J-Sputter-Pole Water Distillers

(3 April 05)

This new type of water distiller is made from pipes and fittings. The name comes from the compound J-shape (looking from the back side of the unit see referenced picture) of the pipes at the end of a pole that sputters when in operation. The unit can be made for use with electric power or an open flame fire. There is a bit different construction depending on the heat source intended. The "J-Sputter-Pole Electric Water Distiller" will be described first then the "J-Sputter-Pole Open Fire Water Distiller" will be described. See electric at http://home1.gte.net/mikelob/Jpole-10.jpg.

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See open fire type at http://home1.gte.net/mikelob/JFpole-8.jpg.

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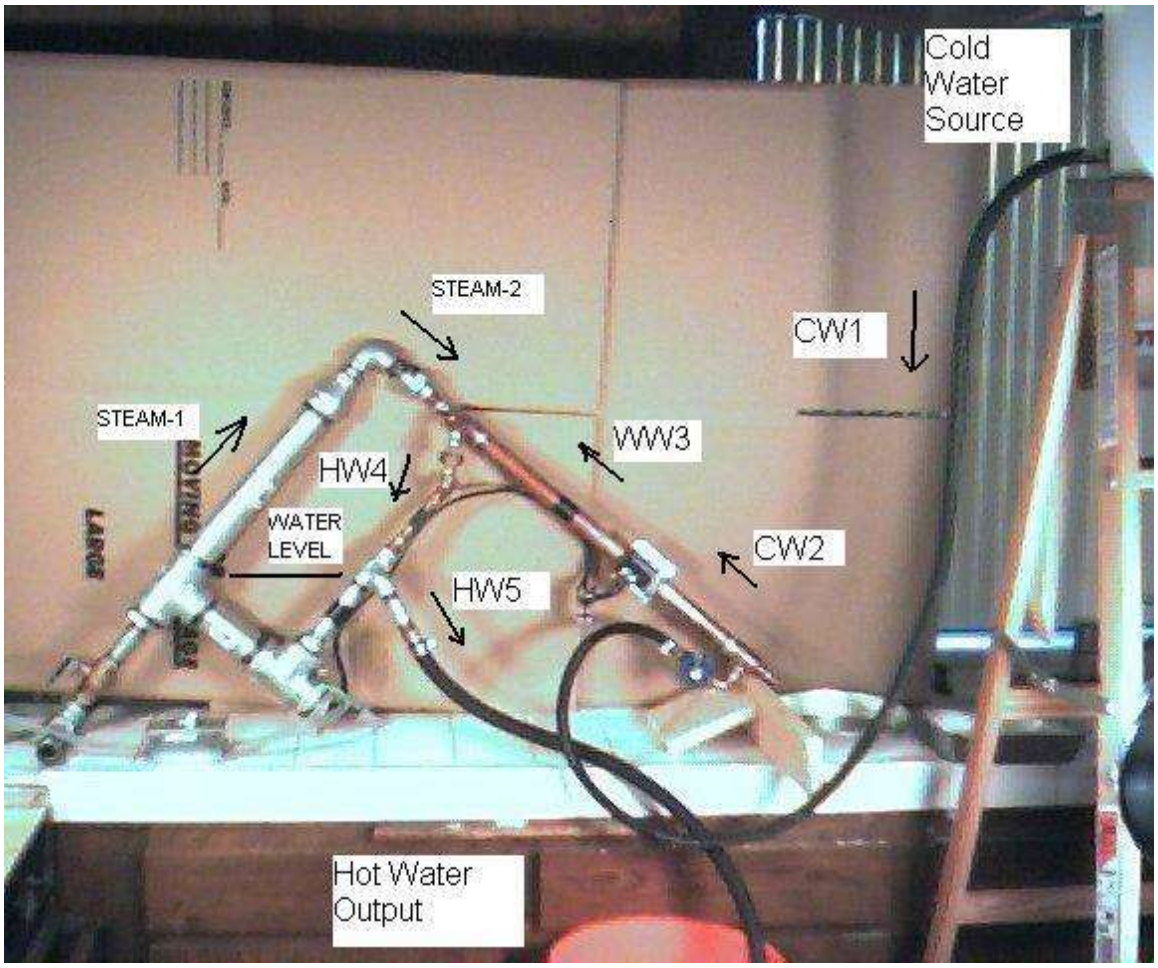
The basic principles of operation are the same for both. The electric version will be used to describe how it works. See http://home1.gte.net/mikelob/Jpole-19.jpg



Cold water from the bucket on the step ladder flows down hill by gravity and is controlled by the blue gate valve at the bottom of the heat exchanger. Cold water flow CW1 goes to CW2 getting hotter and hotter as it goes along the heat exchanger to become warm water WW3. At the top of the heat exchanger the now hot water begins downward to become flow HW4. When this reaches the overflow pipe it fills the lower larger 1.5" pipe up to the water level indicated then the excess runs out the overflow pipe HW5 into a bucket.

The bottom pipe has a hot water heater filament screwed into the end of it that heats the water to a boil. The steam is separated from the water by use of a longer large ascending pipe at a 45 degree angle (Steam-1). The steam turns the corner and enters the beginning of the heat exchanger (Steam-2) see above picture. The heat exchanger cools the steam and distilled water drips into the pan on the right.

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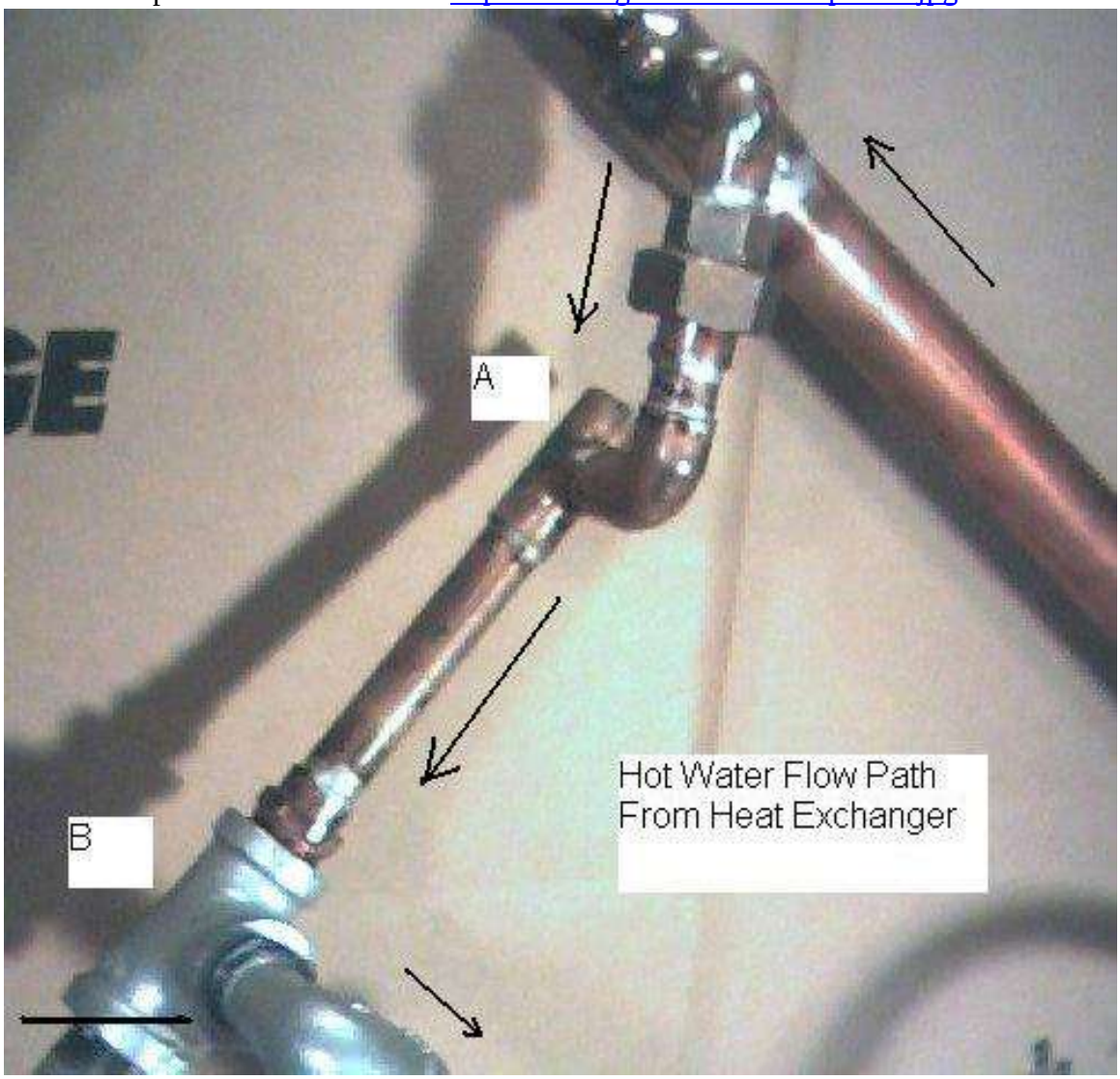
For water replenishment details see http://home1.gte.net/mikelob/Jpole-3.jpg



Hot water from the heat exchanger leaves the exchanger on the side at the top and descends to point "A" in the above picture. At this point due the open air end of the "T" copper pipe fitting air is allowed to mix with the hot water. Between point "A" and "B" as the hot water drops air is mixed and some of the more volatile hydrocarbons (oils) will escape to the open air. Hot air and gases rise in this tube and exit at the top, water drops toward the bottom. At point "B" the water level is reached and the excess runs off and down the waste hot output pipe. In the process some amount of mixing new water with high concentration of salt water happens. This has a tendency to carry off some of the salts into the overflow and thus calcium deposits in the 1.5" boiler pipe are minimized.

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Performance: The maximum rate of distillation for 1500 watts heat source is about 12 Oz/10 min when insulated and 11.5 Oz/10 min with no insulation. See http://home1.gte.net/mikelob/Jpole-8.jpg

Use insulation like shown in the picture to keep the heat in. This adds about 5 percent to the efficiency of the unit.

From a cold start it takes about 4 min 10 sec to start producing distilled water. From a hot start it takes less than 1-3 min to start producing again. The output water coming out of the overflow pipe that goes to the hose and then to the 5 gallon bucket is about 180 degree Fahrenheit. This cools to 150 to 160 degrees Fahrenheit in the bucket depending on how long it was setting in the bucket. Figure on producing about 4 Gallons of waste hot water per hour. This can be used for hot showers or hot baths or stored in an old insolated hot water heater until needed.

The output distilled water is between room temperature and about 115 degree F. If it is any hotter than this then not enough cooling water flow was used in the heat exchanger.

In a test run of three hours of continuous running the inside of the boiler pipes did accumulate a small amount of deposited salts. I suspect this will need to be cleaned out at some long term interval depending on hardness of the water. It is interesting to note that the water dumped out after this time had only about twice the conductivity as local

tap water. I measure about 30 ma current flow with the home made water tester described in an earlier e-mail made from a digital meter and two SS butter knifes.

The first time used, it took about 30 min of operation before the output was measured to be low in resistance (about .15 ma) and the output pipes were some what self cleaned by the steam. It took about 2 hours of running before the oily taste was mostly gone from the result. I recommend using soap and water and cleaning the inside of the pipes as you assemble this unit. A heavy grease or oil residue results from the thread cutting process when these pipes and fittings were made. This is some what difficult to evaporate off during use. You can tell when the resulting distilled water has oil in it. Examine the surface of the output in a sampling container with a flashlight beam reflecting off the surface at an angle. Look for non-uniformity or an oily film. Any oily output can be improved by passing the result through an activated charcoal filter or a water-oil separating unit.

The electric hot water heater element after a bit of use is shown in
http://home1.gte.net/mikelob/Jpole-20.jpg

Warning: Running the eclectic heat element without water only lasts for a mater of seconds before the heater element burns out. It makes a popping nosed which is not all that laud. Changing out the heater element is the only thing that can be done to fix this. Cost is about $8 at Home Depot. You may want to stock up on as many spares as you can afford.

First rule of operation: Always see a flow coming out of the output cooling overflow pipe before turning the unit on. This insures the boiler chamber is full of water and the heater filament is covered with water and thus will not burn out.

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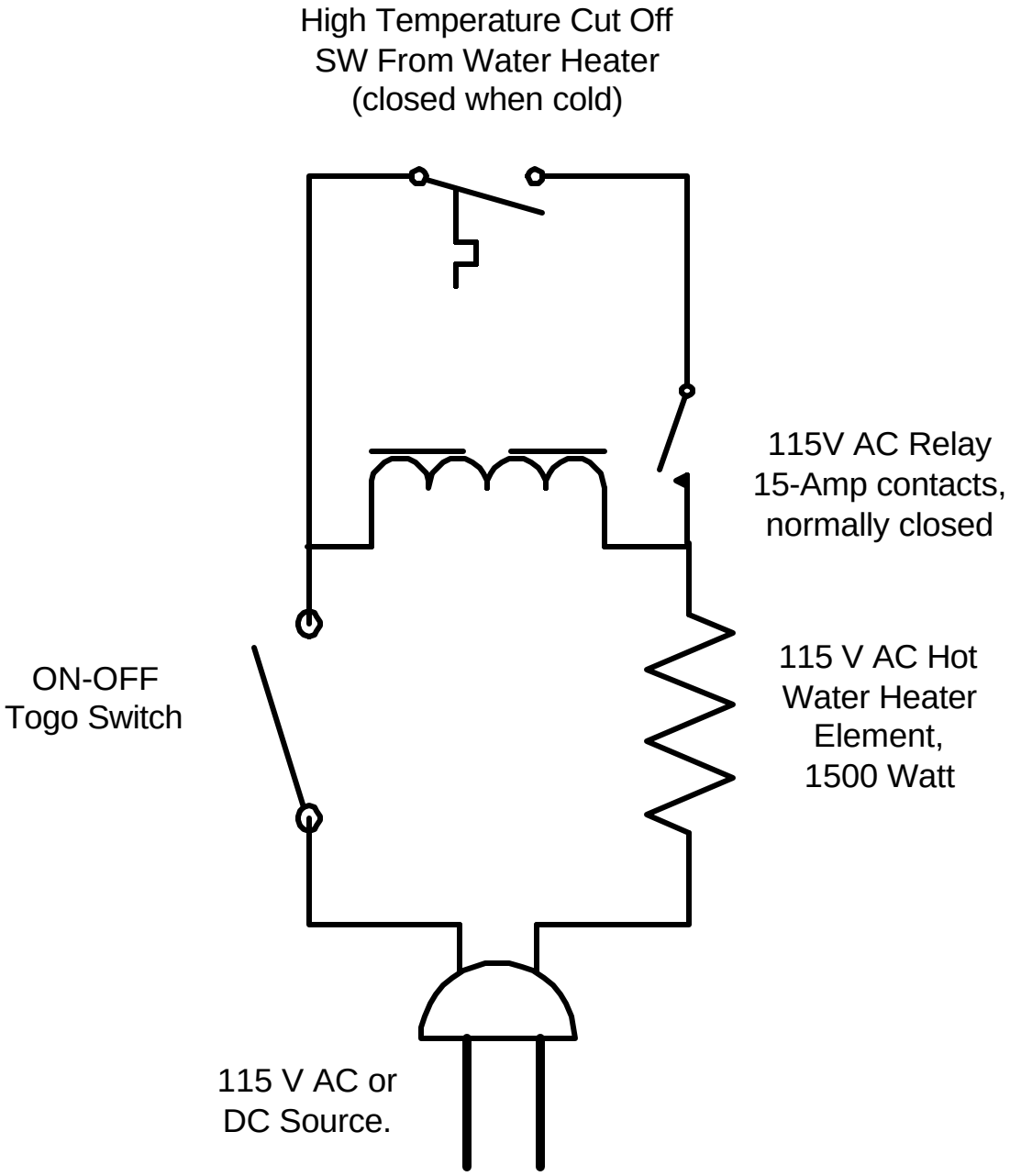
Construction and design notes: See circuit diagram and picture.
http://home1.gte.net/mikelob/Jpole-6.jpg

See http://home1.gte.net/mikelob/J-Pole-Wiring.gif for wiring diagram of the electrical heat source and its automatic turn off circuitry.

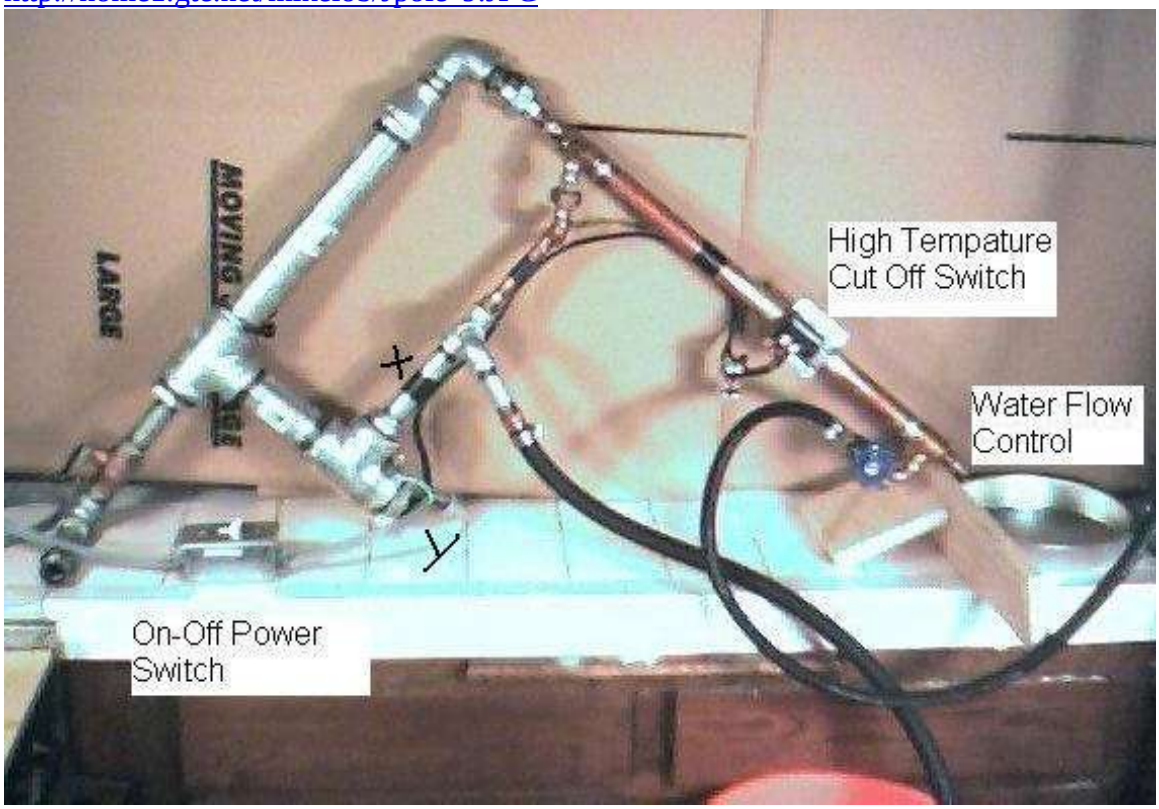
J-Pole Wiring for Electrical Heat Source



If the cooling flow stops then the temperature switch will turn off the current flow to the heater element. If the water flow stops totally then about 40 sec latter the 150 degree F

temperature switch opens and shuts off the current to the heater element. The inline relay will keep the unit turned off until reset by togging the on-off switch. Looking at the circuit above when the temperature switch is opened then voltage is applied to the coil of the solenoid that then causes it to open circuit the current flow to the heater element.

It is interesting to note that during operation the water level in the boiler area is about 1 inch lower than during non-operation. This is due to a back pressure in the steam that builds up due to the smaller .5 inch copper heat exchanger output pipe. One should adjust the length of the pipe at "X" or block up (with wood or a brick) the right end of the unit up until the water level is well above the heater filament when in operation. See http://home1.gte.net/mikelob/Jpole-9.JPG



The 1500 Watt filament screws in from the end at "Y" and extend most of the way along the 1.5" pipe. The blue gate valve "water flow control" is used to adjust the cooling water flow so that the lower end of the heat exchanger does not get warm to the touch during operation. This is normal about a quarter of a turn open from closed. The temperature of the lower end of the heat exchanger just above the gate valve is felt with ones hands at regular intervals until a good adjustment is arrived at for the cooling water flow.

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Heat exchanger construction one end shown see http://home1.gte.net/mikelob/JFpole-7.jpg

The heat exchanger is made up of two pipes one on the inside of the other. Steam flows down the center .5 inch inner pipe being cooled by water held around this by a 1 inch outer pipe. The end caps are 1" x .5" x .5" copper "T" fittings with the ridge filed off on the inside so the .5 inch pipe slips completely through it. The 1 inch pipe is 20 inches long and the .5 inch is 25 inches long. This or longer will work fine.

For construction of the steam or vapor separator see http://home1.gte.net/mikelob/Jpole-16.jpg and http://home1.gte.net/mikelob/Jpole-15.jpg.

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This sheet metal tube is made to fit the inside of the 1.5” x 1.5” x 1.5” T. It has holes at the lower (closer to the ground) end so that water can enter the boiler chamber. It does not have holes at the other (upper) end so that any steam that is made from the electric filament will rise up and travel along the 45 degree 1.5” pipe and turn the 90 degree corner and separate as steam in the longer pipe. The second picture shows the sheet metal steam directing tube, with the 1.5 inch by 1inch reducing bushing and the heater element fully installed.

Bumper guard see http://home1.gte.net/mikelob/Jpole-17.jpg

This is what the heater element fully installed looks like and with a wood strip held on with a hose clamp for bump protection. The ground wire is put under the hose clamp to ground the pipe assembly.

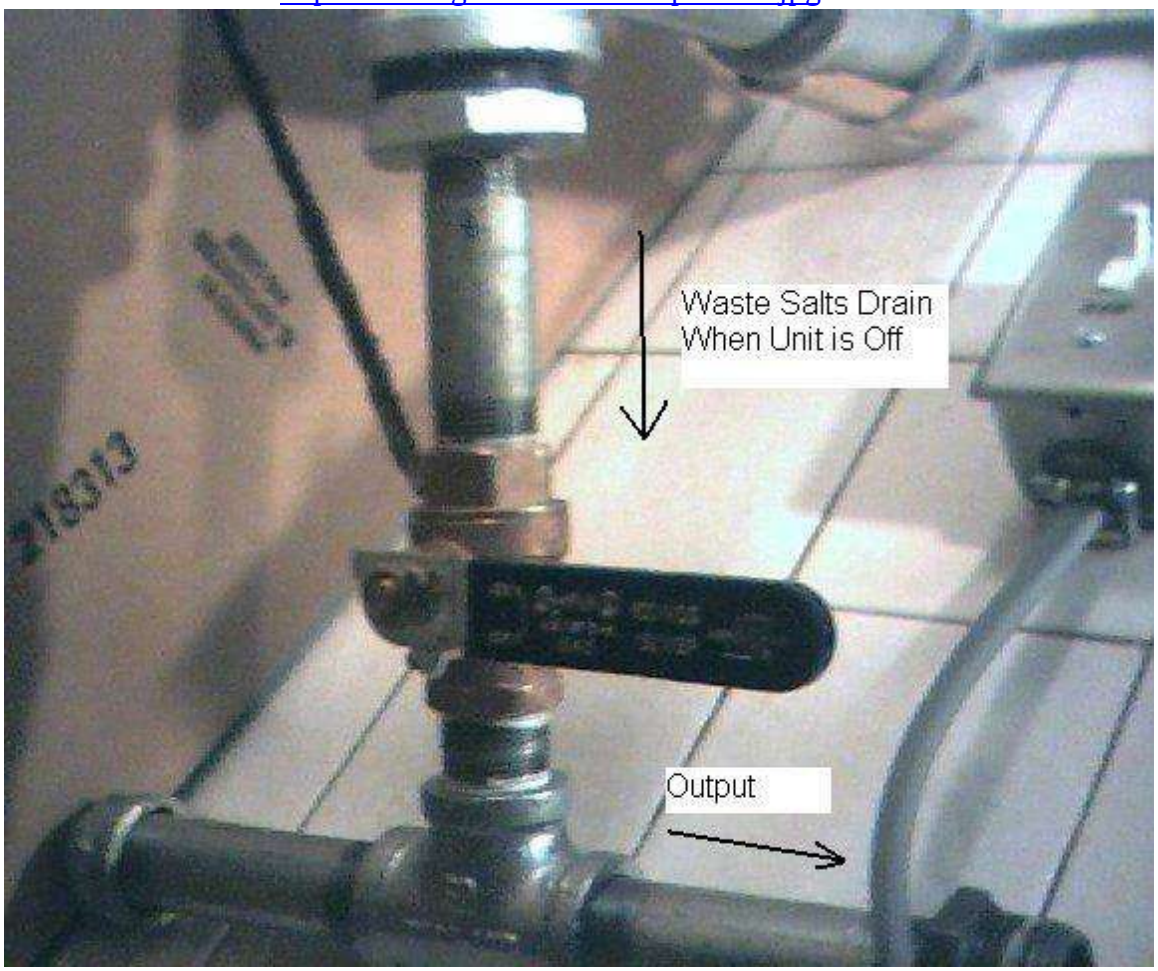
Construction of water-steam separator see http://home1.gte.net/mikelob/Jpole-14.jpg

During the construction process cut in half a heavy duty stainless steel scouring pad (the coarser the better) and stuff this into the end of the steam 1.5" pipe at the reducing

coupler end (top). In operation this helps separate the water from the steam. Sometimes large bubbles of steam can form in the water and this causes a surge of both water and steam up the 12 inch 1.5" stand pipe. If this surge happens to make it to the top of the pipe the stainless steel scouring pad will keep the salt rich water from entering the heat exchanger.

When smaller diameter pipes are used (for the steam separator pipe) or high amounts of input heat are used the surging of water and steam mixture tends to become more of a problem. Also, soap in the water can cause the same sort of problem. Bottom line adjust your pipe size and length and heat source to minimize surging effect.

Waste salts drain see http://home1.gte.net/mikelob/Jpole-18.jpg



This upside down "T" has two purposes. It helps hold the unit up and it allows salts to be drain off when the unit is turned off. Neither one are essential to operation. The unit designed for open fire use has a clean out plug at this point. The salts tend to deposit on the walls of the boiler tube with time. Frequency of cleaning will depend on the hardness of the water source.

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Use Teflon tape when assembling the threaded pipes. I don't recommend using pipe dope. This could harden too much and not allow easy disassembly (especially for the fire version). When assembling the pipes, tight only enough to not leak and to hold its shape while in use. During operation there is not much pressure built up inside to cause it to leak.

Parts list for the J-Sputter-Pole Electric Water Distiller: (from left to right)
Quantity -- Price - Description

Galvanized Steel
2 -- $1.19 - .75" x 4" steel pipe nipple
1 -- $0.99 - .75" end cap
1 -- $1.26 - .75" Tee
2 -- $0.84 - .75" x 1.5" steel pipe nipple
1 -- $4.99 - .75" x .75" brass ball valve
1 -- $1.19 - .75" x 4" steel pipe nipple
2 -- $2.56 - 1.5" x .75" steel reducing bushing
2 -- $3.98 - 1.5" x 1.5" x 1.5" Tee
1 -- $5.47 - 1.5" x 12" steel pipe nipple
1 -- $2.56 - 1.5" x .75" reducer coupling
1 -- $0.99 - .75" 90 degree elbow
1 -- $0.85 - .75" x .50" reducing bushing
1 -- $0.48 - .50" x 1" steel pipe nipple
1 -- $2.98 - .50" union
1 -- $2.76 - 1.5" x 5" steel pipe nipple
1 -- $2.56 - 1.5" x 1" reducer coupling
1 -- $1.38 - .75" x 5" steel pipe nipple
1 -- $1.78 - .75" x .5" x .5" Reducing Tee
1 -- $0.98 - .5" 90 degree street elbow

Copper:
3 -- $0.59 - .5" adapter mail thread and sweat fitting
1 -- $0.06 - .5" x 1" pipe
1 -- $0.35 - .5" x 3.75" pipe
1 -- $0.44 - .5" Tee
3 -- $0.05 - .5" x .75" pipe
2 -- $0.25 - .5" 90 degree elbow
1 -- $0.08 - .5" x 1.25" pipe
1 -- $2.79 - .5" union
1 -- $0.49 - .5" 90 degree street elbow
2 -- $3.94 - 1" x .5" x .5" Reducing Tee (get from a professional pipe supply house)
1 -- $2.80 - 1" x 20" pipe (L-Blue Type $16.48/10 ft)
1 -- $1.55 - .5" x 25" pipe (L-Blue Type $7.48/10 ft)
1 -- $0.42 - 1" x 3" pipe slit length wise and flatten into a copper plate for mounting hot water heater maximum temperature SW
1 -- $4.49 - .5" x .5" Gate Valve

1 -- $1.79 - 3/8” x 3/8” Brass hose Barb and pipe adapter
1 -- $0.19 - .5” x 3” pipe

Electrical:
1 -- $8.50 - Relay SPDT 110 Volt AC 275 0217 Radio shack, contacts normal closed with no current wired in parallel to get 20 amp rating.
1 -- $7.97 - Water Heater Thermostat – Lower – goes up to 150 degree F
1 -- $7.97 - Screw-in Water Heater Element 1500 W – 120 V
1 -- $7.17 - Number 14 gauge wire 6 ft extension cord with ground wire.
1 -- $0.79 - Electrical box metal
1 -- $0.39 - Box cover
1 -- $0.78 - Light Switch single pole single throw
2 -- $0.25 - Wire to box 3/8” clamp connectors

Miscellaneous:
1 -- $2.50 - 3/8” x 5 ft rubber air hose used to supply water from bucket
1 -- $3.50 - 5/8” x 3 ft to 5 ft heater hose from car or garden hose
3 -- $0.69 - SS Hose clamps
1 -- $1.79 - 3/8” x 1/4” Brass hose Barb and pipe adapter (bucket feed through)
2 -- $0.12 - .5” washers (one for each side of the bucket)
1 -- $0.69 - .25” x .25” coupling (nut that holds the washers in place)
2 -- $3.98 - 5 Gallon plastic bucket.

Total cost of this approach is about $127.00.
