

## The Spiral still



**Properties:**

- \* Relatively simple to build.
- \* Small
- \* Cheap
- \* Alcohol is about 92 -95 % if it is run slowly.
- \* Air cooled.
- \* Speed is about 0.1-0.3 litres per hour.

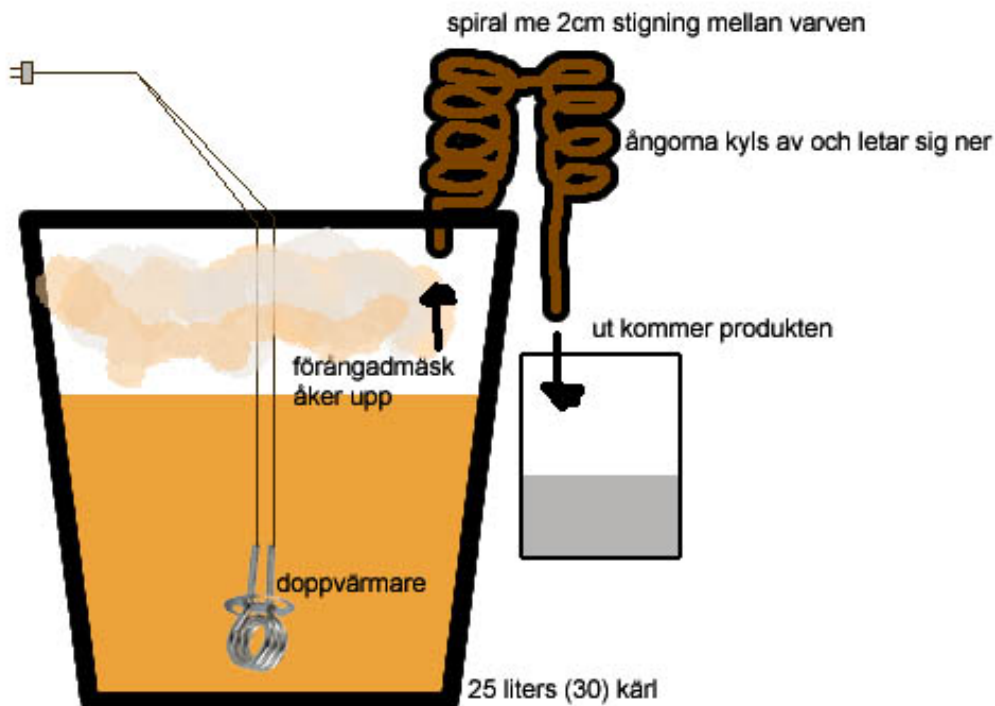
This still doesn't deliver pure ethanol, but the quality is alright and activated carbon will take care of the remaining fusel oil without problem.

It's possible to add a column to the spiral to get as good separation as a normal compound still. Read more about that at the end of this document. A column is highly recommended, even a short one.

The still have been developed and improved by the members of [bryggforum.com](http://bryggforum.com) a Swedish forum. There is a more comprehensive version of this document available in Swedish. More than 50 people use this still (that I know of), so there have been plenty of testing and it has proven to work well.

Det som behövs:

en jäsdunk på 25 l  
en kopparspiral på 5 meter  
mäsk i dunken ;)  
en 300w co doppvärmare  
en handuk som isolerar runt 25 l dunken



The boiler is made of a fermenting vessel in pp plastic.  
Since the still rely on air cooling alone the power is low, a 300 W immersion heater is about the right power for the still.  
Column and cooler is made out of a long soft copper tube winded in a spiral that first goes up to act like a column, and then back down to act like a condenser.

## Parts needed to build a still:

To begin with you need a fermenting vessel:



Make sure you use a vessel that is alcohol proof. You can of course use stainless steel instead. Size is up to you.

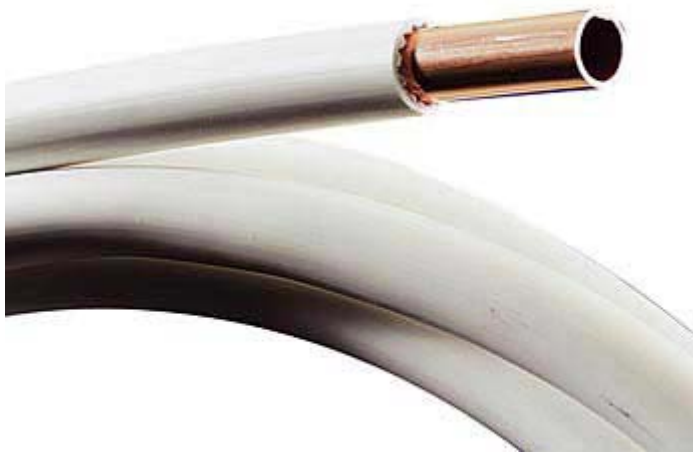
A word about pp boilers. PP plastic can handle alcohol, but it is sensitive to high percentage alcohol so don't use pp containers to redistill high percentage alcohol like 90 % + Distilling mash is no problem.

The heater is made of an immersion heater (300 W):



These heaters need to be modified before they are used. The heater is not 100% waterproof and can cause short circuit after a while if it isn't modified.

Column is made out of a 5 metre long soft copper tube, 10 mm in diameter. Available at hardware stores. Use more than 5 metres if you wish, 8 metres will provide better cooling capability and better separation. 12 mm pipe will do as well (1/2")



Beside this you need extra gaskets for the lid, and some hose. More about that later.

## How to build a still:

Put the tube on the floor. Make a spiral out of it with the help of bottle. A wine bottle for instance. Roll the bottle and wind the tube onto the bottle.



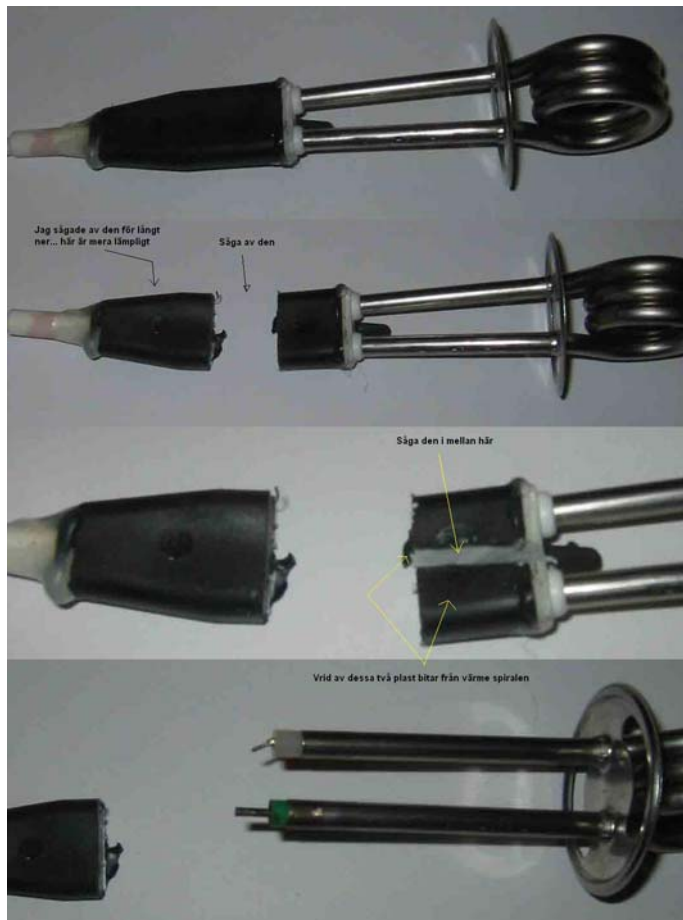
Only wind half of the tube, then change direction to make the spiral going downwards. Result should look like this:



Use force by hand to make the beginning and end of the tube point downwards (check first page to see what I mean). Be careful not break the tube. And remove the insulation.

Important! Vapour will condense in the spiral, the condensate has to have a clear path down back into the boiler. Make sure the tube is in a spiral upwards all the way up. No liquid locks. Expand the spiral some to get a higher slope.

Immersion heater:



This is a common Swedish model, so it's hard to give a good general advice for the specific model you may find. Use a 300W model.

However, in this model the plastic surrounding the heater needs to be removed.

There are several ways to do this. One of the wilder ideas that work is to put the plastic on fire, it melts and you have the metal heater left. A hot gun will do as well. Or why not use an ordinary saw.

Using silicone to make it water tight won't do. PP plastic is hard to glue. After a while in the boiling mash the silicone will come loose.



Solder wires onto the connectors. Put a hose on top and use a hose clamp in stainless steel to tighten.



The hose will go through the lid.

So what hose to use? Silicone is good. Neoprene, Teflon, csm and a few others should do. In the picture it's a PVC hose. PVC isn't 100% alcohol proof so that's not such a good alternative. The hose will hold, but there is a risk of chemicals bleeding out from the hose. Mainly softeners. Good thing about softeners is that it has very high boiling point. What kind of hose you choose is up to you. To be on the safe side, use Teflon or silicone, or do as follows:

It's possible to mount the heater on the side of the bucket instead with the help of cable fittings to avoid the use of hose:

Use a high quality fitting in metal, waterproof. **Make sure to ground the heater!!** (Mount the heater vertically instead, not horizontal like in the picture)







The still can't handle more than 300W while distilling, but while you are heating the mash to boiling point you can use much more power. Heating the mash to boiling point takes 8 hours or more with a 300 W heater and 25 litres of mash.

As an extra feature you can add a water heater element that speeds up the process.

Water heaters are Cheap and got plenty of power (2.2 kW isn't unusual). This will reduce the heating time to about one hour. Best is to use the "wireless" models. The power connector on the wireless heaters fits perfectly in a computer power cable. If you use a power regulator it's possible to use this heater as your main run heater as well and skip the immersion heater.



You need to know what temperature you got in the boiler if you heat with a water heater element. A digital thermometer with an alarm is useful. Simply push the sensor right through the fermenting vessels lid. No drilling. When the temperature reach 85 C, disconnect the high power heater and run with the low power heater alone.



The lid:

The heater and the spiral need to be connected to through the vessels lid. Use either a rubber cork, or cable fittings. It's possible to use the fermenting vessels gasket as well. The one that is used to connect the air lock onto the lid, but you'll need to replace them after a while. The simplest way to make a hole in the lid is to melt the plastic with a heating iron.



## **How to use the still:**

Lay a towel on the floor. Place the bucket on the towel.

Fill the bucket with mash.

Place the lid, and mount the spiral.

Insulate the vessel with a towel. important!! (Otherwise the 300 W heater won't be able to make the mash boil, too much heat will be lost.) You can also use ground sheet to insulate.

Put a towel on the lid.

Turn it on and wait. It'll take quite a while before you get any product. Don't hurry.

Best speed is about a drop per second or less, adjust speed with the insulation.

Remove the towel on the lid for instance.

To make it easier to adjust, use an ordinary dimmer (that handles 300W). Then you can insulate as much as you want and adjust the speed with the dimmer instead. This will save you some electricity and you get better control.

When the mash has low content of alcohol the drops will come less often, when there isn't any alcohol left in the mash the still stops producing, no more product comes out, or the speed will be dropped much. But only if you had slow speed to begin with. That is, the dimmer was set on low power.

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Next is Rikus part on column and spiral.

## Pictures of spiral stills:

Ethanol:

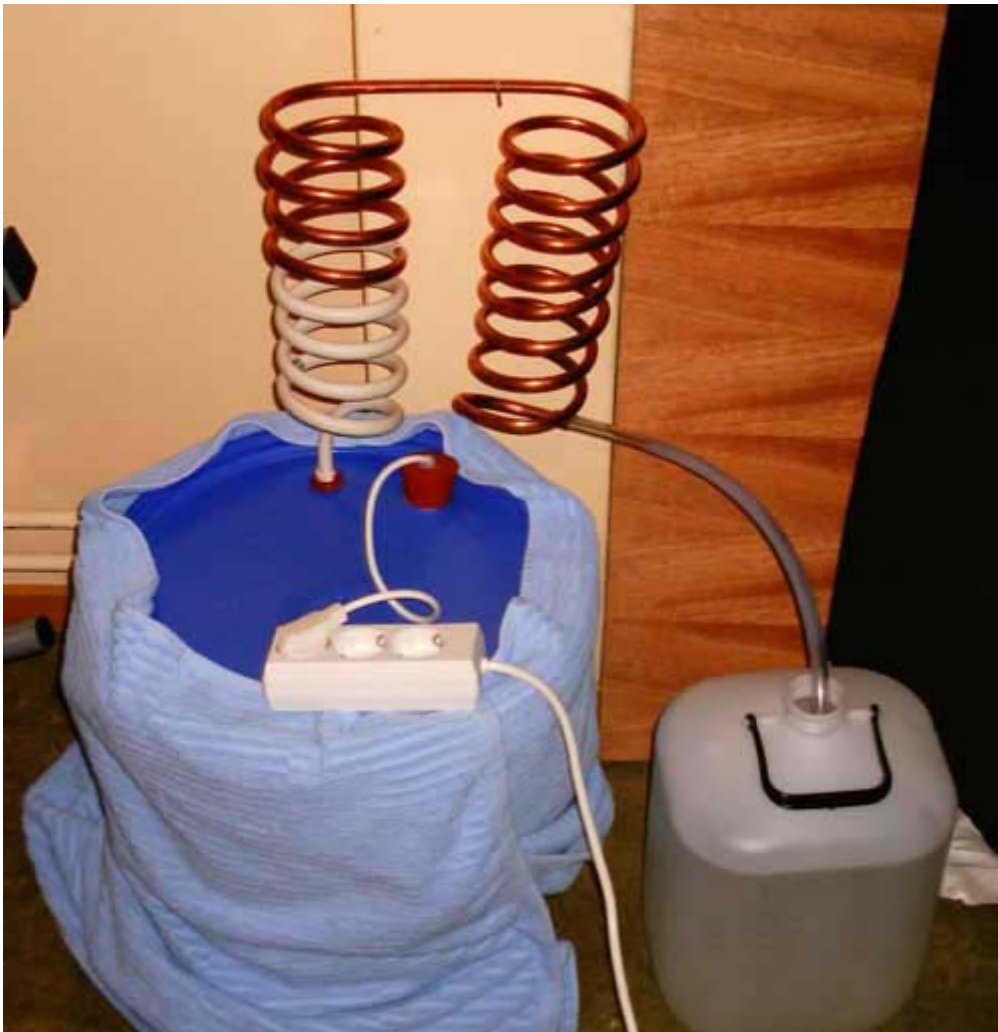


**Groovers still:**





**The Bandits still:**





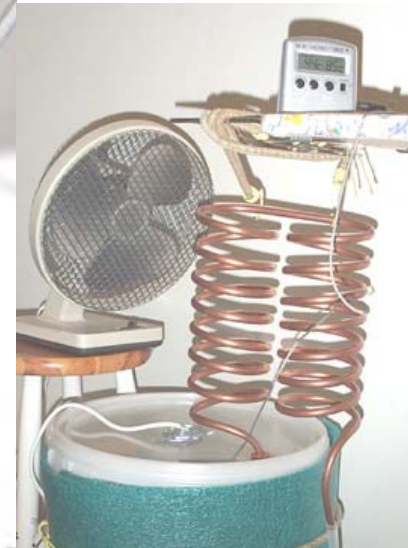
**Masters:**



Azin:



**Lasse Kongo:**





## **Spiral still with column – getting a good separation**



While spiral still in itself is beautiful work of innovation in it's simplicity and delivers over 95% alcohol when operated properly it lacks one property of compound stills, good separation of different alcohol components in a mash. As I like the low power, air-cooled approach I decided to take the next logical step and add a column to the system.

## Construction

I used a 30cm piece of 40mm pipe for my column as I had it handy, but sizing of a column can vary. There are few issues to consider when building a column.

First of all the column length, if you want to play it safe I'd recommend a column length of 90cm or more. My 30cm column works well, but it requires slow output (lots of reflux) to do its job properly.

Insulation, to get good separation it is necessary to insulate your column well. Good insulation prevents condensation at the inner surface of pipe, which in turn causes reflux to run down at the pipe surface instead of packing. If this happens it decreases separation efficiency.

For the diameter of column there are few issues to deal with. Vapor speed is the first and most important one when good separation is needed. Basically the lower the speed the better the results as far as my empirical research and information from others go, but with long columns under 20inches/s is OK. With the 300W max power we use, one-inch (or ~25mm, a common pipe size) diameter gives vapor speed of 18 inches/s, so basically that's the narrowest pipe I'd recommend for full power. With proper insulation 5 meters of spiral will not condense all 300W, so we are practically using 200-250W through the column when heat losses or other methods of power adjustment are counted in. With 200W 20mm column will do. My 40mm column and ~250W power gives vapor speeds around 5-6 inches/ second and works well, so larger columns are recommended.

Now column filling, in my case I used a combination of 15cm amphora copper mesh ([www.amphora-society.com](http://www.amphora-society.com)) + few SS pot scrubbers since that's what I had left over from my previous projects. Both scrubbers and mesh will provide good results, but it's my feeling that amphora mesh will allow for shorter columns since it's packed more evenly giving better vapor – reflux contact. Ceramic materials and pieces of glass are far less efficient than scrubbers, but may be used if there are no other choices. In that case taller and wider column is a good idea.

Column material, I did my first experiments with white polypropylene pipe that I attached with soldering iron to the lid of a fermentation bucket. This didn't work very well. First of all the bucket lid and the pipe I used were somewhat different compounds and didn't stick too well causing leaks. After prolonged testing (well over 100 hours of operation) the PP pipe had deformed from the lower part, and provided slight off smell/taste. There are different brands of PP with different temperature tolerances, so you might find a brand that suits the task (I've heard good things about black PP pipes used for irrigation and such).





After that experience I switched to copper and made a column for my real still that incorporates the spiral. The thing is that I attached the heater to the column, so that I can insert the heater through 40mm hole into the boiler and regulate the power via dimmer switch as usual while keeping my 25L SS stockpot intact. It required slight violence to deform the heater with vice grips in order to fit inside a 40mm pipe, so I'd recommend 2 inch pipe if readily available.



The spiral in my case is not as tightly wound and has inner and outer spiral for stability reasons. A regular spiral as mentioned in the first part can be used as well. I'd recommend 10mm pipe for efficiency reasons though. Also 5 meters can not handle 300W, so if you want to run at full power and good insulation longer spiral is a good idea.

Working with copper plumbing components is thoroughly explained in books from Nixon, McCaw and Smiley + online information can be found at [www.moonshine-still.com](http://www.moonshine-still.com) so I won't go into that.

I used reducers 40mm-25mm + 25mm-15mm + piece of 12mm pipe to attach the spiral to the top of the column. Have the 10mm or 12mm pipe protrude into the column to have the reflux drip in the middle of the packing. A separate liquid distributor may be used (perforated plate for example), but I won't guarantee it makes any difference. Pure tin is strongly recommended for soldering, available at most hardware stores.



The other end, well there are plenty of ways to attach the column to the lid, do the search and find the one that suits your case (Tony's site [www.homedistiller.org](http://www.homedistiller.org) is a good place to start searching).

For copper column on the plastic lid approach I'd recommend permanent joint as easiest approach. Say 20cm x 20cm copper plate soldered to the column as a flange. Column going ~2cm through the lid. Glued in place with aquarium grade silicone. SS bolts, nuts and washers on the edges of the plate to secure the attachment. Bead of silicone in the inside seam of the bucket and the lid. Just one way to do it if you are having trouble figuring it out.

Boiler, fermentation bucket can be used off course. If you have regular still it's boiler can be used as well if the heater is attached to the column.

### ***An example how to connect a column to a lid:***

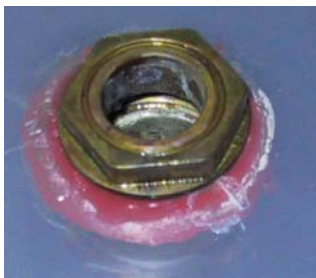
*In this case a brass coupling with R32 inner diameter and R25 outer diameter where used to connect a 35 mm copper pipe to a plastic lid:*



*The edge of the coupling was covered with silicone (red).  
Smear the silicone onto the edge and let it dry.*



*On the bottom a flange nut is used.*



*Tighten hard.*



*To connect the column to the coupling a thread-connector was soldered onto the copper pipe. In this case a 35x35 pipe coupling was soldered onto the pipe as well. That's not necessary.*

Connecting the heater, in my case I didn't want to cut my boiler so I attached the heater to the column. As there will be hot ethanol dripping from the column I added two pieces of 5mm copper pipe to cover the electric wires. They are semi permanent, go through holes in the side of the column and are hold in place with hose clamp. Whole thing is sealed with plenty of aquarium grade silicone.



At the lower end of pipes there are short sections of PVC pipe connecting to the heater (these will be mostly submerged during operation).





## **Operating procedures**

The reason I really like this still is that it suits very well for a lazy persons like me. With power controller you can make it shut down between heads, main run and tails. You can start it in the evening, let it equilibrate over night, slowly collect the heads during next day (while you are at work for example) and start the main run next evening. With predetermined power levels it will close or slow down considerably when main run is finished. All you need to do is start it, adjust power few times and change collecting vessel few times. This all over a period of few days so you don't need to hurry. As a bonus it keeps my garage warm during the run.

### **Starting the still**

Starting is just as usual, assemble and fire her up at full power. It's a good idea to measure the alcohol content in your mash and calculate the boiling point (I usually use one of the calculators at Tony's site). This way you can use a thermometer with alarm to tell you when to adjust down the power (set the alarm 1-2 degrees lower than the boiling point). When boiling is reached adjust the power so that the upwards part of the spiral is warm while downwards is cool. This means you operate in full reflux. Let your rig to equilibrate for some time (I usually leave it overnight).

### **Heads**

After this is finished crank up the power slightly to have roughly 10-20cm of the downwards pipe warm. Let it drip until it ceases or the ethyl acetate smell is gone. Toss the first .5 dl, the rest is heads you can redistill later. You should collect from 2dl-5dl depending on your mash and other variables. The output should be very slow now or even ceased. Crank up the power slightly and test if the product tastes and smells like pure ethanol. If the product is not yet pure crank the power up only slightly from previous setting and continue slow collection until satisfied with the quality. For flavoured spirits you might take some of the late heads phase into the final product, depends on your taste.

### **Ethanol run**

When pure ethanol is coming out, adjust the power to have 30-60cm down spiral warm. This means 1 drop every second or two seconds at 95+% neutral spirits. At this stage you usually make ~1-2 liters in 24 hours. I usually collect the stuff twice a day to ensure I won't accidentally go into tails in case I'm a bit clumsy with power settings. When the main run is finishing the output again slows down or ceases. Some traces of 1-propanol might find it's way into the last few dls. If that happens the product makes pretty good white rum for drinks.

### **Tails**

Now you can collect the tails with both cranking up the power slightly and doing a slow collection, or upping it more and doing a quick collect. There's not much ethanol left in the mash, so unless you are after whiskey or rum you may very well finish the run now. Turn off the power, remove insulation and let it cool down.



## Tips

The dimmer type power controllers usually have a turn wheel that's not permanently fixed to the shaft. Remove the wheel, saw a slot to the shaft and attach your own pointer to get precise control of power levels. It's a good idea to mark your power levels for different stages to be able to duplicate the run.



If you have trouble storing the thing you can use a 10mm compression coupling and some Teflon tape to make the spiral removable.

That's about it. I suppose enough material has been written about drinking the stuff so I don't need to go into that. The good thing about ethanol made with this type of procedure and equipment is that it won't produce many hangovers. I don't take any responsibility though ;) For questions, at times I can be reached at <http://groups.yahoo.com/group/Distillers> or at [abbababbaccc@yahoo.com](mailto:abbababbaccc@yahoo.com)

Greetz, Riku