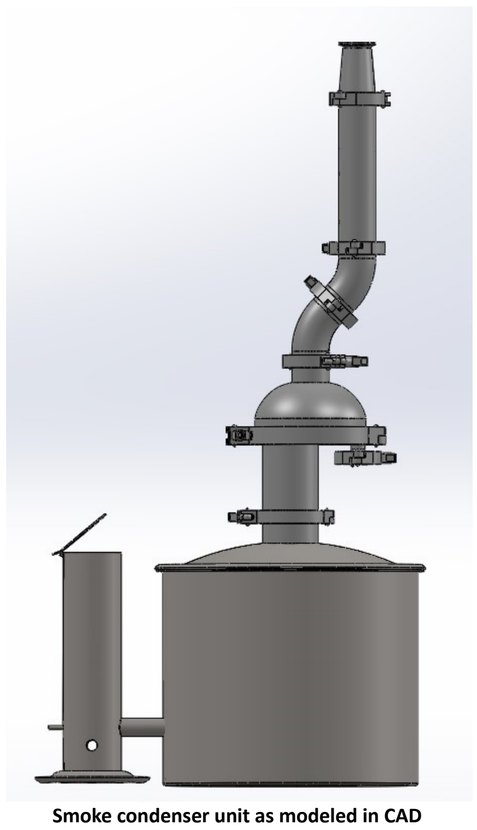
DE6102 ENGINEERING PROJECT by Jonathan Storm

Liquid Smoke Condenser Project for Smokebox Salts



Smoke condenser unit as modeled in CAD

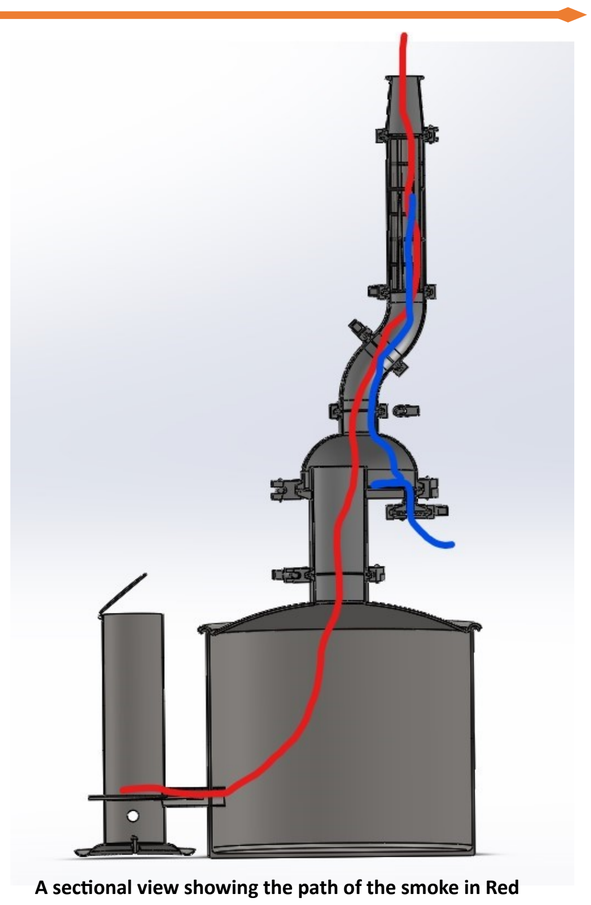
Problem

Design and construct a working prototype of a small-scale smoke condenser. The unit would need to condense wood smoke vapor into a liquid, and be able to handle small batches of different timber. It must therefore be easily cleaned for both flavour purity and hygiene reasons. The unit must also have a good level of modularity with as few custom parts as possible.

Solution

The design that was finally settled on was achieved using various design analysis tools, utilising constraints from both the customer and design perspectives. Different concepts were checked against known competitors to see how the proposed solution compared.

The final design meets most of the original requirements including size, modularity, material, and it utilises predominantly ‘off the shelf’ parts.
All components are stainless steel and uses standard tri-clamp pipe fittings.



A sectional view showing the path of the smoke in Red and the liquid condensate in blue

Function

The unit works by taking generated smoke into a chamber, then passing it through a condenser column which extracts the vapour to form a concentrated liquid smoke. A variable speed air pump helps direct the smoke out of the smoking chamber and up into the condenser column. The column is configured such that all condensate runs down the inside walls of the pipes and is channelled to the collection vessel.

Construction and Testing

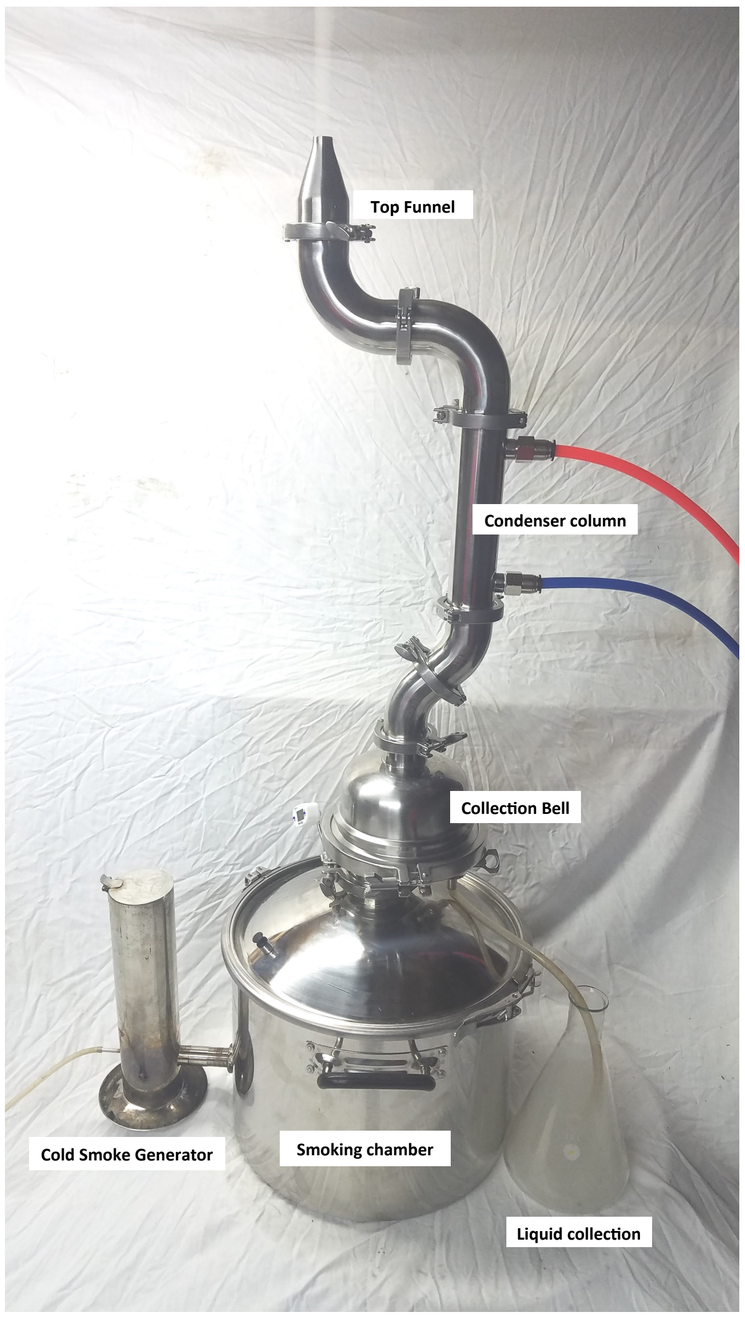
While there were considerable delays in receiving the components, they did all eventually arrive allowing the custom parts to be cut, fabricated and all components assembled. Testing was carried out using both pelletised wood and chipped wood. While the tests were generally successful, they highlighted limitations in the current configuration. These were not serious and can all be addressed during progressive improvements

The top smoke funnel during a test run

Lessons

Testing highlighted that the current Air supply is under powered for the volume of smoke that can be generated in the chamber. A larger blower is required to maximise smoke production.

The compressed hardwood pellets in particular have a very low moisture content, so to increase the liquid yield, an in-chamber humidifier unit should be incorporated. This will enable the humidity to be raised by producing airborne water mist that absorbs the smoke to form the liquid smoke.



The Completed prototype under going performance tests

Conclusion and future developments

The initial test runs gave promising results but further trials are needed to help refine the system. The advantage of the modularity of its construction means that many different configurations can be tested. Adding sensors to the condensing column will enable monitoring of the temperature and humidity of the smoke, before and after condensing. The differential in these values would be an indicator of the overall efficiency the system.

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