGROUND

•Commercial blenders are loud, and it's not uncommon to run three blenders at a time to meet the customer's needs.

•Hamilton Beach's next generation Summit blender was chosen to work as a benchmark for the project.

• Once the next generation Summit blender hits the market it will be the leader in power and noise among competitor's commercial bar blenders.

PURPOSE AND HYPOTHESIS

•The intent of this project is to design a noise reduction system for a commercial blender.
• The potential areas where noise can be reduced:
  • the jar
  • the clutch, and
  • the fan
• The first solution
  •vacuum jar - sound cannot travel through a vacuum decoupled the inner and outer walls to eliminate the transfer of mechanical noise via the ice impacting the walls of the jar.
• The second solution
  •Quiet clutch - to eliminate the chattering noise a urethane insert was used in the existing geometry of the cutter.
•The third solution
  •Muffler System - cross between an expansion chamber and Helmholtz resonator to muffle the sound of the fan.

MATERIALS AND METHODS

Vacuum Jar

(1 – 2) The inner and outer walls are made out of polypropylene. This is used because it is the same material the current jar is made out of and it also has good diffusivity rate.

3. The rubber base is what the vacuum jar will rest on. This is the current design used on the GB24.

4. The sound damping lid is made from rubbers and metals utilizing air gaps and seals. The lid is responsible for damping out 5 dB.

5. The rubber gasket is used to decouple the inner and outer walls. This helps reduces the transmission of the mechanical noise from the inner wall to the outer wall.

6. The stainless steel rings are used to hold the rubber gasket in place, and are stainless so they do not rust.

7. The Jar Geo part is a complex part allowing the current cutter used on the GB24 to also use on the vacuum jar. This part also allows for the rubber base and magnets to align properly on the GB24.

Muffler System

(1 – 8) represent the 8 different expansion chambers used in the muffler system.

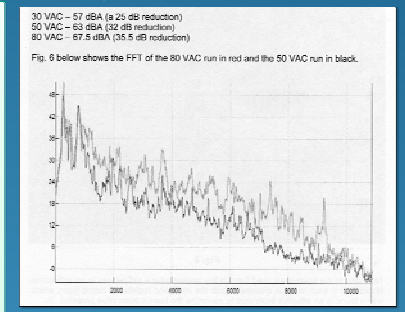
9. Polydamp Melamine Foam used to attenuate higher frequencies and direct airflow.

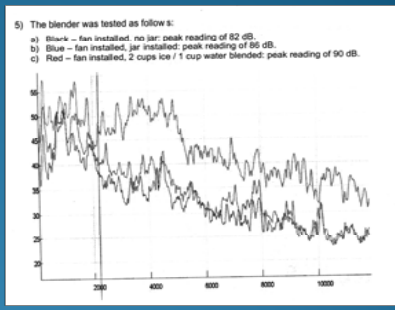
Urethane Clutch

1. The urethane insert is used to damping out the mechanical chattering noise produced by the metal clutches. The urethane material is also strong enough to support the forces produce by the motor over the blenders life cycle.

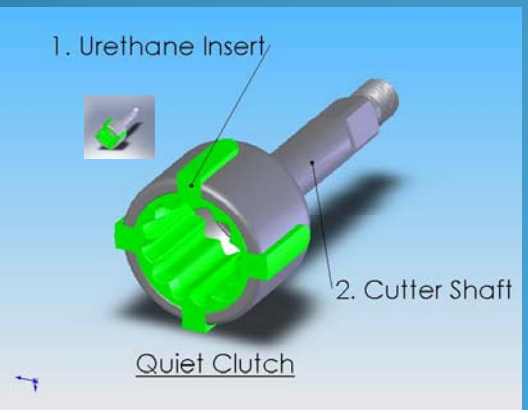
2. This is the shaft the bearings and seals reside on and the blade of the blender.

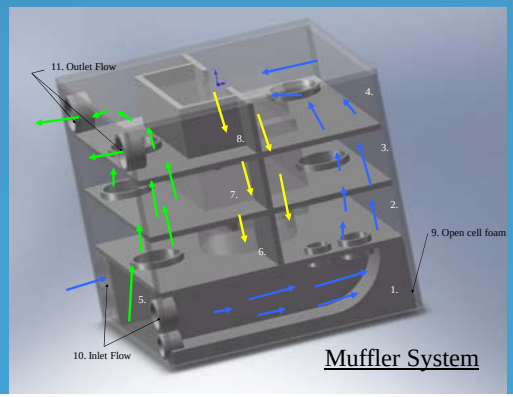
RESULTS

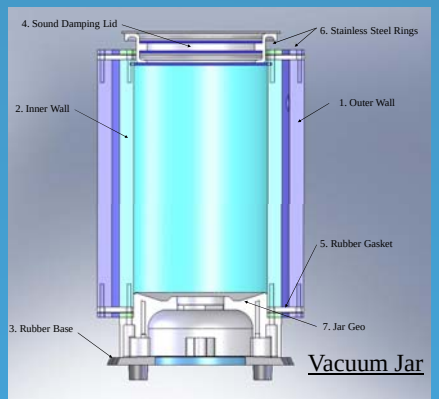




•Vacuum Jar
  • vacuum didn't contribute a significant result to the sound reduction as expected
  •decoupling the inner and outer wall is the largest factor to attenuating the sound
  •adding weight to the walls also improved the ability to reduce the noise
  •The new jar lid did not allow the sound to travel through the air therefore reduce the noise level.
•Quiet Clutch
  •urethane clutch was responsible for reducing the noise level about 3 decibels
  •change the clutches natural frequency reducing the chattering noise found in the metal clutch
  •urethane material also provided enough strength to pass the strip test
•Muffler System
  •the muffler was a large factor in reducing the noise from the base of the blender
  •the muffler was responsible for reducing the fan noise by 32 decibels







CONCLUSIONS

•The most important observation was that reducing the noise level was not the only solution
•Changing the frequency of the noise proved to be just as valuable solution
•I not would recommend using a vacuum
•Decoupling the walls was the most important factor and the thickness of the wall
•The urethane clutch was a good improvement and should be used in future designs
• The muffler system was also a good improvement, however choosing a smaller diameter fan would prove to help the overall geometry of the muffler system to be smaller

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