A Car that Runs on Water Alone:

In July 2005, an American mechanic released the details of his simple conversion system which allows an ordinary car to use water as the only fuel. The details are as follows:

The car, which he runs on a daily basis, is a restored, eight-cylinder 1978 Chevy 'Camaro' with stock 350 (5.7 litre) engine, no computer controls, automatic transmission, stock 4-barrel carburettor and stock fuel pump. The fuel tank has been replaced with a metal water tank with the filler cap vented to release heat and pressure. The exhaust was replaced with a new 2 inch pipe which is ducted into the water tank. The water tank has baffles inside it which also muffles the exhaust noise. The stock exhaust manifolds were used, but they will rust on the inside - custom stainless steel pipes would be best but these were not used due to their cost.
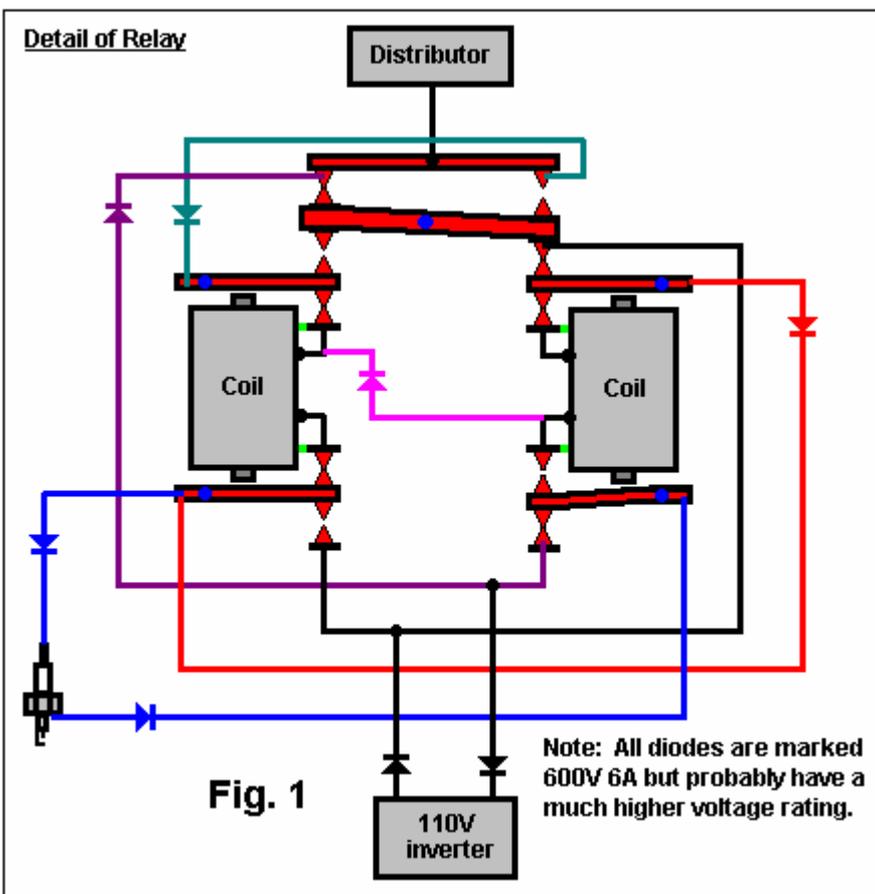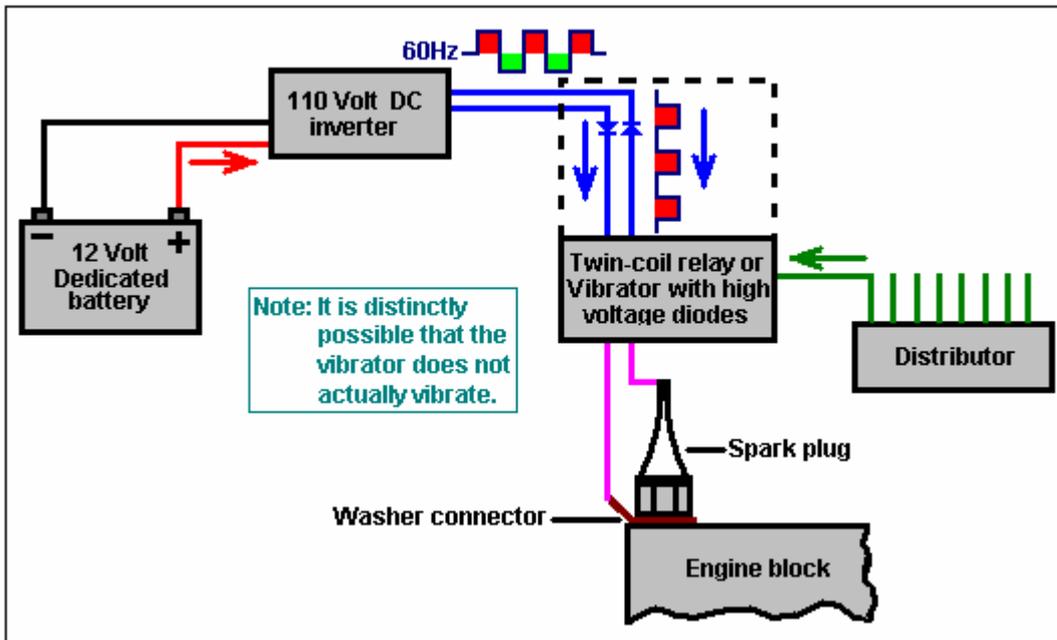
All of the stock ignition system is used and no changes have been made. A second battery was placed on the opposite side in the engine compartment. A 400 watt (800W peak) 110 volt 60Hz DC inverter was placed in the engine compartment on the passenger side and a fresh air duct located behind the grill directs air into covers placed around the inverter to keep it cool.
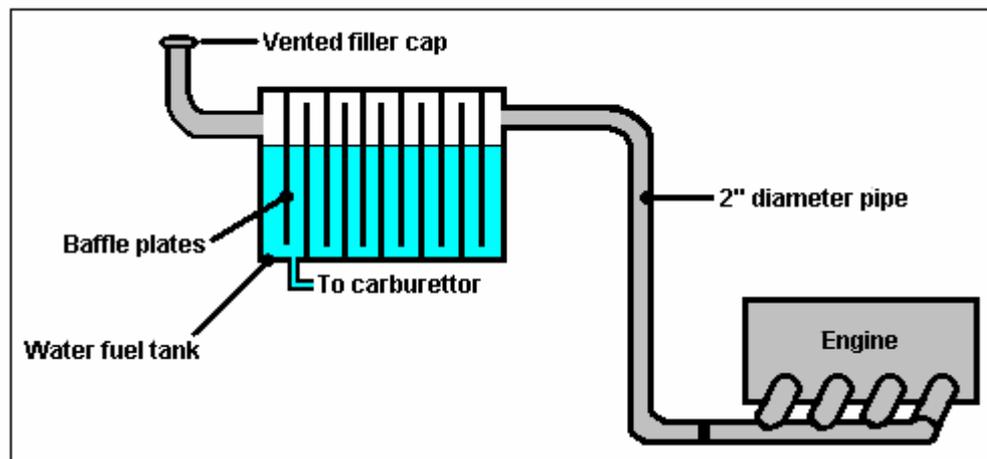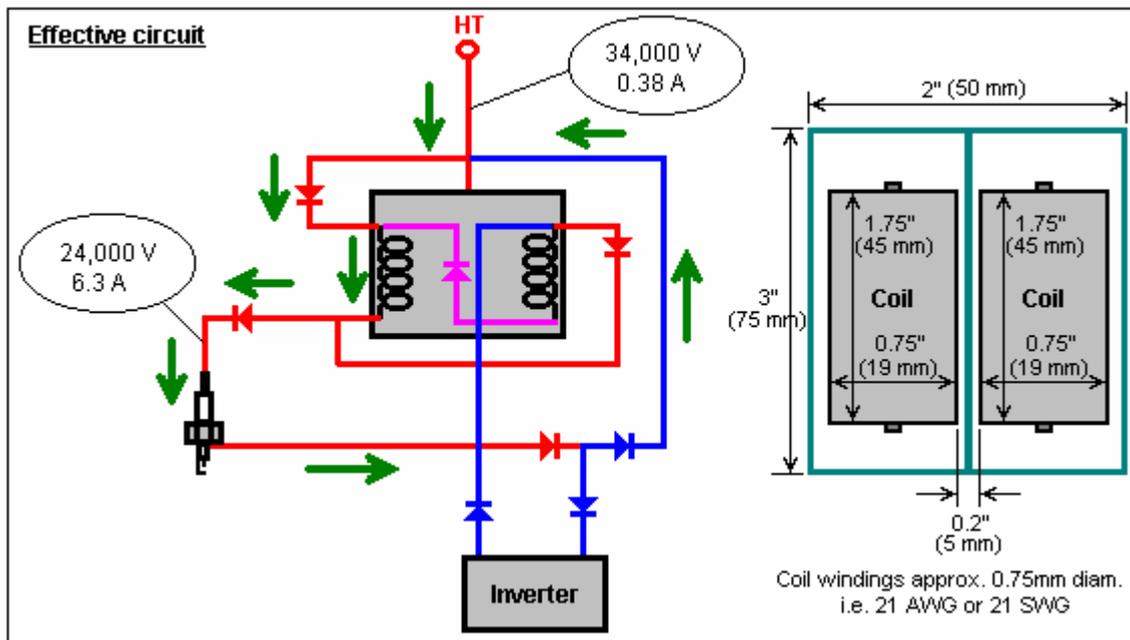
When the ignition switch is on, a relay turns the inverter on, the relay lead contains a 20 amp in-line fuse. This relay only turns the inverter on and off and has no other function. The inverter is connected to the battery via a positive wire and a negative wire (not the chassis). The inverter is not grounded to the car at any point and instead, is carefully insulated to ensure that accidental grounding never occurs.

The wire which would normally go to the spark plug is replaced by a wire which is taken to a box containing one pre-war mechanical twin-coil relay or vibrator per cylinder. Each of these wires drives its own dedicated 'relay', the current energises the relay coil but the other side of the relay coil is left unconnected. The wiring arrangement is shown in the diagrams below.

It is important that the electrical feed to each plug is fed via one wire to the plug cap and a second wire connecting to a washer clamped under the spark plug. This wiring is repeated for each of the spark plugs. To emphasise this, each spark plug should have two wires running to it, one to the cap and one to the washer clamped between the body of the spark plug and the engine block.   The wiring is done with "12-2" wire which is 2-core solid copper wire American Wire Gauge size 12 which has core diameters of 2.05 mm giving 3.31 sq. mm. per core, the nearest SWG size is 14.   The under-plug washer can be made by bending the end of the solid core into a circle of appropriate size and then flattening the wire slightly.

In the relay box, the relays are positioned with a one-inch gap between them. It is important that the physical construction insures that all of the high-voltage connections are fully insulated should anyone open the relay box when the inverter is running. The batteries used are deep-cycle types with high cranking current ratings – this is important because the inverter must stay on when the engine is being started and it will cut out if the starter motor current drain pulls the battery voltage down excessively. The alternator is the stock 95 Amp type and it charges both batteries simultaneously. When the engine is started, the relays are heard clicking until the cylinders fire and after that, no sound can be heard from the relays. It is distinctly possible that the relays take up a fixed, immobile position when the engine is running. The diagram below marked 'Effective circuit' is based on that assumption, and it should be stressed that all of the diagrams are only what I understand from the information provided to date.

60Hz

110 Volt DC inverter

12 Volt Dedicated battery

Note: It is distinctly possible that the vibrator does not actually vibrate.

Twin-coil relay or Vibrator with high voltage diodes

Distributor

Spark plug

Washer connector

Engine block

Detail of Relay

Distributor

Coil

Coil

Note: All diodes are marked 600V 6A but probably have a much higher voltage rating.

110V inverter

Fig. 1

The engine timing has to be retarded for the car to run off water. This adjustment should be made to the point where the engine runs the best and this is likely to be different for each make of engine. The Chevy 'Camaro' engine runs best with the timing retarded by 35°. The spark plug gap used to be 65 thou. but is now set to 80 thou. (0.08"). The plugs used are the cheap 'Autolite' (25) copper core type. Using carburettor jets two sizes larger than normal, allows the engine to produce more power and rev higher than tick-over.

The engine tends to knock when first started from cold but it is likely that this can be overcome by using a heater on the water feed to the carburettor, raising the water temperature to say, 120 degrees Fahrenheit and fitted with a thermostat to disconnect the heater when the engine reaches its normal operating temperature. This car has been run 30,000 miles on water alone and covers some 300 miles per gallon as much of the water vapour in the exhaust condenses in the water tank.

The disadvantages: the car runs with slightly reduced power and the exhaust system will rust unless stainless steel replacements are used.

The inventor of this conversion wants to go on living a quiet life and does not want the nuisance value of high levels of interest. Consequently, he wishes to remain anonymous. He says: "I didn't build this to sell or to get a patent on it, or make big bucks from the information. I did it because I could and I did. The only thing I can add is 'just try it'.

Some points of note:

A car with this modification produces NO carbon dioxide and NO carbon monoxide, but since air is mixed with the gas combustion, it is likely that the greenhouse gas Nitrous Oxide is produced. But Nitrous Oxide dissolves reasonably well in water, so since the exhaust gasses are passed through the header tank which contains the water fuel, it is likely that this engine arrangement is a good deal greener than most.

The vented filler cap arrangement will not suit many European car designs which have a locking flap covering the filler cap. For these cars, it would probably be better if the gas exiting from the water tank is passed through a normal exhaust pipe, and the filler cap be a screwed airtight fitting.

Excerpts from the Yahoo 'watercar' and 'egaspower' groups mail about this modification:

s1r9a9m9 (the inventor of the modification):
Hi, I'm new to the group and I think this might be of interest to the group. I tried to put this in the 'Files' section but it wouldn't accept it there, so I put it in the photos section under 's1r9a9m9'. There are 7 pages. You should be able to print off the pics with no problem. I built this car and still drive it. I will be around now and then to answer questions if I can.

s1r9a9m9:
With the right arc inside the engine cylinder, water will expand very quickly pushing the piston down with more force than gasoline can. This is not a steam reaction and the hydrogen does not have to explode to achieve the reaction needed. I did it with 110 volts at 20 amps per cylinder. I have placed some files in the photo section here.

Michael Price:
Are you saying that you have a water powered car?

s1r9a9m9:
Yes the car is driven daily and I have had no problems so far. The egaspower group has the pages in the files section. Their link is in the 'Links' section here. There are other posts on that group about the way that I changed the car over.

awrj2000:
Some questions:

1) In diagram 5 you left out the ignition coil, it shows 110V ac going to the plug, in the text you mention using the coil.

110V ac on a Bosch Platinum + 4 Plug does nothing. However connecting the 110V ac through the coil creates a nice plasma flame for about 1 second on the plug. My inverter has a ground fault system that shuts it down. (750W Continuous, 1500W Peak, Modified Sign Wave, Creator: Vector, Purchase: Wal-Mart Automotive Section $80.00).

Pushing 110V AC on a 12V DC Pulse automotive ignition coil causes some problems:
1) Heat- Running for long periods of time will cause the coil to melt and be destroyed.
2) Arc-Over- If your spark plug dies, becomes open, then you will be shorting the high voltage at the top of the ignition coil to ground, Path of least resistance.

Voltage Estimate:
12v through coil = 1000 to 1500v out varies with coils
120v through coil = 10,000 to 15,000v out

Again Estimate

2)Ground only at base of Spark Plug???

Spark plug is metal. This metal threads into metal engine. Entire engine is now grounded. Engine has a large ground wire that connects to the body of the car. Entire car is now grounded with the 110v wire.

In AC you have Power wire (Black), Grounding wire (White), Grounded wire (Green)

You must be using the Grounding (White) and Power (Black) wire. This shows the need to keep the Inverter Isolated from the rest of the car.

Keep in mind I have NOT run a car by this method, just trying to figure out some details.

Max. RPM:
Note: this is one cylinder of the 8 cylinder engine.

500 RPM Idle (8 RPS) 8 Hz well within the 60 Hz ac – Strong plasma arc.

3600 RMP (60 RPS) 60 Hz just enough that if the ac is in sync. with the timing then it will work.(weak plasma arc)

Anything above this and the Coil will not energise and to create the plasma. How does a car do it then?? Cars use the distributor: Faster it spins the higher the Hz. In this the distributor is used to pulse the constant 60Hz AC.

Theory of operation:
Plasma can separate H20 – I've seen a patent on it but don't remember the number. The HV Plasma Arc separates and burns in one process. End result is water out of the tailpipe.

Why not change the rotor over to 12v dc, then use 12v dc relay? It seems it would work better if you have 1 coil for each spark plug – ignition coil would stay cooler. (Auto Zone cheap coil: $10.00).

My inverter Draws little under 90 AMPS (3 x 30 amp fuses) at max. load - spark to ground is 0 resistance and therefore Max. load. 90 Amp alternator would barely keep up.

Again: Keep in mind I have NOT run a car by this method, just trying to figure out some details.

s1r9a9m9:
Oh the confusion: The coil is in the top of the distributor cap as a stock Elcamio 350 engine has. Sorry - I left this out. The inverter does not put out full load at all times, it only uses what it needs, this is never the total of the power of one battery, the second battery is for the other stuff on the car but both are used in the whole system as needed.

Ah yes the cheap Auto Zone coil: put one on our jeep and cost $110.00 towing plus the $28.00 for the coil . If you're going to use a good coil use a MSD ? (MDS). These coils will give out a triple spark at 80,000 volts and 2.83 amps. These are killer coils and they make ignition modules for vehicle too. Buy cheap and stay cold - just buy the good stuff to start with.

The Bosch Platinum plugs have stranded about 50 people that have brought their cars to me to repair, I don't recommend these ether but maybe there is a good one out there somewhere. I am using cheap AC plugs in the water car and only replace them every two months , if needed.

I did tell Brad NOT to use the 110 on the auto coil it will blow up because it was designed for 12 volt use only. The coil fires the relays only. An earlier post suggested that it may be piggy-backing to the plug as well. I don't now about this, I don't have the equipment to chase the fire down.

Most automotive coils fire a voltage around 28,000 to 48,000 volts at 0.87 amps. Simple one this: call a parts dealer and ask the voltage on the coil for your vehicle and see what it is.

Crunching numbers is a way to tell some one how close to get when they are trying something new. BUT once they have got it to the point where it will run, the numbers will change a bit and slight changes made to make it run better. The numbers will change for each application. As with my car, the coil will put out 48,000 volts at 0.87 amps, BUT when in use it only puts out 35,000 volts at 0.85 amps.   The heat of the engine makes a difference as well and will increase or decrease the numbers.

Grounding at the base of the plug ends the 110 at the plug, it does not have to travel through the body to get to where it is needed and there is no static on the radio either. If you use the positive as ground you will short out the 12 volt system burning out all electrical wires in the vehicle.

I hope this helps some.

MastahScott:
Nice to be here and see everyone going in the right direction.   I do have a problem with the water car concept for

a few reasons:

One is because you keep saying that 110 volt gets finally grounded at the spark plug but this does not hook to ground - they are one and the same my friend. The engine block IS ground and the body and the battery. It is all tied together.

Two, because an engine that runs on water all the time would not last long. There are natural lubricants in gasoline which lubricate the valve guides and cylinders as well as other things like keeping the compression rings from sticking, etc. Those components would rust up without gas if you use water only. Heat would accelerate the process.

Patrick:
Mastahscott, Just a brief observation. What you say about the engine block being part of the vehicle's earth system is perfectly correct. However, while the 12V input side of the 110V inverter is grounded to that earth, the output (ac) side is floating free.

If you have two nine volt battery-powered radios and you connect the negative side of the two batteries together, it has no practical effect as no current flows along the wire. All you have achieved is to ensure that both radios have the same voltage (relative to the Earth) on their negative rails.

s1r9a9m9's design takes his floating 110V supply along two separate wires and attaches ONE side to the car's earth via the screw threads on the spark plug. This is irrelevant as far as the car's earth is concerned because the other side of the floating 110V is connected to the cap of the spark plug and NOWHERE else. This is exactly the same as connecting the two self-contained radios. No current from the 110V system flows through any part of the car's earth (even though one side IS connected to the engine block. The current flows along the two wires and through the spark plug, and nowhere else. No ac current flows through the engine block.

In my opinion, the major voltage pulse coming via the distributor, energises the relay coil, creating a major magnetic pulse/induced current, which rides along the pair of wires going to the spark plug, the 110V acting like a wave-guide for this energy, while at the same time, modulating it. It may well be that the magnetic pulse also picks up a whole bundle of extra energy (in the same way that Sweet's VTA magnetic device does and Tom Bearden's MEG does) and this helps to create the vital plasma discharge which splits the water droplets into the hydrogen/oxygen gas mix. But that is only my opinion - I can't prove it.

Surely the lubrication of the piston rings comes from the sump oil which the crankshaft splashes up on to the walls of the cylinders? In straight 4-stroke gasoline engines, is the lubrication of the valves wholly dependent on an additive in the fuel? I know that 2-strokes do that but aren't 4-strokes quite different?

Scotty:
Hello everyone. I have followed this forum for a couple of years now and finally find a plausible discussion of the way things work in reality. I'm no physicist or chemist just an old fashioned electronics field engineer. My expertise is primarily GHz work in satellite communications, but I have worked in nearly everything imaginable.

Patrick is exactly 100% correct in his description of what is happening in this circuit, as far as the grounds and imposing a modulating voltage etc. I won't even begin to comment on the less than main stream parts of science however. I subscribe to a philosophy that its all simpler than anyone imagines, in fact its likely simpler than anyone CAN imagine.

In automotive engines (not small lawn mower engines) the piston rings are lubricated by pressure feed oil from the crank through the connecting rod, through the wrist pin and through the piston to the under side of the rings. An alternative or duplicate route is that oil on the cylinders is scraped off by the top ring and gravity pulls it down through the lower rings. at running RPM this is more of a splash operation than anything else, its kinda hit and miss what rings get how much splash lubrication, hence the pressure oil feed systems.

Valves are lubricated through pressure-fed oil as well, both at the guides, and at the rocker arm ends. The old fuels which contained lead, lubricated the valve seat (as well as clogging it and the gas passages) and to a tiny degree lubricated the valve guides. With modern steel or stelite and sodium filled valves, temperatures are not so much of a problem as in the earlier days.

s1r9a9m9's work appears to be valid to me, enough so that I am going to begin collecting and ordering some parts and attempt to duplicate what he has arrived at. I will be using a 1986 GMC pickup truck with 350 CID crate motor with about 2k miles on it. Turbo 400 Auto Transmission and 4x4 drive-train. This set-up has a new aftermarket Rochester 4-barrel carb and a stock GM HEI distributor. The set-up is currently rated at 260 HP with

the carb and HEI ignition. There is NO computer controlled anything and there is no smog equipment except for the PCV valve.

As I progress I will create a web link for images and results, for all to see. Not having been actively posting here I suspect my posts would be edited and that is fine, however an original of anything I post will be put on my server page as a .jpg whether it is a text document or an image from the camera.

I am a bit excited and anxious to get this into trials. I will first look for an HVAC shop locally that carries the relays. I see nothing else that might be difficult to make or fabricate. All the best to everyone and keep up the testing and trials.   I will make it a point to be more active now that something is happening that I can understand.

s1r9a9m9:
I'll make it simple to understand: the ground is at the plugs. The inverter is not grounded to the car. The relay box is not grounded to the car.

Battery+++++++++++++Inverter+++++++++Relay Box++++++++++++Plugs

The inverter is grounded by the connection with the battery wires only, the 110 volt is grounded at the spark plugs.

Trying to crunch the numbers to make it work on paper has confused a lot of people here. I didn't draw a picture of this before I made it work I just put hands on work to it and did it.   I drew the picture after someone here asked for one. If you really want the numbers then you need to build one and then reverse engineer it and write down the numbers you want, but the next person who builds one will have a different set of numbers that they came up with on their project. So this will be the only way to get the big oil company's involved, confuse the masses as always. It works, it isn't for sale, the info is free.   To copy it, you will need to get your hands in grease and oil and build one for yourself.

Emil:
Additives in the gasoline may help some, but not much. Oil from the bottom of the engine is pumped to the engines extremities thus oiling the engine. Also, water is actually injected directly into the intake of high performance engines in racing thus increasing power cleaning the engine and reducing the need for as much fuel. In the engines in question, water is not injected into the engine, water that has been split into its components, hydrogen and oxygen, is injected.

When the combustion cycle takes place, the components, hydrogen and oxygen, recombine to once again form water molecules. Thus only water and extra air exit the exhaust pipe. Next, being that this water is in a highly excited state, very hot steam, it exits as something similar to very moist air.   Ever driven your car in the rain? Doesn't kill or rust it does it?   And there you have a car that runs on water.   Just needs the right modifications performed.

Tom:
Patrick, you are a bit off on the function of the relay. The DC voltage from the distributor only triggers the armatures that open and close the AC circuits. There is a question concerning s1r9a9m9's relays as it is not clear where they ground on the DC side and thus they may be grounding to the AC common at the base of the plug. This would cause an additional power surge which may back-up into the inverter.   We need some more information here before we really know though.

s1r9a9m9:
The only things that are not grounded to the car are the inverter and the relay box. All of the original wiring is the same as before with nothing changed.   Just a extra battery on the other side of the engine compartment, and connected to the other battery. **Why would I isolate the engine from the rest of the car**?   Keep it simple and others can do it !

Tero:
Hi s1r9a9m9. Do I understand you correctly, that you are injecting plain water into your engine cylinders and igniting it with a plasma discharge created by the inverter and a standard spark plug?

What a brilliant idea!   About ten years ago I read of someone who exploded small amounts of water by making an underwater arc with a spark plug attached to one end of a metallic tube. I think the guy was able to puncture 1/4" aluminium sheets with the explosive force of the water.

This is really something if it really works in a normal internal combustion engine. I'm really astounded by the cleverness of the concept!

s1r9a9m9:
I have a well at a spring head where we get some of our water. I have used city water in it as well; no difference in it.

Mike:
Did you try using an extremely high output 12v coil, such as a racing coil, or even try using two 12v coils to make a big spark?   A while back, a friend of mine put an electronic ignition set-up off a '91 Toyota Corona on to his '85 Corona.   He reckoned that he got better mileage due to a bigger spark??? I'm sort of picturing using a dirty great V8 coil on a small four cylinder engine. Would this allow a bigger spark gap, and bigger spark, make big mess, or just not make enough of a difference???

s1r9a9m9:
I tried a high-output coil but for some reason it didn't work. The 110 volts at 20 amps arcs better than the 12 volt 0.87 amp system on the plug.   Don't know the math to it, but it works well.

Mike:
Cool, I'm gonna give your idea a go. We have 240v in N.Z. should I go for same size (750w) inverter, or being double the voltage, go for half the watts? My victim car is a Fiat X1-9, similar to the Toyota MR2, smaller motor (1500cc SOC), but it has a wee boot behind the motor, so I've got heaps of room to put stuff, and if I can get it working, I'll get a dirty great V8 to play with. Do you use electrolysis as well, or are you running your car on straight water?

Your help is much appreciated,

s1r9a9m9:
The fuel used is just water. The inverter should be 750 watts or larger. I'm not sure about your donor car. Does it have a computer or smog controls on it?   This stuff is not needed. You will need - A manual fuel pump on the engine. This helps heat the water some.   A carburettor that allows the jets to be changed - they need to be larger. A points-style of distributor helps but any type will work provided that it is not computer controlled .   I had a Fiat 600D years ago, it was a 1962 model. It would have been a good donor car.

Mike:
Thanks for your reply.   No, there's no guff on the motor, and they are still quite common here (the motors for them). I am looking round for an S.U type carb to modify to fit, they have a much larger range of adjustment. I'm gonna make a wee heater to get rid of the cold knock, I'll get an inverter with two outs, and destroy an electric jug, with a switch on it. Wish me luck.

P.S. Have you tried adding antifreeze to the water to help reduce corrosion in the fuel pump and carb?

s1r9a9m9:
I use a small bottle of baby oil in the engine when I change the oil, and a little in the carb before I let it sit longer than 2 weeks. Ever see rust on a baby's butt? The intake vacuum of the engine helps oil the valves and helps prevent rust as well.

Steve:
Hello. Thank you for sharing your design with this group as well as the Egaspower group. I have a question about grounding the 110V to the base of the spark plugs.

Did you ever experiment with isolating the 110V to only the spark plug by using an isolation washer, similar to a spark plug indexing washer, but made out of a non-conducting material between the base of the spark plug and the motor? Would it still fire and run in this manner?

Would this open up the possibility of being able to use this ignition design on cars with electronics? Just curious?

I am still looking for a suitable carburated, non-smog, pre-1975 vintage donor car. In California, cars built prior to 1975 are smog test exempted, so then no government agency would know that I have a car running on water....

s1r9a9m9:
A simple connector can be made if you bend the 12-2 wire in a curve around the plug's base and then flatten it with a hammer a little, so that it will hold its shape when you tighten the plug. Some plugs don't come with the washer that goes under them.   Why would you need a computer on a car to control the engine if you use water as a fuel ?

Tero:
Here is an interesting link about experiments regarding exploding water with a plasma discharge. This is very well related to s1r9a9m9's claims to explode water in his engine with a plasma arc created by his 110V AC inverter. **http://www.amasci.com/amateur/capexpt.html** In the links case, they explode liquid water with a hefty capacitor bank that is charged up to several tens of kV. This makes for a huge electrical discharge pulse across the spark gap which practically vapourises the water and creates a huge shockwave. s1r9a9m9 uses water vapour or steam in his engine cylinders instead of liquid water which could explain the relatively low energy needed to explode the water...

Norman:
I would suggest one use a small lawnmower engine to test and develop this in the garage first and then when refined move on to the auto.... It will teach you a whole bunch safely in the garage and not out on the road where you might need a tow truck to get back home....

s1r9a9m9:
Resetting the timing on a lawn mower engine is hard to do, you will need to remove the flywheel and change the shear pin setting. This involves welding the old cut and cutting a new place to set the pin, and getting this right is very hard to do. There are other methods that could be used but that would involve changing to an electronics controlled system.

Tero:
Does anyone know where to get an electronic easily-adjustable ignition system for a single cylinder lawn-mower type engine? It would be great if you could advance or retard timing just by turning a knob.

It's not very difficult to do adjustable electronic ignition timing by yourself with an optical encoder connected to the engine shaft, but I'd rather get a finished product if available.

Norman:
There are magnetron ignition systems for small engines and my local mower shop said they could get them. Check them out because they may be adjustable like you need.

s1r9a9m9:
You could move the coil around to do this but the way the engines are made it might prove hard to do as well. Maybe a plate under the coil would be useful. I have been working on a generator with an old chevy 305 v-8 engine which I had in a old truck that I scrapped. I found a new gen head pto driven 65,000 watts. If I get it going, I'm going off grid with our power.

John:
Would a mechanical relay react fast enough to let each cylinder fire at the correct time?

Tero:
Many people have asked that, how is it possible that s1r9a9m9's relays are switching so fast that they are able to run at high engine RPMs without melting or breaking? But what if his relays are not switching at all...

s1r9a9m9 says that his relays are powered by the High Voltage pulses from the distributor (the coil is in the cap of the distributor), but he is unsure how the relay coil gets grounded (if it's grounded at all).

It just occurred to me that what if his relays are wired "wrong". What if his HV pulses from the distributor & coil are not even trying to energise the relay coil, but instead acting as a kind of pilot spark to the spark plugs to trigger the 110V AC plasma discharge. It could even be that there is arcing between the contacts of his relays due to the HV pulse that makes the circuit to connect the inverter to each spark plug in turn. So his relays would actually act as triggered spark gaps.

110V AC from the inverter itself is not able to make a plasma discharge in the spark gap. But if the spark gap is somehow triggered by the HV pulse from the distributor & coil, you could then have a high power plasma discharge in the spark plug provided by the inverter.

Basically the distributor & coil would give a pilot spark to each spark plug in turn and the 110V AC output from the inverter would provide the high power plasma. If this is the case the relays would not be needed at all, but you would need to devise a system to be able to use the triggering spark and the inverter plasma discharge, which s1r9a9m9 may have done by accident.

Patrick:
Tero, I think something along the lines of what you say is very likely to be correct. However, the relay has a coil which is connected to the high-voltage line from the distributor, and it is quite likely that the massive magnetic field generated by it when pulsed with tens of thousands of volts, is part of the system which feeds major power to the plug. Even if the relays don't directly switch the power ahead of the spark, I suspect they are an essential component of the system.

s1r9a9m9:
If this is true I could make a higher-output coil for each plug and run the plug wire to it. The coil could fit on top of the plug and just connect the plug wire to it there. The voltage from the HV coil could be stepped up to a higher voltage than before. But where would the extra amps come from to fire the water in the cylinder ?

110 volts at 15 amps will give you a shock , but 110 volts at 100 amps will fry you. The extra amps is the main part of how the systems works.

Tero:
No that wouldn't probably work because you need the amps for the plasma. So you first need to trigger the spark with the high-voltage ignition coil and then use the inverter amps. The trick is in how to make this triggering HV spark across the spark plug and then connect the inverter output across it without breaking the inverter.

Connecting only the 110V AC inverter output across a spark plug does not create a spark, you need to somehow make a high voltage transient to start the arc.

Do you hear a buzzing sound from your relay box? Can you be sure that your relays are actually switching back and forth? They could also be just buzzing without actual switching (switch only halfway between the two contacts).

Mechanical distributor does not have a lag like a relay has. If your system was based only on connecting the inverter output across the spark plug, you could make a dedicated mechanical distributor to do the connecting, which would be much better than relays. But I doubt it would work because 110V AC doesn't spark across the plug without tricks.

Mike:
To all regarding relays: The reason I am particularly interested is that the relays suggested for use are the same types we supply to the refrigeration Industry.

With regard to points in a distributor, these are opened mechanically with the resulting bounce, lag and dwell, however electrically operated relays rely solely on the induced magnetism of the operating coil.   In this instance are we expecting each relay to operate, lets say, assuming 6000 rpm, that the relay will operate a hundred times per second?   How is the back emf of the relay coil accounted for?   Or does it just work anyway ?   I must admit I am confused but not too doubtful especially if someone claims that it works, you never know!!!!!!!!

s1r9a9m9:
As with any power supply load, the shorter the distance traveled the more power is delivered to the load. This is why each plug is grounded at the base.   When the relay sends power to the plug, it makes more sense to have the ground at the plug than have the ground on the other side of the engine where it would take extra time for the current to travel back to the plug. This would offset the timing even more and make for delayed reaction on acceleration of the vehicle.

The vehicle is 12 volt grounded with a 12 volt electrical system and has very little distance to travel. If the 110 volt is also grounded to the 12 volt then there would be feedback and the engine would not run. The relays provide the time lapse for the 110 volt not to be continuously grounded to the engine, this delay prevents the 110 volts from overriding the 12 volt system in the rest of the vehicle.

Rex:
I don't post much but, when s1r9a9m9 made his posts to watercar I, like others, tried to imagine what was going on with the system he put together.   I thought that the spark-plug was creating a plasma and decomposing water to hydrogen and oxygen at least near the plasma, and then resulting in some steam. Now that I have found a .pdf on the net, put out by scientists at Hokkaido University, I am thinking that there may be more hydrogen and oxygen production than I first thought.

The pdf is titled "Confirmation of Anomalous Hydrogen Generation by Plasma Electrolysis".   It goes on to say that "continuous generation of hydrogen above levels predicted by Faraday's Laws is observed when temperature,

input voltage, current density and electrode surface meet certain conditions", and guess what, s1r9a9m9 has met those conditions, at least starting at hydrogen production. They state 110 volts and increasing the voltage upward to say 130 volts and that is where the anomalous 800% increase above Faraday's Law is observed. Something is going on here. My congratulations to s1r9a9m9.

Now imagine using Mr. Robert Krupa's Firestorm (plasma) sparkplugs with this system.   The tweaks and experimentation are endless. I had some trouble connecting to the address so if the link does not work the best way to get to the .pdf is to go to Google and put in the keywords WATER PLASMA HYDROGEN and its the 9th link down.   Also, when reading the .pdf they mention ~3000 degrees C but they are talking about hydrogen pyrolysis decomposition. Near the end of the .pdf they mention 80 degrees C to meet the requirement above.

Faraday. **http://www.lenr-canr.org/acrobat/mizunoTconfirmatib.pdf**   Remember, you heard it here first.

Brad:
Is it possible to take some pics of your set-up?   I must admit that I remain sceptical about your set-up for the following reasons:
 1. No pics. People have asked if you could take some pics but that hasn't happened. That question seems to be avoided by you.
 2. I have tried to get a relay to work with the high voltage from a coil, but was unsuccessful. Doesn't mean it can't be done I guess.
 3. I tried many ways to get a spark-plug to fire using 110V and was unable to make it happen. Is it possible? Should be. But....
 4. I have a gut feeling that something just isn't right here. Just my intuition, I could be wrong. Hope I am.

s1r9a9m9:

I would be happy to provide photos of my car, but only if my well-being and safety is protected.   People here know my name, so my address is public info.   There are people who are waiting for me to make the mistake they need to start their dirty deeds towards me and my family.

There would not be much to see in pictures anyway as the only thing you would see in the engine compartment would be the two batteries, the relay box and the cover which helps to cool the inverter.   Everything else is stock stuff.

I have avoided some questions because it would involve sticking my neck out. The info has been free, detailed, and even some new ideas accepted on my part. I didn't give up on the car, so why should I give up here ? I will continue to help as and when I can, but no photos will be posted showing any part of the car - the car has been in car shows, so you can see that people would know who to call and bother.

The info I have given is enough to build the conversion and make it run. There has been some good input and ideas given to help improve this system.   The maths level needed to do this conversion is 2 + 2 = 4 it is simple to do - just do it. I don't have any further information on the relays which I used.

If you want to experiment, then you must try the experiment under pressure with the pistons in motion. The compression in the cylinders is 165 to 180 psi. in each. The engine turns over 4 or 5 times before it starts. Repeated compression and the right amount of fire in the hole and it will work.

This is not rocket science, it's simple hands-on work. Understanding all aspects of how it works is not needed. Not every one has a donor car, but your friends or co-workers may have one, car that fits the profile will do. If you need info on the change-over of your donor car just ask.

Bill:
Thank you s1r9a9m9, I understand totally.

Brad:
Hi s1r9a9m9. As a matter of fact, I do have a donor car - 2 of them.   An '86 Camaro with a 350 4-barrel carb and a '68 Mustang with a carbed 289 with the distributor in the front where they belong. I just can't for the life of me, get over how them plugs are firing, so I guess I'll just have to drag my sorry ass out there and hook it all up and see what I can come up with. Now do I want to possibly destroy the 350 or the 289: Decisions, decisions!

OK, you got me. Question: The HV out from the car coil is hooked to a relay. Where is it hooked to the relay and where is the other end connected to?   I know the contacts are connected to the 110V inverter going to the plugs. Do you have one of the 110V always connected to the plug and the relay contacts in between the other 110V

wire? Are they DPDT relays? Hopefully I haven't offended you. I'm just trying to get to the bottom of this and now I'm just gonna do it. Thanks.

s1r9a9m9:
Good donor cars. The Camaro has a computer on board , I have one with a v6 vortec.   The Mustang will be the better bet as the car won't need to be modified. Just print off the diagram and use the parts listed. Don't change the fuel tank or exhaust at this point in time. Just hook a hose to the fuel pump from a separate tank of water, you won't have to mount anything on the car either.

Hook up the inverter, then the relay box and finally, run the wires. Do make sure that neither the inverter nor the relay box get grounded to the car anywhere except at the battery connections and the plugs.   Check the plugs to see if they are clean and clean them up if they need it.   Good plug wires help too.   Just to get running, you won't need the second battery. The only thing to change is the timing, just turn the disc. cap until it starts. You don't need to change the jets now, it will idle but won't rev at this point. You may need to adjust the jet screws to allow more water into the engine.

See - no major modifications needed to test it, are there ? As I said, it is simple.

A good inverter only costs $50 - check at Wal-mart. The relay brakes contact on both wires from the inverter. Mark the disc. cap before you move it so you can reset it if need be.   The water in the engine will not be enough to hurt it, you can always put it back on gas and run it for a while. Quacker state motor oil draws water into the engine to help cool the oil down faster.   It always leaves a milky gunk in the valve covers.   If it does lock up, just take the plugs out and turn the engine over.

John:
Water in a fuel system will cause problems because the water sits in the bottom of the fuel bowl in the pump or carburettor and creates much muck and disasters. The situation will be quite different when there is only water in the pump and carburettor. I service quite a few aluminium and alloy pumps for water in the agricultural industry and water alone is not a great problem. It cannot be compared to the damage done with carbon fuels floating on water. even water without antifreeze will last quite a while in auto cooling systems without significant problems until the heads pit and corrode because of the heating -cooling regime. so don't get hung up on this problem - with water flowing through the system there won't be major concerns.

s1r9a9m9 hasn't mentioned changing the filter gauze in the fuel pump and carburettor and this concerns me. The size of the mesh is designed to not allow water to flow through but once again the filter is only designed to allow carbon fuel to preferentially flow through - with water alone, the flow may be sufficient. Filter gauzes used in nozzle filters on chemical spraying equipment are similar mesh sizes and don't impede the flow of clean water. Roger Billings used this system to provide water induction to a hydrogen engine for the US postal service SEE the hydrogen technical papers from the International Academy of Science.

Quote "During this contract period, two important improvements have been made in the area of backflash elimination. The first major improvement involved the installation of a conventional gasoline carburettor (connected to a de-ionised water supply) between the gaseous carburettor and the intake manifold. This method of water induction provides more finely atomised water to each cylinder, and is a vast improvement over the previous pressurised sprayer design."   So it has been done before albeit for a different purpose. Maybe Roger could have eliminated the use of hydrogen altogether.

Willard:
Here is my thinking on what happens in one cycle:
1. The spark voltage flows to the coil and from the other end of coil to the spark plug.
2. The spark plug conducts.
3. 15 to 30 milliseconds later the contacts on the relay close.
4. 110 volts is now placed through the coil to the spark plug and latched by a portion of the current in the plug.
5. In the gap of the spark plug now is a plasma at 110 volts.
6. As hydrogen and oxygen are separated and explode a higher pressure occurs.
7. The increased pressure causes a higher current to flow and the plasma discharge continues.
8. When the implosion occurs (possibly at the end of the power stroke) the pressure becomes low (possibly assisting the return stroke). Due to the low pressure the plasma is extinguished and the relay drops out.
9. Possibly the exhaust pipe can be restricted so that a good vacuum occurs.

Patrick:
Willard, I like your suggestion on the operation of the engine - it "feels" right. There are some snags though:

At 3000 rpm, my car runs at or above the USA speed limit for public roads, so lets examine the situation at 3000 rpm as being a practical rate for normal running.

The power 'stroke' of the engine is carried out in half a rev, or 180 degrees. At 3000 rpm this half rev happens in exactly 60/6000 seconds or 1/100th of a second, which is 10mS (as 1 millisecond = 1/1000 sec).

To say that another way, at 3000 rpm, the piston in the cylinder moves from Top Dead Centre to Bottom Dead Centre in 10mS.

The other three 'strokes': exhaust, charging and compression each take 10mS each so there is a 30mS gap between successive power 'strokes' on any one cylinder.

It gets worse. The ignition spark does not occur at Top Dead Centre. If we assume that the spark is at 30 degrees after TDC, then only 5/6 of our 10mS is available for any useful burn. This means that we are looking at a burn period of some 8mS.

I am quite convinced that the HV pulse from the distributor runs down the 110V wire(s) to the plug to cause the initial spark. If I were a betting man, I would give you very good odds on the relay coil being essential to the operation of the engine. Also, I am convinced that the 110V ac creates or maintains the plasma discharge which drives the engine.

However, your 15mS is just not possible (unless it powers the following power stroke) because the power stoke has been over for 7 milliseconds when you think the relay contacts close. At that time, the piston is 70% of its way up the exhaust stroke and the 'burn' opportunity is long gone.

You and I both think that the 110V ac drives the plasma discharge, so how does it get there so fast ? Tero may well be right in thinking that the relay contacts are not actually switching the 110V ac through to the plug. I suggest that the 110V ac connected to the inverter side of the relay contacts is picked up by induction when the massive HV pulse races down the wires to the plug. I think that it rides down with it and creates the plasma discharge immediately.

So, why does the timing need to be retarded - if that is so, the spark will occur at the same time as with gasoline and the timing should not need to be altered ? I suggest that the process which generates the hydrogen/oxygen splitting of the water droplets is not quite instantaneous and as a result, the explosive burn is delayed slightly.

A pointer which might support this suggestion is the life of the relay contacts. I estimate that in 30,000 miles of driving, each relay will have operated 15 million times. This is 60 times the rated life of the relays in s1r9a9m9's spec sheet. He has not said anything about having to replace any of the 8 relays, and while his relays are not necessarily equivalent to those in the spec sheet, and the spec sheet will be giving the most pessimistic assessment of contact life, the relays have been very lucky to have survived 30,000 miles. If, on the other hand, the relay contacts are not being used to any great extent as I suggest, then the relays may well never wear out and the suggestion of replacing them with solenoids might well be viable.

I think what you say is nearly 100% right, it's just that the timing forces us to look for some other way for the 110V supply to get to the plug fast enough.

Gerry:
Hi Guys, I Would like to ask a question: if a pilot arc, say provided by a distributor, is required to ignite the Plasma on the cylinder which is firing, why then can't the 110 volts high current signal be applied to all cylinders at all times, as it would only be on the application of the firing signal that the arc would strike on the appropriate cylinder, or am I off the track here?

I guess one problem arising might then, be how to stop the Plasma arc once it is initiated? Well I was thinking of suggesting a high current version vacuum glass encapsulated fast reed switch on the Neutral side of the Inverter output wires. This could be a Normally Open 12 Volt type which grounds the Inverter Neutral wire whenever the Distributor points are open. In this way the 110V ac supply could be fed constantly to all the plugs.

Also, reading up on the latest inverters, many of them nowadays, for safety reasons, have their outputs completely isolated from the internal circuitry by having the Active and Neutral wires coming from a separate winding on a double insulated ferrite core.

This would reduce somewhat the fears of blowing up the Inverter from feedback of High Voltages (DC) and High Voltage transients to some extent. Other measures like feeding the inverter output through an inductor with a

high voltage capacitor connected to ground on the input side of the coil may assist here.   Dunno if this helps anyone or not, but thanks for listening.

Patrick:
Gerry's suggestion of providing the 110V ac to all plugs all of the time is interesting. If you were doing that, you can leave the original spark plug lead in place and just add in the two 110V ac connections to each plug.

This raises an interesting issue: On firing, the HV pulse from the distributor will run back along the 110V wiring to the output side of the inverter. Can the inverter survive that? Well, at present, it is highly likely that the inverter is getting it anyway, via induction through the relay coil and possibly via stray capacitance between the wires.

This in turn raises a very interesting issue: The HV pulse is not intelligent and does not know we want it to run up the leads to the spark plug, so it heads off in every direction. The induced pulse will head up the wiring to the inverter AND BACK down the wiring which runs from the inverter to the other relays. So each relay is not just getting the 110V ac but gets in addition, a high-speed train of induced HV pulses.

At 3000 rpm, an 8-cylinder engine generates 1500 x 8 = 12000 pulses per minute which is 200 evenly-spaced pulses per second. So the induced pulses are running at nearly 4 times the speed of the 110V ac, and this pulse speed increases when the engine speed increases.

 We can't get away from the 8mS period (at 3000 rpm) which is available for:
(a) Creating the arc
(b) Creating a plasma
(c) Splitting the water droplets into gas (IF this actually happens) and
(d) Generating high pressure in the cylinder.

8mS ain't long and you have to be done and dusted in that time. The 60Hz supply cycles 60 times in 1000mS, or once in 16.66mS. In other words, we are expecting the 110V ac to create and sustain a plasma in less than half of one cycle (are we optimistic or what?).

In any 8mS period, if I am right about the inter-relay feedback, the plug will receive an additional one or two HV pulses. It's not much, but it is slightly better than before. If it is having an effect, then an 8-cylinder engine is much more likely to run than a 4-cylinder engine which generates only half as many HV pulses per rev.

Two encouraging things:
1. The car does run, and
2. s1r9a9m9's inverter survives the HV feedback.

Any comments anyone?

Willard:
Patrick, you may not be thinking this through clearly. In a four cycle engine any firing during the other 3 cycles could be bad and certainly does not add any power.

Here is what happens if fired at every stroke:
1. The beginning of the intake stroke (a backfire out the intake manifold).
2. The compression stroke (an explosion with no valves open and the crank down).
3. The power stroke (power to the crank).
4. The exhaust stroke (explosion of any unburned gas with the exhaust valve open).

Two diodes to each plug will allow the higher of two voltages to go to the plug. The reverse rating voltage of the diode to the low voltage would have to be over 40,000 volts. But these are easy to obtain.

As I mentioned in a previous post, I think the coil of the relay is providing isolation between the low voltage AC and the HV.

Patrick:
Willard, thanks for the feedback. I take your point. I am not sure that the cylinder would be is a position to give a power output during the other strokes, but it might well be able to do so if it got a pulse just before TDC.

You could eliminate the inter-cylinder feed on a 4-cylinder engine by using four separate small inverters instead of one larger one. The small ones are fairly cheap and many have overload-protection circuitry so no fuse is needed in the battery lead - those that don't will have their own fuse. With this system, each inverter feeds just one

cylinder and the 110V ac feed to each cylinder is isolated from the other cylinders.

I think that there is considerable value in having a continuous ac feed to each plug as I am still bothered by the relay timing. At higher revs, the burn period is so short that to get, say, 75% of the available period, the relay has to switch the ac through in maybe 2 milliseconds and I don't think that that is physically possible for any mechanical relay. Also, I can't see the 110V arcing from the input contact to the output contact on a relay which was specifically designed to switch that voltage.

It may be that the relay switches the ac through so long after the HV pulse that it accidentally provides the ac for the following HV spark pulse. If so, it is not something I would be keen on relying on. Any thoughts on the subject?

Are we sure that 110V ac is essential - the system might work well with pulsed DC so that the inverter output is 0V----+110V ----0V-----+110V---- etc. with the mark/space ratio heavily favouring the +110V. If you can do that, then one 110V unit can drive all cylinders with just one HV diode to block the reverse HV pulse. At this point in time I think that we can be reasonably sure that what is needed is:

1. A pulse of voltage high enough to generate a robust spark across a plug gap of say, 80 thou. at the moment the cylinder should fire.

2. Immediately afterwards, a sustained (probably ac) current supply to maintain a plasma discharge through the ionised path of the spark. This supply should probably be insufficient to create the spark in the first place and it should continue to the end of the power stroke or alternatively, for a reasonable length of time, say, 5 milliseconds. It has been suggested that 110V is about right but the only way to assess the effect of 220V ac is to try it.

3. Either some way of blocking the spark pulse from reaching the equipment producing the following-current (perhaps a notch filter or a triac triggered briefly by the higher voltage to short-circuit the incoming pulse), or a following-current generator which can absorb the incoming pulses without being bothered by them.

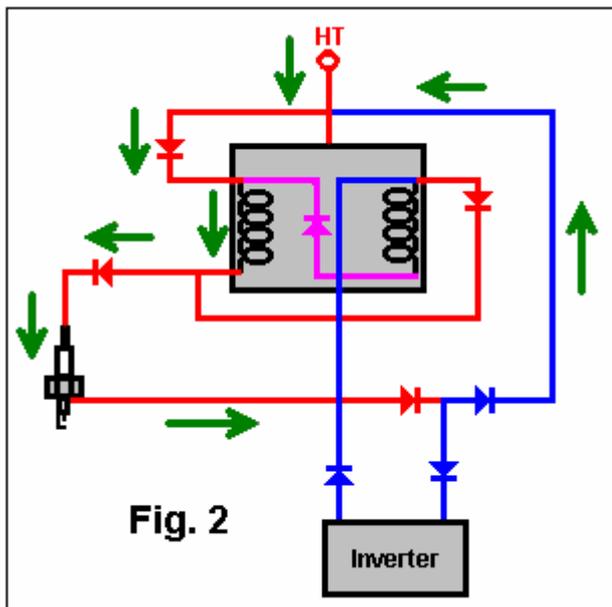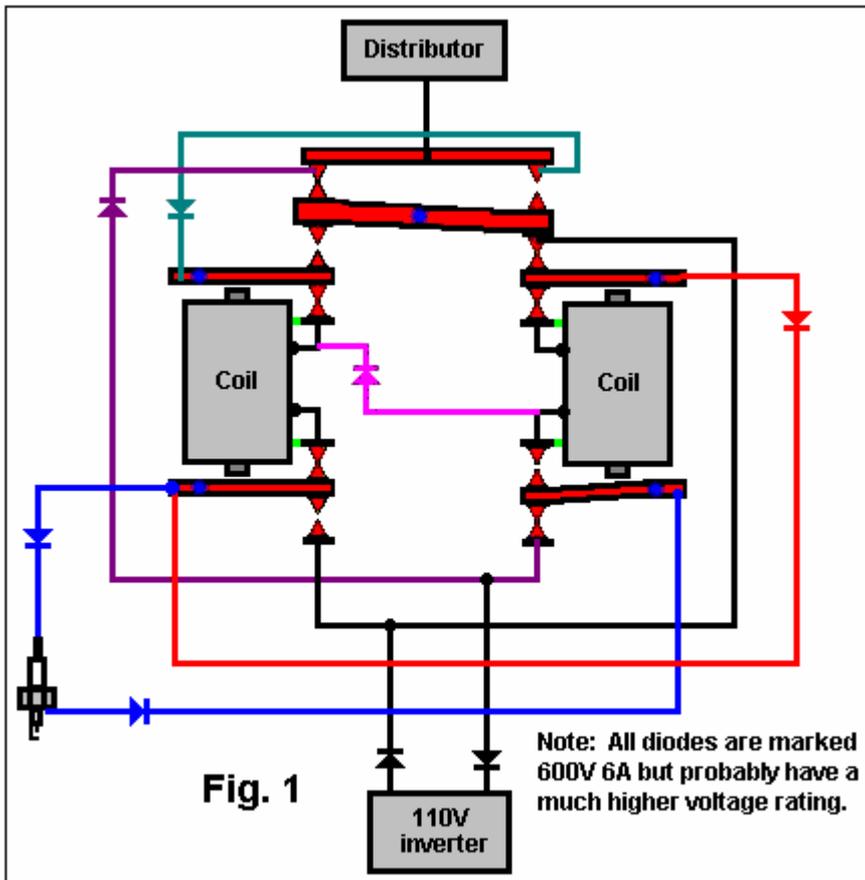It is starting to look as if a custom electronics circuit might be the optimum drive for a converted engine.

s1r9a9m9:
OK, I ain't perfect. I found the info on the inverter I used on the car. I put a file in the 'Files' section, with pictures of the book that came with the inverter. The one I used was a 400 watt with 800 peak watts, NOT a 750 watt as I thought I did. Sorry about this mistake - I used the 750W on my work trailer for a power outlet at job sites.

My son works for a power company and took one of the relays in for a test. He told me I had it hooked up wrong on the car, and it shouldn't work as it is hooked up. He then ran another test and found that the relay was boosting the amps from the disc cap to the plug. The coil output on the car is 34,000 volts at 0.83 amps; the power at the plug is now 24,000 volts at 6.3 amps. The inverter and the relays reduce the voltage and increase the amps to the plugs. The spark advance in the disc., keeps the engine from passing the firing zone when the engine is running, it locks in place because of the time setting. It was a lucky mistake that I happened to find the right wiring to make the car run like this.

The relays have double feedback diodes in them rated at 1800 volts ac. This is why there is no feedback to the inverter. They also have a double coil with locking contacts under load. The 4 or 5 turns of the engine when starting, is when the coils get charged and change the voltage and amps to the plugs. Once the coils charge, the contacts stay closed and the coils stay charged.

You raise your kids to go to school to learn more than you did in school and what happens? - they show you where you were wrong. Love my sons a lot. I hope this info is more helpful to you all. Here is a picture of the way they are wired up:

Fig. 1

Note: All diodes are marked 600V 6A but probably have a much higher voltage rating.

Fig. 2

Please note: The above drawings have been redrawn from s1r9a9m9's original drawing and so must not be assumed to be absolutely accurate. Fig. 1 shows that the item earlier called a 'relay' is in fact some kind of dual mechanical relay whose operation is not at all clear. The device is unmarked and of pre-World War II vintage. Fig. 2 shows how the diodes pass the distributor pulse to the spark plug. Each figure shows the circuit for just one cylinder and so the circuit is replicated for each cylinder of the engine.

Bill:
I'm confused ??? Is this a triple pull relay? Also on the left coil it indicates that both contacts are closed ? What's your take on this?

John:

Bill, I think this is a multivibrator and not a relay at all. It was the pre-solid state method of making an AC signal out of a DC input, probably from an old telephone system or vacuum tube driver. You will note that there are no connections from the coils to any of the terminals, except through the contacts (I expect the coils are connected to their respective end contacts). So both contacts on one side will be closed to complete a circuit - when power is applied these contacts will open and the opposite pair close and it just keeps doing this at its resonate frequency. There is one thing for sure - it is not operating as a relay in any way at all.

I will have to spend a long time studying the flows through the device but from first appearances it may be that the coils are operating as some sort of inductive coupling. It really puts the operating method of the idea into a whole new light because there is no ac going to the plugs at all - the input diodes from the inverter see to that.

There also seems to be a direct half wave short across the inverter input as both the inverter inputs are connected to the distributor input through a diode but maybe this stops all the current as it is hooked in reverse to the diode on the neutral input from the inverter. But from first appearances we can bin the idea of a relay operation. This explains of course why the "relays" are getting such an extended life.

It's back to the drawing board folks, cause I don't think we are going to be able to get these beasties anywhere these days, to do a straight replication.

Just my first take - now I'd better go and earn a living while I think it through a bit.

Bill:
Hello s1r9a9m9, after reviewing your drawing of the relay most of the day I'm still confused regarding the operation, so the only way I know of is to ask questions - please bear with me. Your last post you indicated that the top part of the relay would only allow one coil to be energised at a time.

Q1. Is this on a rocker or pivot - a seesaw if you will?
Q2. On the left side of the drawing it shows both contacts in closed position. If this is the case are the swingers designed to pivot independently in part of the relay layout?
Q3. The Voltage input to the relay is 110 Volt + Is the 110 Volt Neutral be use like a standard household plug?
Q4. Are all the Diodes utilised of the 600-volt rating?
Q5. The power feed to the actual coils is not clear, I see a jumper and diode between the two coils but really no other hook-ups for the coils except where the swingers are contacting the coil ends - is this where they obtain their power?

I apologise if some of these questions seem redundant, but for some reason, I find the drawing confusing. Thank you for your patience.

s1r9a9m9:
Q1. Yes. .
Q2. Double contacts on the bottom of the relay independent of each other under the coils, and double on top but with a pivot point in the middle of the two coils.
Q3. Yes.
Q4. Yes, the direction is shown as ^, >, < or v. The lower amps allow the higher volts from the disc to go through without burn-out.
Q5. The power feeds into one coil and then to the other where the disc cap wire also feeds in, then it goes into the second coil. The ground seems to be neutral at this point. Not sure about the purpose of the ground, other than for the charging of the coils at start-up.

The power is in one direction through the relay but the 110 volts is incorporated into the voltage from the disc cap when they go to the plugs. The relays make no noise when the car is running. You can hardly hear the fan on the inverter. They do click a few times when starting the engine from cold, but they stop once it starts up.

John:
The more I look at this the more I feel that Tero is right and that diodes in series with the HV and AC will possibly replicate what this device is doing, and the coils are incidental to the task.

If you trace the drawing you will see that in its rest state, the circuit is just connecting the spark plug to both the AC and the HV through diodes. These old diodes although rated at only 600V will probably handle the pulse at a much higher voltage. I would not trust modern plastic diodes to do the same. I feel it would be safer to use something rated at 40000 or so volts, if they are available - my catalogue doesn't list anything over 1000V.

Maybe time to get the hands dirty and actually do something! Unfortunately Google gets swamped with all solid

state stuff - I only found one mention of this type of gear for driving radio valves and something similar (but single coil) for a model T ford coil driver.

Tero:
Hi John, I'm thinking the same. By the way, you can build your own high-voltage diodes instead of paying a huge amount of money for dedicated HV diodes:
If you need 10kV 10A, you just buy 10 diodes rated at 1kV 10A and put them in series. You might need to put some voltage equalising capacitors and resistors across the diode string, but that is easy to do. I think there are 2000V 10A "ordinary" diodes that could be used. But I also think that a normal diode stands more peak reverse voltage than quoted in the datasheets.

By the way, microwave ovens also have one rated at about 10kV and 0.5A for each diode, and some repair shops sell them (I got mine for 5 euros each).

Bill:
Hello John, If a diode could be located, what Amp rating do you think would be required?

Joe:
You can pull some tricks when you understand the failure sequence: Ordinarily - when a diode does a reverse voltage break-over - the current rises catastrophically, persists as a near-short till the junction heats & self destructs, usually shorts & then burns open - and then the dead silicon freezes.

If you add a lot of series resistance - enough to limit the current heating - they behave like a ratty zener and can recover lots of times. You have to see what else happens when you add that much resistance - might destroy other needed features - or maybe it's tolerable.

Note that you see a surge rating - a 1 time in however many mS till you can repeat it - allowable big current for a short time - on the order of x 10 the continuous rating. The lots hotter MSD coils do 300 mA - for 200 uS - when it's time. If you were to stick with 1/2 that & hope nobody after you decides to upgrade - should be a safe enough selection. Also - they are power sensitive so since you have pulses - can reduce the de-rating. Understand that every sane designer likes lots of margin till it affects the cost - like millions to buy so a few cents change gets significant. Here, it only has to stay together long enough to see if it works.

Tero:
Hi, I just built a 12V DC -> 2500V AC (5000V AC peak-to-peak) inverter. I took a Microwave Oven Transformer that had a 230V AC primary with 220 turns. The secondary was 2000+ turns and the filament winding about 3 turns. The core is rated 1kW. I removed the primary and the filament windings but kept the original 2000+ turn secondary.

I wound a new primary: centre-tapped winding with 24 turns in total (12 + 12). I also wound two feedback windings of 8 turns each. I used two BD249C transistors that I turned on and off with the pulses induced to the feedback windings. The device outputs a nice "square-wave" at 2500V AC and about 75Hz. Parts count: 8. It still needs some work, but as such I get nice blue plasma on the spark plug gap.

Joe:
Tero, you should increase the frequency until it gets as high as it will still arc under compression pressure reliably. Need that to reduce timing jitter.

Tero:
I just noticed that the unloaded output frequency is 75Hz, but when it's connected to the spark plug and it's firing, the output frequency increases to about 800Hz. The feedback causes the frequency of the inverter to adapt to the load, which is not ideal because the core is designed for 50Hz. But hey, it works :-)
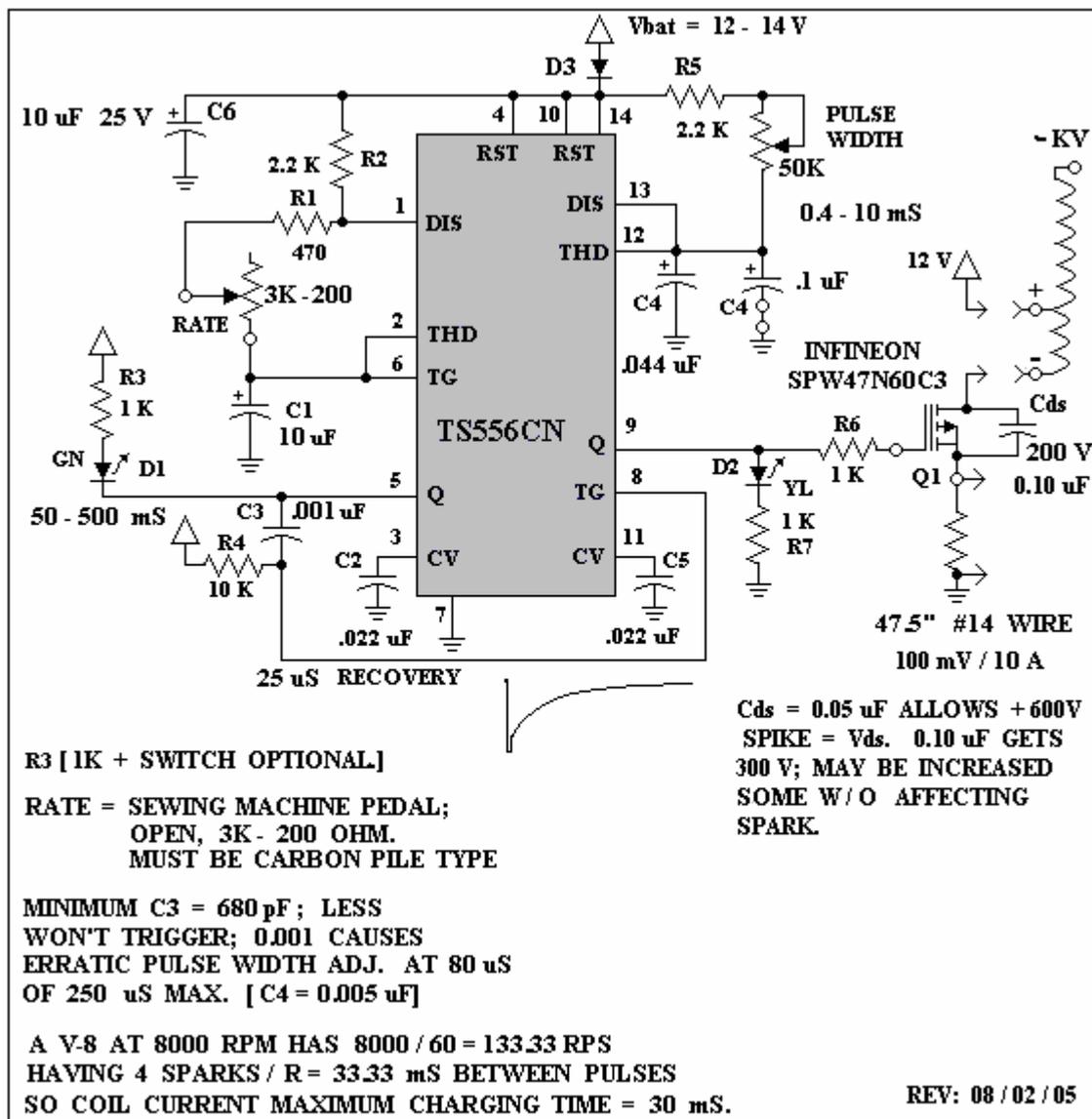
Joe:
Find out if pulse-width control is needed first. There won't be a filter cap on the bridge at first - didn't find any big enough from favourite source with a 600 V rating. Will result in a pulse train at the converter frequency.
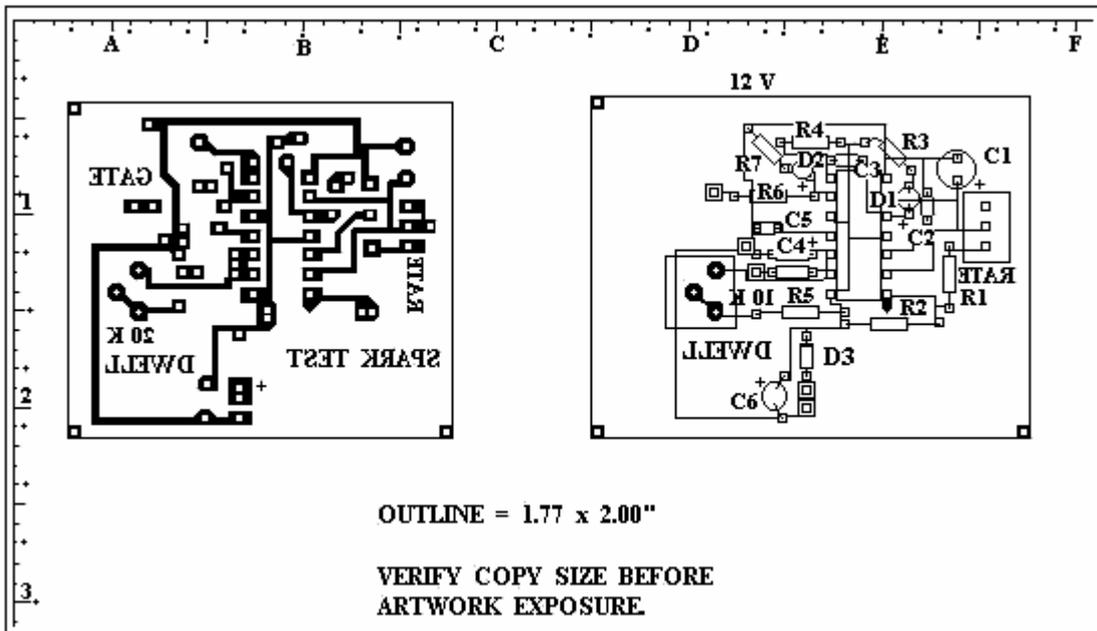
I'm not at all familiar with those diodes. My plan is to load the coil with 200K & use the Q1 forward diode drop to regulate the transistor input voltage similar to a zener; could increase R1 if it doesn't stay together. Also - enough pad spacing to stop arc-overs.

The 2N2222A has a 200:1 attenuation as drawn, can add a couple meg ohms if needed but would sacrifice arc resistance since the distance needed would rise. Just finished first pass on the artwork mods; would need to add

maybe 0.5" to card length if it comes to that - don't need to move anything else to do it. Would keep the standard resistance wire so current stays limited. Seems like a good idea to build in that flexibility, re-space for 1W resistors.   Also - opto-isolator comes in a TO-18 package for the part listed; found another that is rated at 5 MHz so might need to change that pattern footprint too.

Joe's updated circuit diagram:

OUTLINE = 1.77 x 2.00"

VERIFY COPY SIZE BEFORE
ARTWORK EXPOSURE.

I don't think the divider is in here: use 3 - 1.5 Mohm 1/2 W resistors; might need 4 if you want to handle wide plug gaps; add 1 K from above string to ground, junction to 'scope probe. The 1/2 W is important; affects insulation for arc-over along the divider. New scale factor [for 3] is 4.5 K, do a precise measurement of each - to 1% if you can manage it - so you can correct for tolerance. This is a MANDATORY MOD to get to 150 PSI at 0.032" plug gap.

I found today that stiff wires from the battery will break off the card supply plug pins as shown - use better connector or drill the card & tie in place. Have been letting it flap in the wind, pins are too tender to do much of that; need the solder joints epoxied for strain relief. Is idiot resistant in case you get the plug in backwards - fried a chip at 3 a.m. once.

It would be helpful to add an ignition switch to the coil - avoids case heating from ON all the time since no series resistor is used, also allows you to handle the card to trim the pot without getting zapped, BTDT.

Have a text that shows the coil to have the secondary winding connected at the primary - terminal instead of as shown; makes more sense. Include reference to the 2nd 'repeat' file #; maybe add that to p.3. Used a margin adjust from 'way back' to set H & V scale in Paint of .45 instead of the default .75 on all 4; wider effective drawing area. If you don't scale it there - will need to go to a copy shop & adjust the outline to get the amounts as shown or will have trouble getting the chip pins in the drill pattern. Nothing else comes to mind.

Patrick:
Hi everyone, s1r9a9m9 - thank you for your relay diagram, it must have taken a good deal of effort to produce it. The diagram clarifies a lot of points.

It is now clear how the HV pulse reaches the spark plug as it is fed directly there via the diodes. It is also clear that although an inverter is used, no ac is fed to the plug as it is converted to pulsed DC by the diodes in series with it.

Without having further test results to hand, perhaps we can predict what is needed to reproduce the water burn of s1r9a9m9's vehicle. Perhaps the following would work:

1. Let the original HV pulse feed directly to the spark plug as it always did.
2. Block the pulse from our extra circuitry with a HV diode.
3. Use the HV pulse to trigger a monostable of say, 5 millisecond duration. Use the monostable to power an astable of say, 500 Hz 100V dc pulses to feed through the diode to the plug.
4 This should be easy to build and test and I think it will work.

Any comments anyone?

Tero:
Having a solid-state electronic device to trigger on a HV pulse is also tricky, because your ICs will smoke if you make one mistake. The HV pulse would need to driven through a voltage divider made of 10 x 1M ohm resistors

plus one 100k resistor, which would form a division ratio of 1:100.

I just looked at the HV pulse waveform of my 6.5hp garden engine, it is not a single pulse but looks like 1.5 cycles of AC. I also ran a test using a neon sign transformer (outputs 4kV @ 50mA) and a 230V AC->110V AC mains transformer.

First I connected the 110V AC output of my mains transformer across the spark plug. It wouldn't strike a spark. If I connected the spark plug across the 4kV neon sign transformer I got a nice blue plasma.

But if I connected the 110V AC output to the spark plug and tried to connect the neon sign transformer output also across the spark plug, I wouldn't have a spark because the secondary coil of the mains transformer "shorted" the spark plug out.

This system needs blocking diodes both ways. s1r9a9m9's inverter with it's rectifier bridge is different. I'm not 100% sure, but it may need a blocking diode in series with the ignition coil.

s1r9a9m9:
The high voltage goes in at the top of the relay and the 110 goes in on one side. The 110 charges the coils in the relay and then it's on stand-by to keep the coils charged when needed. This charge in the coils, changes the high voltage to a lower voltage and higher amperage as it passes through on its way to the plug.

The sides of the relay were removed so it could be used in another project. I don't know why it works this way, but it does.   When my son drew this up, I had a few questions for him as well. Why the 110 floats is uncommon, but it does, and the high voltage passes through without interfering with the 110 stand-by. The HV has no place to arc inside the relay as it has heavy insulation around all wires and the coils.

It is evident that the 110 ground is at the relay, and not at the plugs. The relay is the load. The HV connects with the vehicle ground and grounds at the plug. For some unknown reason, the system will not work without the ground wire for the relay running to the base of the plug - I knew I should have taken that class in rocket science! A meter shows no reading between the ground wire and the plug base when the engine is running, or as it starts, The engine just won't run without the ground wire being in that position.

Patrick:
Joe, my apologies, I had not realised how close your circuit diagram is to what my last Group e-mail was suggesting (that's me being slow on the uptake again). If we get this style of circuit up and running, perhaps a later mod would be to use a car's electronic rev-counter circuit to adjust the length of the monostable pulse so that the burn length is proportional to the current engine speed. What do you think?
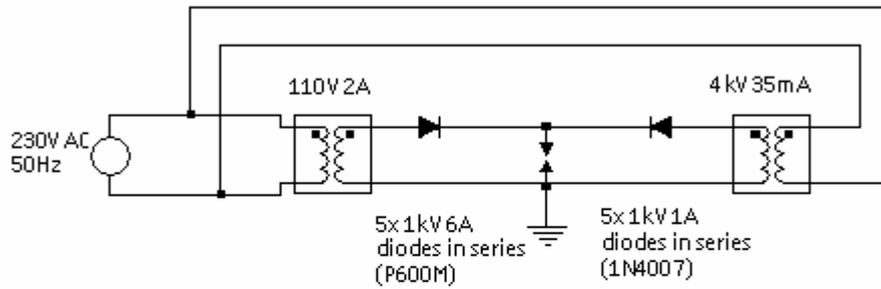
I came across a couple of diodes on offer yesterday: the 1.5KE400CA transient suppressor diode WE 1.5Kw 400V bi-directional and the 1.5KE180A transient suppressor diode WE 1.5kW 180V unidirectional. Not having seen these before, I gather that they soak up voltage spikes above their rated voltage. I can't seem to see any spec of how high a transient they can handle. Have you any info on them and would it be worth incorporating one in the circuit to help protect your electronics? Presumably, one of those would limit the incoming HV spike to 180V or 400V ?

A question in passing: will your 2N2222A not get fried if 35,000V gets applied to your divider chain? Won't you get some 175mA driven into the base as it is common-emitter?   Pardon my ignorance, I'm only self-taught in electronics.

Tero:
I have managed to make 110V DC 50Hz to strike a spark in a spark plug gap by using a HV trigger spark through two 5kV diodes.
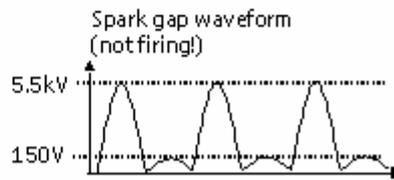
Using a 4kV Neon Sign transformer to trigger a 110V ac spark across a spark plug gap of about 0.3 mm. The 4kV spark is blue and "sharp". The 110V arc is completely different, yellow and an extremely bright flash, similar to arc welding.

The 110V DC spark is not continuous, but intermittent, while the trigger spark is continuous. Using higher frequency (e.g. modified inverter for example) and perhaps higher voltage (250V DC) should help to get the 110V DC firing more consistent.

I observed that the spark plug electrodes tend to "weld" together because of the use of pulsed DC. The 110V DC spark is extremely bright and yellow. In this sense it would be better to use AC to avoid welding, but how can you achieve the triggering with just diodes if you do that?

Brad:
s1r9a9m9, Have you ever taken a sparkplug wire off and connected it to a spare plug to see what the spark looked like?

s1r9a9m9:
Bright blue with a white flash up to a 1/4 inch around the tip and gap.

Tero: Great! This is exactly what I saw in my test with the HV-triggered 110V AC arc. The bright blue is the standard ignition coil spark and the white flash is the 110V AC arc.
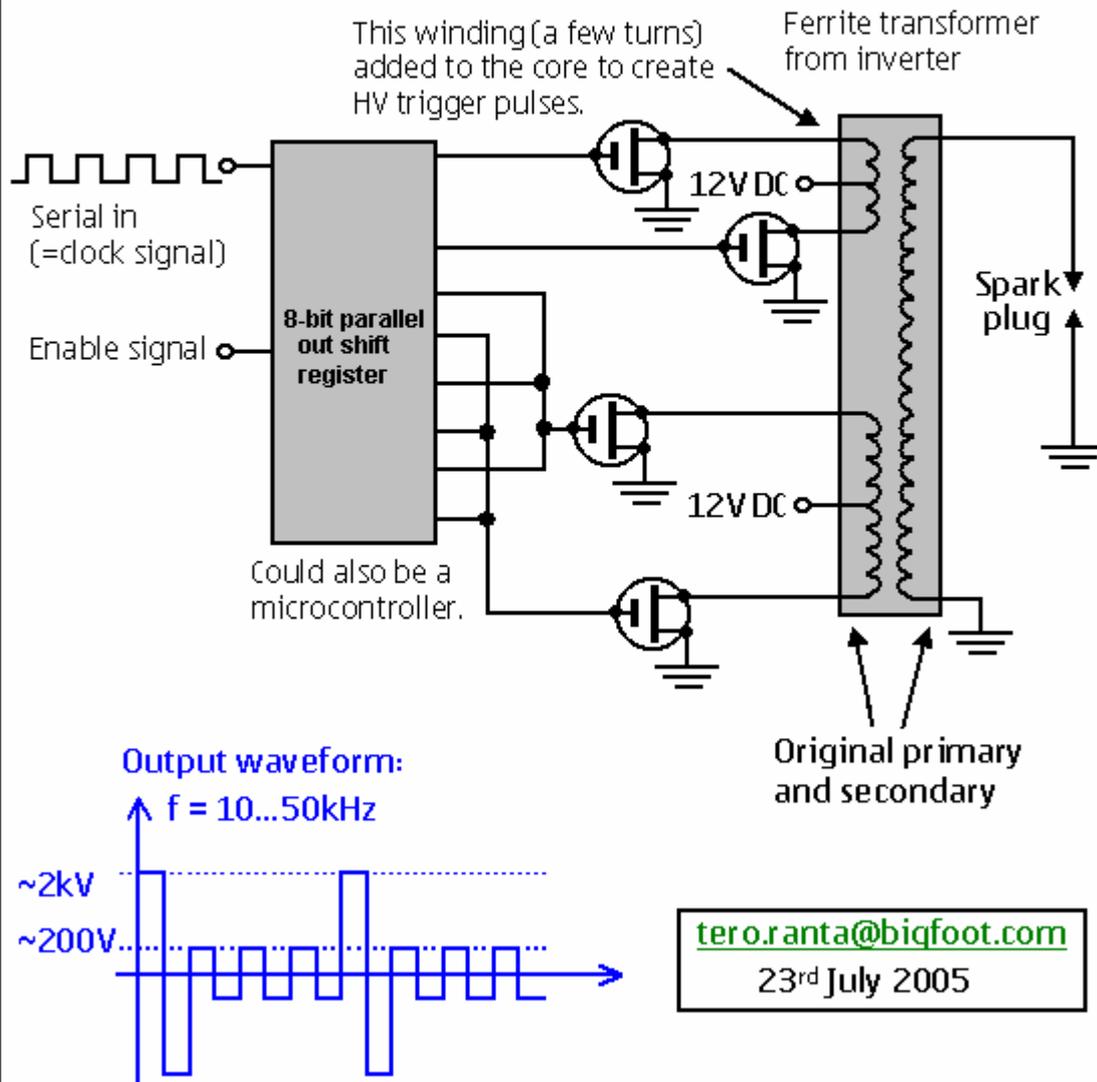
I have a good feeling about this... For so many years so many of us have been chasing something, "overunity" or whatever, but this time this could be it... Thanks s1r9a9m9 !

Here is an idea how to make a custom inverter (by using a ferrite core transformer from a commercial inverter) to create HV trigger pulses between normal inverter high-frequency output pulses. The output frequency is the same as original inverter switching frequency (typically 10..50kHz). This circuit drives each spark plug separately and can be switched on and off with a simple logic signal. No switching is required, but each spark plug requires it's own inverter. The output waveform is AC for both HV trigger and normal pulses which reduces electrode erosion.

It would also make sense to use fast diodes instead of the ones I have used (P600M and 1N4007). I noticed that the diodes do not switch quite fast enough, as they are designed for 50Hz sine-wave operation. The inverter output is basically square wave with very fast rise times. Also the ignition coil rise time is extremely fast and the 50Hz diodes don't "suppress" voltage spikes quite fast enough.

A good fast diode could be: BY500-1000: 5A 1000V 0.2us

A normal ferrite transformer from an inverter is modified to output HV trigger pulses to the spark gap. The HV trigger pulses initiate the spark, while the low-voltage pulses maintain the arc between the HV trigger pulses. The output waveform is AC which reduces spark plug electrode erosion. Each spark plug has its own inverter, so no switching is needed. The spark duration is controlled by the ENABLE signal.

Serial in (=clock signal)

Enable signal

8-bit parallel out shift register

Could also be a microcontroller.

This winding (a few turns) added to the core to create HV trigger pulses.

Ferrite transformer from inverter

12V DC

12V DC

Spark plug

Original primary and secondary

Output waveform:
f = 10...50kHz

~2kV

~200V

tero.ranta@bigfoot.com
23rd July 2005

Willard and Jack:
Jack and I did two successful experiments yesterday. Here is what we did:

We built up two HV rectifier banks. Each was good for over 40,000 volts. The diodes we used are 1000 Volt, 1 Amp. We used 48 in one diode bank and 58 in the other. We put a 1 meg ohm resistor across each diode to make sure that the voltage divides equally.

One bank was connected to the spark coil and the other to the output of my microwave oven transformer. The variac was set to just below the arcing of the spark plug. Then firing the spark coil caused the plasma to start the arc from the microwave transformer. If we set the variac low enough the plasma would stay for a few seconds and then stop until the spark coil was fired again. Then it would stay again for a few seconds and so on.

Then we decided to try using the DC of the Microwave Transformer set. We wired in the bank of diodes that had been used with the microwave transformer and its capacitor (a 10.000 volt oil filled) before our bank of diodes. We put in a current-limiting resistor between our bank of diodes and the microwave's bank after the capacitor. We started with 1000 ohms here and gradually reduced it down to about 40 ohms (we where afraid to go lower for fear of blowing our diode bank). Each time we reduced it and tested it we got a louder bang when the spark occurred. At one point we had two 500 ohm resistors in parallel and one opened up. This was the loudest bang of

all as the open resistor had a bigger arc in it than the spark plug.
 So the choice now is do we want a powerful single spark or a longer plasma arc? It appears that the hotter the air in the plug and the moister it is the lower the voltage needed to maintain an arc once it has been started. Our results with DC are the same as with AC, as the peak voltage is the same, whether the current is rectified or not.

When we put a drop of distilled water in the plug and fire it, the bang occurs and in addition, several after-bangs occur as water runs down into the gap. This is with the capacitor in the circuit. If we use a drop of tap water we can see electrolysis occurring before we fire it. But the amount of E-gas would be minute. We can see wafts of steam rising from the plug but they are never pushed out by any force as you would have in an explosion.

We are wondering if the steam is the only thing running s1r9a9m9's car. We welcome your comments.

Ronald:
The coils make a difference. The diodes are steering the collapsing spike into the plug. With no coils I get one HV spark arc at 20 Hz 50% duty using a 555 pulse generator.

With a coil set connected as they are in the s1r9a9m9 drawing, I get two arcs in the plug gap. The sound is different...there are two individual times these are arcing. It's a double arc.

This is not theory or conjecture on my part......I did it. Have seen it. A coil in the mix makes things different. I don't know if it makes things better. Out of several types of coil, the one that made the most difference was the 2" x 2.5" #8 AWG magnet-wire, two independent overlaying coils over the same core. First one has 13 turns and the overlay has 9 turns. Core is S-320 soft iron-shot/epoxy torroidal (hollow) with 1/2 inch steel bolt through it. The further the core is inserted, the louder and more vicious the sparking activity becomes.

I'm using an old Chevy 20,000 volt ignition coil pulsed by a 555 @ 20 Hz 50% duty. This is just talking about the HV spark. Power source is a 12 volt 8-battery bank. Switching is done by an IRG4P254S IGBT.

There might be a better ratio of turns or size of wire that works better. I just experimented with some coils I had lying around which I had made for other purposes.

Tero:
This does make sense. I will have to try it myself. Do you get two 110V AC inverter arcs or two ignition coil arcs?

I experimented yesterday with capacitor discharge into a spark plug. The set-up is what Peter calls "S1r-Tero" - the low and high voltage sources connected through two HV diodes to a single point. The spark plug is connected between this point and ground. It probably doesn't make a difference in the car if you get two ignition sparks (as they are just pilots for the big bang discharge through the inverter capacitors), but it could make a difference if you get two 110V AC arcs.

In this case I didn't use an inverter as a low-voltage source, but a flash circuitry out of a disposable camera. It consists of a 120uF Photoflash capacitor that is charged to about 300V DC in about 5 seconds from a 1.5V AAA battery.

I soldered two wires to the Photoflash cap terminals and connected it to the diode-spark plug circuit. As a trigger I used just an ignition coil connected to 12V battery through a switch. Ignition is manual by closing and opening the switch.

The cap discharge to spark plug is an extremely loud and sharp BANG. It does not work so well with a drop of water between the spark plug electrodes, but it does still arc if you spray water on it.

The discharge bang can be "slowed-down" by putting an inductor in series with the cap discharge path, which also limits the peak current. I used a 1.8mH loudspeaker cross-over filter inductor. This changed the discharge characteristics to a much smoother POOF instead of sharp BANG, and the arc was more "plasma-like". A relay solenoid coil could be used in it's place, but inductance is a lot higher.

The discharge energy of a normal ignition coil is about 0.045J (equivalent to discharging 1uF 300V cap through ignition coil primary, this is how CDI ignition systems work). In my capacitor discharge experiment the discharge energy is $E = 0.5*120uF*(300V)^2 = 5.4J$. Thus the diode circuit uses about 0.045J energy to trigger a 54J discharge, or the circuit acts as an energy amplifier with a gain of 120.
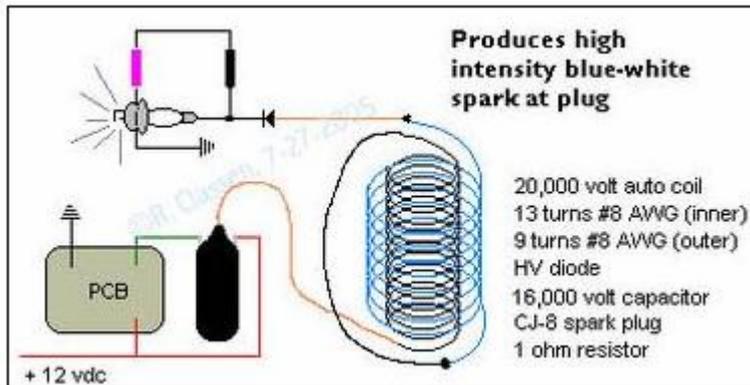
It's also interesting to note that my 230V AC inverter has a 100uF output capacitor that it charges to 300V DC, which is 4.5J. If the spark plug fires 100 times per second you need 4.5*100 = 450W of continuos power to be

able to charge the output capacitor fully between bangs.

Next I'm planning to build a system where I continuously charge and discharge a 100uF capacitor through the spark plug at about 50Hz frequency.

Ronald:
Gentlemen, I took my double coil (the one in the photos section) and placed an old SPRAGUE BUFFER (.002-16,000 volt) capacitor from the top of the plug to the base., cathode to hot. (part number MD-D2). It increased a 3ms spark from a 20,000 volt Chevy coil so much that it screeches when it fires. Very bright. Haven't tried it in the motor yet but I thought it was significant enough to mention. If you wind a coil like this make sure you wind both layers in the same direction. There may well be a better ratio of turns and a better way to amplify this. I just used a coil which I had already made.

Produces high intensity blue-white spark at plug

20,000 volt auto coil
13 turns #8 AWG (inner)
9 turns #8 AWG (outer)
HV diode
16,000 volt capacitor
CJ-8 spark plug
1 ohm resistor

So the path is:

Chevy coil >>>>>>>inner layer (13 turns) >>>>>>>outer layer (9 turns)>>>>>>>Plug w/ cap between top and base.

It's just pretty impressive, folks. Kinda scary even.

Russ:
I've also presumed that the rationale for lowering the Voltage is to increase the amperage potential while utilising conventional/inexpensive sources of sparking power, since higher amperage is necessary for efficient water gasification. Since water vapour is the primary fuel (which turns into steam), electrolysis should be limited only to the amount necessary to initiate and perpetuate steam production during the power stroke.

Electrolysis limiting is done by current limiting. My point is that although the present challenge may be to provide "enough" electrolysis, there is such a thing as "too much" (again, assuming my understanding of the operational principle is correct). I infer that hydrogen combustion is NOT what powers the s1r9a9m9 engine directly because:
1) hydrogen burns too hotly and
2) hydrogen oxidation produces water, which actually yields "negative" pressure (I've witnessed stoichiometric water-gas produce a "vacuum" when it ignites & reverts to water).

It seems like the efforts to prolong the sparking are meritorious and germane if my surmise re: the s1r9a9m9 operational principle is correct. Do you concur that:
1) Water vapour is pressurised by the compression stroke
2) Some the water vapour is electrolysed into dihydroxy (Brown's gas, etc.)
3) Some of that gas is ignited by the selfsame spark which causes a spike in temperature in the immediate vicinity of that hydrogen oxidation
4) Which turns some of the water vapour into steam (expanding to 1500x the aqueous volume)
5) Which causes a pressure surge within the pressurised cylinder
6) Which causes a consequent temperature rise
7) Which propagates the steam production in chain reaction throughout the power stroke

Jim:
On item 4), your value is for slightly above atmospheric pressure. At the 11.2 bar you get when the spark is due - you only get x 153.

On item 7), Not 'throughout' - it happens within about 10 degrees crank rotation since most of the ingested spray

flashes to superheated steam before the spark gets there.

Peter:
What I'm going for in my thinking is to conceptualise s1r's invention (process) in my minds eye. Tero says his spark is gratifyingly loud. Elliot says the flame goes out under pressure. At first glance the idea of s1r's invention is to super-heat water vapour turning it rapidly into steam thus driving the piston down due to the vapour --> steam expansion. S1r says the spark timing is retarded and the water is metered as spray or vapour into the cylinder. OK, then, when the piston starts going downwards on it's power stroke the pressure reverses the effect being that the plug will fire. This overcomes Elliots pressure problem. Now with Tero's big banging, hot spark, it is logical that the steam will vapourise having the effect of providing power. If my memory serves correctly water will disassociate at about 700 degrees, therefore two things are happening:
1. The water droplets vapourise (pressure source one) and the temperature of that disassociates the molecules.
2. The ensuing flame then ignites the Hydrogen/Oxygen mixture thus providing pressure source two.

Eugene:
Peter, it would be also a great pleasure for me to understand how s1r9a9m9's car works (if it really does). I believe that Tero's spark is 'gratifyingly loud because I have also experimented a lot with these things and a 10J discharge performed in open air is rather loud.

It could well be that, as Elliot says, the flame goes out under pressure. On water disassociation, if you calculate thermodynamic temperature of such a reaction you will get about 30000K. That is $T = E/(Na*k)$. So to my mind, only a small amount of water will be converted to H2 and O2.

I totally agree that the water droplets vapourise. But when you say that 'the temperature of that disassociates the molecules' this is:
1) Only a small amount
2) This dissociation is endothermic so it LOWERS both temperature and pressure in the cylinder if it occurs there.

Also, if the Hydrogen/Oxygen mixture ignites, the total pressure will not be higher than it was before, it could only be lower due to unavoidable losses. So we should think further.

Tero:
If the s1r9a9m9 engine is ever going to run the static test must work. That is, we must get at least some piston movement by turning water into steam with the plasma discharge in a static configuration.

The easiest way of course is to use a small single cylinder engine and use a single-shot plasma discharge system. For example with manually controlled ignition coil or other HV source and pulse capacitor discharge from the flash unit of a disposable camera.

The engine must be warmed up first by running it on gasoline or by heating the cylinder block otherwise all the produced steam will condense immediately on the cold cylinder walls. This happens in my syringe tests.   I don't get any pressure rise and the inside walls of the transparent syringe are covered with tiny droplets of condensed water.

The engine should then be rotated manually, water injected and spark plug fired using the discharge capacitor to produce plasma ignition. The piston should move at least a small amount...

Here is a quote from www.flashsteam.com, where they are injecting flash steam in an engine cylinder through the spark plug hole to make it run:
I modified a 11hp Briggs and Stratton engine to accept the L912™Injector. Then set about discharging it while it was installed on the engine. First I rotated the engine to top dead centre on the compression stroke. Then installed the injector, heated it up and discharged it. It was discharging into the combustion chamber of the engine. The injector developed an internal pressure of about 3000psi. If the concept was to be sound, I needed good results from a static test such as this. So I crossed my fingers and discharged the injector into the engine. I was astonished to see that nothing happened. The piston didn't move one millimeter. I was overcome with disbelief. The engine was suppose to turn over but it did not. And I knew that if the engine did not rotate through a compression stroke. In a static test, then it would not operate at speed. Or perhaps not at all. I asked myself "what is going on here?". This should work, the results in open air discharge were so fantastic. So I decided to put some more thought in to it. A day or two later I figured out what was happening.

Flash steam can form, or condense in a micro-second. Generally you're expecting it to flash instantaneously when your trying to run an engine off flash steam, and this is possible. But it can destabilise just as quickly. And this is what was happening in my experiment. I was producing the flash steam just fine, but the engine block was cold,

and it absorbed the flash steam directly into water. It was happening so fast that it was almost producing a vacuum. The room I was working in was air-conditioned and at a temp of 74°F. The mass of the engine block was at equilibrium with the room temperature and since the mass of the engine block was so much greater than the mass of the actual flash steam discharge, it simply absorbed it. This is probably the most important thing to consider when contemplating a flash steam engine.

Back to the static test. I then proceeded to take a small propane torch and heat the block and cylinder head of the 11hp Briggs and Stratton engine. First I heated it to 180°F and set up the experiment the same as before and discharged the injector. This time it worked. The engine kicked over about 740°of rotation. At 212°F the results were almost twice as good. In fact, the rotation of the engine was so dramatic the engine almost jumped off the table. This is a very important thing to learn. What is going on in this situation must be watched very closely since it is a relative factor that will affect performance drastically. For example, it has been observed to cause extended run times, in four-cycle engines running on argon.
 The hotter the engine block the better the performance. It has been observed that ice can form on the exhaust valve stem in engines that are running on argon. And the block is generally cooled by the compressed argon. However, if you heat the block before running the engine, you will always get better performance. So this phenomenon is relative even in non-flashsteam applications, as should be the case.   But the effect is much more critical in the case of a condensable vapour such as flash steam.

Russ:
The popping from a downed power line probably occurs from sudden steam expansion due to heat from high current (just as popcorn 'pops' because of the concussion of steam released from moisture trapped inside the kernels).

I'd still like to see mathematical proof that the "explosion" of water is not explained by:
1) Electrolysis & ignition, and
2) Sudden phase change to steam due to heat from a sudden current rush due to the instantaneous HV discharge.

The water cannon picture shows a spray of liquid water, but this would result from the sudden depressurisation of steam immediately upon escaping the muzzle. Since there is a relationship between pressure, temperature & time, I'm not convinced that these two processes don't explain the s1r9 power stroke.

To iterate: water vapour and air are pressurised by the compression stroke, partial electrolysis occurs, partial H2 ignition occurs, causing heat, which changes some of the vapour to steam, which elevates pressure, which increases temperature, which forms more steam, which continues to propagate in chain reaction during (perhaps the first 10% of) the power stroke. Is it true that s1r9's HP output cannot be explained thus -- especially in view of the unprecedented application water in a 4-stroke cycle??

s1r9a9m9:
You people hurt my head , thinking so much about what is going on inside the cylinder that my head hurts.

Inside a gasoline engine the air and gas are compressed to somewhere between 85 psi and 180 psi in most engines. When the piston is just past TDC the plug fires and the gases explode as the carbon components superheat under pressure.

Inside the water engine, the process is a little different. The water is taken into the cylinder as the piston goes down after the exhaust is released. The piston goes up to compress the water and air. When the piston starts back down, water is on the piston and the head, while the cylinder walls should be clear of water.   Just after the piston starts down, (if the timing is set right), a vacuum will form between the water on the piston and the head. Then the plug fires in the vacuum area, creating a hot shock-wave between the water on the piston and the water on the head, most like a dieseling effect.

My engine does not have the power it did have, but it's not that much less than before. The rpms at which my engine turns is not 3000 rpm. When I am driving down the road at 55 mph the engine is only turning about 1800 rpm. Each size of engine turns at different rpms for its application.

Does the water inside the cylinder explode? - I don't know.
Does the water separate inside the cylinder to make a gas, and then explode? - I don't know.
Does the water turn into steam inside the cylinder? - I don't know.

Maybe I should have never posted this info on the net; it seems to have stirred up more conflict than interest. If you are unemployed, don't waste your money on dreams. Get a job stabilise your life and then build your dreams.

The big car makers won't move over to make room for you and your ideas, they will step on you and keep you down. Sure, a car like mine will save you money, but not that much. A tank of gas costs $28.00 and lasts 1 week, that's $1,456 in one year. The changes which I made to my car were done using stuff that I had around the shop and help from friends at the welding shop and that's why the cost was so low on my car. Don't spend money on stuff you may not need, there are people out there who have surplus stuff that they will share with you if you ask, or exchange the parts in exchange for some work.   I worked on my car for over a year to get it right, it took that long to figure to change the timing. You will run into the same problems throughout the building of the car as well.

This does work, but you need the time and money to spend on it as well. Just because you have all the parts and have it all in place does not mean that it's going to start the first time you turn it over. It is simple to build but to get it right on your car will take time.

As far as I can see, no laws of physics have been broken to make this work. It may be a fine line as to how it works, but that ain't for me to figure out.

In the cylinder, on top you have a high pressure, in the middle there is a low pressure, and on the piston there is high pressure. What happens between two high pressures when you add a strong electrical charge between them? - It ain't rocket science.

Tero:
S1r, "just after the piston starts down, there will be a vacuum formed between the water on the piston and the head" ....
No there will not be vacuum, but lower pressure than at TDC. Still pretty high. I think Aubug already showed that the water mist that came through the carburettor would flash to steam before TDC due to compression alone. So you most probably have pressurised steam in the cylinder when it's firing.

"then the plug fires in the vacuum area creating a hot shock-wave between the water on the piston and the water on the head, most like a dieseling effect"
If you fire a low-power spark or plasma or whatever in a vacuum (without water) you will not get any pressure increase (other than from a little bit of heating). The shock wave is so small that it will not do anything. The same with the spark in high pressure (without water). There will not be an appreciable shock wave. Certainly not enough to run the engine.

"Does the water inside the cylinder explode? - I don't know"
It has to in order for the engine to work.

"Does the water separate inside the cylinder to make a gas and then explode? - I don't know"
Probably not, even if it did it would contribute very little power.

"Does the water turn into steam inside the cylinder? - I don't know"
Yes it does. I think the compression is enough to turn the water mist into steam before it reaches TDC. Even if didn't, the spark or plasma would be hot enough to turn the water into steam.

"Maybe I should have never posted this info on the net , it seems to have stirred up more conflict than interest"
We are all grateful that you did!   We are just struggling to understand how your car works, because based on the information you have provided (the first schematic with relays) it should not work.   Now it seems that the diodes inside your relays are doing all the work.

"Sure a car like mine will save you money, but not that much.   A tank of gas costs $28.00 and lasts one week, that's $1,456 a year"
Where I live, a tank of gasoline costs about 70 euros, which translates to US$85.   If I need a refill once a week, I'm spending $4,420 a year.

"As I see it, no laws of physics has been crossed to make this work . It may be a fine line as to how it works, but that ain't for me to figure out"
You are breaking the laws of known physics. As mentioned many times, the amount of gasoline injected in a cylinder has an energy of about 3000 Joules. The normal ignition spark contains about 0.05J of energy and my 300V capacitor discharge spark contains 5J. To have the same power with the 5J cap discharge as you get with 3000J gasoline, you would need to get 600 times more energy out from the water explosion than you put in to ignite it. There is no known mechanism to explain this.

John:

Jonathan, If you are absolutely intent on chasing the "relay" and not proceeding on the ideas of Tero, I would suggest that you start looking at military surplus. After a fair bit of reading I suspect, but have no proof, that it is a mechanical chopper for transforming DC current in a radio power supply from possibly an Airborne Warning System (AWACS?) probably from the late 50's or early 60s.

Another possibility is the same thing for a turbine ignition circuit, or a heating combustor igniter from the same time period. There is very little on the net and I'm out in the country and haven't access to a good technical library here. But the very robust design, suggests military, and none of the civilian designs I have seen use two coils.

Because there is no external supply to the coils, they are powered through the contacts, and this pretty well defines them as some kind of vibrator. As your friend said; if it were a relay it would need about 14 connections. I can't actually figure out the operation of the device from the circuit that s1r9a9m9 supplied, but it is possible that there is another hidden coil wire, also, the operation of the rocker arm on the top contacts is hard to determine without knowing the spring loadings on the various contacts. I think it is pretty certain that there is nothing available today in the usual relay field which is even close.

Tero:
I have been wondering why s1r9a9m9's diodes inside the relays don't break as they were spec'd at 600V or so, while the ignition coil produces a lot higher voltages (10-30kV).

Could the answer be so simple, that the spark plug does not allow the voltage to rise to very high levels, as the air in the gap breaks down well before the ignition coil reaches is highest open circuit voltage.

The electrical breakdown voltage of air is about 1-3kV/mm at 1 atmosphere. The pressure inside the cylinders increases this somewhat, though. I measured the voltage across the normal spark plug while my 6.5hp engine is running with an oscilloscope and voltage divider. The voltage reaches about 4kV before it arcs.

s1r9a9m9:
I and my son are reverse-engineering the relay that I cut the sides off of and we are going to find newer stuff that can be used for the same use as the relay and as cheap as we can. I found a guy who is 85 years old who knew what the relay fit. It operated two pumps on a 1949 Johnson-Prutte air cooling system. The relay was used to the turn on two pumps, when one would start to get hot the relay would switch the power to the other pump before the other shut down, that's the reason for the diodes in the relay.

I'll post the info as soon as we get it together. Since my car is running now, I will replace one relay at a time to test the tech we try. YES, I will keep records of events on this project and take pictures of the stuff needed for the system.

I didn't change any of the stock stuff on the engine. The spark advance still works, and stock HEI coil in the cap is GM equipment. The vacuum hoses were all replaced with new ones along with the base plate under the carburettor and behind the heater controls. I know the timing seems way off on the engine, but that's where it runs the best and the smoothest. Other engines may not even have to have the timing changed, I haven't done that yet.
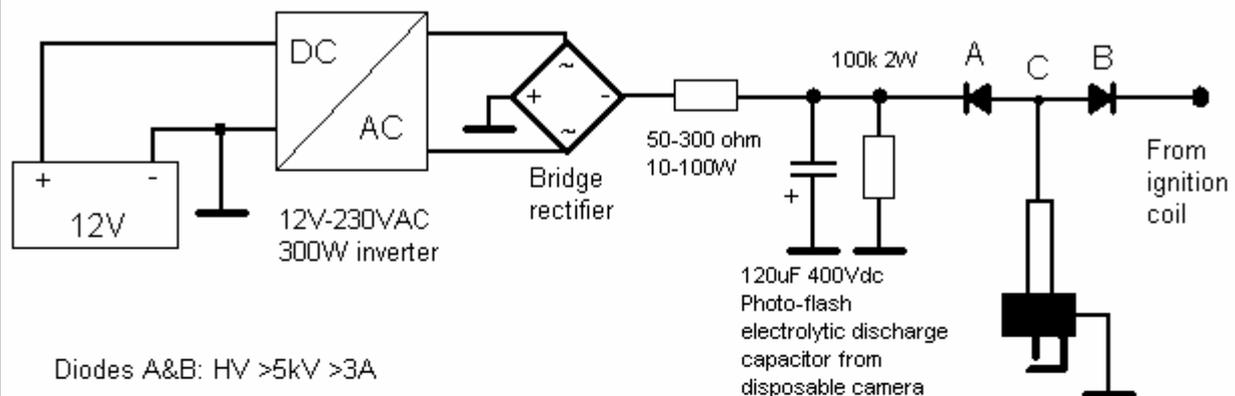
I thought I would start a new group to help with storage space here. I'll put all my file in the new group. Any one who needs the space is free to join. Here is the address:
groups.yahoo.com/group/WaterFuel1978/

Tero:
I tested the plasma ignition system in my 6.5hp 4-stroke engine with gasoline and propane (didn't test water yet). I used HV pulses from the original ignition coil as trigger or pilot sparks. I had to reverse the polarities of the bridge rectifier, two diodes and the capacitor to get a better pilot spark. The schematic and details are:

"S1r-Tero" plasma spark plug system for a single-cylinder engine using the original ignition coil

DC / AC — 12V-230VAC 300W inverter

12V + −

Bridge rectifier

50-300 ohm 10-100W

100k 2W   A   C   B

From ignition coil

120uF 400Vdc Photo-flash electrolytic discharge capacitor from disposable camera

Diodes A&B: HV >5kV >3A

The inverter charges up the 120uF Photo-flash capacitor to about 300Vdc. The resistor (or lamp or an inductor) is used to limit the charging current to the capacitor. The polarities of the bridge rectifier, capacitor and two diodes are reversed, because it seems that the engine's ignition circuit gives a better spark in the negative direction.
   The capacitor is discharged instantaneously through the spark plug when the ignition coil creates a spark in the plug. The discharge energy is about 5J, or about 100 times stronger than the spark created by the ignition coil itself. You can switch between original and plasma ignition by switching the inverter off and on. Bleeder resistor safely discharges any residual charge in the capacitor.
   The engine's RPM rises when the plasma ignition is activated (at least with gasoline and propane). The gasoline consumption seems to be a little bit less than with stock ignition. The engine starts extremely well with the plasma ignition.
   NOTE: Make sure that the spark plug is not resistor type (measure resistance from tip to center electrode, should be less than a few ohms), otherwise the capacitor does not discharge fast enough through the plug.

31st July 2005
tero.ranta@bigfoot.com

I ran the engine on gasoline and propane. In both cases there was an apparent increase in RPM when the plasma ignition system was activated (engine not loaded). There was some plug erosion, but that can probably be solved by lowering the discharge energy (smaller capacitor or lower voltage). The discharge energy is quite high (about 5J) and makes a very nice and loud bang in the spark plug when I pull the start cord with the spark plug removed from the engine.
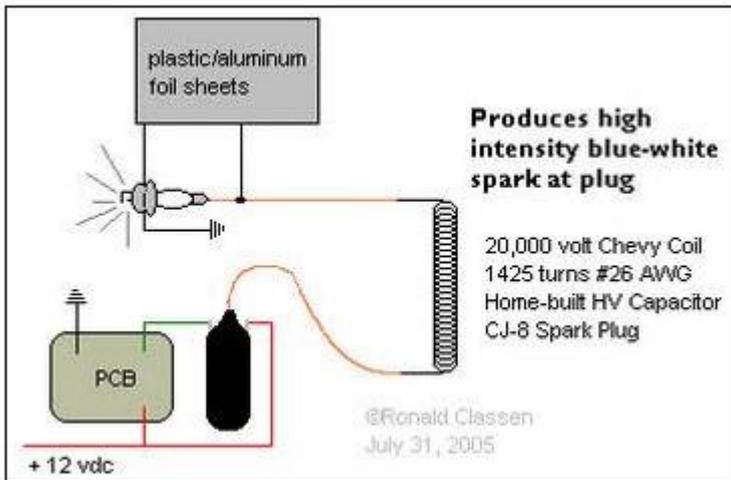
Note: Even though there is DC at the spark plug all the time, the discharge itself lasts only a very short time (so short that it's difficult to record it with video camera at 30 frames per second).

Jonathan:
S1r9a9m9, thank you again from all of us, to you and your son, for all your efforts in helping us. You are good people, to others and our environment. Also thank you more than we can say, for coming here and helping everyone follow your plans rather than try to make money off of it and eventually lose it in the greed. You and your son are great men.

Ronald:
Here is the diagram of the way I've got it hooked up at the present time. It's getting simpler. I got tired of blowing up HV capacitors so I just made one from plastic and aluminium foil. Fixed that puppy!   We got bang now.

Produces high intensity blue-white spark at plug

20,000 volt Chevy Coil
1425 turns #26 AWG
Home-built HV Capacitor
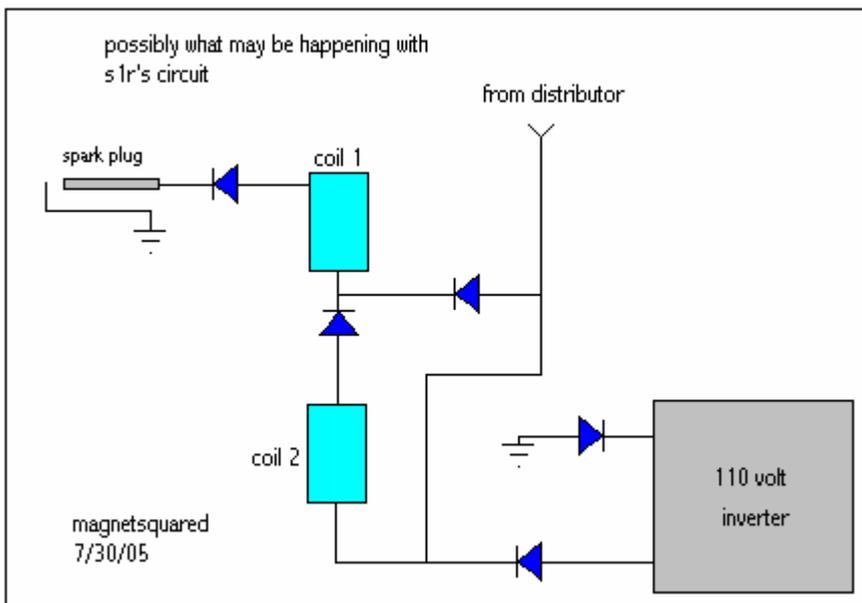CJ-8 Spark Plug

©Ronald Classen
July 31, 2005

Jim:
Wow, you learn something new every day. It seems that it requires 5000 more volts to jump the gap if polarity is wrong on the plug centre. It should be negative for more efficiency. This means that the main flow of electrons would be from centre of the plug out to ground. The only problem is the wear on the centre electrode is greater with negative centre, while wear is greater on the ground electrode when using a positive centre. I will need to rethink my view on S1r's circuit in that light. Here's a couple of links on that:

http://members.aol.com/bgahc/01_jwha_coilpolaritysparkplugs.html
http://www.nurex.com/catalog.htm?show_product.asp?pid=A-12116~main

Here is what I, initially, think may be going on with s1r9a9m9's circuit:

Tero:
There's a very simple explanation why the spark plug receives a negative HV pulse. In a points-ignition you first make the contact (current starts flowing from the battery to the ignition coil primary) and then after what's called 'dwell time' the contact is broken. The spark is formed when the contact is broken.

When the current through an inductor is abruptly switched off, it creates a negative EMF pulse. Then there is some ringing and the voltage swings back and forth across GND, but in general the highest voltage spike seems to be a negative one.

I'm not sure if this applies to CDI or other types of pointless ignition, but at least my 6.5hp engine with transistor ignition also produces a stronger spike in the negative direction.

Rex:

I always thought that the centre terminal of a spark-plug got a positive polarity. Not so:

Go to http://beyond-designs.com/pspice.htm and scroll to the middle of the page to the title "Level 3 spark gap model and test circuit" the second to last sentence says "Note that the centre terminal of a spark-plug is normally fired with negative polarity".

Tom:
Hi Guys. I have looked at the problem starting at the power source, that is, the alternator in your car. This is the only renewable (charging) source to run any ICE thus this is the principal limiter in a system design. Small cars have alternators producing about 60 amps at 15 volts + or -. Saloon cars run with about 80 amps and trucks or luxury cars 100 amps. This gives a total watts or power available as:

15v x 60 A = 900 watts 15v x 80 A = 1,200 watts 15v x 100 A = 1,500 watts

You cannot squeeze any more power out of the alternator without burning it up and this output is based on the engine rpm's, thus at low rpm's you are actually draining the battery to make up for the lower power produced by the alternator. The battery is just an equaliser in the system but does require recharging. Technically, the car's electrical system is designed to be operated at a much less load with everything turned on, thus you only use maybe half of the watts produced for normal operations.

 Now what we are trying to do is replicate the benchmark that S1r9a9m9 tested at his plugs, that is delivering 6.6 amps and 24,000 volts. We know that this is a combined electrical system, that is, it is a AC pulse of 110v at 6.6 amps = 726 Watts PLUS the output of the HV DC from the coil of 24,000v x 0.0005A = 12 watts EQUALS 738 WATTS of power. This is equivalent to almost 1 horsepower or 529 foot pounds or "force per second" that is being released as energy at each plug when it fires!

A 4-stroke internal combustion engine running at 2000 RPM fires each plug 1000 times per minute or 16.7 times per second. We are now INPUTTING 738 Watts or about 1HP into each cylinder with each firing or 16.7 HP per cylinder per second. Is that enough?

Also in discussions that I have had with professional electrical design engineers and with varsity professors, we have come to the conclusion that S1r9a9m9's design must be using 110v AC to the plugs as only AC current can carry a high frequency DC spike. You cannot mix DC-to-DC at different voltages and frequencies as they will clash and arc violently at the point of contact. Thus, half, or full rectified DC, is not an alternative. Pulsed DC which is essentially AC may be possible under certain circumstances.

Using AC as a carrier, is currently seen in cases where they are using power lines to carry telecommunications signals. You still have to jump around transformers, but that problem has been solved. You can also use your house wiring as a TV antenna....same basic principle.

Patrick you were partially correct in your analysis of what is happening in the cylinder. What is happening is that water vapour is being taken in on the intake stroke, compressed and heated on the compression stroke and turned to a "fog" or a more finely vaporised gas on the first part of the power stroke just prior to getting kicked by that ONE HORSE!

At the firing of the plug, there is very little plasma dissociation of the water and any that does is almost immediately recombined as I mentioned before. This dissociation of water occurs at about 3,000F and the spark is 5,000F-7000F at the arc zone ONLY. Thus, what we are getting is not much plasma dissociation of water but more realistically, a FLASH STEAM or "EXPLODING WATER" reaction to the flash heat being pulsed through the spark arc.

Tero has demonstrated this with his experiments noting the flash burst when the HV DC kicks in. The flash is a result of the ionisation and heating of the surrounding (moist) air near the arc. The more power (energy) supplied, the bigger the flash and louder the bang! Thunder and lightning!

This is a physical reaction and not a chemical one. The plasma flash is inputting the equivalent of one horse-POWER of energy into the water vapour in the cylinder only. As this involves a highly polarised water molecule in a strong polarised electromagnetic field you will also get a flipping of polarities to realign the molecules to the lines of force and as the force is being applied in one direction (top down) a shockwave effect should occur (driving the piston down as the water vapour expands as flash steam from the energy being applied).

This all happens in a very brief time period with what appears to be an explosive force, but as the steam expands the piston is dropping further thus creating more space within the cylinder that causes the steam to cool AND

CONTRACT as the energy that has been applied is being dissipated over a larger area.

The reason the cylinder is fired after TDC is thus to better atomise the water vapour (fog) prior to hitting it with a plasma 1HP charge AND because the water vapour being charged will tend to contract as the piston drops and more space is being created. The trick is to limit the amount of potential contraction or hit the bottom of the power stroke while you are still expanding. To put it simply, as the volume increases, the available power decreases, so we need more than enough power to move the piston to the bottom of the stroke before the exhaust stroke opens the valves. This is also why we need bigger jets in the carburettor to allow more water into the cylinder as it expands at a different rate than other fuels when energy is applied.

Now, are we producing enough power at the alternator to do this? Yes. 15v at 100 amps yields 1500 watts and we are only using 738 watts. But if we turn on the wipers, A/C, lights, etc. there may be a bigger drain and thus S1r9a9m9 logically installed a second battery to compensate for driving in the rain late at night. As the batteries are in parallel, they will both recharge during normal day driving.

Now also note that you can deliver 1,500 watts DC (or less) to your firing system in several other ways:

$$1,500 \text{ watts} = 15V \times 100A$$
$$= 100V \times 15A$$
$$= 500V \times 3A$$
$$= 1,500V \times 1A$$
$$= 15,000V \times 0.1A$$
$$= 30,000V \times 0.05A \ \ (A \text{ car coil uses } 0.0005A = 15 \text{ watts})$$
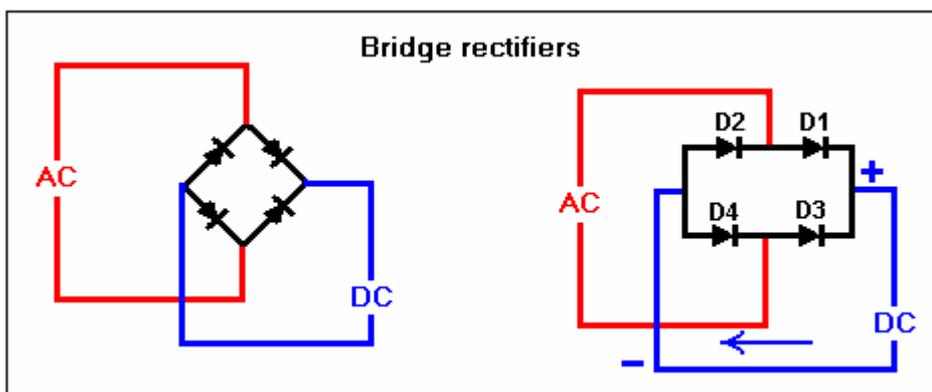$$= 60,000V \times 0.025A$$

Thus you can use different sized transformers to deliver the same power, however, please note that heavy DC amps require multi-strand heavy duty cables on the one side (due to heating) and high voltage lines can arc all over the place thus require proper shielding like those used in racing or high performance cars.

The reason that it is advisable to go to AC current is that AC can carry higher amps down a smaller line without overheating. If you switch it back to DC, the DC line to the plug should be the shortest possible to prevent overheating. The fact that S1r9a9m9 is using household wire, is another indication that he is delivering AC to the plugs and has an AC return wire to complete the circuit.

Also note that when you invert DC to AC, as the AC volts go up the available amps go down on a normal system (110v @ 6 A = 220v @ 3 A). Inverters also control the frequency (50-60 Hz or cycles per second for AC) and that DC through the ignition coil is coming out in KILO-Hz. Simply you cannot mix DC and DC currents direct without drastic results, BUT you can mix DC-to-AC by piggybacking.

Creating the plasma arc should also be possible with only AC (as Willard and Jack have done), but the HV DC spike has to ride on the AC current to the top of the plug. Piggybacking is controlled by diodes which limit the current and voltage flow to only one direction. The sizes of these are based on the amount of voltage and current passing through them. In S1r9a9m9's basic circuit, these are in part of the relay. I properly wired, these diodes should prevent back flow of current into the DC circuit (in this case to the coil and points).
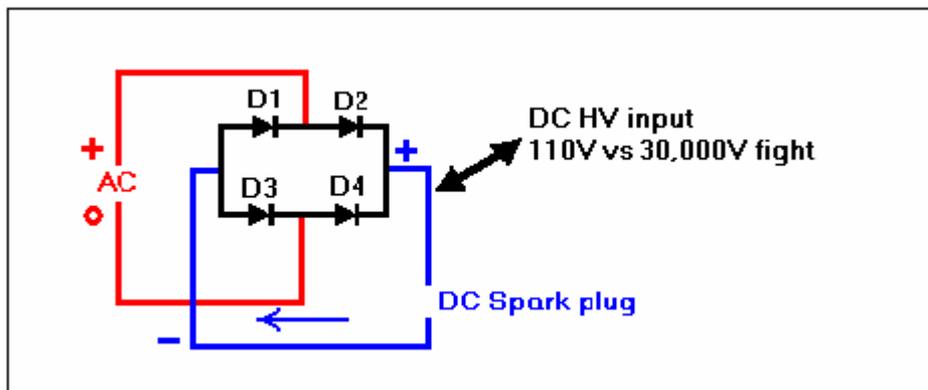
Almost all AC relays have a 4 diode bridge rectifier as this is required to convert the AC to DC to drive the relay coils. In S1r9a9m9's drawing there are 8 diodes! And these are not hooked up as a rectifier circuit, thus as drawn, the circuit will not work, as there is no proper DC to AC return through the D2-D4 diodes as shown below:

Diodes may be a bit confusing, but they are only a one-way valve that has the + current flowing in the direction of the `arrow'. Simply put, positive current flows from right to left in the above diagram. Alternating current, however, moves back and forth, thus the diodes will block current flow in one direction each way, only allowing a half-wave + to pass into the DC circuit at any one time.

Tapping into which of the 4 `LEGS" of a bridge rectifier will determine whether you are using one or more of its diodes. In S1r9a9m9's case, the DC is obviously piggybacking on the AC, but where and how?

He cannot be tapping into the positive leg diode D1/D3 for full wave DC rectification as the HV DC does not have a protecting diode and the system would blow.

In S1r9a9m9's drawing, the lead from the distributor comes in at the top of his relay and connects to the rectified half wave positive DC lead through the contact armature at the top of the first coil. Technically this should not work without some other components in the circuit.

Also, EVERYONE PLEASE NOTE that S1r9a9m9's drawings and other reproductions of his drawings of the relay circuit MAY NOT BE CORRECT and the circuit may not work as drawn. This I have confirmed through talking to university professors and electronic experts. The normal circuit must follow the same basic flow pattern as shown in normal bridge rectification for the relays to function (engage) but not for the AC piggybacking to occur.

So by attaching the HV DC to the "out" leg of D1/D3 and with D1 connected to D3 which both block the HV from entering the inverter, the piggyback HV DC charge would clash with the 110v/6.6a half (or fully) rectified DC at the point of contact. That is, you should be blowing the diodes in the relay real quick! Which may be what happened, that is, S1r9a9m9's relay diodes may have been blown and thus are dysfunctional and are allowing the AC current to flow through the circuit to the plugs (but also to the coil which may have internal diodes that prevent back surges).

In an inverted system, the DC can only travel to the plug where it arcs and is then grounded through the car body back to D2/D4 which allows the ground negative current back through D2 /D4 to complete the circuit. The HV DC grounds to the engine block but the lead back from the plug is needed in S1r9a9m9's circuit to complete the 110v AC link because the relay was not grounded to the car. Tero is correct in stating that there should be no need for the relay, as a series of diodes does the job, particularly on the HV DC backflow side.

Now let's look at the coils inside the relay. The coils in the relay are normally DC activated only through a bridge rectifier. (see circuit drawings of AC relays and note the diamond shaped symbol for a bridge rectifier). They function as a switch to open the circuit, which stays open as long as the inverter is turned on. (one Click). If the relay is working on AC current it will buzz as the latching is switched back and forth.

In S1r9a9m9's circuit if the wiring is correct then this means that the 110v DC is constantly being supplied to the plugs, but because this voltage and the amps that it is carrying is not enough to create an arc and because it is being looped back with the plug ground wire there is no current flow until the HV charge comes along and shorts out at the plug gap. Only then is everything released with a big banging plasma arc of 1 HP! The problem, however, is still that the piggybacking of DC-DC should not happen without sparks flying at the relay.

Willard and Jack's experimental findings using AC direct required 2,500V at about 3.8 amps or 650 watts of power to initiate an AC spark. They also found that the spark could then be sustained, even if they dropped the voltage down to 650 volts at 0.12 amps (78 watts). Tero piggybacked the HV DC from a coil on to the AC through a capacitor and got a really big bang!   Are you getting the picture now?

To answer Willard's question about which is better, a single powerful discharge or a sustained spark, I would recommend a quick blast versus a sustained charge that will heat up the plugs too much and because the actual discharge time in the cylinder is very short due to engine RPMs.

Now the problem comes of how to deliver the 6.6 AMPS. A 400 watt inverter at 110 volts only supplies 3.6 amps. (400/110 = 3.6) However, an 800 watt inverter at 110 volts yields 7.3A. You can still suck more amps through a 400w inverter than its rated capacity, however, it will heat up and that is why S1r9a9m9 is using a separate fan and cooling system around his inverter. See? Smart guy, huh? That's what tinkerers do when they run into a problem. Better to go with a bigger inverter next time.

Not all inverters allow for high amps to flow through them as this may be determined by internal components and their loading capacities. Read the manual first before buying as we need the amps to power this system. You need a heavy duty inverter that can run big power tools. OK? Tell them you want one that can power that 1 HP impact drill you're holding between your legs, Macho Man.

What we are looking for is an inverter that can deliver 720 watts. This can be done by using different AC output voltages too:

110v x 6.6A = 720 watts
220v x 3.3A (the Minuzo Effect may happen around 150 v)
440v x 1.65A
880v x 0.825A
1760v x 0.4125A
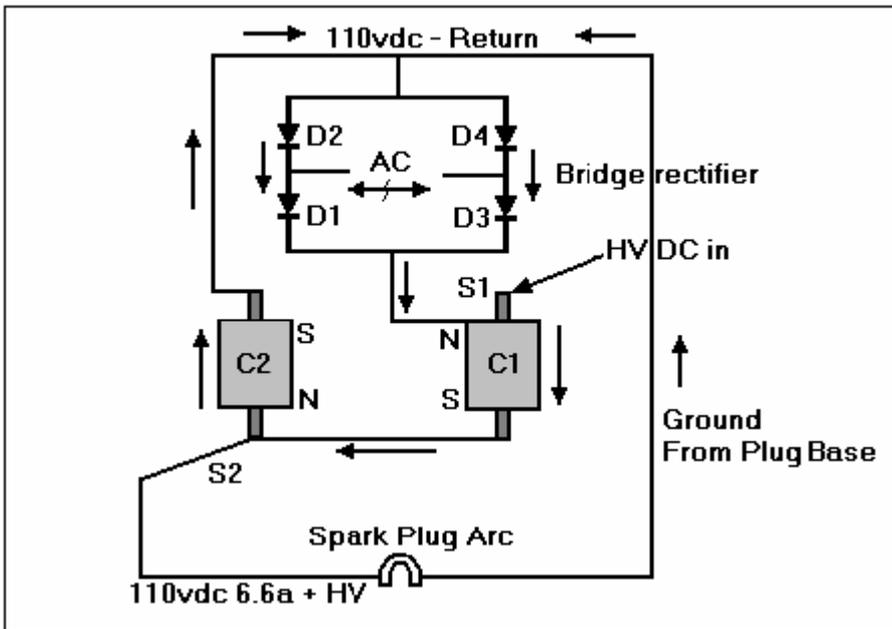3520v x 0.20625A
7040v x 0.1031A

They all produce the same power output.

Now the coils inside the relay, what do they do? The positive DC to the top of the first coil activates the coil around the core to create an electromagnet that opens the relay switch at the top (to allow the HV DC in) and then the current flows to the next coil which opens the switch at the bottom of the second coil. The diode shown in between the two coils makes sure current flow is only in one direction. The positive rectified DC activates the core to open the relay switches as indicated but the current must flow through the coils to activate the ferrite cores that control the switching. The cores can then conduct the higher amps through to the plugs.
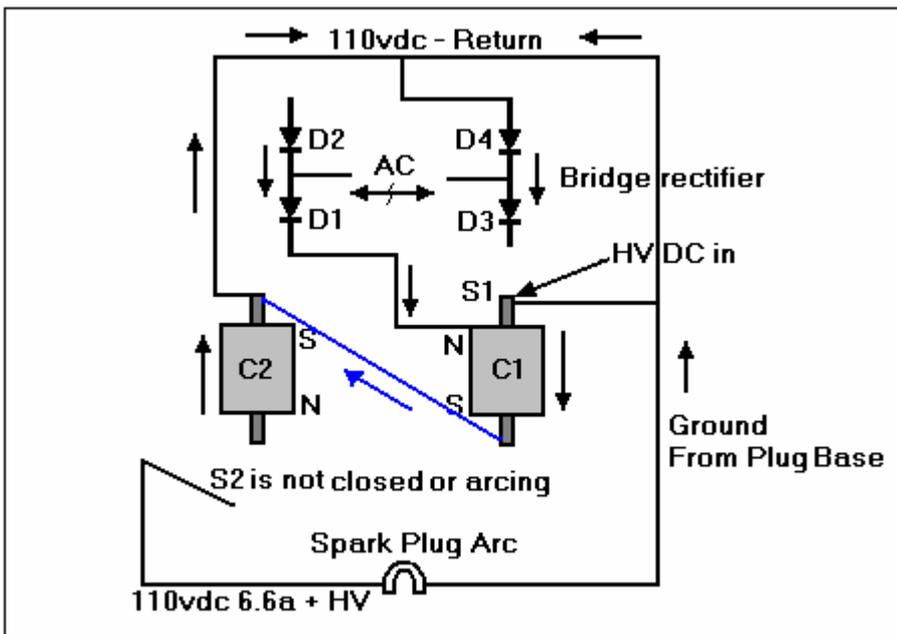
Now, due to the fact that S1r9a9m9 indicated that he has no "noise", that is, high frequency arcing noise on his radio or any other disturbances caused by high frequency arcing, this means that the coils in the relay may be acting to attenuate the HV spikes, that is, they are acting as a choke or a suppressor and a reverse suppressor that prevents the HV spikes from arcing within the relay and thus only at the plugs. Clever boy!

Is this necessary? No. The HV high frequency spikes generated by a car coil are already filtered out by the car's on-board electronic equipment, thus any additional attenuation is unnecessary.

Now how are things actually flowing through the relay? Since there are 8 diodes in S1r9a9m9's AC relay drawing and the normal arrangement for an AC relay is to have a 4 diode bridge rectifier in it to control the latching of the circuit, then the wiring of the circuit should be as follows:-

Refer to S1r9a9m9's drawing or the replication below and you will see that there is no proper rectification as the 2 leads from the AC only have one diode each and there is no return link for the other half rectification. Secondly, the wiring to the second coil would create a reversed polarity that would `open' the S2 switch thus preventing any spark at all. With only 2 diodes connected to the AC, he could only achieve half wave rectification through the coils and they might chatter or buzz or unlatch on the missing other half wave. This does not appear to be happening, thus the drawing is most likely incorrect.

In fact since there are 8 diodes shown in S1r9a9m9's drawing, these are most likely arranged as 2 bridge rectifiers and wired to run the relay as a switch, clicking on when AC is applied to one side, then switching if AC is applied to the other side contacts with the top pin being DC OUTPUT POSITIVE that could be grounded anywhere. S1r9a9m9 just got lucky and wired it up wrong in reverse and may only be getting a half wave rectified DC current if his AC is wired with D1 and D3 diodes only and not to any D2/D4 diodes.

I have left out the other 4 diodes in the above drawings as these as shown in S1r9a9m9's drawing are merely directional components that limit back DC voltage to various circuits. This includes the fact that the 110 DC half wave flowing back from the plug is also connected to the connecting armature that the high voltage from the coil is coming in on. This could, or does, cause a back-flow current to the coil between sparks, but since the coil is firing so rapidly with such high volts the back 110v half-wave should have little time to cause any major effect except for probable arcing within the relay.
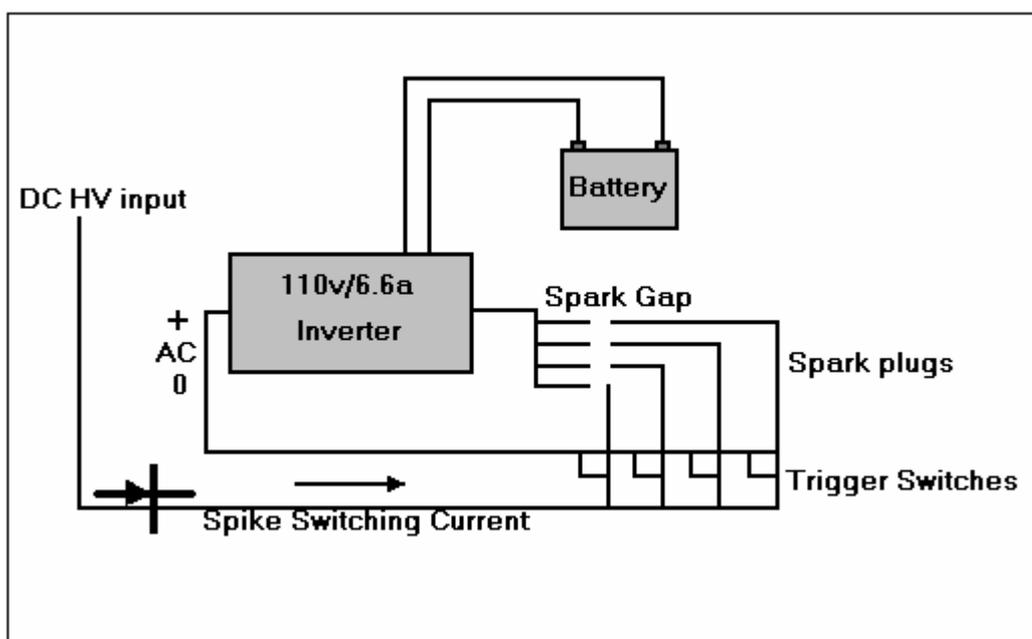
Also in normal 2 coil relays, the coils are mounted in a `U' shape with the cores connected across the bottom mounting plate. This configuration would allow for both S1 and S2 latching. In S1r9a9m9's drawing, the second coil would have reverse polarity and thus would not latch properly as shown.

Now is S1r9a9m9's relay being used as a relay? Yes and No. The single `CLICK' when the inverter is turned on indicates that the relay's coils are DC activated and thus open the circuit.  It is clearly not operating as an AC circuit or `vibrator' as the relay is not `buzzing' and would have been burned out long ago. But the fact that the top pin has a reverse flow potential, this relay design would not be operating in a normal mode the way that it has been wired.

Then the question arises again….do you really need a relay in this circuit? Yes and No. What you need is a switch to turn `on' the circuit to the plug that will carry both the 110v/6.6a AC and the HV DC spike when the HV spike occurs. You do not want the 110v/6.6a current to run continuously to the plug if you can help it. A mechanical relay most likely will not last very long with such rapid switching, so what we will need is an electronic switch which will allow both the AC and DC to flow to the plug and a switch that would be tripped by the normal ignition timing system.

So the simplified circuit would be an inverter with the AC out and NOT rectified and merged with the HV DC from the coil (or other source) that would be switched by an electronic component triggered by the distributor. Now what is the electronic switch? I already know several ways, but let's hear from you guys on your thoughts….

Also note that this simpler design allows for only a single AC inverter on a switching bus. You have one switch for each plug.

Now who can guess what components are in Kramer's Watercar Circuit? This is what I have designed and will be testing soon in a circuit without a coil or distributor contact points and no relays….please!

I now need some more robust plugs to handle Eugene's "fat banging sparks". Any better ideas on new plug designs? Tungsten rim firing? Multi-Head? Grand-Arc Blasters? Water-Jacketed Cool Plugs?, Plasma Storms? Here we go again…..   Intelligent comments welcomed.

Ronald:
If it helps in any way, I did manage to prove that the big arc/spark is essential to operation using the method that I am trying to do. I tried to perform the very same run test using the spark from the magneto and coil that come stock on the motor. It absolutely refused to do anything......in fact, it didn't even want to run on gas very well with all that steam blowing in the carburettor. (I had a LOT of steam going in there). Anyway......something to think about.

Tom:
I expect that the plasma spark might be necessary just to reliably ignite the egas alone, without even considering

the steam. You could probably make a more conventional (and FCC pleasing) ignition system work OK for egas alone, but it wouldn't be easy. To ignite water molecules in the combustion chamber, if that can be done, I expect that you'll need to have good control of the oscillator system that creates the spark. With a well designed experimentation system, one could can try to find an "ideal" algorithm to cause resonance in the water molecules that leads to separation and ultimately to combustion. It would be great to have a system that allows running experiments that could test different algorithms for cracking the molecules. I don't have a clue yet what a good starting algorithm would be, but I bet some folks here could recommend a few to try.

You can build and sequence a spark event many ways (if money and time were of no concern). For example, one algorithm might be to "build" a high voltage pure AC signal of a "programmable" frequency profile across the spark plug electrodes, hoping to cause water molecule resonance of some sort, but with slightly less voltage than would cause it to spark, increasing the voltage until continuous arcing occurs and then build additional DC voltage across the electrodes, combining the AC and DC to make a sort of plasma with a "DC bias" in its applied voltage. The DC bias would hopefully cause some variation of the electrolysis effect. Alternately, the DC bias could be added earlier in cycle, then building the AC voltage second, or nearly any other control algorithm desired. Hmm... sounds like we need some sort of sophisticated computerised welding controller.

We might find that 32KHz signal at 20KV riding on 20KV DC applied to a spark plug 5 times per power stroke causes some "special" behaviour (random example).... or it might be that 5KHz of 30KV with 10KV of DC bias, fired continuously for all 180 degrees of the power stroke works better. OK, I'm getting a little ahead of myself here, but the very thought of such a system gets my mind racing.

This proposed control/test system will need to be controlled with a computer model to "automate" each new algorithm. The engine would need to have an integrated dynamometer for accurate shaft power measurement. I made a dyno for some electric motor development work I did a few years ago that I could re-use some of the parts from. I also have access to most of the necessary monitoring, control system, and computer hardware and software, but I lack the time to build the whole system myself right now. It would be a tremendous effort going at it alone. Perhaps a long distance group project of some sort? I live in Rochester Hills, MI, near Pontiac, if anyone is interested in collaborating. We need input from a chemist - I hope he will be one of the long-distance team members.

Mike:
After reading through several posts, it appears as if there is a problem regarding the current method of gas production coupled with its delivery into the combustion chamber. First and foremost is the "backfire" issue. Obviously it doesn't take much to cause diatomic hydrogen and oxygen to combine; it's a rather unstable combination to begin with and not something to utilise carelessly.

The electrolysis cells that I made in the past, were dedicated to the separation of the two differing forms of gas that are produced at their accumulative electrodes. Because of this, I had never taken the time to simply reduce the band gaps, remove the partitions and monitor the overall production of raw gases when not applied through a separation chamber configured electrode system. So, I had always been under the opinion that electrolysis was a rather inefficient form of gas production, regarding water to diatomic-hydrogen and oxygen. Now, after reading through some of the data tables available here, I see that electrolysis efficiency is excellent when not configured for dissimilar gas separation.

This leads me to begin from a fresh perspective regarding an efficient and safe production and separation procedure. From doing many other experiments within other subjects, I believe the separation of the two differing gasses can be achieved after the batching type raw production process. Because the cell provides a suitably conductive (moist) environment within its interior, the chances of ignition are minimal and merely contingent upon the voltages applied, coupled with the plate/electrode band gaps, however, even when using the check-valve/bubble system there remains a very real danger in "backfires", obviously due to the intake/delivery method employed, highly unstable mixtures (Diatomic hydrogen and oxygen) in the intake manifold spells disaster, one way or another. This is not "gasoline", which is fairly stable within the intake manifold environment.

Coming to mind are three natural advantage characteristics between the differing atomic forms that can be utilised to compel their separation after the batch production process has taken place. The first is self evident; their atomic mass distinction. With this alone, there can be applied a centrifugal process based on $m = v^2/R$ or the mass by the velocity squared divided by the radius of the rotating chamber, which obviously "accelerates" the natural mass layering effect of gases and fluids, etc.

This method of separation alone, is achievable, however, there are a couple of other methods that can be integrated into this procedure to help achieve its goal more effectively/rapidly. Of the remaining two self evident

distinctions, there is an acoustic "resonance" difference. Using high frequency sound waves, the two gasses can be assisted further in separation from one another while within a centrifugal chamber. The final of three useful distinctions is their atomic "charges" and using magnetic resonance, they can be compelled further towards an area divisional state.

Once this has been achieved, each can be introduced into the engine appropriately; to insure that no premature ignition takes place.

Tero:
My 7-cell electrolyser seems to be running at well over 100% efficiency. It is currently producing 48 litres per hour at about 13.96V and 6.4A. Power consumption is about 89.3W straight DC. The electrolyte is 20% pure NaOH by weight. The ambient temperature is 15C and the temperature inside cell 36C. The cell has been running for about an hour.

The total efficiency is 1.86 Wh/l (conventional 100% efficient electrolyser 2.36Wh/l). The current efficiency is 0.93 Ah/l per cell (conventional 100% efficient electrolyser 1.6Ah/l). The voltage across one cell is 1.99V.

Thus the cell is about 127% efficient in terms of power consumption per output gas volume and 175% efficient in terms of current consumption per output gas volume. Surely overunity.

I would like to thank Bob Boyce for helping me. I would have never believed these numbers without actually building the thing. We are working on a very comprehensive FAQ of this design that will be posted at some point.

The construction details of the electrolyser itself are here:

 http://groups.yahoo.com/group/egaspower/message/3518

The electrolyte is very conductive. In my example of 7 separate containers wired in series, there's no charge applied to the middle ones either because they are in series!   If you wire 7 resistors in series you have 1/7th of the total voltage across each resistor.   I wanted to get about 2V dc per cell, and with 7 cells you can use a 14V dc power supply (for example a battery charger). You could scale up to any number of plates, but the voltage across the stack would be higher. If 7 cells produce 7 units of gas with a given current then 100 cells would produce 100 units of gas with the same current, but the voltage across the whole stack would need to be about 2V multiplied by the number of cells. Thus the power consumption increases approximately linearly with the number of plates.

The gas output is dependent on current, but the "overunity" gas production is very dependent on the configuration (current density, plate spacing, isolation between cells, electrolyte concentration and purity, etc.). It seems that you cannot get overunity (200% Faraday's law) gas production with a normal type of parallel plate electrolyser or several parallel plate electrolysers wired in series. I'm using 12-14.7V dc, my current limited power supply will adjust the voltage to maintain a certain current through the electrolyser. My electrolyser is good up to about 10A, but this requires higher voltage across the whole stack than I currently have. By using KOH electrolyte I hope to get 10A through the cell (6.4A now with NaOH) at the same voltage as now.

Ford manufactured a Ford Focus C-max hydrogen powered car that consumed 250 litres/min of H_2 from a tank. We are looking at ways to use steam mixed with electrolytic gas to significantly reduce the amount of gas needed. Also, the electrolytic gas is different than tank hydrogen. One patent (Juan Aguero's EP0405919) states that to run a 1400cc engine you only need 10cc of electrolytic hydrogen per second when it's mixed with "dry" steam. That is about 36 litters of hydrogen per hour.

The spacer material does not need to be PVC, I used it because it was transparent. You could use rubber gasket material, just make sure it's soft so that the stack doesn't leak. Transparent silicone rubber would probably be better than PVC, but it's also a lot more expensive.   Just make sure you go with 1/8" or 3mm spacing.

If I were constructing another one, I would have put the gas vent hole in the uppermost corner of the plates so that draining the electrolyte out would be easier when the electrolyser is turned upside down.   I would also have put two gas vent holes on each plate at both upper corners to help in equalising the electrolyte levels in each cell when it's turned upside down. You would need the other hole to allow the air to flow freely between the cells when it's turned upside down to equalise the electrolyte levels.

The electrolyte is filled in through either of the holes. There is no continuos water replacement mechanism. To equalise the electrolyte levels in each cell, the electrolyser needs to be turned upside down. It's crucially important that there are no holes in plates that are in contact with the electrolyte. The gasses are mixed inside

the electrolyser.   The output gas is a mixture of hydrogen and oxygen. I'm not using any vacuum or pressure, but am collecting the gas at atmospheric pressure.
 KOH is the ideal electrolyte and offers better power efficiency than NaOH (lower voltage across cell at the same current draw).   I don't have pure KOH yet so haven't been able to test it.   The whole trick to high efficiency is the series cell design, done so that there is no current leakage between cells. It's also important to reduce voltage across each cell to as low as possible to increase the total efficiency. I'm currently using 2V across each cell. Also, there are no holes in the plates (other than the gas vent hole at the top) and the electrolyte in one compartment is not in contact with the electrolyte in the next compartment. At 1mm spacing you could have problems with bubbles reducing the effective surface area of the plates so keep the spacing at 3mm.

Jim:
Just to help clarify; the flashing of steam is from the lowering of pressure to a point where it will mostly vaporise and expand. See below:

"As the pressure in the engine cylinder is always much lower than the saturation pressure of the water in the coil, once it is injected there is no possibility for the water to remain in the liquid phase and part of it 'flashes' into steam. The flashing process results in 'wet steam' because only part of the water is converted to steam while the rest is atomised by the flashing process into tiny droplets of water.

If the water were to be injected into a cold engine cylinder, the flash steam would immediately condense and there would be no pressure rise. To overcome this problem, the cylinder head and walls are heated and supply additional heat to the wet steam entering the cylinder. The atomised water droplets experience extremely high collision rates with the cylinder walls because of the explosive effect of the flash process. The tiny size of the droplets, coupled with high collision rates ensure rapid absorption of heat allowing them to be quickly converted to steam which is then heated further to superheat.

A flash steam generator permits the construction of a steam generating unit which is much more compact and has fewer thermal losses than a traditional steam boiler."

Eugene:
Hello all, today I'd like to present you some of my thoughts concerning s1r9a9m9's approach. It's only my assumption as yet, but I think that the excess energy released in water explosions has nothing to do with hydrogen and oxygen, in other words with the covalent bonds in water molecules.   The reaction of dissociation is reversible: so we can't get more energy out than we put in when we extracted the hydrogen from water.

We know that there are also hydrogen bonds in water. It is these hydrogen bonds which make water a unique liquid, very different from other liquids even those which have a similar chemical structure. The hydrogen bond between hydrogen atoms in different molecules, is approximately 10 times weaker than the covalent bond. But we really operate with these bonds when we break liquid water into cold mist!   This has led me to the conclusion that the hydrogen-hydrogen bonds are somehow connected with excess energy release.

If we consider that the total energy of hydrogen bonds is 10 times lower than enthalpy of burning hydrogen it will give us a value in the order of 20kJ per mole or 10kJ per gram of water.   Also, we can assume that the so-called "cold steam engine" differs from an internal combustion engine because it doesn't use the principle of a thermal machine to work. That's why the efficiency of an engine operating in cold-steam-mode could theoretically rise to 100% rather than the 35% or so for an internal combustion engine.

Thus, if we really release somewhat 10kJ per gram of water we need about 3-5 grams of water per second to operate an average engine. This seems to be consistent with s1r9a9m9's system as he reported rather high water consumption in his car.

JohnH:
Thanks Eugene, Very informative. It is also along with some of Kanarev's theoretical musings on ultra efficient electrolysis where he surmises that in certain instances electrolysis can break the hydrogen bonds instead of the covalent
bonds with much less energy required.

My feelings are that we often think of water as a completely inert and non active medium but it is useful to remember that the hydrogen bonds have a half-life of only seconds and that clusters of water molecules are constantly being broken and reformed and there is always a small proportion of D_2 and H_2O_2 in normal water along with dissolved H_2 and O or O_2 because of nuclear "accidents" in this activity.

Joe:
Quick review of standard coil option:

Start the spark, get a - spike to maybe -40 KV. When the plug ionizes, arc starts, does damped oscillation for about .5 mS, plug voltage drops to maybe -200 V. Continues until the coil field can't maintain the arc. Arc ends, get a + spike of several KV, then a - spike of similar size, a few damped oscillations, end of activity.

There are 2 conflict areas:

1. When the plug ionizes - get big -KV transient; need the low voltage source diodes capable of isolating the source from the lots of KV to prevent the coil energy from going into the supply instead of the plug arc. Needs a -40 KV diode stack to ensure that there is no supply current till after the arc starts and the voltage drops to the -200 V, actually the arc voltage added to the diode stack forward drop.

2. The purpose of the adder is to extend the arc duration past the + spike & coil end transients - without letting them get into the low voltage supply, besides increasing the arc current which should begin when the arc current starts it's initial damped oscillation. My best guess is that since the coil has spent it's current pulse, the remaining energy needs to be added to the low voltage supply current without an apparent transition, until the low voltage pulse expires - stretched from about 2 mS standard to your selected duration of maybe 8 mS.

There needs to be a diode [assembly] to prevent the low voltage supply from leaking back into the ignition coil. Many engines can do this by relying on the distributor cap gap to extinguish the spark during its transition to the + transient as it passes through zero volts. The alternative is to let the 8K ohm, or so, coil secondary wire to just leak - for the duration of the arc.

As I recall, Tero and others did bench tests and got impressive improvements in spark appearance, but weren't far

enough along to try full pressure engine or bench tests.

I have done a little testing at maybe 7 bar - till it started arcing in the rectifier. Current problem is specifying the adder diodes - direction, count, etc. I am using 1 KV 75 nS Trr - quick recovery diodes, costing $.09 each, in parallel with 1.5 M 1/2 W metal film 1% resistors.

Big change, it looks like about 40 needed in the low voltage adder between the supply output and the plug terminal.   Can easily afford the about 30 V fwd drop, think the toroid will do about 900 V rectified.

Have found the 1.5 M resistors can handle about 8 KV before they arc across the paint. I am using them with no diodes,   to sample the distributor wire signal to start the gated low voltage supply.

distributor wire >>>>>>>>> adder card >>>>>>>>> plug

The Adder card extracts the spark start time, and makes a gate start pulse to the toroid low voltage supply card; adds the coil voltage to the low voltage supply, 1 adder is required for each plug.   Will get a low voltage pulse on every plug whenever any 1 plug fires. Looks like about 6 diodes can block the low voltage supply from leaking into the ignition coil secondary and still survive the + spike on engines having direct connection, no gap.
Comments?

Tom Kramer has written an excellent synopsis of the current situation:

Watercar Technology Introduction:

There are a number of ways to operate an internal combustion engine using only water as fuel. The traditional approach is to separate water into hydrogen and oxygen gas using electrolysis, however, this process is quite inefficient. To improve the efficiency of electrolysis, various inventors have sought to stimulate water at its resonance frequencies and thus get more gas production with less energy inputs. This approach works, however, problems have always been in making enough gas on demand as needed by an engine, noting that storing H_2 and O_2 is a highly explosive alternative that should be avoided. There is also another group of inventors who make mono-atomic H and O gas, which is very nice as you get larger gas volumes and a more reactive fuel so you use less, but it still must be made on-demand. But basically, the on-board electrolysis approach has not been very successful.

Others have tried chemical reactions with water to produce hydrogen gas. The typical approach is with sodium hydroxide (NaOH) and aluminum which will produce enough gas so long as you have empty beer cans to keep the car running. Sodium hydride (NaH) is even more reactive, but highly dangerous to handle unless properly encapsulated as a company called Powerballs, Inc. is proposing. There are many other chemical reduction reactions that can be used, however, the metals become more costly and re-refining or reprocessing the waste water will be a messy problem. Not such a good ecological approach.

A recently revised approach is to use a plasma arc to dissociate water. US Magnegas Inc. does this in reactors that recycle carbon-based liquid wastes like sewage, used cooking or automotive oils, soaps and cleaning solvents, and so on, to produce a stable and compressible "Magnegas" which has been very successfully combusted in ordinary vehicles and can be used for cooking, metal cutting or in various power generating technologies. This is a worthy approach for liquid waste disposal and generation of a limited amount of usable gas for running vehicles.

The latest watercar technique utilizes a little known "exploding water" technique. This is based on a high capacitance discharge in water or water vapor which causes a "cold fog jet" pressure pulse together with light flash and sonic concussion. This is basically a lightning and thunder reaction and is the approach that shows the most promise when applied to an internal combustion engine. This is the recommended approach as it requires less energy and produces a powerful result without consuming the water, which is simply recycled repeatedly in order to achieve 300 mpg or more.

S1r's Plasma Fog Jet Watercar

An automotive mechanic who goes by the Internet name of s1r9a9m9 has the distinction of making the first plasma fog jet watercar. He did this somewhat by mistake using an old 1978 Chevrolet El Camino with a 350 cu in engine. His 'eureka event' happened when he accidentally dropped a 110v AC wire into a bucket of water. This resulted in an immediate explosion in the bucket. He thought that that was really cool so he did it again but with a board over the bucket this time. Well, the 2 x 4 imbedded itself in his shop ceiling so he concluded that that wasn't such a neat thing to do again, but if he could get the same explosion to happen in a car engine, now that would be something!

A year later and after a lot of tinkering S1r succeeded! He now has his 350 cu in running on only water and he gets over 300 miles per gallon…..and he has put over 30,000 miles on the car to prove that it works.

What did he do right?

He started with a stock ignition and carburetor system. This, however, did not deliver enough 'spark' to explode the water, so he added a 12v-110v inverter and wired the spark plug leads through a relay that had rectifying diodes inside so that the high voltage (low amp) spike from the coil would piggyback on the low voltage (110v) high amp (6.6amp) coming out of the inverter. This combined current was enough to trigger the water explosion reaction when the relays (one per plug) were wired to each plug. Both the inverter and relays were <u>not</u> grounded to the car except at the plug base.
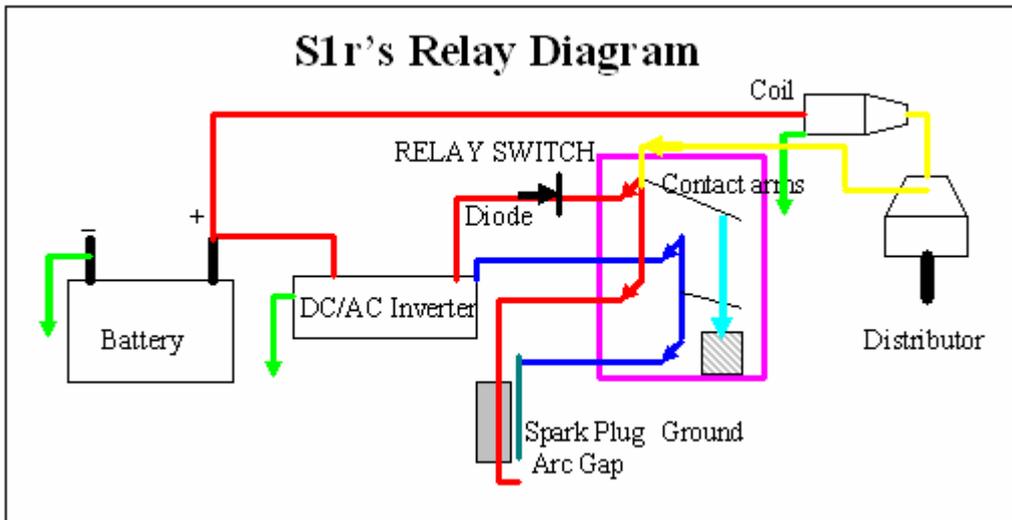
Since the plasma flash is so rapid, he had to reset the engine timing (turn the distributor) to about 20-30 degrees AFTER TDC (top dead center), which just happens to be the best point of highest compression in a normal engine, the point where the piston is just starting to push the crankshaft down.

The other thing he had to do was to increase the water flow to the cylinders. This he did by increasing the jet size in his carburetor to about 2 sizes larger. This allowed more water vapor into the cylinders for each firing and consequently gave a stronger reaction.

His car came standard with a 100 amp alternator which worked just fine under the new ignition system, however, he added a second battery in parallel for load sharing to cover the other electrical systems on-board.

Later he added a new water fuel tank into which he ran his exhaust pipe. The tank had several baffles to suppress exhaust noise and to allow for the condensation of the water in the exhaust, heat retention in the water and for the separation of the air in the exhaust which was then vented out the filler cap (or anywhere else out the back).
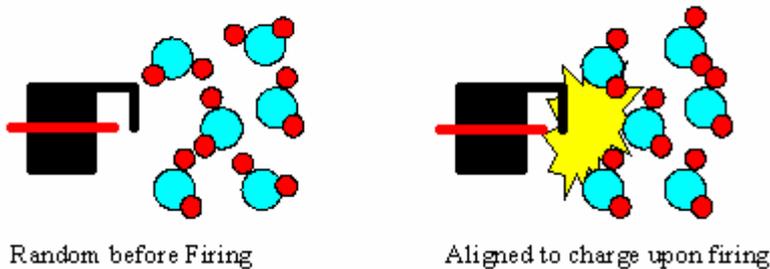
The whole system is very simple…..well, with the exception of the 'relay'. The relay that he used was an old fashion one that is no longer in production and he actually wired it up incorrectly, thus any chance or replicating his system as originally done is almost impossible. This, however, has led to several design modifications that should be just as successful.

S1r's Relay Diagram

This is not an accurate depiction of S1r's relay as the wiring inside contained 4 diodes in an unusual configuration with dual solenoids, but it is indicative of the actual flow within the relay to the plugs.

The problem with S1r's design was that the relay was not acting as a relay but was acting more like an open pulsed DC circuit which merely allowed the HV spikes from the ignition coil to piggyback onto the 110v higher amp circuit to the plugs. This created a plasma arc very similar to that used by arc welders but in short duration pulses.

This essentially causes a bigger avalanche of electrons to flow through the arc thus polarizing the water molecules in the cylinder to rapidly flip-flop into alignment with the direction of the strong electrical current being applied. This results in the high pressure cold fog reaction and the noticeable flash and bang that the plugs emit when fired in normal atmospheric conditions.

Random before Firing   Aligned to charge upon firing

Fundamentally what is required at the plug is high voltage (either delivered through inductance or capacitance discharge) and more amps (current flow) that will better allow the rapid release of electrons into the compressed fog vapor in the cylinder to create the avalanche reaction. This can be done as S1r has successfully shown or through various other techniques discussed below.

In a normal engine it takes 10,000 to 14,000 volts to initiate a spark under normal sparkplug gap settings. S1r actually increased the gap settings, thus he should be running a bit higher volts. A normal induction coil, however, can deliver 25,000 to 30,000 volts, but not all is used because once the arc is formed it takes much less voltage to sustain it and secondly, the circuit closes rapidly as the points trigger the next cylinder. Seldom does an induction coil fully discharge or have time to do so.

The use of heavier duty wire from the inverter does allow for more amps to be delivered, as well as, more volts, so most likely S1r's coils are more fully discharged than in a normal car, but are still within their normal rated capacities. To go much beyond these limits will only cause electrical arcing along the plugs or anywhere else that the electricity can find its easiest path to ground or alternatively, you will melt your plugs.

This simply means that it is not necessary to go to high voltage racing coils and CDI systems to deliver the biggest bang possible. Once the arc forms, the voltage drops. Also, you do not want to arc weld your plugs as they will melt very quickly (more on plug designs below).

There is, of course, an optimum point at which the plasma fog jet reaction occurs with enough force to run an engine and this is based on the available power supply from the alternator. Simply, S1r proved that this system works well within the 100 amp 13.8 volt (1,380 Watts) supply from his standard alternator.

In actual fact, it is the amount of Joules supplied through the arc that really matters. This requires the high voltage to create the arc and the higher amps to allow a greater flow of electrons into the cylinder to create the plasma fog jet from the water vapor. The minimum 'bang' occurs below 1 Joule and increases in strength with successively higher Joule inputs.

Since an engine is turning at relatively high RPM's, there are multiple firings of each cylinder every second. This means that only a relatively small charge is required for each 'bang' in order to sustain engine momentum. How much? This is obviously based on the alternator capacity and the particular delivery circuit. The approach is to get the biggest 'bang' possible (most Joules per firing) without using up the capacity of the alternator and still be able to run all the other electrical circuits in the car at the same time (lights, wipers, air conditioning, fans, CD player, etc.)

S1r found that he was running at close to his alternator's limit and thus added second battery in parallel to handle his car's other electrical demands. Under normal daytime driving, both batteries would charge, but at night and when raining, the loading would most likely be more than the capacity output of his alternator, thus the need for a backup supply.

A simple solution to this problem is just a bigger alternator or 2 alternators.

Now, how to get that big "bang"!

Spark Plugs.

The following pages are some of the circuits that may be used to deliver enough Joules to make the engine go round. But before that, I would like to briefly discuss 'spark plugs".

There are many types of spark plugs on the market. Generally what you want is a normal low resistance plug for starters that you will gradually increase the gap in order to get a "hotter" (higher voltage) arc. S1r uses normal cheap plugs and replaces them every 3-months or so as the arcing will cause plug decay as in welding. Normal plugs arc only at the tip of the little grounding arm and thus this point gets very hot as the arc forms repeatedly only in one narrow place.

An alternative, if you can find them or make them your self is 'rim firing' plugs that fire from the central electrode in a circular pattern to the outer rim. These have a fixed gap but you can experiment in making your own by welding washers to the rim having differing hole sizes to create your own gaps.
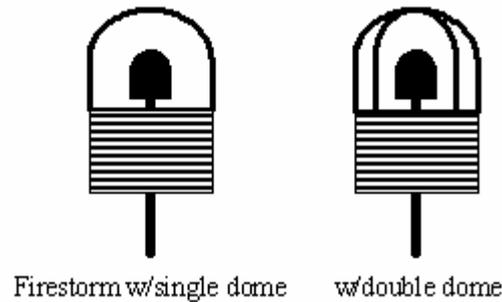

Normal Plug   Rim Fire Plug   Rim Fire Plug w/washer

Rim firing plugs seldom fire in the same place, but the arc tends to move around the rim and consequently you end up getting less plug wear and a longer lasting plug. These plugs are not too common as they tend to carbon up in a gasoline run engine and thus foul easily. This should not be a problem with a water fueled car. You may have to make your own though, but that really isn't too difficult. Just cut the arm off a plug and weld a washer in its place.

There is another plug that has been patented but is waiting for manufacture called the '**Firestorm Plug**". This comes in several design variations but all have the same basic concept of having a domed central electrode and

an equidistant domed grounding electrode. The idea is that the arc can jump across at virtually any point from one dome to the other as the spacing is equal at all points. This ensures better firing and no hot spots plus a longer lasting plug. The problem is that you have only one fixed gap thus your circuit must be designed to arc at that fixed gap distance. This is quite easy to do, but current Firestorm prototypes do require racing CDI circuits to fire them properly.

Firestorm w/single dome   w/double dome

If these plugs ever come onto the market, they have very good potential for plasma fog jet engines as they create a plasma ball type explosion around the electrode. Till then you will have to make your own which could be done by welding a small dome onto the central electrode and then a wire dome over the top. Prototypes may not look that pretty, but they should work.

Circuits:

Electricity has the unique characteristic that it always finds its shortest and least resistance path to ground. Remember this.

In S1r's case, his circuit above is based on this principle, even though the circuit should really not work as shown, due to the fact that currents from the inverter (AC) and the coil (DC) would normally clash and be incompatible.
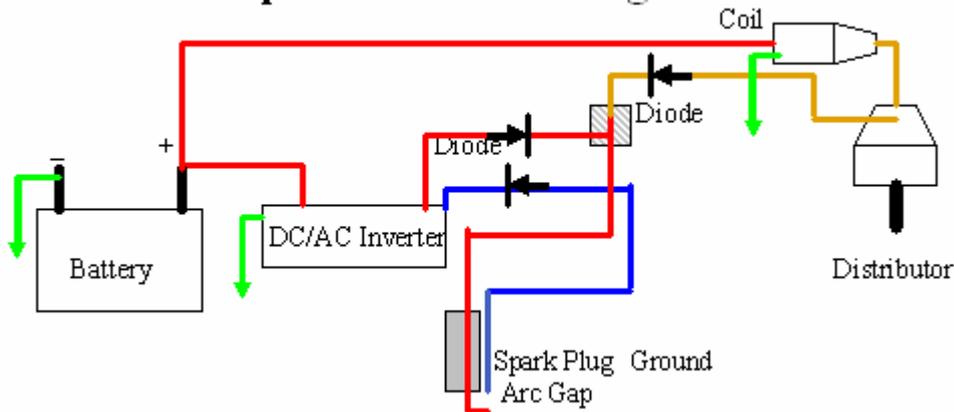
His circuit works because of the above "known" direction of electricity and because he had "diodes" in his old relay. Simply put, the diodes rectified the AC current to either half or full wave rectified DC which is compatible with the DC HV pulse from the coil. Then the only problem was finding the fastest way to ground.

In S1r's case, he made sure that the inverter and relays were not grounded to the car body, thus the only way out was through the insulated heavy duty copper wire leads to each plug and ground at the arcing point.

Technically S1r's design would also have 110v AC flowing back to the coil, which would cause some problems, but since this would cause resistance, the electricity would look for an easier way out, thus through the relay and diodes to the plug.
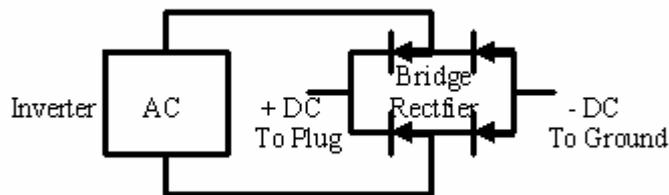
A better design is to first rectify the AC through a single diode (half wave rectified) or through a bridge rectifier (4 diodes) to give 110v (or 220v) DC and merge this with the HV DC through a HV diode and then to the plug arc ground.

Improved Circuit Diagram

The diodes used should be of a high voltage type, but it should not be necessary to match the voltages of the inverter and the coil as the principle involved here is to temporarily block any back flow of electricity and direct it in only one direction to the plug gap. Since the electricity will seek the least resistance route, the diodes only have to be big enough to let the 110v (or 220v) through and block the HV spike from flowing back to the inverter. Similarly, the diode on the coil side is just to prevent the rectified 110v (or 220v) from getting into the coil between pulses.

Note also in the above diagram that the half wave rectified approach requires the inverter to be grounded at the plug in order to complete the circuit. In full wave rectification the bridge rectifier can be grounded to the car body or preferably at the plug.

Another interesting thing about using an inverter is the fact that besides raising the voltage from 12VDC, and inverter will also pulse the AC at 50-60 Hz (cycles per second). This is caused by a capacitor discharge circuit inside the inverter. This is equivalent to a cycle rate of one (1) cycle every 0.0167 seconds (60 Hz) or 0.020 seconds (50 Hz). (16.7-20.0 milliseconds (mS)). The dwell time of the contact points (open time) is between 1 and 6mS, which is the time needed for the coil to fully recharge, thus it is easy to piggyback on either a full wave or half-wave rectified pulse from the inverter since the rise and discharge time of the coil is well within this time-frame window. (Coil rise time = 1 to 6mS: discharge time = 1 to 2mS).

And furthermore, once the arc is formed, the 110v (or 220v) can then sustain the arc for longer even after the coil has been discharged, thus creating a longer 'burn' of several micro seconds.

It should also be noted at this point that an induction coil ignition system has a longer discharge period (1-2 milli-Seconds) compared to a CDI (Capacitor Discharge Ignition) system (10-12uS (micro-Seconds)) or 0.001 versus 0.000012 seconds. This means that you have a longer time to discharge electrons into the plasma fog in the cylinder with an old induction system versus a modern CDI system. (More on CDI approaches later)

The cycle times are important as this determines the length of time that the plasma arc is being formed. When the voltage drops at the end of a half cycle, the arc will cease. **Thus the cycle time acts as a timing switch for the arc.**

Remember, the objective is thus to create the longest 'reasonable' spark arc duration in order to maximize the electron flow for the plasma cold fog reaction, but not so long as to melt the plug electrodes. Obviously, S1r's timing is within reasonable limits, though it may not be optimized for maximum performance.

It should also be noted that the plug gaps should be set far enough apart to prevent 110v (or 220v) arcing prior to the HV coil spike initiating the arc (0.08" is recommended but you should start with normal settings and work up till you get the best performance). Pre-ignition at low voltage will not cause the electron avalanche but will just heat the plugs and water vapor which is a waste of energy. Simply, the constant application of the inverter voltage to the plugs is not that advisable, thus a triggering mechanism is needed for the 110v (220v) side that coincides with the HV coil discharge. More on this later.

How many AMPS?

Now the question is "how many amps are needed?" Batteries are rated at 500-600 amps and these are needed to run the starter motor. The alternator puts out 60 to 100 amps when the engine is running. But inverters normally have resistors or fuses inside that limit the number of amps output to 5A, 13A or 15A which corresponds to normal AC usage for lights or small electrical tool operations. The rating of an inverter is usually noted on the casing or instruction manual or you can work backwards if you are given the wattage of the inverter.

$$Volts \times Amps = Watts$$

S1r used a 110v 400 w inverter (400w/110v) or approximately 4 amps. He actually measured a draw of 6.6A which only means that fuses or resistors inside were actually larger than the nominal noted capacity of the inverter which is normal for manufacturers to do so that users will not overload the inverter under normal usage conditions and burn it out.
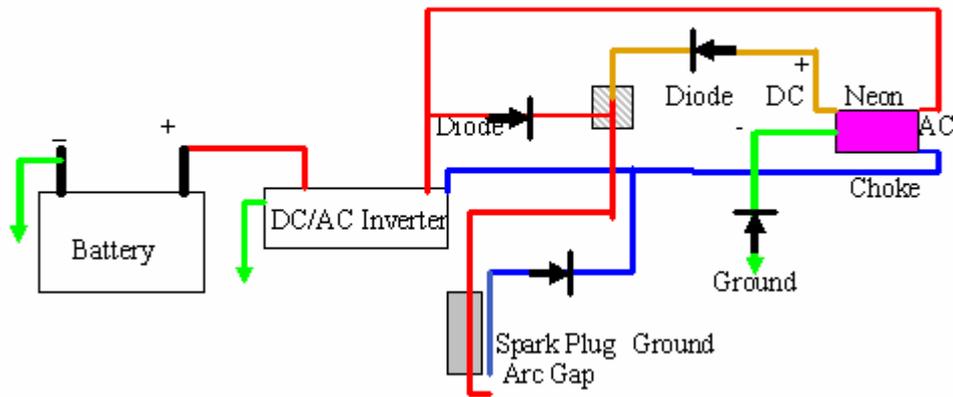
The amps dictate the maximum current flow to the plugs. The volts are essentially the 'pressure' behind the current. An analogy is in plumbing, if you have a small diameter pipe you can only get so much water to flow through it even with increased pressure (Volts), but if you increase the diameter (Amps) then more water can flow through the pipe given the same pressure. Thus what we are doing with increasing the amps is to essentially increase the total flow of electrons which can pass through the arc at the plugs when fired. This causes a more thorough discharge of the coil and a 'hotter' and possibly longer duration spark.

Thus increasing the amps and using lower resistance (thicker) wires to the plugs basically allows for a faster and more thorough electron discharge at the plug. The induction coil alone cannot deliver the amps because of the high resistance caused by the thin wires used in winding the coil, thus though the windings increase the voltage, they restrict the amps delivered to only several milliamps. And though the inverter can deliver higher amps, it cannot produce the high volts to initiate the spark. Both circuits are thus needed for the proper reaction spark.

Other Circuit Approaches

Another circuit approach is to use the inverter to supply the 110v say 5 amp supply, as well as, an AC supply to a neon light choke and then using the HV DC discharge from the neon choke to merge with the half or full wave rectified inverter supply that is fed to the plugs. A neon light choke (transformer) puts out approximately 4,000 volts DC (4 kV) and though less than an induction coil, it is still enough to create a plasma spark.

Neon Choke Circuit Diagram

Diode | Diode | DC | Neon | AC
Battery | DC/AC Inverter | Choke | Ground
Spark Plug Arc Gap | Ground

You could also use a higher voltage transformer instead of the neon choke but these are often custom-made.

Do note that when using step-up transformers (induction coils) that in order to create the high voltage electromagnetic field in them, you must use either AC or pulsed DC current. The capacitor in an induction ignition system does this pulsing. In the above circuit the capacitor is in the inverter (50-60Hz).

The above design would also require a switching mechanism to coordinate the firing at each plug. Typically the cap and rotor of the distributor provide such a switch in a normal ignition system, thus it may be possible to take the 2 leads from the inverter and neon choke and feed these into the top of the distributor cap and this would then be fed to each plug by the rotor and cap plug wire points. This would eliminate the need for contact points, but would also eliminate the spark advance mechanism which may affect acceleration.   Actual experimentation with this circuit design will determine if spark advance is actually necessary since the plasma reaction is very rapid and already occurs after TDC.

Another trick that requires further experimentation is the use of a rotor with a longer head or one with a 'split' head. The idea here is to create a longer contact time for discharge to the plug or, with a split head, to create a double or multiple firing at the pick-up contacts in the cap.

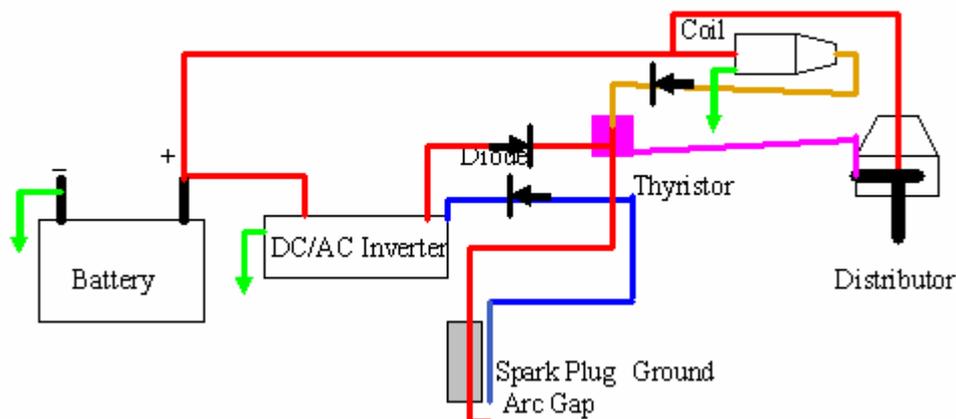Normal 4 Cylinder Cap & Rotor   Modified Split Rotor

The cap and rotor approach could also be replaced with a disk and brush assembly whereby the length of firing could be controlled by the width of the contact area on the rotating disk (i.e., something less than 45 degrees for each firing in a V8 (or $< 90^o$ in a 4 cylinder engine)).

A third timing alternative would be to use a Hall type distributor that uses electromagnetic induction to trigger the firing. Modifying a Hall ignition system would require widening the gaps in the rotating screens or plates that block the EM induction. That is tricky business and may require costly re-engineering works.

A simpler variation would be to use a normal Hall ignition system where you use the induction pulse to trigger a timing circuit to open the HV combined circuit for a specific period of time. The timing can be simple capacitor based or use a simple 555 IC timer with an adjustable variable resistor used to set the actual timing of the firing period.

The 'HV switch' in this case would most likely be a thyristor (SCR). A thyristor is a type of transistor that allows high voltages to pass through it once a small trigger voltage is applied to the base. They work the same as a solenoid switch but much faster.

Improved Circuit Diagram #2

This same rotor-cap-thyristor approach can also be used in the inverter-diode-induction coil approach noted above as the triggering mechanism instead of using the traditional points. This approach would allow for the switching 'on' and 'off' of the inverter and coil circuits together and for a determined firing period or multiple periods.

A small problem with these approaches is the fact that in some 4-stroke engines you will get 1 firing every 360° or one revolution of the crankshaft. In a gasoline engine this 'waste' firing would be 24+ degrees before TDC on the exhaust stroke and thus have little or no effect on engine performance.

But in a watercar with the firing at 20°-30° AFTER TDC, the firing would be at the very beginning of the intake stroke. This may be beneficial or detrimental. Since there is very little water vapor in the cylinder at the beginning of the intake stroke, there would be very little water to explode and thus it would have little effect or at most just give a little shove to the crank and a bit of back-pressure to the intake manifold. Such an electron avalanche on the intake stroke most likely would not cause a backfire or much back pressure in the intake manifold because of the stronger suction pressure of the pistons dropping and because the charge would be dissipated and grounded before it entered the manifold. The flash is also very rapid compared to the duration of the whole intake stroke.

To avoid this firing on the intake stroke you would have to go to a modern computerized ignition system that limits firings to only the power stroke. These operate on a 720° cycle and can be programmed to fire single or multiple times at precise timing points (degrees after TDC) based on engine RPM's. The programs that run such computer ignition systems, however, are fixed at the factory and thus you will have very little chance of fiddling with them. You would be better off designing and building your own.

Some engines also run the distributor or engine timing off the cam shafts that operate the valve opening. Since the valves open only once in 720 degrees in a 4-stroke engine, it is thus quite easy to time firing off of a cam shaft.

Other systems use a timing belt or chain to run the distributor in much the same way by using a reduction gear and then an adjusting screw for fine tuning. To reset such systems to fire AFTER TDC is a matter of resetting the timing chain or belt or gear teeth that operate the distributor. This is a job for a mechanic.

CDI Systems

Capacitance discharge ignition (CDI) systems operate like an inductance coil system except that they use a high voltage capacitance discharge either to charge a coil or to replace the coil. A capacitor is like a battery in that it can store a charge, but it can then release that charge virtually instantaneously when triggered.

The typical CDI system uses a pulsed DC transformer to raise the voltage from 12v to 300v-450v which then charges the capacitor which then discharges to a heavier duty induction coil that can release 40,000+ volts (but is usually much less) per firing.
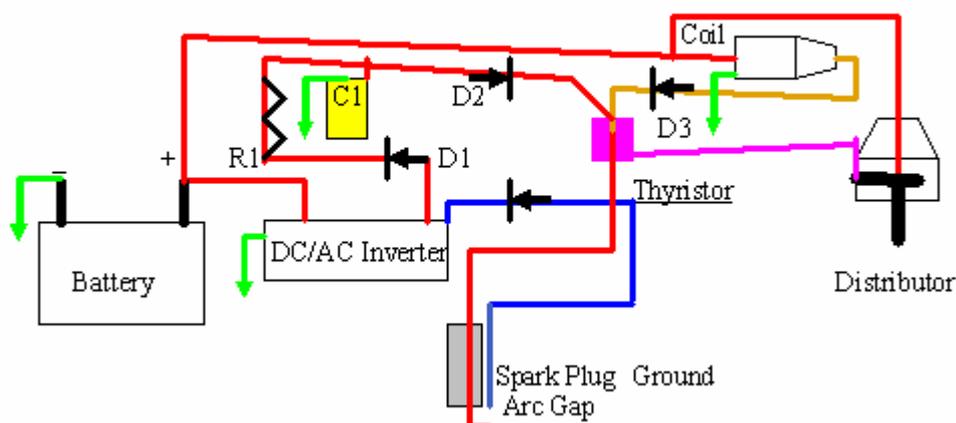
CDI systems have become the predominant ignition systems since the 90's due to the increased reliability of their electronic components and their precise timing ability. Racing CDI systems are even able to fire the plugs 8-12 times at idle on each power stroke but usually only once above 3,000 rpm. This gives better fuel burn and more power.

CDI systems also allow for higher revving of engines (up to 19,000 rpm in racing cars) since the spark duration is much shorter than in induction coil ignitions and the recharging is faster. This may be advantageous in racing cars, but may not deliver enough amps and volts to a watercar.

Typically racing CDI systems only deliver a 0.1 Joule spark for 1-2 microseconds, versus the longer and larger Joule discharge of an induction system. This can be rectified by simply changing the capacitor in the CDI circuit. Good luck. These boxes are usually sealed tight. It might be better to contact the manufacturer and request a special order. Otherwise you will have to make your own.

CDI systems generally use 'low resistance coils", meaning that they use bigger wires in winding the coils. Since the capacitor discharge voltage is higher and faster, less resistance is required.

The above diagram is a modified CDI approach that uses the pulsed DC from the inverter to charge an electrolyte capacitor (C1) which is discharged through the thyristor when the circuit is opened by the distributor cap/rotor timing.

The resistor (R1) is used to control the capacitor. The first diode (D1) can be either a single diode (half wave rectified) or a bridge rectifier. The second diode (D2) is to protect the capacitor from the HV spike from the coil and should be large enough to provide blocking resistance to this spike. The third diode (D3) similarly prevents the capacitance discharge from flowing back to the coil.

The diodes used are normally high voltage types used in microwave ovens or other HV circuits such as in TV's. These can be linked in series if the rating is not high enough to provide the necessary blocking effects.

The bigger the capacitor in the above circuit, the bigger will be the discharge, but also the longer time it will take to re-charge. In a rapid firing engine it may be necessary to have a bank of capacitors for each cylinder or a series of smaller, faster charging capacitors in stead of larger single ones.

Very high voltage capacitors generally take too long to charge to be effective in an internal combustion engine. Similarly, normal small capacitors cannot reach the high volts needed for the plasma discharge reaction, but since they are on the higher amp line from the inverter, they can give a boost to the spark. Technically it may be possible to hook up a series of smaller capacitors in parallel or in series from the inverter to produce enough volts to create the plasma reaction and thus possibly eliminate the induction coil.

The amount of Joules discharged through a capacitor is dependent upon the rated capacity of the capacitor (generally stated in micro- or pico-farads or 10E-6 or 10E-12) divided by 2 times the volts squared (J = C/2 * V*V). The farads and volts are normally printed on the sides of the capacitors. In actual fact, however, capacitors never fully discharge in normal circuit use, thus the power supplied is slightly less than calculated above.

Modern CDI Systems

Since the 90's most automotive manufactures have opted for advanced computer controlled CDI ignition systems, primarily because of better firing reliability and because of increased environmental legislation.

These modern computer controlled ignition systems use multiple sensors to determine optimum firing. This may include double pick-up sensors on the flywheel to determine rpms under acceleration and deceleration, intake and atmospheric pressure compensation, oxygen sensor levels to maximize combustion, temperature sensors and exhaust emission sensors. All this data is constantly fed into the on-board computer and processed using complex algorithms to determine optimum firing and fuel consumption levels.

This is all very nice to meet environmental standards and improve overall performance, but if only one little component or wire lead is broken, your car just won't start. And then it is several thousand dollars to replace the whole electronics package. Thanks, but I still prefer the old way as it is much easier to convert an old points induction system to run on water that it ever will be to convert a computerized system.

There are ways, of course, to convert a computerized ignition system to run on water, but this is basically a major re-programming task that manufacturers are not about to do until watercars become a legislated fact or we run out of gasoline.

Watercar Summary

S1r's plasma fog jet watercar approach is one of the simplest, yet most effective and safe approaches to creating a water powered car. It only requires an electrical system that can deliver 5-10 amps and 14,000+ volts to the spark plugs at each firing. There are any number of different ways that this can be accomplished using off-the-shelf parts and equipment.

It is best to start with an older model car with a points induction ignition system as this requires very little modification. You just add an inverter for the higher amps and connect this, using protective diodes, to the existing plug wires. Then you set the timing forward to 20°-30° AFTER TDC.

You may need to use bigger jets in your carburetor or an add-on water injection system to increase the amount of water to the cylinders for better performance. And a couple winds of copper tubing around the exhaust pipe from the fuel (water) pump would raise the water temperature for better vaporization too.

That should get you running. Later add the stainless steel exhaust pipes and a baffled water tank in the back for re-circulating your water to get that 300 miles per gallon or better.

The ignition modifications suggested here should all work, however, I would recommend to first bench test your circuits to see that they really go "BANG!" Also recommended is that you do this as a team effort. Make friends with a mechanic, an electrical/electronic engineer and others that may contribute to your project. I have found many interested and willing helpers at tech schools and universities. They all want to run their cars on water too. And this makes your project much more fun.

And when you succeed, please post up your progress and results to some of the active watercar Internet databases such as
www.groups.yahoo.com/groups/watercar or
www.groups.yahoo.com/groups/easpower or
www.groups.yahoo.com/groups/box or
www.overunity.com/.
There you can find me and many other experimenters to help you.

Special Thanks

A very special thank you must go out to s1r9a9m9 for his truly remarkable ground breaking efforts. Although he wishes to remain anonymous at this time for obvious reasons (Men-In-Black have already visited him), I can only

hope that some day his efforts will be recognized, rewarded and properly recorded in history. His watercar technology is a major turning point in transportation for the future.

Acknowledgement should also be given to Teroranta, Willard, Eugene, Joe, Ronald, Peter and others over at the 'egaspower' group for their contributions to the understanding of Sir's work and for building and testing alternative approaches.

The works of the Graneaus in their study of plasma fog jets has also been instrumental in understanding the physics of what may be happening inside the engine cylinder.

The beauty of S1r's approach is that water remains as water throughout, thus there is no pollution and no wastage of resources. Humanity and our precious world thus owes S1r a great deal more than can be even estimated.

Thank you.

Thomas C. Kramer
Advanced Interactive Technologies
September 2005

It has been several weeks since there was any technical input from "s1r9a9m9" so here is a summary of the information received to date:

A recently encountered e-mail from Robert Calloway states that Tesla's bi-filar series-connected coil is effective in picking up radiant energy. In the light of that, and in the absence of further information from s1r9a9m9, the following suggestion might be useful for those who intend to try to reproduce his car design:
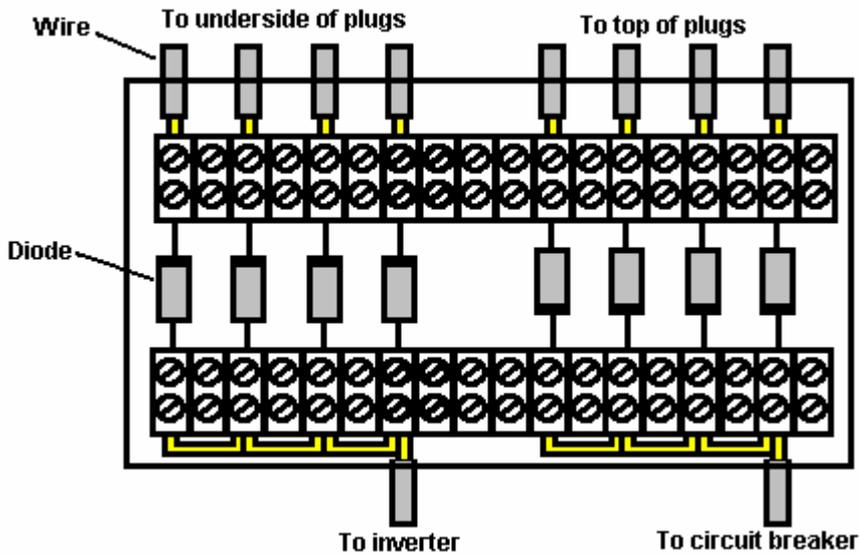
The car to test needs to be a gasoline type with a carburettor and no computer control so that the timing of the spark can be adjusted over a wide range and the fuel mixture set where you want it.
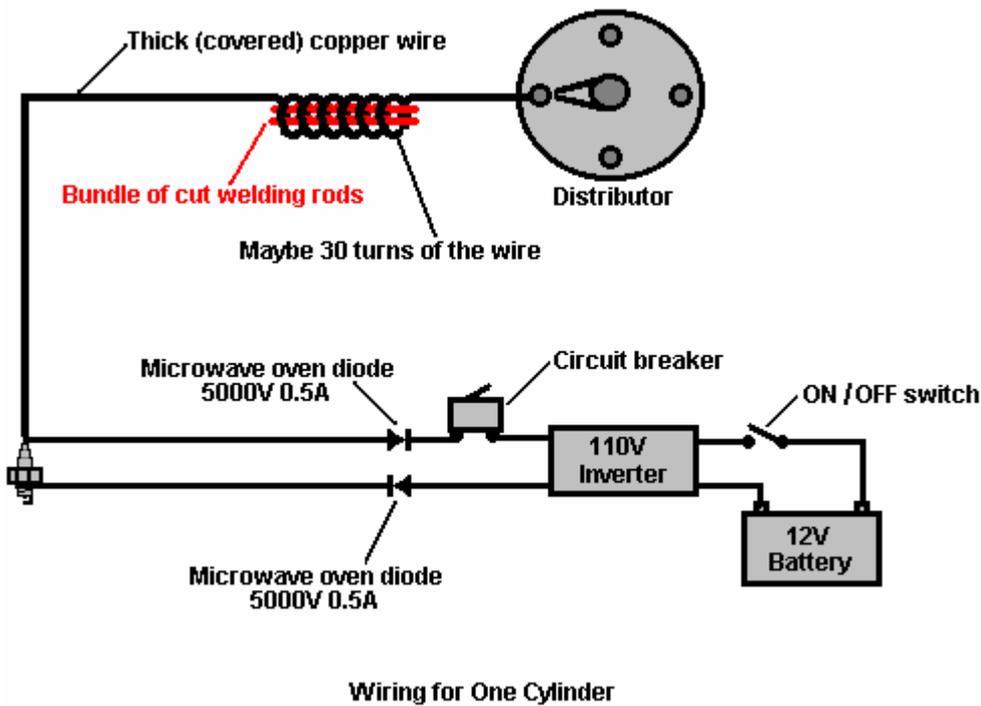
Components needed:
Heavy-duty insulated copper wire
110V ac 12V alternator of 400 watt or higher rating
Insulating material
Small plastic box
Two screw connector strips (large)
Diodes for microwave ovens (2 per cylinder)
"Autolite" (25) copper-core plugs (1 per cylinder)
PVC piping
Tape.

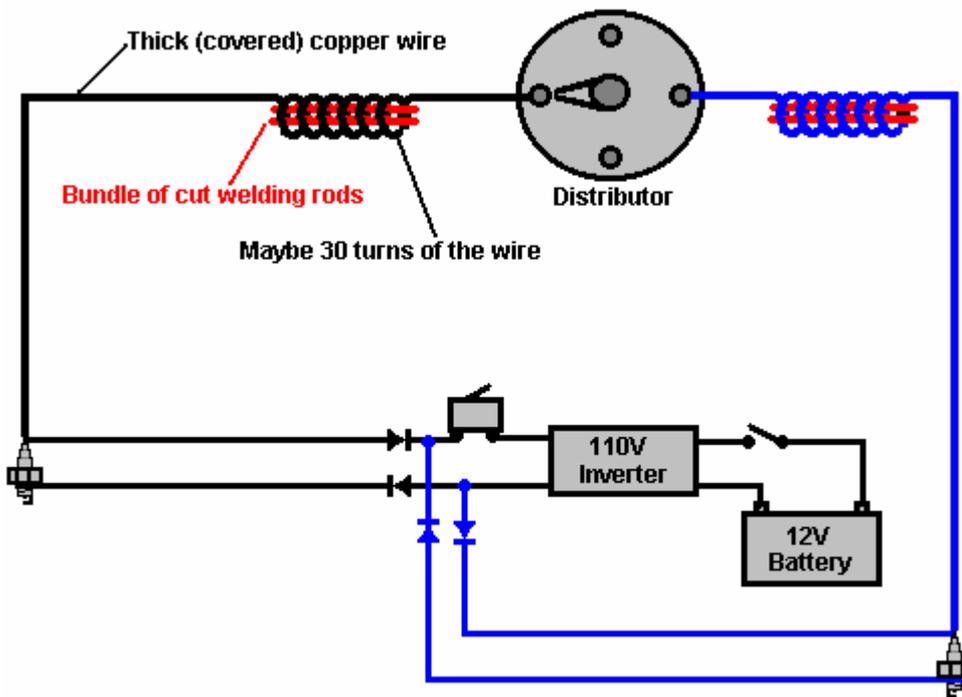The first step is to get the engine ticking over on just water:

1. Replace the plugs with the cheap "Autolite" (25) copper-core plugs, set to 80 thou gap.

2. Retard the timing to about 30 degrees **after** Top Dead Centre.

3. Mount the inverter so that it is fully insulated from the engine block.

4. Get two microwave oven diodes per cylinder. These should be available from an electrical repair shop, or failing that, they should be able to tell you where you can get them locally.

5. Connect one of the outputs from the inverter to the circuit breaker (either output will do).

6. Get a little plastic box and mount the diodes inside it. Two strips of screw connectors from a hardware store would be good for this. Get the largest size, place them in the box, along the outer edges and just screw the diodes across the box between the connectors. You can then run the wires to them through holes drilled in the box, straight into the connectors:

Wire → To underside of plugs | To top of plugs

Diode

To inverter | To circuit breaker

7. Run a 12-2 solid core wire from a diode to the underside of each plug. You can bend the wire round into a loop to fit tightly around the base of the plug, and then flatten the loop slightly with a hammer. The loop goes around the screw thread of the plug in a clockwise direction when looking down on it, so that turning the plug to tighten it, also tightens the copper wire loop. Alternatively, solder the open end of the loop to make it a rigid complete loop:

Thick (covered) copper wire

Bundle of cut welding rods

Maybe 30 turns of the wire

Distributor

Microwave oven diode
5000V 0.5A

Circuit breaker

ON / OFF switch

110V
Inverter

12V
Battery

Microwave oven diode
5000V 0.5A

Wiring for One Cylinder

8. Be sure that the diodes going to the underside of the plugs are all the same way round and that the ones going to the circuit breaker are all the other way round as shown in the sketch. The other cylinders need to be wired like this:
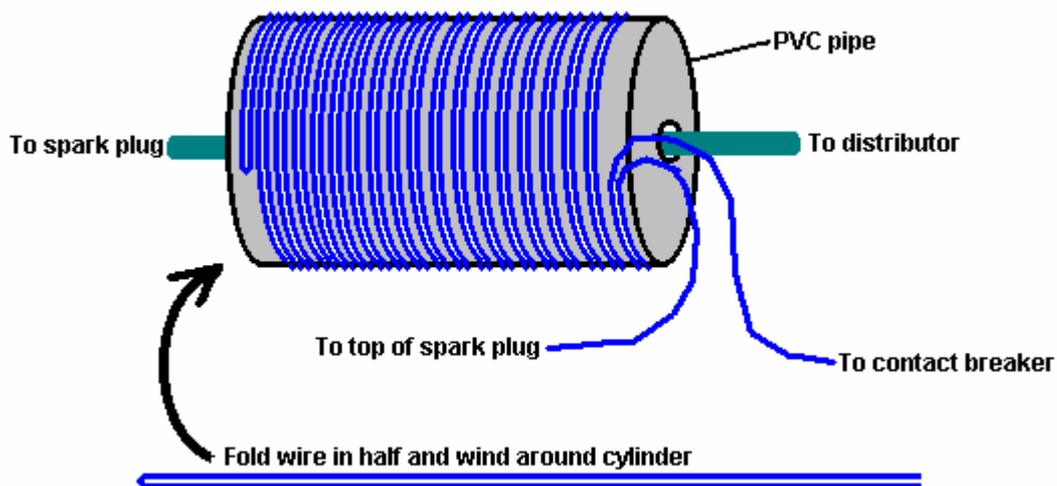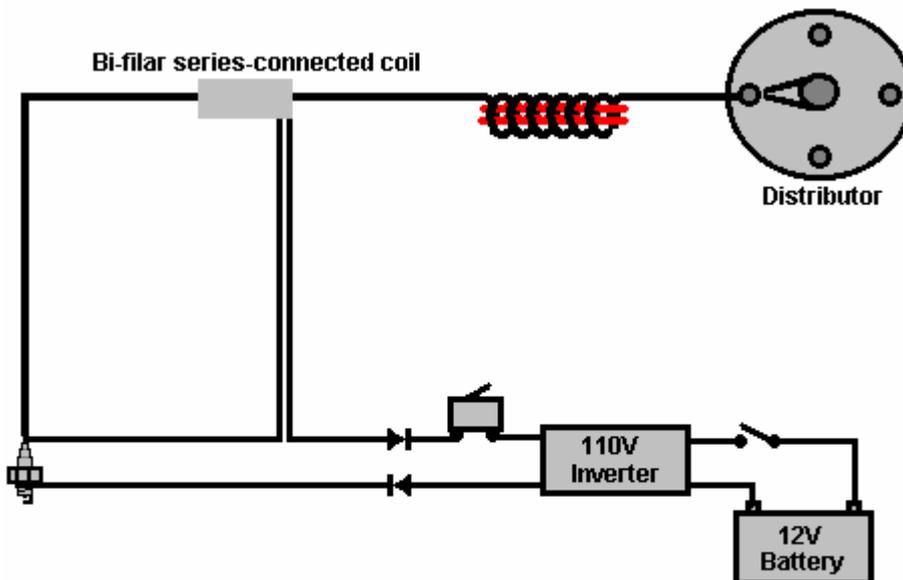
The wiring for two of the cylinders

9. Now we come to the wires from the distributor. As I understand it, the existing wires need to be replaced with very heavy-duty copper wiring. We don't have s1r9a9m9's relays and it would be sensible to assume that we never will, nor will we get any further information about them. The spark will be much improved if there is a coil in the wire from the distributor to the spark plug, so I suggest that you wind about 30 turns of the connecting wire around an iron core. Initially, the core could be an iron bolt. A solid metal core will have electrical currents induced in it. These flow sideways, heating the core and wasting energy. This is why mains transformers are wound on laminated cores where thin iron strips are insulated from each other to block these 'eddy' currents and raise the efficiency of the transformer. So, later on, if your tests are successful, you might like to replace the bolts with lengths of steel welding rods with the coating cleaned off and painted to insulate them from each other.

10. Remove the gasoline feed pipe from the carburettor and seal it off very carefully. Connect a similar pipe to it and connect that pipe to a water tank, positioned so that the bottom of the water tank is higher than the carburettor.

11. Connect the inverter to the battery, placing an insulated ON/OFF switch (not shown on the diagram) in the lead to the side of the battery which is not connected to the car body - this is normally the Plus side of the battery, but not always, so check it.

12. Turn the engine over to get rid of any gasoline in the carburettor.

13. Heat some water in a kettle to get it hot but not nearly boiling and pour it into the water tank.

You are now ready for your tests. The engine is not likely to fire before turning over four or five times. You will probably need a battery charger to keep topping up your test battery (the one already in the car) when you run it down through trying to get the motor to fire. It will take a lot of fiddling around to get it to work. It may be necessary to adjust the carburettor jets to allow more water vapour into the engine to get it to run. Who knows? Only s1r9a9m9 has managed it so far.

OK, so it ain't firing and looks as if it never will. It might be worth trying the following for each cylinder:
Take a few inches of PVC pipe of say, three inch diameter. Cut a couple of discs to fit the ends. Take a length of the wire used to connect the 110V inverter, double it over and wrap it around the cylinder like this:

You can tape the wire in place on the cylinder. Now, run the spark plug wire through the cylinder to produce this arrangement:
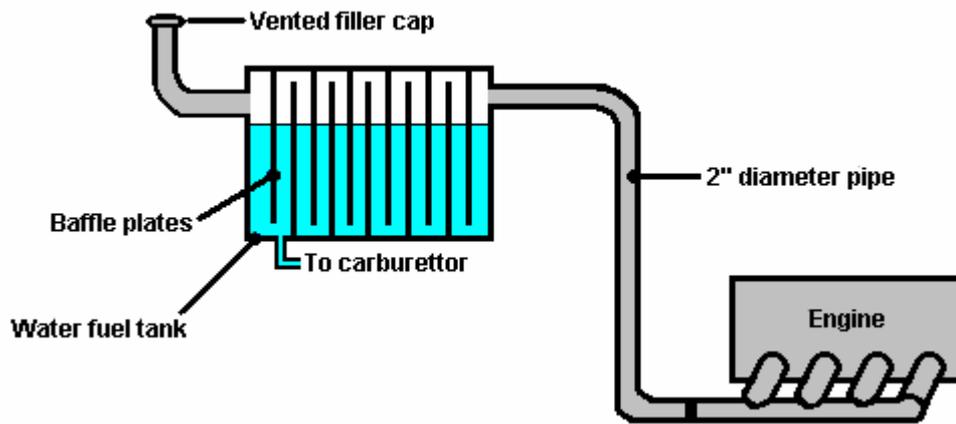

Possible experimental test

This may give you a better spark and get the engine running. The reason for this is that Ed Gray managed to pick up a major amount of extra energy from a copper cylinder arrangement somewhat like this. He got enough extra energy to run a 80 HP electrical engine on it, so you might well get enough extra energy to get your engine going, especially as it appears that the coil shown here is much more effective at picking up extra energy from the current pulse to the spark plug.

It is said that magnetic fields do not help the pick up of the extra energy, so the larger the diameter of the PVC tubing, the lower the magnetic field on the winding.

If you succeed in getting your engine to tick over on just water, then:

1. Replace the carburettor jets with ones two sizes larger.
2. Adjust the timing to get the smoothest running.
3. Feed the pipe from the exhaust manifold into a water tank with baffles as shown below.
4. Connect a second battery in parallel with the existing battery, or add a second alternator:

Vented filler cap

Baffle plates

To carburettor

Water fuel tank

2" diameter pipe

Engine

Thrival:
First I want to say I'm most grateful to S1R9 for starting this group and showing us what he accomplished and that his watercar is indeed possible. I've been studying his circuit for weeks to understand the wiring and principles. I understand that the goal is a hotter spark and that by some combination of coils and inputs, and a second battery, he's adding HV from his ignition coil and medium current from the inverter, to achieve a medium amperage and a slightly lower HV than the coil otherwise produces.

This got me thinking in terms of simplifying the arrangement. My first desire would be to dispense with the second battery if this is possible, due to the power requirements being minimal. Second I would eliminate the inverter, and third, the vibrators. Most of you will then ask, "What's left? How could such a system work, lacking 95% of the hardware that makes it possible?"

Let me take the parts in turn. The need for a second battery derives from the power consumed by the inverter. S1R9 did say the system would idle on just one battery. The inverter is of course necessary to pump enough energy into the relays to create magnetic fields which upon collapsing, deliver sufficient current to amplify the spark. But is the inverter really necessary?
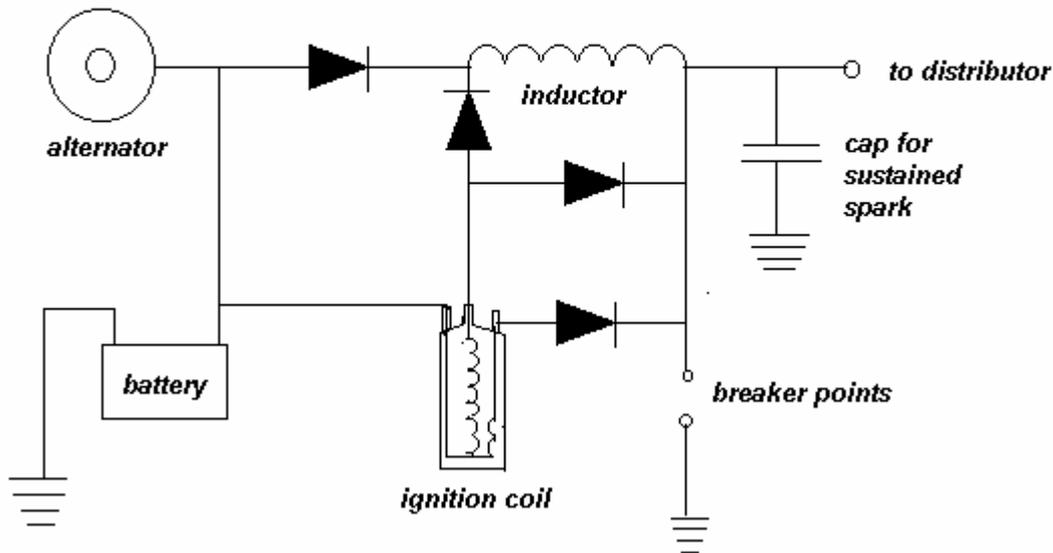
Perhaps it would be possible to use just two coils: the ignition coil for HV, and another for amperage. If both conducted and collapsed at the very same time (from the same points break or HEI circuit) then the two flows could be mixed just as S1R9 shows in his relay diagram. This simplified coil arrangement might then deliver power to the stock distributor, that would in turn deliver the power to the stock wires and through them to the plugs.

A single coil might suffice for a points-style ignition, or a transformer for an HEI system. The purpose of the transformer is to isolate the low V and high V to prevent shorting to the frame, while allowing mixing of the added current and HV.
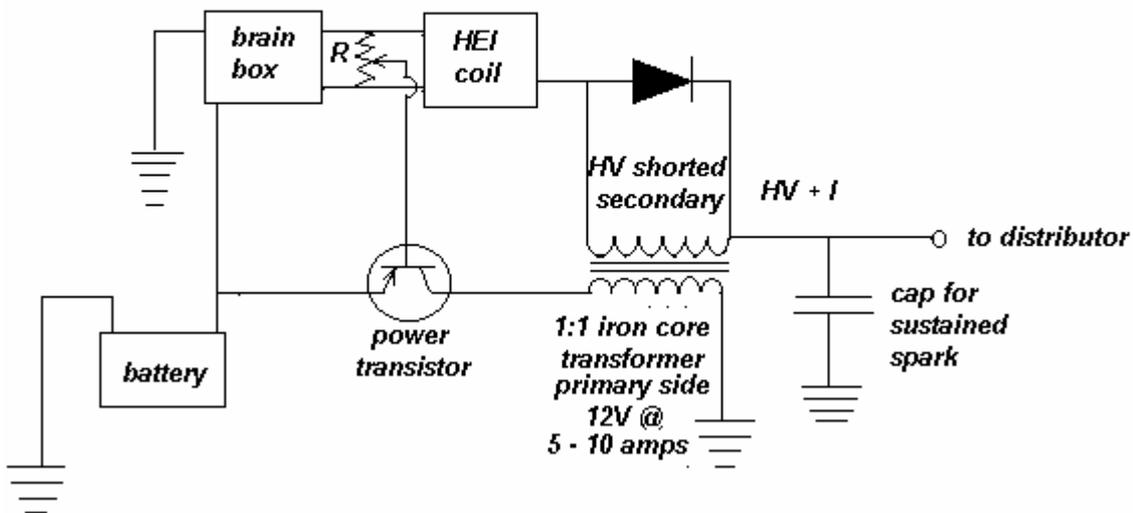
Some have suggested my diodes point the wrong way. They point the direction I intend current to flow; while actual polarities may need to be reversed in practice. I don't want to waste time with conventions that don't make sense.

Here is a diagram to show what I mean. I'd appreciate anyone's input, including S1R9, if they think this method is feasible, and any corrections or suggestions they'd like to make. I intend trying this on my car, which could take some time due to financial constraints.
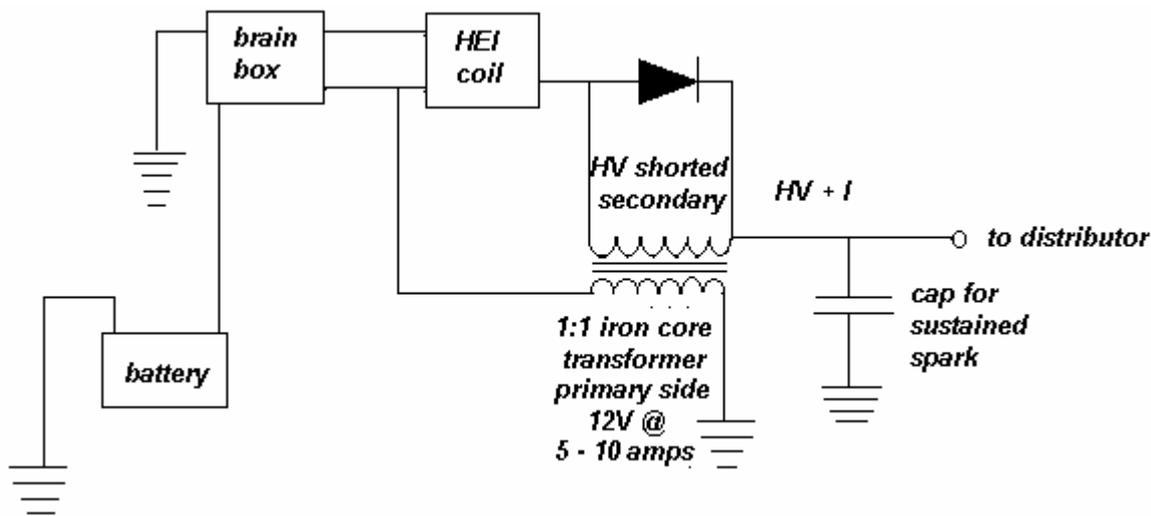
Spark plug intensifier for water-fueled ICE

alternator

battery

inductor

ignition coil

to distributor

cap for sustained spark

breaker points

Spark intensifier for Electronic ignition

brain box

R

HEI coil

HV shorted secondary

HV + I

power transistor

1:1 iron core transformer primary side 12V @ 5 - 10 amps

battery

to distributor

cap for sustained spark

The transformer primary side is powered by the battery and turns off at the same time as the HEI coil. The primary carries 5 to 10 amps, conveyed to the secondary side by its collapsing EM field. At the same time, a HV spike is emitted by the HEI coil, from the collapsing voltage in its primary. Because the transformer secondary is shorted by the HV wire, it doesn't interfere with the primary side induced current. The HV and transformer current are therefore additive, creating a much hotter spark. R = 1 M ohm.

Option 3: The switching transistor is done away with and current is sourced from the electronic ignition circuit ("brain box") and passed directly to both the ignition coil and the transformer. This simplifies the wiring but may possibly halve the total amount of power sent to both. The effect of extra current demand through the brain box to power both coils is unknown. There is the danger of frying the brain circuitry.

Because HV is shorted across the transformer secondary winding, it doesn't actually pass through it, whereas high current induced in the transformer secondary from the collapsing primary field, does pass through. This puts relatively little demand upon the transformer windings. It is very important not to ground the HV side or to short to the secondary for risk of burning out the vehicles entire electrical system. Also, this is every bit as dangerous as a TV or microwave capacitor, in fact, more so. HV + high amperage **ABSOLUTELY WILL** kill you if you touch the distributor wire, spark plug wires or unshielded secondary while the engine is running, and the same applies to the capacitor even after the engine is off !!

Someone remarked that my diodes point the wrong direction. They point in the direction I want actual current to flow, although manufacturers use a different convention which doesn't necessarily make sense. My understanding is that current flows from negative to positive (ground) and that all electricity IS negative. Just test the diodes in the direction you want continuity, before installing them in the circuit.