Fluidyne 25 years

Introduction

2001 marks the 25th anniversary of our company Fluidyne becoming involved with the research and development of wood gasifiers for electrical power generation.

From a commercial perspective, gasification is still struggling to overcome the bad impressions created by prematurely implemented projects of the 70s and 80s and to a certain sector of our administrations these problems still exist into today's technology.

During the years we have all contributed to this forum I have endeavoured to assist those committed to using gasifiers within the limitations imposed by my commercial commitments and in part by paranoia of having other companies copy our designs.

On reflection for many interested in gasifiers, just having questions answered is not enough, and they have a real need to actually build a correctly designed gasifier that can run an engine without destroying it.

There is also a need by some to investigate the various changes that take place in the transition of wood to char to gas. Clearly its time to provide assistance in a more practical manner than just answering questions.

In 1989 Fluidyne was awarded a contract to supervise the gasification research team at Bremen University in the development of a simply constructed wood gasifier for developing countries.

The design was really just a larger more versatile gasifier based on Fluidyne's Pioneer Class gasifier that did not reach commercial production. Originally designed for 10kWe output consuming 14 kg of wood/hour, its an ideal little gasifier for running engines up to about 2000cc, or just flaring the gas for testing fuels etc. Construction could utilise existing scrap cylinders, and if you don't mind frequent cheap replacement parts, you can make everything out of standard steel pipe and plate. For more reliability however, using a heat resistant stainless steel, like Inconel, or Avesta 253MA for the reduction tube, grate and nozzle tips will give you years of operation (ours is about 13 years old).

This is a great little gasifier with no vices, and it tolerates beginner operators. Easily opened the fuel bed remains intact for examination layer by layer, enough data for any ardent researcher or student demonstrating renewable energy.

At the mention of students, this is not a toy or a model gasifier and all safety regulations must be applied to its use in any location.

Correctly operated, this little gasifier produces a tar free gas from a wide range of wood fuel particle sizes from chips or small blocks, so it should work on fuels available to most users. It does not however gasify sawdust, peat, MSW or other unmentionables which from years of experience we know don't work in our systems.

Gas cooling and cleaning can be complicated if built to commercial standards, so I will let you sort out the best option to suit your situation. Besides I still have to keep some secrets for myself!

The original Pioneer Class drawing is on the Fluidyne Archive with a basic description of parts. There is plenty of room for innovation, just don't change they key dimensions except in the manner prescribed.

As I am preparing for my 12th trip to Europe in as many years leaving on the 1st June, I don't have time to answer endless questions. Just build it and then in July when I'm back in New Zealand we can sort out your individual queries. With any luck several will be operational and others will be encouraged to join in the fun.

Looking forward to seeing your projects posted in July.

Regards
Doug Williams
Fluidyne Gasification.
http://members.nbci.com/whitools/

Operating Notes

A gasifier's performance is only as good as the fuel preparation, and each type of fuel or species of wood may require ad adjustment of the throat tube or grate to perform trouble free. All fuel must be dry (about 15-20%).

Fuel flow creates problems if the fuel doesn't flow, and we use a steel bar connecting the engine to the gasifier base leg to put a little vibration into the system.

Depending on whether you blow the gasifier or suck it, a manometer on the inlet or outlet will provide a resistance measurement across the hearth bed. The actual measurement depends on the fuel but I like to see about 3-4" W.G. On suction.

For first time start-up set the internal measurements as shown in red (on the drawing) as this is OK for most wood types using small blocks or large chips. Fill the hearth with charcoal crushed to about the size of your thumb nail, until its about 100-l20mm over the nozzles then add about 40 litres of wood. If there is a large air space over the top of the wood, drop a couple of pages of burning newspaper inside and close the lid. This consumes the surplus oxygen and prevents start up explosions.

Now start the suction fan and offer a flaming rag or torch to one of the air nozzles. It should light instantly and gas should evolve within minutes.

The fire should burn very bright if you have plenty of suction and really you want to see it stay like this all the time. If for some reason your suction or engine isn't big enough you can squeeze down the end of the nozzle horizontally to get the right colour.

Should the hearth bed increase resistance lift the grate until the pressure stabilises, or lower it if resistance keeps dropping away.

Tar may be present in the gas if the throat tube is too low, so lift it slightly, but try to stay out of the oxidation lobe or it will melt or burn the throat inlet.

Producer gas from wood is very wet and as the gas cools it is important to strip the condensing water away from the gas steam.

Safety

Under no circumstances operate the gasifier in an unventilated situation and every care should be taken to avoid inhaling smoke or fumes from the system.

Regulations may exist that prevent you from operating these systems and it is important to check any restrictions that may apply to your situation.

Questions

All questions should be directed through the Gasification List in order for answers to become ongoing archive reference.

http://www.crest.org/discussion/gasification/current/

Fluidyne DIY Gasifier

Construction

The basic requirement for this project is two 3mm steel cylinders rolled out of sheet, or a long existing scrap cylinder that can be cut in two. Both cylinders should be about 460mm in diameter so that the taper above the nozzles is avoided.

Retain the same length for the hearth cylinder and taper as shown on the drawing, but the fuel hopper can be as long as you can practically handle. We found 60-80 litres is a good size.
Join the cylinders in the middle with a flange using 6 x 10mm bolts. You can use a H.T. Sealing rope or a joining compound, we use the rope.

The three nozzle mountings are half inch BSP pipe sockets or pipe joiner welded half in through the wall. The half inch pipe nozzles screw in from the inside, and a small sleeve of heat resistant stainless Avesta 253ma or equivalent, welded around the end make them last longer.

For safety reasons the air inlets on the outside should have a connecting manifold or a 90 degrees bend screwed in facing down. You need to cap these for shut down of the gasifier.

This prevents any flash backs blasting you with flaming charcoal.

The throat tube/reduction zone is 160mm long and passes through a support plate made out of 5 or 6mm steel plate. We cut two notches out of the plate on opposite sides of the central hole, and welded tits onto the tube so it can move up or down in small increments. The support plate sits on lugs so the whole inner assembly can be removed to access the bottom end.

Make the grate exactly as shown with clearance of the ends inside the throat tube. It really is best to use the heat resistant stainless for this job, but if nothing is available, make a heap of replacements out of steel bar.

A stalk hangs down from the centre of the grate and passes down the tube support through the bottom end. Weld a 12mm nut on the outside of this support tube so that a long bolt or threaded rod can be screwed in, to push the grate up or lower it a little. You can also tap this bolt and shock the grate a little if a plug develops.

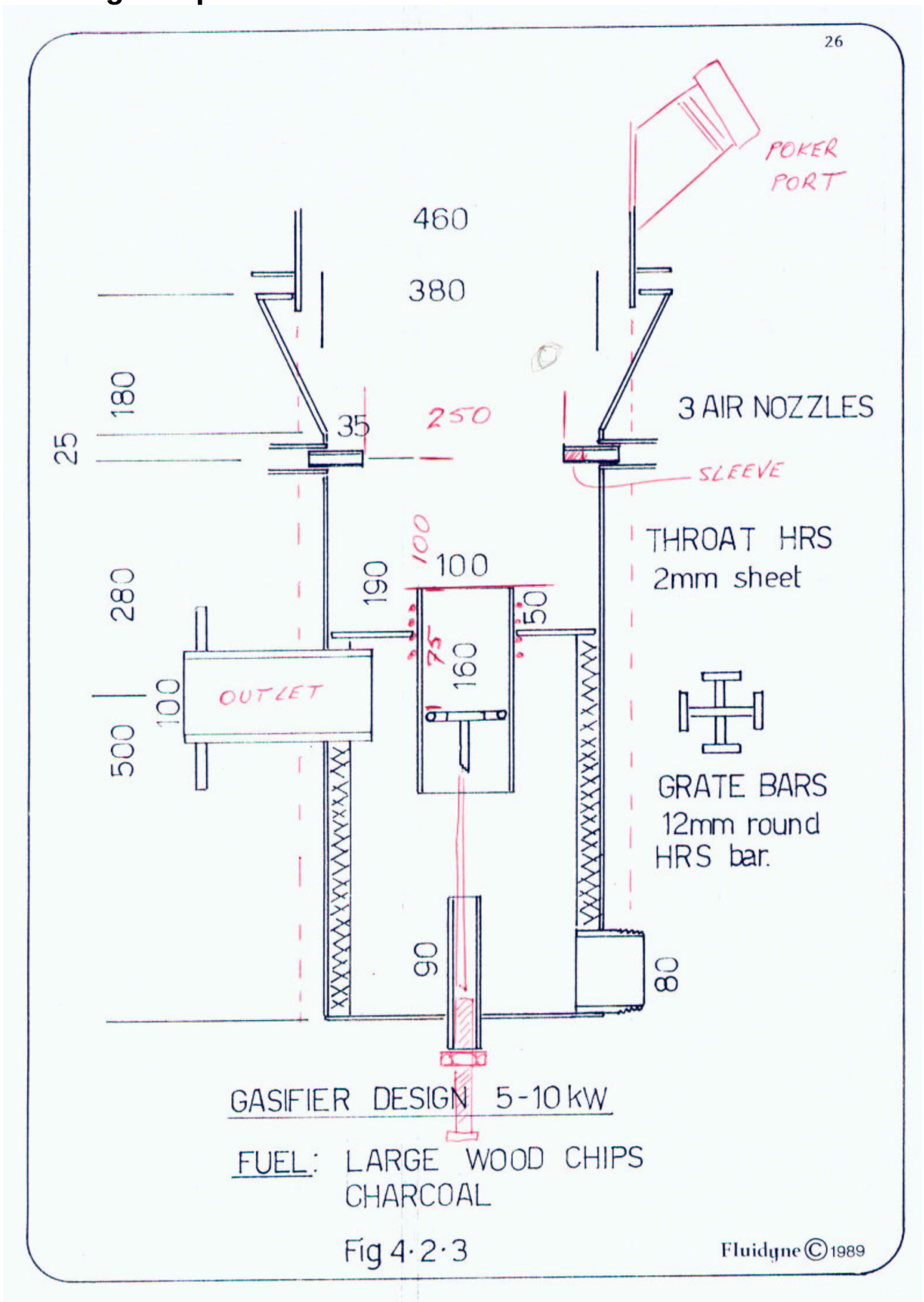
Clean-outs are through a short 80mm pipe barrel nipple cut in half and a pipe cap screws on to make a seal. Make sure it does seal or air will leak in or gas out!

It is important to make a large outlet connection or you will throttle the hot gases exiting, and flange it to whatever you are going to connect onto the hearth.

By necessity the fuel hopper must have a sealing lid and it should have a spring clamp as a safety valve. Any air leaks through the lid will cause repeated small explosions in the hopper. A poker port just above the flange is useful to ensure the bed is packed before start-ups.
Try to obtain Avesta 253ma or Inconel for the nozzle sleeves and throat tube (2mm) and 12mm for the grate bars.

Mountings can be welded to the hearth outer case and a clearance should be left underneath to access the grate adjustment and "tapper".

Drawing and picture



This was the original size of the Pioneer Class hearth and fuel hopper, but the narrow hopper caused fuel flow problems. We fitted a larger hopper, hence the taper on the drawing above the nozzles. It is easier to just have the larger parallel cylinders.

You can see the ignition port, and air inlet which is between two nozzles. The grate shaker lever didn't really work and tapping the bottom is OK.

Mount the vibrator arm from the engine about 150mm below the bottom on the leg mounting. Sandblast and paint with silicone manifold paint.