

Understanding Atomizing Waste Oil Burners

Why waste oil?

- Economy
- Resilience
- Full circle - waste becomes a resource
- Predictable, steady output compared to other biomass heat sources
- On a working farm or garage, chances are, you already have some waste oil

“Waste” Oils:

- Varying degrees of *Viscosity*, and viscosity response to temperature changes
- Varying degrees of *Heat Value* - expressed as btu/gallon (generally 100-150k)
- Graded petroleum oils: #1-6. #2 most common, heat value: 137K btu/gallon.
- WMO - Waste motor oils. Estimated 125K btu/gallon
- WVO - Waste Vegetable Oils.
- Pyrolysis Oil - ‘bio-oil’ ‘tar or pitch’. Estimated 65% heat value of #2 fuel oil.

What is Atomization:

- Creating a fine vapor-like mist of fuel - through or across a nozzle with a very small orifice
- Maximum fuel *surface area* to combustion air ratio.
 - Same reason kindling burns brighter and faster than firewood

Disclaimer

- We are not recommending modifying existing household furnaces (insurance!!!)
- Experiment at your own risk - know your limits
- Fuels can have explosive vapors, use caution.
- Know the side effects of skin contact, inhalation of vapors.

A nod to the pioneers of this work:

- Jesse Parris and the thousands of members of online forums- [altfuelfurnace](#), [altfuelbabington](#), [wastewatts](#)
- Robert Babington, inventor.
 - Developed all fuel oil burners for european residential markets. Now used widely in remote military cooking applications

Oil Burner Designs

Drip Style

- Low Tech. No atomization.
- Natural Draft possible (no electricity)
- Mother Earth News' design is widely used. Designed in 1970's.
- Today's motor oil has additives that resist degradation and allow engines to run at higher temperatures. In effect, waste oils are now much harder to burn cleanly and likely require preheating and atomization.

"Gun Style"

- Conventional fuel oil burners
- Modest efficiency improvements over time - although overall burner design hasn't changed much
- As homeowners upgrade to modern heat pumps, these old style burners are ubiquitous in scrapyards and can be purchased for very little cost.
- Most can be operated without modification with up to 20% biodiesel. (B20)
- Predictable issues with higher ratios of biofuels - 'gelling' and damage to rubber seals. Commercial biofuel safe pumps and preheaters available.
- Very convenient, tight design.

Siphon Nozzle

- Requires high capacity air compressors
- LP can be used in lieu of air
- Fuel pumps not required
 - Preheating for reliable viscosity
 - "Constant level device" to maintain consistent fuel flow
- Simple DIY nozzles can be made from off the shelf hardware
- Manufactured nozzles available for retrofitting gun style burners for Waste Oils

Babington Style

- Fuel flows OVER nozzle, rather than through nozzle
- Imagine fine mist from a whale's blowhole
- Filtration matches your pump - not your nozzle
- Requires sump and pump
- Same preheating issues with alternative fuels

Components:

The Burner

Nozzle

- Very small hole req'd. Difficult to drill.
- Pressed aluminum idea
- Subject to degradation over time

Sump

- Any vessel will work. Think safety with open fuel containers

Pump

- Possibly most vulnerable part of system. Requires constant operation.

Atomizing propellant

- High capacity compressor necessary for any siphon nozzle
- Also requires constant operation. Consider noise.
- Refrigerator compressor possible for babington nozzle. Consider safety
- Propane can be used in lieu of air. Consider safety

Ignition

- High voltage transformer and electrodes, continuous duty

Combustion Air

- Additional air necessary for proper fuel/air mix
- High volume, low pressure. Lots of salvage sources

Burn tube

- Has to tolerate high combustion temps
- Can be arranged to provide preheating for fuel and combustion air

Ancillary Equipment

Preheat

- Direct exchange: fuel proximity to burner, copper coil around burn tube
- Hydronic: better temperature control
- Band heaters, Plug style heaters
- DIY - heater from large glue gun?

Flow control

- Devices to limit motor speed
- Return line on fuel supply to nozzle

Air control

- Devices to limit motor speed
- Blower dampers

Ignition Control

- Honeywell R8184G with cad cell and timeout

Reserve tank

- Float valve controlled.

- Consider preheat

Burn chamber

- Sizing
- Built right for flame pattern: direct hit of flame on sidewall will eventually wear it out
- Refractory helps retain heat, helps flare off any dripped oil

Applications

- Water heating
 - Domestic
 - Industrial/Agriculture
 - Space Heating
- Furnace
- Glass and Ceramics kiln
- Soft Metal casting

Resources:

Wasteoilheaterforum.com

Yahoo Groups:

Altfueelfurnace
Altfuelbabington
WasteWatts

Ckburners.com - supplies

Yellowbiodiesel.com YellowHeat furnace - Designed for vegetable oil. Uses mild steel ball.

http://www.aipengineering.com/babington/Babington_Oil_Burner_HOWTO.html

<http://www.thsengineering.com/2009/03/waste-oil-furnace-secrets/>

<http://home.cogeco.ca/~woproject/atomizer.html>

WMO - 125K btu/gallon

#2 - 137K btu/gallon

#5 - 150K btu/gallon