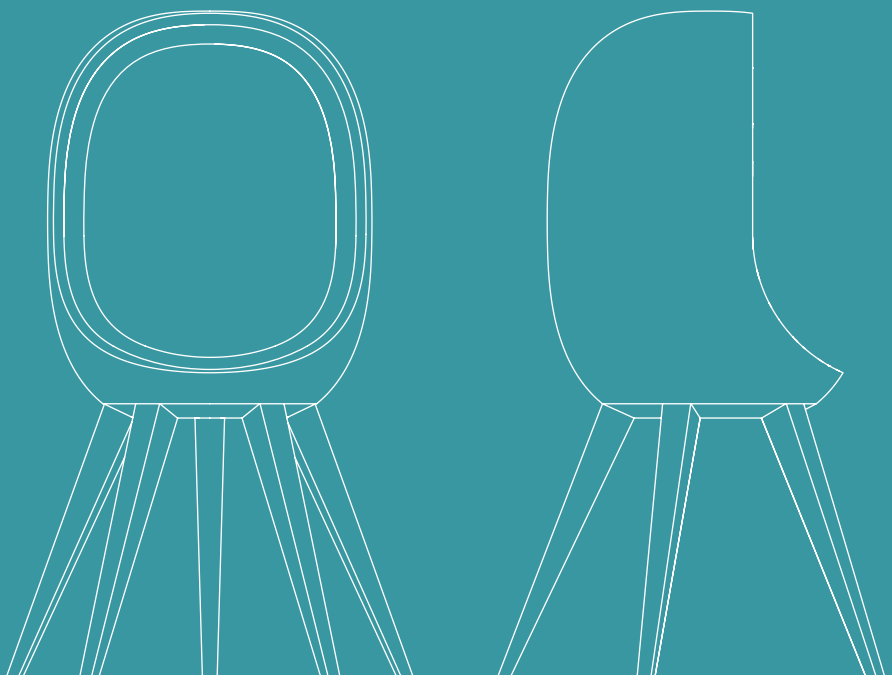
Fire Furniture



catching fire

Diploma Work by Fredrik Hyltén-Cavallius - Industrial Design - Lund University 2009

Fire Furniture

catching fire

Fire Furniture - Master Thesis from Lund University, Industrial Design, LTH, 2009 - Department of Design Sciences
Examiner: Claus-Christian Eckhardt - Superviser: Charlotte Sjödell - ISRN: LUT-DVIDE/EX-09/50105--SE

Abstract

This is a diploma work in industrial design by Fredrik Hyltén-Cavallius. In this project my goal was to find a product that could make the ancient fire fit better into our modern homes.

I started out by looking at fire related products such as stoves and barbecues on the Swedish market. Through several interviews I also looked more closely into a couple of heat related technologies such as stirling engines and peltier elements. The research phase also included the study of materials with good thermal properties such as airglass, cork and ceramics. This was also the phase were I learned more about ethanol as a fuel and the sustainability issues around it.

After the research I chose to work with a chimneyless stove with an ethanol burner. This was followed by a first ideation round. The concepts that came out of it were in hindsight too technical and didn't focus on the right issues. I realized that the problem to be solved was not how fire could help the customer in a technical way like giving heat or cooking food. I also realized that the question was rather how fire could be presented in a way so that emotional qualities like Scandinavian cultural heritage and relaxation was enhanced.

I did another round of ideation after a second, more emotionally oriented, research phase. I found important inspiration in 18th century tiled stoves and in the brass reflectors of old candle holders.

In the concept refinement phase I made full scale print outs, real fire tests, full scale 3D paper models as well as interviews and study visits to learn more about materials, production methods and how fire and flames behave.

What I learned during the refinement was later applied to my chosen concept, a super ellipsoid ceramic stove with brass reflector and five wooden legs. I was ready to go into the prototype phase.

In the early stages of the prototype phase I had another setback. My first production partner for the ceramic part, toilet maker IFÖ, jumped the boat after several weeks of planning.

This, in combination with the wrong target focus in the first round of ideation, substantially prolonged the project and I felt forced to extend my time line to cover the summer.

However, I managed to find partners and sponsors for the two large parts I could not produce at the school workshops. The ceramic piece being manufactured with formidable stucco artist Hans Räthel in Lund and the brass reflector water jet-cut by extremely helpful Morgan Svensson at Pilum in Malmö.

In the end I had a functional prototype, with most parts made in real materials, of a chimneyless stove with an ethanol burner.

Acknowledgements

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Introduction

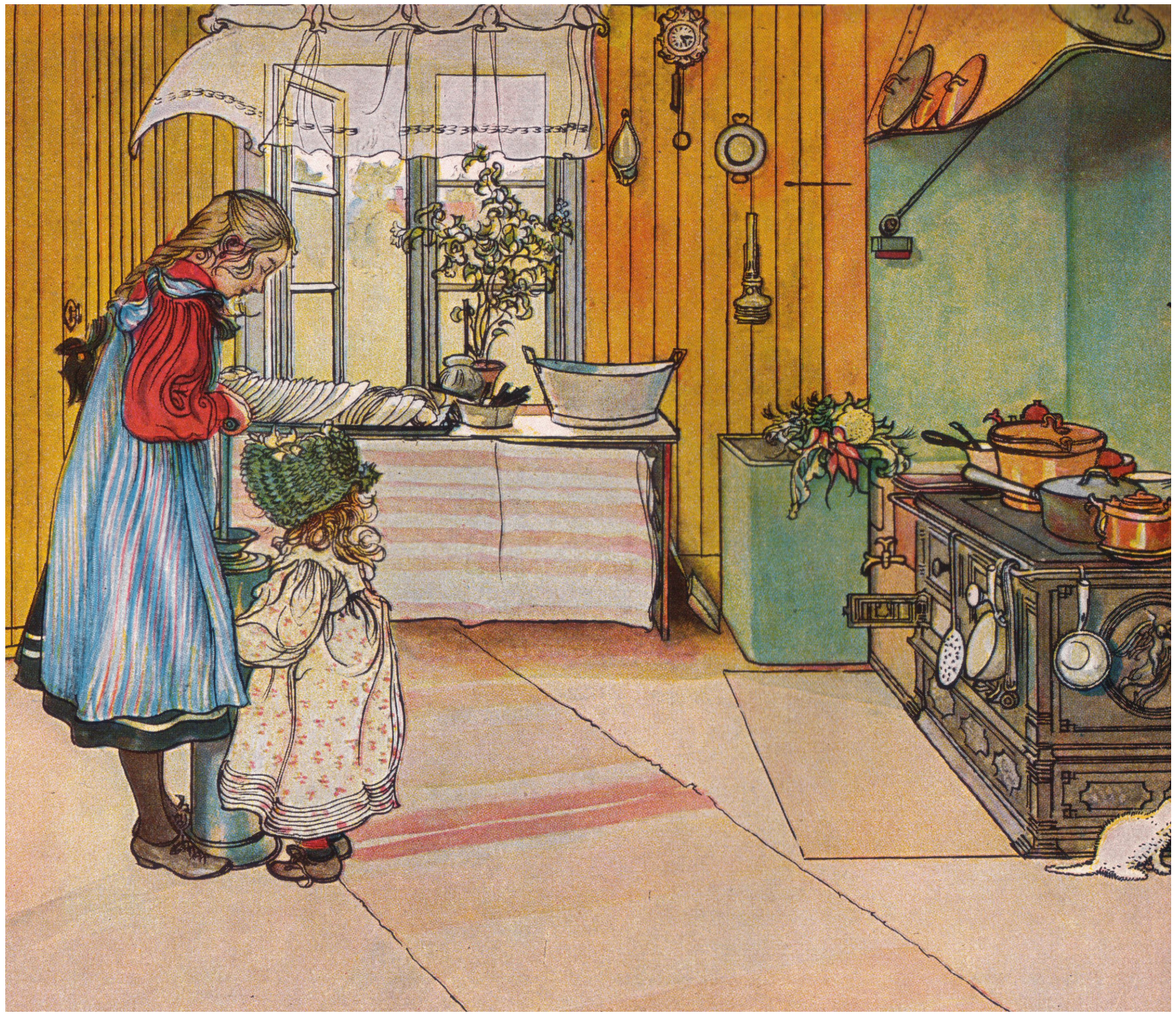
Project background

So why did I choose to work with fire? During my childhood fire was very present both at home and during my time as a scout. I've always been fascinated by fire and how something that is so simple to make can room such complexity and power.

Fire is fairly rare in our modern society and more and more children grow up without knowing what a fire feels like. With lack of experience comes fear and also lack of respect. I think it would be really sad if future generations only connect fires with house fires and natural disasters.

With this project I hope to find a way of bringing fire back into our homes in a simple way, so we once again can relate to one of the most basic elements on earth.

Since the brief is completely my own, and I thereby take on both the role as the designer and the customer, the project becomes very personal. In line with this I have chosen to keep the tone in this documentation quite personal and rather describing the journey this project has been for me than writing a scientific report.



A Carl Larsson painting from 1898 of his children standing in the kitchen with a wood fired stove

Brief

The heat from a simple fireplace instantly gave the caveman protection from predators, heat, something to gather around and the ability to cook food. As soon as we learned to control it, fire became a necessity for survival.

Today we are not dependent on fire for our survival, but the question is if fire could give the modern man something else, and how this in turn could be made into a product to fit our modern homes?

A fire during hiking is perhaps one of the few occasions in modern life when we experience fire as it may have been during the stone age

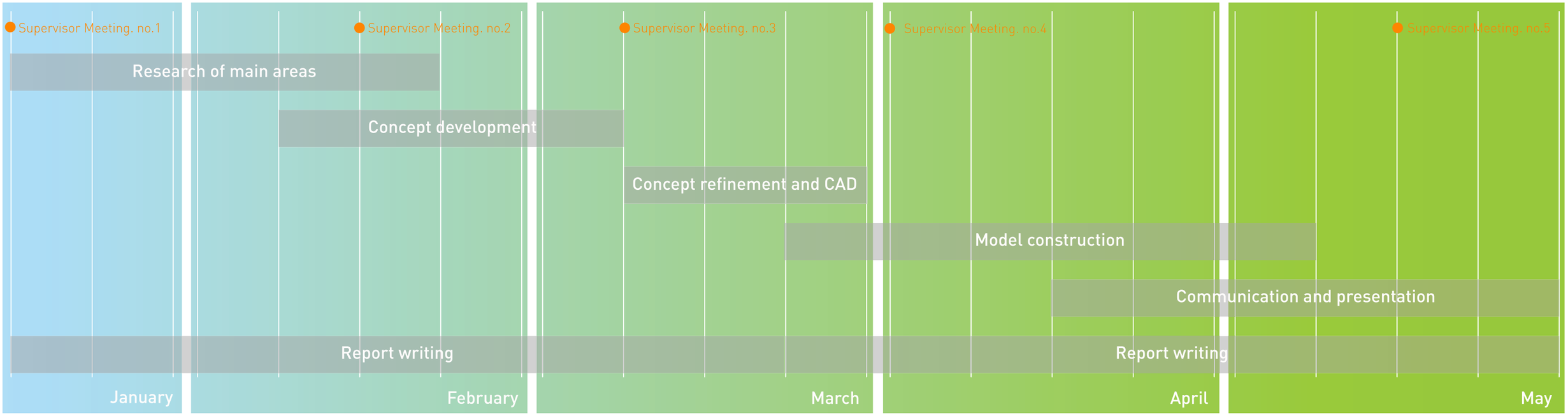
Scope and limitations

One of the goals with this project was to end up with a functional prototype along with a rough plan for how the final product could be produced. This proved to be a challenge to achieve within the course limit of twenty weeks.

This also limited the complexity of the final product and in some areas the level of detail in the prototype.

In the market research I have skipped pure heat and light emitting devices to narrow down the search. I also excluded cooking stoves with gas burners.

Initial time line



The initial time line

Research

When I started the research phase I wanted to keep the project open and I looked broadly across the heat and fire areas. I started with a market research of the products available on the market in Sweden today but I also looked into pure heat related technologies, old as well as new, to see if there could be something to build my project around.

A brief history of fire

Fire has been controlled by man for at least 800 000 years[1] and probably occasionally used by man long before that. It protected us from carnivores, gave us heat, light and a dry refuge in our caves and huts throughout history.

It also helped us to cook our food and when man started to develop farmlands, the fire also became a tool in landscape management[2]. Even if fire in a way led the way to the modern civilization (e.g. by giving the power to the steam engine) it also has been one of the most feared elements. Fire quickly became a weapon in warfare and was a destructive force that ruined many cities around the world until efficient fire extinguishers and water pumps were developed.

In Scandinavia our cold climate and dark winters historically made us particularly dependent on fire for heat and light in our homes. I believe that remains of this still can be found in the north European culture.

A painting of the old St Pauls cathedral during the great fire of London in 1666

IKEA candle sales

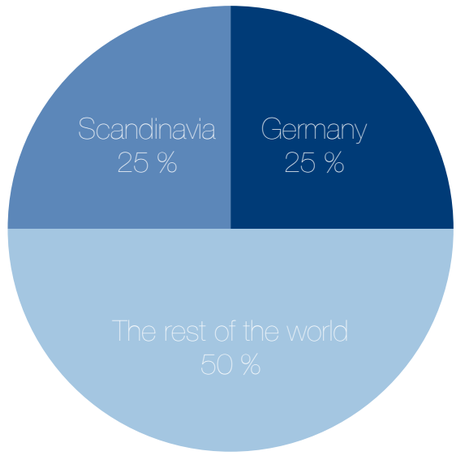
In order to, in some way, find support for my general idea that north Europeans are quite fond of fire and the warm light it gives I contacted IKEA. My question to them was if they, as a global company, could see any patterns in how candle sales differed between countries and regions.

Hannah Holmquist Carleke who is Product developer for candles at IKEA gave me some figures. Of their standard candles (Jubla) 65% of their sales are in Scandinavia, the rest is sold quite evenly over the globe. For the tea-lights (Glimma) 25 % are sold in Scandinavia and 25% in Germany and the remaining 50% in the rest of the world.

This may not count as scientific proof in any way but in my opinion it could give a hint of the popularity of cosy lighting in our northern countries.

Sales of candles

Sales of tea lights



Candle and tea light sales at IKEA 2008

Market research - Wood fired stoves

Normal wood fired stoves have been used for centuries as the primary heat source in many homes around the world. A standard cast iron stove is more efficient than an open fire but less efficient than for example tiled stoves[7-8]. This is something that is addressed today by adding technology as heat exchangers to cool the smoke before it enters the chimney. It is also common to add soap stones or water tanks to the construction to even out differences in heat and release the heat over longer time[9].

There is a large range of stoves to choose from and there are decent stoves from around € 500 and all the way up to € 15 000, plus installation. Many people still buy a stove as their primary heat source for smaller houses, for example a summer house or in the countryside, where there at least in Sweden is a good supply of fire wood.

Even if modern stoves can be the primary heat source in a home a lot of customers seem to choose a stove for pure pleasure as well. More and more stove models come with glass on several sides to allow the fire to be viewed from all angles.

An obvious problem I see with stoves is that they require a chimney. So even if some of them are quite small and handy it is almost impossible to move them around once they are installed, unless you are willing to make another hole in your wall.

Four examples of wood fired stoves available on the Swedish market today

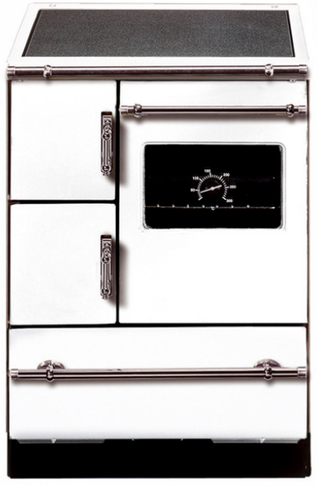
Market research -
Wood fired cooking stoves

From having been the number one cooking stove type in Sweden until the early 1900s, the range of wood fired stoves are very limited today. The existing products mainly aim for customers with traditional old summer houses or those who want a second stove in a more luxurious kitchen.

The wood fired stove was (and is still) a very effective heat source and can heat large rooms.

They range from the 19th century retro style cast iron stoves, through the 1940s white enamelled iron to newer materials like soap stone etc. But these newer stoves are also often retro styled and very few show any tendency to renew the market.

The prices range from around € 2000 for an ordinary stove to € 3000-4000 for the more exclusive models equipped with soap stone. The price seldom include installation, which can be quite expensive, especially if your house doesn't have a chimney today.



One traditional wood fired cooking stove (lower left) and three examples of stoves available on the Swedish market today

Market research - Barbecues

Who can resist the smell of a barbecue in a garden a warm summer evening? But what is within that smell? The smell of the food and the coal is of course the obvious answer, but in your mind you probably add on a few elements to the picture. You see yourself in the garden with your friends and family, maybe a cool drink nearby. It's probably some sort of holiday or weekend since we usually don't have time to fire up the barbecue after work on a working day.

This feeling is probably the fact that makes the barbecue the most popular fire related product I've came across. Anyone with a garden can buy a barbecue for a mere € 40. And if you don't have a garden a cheap disposable barbecue (for € 5) for the picnic in the park could give you the same feeling. If you want to flash your money or just really enjoy cooking for many people you can get a luxurious gas fired barbecue for € 1000 and up. These semi-mobile kitchens usually come with larger cooking areas, hoods and tons of utilities.

Another reason for the barbecue's popularity might be the fact that they don't require any installation (except perhaps the really large gas burner ones). The cost for the product and the fuel are the only things you have to worry about. There is no need for a chimney or chimney sweeper.

Some examples of barbecues, disposible, classic and gas fired ones

Market research - Tiled stoves

There are examples of tiled stoves in Sweden from as early as the 15th century[3] (for example from Allhelgonaklostret in Lund, Sweden). The development of the tiled stove was in the beginning a question regarding efficiency. In these early models the smoke was kept in a larger space within the stove so that more of the smoke's heat was left inside the room before the smoke went out through the chimney. But although this increased the efficiency a bit the model never got a truly wide spread in Sweden.

In the mid 1700s the stoves in most Swedish homes where so inefficient that it led to a national shortage of fire wood. This in turn made the The Royal Swedish Academy of Science react and in 1767 they set out to make the tiled stoves more efficient. Their new version led the smoke in long channels within the stove and reduced the opening, these changes made the stove use less than half the amount of fire wood compared to previous models. It became a success and in the late 1700s and throughout the 1800s it was the most common heat source in Sweden[5].

Today it's a quite exclusive product to aquire since it is both expensive to buy and to install and requires quite a lot of space. The price for the stoves ranges between € 3000-20 000 and € 1000-3000 for the installation[6]. Most new tiled stoves are made retro styled but there are some producers (like the Gabriel Keramik stove seen to the right) who make more modern looking models.

An old Marieberg stove from the 18th century

A more modern stove from the Swedish producer Gabriel Keramik

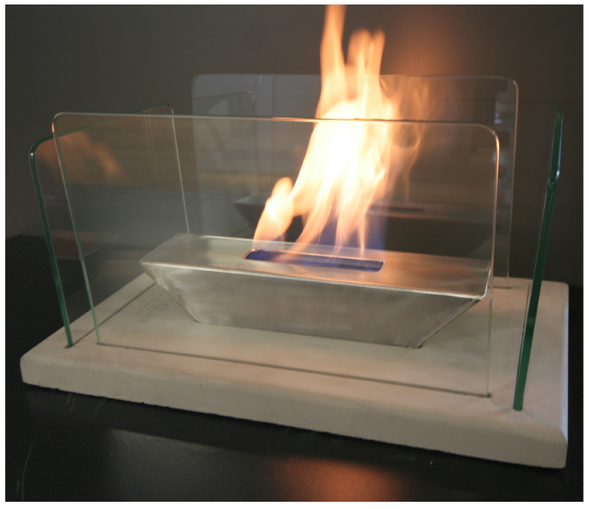
Market research - Chimneyless stoves

In the last few years a new type of fire product has entered the market, stoves that use ethanol rather than wood as fuel for the fire. This leads to a smoke- and soot free fire and thereby eliminates the need for a chimney. These stoves can be placed anywhere in- or outdoors as long as they are kept away from combustible materials and the room has normal ventilation. Even though there is no wood or smoke the fire itself is very real and should be treated with the respect and caution that any fire requires.

Another benefit apart from not needing a chimney is the ease of use. You can just buy one, fill it with ethanol (in liquid or gel form) and light it. There is no need to require the knowledge it takes to tend for example a wood fired stove. Since a decreasing number of people today, in our western society, are in contact with fire in their everyday life the knowledge of fire keeping disappears. I believe that this leads to increased fear for fire and a growing reluctancy to buy and use classic wood fired products. This may be another reason for the increasing market share for these easy-to-use stoves.

The prices range from around € 300 to 3000. But even if they are cheaper to buy than many other alternatives the fuel itself is still quite expensive. One liter of ethanol burn for around 2-4 hours and cost € 3-5/lit in Sweden today. But I think this is a pure question of demand since the ethanol for cars only cost around €1/lit.

Despite the popularity the range is quite limited. Most stoves are pure 19th century retro style or modernistic pieces in brushed steel and glass. These two styles certainly don't reflect the look of all the Scandinavian homes today.



Some examples of chimneyless stoves sold in Sweden today

Technology research - Stirling engines

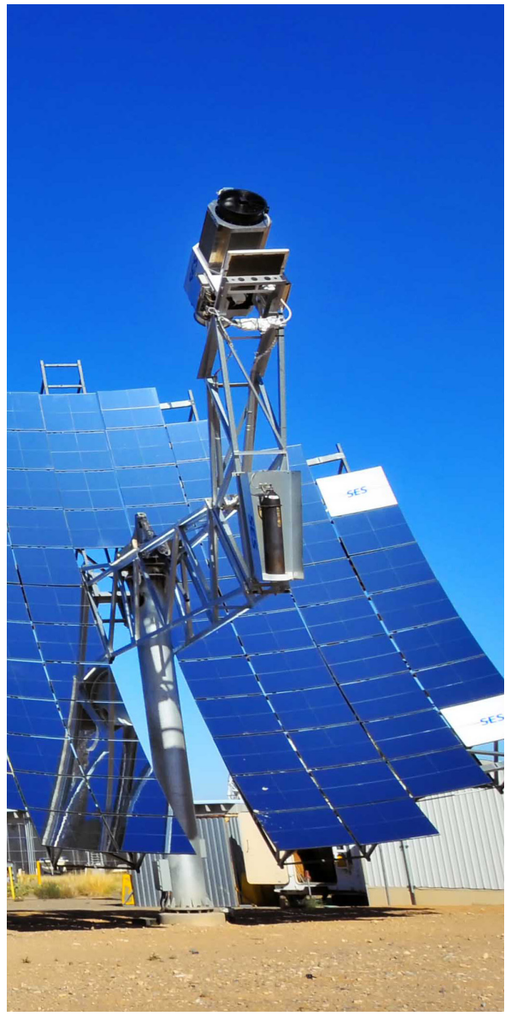
facts from interview with Dr. Rolf Egnell Ph.D. in energy sciences and combustion engines at Lund University - in Lund February 2009

A stirling engine is an engine that only need a heat source (could be anything) and a temperature difference to the surroundings to run. In a way it works like a steam engine but instead of using liquid water expanding to steam it uses cold air that is expanding when heated. The sterling engine was invented by Rev. Robert Stirling in Scotland 1816.

I contacted Dr. Egnell who prior to his research at Lund University took part in the team developing the very successful silent stirling engine systems for the submarines built at the shipyard Kockums in Malmö.

My question was primarily if a simple stirling engine could be constructed in a cheap and reliable manner to for example be used as a hot air pump or fan in a home. I had two meetings with Rolf Egnell, where we discussed different ways to achieve this in a effective way. We looked at drawings of the first stirling engines and tried to simplify it down to a 'hot air muscle' using as few moving parts as possible.

Our conclusion was that it would be possible to construct something that used the excess heat from a fire to pump air into the room but that this device would be too expensive (it would probably cost several hundreds euros) and be hard to control for the mere benefit of getting a more efficient air flow in a room. But the stirling engine remain a very interesting technology and is now in fashion again partly because of its role as generators in modern solar power plants.



Left: Stirling engine that can run by the heat from your hand Right: Solar power station with stirling generator

Technology research - Peltier elements

facts from interview with Johan Seiberlich, engineer at Peltier producer Supercool - over telephone February 2009

A peltier element is a semiconductor component with the ability to use a difference in temperature to produce electricty. Since electronics on this level is way out of my knowledge area I contacted the peltier expert Johan Seiberlich at Supercool, the leading supplier of peltier elements in Sweden.

We discussed similar plans like the ones I discussed with Dr. Egnell, would it be possible to use the energy from a fire to produce any useful power? In this case the power is not mechanic power but pure electricity giving power to a motor. We discussed different sizes of peltier elements and possible heat differences that could be achieved with an indoor fire.

When I had descibed my problem in more detail Mr. Seiberlich confirmed that it would indeed be possible to use peltier elements as generators for smaller electrial engines like fans. It's pretty much a question of how much power you need and then choose the corresponding peltier element. The price for a peltier element is not as high as a stirling engine, only about € 50-100.

I was glad to have found an interesting area where new products perhaps could be designed, but after some more research I found several products built around the same technology so the novelty of a peltier driven product would not be so high.

The "Ecofan" is a fan driven by a peltier powered electric motor, just place it on a stove and it starts to distribute the hot air around your room

Technology research
- Soap stones and water as heat storage

A typical fire in a standard stove vary in heat during its different phases. This may lead to uneven temperatures in the room. To even this out a material that absorbs the heat and then releases it to the room in a steady, constant fashion, is commonly used. Systems like this does not only even out the fluctuations in temperature but also makes the stove heat the room for several hours after your fire has burned out. So if you for example put out your fire when you go to bed you may still have a couple of hours of heat left.

The most suitable materials for this are materials with high heat capacity. This means that they can store a lot of heat per unit of mass. The most common ones are soap stone, olivine stone or water[10]. In the case of soap stone or olivine stone you need at least 100 kg or more to get a good effect and good heat storage. Both stones are quite heavy, soap stone has a density of 2.9 kg / dm^3 and the slightly more expensive olivine stone has a density of 3.3 kg / dm^3 [11].

In the case of water (which has a density of only 1 kg / dm^3) you may need to connect the stove to a water radiator system to get a good efficiency[12]. With a system like this you will not only get hot water from a tap, you can also spred the heat in your whole house through your radiators. The drawback is of course, as so often, price and cost of installation. Soap stone and olivine stone are expensive to buy and to install a water radiation system in your house is an heavy investment.

A soap stone stove, for a good heat spread the producers recommend 100 kgs of soap stone or more

Technology research - Material research

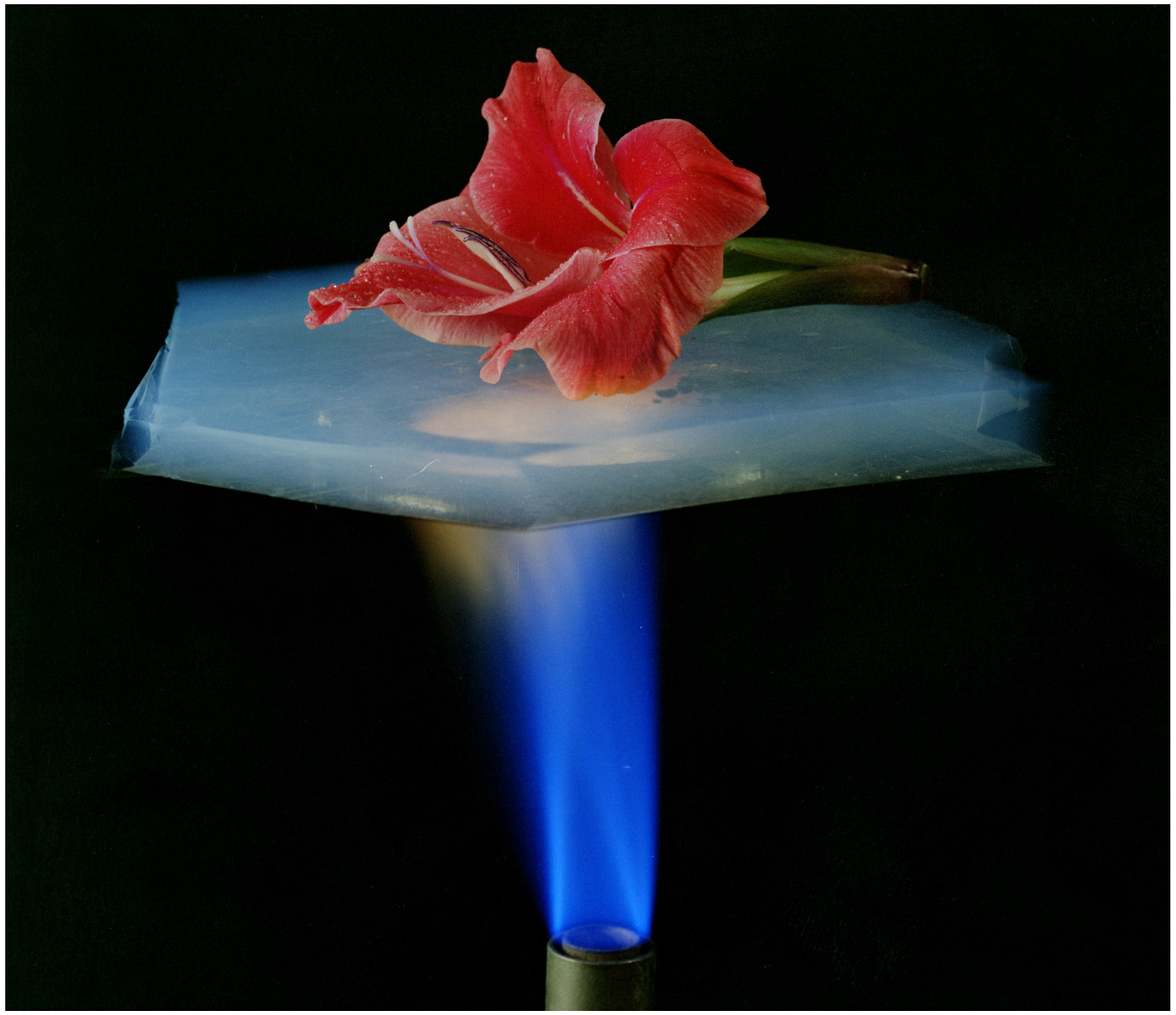
As another part of my research I looked into different materials, again both new and old, to see if any of them gave me inspiration for a new fire related product.

One of the interesting materials I found was a fire resistant cloth made from already burned wool fibres. This material, called Varmex, is a interesting green (and Swedish) alternative to fire resistant cloths that normally contain very aggressive chemicals[13].

Another Swedish invention that caught my interest was AirGlass (also known as AeroGel). An almost transparent quartz material that insulates better than rock wool[14]. It could be used for super insulating windows in a house or a stove. Unfortunately it is still very fragile and cannot yet be made completely transparent (see picture).

Two more commonly used materials with good heat resistance and insulating properties are cork[15] and silicone[16]. Both can sustain temperatures of more than 200°C and are quite lightweight. Cork is perhaps even more interesting since it is a 100% natural and recyclable material. Silicone on the other hand is a manmade polymer and harder to recycle.

None of these materials gave me an instant inspiration for the product to come, but it felt good to have this knowledge with me as I continued the project.



Airglass holds two Guinness world records for best insulator in the world and worlds lightest solid material

Technology research - Ceramics

Facts from interview with Ola Lyckfeldt, Swedish Ceramic Institute - over telephone March 2009

Another material group with good thermal properties are ceramics. To learn more about ceramic materials in combination with fire I contacted The Swedish Ceramic Institute and interviewed Ola Lyckfeldt. He explained the difference between different kinds of ceramics and porcelains and what factors that influence their ability to withstand heat and fire.

Almost all ceramics are very good at withstanding high temperatures, most ceramics are burned at around 1000 degrees Celsius. However, the problem is not what maximum temperature the material can withstand, it is the temperature gradient within the material and the fast changes in temperature that will make it break. If you for example put a ceramic cup in an oven and heat it slowly and evenly, it is often no problem. If you on the other hand heat up a part of the cup with a flame and maybe even cool it down rapidly most ceramic products will break.

To avoid this, another component, chamotte, is added to the clay mix that make up the ceramic material. These are crushed pieces of already burned ceramics, they will not shrink as much as the rest of the clay when burned, thus making the final product more heat proof. The chamotte should preferably be made from the same kind of clay as the rest of the product.

While porcelain and ceramics without chamotte can be cast and produced in a number of ways, the chamotte clay is quite thick and harder to use in mass production.

Oven for melting glass built with fire proof bricks with a high percentage of chamotte

Sustainability - Bio ethanol as fuel

facts from interview with Jan-Erik Andersson, head of sales at Agroetanol AB and Birgitta Kjellin at Kemetyl AB - over telephone February 2009

I limited my research to Sweden since I would like to see if it was possible to produce everything that I needed for my product locally. A quick internet search of the Swedish market unfortunately didn't give that many hits, today there is only one large producer of bio-alcohol in Sweden that offers it in smaller quantities to end consumers, Kemetyl. Their product, Karneval, is aimed at ethanol stoves and is produced by fermenting cellulosic materials (mainly spruce) in Norway. This seems to be a quite good product but is still very expensive (ca. € 5 / l). The price may be a result of the weak competition, but also the small Swedish market today. Karneval is ecological as far as Kemetyl tells me but I think it needs an independent ecological control to be trustworthy for the customer.

The only other ethanol producers for the fuel-market are Sekab and Agroetanol. They are both exclusively aiming for the vehicle-fuel market and have no plans of getting into the small-scale home market today. But Jan-Erik Andersson at Agroetanol says that they are not excluding a development towards end consumers in the future. Agroetanol make ethanol from grain with a new technology, that from 2,7 kg of grain gives one liter of ethanol and 0,85 kg of animal forage. I think this kind of parallel production is interesting and could be one of the future ways of producing ethanol fuel in Sweden.

Wood pellets like these can be fermented to produce bio ethanol

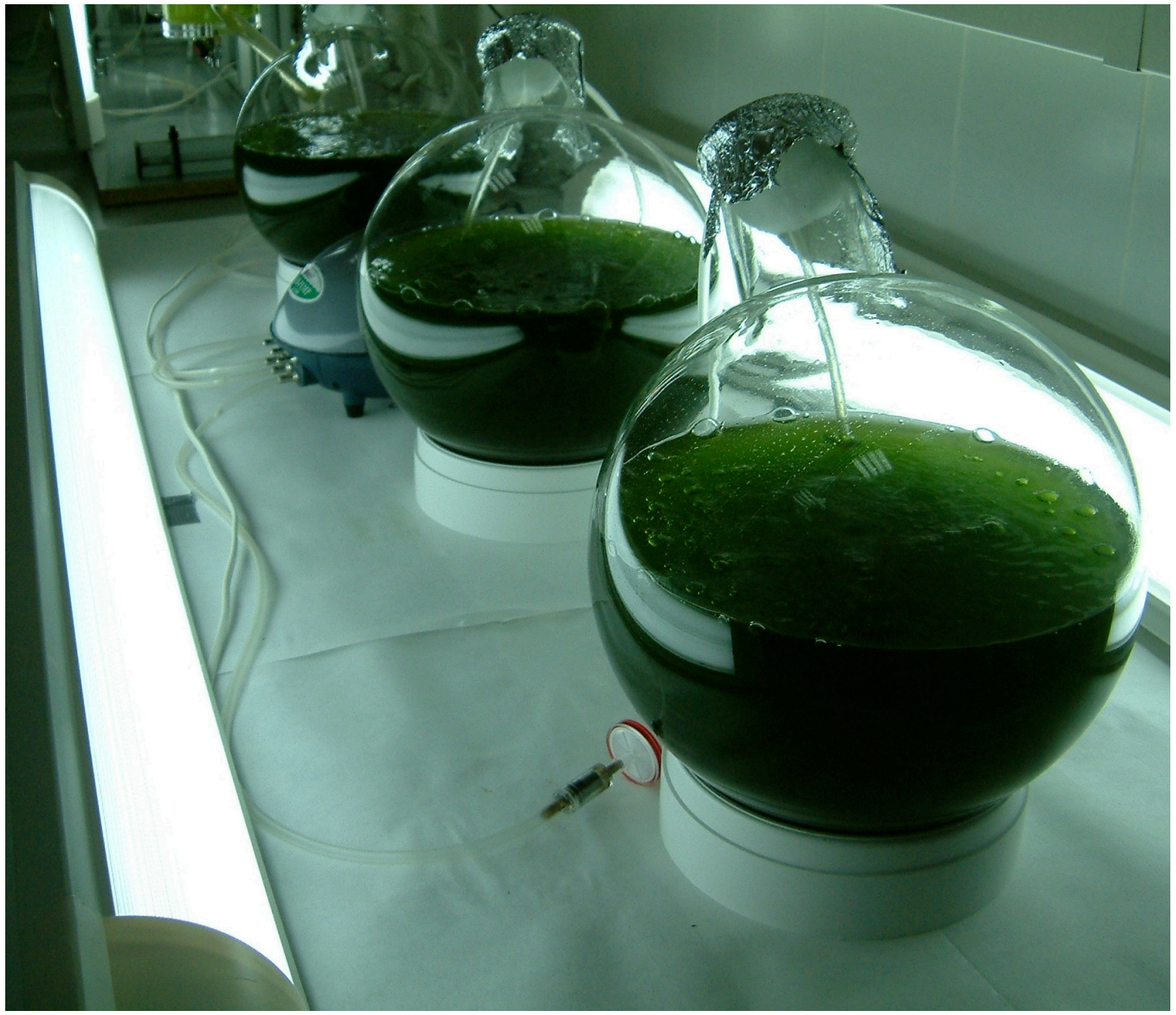
Sustainability - Second generation bio fuel

facts from interview with Mathias Gustavsson, energy expert at The Swedish Society for Nature Conservation - February 2009

To learn more about bio fuels from someone unaffiliated I also contacted Mathias Gustavsson who is one of the energy experts at 'Svenska Naturskyddsföreningen' the Swedish Society for Nature Conservation. He supported me in the search for something produced as local as possible. He also stressed the need to look at the production chain as a whole. This means that one has to see how much fossil fuel is used to get one liter of bio ethanol. This ratio is what makes locally produced ethanol from forest or grain superior to for example corn based ethanol from the US. It would also be preferred to use a non-edible source for the ethanol production, so rather forest than wheat, something that supports the product from Kemetyl.

The ethanol that is around today is already better than oil, but if we find effective ways to produce ethanol from waste material and not from for example crops it would be even better. If we could grow corn and eat the corn but instead use the leaves and stem for ethanol production we would come much closer to a sustainable society. Fuels produced in this way are known as second generation bio-fuels and the research within this area is massive. There is unfortunately no final large scale production yet, but the research on for example enzymes who can make ethanol directly from long carbon hydrate cellulosic chains might be just around the corner. There is no final answer to what production method is the best, it is all dependent on where you are and what can be grown.

After this research I found Kemetyl Karneval to be the best alternative available for Swedish consumers today and I chose to use it as the fuel for my product.



Lab test of second generation bio fuel production by using oil from algae

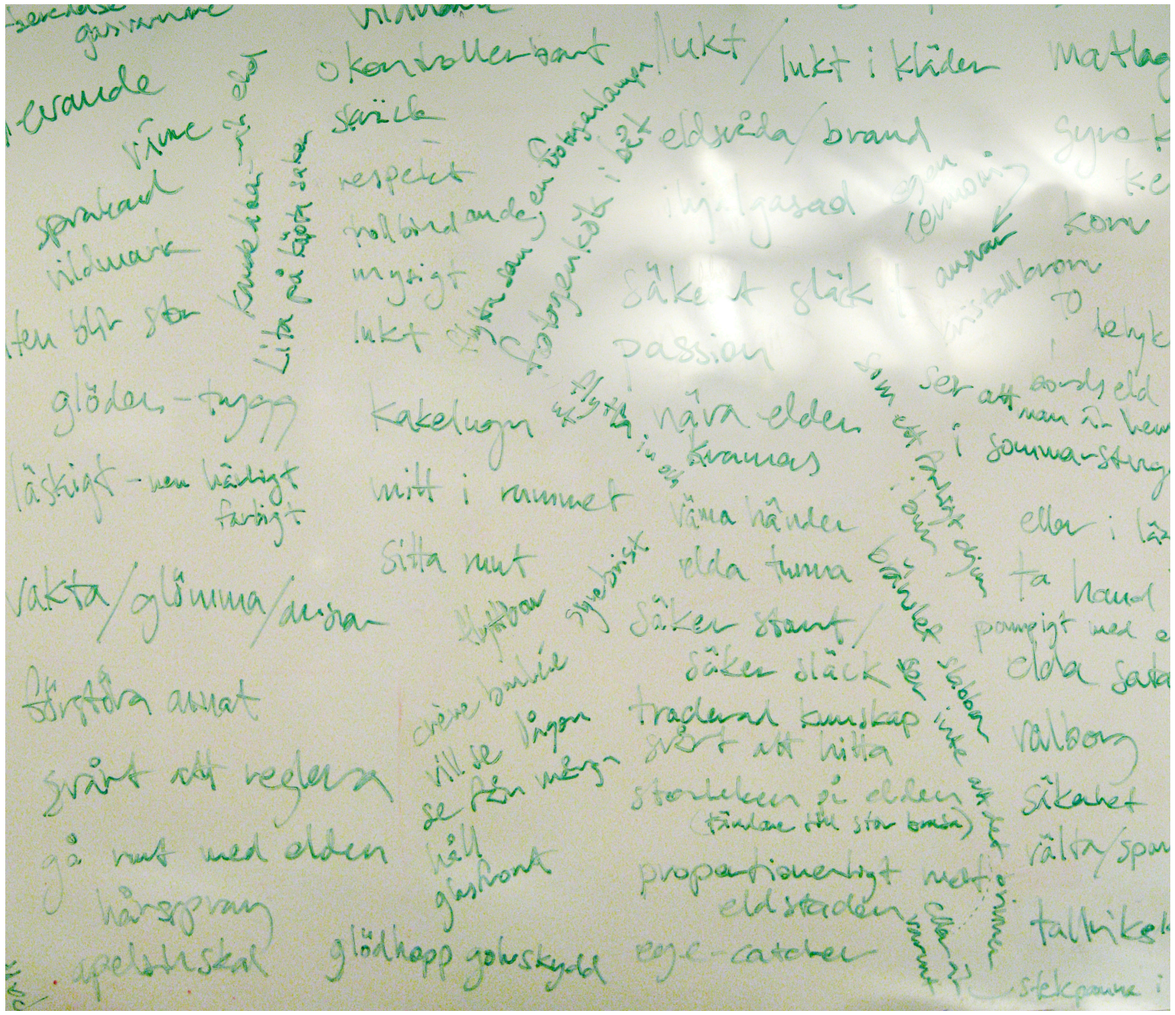
Group interview / brainstorm session

When my head was full of technologies and material properties I felt that I needed some more human/emotional input on my core subject, fire. I asked my fellow students to sit down with me and together we tried to write down our collected feelings for fire and exemplify situations in our life when fire have played a significant role - positive or negative.

Some of the comments and thoughts came up again and again, and the group agreed that some were especially important. Here is a list with a few of them:

Knowledge - Little knowledge of fires and how to tend them
Security - Today a lot of people are afraid of fire
View - Want to see the fire as much as possible
Tiled stoves - Many seem to like tiled stoves
Put it out - Want to be sure the fire is not burning anymore
Mobile - Many felt the mobility of a kerosene lamp was good
Eye-catcher - A fire is, and should be, an eye-catcher
Control - You should always feel, and have, control over the fire
Alive - A fire is almost like an organism, for good and for bad
Relaxation - A fire is still a mesmerising thing

These words and many others I took with me to the function analysis and the first ideation phase.



Notes from the group interview / brainstorm

The social fire - an experiment

To try the effect of a fire in a modern social context I decided to do a small test. After a dinner with some friends I lit an old ethanol heater and placed it on the floor. After only a couple of minutes everyone in the room had gathered around the fire and saw it as the natural centre.

Another effect this fire had was that it was suddenly socially accepted to sit a bunch of people in a room without constant conversation. To have the fire as a common focus point often seems to be enough.

This was very encouraging to me, many of my friends are not particular outdoor people with long experience of fire but apparently they still enjoyed and appreciated a fire.

My friends around the fire

First Conclusion

After the initial research I made the decision to develop a chimneyless stove. The reason for this is that an ethanol burner gives a lot of freedom and ease of use for the consumer. The ability to turn it on and off at any time in combination with almost no exhausts makes it a winning alternative for a clean modern home. The fact that ethanol fuel is more accessible than fire wood in most cities also contributed to my choice of technology. It is also easy to use and may attract consumers who normally wouldn't feel comfortable around fire. An ethanol stove could then be a stepping stone to becoming more familiar with this element.

During this stage I was determined to construct the optimum fire product with smart, refined technical solutions. These should make the product fit a variety of situations, cooking and viewing, indoors and outdoors, etc.

This led to a quite comprehensive function analysis.

Analysis and ideation 1

This phase was colored by the rather technologically-centered research I had made. I wanted to see if I could incorporate any of the technologies and materials I found during the research and if they could strengthen my concepts. The construction of the burner and how it could be made safer took up a lot of my time.

Function analysis no. 1

MF Main Function
NF Necessary Function
DF Desirable Function

USE/BASIC FUNCTIONS
MF Offer the possbility to have a mobile fire without a chimney indoors

NF Be easy to light
NF Possibility to control the size of the flame
DF Be safe for children
DF Be ergonomic to use
DF Cook simpler meals
DF Be able to create an airflow for more efficient heating and heat evenly
DF Warm up smaller rooms
DF Be easy to dissassemble and clean
DF Offer self explanatory use

FEEL
NF Give the feeling of safety in all steps of use and handling
NF Give a feeling of our Scandinavian fire heritage
NF If equipped with air moving device - minimize the sound
NF Be comfortable to carry
DF Easily exchangeable parts for customizing
DF Offer materials that age beautifully
DF Give a feeling of a private product (not a company foyer feel)
DF Give a furniture feel

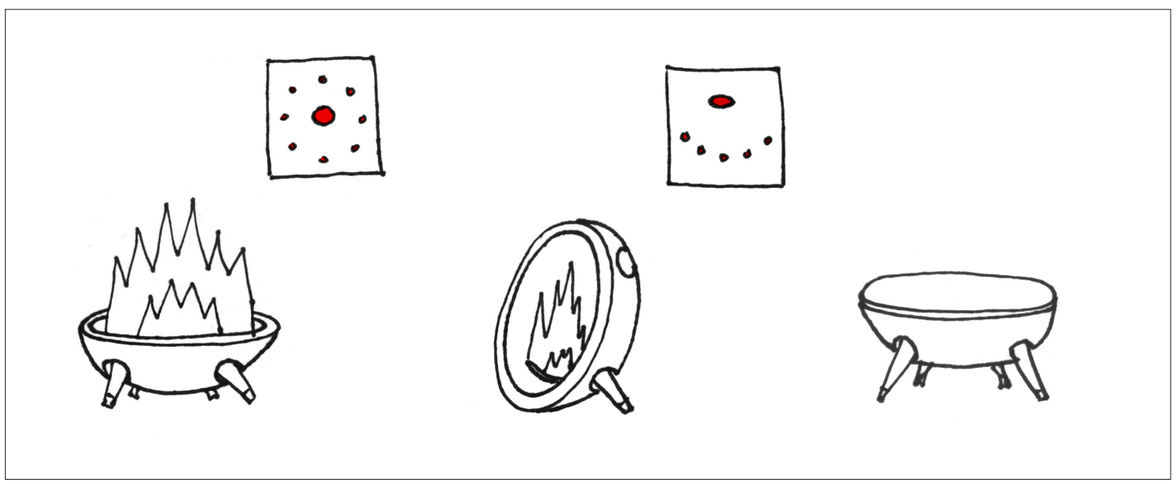
SAFETY
NF Be safe to use indoors
NF Have relative cool outer surfaces
NF Be stable in all positions
NF Have a reasonable safety zone for heat (less than 1 m)
NF Good fuel handling
NF Be safe to use outdoors
NF Have a safe fuel refill solution
NF Have a safe and good sized fuel canister
NF Give large and/or flexible viewing angles to the fire
DF Show when the fuel canister is full/empty
DF Be safe for children

MOBILITY
NF Be gentle to sensitive floors
NF Ability to stand on soft ground
NF Ability to stand on rough ground
NF Possible wind protection
NF Be flexible to install in a variety of homes/situations
NF The possibility to transport in a car
NF Be easy to carry
NF Have a low enough weight for transport yet offer a stable solution
NF Weigh maximum 10 kgs
DF Offer the possibility to stand on the floor/ground
DF Offer the possibility to be suspended
DF Offer the possibility to be mounted on a stand
DF Offer the possibility to be mounted on a wall
DF Offer warm keeping of food e.g. in the garden
DF Offer several flame modes for different positions/situations

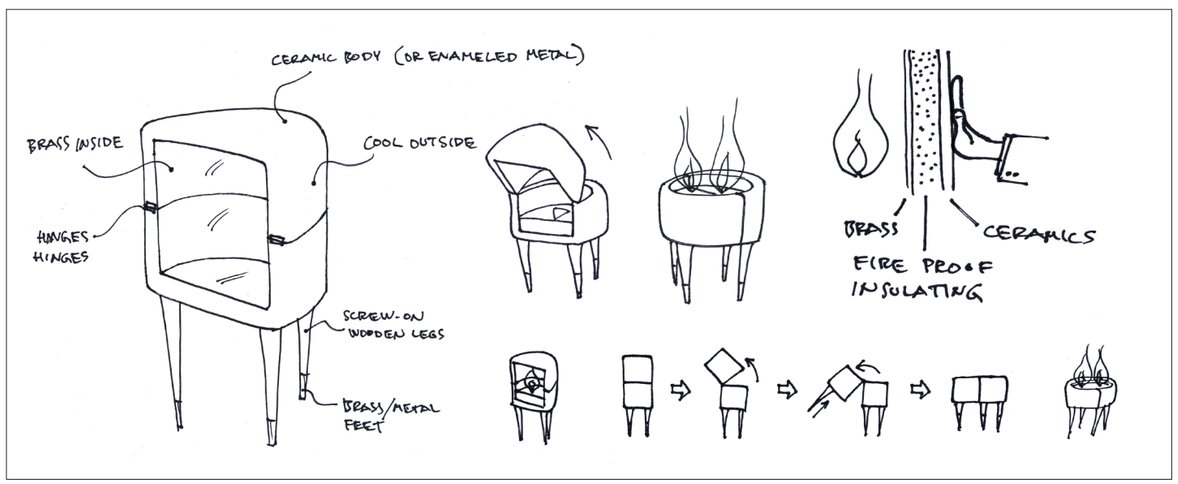
MARKETING
NF Maximize the look of the flame
NF Minimizing the fuel consumption
NF Push the sale and development of 2nd generation bio-fuels (ethanol)
NF Stress the fact that all energy stays indoors
NF Be flexible to install in a variety of homes/situations

PRODUCTION
DF Minimize production/material costs
DF Have as many fireproof materials as possible
DF Have as much ecofriendly materials as possible
DF Have as much of the production as possible in Sweden/Scandinavia

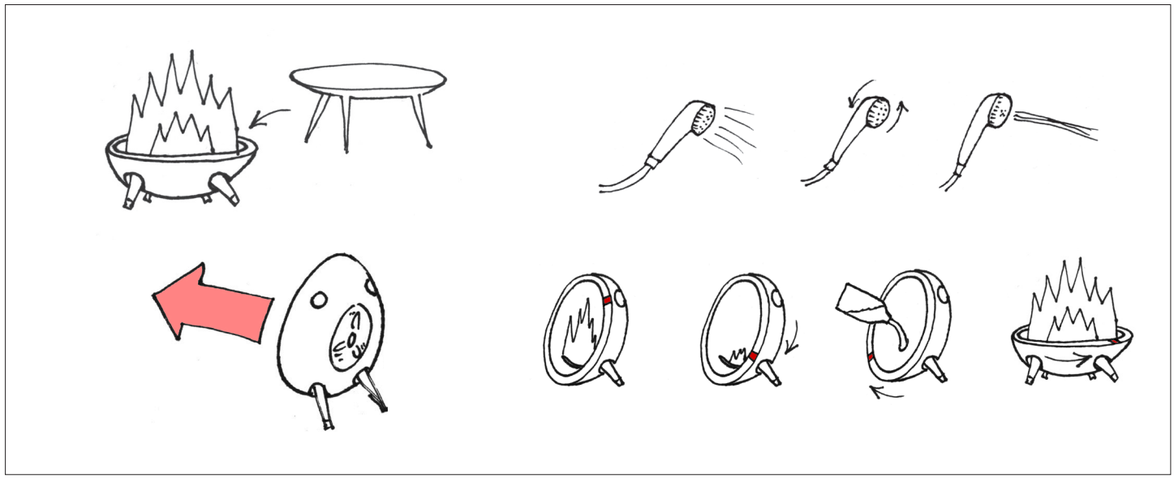
Stove concepts related to Function Analysis no. 1

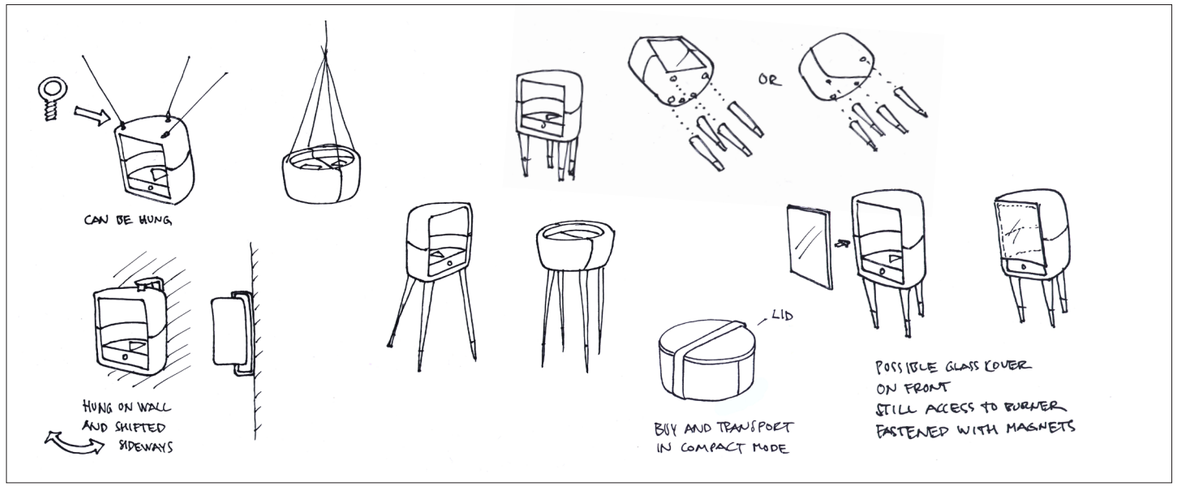


One of the first concepts. A fire that can be flipped 90 degrees to alter the viewing angle and functionality



Another concept that can be installed in many ways and use insulation to make the outside cooler

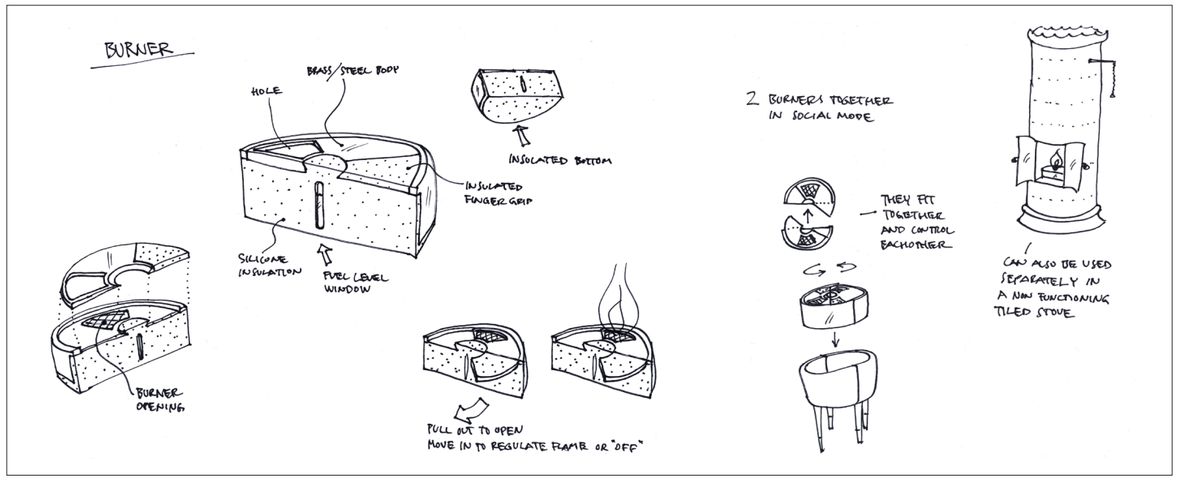




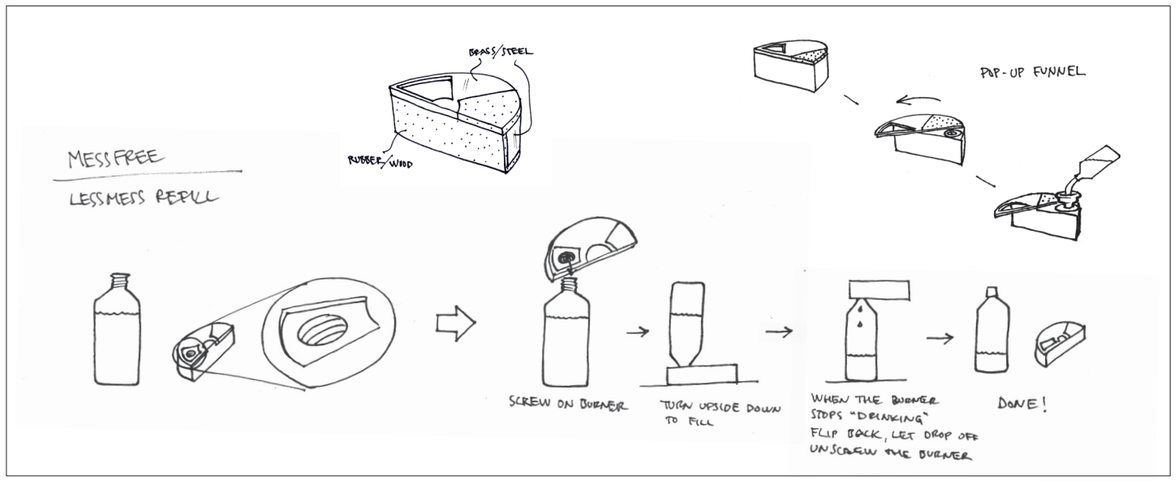
One of the first concepts was based on the idea of flipping the stove. By turning the stove 90 degrees you could alter the viewing angle. In the horizontal mode you could sit around it and in the vertical mode you concentrate the look of the fire towards a certain area. In the horizontal position I also saw the possibility to cook simpler meals with the wok-accessory. With a lid it could also work as a side board when not lit. A built in fan spreads the hot air in the room. This fan could be driven with a stirling engine. One idea was also to regulate the size and look of the flame by turning the inner part of the stove, just like a shower nozzle with different modes.

Another concept was based on the idea of making the stove installable in as many ways as possible. The legs could be unscrewed and replaced by rings for hanging or mounting on a wall. This was also the concept where I introduced ceramics as the body material and the use of rock wool insulation to make the outside of the stove cooler. To reach a similar effect as the first concept I split this stove in two halves joint by a hinge so it could be viewable at both 360 and 180 degrees.

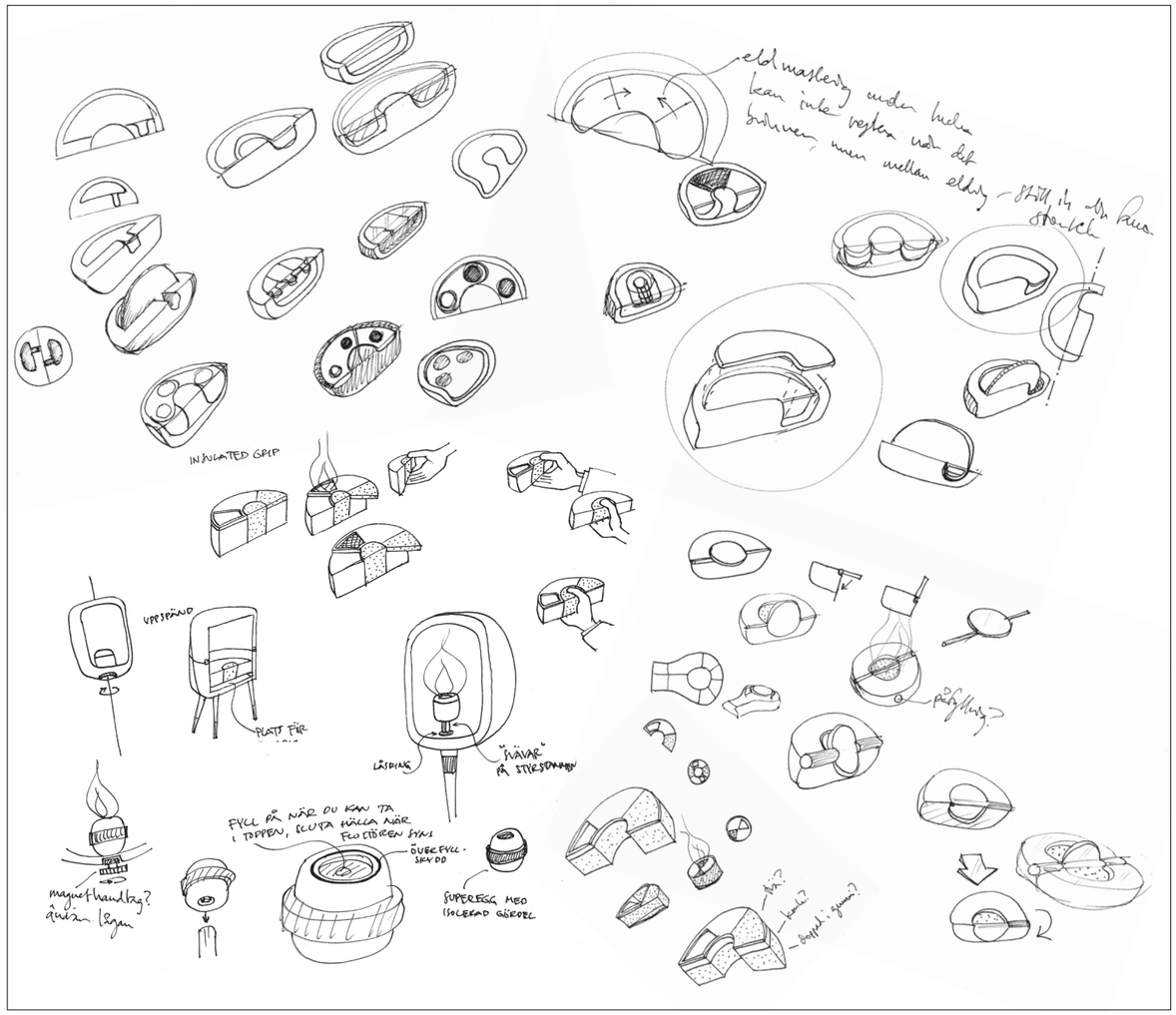
Burner concepts related to Function Analysis no. 1



Burner concept for the stove that can flip over. Two burners can be combined for a larger fire when used in the 360 degree viewing mode.

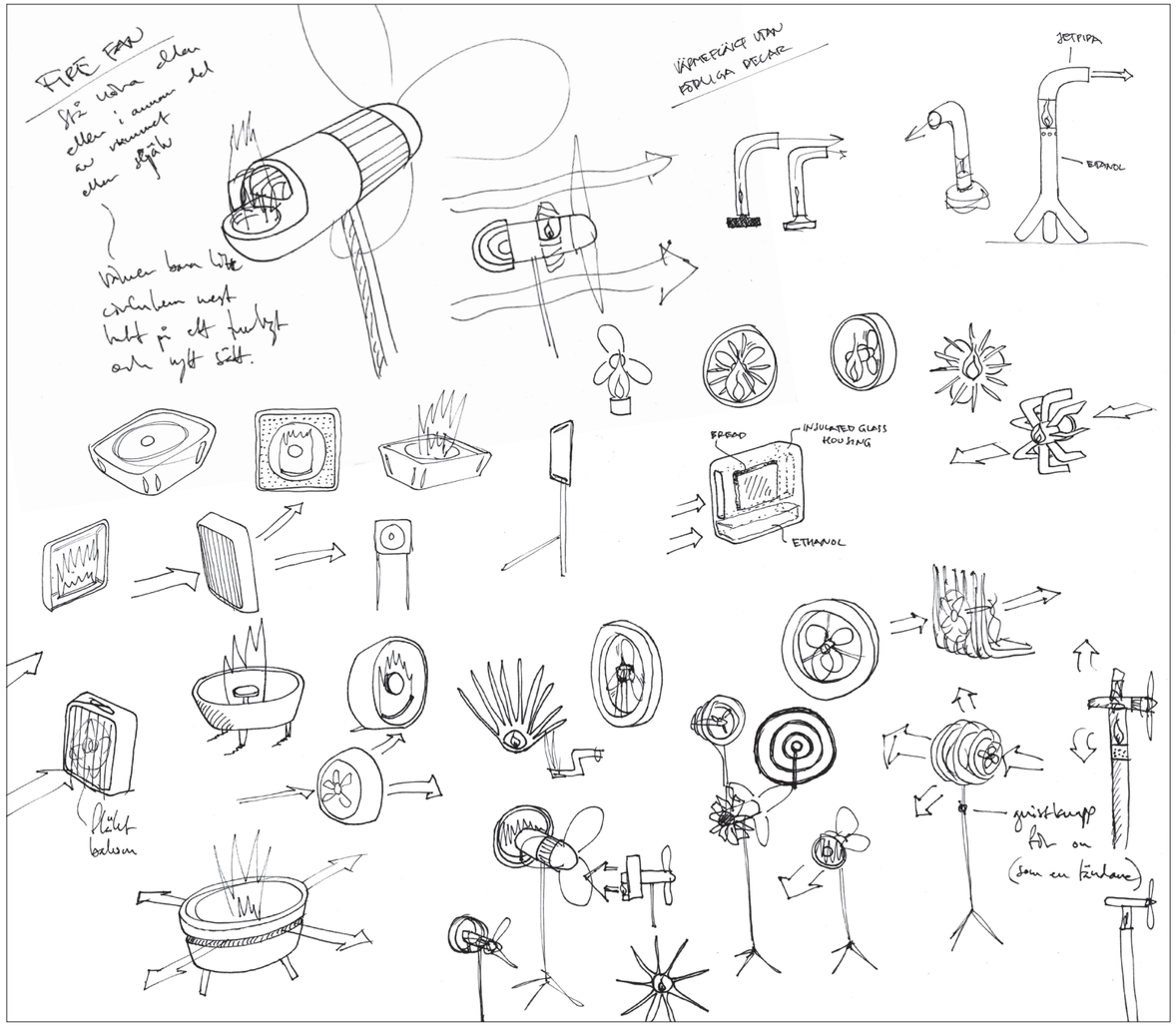


A substantial amount of my time during this phase was spent on looking at different burner solutions and how they could be made safer or even fool proof. How could you regulate the flame without burning your fingers? How should you refill the burner without any risk of the fuel bottle catching fire? Could you combine several burners to get a larger flame in certain modes? Should there be alternative use of the burners when not placed inside the stove?



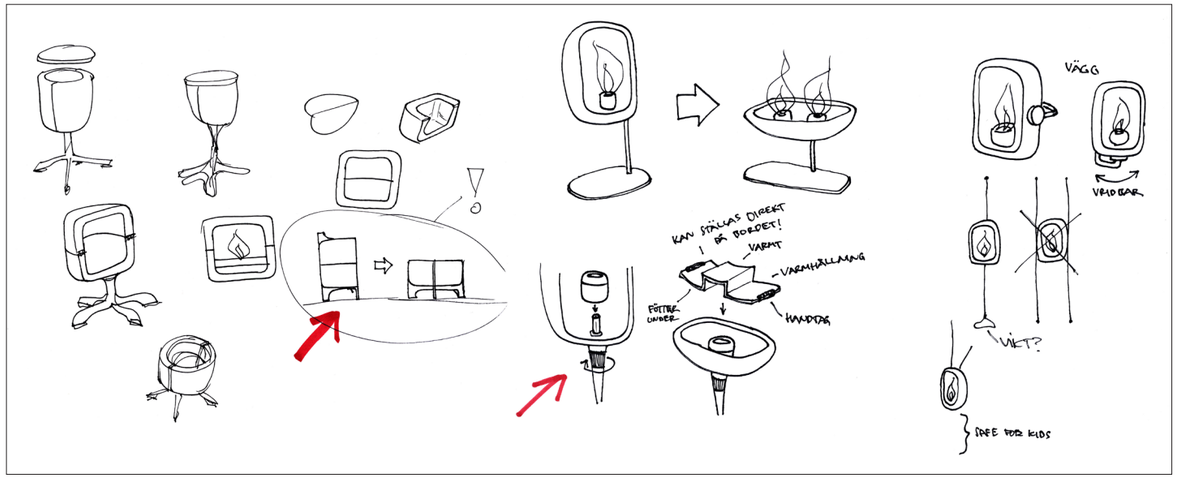
The problem how to regulate the flame when the burner is placed inside the stove turned out to be a really hard nut to crack. The solutions I came up with made my stove very technical looking with way too many different parts.

Other concepts related to Function Analysis no. 1

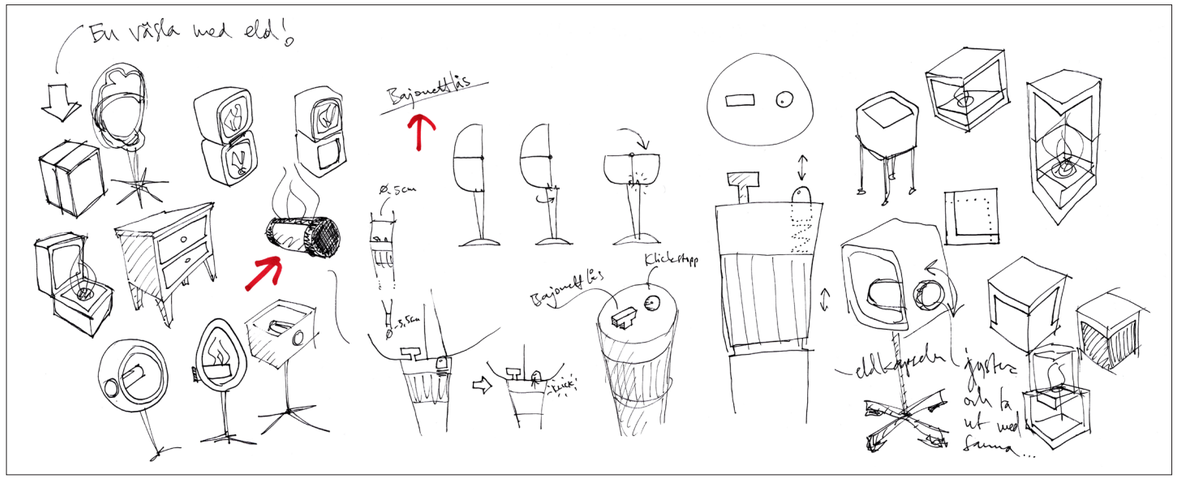


Different heating fans

Another idea was to make a more articulated heating fan as a complimentary piece in a product family or as a separate product. The technology behind it would be a stirling engine or a peltier element. The amount of fire it would take to heat up the air quick enough was not really possible to combine with a small attractive package.



Some more sketches on the main concept and different types of stands



Second Conclusion

After analyzing the concepts I had made so far and discussing them with my classmates I came to the conclusion that I tried to accomplish too much in each product. The ability to move and spread hot air in an effective way is for example not that important to the consumer since this product would not be the main heat source. I had made a major mistake and forced solutions on problems that didn't need solving.

The longer I worked with this project I got the feeling that the most important things a fire can give the modern man is not related to heat or any fancy technical solutions. As I stated in the brief we don't need fire to survive anymore, we have loads of technical solutions for this and hardly want another one on top of that.

The conclusion was that this project is really about emotional relaxation and a sort of connection to the past and nature through the fire. We mustn't forget that Sweden was a completely fire supported nation only six generations ago. I decided to look closer at our 'fire heritage' and the products, shapes and materials related to that.

Regarding the safety aspect I decided that it should not be fool proof nor totally safe. Fire is never totally safe and to offer a 'fool proof' solution might even make the customer negligible and uncautious. I therefore decided to make the burner and fuel handling as basic and open as possible. This would hopefully help the customer to understand the nature of fire and eventually grow more accustomed to it.

It was also time to make some changes in my function analysis.

Analysis and ideation 2

It was a hard insight to understand that much of what I had done had been aiming towards the wrong goal. But in this next phase I felt revived and inspired again when I set off in this new, more emotionally oriented direction.

Function analysis no. 2

MF Main Function
NF Necessary Function
DF Desirable Function

USE/BASIC FUNCTIONS
MF Offer the possibility to have a movable fire without a chimney indoors

NF Be easy to light
DF Be ergonomic to use
DF Warm up smaller rooms
DF Offer self explanatory use

FEEL
NF Give a feeling of our Scandinavian fire heritage
NF Maximize the impression of the fire
NF Basic controls so that the user becomes accustomed to be close to fire
DF Offer materials that age beautifully
DF Give a feeling of a private product (not company foyer feel)
DF Give a furniture feel

SAFETY
NF Be safe to use indoors
NF Have relatively cool outer surfaces
NF Be stable
NF Be able to place near other pieces of furniture
NF Clear fuel handling
NF Have a safe and long lasting fuel canister
DF Give large viewing angles to the fire

MOBILITY
NF Offer the possibility to stand on the floor/ground
NF Be gentle to sensitive floors
NF Be flexible to put in a variety of homes/situations
DF The possibility to transport in a car

MARKETING
NF Maximize the look of the flame
NF Minimizing the fuel consumption
NF Stress the fact that all energy stays indoors
NF Be flexible to install in a variety of homes/situations

PRODUCTION
DF Have as many fireproof materials as possible
DF Have as much ecofriendly materials as possible
DF Have as much of the production as possible in Sweden/Scandinavia
DF As much as possible of the materials should come from Sweden/Scandinavia

Heritage

From the top left: A hammered brass kettle, a Swedish tiled stove from the 18th century and a classic tripod pot to be put directly into the fire

After this semi-restart in the project I felt that it was more important than ever to look back more in detail and see what references I could find in old fire related products. The hammered kettle spreading the reflection of any light in all directions and having a clearly insulated handle was one nice example. It is easy to read what is hot and what can be touched in this product. The three legged pot is an icon, you can almost see the fire beneath its stable body posture. The tiled stove that stands in the corner must have been a great comfort when you lived in badly insulated houses. The ceramic tiles get hot but never red-hot like a iron stove.

Brass reflector on a 18th century candle holder and my own simple test of the efficiancy of a reflector

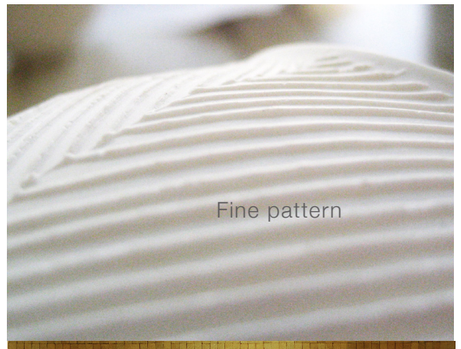
The brass reflectors used in candle holders are often very effective and were used for centuries to get directed light from candles. When I did a simple test with a spoon at home I was amazed to see the effect. With this extremely simple technique I could get a stronger visual impact from quite a small flame. Just like in the old days when poor families tried to get the most out of a single candle I could use a reflector to enhance the look of my fire and at the same time minimize the fuel consumption.

Inspirational objects

A centerpice, yet movable

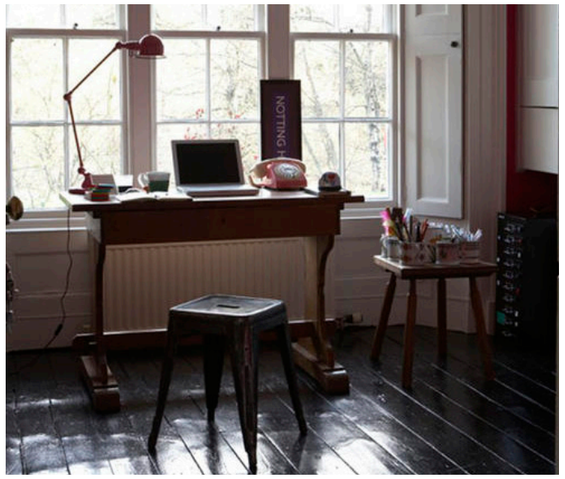
Somewhat unexpected
(it's a speaker)

Presented above are some of the more modern objects I found that stand for some of the new 'softer' values. I wanted this fire product to be similar to an armed chair and that the customer buys it for similar reasons. It's not just something to sit on, it's comfortable and could add another dimension to the room, like a piece of history or as an eye-catching centerpiece. The spherical chair is padded and probably feels very safe to sit in. In the same way, I wanted my object to be a safe haven for the fire. You should feel confident that the fire stays inside the stove.



I found some other objects that inspired me in the choice of colors, materials and finish. I was fascinated by golden reflections and the contrast it gives when placed next to a white matte surface. The presence of wood and/or a fine pattern could also make a cold material like ceramic a bit warmer and human.

Inspirational rooms



Rooms that inspired me

I saw that I also could define my product by looking at in what surroundings it could fit. This helped me a lot in the further development.

What most of these rooms have in common are the casual combination of old and new. It's not just one or the other, it's a balanced mix.

Third Conclusion

The process of looking at referential objects and environments, through the history and up until now, helped me to define my goal more clearly than ever:

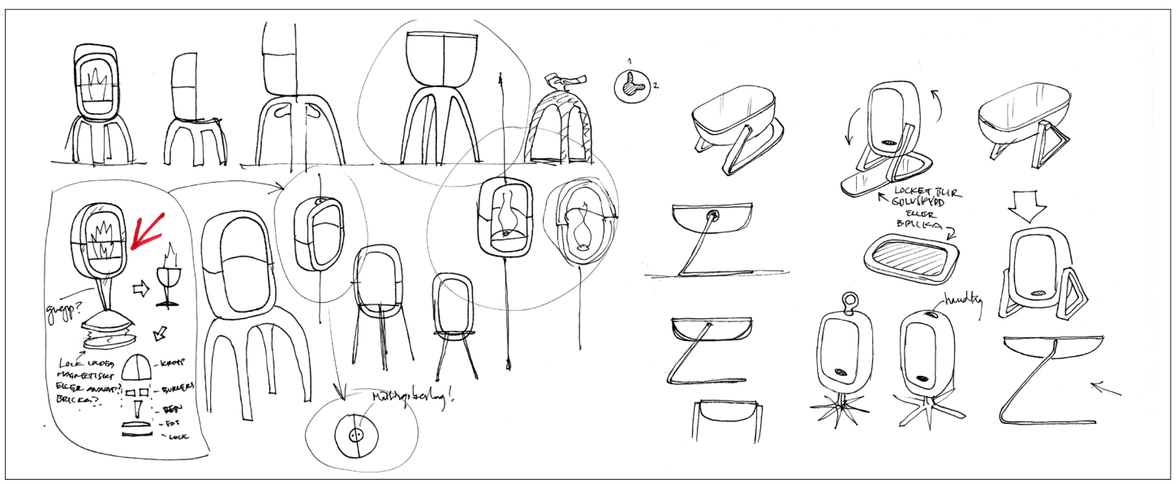
- I still wanted to do an ethanol stove.

- I wanted to use the somewhat forgotten reflector technology. Candles are not used as primary lighting today and therefore not in need of reflectors. Stoves have up until now only been fired with wood or fuel that gives a lot of soot, hence they are not suitable for shiny brass reflectors. But with ethanol this can suddenly be a both efficient and ambiance enhancing combination.

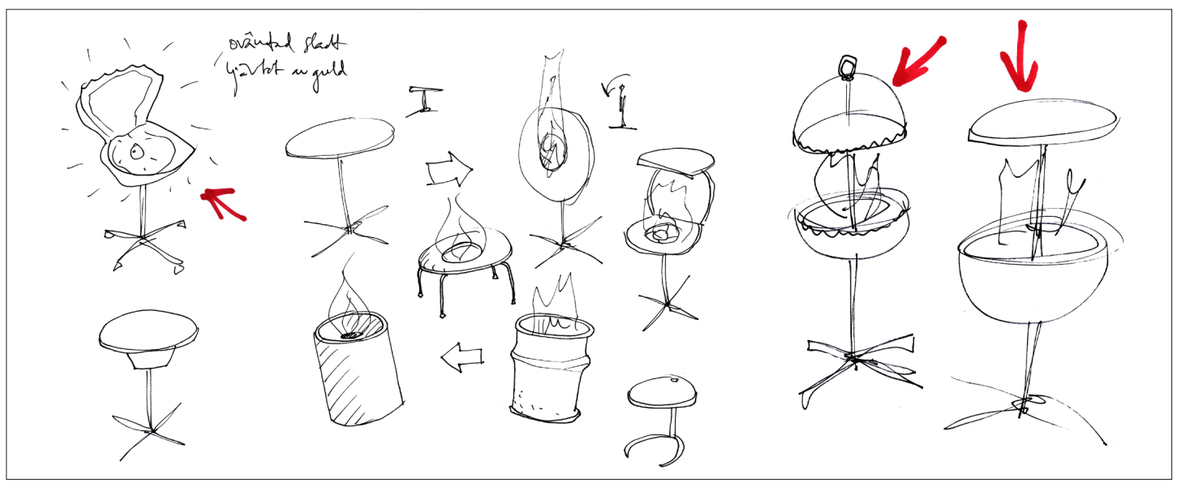
- The tiled stove with its warm ceramic was a perfect reference for me. You know that it can't catch fire and it is usually not as aggressively hot as an cast iron stove can be. The comforting warmth from a ceramic teapot is another reference with the same feeling. The tiled stove feeling is something I wanted to transfer to the usually quite hard ethanol stoves without being a straight form copy à la retro styling.

- The result should be something personal and human to put in your home and not a fancy show off piece to place in a company foyer. In a home it could still be a centerpiece. Here I thought the armed chair reference worked quite well, it may be quite expensive and eye catching but still a piece of furniture that could fit in a home and not just in a public space.

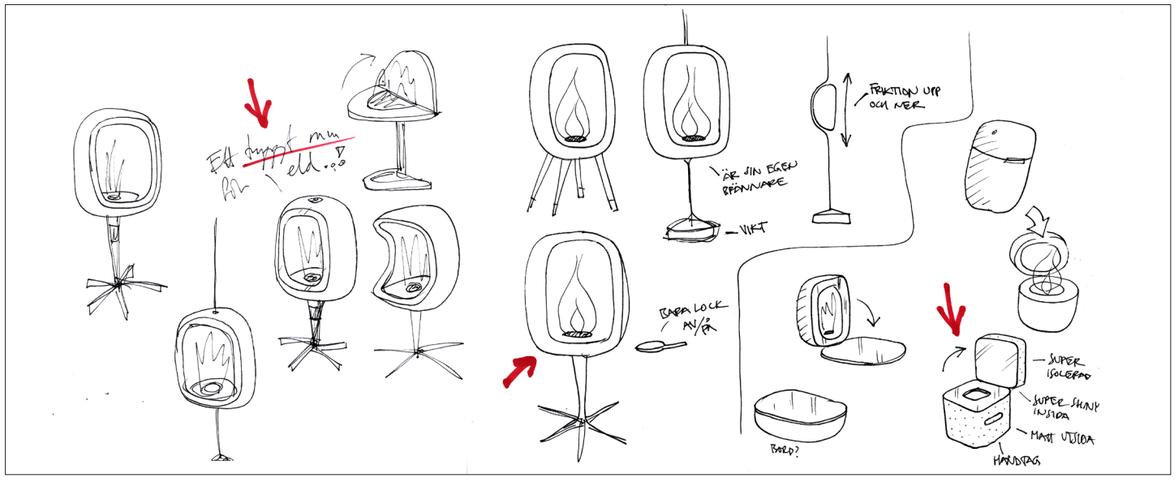
Concepts related to Function Analysis no. 2



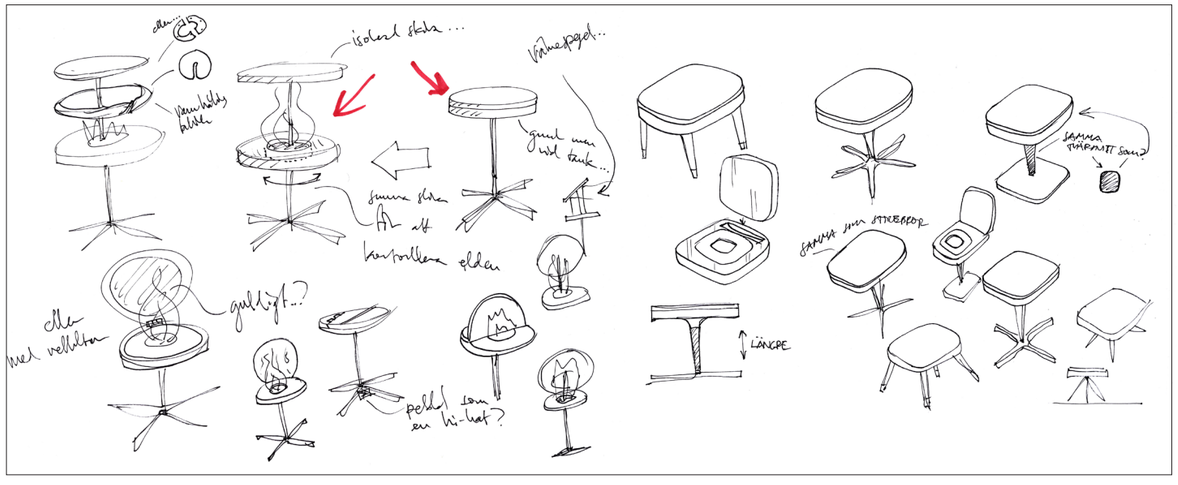
Some of the first sketches on a less technically oriented concept



The initial side board table concept

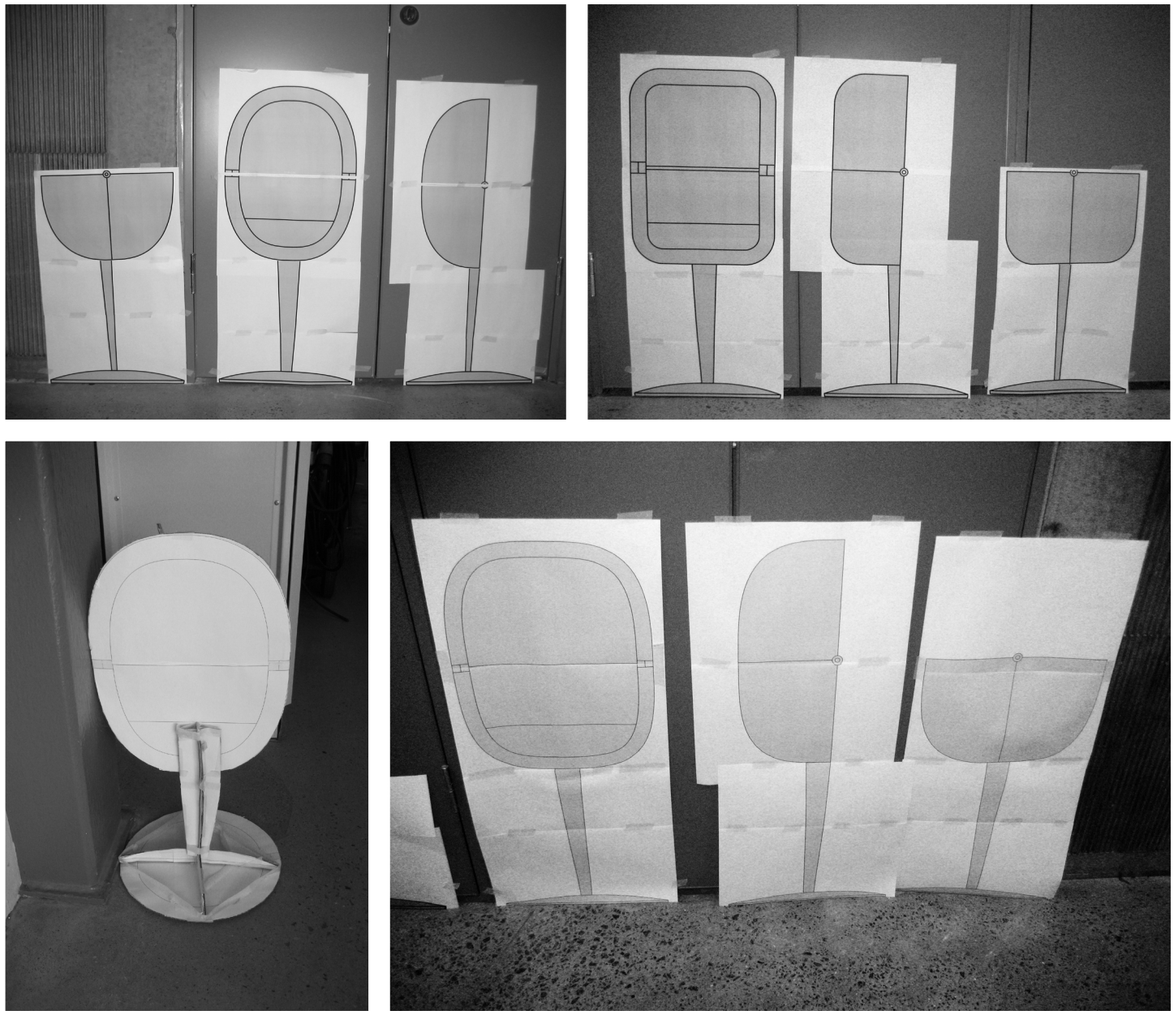


Eventually I dropped the flip-over function and decided to go for something simpler but more pure-looking. This was something for people who would like to have a fire quite often, but who does not have or could not install a chimney or those who want a simple fire with a lot of 'coziness'.



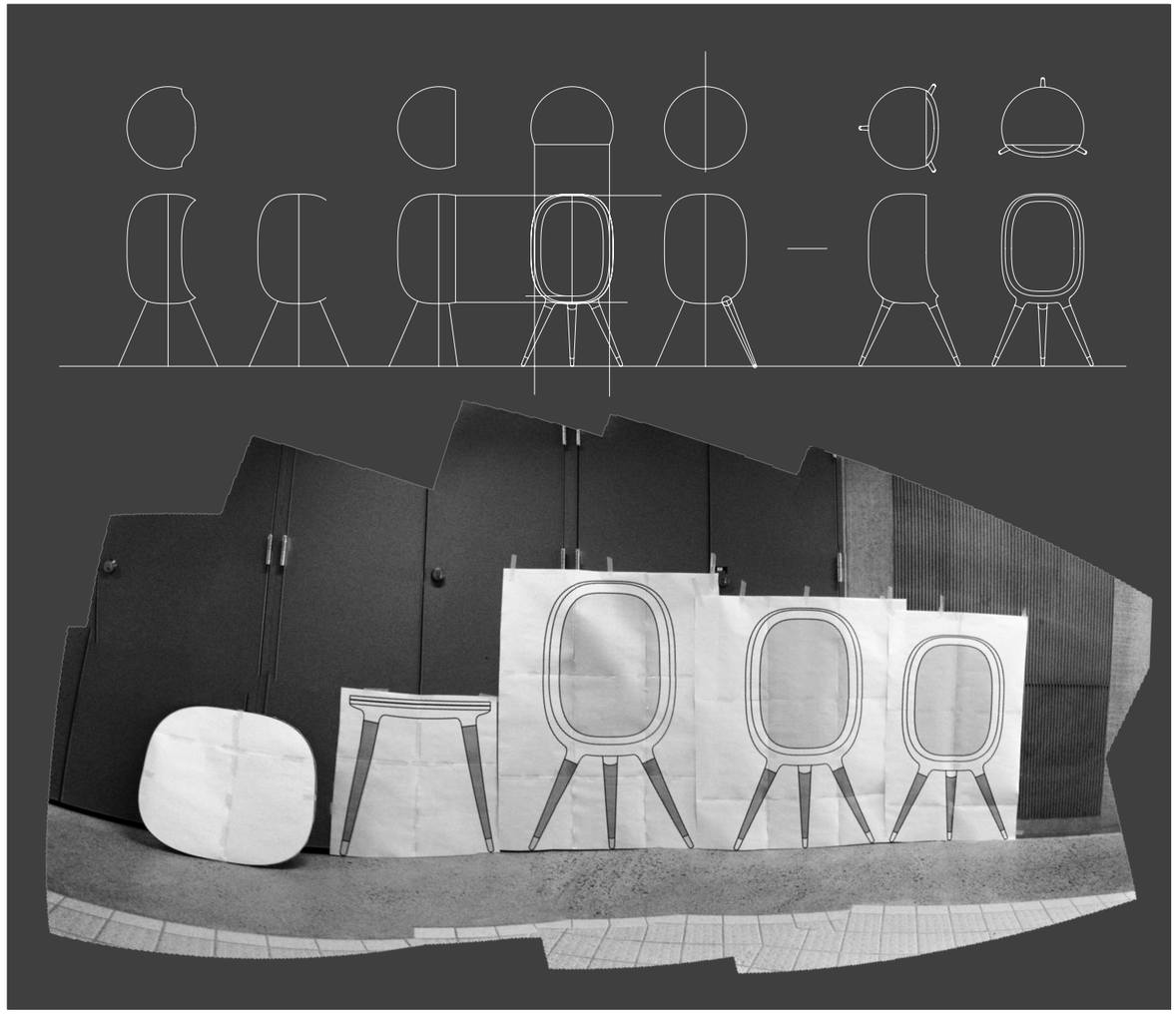
Another idea was a side table concept. The table could transform into a fireplace and it would not take up unnecessary space when not used as a fire. This concept was aimed at people who enjoy a fire but don't want it to take upo much space. By converting it into a side board table it could fit almost anywhere in a home and still blend in with the room.

Concept development



Life size printouts of the earlier flip-over version.

I moved on with making 2D line drawings of the two concepts and tried out different basic shapes that could fit well with a reflector. I wanted to find a shape that could suit a reflector like the one in my spoon test (see page 73) as well as convey the image of the cylindrical body and squarish opening of an tiled stove.



2D drawings and life size printputs of the later version based on the super ellipsis

The result was to be found in the world of mathematics, the super elliptic[17] shape gave, in my opinion, a relaxed merge between a rectangle and an ellipsis and gave a more interesting rotational form (the super ellipsoid) than an ordinary cylinder. The super ellipsis was introduced in furniture design by the Danish architect and designer Piet Hein in the 1960s which gave my project another Scandinavian furniture connection.

Two chosen concepts

Early renderings of the egg-concept

This fire egg was developed to give the ultimate fire experience. It's large, rounded brass reflector would amplify the look of the fire. And like the brass the ceramic enclosure shows the heritage to older fire products, such as tiled stoves. To me it conveyed the essence of a stove with the large fire opening and very little around it to disturb the impression of the fire.

The straight wooden legs gives it a clear furniture reference and shows that it can be moved and placed anywhere you like. Between the ceramics and the reflector is a layer of rock wool insulation to keep the outside cool. The main issue to solve was the stability, would this three legged design be stable enough?

Renderings of the table concept

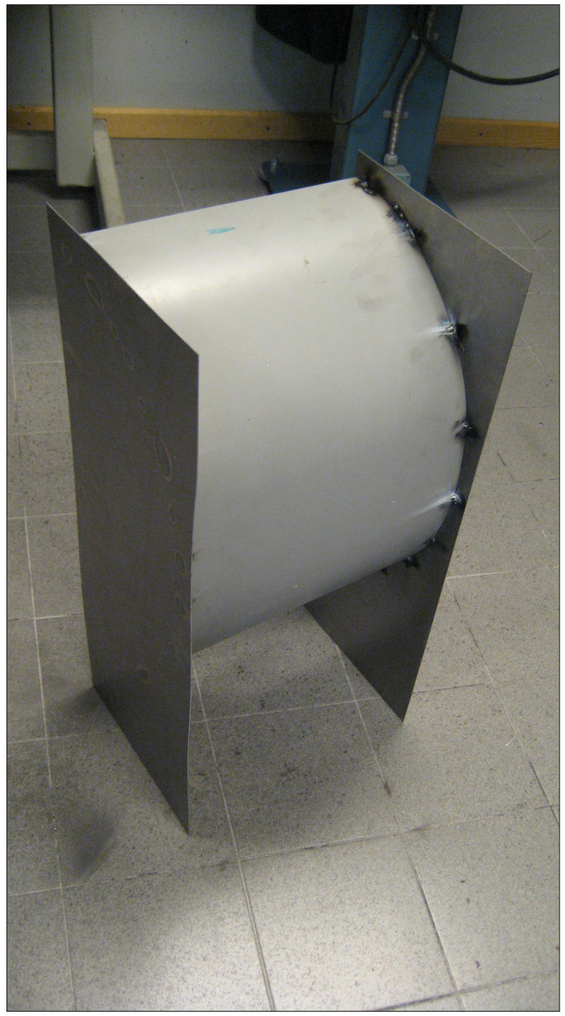
The table was another concept for people with a little bit less space but who still occasionally want a fire. It is a ceramic side table that could easily be transformed into a fireplace. A large brass reflector enhances the fire experience and the whole product would still be quite easy to fold together and move around, more mobile and versatile than the egg.

The problem with this concept was the feeling of safety, or lack of it. People might find it scary to cover a fire and then use it as a normal table, what happens with the fire inside? Is it perhaps too similar to a chair/toilet when open?

Refinement

Of the two concepts, the egg and the table, it was the egg ,with its rounded reflector, that conveyed the spirit of the fire and thus, the project, the most. I could have made a product family but since I wanted to get a functional prototype in the end the time to develop a family wasn't there. In this next phase I chose the egg and went on.

Main shape



I welded a rough prototype for fire test

To try out how a fire would behave in a confined space like this I made a rough prototype that could stand a real fire testing. Happily I found that the fire behaved just like normal in this shape. Maybe the flames twisted a bit more than in a standard stove, but the movement of a fire is something I find very relaxing. The movement could also be beneficial since the source is not a random pile of wood but a fix burner who might give a very steady and dead-looking flame.

I also made a cardboard mock-up to get a feeling of what the final shape would look like.

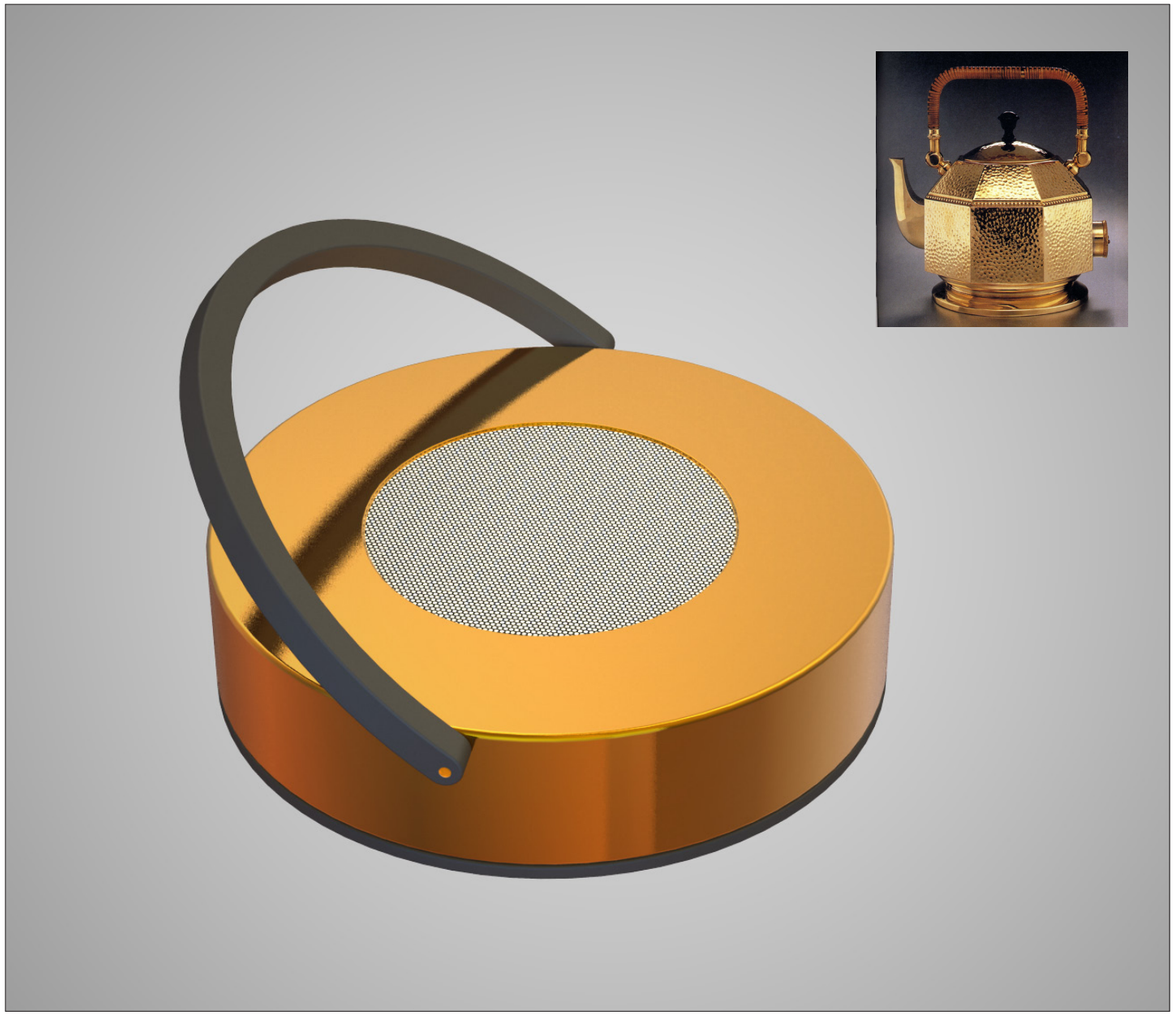
To see the volume of the egg I printed out sections of the CAD-model and cut them in cardboard. This 'skeleton' was very good to have next to me during the continuation of the refinement process.

The burner

facts from interview with Hans-Ola Andersson, Dometic AB
- over telphone march 2009

Photos of the HeatPal burner (supplied by the very generous Hans-Ola Andersson at Dometic) and some of my own early burner tests

Ethanol for chimneyless stoves comes in two kinds, in liquid and in gel form. But whichever you choose you basically pour it in a metal can and light it. The most obvious problem arise if you would tip the can over, spilling the burning fuel on the floor. How could this be avoided? Hans-Olof Andersson, engineer at Dometic, developed the ethanol heater "HeatPal" to be used in trailers and boats. In these often crowded environments with lots of combustible materials around it is crucial to have a safe fuel solution. Hans-Olof and his team developed a burner where the liquid ethanol is absorbed by a rockwool/fibre glass sponge inside the burner. The sponge releases fuel by capillary forces when lit but holds the fuel back when tipped over. This means that the burner can even be turned upside down without spilling any fuel.



One of the burner CAD-versions with the reference image of the brass kettle. You instantly know what part is hot and where to grip it

Since liquid ethanol also is more common than the gels I found this technology to be perfect for me and I decided to apply it to my own concept.

Another danger is if you refill it when it is still hot which may lead to igniting the fuel in the bottle. I looked at many different technical solutions to avoid this but I couldn't come around the fact that metal needs time to cool down and that people generally are quite impatient. The solution was finally as simple as supplying the customer with two burners so that an instant swap to the cold and prefilled burner is possible and the dinner guests never have to sit and wait by an empty unlit stove.

Flame size and burner opening

facts from interview with fire engineer student Joel Lundberg
Lund March 2009

To understand more about how flames, and a burning fire works, I contacted an expert on the subject, fire engineer and risk analysis student Joel Lundberg. He explained different formulas that are used to assess the size and behavior of so called pool fires, a fire based on burning liquid, like a fire in an ethanol burner.

Using these formulas you can anticipate the size and height of a fire over time depending on the area of the burning liquid, but since the formulas were developed with a theoretical circular fire and often for larger fires than mine I also did some testing of my own.

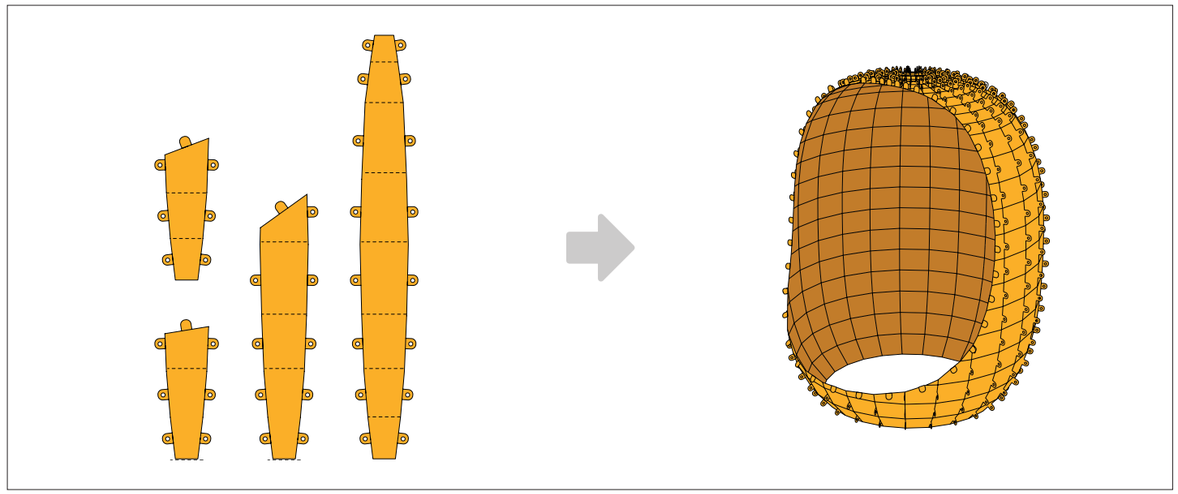
Would multiple holes or a long slimmer hole be something for me? After my tryouts I found that the only shape that produced a resonable high and visible flame was something quite quadratic or circular. This was very good since I then knew I could use the formulas after all.

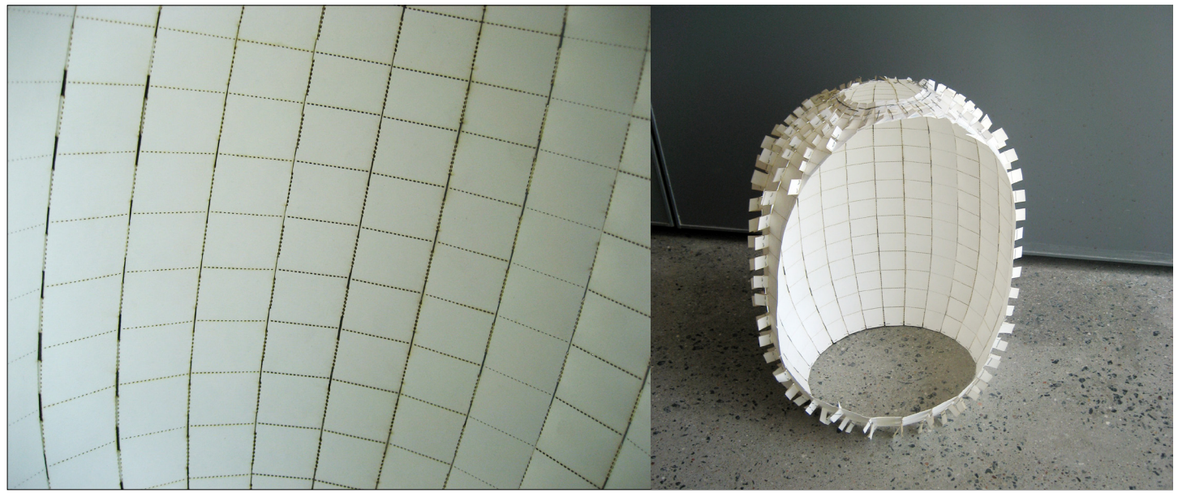
Testing different sizes and shapes of burner opening

The reflector

Reflector mockup in aluminum foil shows the drastic enhancement a reflector gives

First I saw the reflector as being spun to create a smooth and even surface. But after discussions with some craftsmen I found out that the tool for such an operation was very costly (roughly 2000 €) so I had to find an alternative solution. I made a reflector prototype of aluminum foil and during the testing of this I saw how the facets of the aluminum foil actually enhanced the look and feel of the fire.

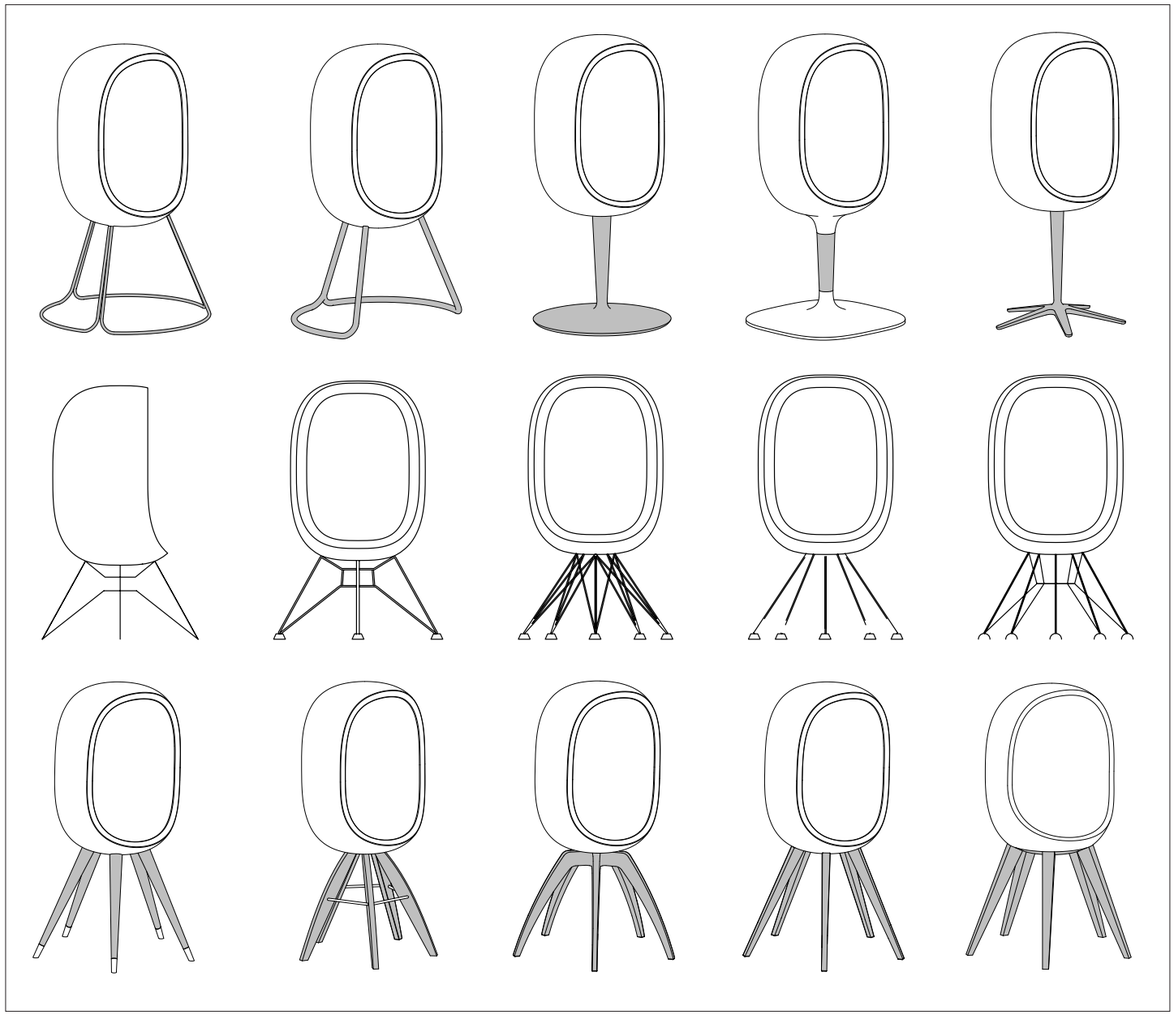




Above: The technique of gathering strips of metal with blind rivets to a complete shape Below: The first paper test

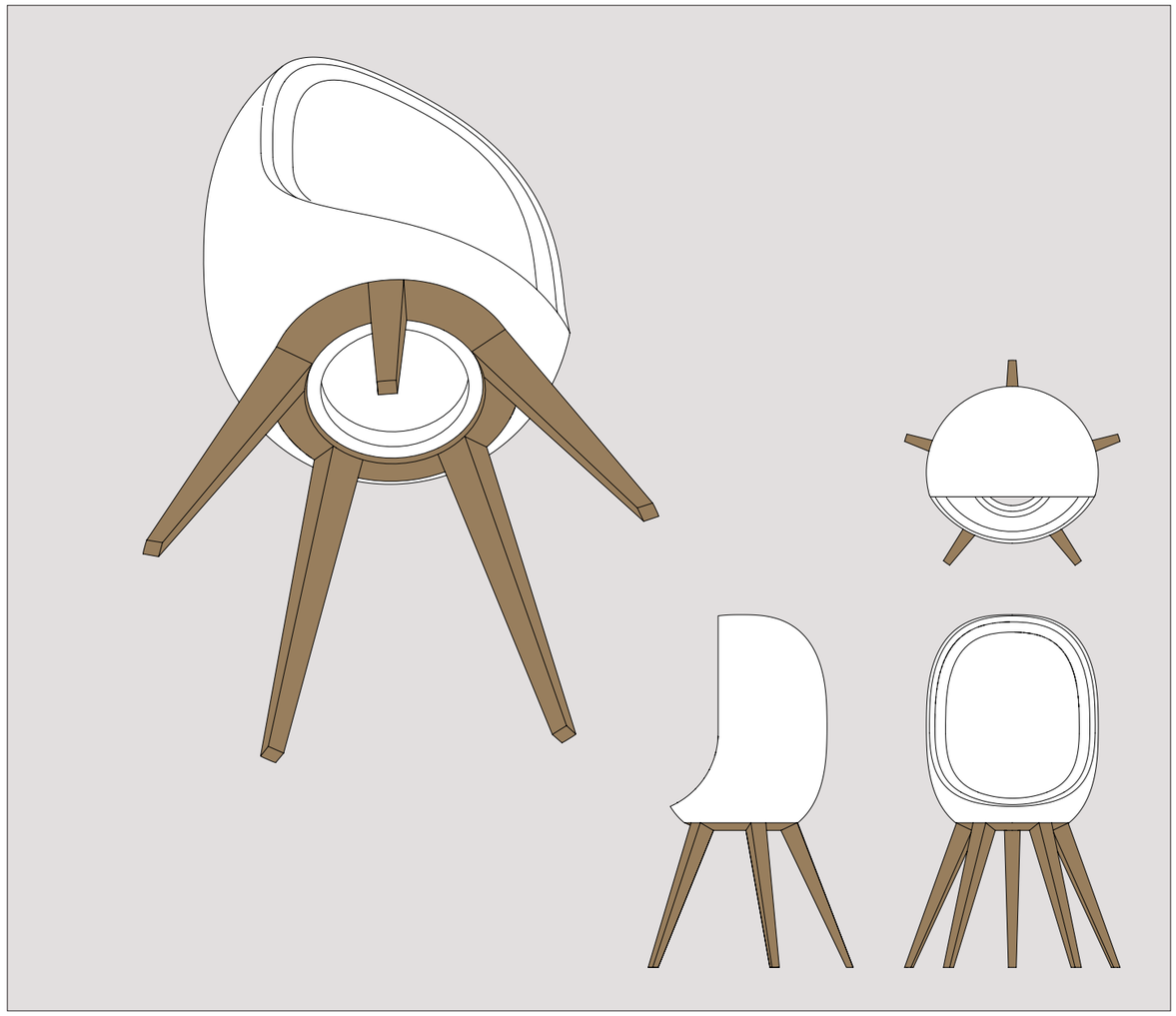
Could a similar effect be produced in the final reflector? I started to play around with facets in CAD-software and soon found a way to produce strips of metal with perforated segments that, when connected, formed the superellipsoid shape. In this way I got small facets surrounding the fire, making the look of the reflections even more dynamic and interesting to look at. A problem had turned into a better solution!

Concept development - Legs



Some of the different versions that led me to the final five legged solution

Even if the egg was the winning concept the design with three legs would not work, three legged furniture are prone to fall over sooner or later. This security flaw forced me to look at another leg solution with more legs or a larger supportive base.



The final five legged version

Sketching on everything from tube legs to monopods I finally found a solution with five wooden legs all connected with a wooden ring. It was very stable and picked up the heritage from the historical pot rests that were put over open fires. This solution also gave more room for the burner since it could be totally open in the bottom.

Signe Persson-Melin

interview with ceramic designer and professor in industrial design Signe Persson-Melin - Malmö April 2009

Since I was thinking of having a large part of my concept made in ceramics I decided to contact someone who works professionally with the material. Signe Persson-Melin has been one of the leading ceramic designers in Sweden since the 50s. I met her in her studio in Malmö.

After presenting my concept to her we discussed it back and forth and came to a number of conclusions regarding the look, the materials and what production method that could be suitable.

She told me how you the clay could be tinted and how to use different kinds of glaze to reach different effects. Since I wanted a white finish we discussed the use of a white, dense clay that wouldn't absorb water when burned. To get some life and warmth in such a large white, matte surface Signe suggested some sort of very faint pattern to give the light something "to grip" onto the surface.

Signe also agreed on that slipcasting would be the best production method and that a large ceramic producer like IFÖ (a large Swedish sanitary products producer) could be a suitable partner. This way of casting could also fit well with the pattern effect since it could be made by hand directly in the mold to give a more human feeling of craftmanship to such an industrial process.

I'm happy that I had the opportunity to meat Signe Persson-Melin and gain from her life-long knowledge.

Signe Persson-Melin in her studio in Malmö in April 2009

IFÖ

study visit at IFÖ
- Bromölla April 2009

To learn more about slipcasting I decided to contact IFÖ who have been working with large scale slipcasting for more than hundred years. Today IFÖ slipcast more than 1,6 million pieces of WCs and washbasins every year in their Bromölla production line alone.

I met with Tommy Bengtsson who is head of development and Ola Persson who is development engineer at IFÖ sanitär Bromölla.

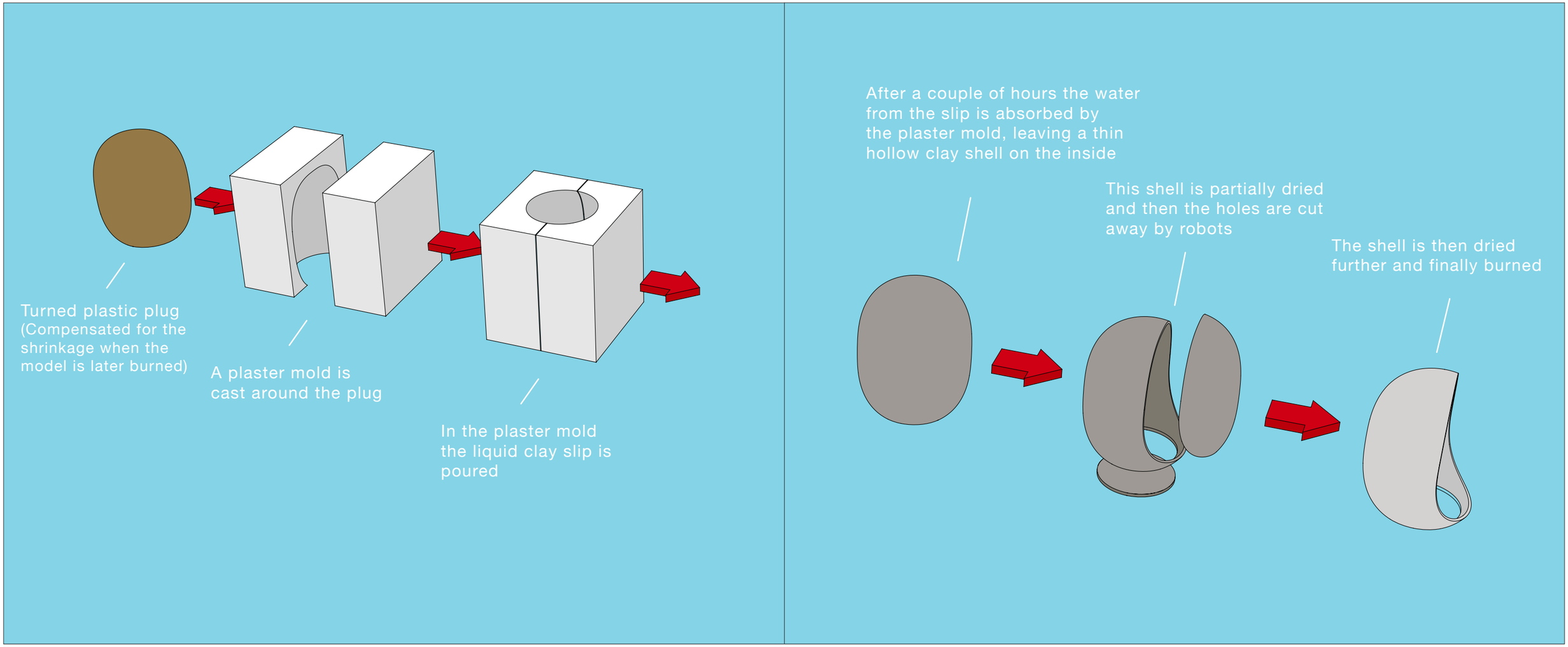
I got a full tour of their production line and got a deeper understanding of the pros and cons of slipcasting. I saw their robotized line, the 100 meters long ovens and much more.

Among other things I learned how the use of different clay affects the production and gives different shrinkage during burning. This must be compensated in the mold and is the single hardest part of developing a new product and could in the worst case prolong the develoment of the mold with several months.

Tommy and Ola also told me that I piece like mine could be produced quite easily and at a reasonably low cost if the number of pieces produced was high enough. It is of course hard to get any exact figures without doing a deeper analysis but if some 3000 pieces were to be produced Ola estimated a rough cost of under €100 per piece. €

Slipcasting - the process

Facts from study visit at IFÖ Sanitär - Bromölla 2009



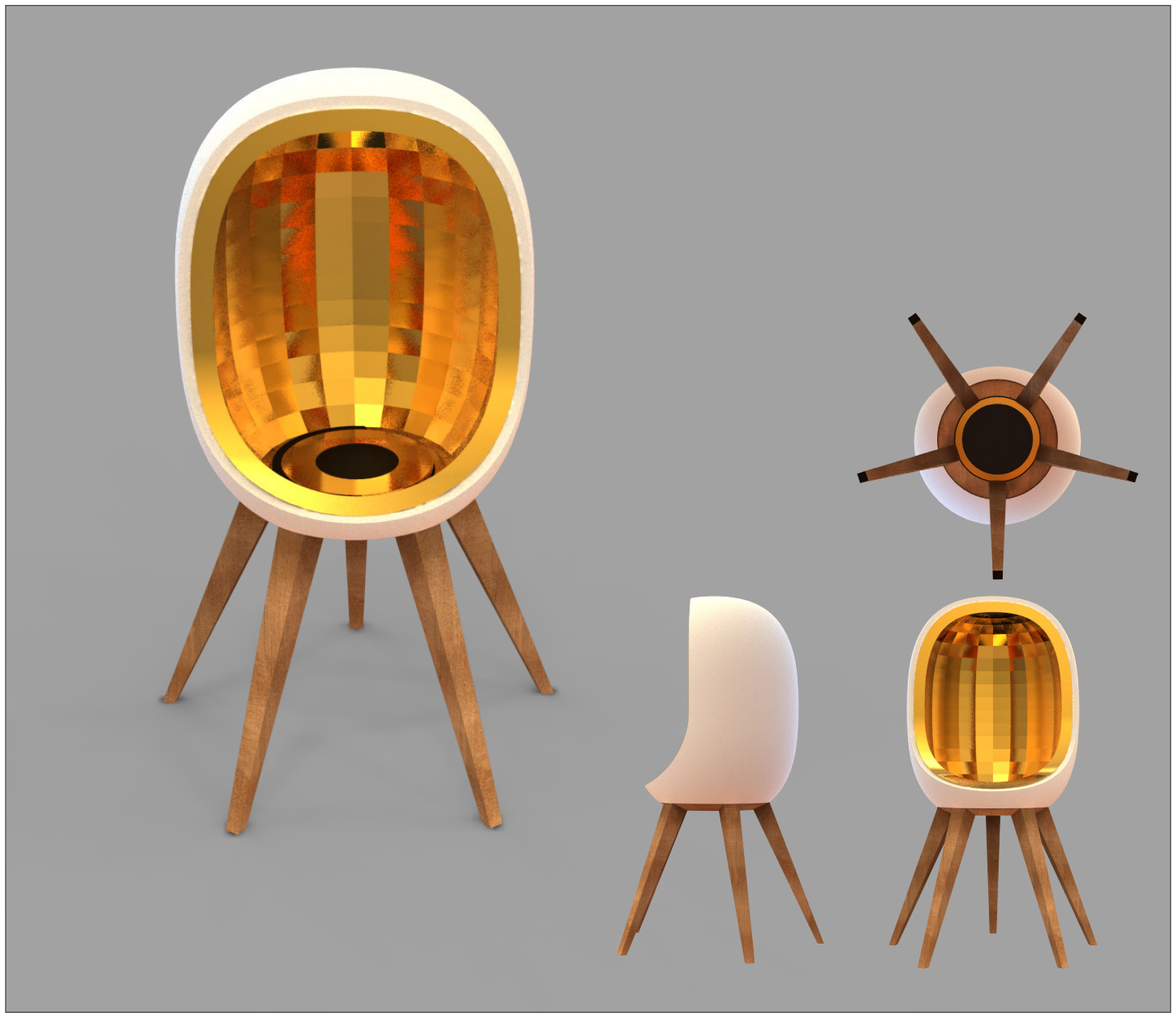
A simplified illustration of what the slipcasting process of my piece could look like

As the name inclines, Slipcasted is based on slip; a very watery soup-like clay mix. Once poured into the mold the plaster absorbs the water in the slip leaving a layer of clay “sediment” on the inner walls. The longer you wait the thicker your layer will be. One very good thing with this technique is that you can mold thin hollow ceramics in complex shapes with only an external mold. You can even cast products with double walls and air in between.

The main issue is, as described before, compensating for the shrinkage during burning which can be very complex in the case of for example a toilet. Depending on the shape and weight of the different parts the shrinkage will almost always be non-uniform. This work demands highly experienced engineers and fast computers for the complex CAD-applications that designs and computes the molds.

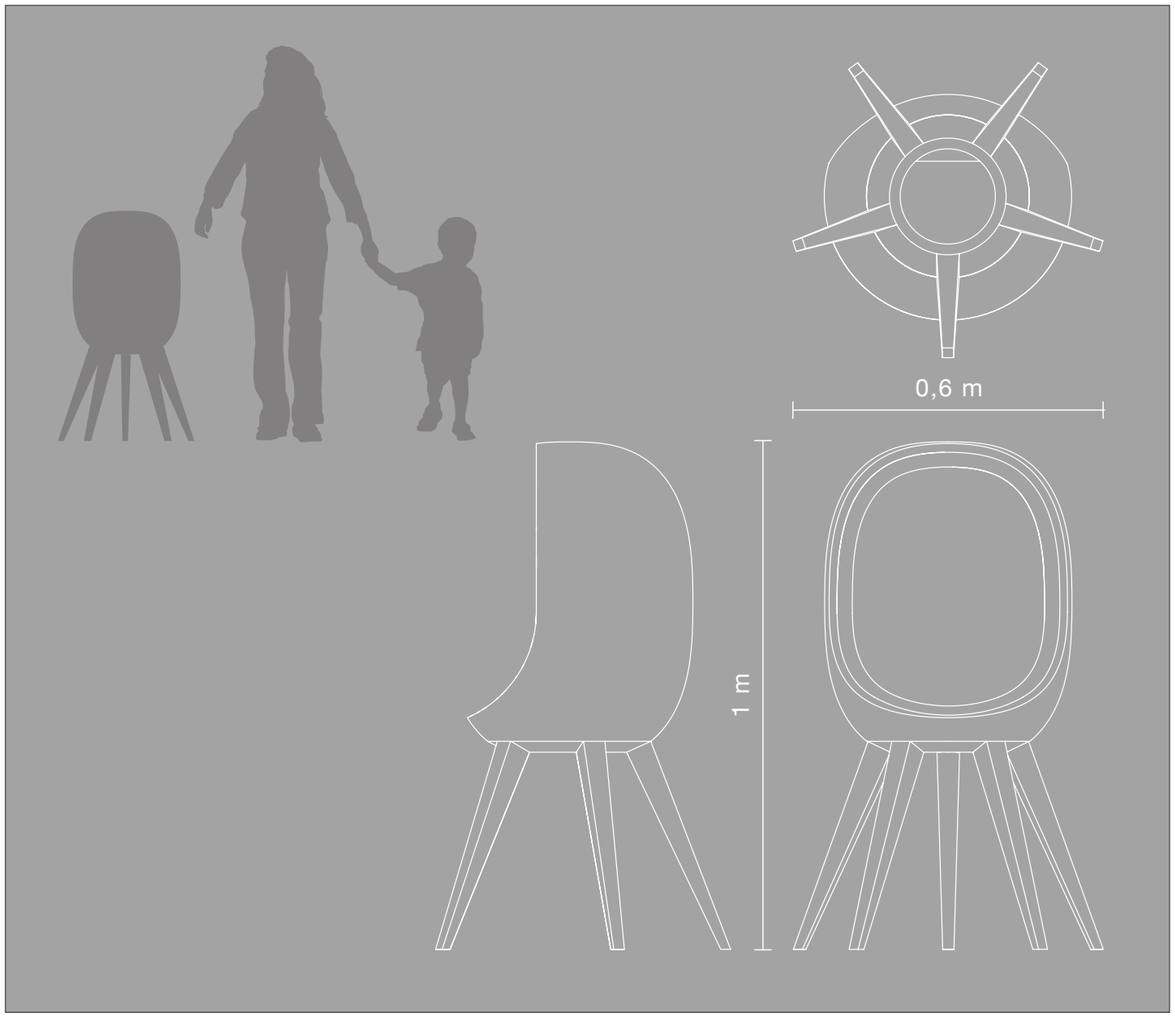
Final concept

Final exterior and measurements



Rendering of the final CAD-model

After a long process this was what I had. A chimneyless stove with a ceramic shell and a large brass reflector. I think the impression of the reflector and the ambience it creates is a large part of the project. The fact that none of this technology or the materials were new was also very pleasing to me. I'd only taken exisiting production methods and materials and technology from old fire related products and combined them in a new way. I hope this concept could fit in a variety of Scandinavian homes and perhaps give more people a positive relation to fire. Since I went with the super elliptic concept I decided to name my product Piet as a tribute to Piet Hein.

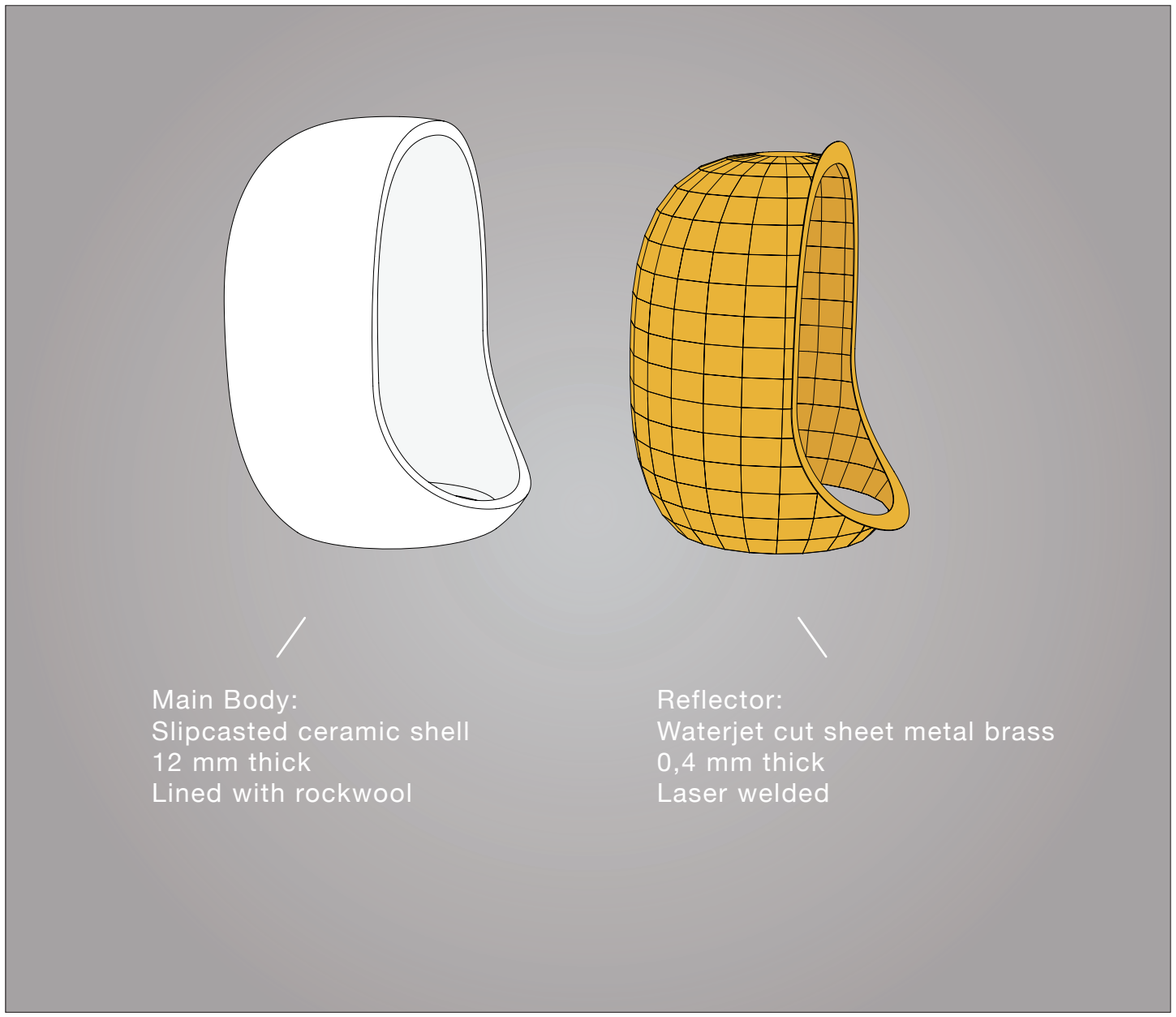


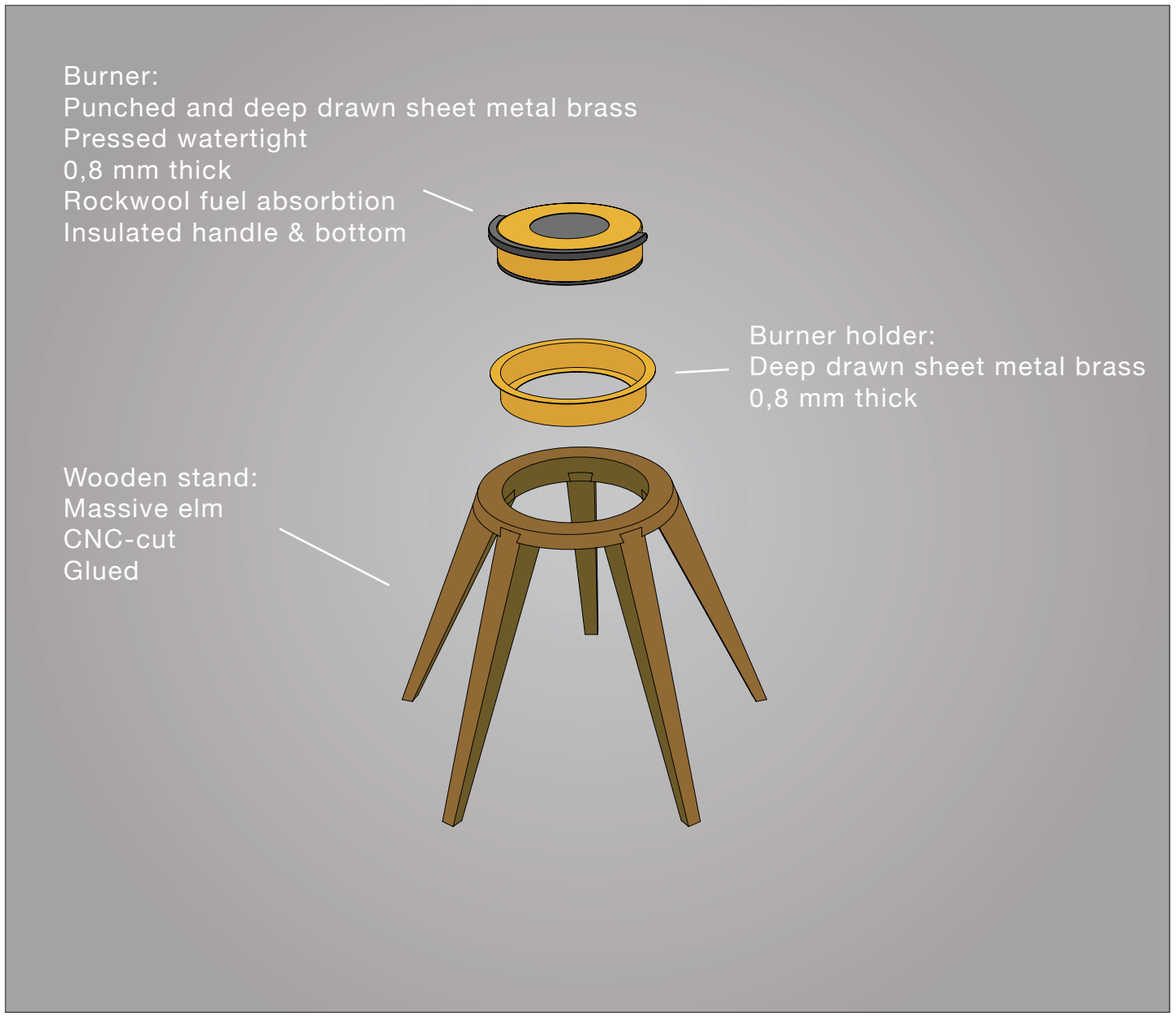
Measurements

The idea I got from Signe Persson-Melin with having a faint pattern in the ceramics I put aside for a while. The facets of the reflector gave a strong pattern feel to the stove, so I decided to keep the ceramics smooth until I saw the final result.

The measurements of the stove are about the same as those of a chair. This is large enough to be an eye catching center piece and at the same time small enough to be placed in many different areas in a home.

Parts and future production

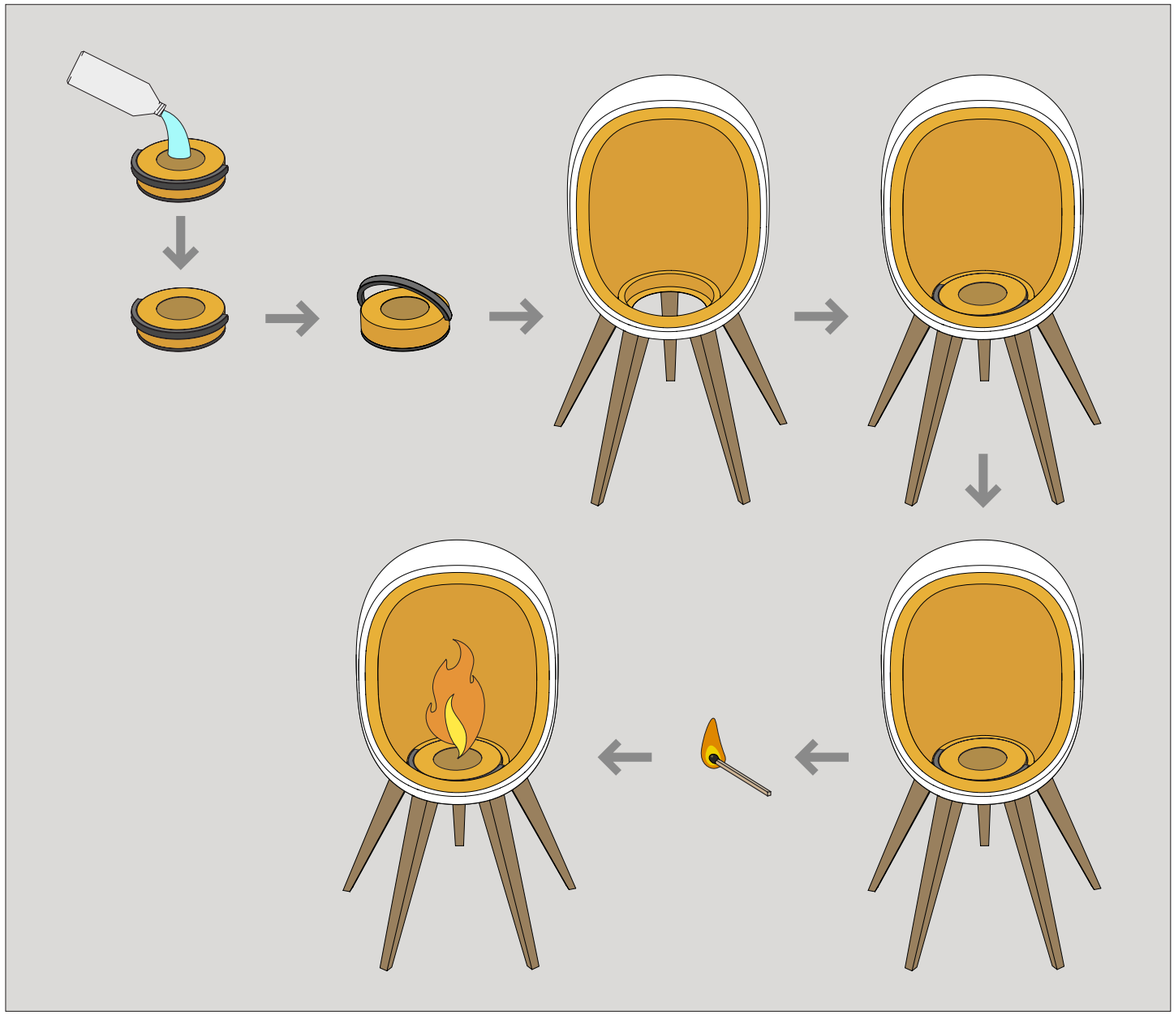




The illustration above shows the major parts of the Piet stove. The main body is a slipcasted ceramic piece and the reflector is made from water jet-cut sheet metal brass. Even though some of the parts are expensive to produce I hope the stove as a whole could be sold at a retail price below € 2000 which is about what you pay for an ordinary wood fired stove.

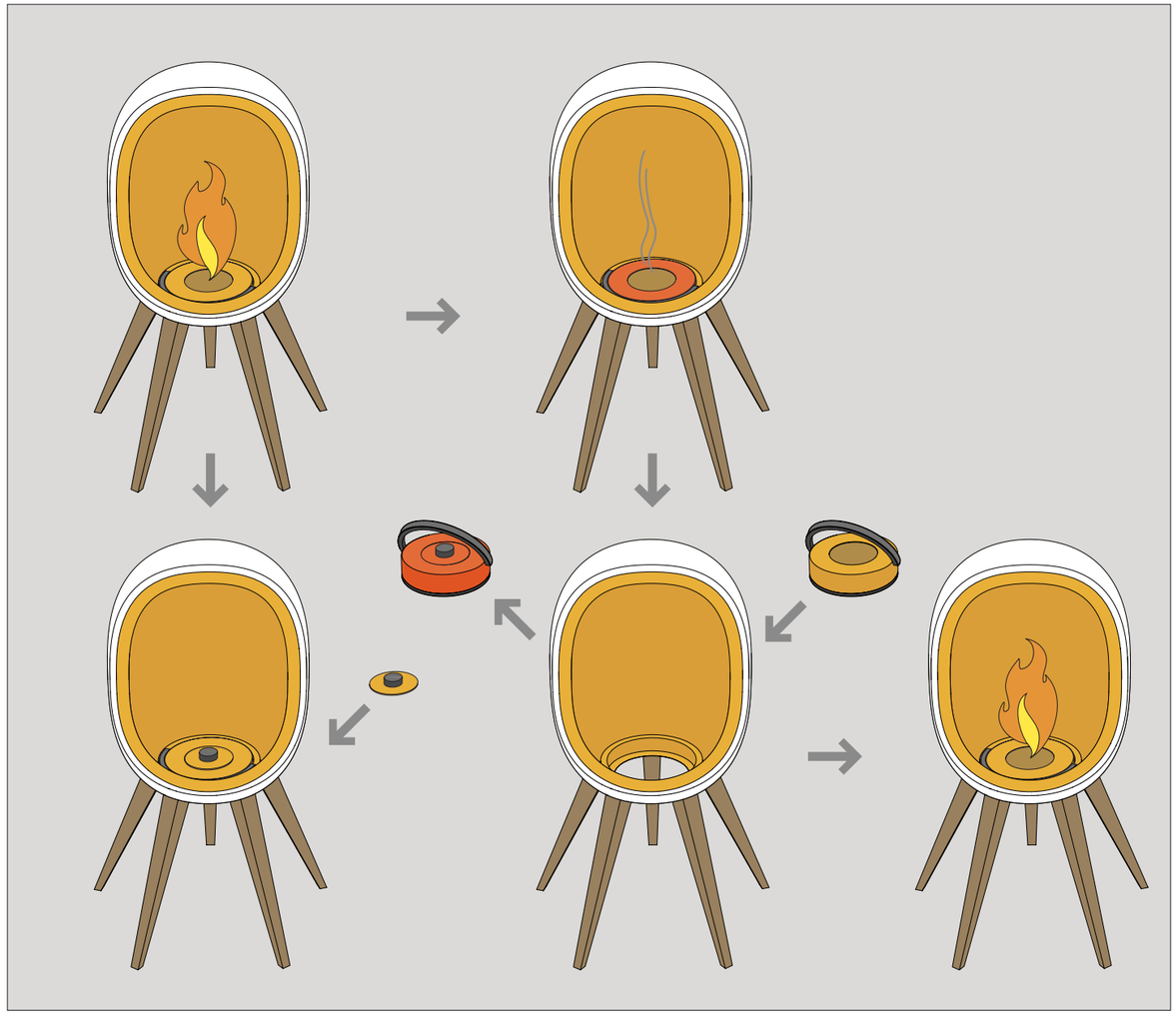
In the making of the prototype most of these parts would be produced differently. This is due to the fact that many processes are not economical to use below a certain number of produced pieces. All parts in the prototype are done in the same material and with roughly the same thicknesses as a future retail product would have.

Usage and handling



Fill up the burner and place it in the burner holder inside Piet. It is now ready to be lit.

The usage of the Piet stove works like this: Fill the burner with the ethanol fuel. When the rockwool doesn't absorb more fuel it is full and ready to be lit. Place the burner in the burner holder inside Piet and light it. Once Piet is lit you have two choices, either to put out the fire with the lid or let it burn all the fuel. If you have put it out with a lid you can just take off the lid and relight it with a match at any time.



Either put out the fire with the lid or let it burn all fuel. I the burner is hot do not refill it, replace it with the cool, already filled second burner.

If you burn all the fuel the burner will most likely be hot and it should not be refilled at once. To minimize the risk of the consumer not waiting long enough to let the burner cool down, I decided to provide Piet with two burners. A two burner solution lets you have one burner prefilled and ready all the time and you can have a continous risk free fire.

Physical model

Already during the refinement phase I had contacted several companies to see if I could find any partners for producing my model. This became a rather long journey for me and my choice of making the stove in real materials proved to be quite a challenge.

Partners

Since the three major parts of the stove; the stand, the ceramics and the reflector, would be produced in different materials it required three rather different areas of knowledge.

I managed to produce the wooden stand in the school workshops. I got a lot of guidance from excellent cabinet maker Claes Dorthé from whom I learned a great deal about wooden joints.

I thought that I had found a partner in IFÖ to help me produce the ceramic prototype but unfortunately they jumped the boat due to lack of resources. This setback prolonged my prototype making quite substantially and I had to go looking for an alternative.

I contacted concrete specialists and even a sculptor to see if their knowledge could help me set up a good workflow. They were all extremely helpful and supportive but didn't have the experience of the kind of thin wall casting I needed.

Luckily I then came in contact with Hans Räthel who is one of the few professional stucco artists in Sweden and is very experienced from many years in the business. He told me how my piece could be made and even supported me with his own time and material during the process.

As I stated earlier, I first saw the reflector as being manufacured as spun from sheet metal. When this proved to be too costly I contacted Pilum AB in Malmö who produce water purifiers and are specialists in sheet metal processing. Together with very helpful manager of operations, Morgan Svensson, I found a possible way of producing the reflector using their water jet cutting machine.

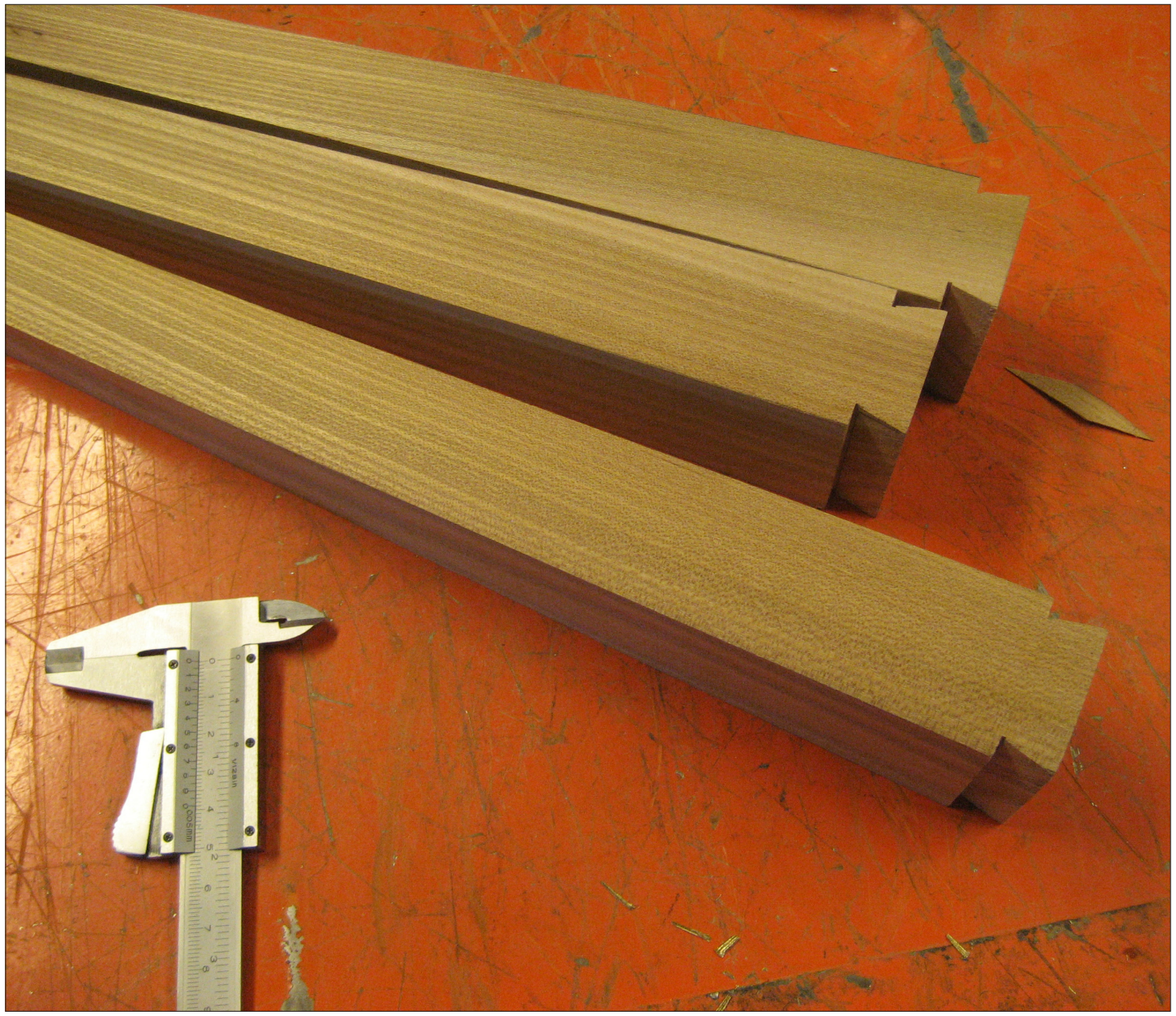
PILUM

Pilum technologies produce water and air purifiers. Pilum Malmö are specialists in sheet metal processing, including water jet cutting

Stuckaturfirman Hans Räthel AB

Hans Räthel is one of the few true professional stucco artists in Sweden. He can make almost anything in plaster, cement or parget

The making of the wooden stand



My vernier caliper, an essential tool when making complex wooden joints

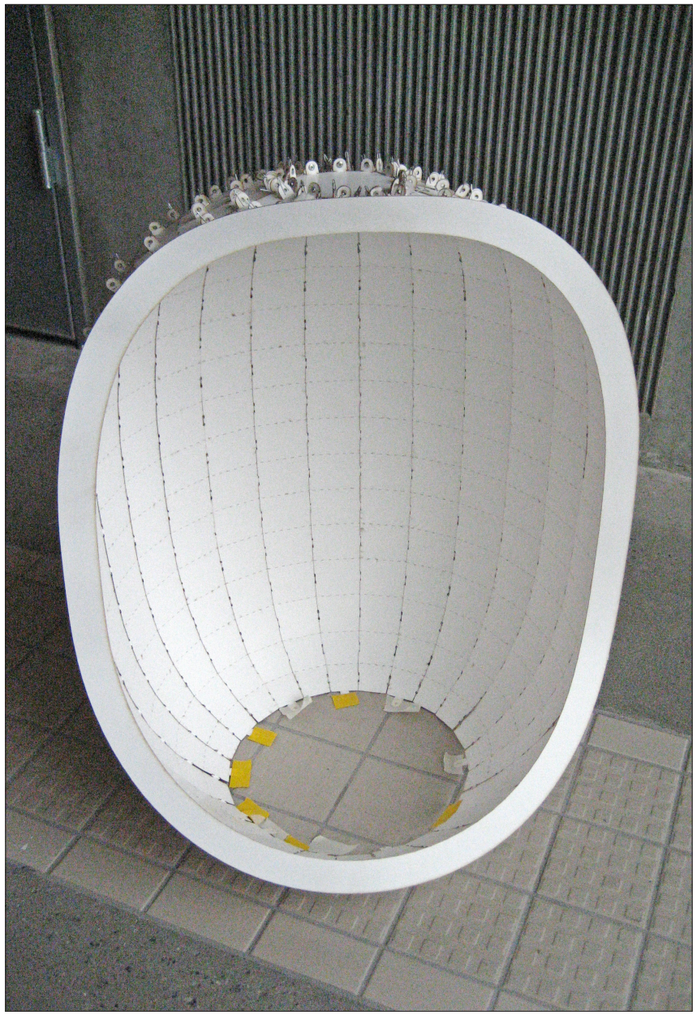
The wooden stand was made in massive elm. I chose this type of wood because it's hard and stable but also because its sheen when oiled looks beautiful together with brass. Furthermore the elm tree is naturally occurring in Sweden and thus a locally produced raw material.

The wooden ring with the dovetail joint legs

To make the ring that holds the legs together I started out by gluing straight pieces of wood together. This block I later turned in a lathe to make it round and smooth. The wooden disc was then placed in a milling machine and I milled out the five cuts for the dovetail joints. The top of the legs were also milled to reversed dovetails to fit the ring. They where assembled and glued. These large wooden joints doesn't require any screws, bolts or anything else than ordinary wood glue but are still very strong.

The making of the reflector

Made together with Pilum AB in Malmö



One of the detailed paper versions of the reflector, made prior to the water jet cutting of the brass

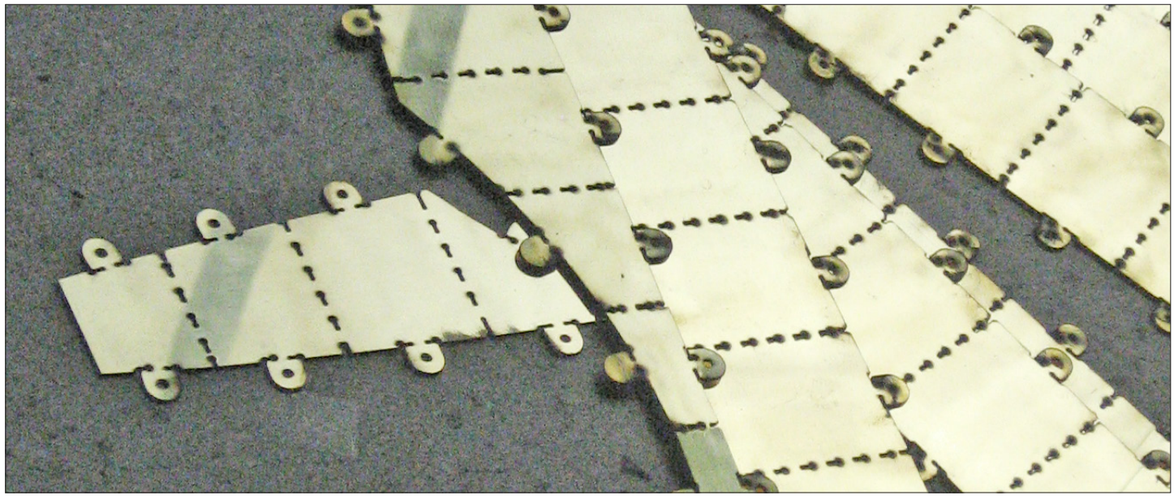
To make that sure the reflector and burner would have the correct sizes I made a more exact paper version in a laser cutting machine and tested it on the wooden stand. The same file was then sent to Pilum AB where Morgan Svensson had it water jet cut in sheet metal brass. Without the aid of Pilum I would not have had such a precise model.

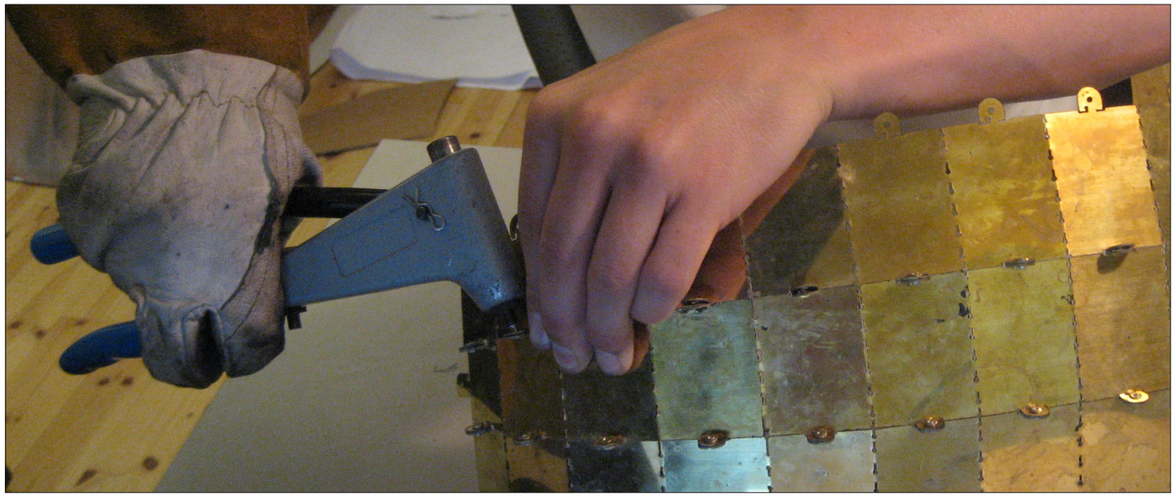
The water jet cutting machine at Pilum.

The technology that made the production of my reflector possible was water jet cutting. By applying an enourmous pressure and mixing the water with a very fine abrasive the water jet can cut through more than 200 mm thick solid steel. This is of course much more than I needed for cutting my 0,8 mm brass sheet metal which therefore could be cut relatively fast.

The making of the reflector

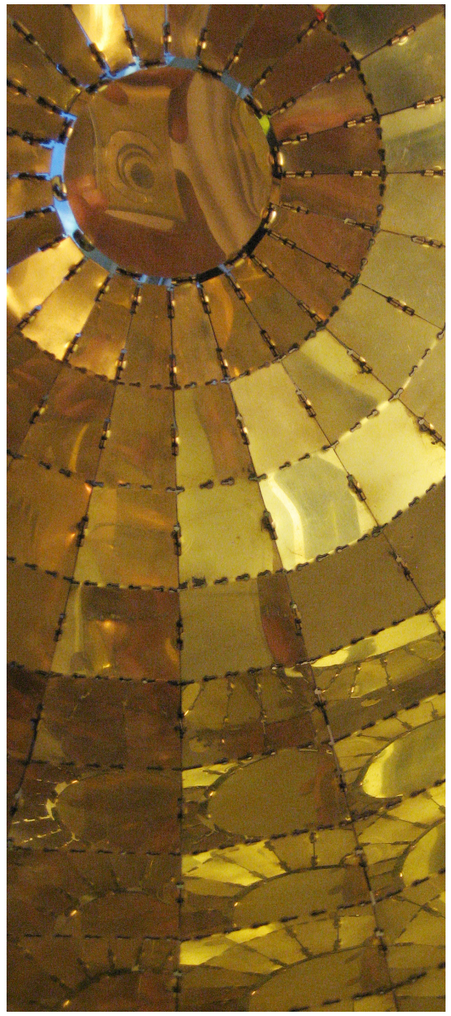
Made together with Pilum AB in Malmö





The water cut pieces of metal before and during assembly. In the prototype they are held together by blind rivets.

The shape of the metal pieces were made in CAD software and were constructed in such a way that the shape of the reflector is automatically formed when it's assembled.



Left: The final brass reflector on top of the wooden stand. Right: Detail of the inside.

I only had to prefold the metal strips in a rough way and then put it all together.

The making of the ceramics

Made together with Stuckaturfirman Hans Räthel AB in Lund

Hans Räthel in action, making the inner plug for the mold. The shape of the plaster was determined by the metal profile turned around it

Since the prototype could not be made together with IFÖ I couldn't do it in real ceramics. Hans Räthel works in both plaster, cement and parget and is a very experienced stucco artist. My shape, that many other professionals found impossible, was just another piece for Hans.

The plaster center core covered in clay.

I started out with turning a rough styrofoam core. This core was then covered in plaster and shellac to form the inner core of the mold. The inner core was later covered in clay in the same thickness as my future ceramic piece and the front hole was cut away.

The making of the ceramics

Made together with Stuckaturfirman Hans Räthel AB in Lund

On top of the clay four pieces of plaster were molded. These formed the outer mold.

On top of the clay we molded four pieces of plaster, together forming the outer mold. When hardened these parts could be separated and the clay was removed. The outer plaster mold was also painted with shellac on the inside to keep the molded plaster from sticking to them.

The shell before the plaster core was removed.

When the outer mold was put back together on top of the inner core we were ready for casting. We casted the prototype in plaster so that I could make changes and repair possible cracks or dents in a simple way.

It was a joy working with Hans and I found it very interesting to get a hands-on glimpse of his fascinating profession.

Assembling the final prototype

All the three major parts ready to be assembled.

The final plaster shell was reinforced with fibreglass on the inside to become more sturdy. It was then painted with plaster paint and mounted on the leg support. The reflector was inserted together with the layer of rockwool insulation.

The reflector and the rockwool insulation on its way into the outer shell.

Since the shell was a bit thicker in this prototype, due to being made from plaster instead of ceramics, this layer was thinner than planned but still proved to work very well. The burner holder and the front frame ring was mounted and my piece of fire furniture was ready!

Photos of the final prototype

photo: Bjørn Wennerwald

Studio shots of the final, assembled prototype unlit and lit.

Photos of the final prototype

Indoor setting shot of Piet being lit.

Piet in the living room.

Photos of the final prototype

Piet in the hallway.

Piet in the bathroom.

Photos of the final prototype

Piet in the kitchen, finally even the cat accepted it.

Conclusion

I started this project by looking at my own personal relation to fire and then on different fire products found on the Swedish market today. I realized that fewer and fewer persons of the materials have as strong relation to fire as I do since fire is becoming a scarce commodity in our society today.

The most obvious reason to this is of course that we are not dependent on fire for heating our homes and cooking our food anymore. But only three generations ago we were all dependent on fire for survival. Since we have this cultural heritage so close (at least in Scandinavia) I think many of us long for a real fire in our homes. This is however seldom possible since so few of us live in a home with chimneys.

The solution I found, using the ethanol stove, doesn't require any chimney at all. A stove like this could be placed anywhere in a modern home.

However it took quite some time before I knew how to apply this technology to a product in the right way. I did an extensive technical research of both materials and heat related technologies. After this I lingered around in the technological area much too long trying to merge several of these interesting findings into one product.

It wasn't until I realized that my solution would not be a technological product at all, but more focused on our emotional realation to fire, that I really could define my product.

When I had decided on how the final product should look I contacted production specialists within each field and learned more about ceramics, slip casting, sheet metal processing and cabinet making.

The slip casting experts at IFÖ were very helpful and first agreed on helping me producing the final ceramic prototype. After weeks of discussion and changing plans they unfortunately changed their mind and I had to find another way of producing my ceramic piece. This led to a severe delay in the model making and I had to prolong the model making and the presentation until September (it was initially planned for June).

You can of course argue that I could have presented my project without the final model but that would, in my opinion, have ruined the impression of my work. Since this project has such an emotional core you have to be able to experience a working prototype to fully appreciate and evaluate what I have done.

I'm very happy that I went all the way and succeeded in producing a working model. I have gained a lot of knowledge of how different products and materials behave in relation to heat. I also got deeper knowledge of several interesting production methods that I only knew in theory before. So even if the project as a whole, was delayed I think I've learned many valuable things along the way.

What also struck me is how unreal a project like this sometimes is. To do a big project like this on your own is very inefficient both in relation to time and creativity. I now really know that my creative process thrive in the company of peers and not in solitude.

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16 http://en.wikipedia.org/wiki/Silicone (2009-05-11)
17 http://www.bambooweb.com/articles/s/u/Super_ellipse.html (2009-06-01) and http://sv.wikipedia.org/wiki/Superellips (2009-06-01)

Interviews and study visits

Study visit and interviews at:
IFÖ Sanitär AB, Bromölla Sweden
Signe Persson-Melin, Malmö Sweden
Pilum AB Malmö Sweden
Stuckatörfirman Hans-Räthel AB, Lund Sweden

Interviews with:
Engineer Hans-Olof Andersson ~ Dometic AB
Cabinet maker Claes Dorthé
Fire engineer student Joel Lundberg ~ LTH
18th century furniture expert Alf Laurell
Engineer and senior fellow Rolf Egnell ~ LTH
Product developer Hannah Holmquist Carleke - IKEA of Sweden
Energy expert Mathias Gustavsson ~ The Swedish Society for Nature Conservation
Engineer, peltier element expert Johan Seiberlich ~ Supercool AB
Ola Lyckfeldt ~ Swedish Ceramic Institute
Product specialist Birgitta Kjellin and Christer Ahlström ~ Kemetyl AB
Jan-Erik Andersson ~ Agroetanol AB
Concrete expert, engineer Bo Johansson - LTH
Ola Letin ~ Euroquippe AB
Filip Malec ~ Paroc AB
Sheet metal spinning expert Leif Pettersson ~ Malmö Press-Mekano
Sculptor and artist Niklas Nilén

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