Part 12: Tesla Electrolysis

(It's in the SPIN)

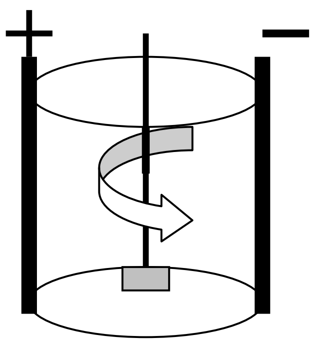
by Thomas C. Kramer May 2004

This chapter is dedicated to Nicola Tesla out of my deepest respect for the accomplishments of this man and his impact on our modern way of life. His Tesla Pump design is the underlying concept of this form of electrolysis, that is, the use of closely spaced rotating charged disks.

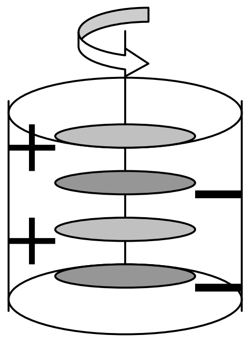
Credit should also be attributed to Faraday and his homopolar generators, Victor Schauberger for his vortex theories and Thompson (US patent 1,701,346) and Hoover (US patent 3,119,759) for their work in hydrodynamic electrolysis, and even Archie Blue (covered in an earlier chapter) for his fundamental design.

Hydrodynamic Electrolysis

Hydrodynamic electrolysis in its simplest form is just spinning the electrodes OR the electrolyte solution in the electrolysis chamber in order to disturb the gas vapor layers that build up on the electrode surfaces. Simply, it is a better way of shaking the bubbles off the electrodes using centrifugal force (spin or vortex movements).



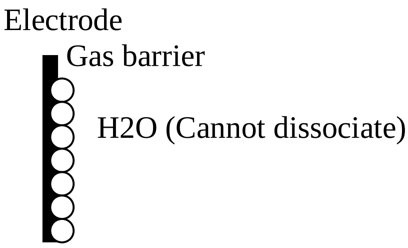
Stationary Electrodes



Rotating Electrodes

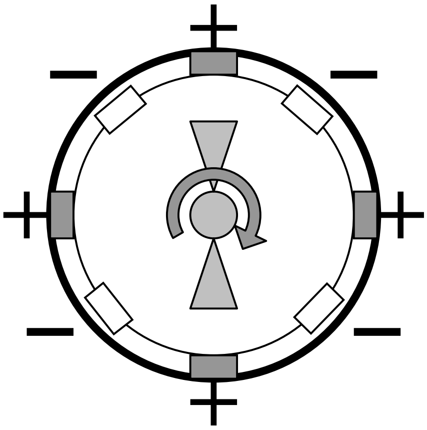
Either design will work to increase the efficiency of normal or advanced forms of electrolysis. The amount of increase in efficiency is proportional to the rate of spin with a steep rise up to about 50 G's (50 times gravity) and then only marginal increases thereafter. Even a slow spin will give you significant increases in efficiency as any movement of the electrolyte or water across the electrode surfaces will better strip the bubbles off the surfaces.

The biggest problem with normal electrolysis is the development of a vapor or gas layer that forms on the surface of the electrodes. This blocks and insulates the electrodes from the water so that further dissociation of the water molecules cannot occur. Shaking, tapping or stirring disturbs this gas layer and allows more water to be dissociated as a result. This process is what we are describing in this chapter.



One of the easiest ways is just to spin the water using a small motor and a paddle stirrer. This will create a vortex thus for maximum efficiency you should use a tube cylinder and place your electrodes flush with the inside of the cylinder.

Note that multiple electrodes can be used.



Vortex Effects

An interesting thing happens when you create a vortex in water. Recommended is that you take a glass of water and stir it with a spoon to create a vortex tube. Look carefully at what is taking place in the funnel of the vortex. The faster you spin the water the deeper the tube that forms and water raises in the glass. But look closely at the tube. It isn't smooth. It forms rills or wave lines.

What is happening is, as you spin the water, it forms 'strings' or chains of water molecules. The water molecules align themselves in a polarized manner, head to tail, as they are now all traveling in the same relative direction.

These ‘stings’ of molecules act like wires in a dynamo or generator as they can transmit electricity because of their polarized form. This is the fundamental basis of Dr. Oleg Gritskevich’s **hydro-magnetic dynamos (HMD’s)** and has been successfully used to generate megawatts of power using the same simple multi-electrode approach shown above. In fact, Dr. Gritskevich was originally experimenting with advanced electrolysis but found that his design worked better as a dynamo to produce power than to increase the efficiency of electrolysis. This is an “Oops” that will change world power production in the near future, but it isn’t too practical to use in a car.

But back to electrolysis, the spinning of water or an electrolyte in a cylinder (or toroid) will strip gases off the surface of the electrodes. The gas, being lighter than the water, will rise and migrate to the center vortex as a result of centripetal forces (inward movement) where it can be easily removed.

The rotational movement of the water can be created either by mechanical stirring or by pumping the water into the chamber at a tangent (90 degrees to the center). You can also use electromagnets to spin the water (without a stirrer), but that is for the more advanced practitioners. (See me after class for this explanation)

Because the water is forming polarized strings, the water molecules are not only knocking the gases off the electrodes, but are providing charged heads and tails to the cathodes and anodes as the charged strings pass by. This creates an increased opportunistic situation for increasing the efficiency of electrolysis.

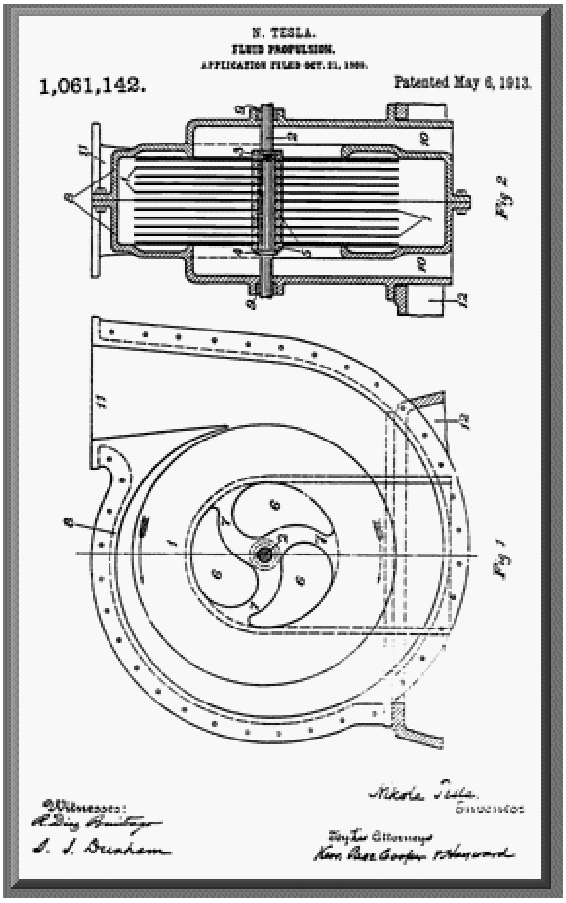
The problem with a cylindrical vortex system is that you have limited space for electrodes around the inside perimeter of the cylinder. This limits the surface area of the electrodes and thus the reactive potential of a particular unit. Large diameter cylinders are not practical for a car, but multiple smaller units may produce enough gas to be practical. This will take some experimentation to justify this approach though.

You could also place some electrodes in the electrolyte flow but these will result in deflection currents and eddies thus disrupting the smooth chain linking of the water molecules. Aerodynamic designed vanes for electrodes would help but disturbances would still occur.

But there is a better way….

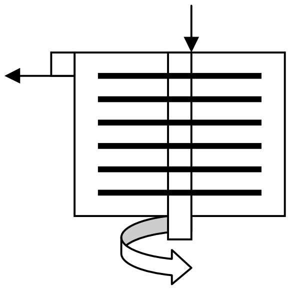
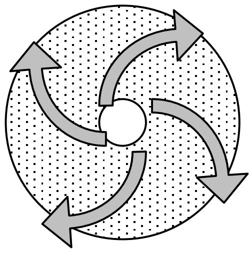
The Tesla Pump Electrolyzer

For those of you not familiar with Tesla's Pump, this is a unique 'bladeless' pump that operates using closely matched circular plates. Water comes in from the center of the plates and their spin causes the water to be centrifugally thrown to the outer edges of the plates thus causing a higher pressure and a pumping action. No impellers needed. Just flat disks. His patent is US Patent No. 1,061,206 (1913).



Tesla Pump

The Tesla Pump operates by sucking liquid in through the center of the plates and then the spinning plates force the liquid to the outside thus creating a pumping action. Many of these bladeless pumps have been produced over the years, but they have never been brought into large scale manufacturing, primarily due to a lack of engineering knowledge and the reliance on old blade or cup techniques for pumps.

The drawings above are simplified graphics that show basically what happens in a Tesla Pump. For more detail, do a web search and you can find detailed drawings and people who are actually building these bladeless pumps!

But I'm not so interested in using this technique as a pump. My interest is to use these spinning disks as **electrodes!**

To do this requires altering the charges on the plates, like in an Archie Blue reactor (positive-negative-positive-negative, etc.). This creates alternatively charged surfaces on which electrolysis can occur using various voltages, currents, pulse rates, frequencies and so on.

The fact that the electrode plates are spinning is what adds efficiency to whatever electrolysis process is used. It is the increase in efficiency that we are after, right!?

Now the advantages of this approach are:

(1) you can stack up a whole bunch of plates in a small area (large electrode surface area),

(2) you can use just about any electrolysis technique,

(3) you are assured of increased efficiency because of water or electrolyte movement over the electrode surfaces, and

(4) you get a ready-made pump to circulate your water/electrolyte from your storage tank to the reactor.

These are significant benefits as they have the potential for increasing the efficiency of the overall system just by some simple design changes.

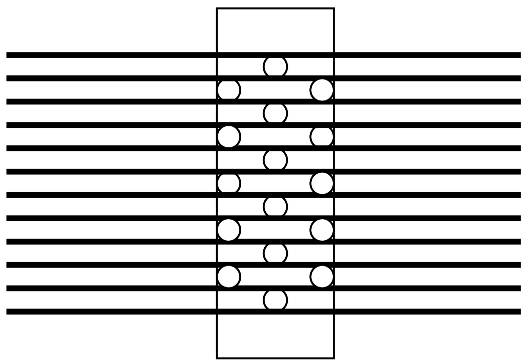
How to Make a Tesla Electrolyzer

The construction of a Tesla Electrolyzer is much the same as an Archie Blue unit, except I wouldn't use old tin can lids. Round and flat metal plates of the same or different metals will actually work the best. But if you are on the cheap, use old CD's that you glue foil onto both sides. (Use your wife's rolling pin to get the bubbles out, then sand off the glue before she finds out and uses it on you!) Hey, I got such a deal on old 5 ¼" floppy disks, if anyone is interested. I got a few crashed hard disk drives too!

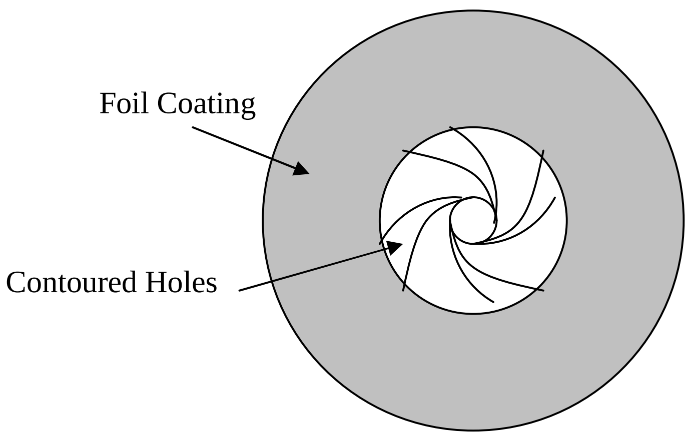
Tesla mounted his plates on a central shaft and cut holes in the plates near the shaft that allowed the water to be drawn down into the plates. Such holes have to be fairly large like the holes on the sports rims of a hot car. Shaping then in curves also helps to direct the water between the plates.

Alternatively you can use a hollow shaft and drill holes at equal distances so that the water will be forced out of the holes that are aligned with the gaps between each plate.

The plates are then stacked with plastic or other non-conducting spacers between them.



Our try it with old CD's:



You can try different foils on your CD's (aluminum, tin, stainless steel, copper, lead, etc,) and if you have access to electroplating equipment a gold, silver, chrome or nickel coating over most other metals would also work fine. There are plenty of plating shops around and even cheap jewelry manufacturers have electro-plating equipment.

Now comes a tricky part. The plates have to be pretty close together for maximum effect. This means that you don't have much room for wiring. And you will have to wire both the top and bottom sides of the disks if you are not using solid metal disks.

If you are using a solid or hollow metal shaft for spinning the disks, this can be used as your negative or 'ground' lead. This can connect directly to every alternate disk just with either a tight fit contact or a bit of solder to the shaft.

The positive electrode contacts are a bit more difficult as these have to be insulated from the main shaft using non-conductive materials AND be wired to a positive voltage lead. Insulating rings can be used that slip over the shaft but these must also be glued to the shaft and disk to prevent slippage. This will also require you drill out a bigger center hole on your positive plates to accommodate these insulating bushings. Plastic washers may also be suitable as these can also be used as spacers.

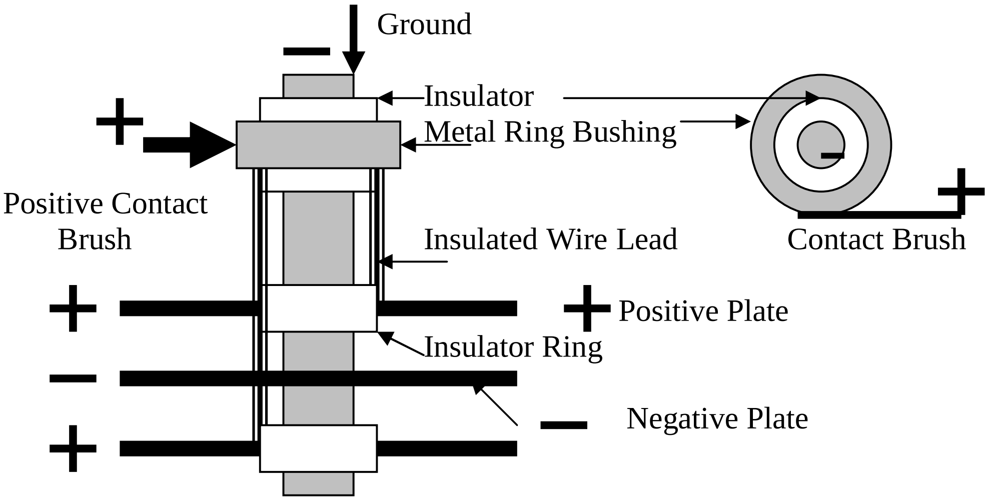
You will also have to have a positive contact point. This can be done by placing a non-conductive sleeve over one end of the shaft and then overlaying a metal bushing over the sleeve and gluing it in place with a bit of epoxy or silicone. Then you will have to run an insulated wire down the side (or inside) of the shaft and splice into this lead at each positive plate. Each splice point will have to be re-insulated with a dab of silicone too.

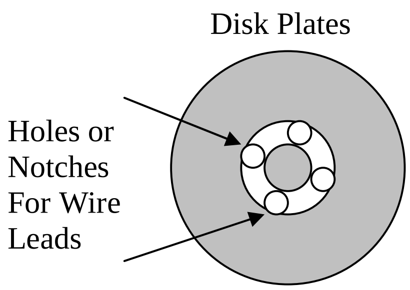
Running a wire down the shaft will require you to either drill a hole in the plates or notch them next to the shaft so that the insulated wire can pass through to the next plate.

Also, for balance, you may wish to use several wire leads in order to eliminate some vibrations, as well as, to spread the charge more evenly over the spinning disks.

Multiple positive leads can also be used to 'pulse' the field by simply splitting the ring bushing into several fields or by using an old distributor cap and armature to 'spark' individual disks or portions of each positive disk.

Wiring Diagram for Plates





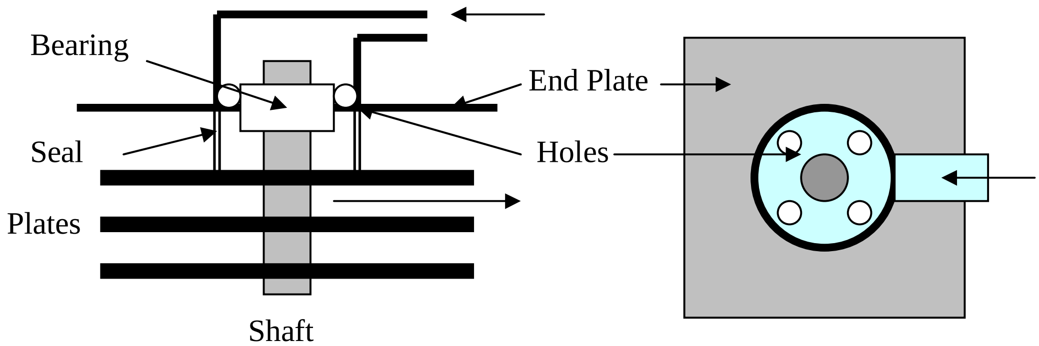
The distance between the plates is a variable that is dependant more on the speed of rotation of the plates. The faster the speed will require slightly more separation. Thus to optimize any particular gap setting it would be wise to use a variable speed motor (i.e., a 12 volt DC motor with a pot to control rpm's).

The gap between your plates should be wide enough to allow for both the electrolyte and the bubbles to be flushed from the center intake to the edges of the disk. This is fixed during construction and stacking by using plastic washers or other insulators of the same size between each plate. I would estimate that 1-2 mm (1/4 inch) should be sufficient for slow speed units, but this gap may be increased for higher speed drives (those scavenged from old hard drives or CD players (?!)). This is something that you will have to play around with based on your own disk sizes, rotation speeds and the motor you use.

When the unit is used as a pump, you will have to construct it so that the intake is sealed from the outflow. This doesn't have to be a hard leak-proof seal because the suction caused by the spinning disks will draw the electrolyte through the intake.

But since you don't want the pressurized water to circulate just in the chamber, you will have to create a loop system from your electrolyte tank to the reactor. This causes another adjustment problem in that the placement of the electrolyte tank may be critical. Too high up and you get good gravity feed to the chamber, but the pumping action must be greater. Too low and the suction must be higher. This is all determined by the effectiveness of the Tesla Pump that you construct. Again, this is a result of disk spacing, rotational speed and other factors, such as the shape of the chamber, and so on.

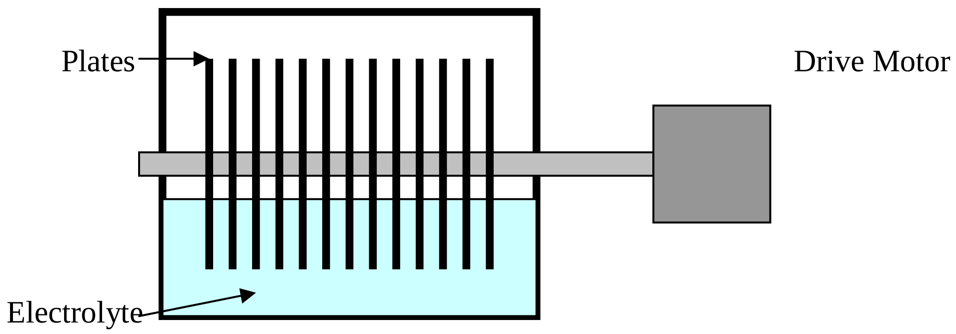
Intake Feed Diagram



Sideways

Shown above is a vertical shaft arrangement when used as a pump electrolysis unit. The same thing can be arranged horizontally with all or only a portion of the disks submerged in the electrolyte solution. This is more of a 'splash-and-dash' alignment but may be easier to initially implement and experiment with.

Horizontal Mounting



Horizontal construction allows for closer placement of the disks due to the fact that a portion of the disks will be out of the water during part of their revolution, thus creating an easier escape of the gases formed. This will still create a thin film of electrolyte being flung off in the portion above the waterline, and thus you would also expect to create more water vapor in this approach. That is quite all right if you are burning the gases and vapor in an engine. It gives you better combustion and some steam expansion.

Getting the Gas Out

This horizontal approach is also easier to get the gas out. It just rises to the top of the chamber and can be either fed directly into the engine or through a bubbler to a gas buffer cylinder and then to the engine. Pressure gauges will show gas production.

Using the Tesla Pump configuration, however, requires a gas separation chamber to be added to the setup. Simply, the flow of the electrolyte over the plates scavenges the gases produced and pushes them out with the outflow of the pump. This outflow then must go into a separate tank that will allow the gases to naturally separate out of solution.

A gas separation tank is usually a short column (a piece of 8” PVC pipe) that may be partially filled with marbles or other inert material that acts to increase the surface area of the inside of the tank so that the gas can be more easily separated.

The top of the column is a cone to collect the gases and may have a pressure gauge and valve mechanism, and recommended, a pressure relief valve.

The bottom is another cone for the collection of the water electrolyte to be returned to the electrolyte tank, usually via a gravity feed or via a small water pump if the pressure from the Tesla Pump is not enough.

For a watercar it is not necessary to separate the gases or water vapor as these can be fed directly into the engine, however, you should have a small bubbler on the line just to prevent flashbacks.

A small gas buffer tank is also recommended to compensate for throttle variations. This can be the gas separation tank if it is made a bit larger, or a separate tank. If a separate tank is used, then make sure that you have a bottom drain, as some of the water vapor is sure to condense in the tank over time and will have to be manually drained off. This is not a problem with a separation tank as the water/electrolyte flows back to the water storage tank for re-circulation.

Heat Release

Hydro-dynamic electrolysis enhances heat-to-mass transfer. Simply, the electrolyte will heat up as a result of the water dissociation and movement (friction) over the plates.

This is not much of a problem as you can use finned tubing in the loop between the pump or reaction chamber and the water/electrolyte tank and back to the pump/chamber. Such tubing will act as a radiator to keep the system cool.

Fancy designs may incorporate small radiators in the electrolyte and even gas lines. If placed on the gas line, however, it may cause water vapor condensation and that will reduce the efficiency of the engine.

Electrode Corrosion

Electrode plates can be made from various materials noted above, however, because electrolysis, friction, heat and corrosive electrolyte solutions involved, it may be best to use non-corrosive metals when possible. Stainless steel or nickel coated metals should work the best.

This does not mean that you should not experiment with other combinations or intentionally use metals that will degrade over time (and thus create a nice replacement industry and jobs for mechanics). In fact, using aluminum or magnesium disks may be a reasonable alternative for a replacement market design ("Hey Mac, ya need to change yer disk pack!")

If you are using degradable disks, you will also face a problem of sediment build-up in your reaction chamber and electrolyte tank. Design these with flush valves.

Degradable disks will also cause a balancing problem as they degrade. This is not too much of a problem with foil coatings over plastic disks, but it can be a major problem with solid disks when surfaces deteriorate to the point of breaking off bits and pieces.

Degradable disk systems should thus use slower revolution speeds and thus will yield less pumping action.

Electrode Design Alternatives:

Electrodes do not have to be just flat plates or disks. You might want to try pancake wire spirals, spiral brush designs, grooved spiral plates, wire brushes (like those used on electric drills), or many other designs that may result in a higher surface contact area.

With brush designs you can also try just charging the central brush shaft positive (+) and then use a stainless steel outer cylinder charged negative (-). The gap between the metal brush ends and the outside cylinder is a bit more critical in this design and it may be a bit more difficult to pump the electrolyte through the brushes.

The point here is that you can make a number of different electrode designs under this ‘spinning electrode’ concept, so don’t get stuck-in-a-rut (unless you are intentionally ‘rutting!”)

Charging the Electrode Plates

Here you can also have a lot of fun and miles of leeway. As mentioned above, any charging system will do.

One of the simplest systems is to just use a 12 volt battery feed. If you want more volts, connect this to a car coil.

If you want a frequency or resonance cell, plunk in a pulse circuit or frequency generator (note that a coil generates high frequencies).

If you want a spinning plasma gas system, well, you will have to design that one yourself, but it can be done. (Refer to the chapter on plasma reactors.)

Simply, a spinning electrode system should in most cases be compatible with just about any charging system. I would start with simple systems first though.

Testing Your Invention

Testing the efficiency of your creation is quite easy. Use the old “bubbler-over-time test” to test gas production of your unit first as a stationary unit and then as a spinning unit at various rates of revolution. Record and graph your results. It is that simple.

Then post your results to the Internet! We all want to know! OK!

Conclusions:

Spinning electrodes will increase gas production primarily because of the disturbance to the gas vapor barrier that forms on electrode surfaces. This is a friction process that will result in some heat exchange, which can improve electrolyte efficiency to a certain degree.

Spinning system designs thus should lead to higher efficiencies of electrolysis. This will result in marginal increases only over whatever system of water dissociation that is being used, but a few percentage points increase is measured in more gas production, which is the objective of a hydrogen-on-demand water powered vehicle. Happy experimenting!