The Polywell: The Worlds Most Important Invention You Have Never Heard Of

Imagine a machine which produces cheap, clean, free electricity, with no carbon foot print. Imagine that we could purchase such a machine, install it in our business or apartment complex and, be done with purchasing energy from the grid. Imagine a company, selling these machines all over the world, licensing the technology. An invention like this would be akin to all other great inventions, the car, the computer, the phone. Such an invention would end global warming, fix energy poverty and, solve the energy crisis. It could change everything. If such an invention existed, it very well could be the greatest invention in human history.

This was the dream of a physicist name Dr. Robert Bussard. In 1984, he came up with an idea for just such an invention. He called it the Polywell. For 20 years, the US government funded his research. Millions of dollars were spent in pursuing this dream. Right before the funding was cut in 2005, Bussard claims to have a research break through. He spent the last years of his life fighting for research to be re-started. He died before this dream was realized. What has happened since is akin to a rumbling in the science community. The Navy has restarted funding and after a proof of principal study, has increased funding to the highest level in Polywell history. Have they found something? They are not saying. Real physicists only give the Polywell an outside chance of working. There is a growing movement of followers in the internet community; the Navy is keeping all results hidden from the public. What follows is an explanation of why the Polywell, might be the greatest invention that you have never heard of.

Introduction:

Dr. Robert Bussard received his PhD in Physics from Princeton University in 1961. In 1970 he went to work for Bob Hirsch in the Atomic Energy Commission the forerunner to the department of Energy. Together, they founded the US Tokamak Fusion program. Dr. Bussard saw fusion as the path to energy. Fusion is the nuclear process where atoms fuse together. In the process a small amount of mass is converted to energy; through Einsteins' famous equation E=MC^2. Bussard worked on the Tokamak, but eventually gave it up as a lost cause. "…even some its proponents say, they don't think it will ever be economic, but its' really good science…" In the late 1970's and early 80's Dr. Bussard turned his attention to the Fusor.

The Fusor is a very old technology. It was created by PT Farnsworth, one of the inventors of the television. It is a simple device for fusing atoms. It can easily do fusion, but will never produce power because it requires so much energy to operate. Here is how it works. Two metal cages are placed one inside the other in a vacuum chamber. A voltage is applied between the two cages. This voltage drop is analogous to a hill. Imagine you are standing on a mountain and you start to roll down it. If the mountain is thousands of feet high, by the time to reach the bottom you will have a very high velocity. This is the same as the Fusor. Ions start at the outer cage, with a very high voltage. They fall towards the inner cages' low voltage and pick up energy. By the time they reach the center they are moving so fast and are so hot, they can slam into one another and fuse. In fact, for every 1 volt an ion falls down it picks up 11,608 degrees Kelvin in energy. You maybe surprised to know that electrons in a typical cathode TV are hot enough to theoretically fuse together.

The Machine:

In the 50's and early 60's scientists were very excited by the Fusor as a possible energy producing machine. However, they had a problem. The Fusor had metal cages. These cages would conduct electricity. Much of the electricity created by the Fusor was sapped away, and leaked out through the cages. It seemed that nothing could beat this. Many people gave up on the Fusor as a fusion machine and started work on laser fusion or Tokamak fusion. Bussard started to look at these devices and realized a possible change. He asked himself, how else can one make a big voltage drop? The idea of creating a point charge occurred to him. Imagine if you had a very strong negative charge in the center of a vacuum chamber. Charged Ions would see this, like a valley between two mountains. They would fall down the valley, build up enough kinetic energy and slam into one another in the center and fuse. But, how do we contain a cloud of electrons?

The solution was pretty ingenious. The idea was to contain the electrons with a magnetic field. This concept was nothing new. The Tokamak contains ions, electrons, and everything else in a strong magnetic field. This field makes a ring, like a race track, for atoms to race around. Bussard needed a magnetic field which forced the electrons into the center, while giving them field lines which they could re-circulate on. Much like an interstate highway system, magnetic field lines act like roads electrons can re-circulate on. They "recharge" as they re-circulate. What he designed was 6 magnets in a cube. Here is a picture of this:

When all these magnets are turned on, they create a pocket in the center. This pocket of no magnetic field is where the cloud of electrons gets focused. Wayward electrons re-circulate back along the magnetic field. The whole thing creates a giant point charge in the center. Ions get injected, and boom, fusion occurs.

Bussard claims that in 2005, he got fusion at a rate 100,000 times better than any Fusor had ever achieved before, ever. If this were true, it would be a scientific breakthrough. He claims that the power rate increases as the 7th of the radius. He claims that the power gained increases as the 5th of the radius. If this were true, you could start seeing significant power output with a machine 6 feet by 6 feet by 6 feet cubed. There is no exotic technology in the device either. Ion guns, vacuums, electron guns have been around for decades. Bussard also showed that by increasing the number of rings from 6 to 12 or 24, your electron containment is significantly increased. He claimed that a machine of this design makes Proton Boron-11 fusion possible. This type of fusion produces a huge amount of energy with a tiny amount of radioactivity and no global warming gases. If all this were true, it would make this technology; quiet possibly, what the whole world is looking for.

Skeptics:

There are legitimate arguments against this working. The main work that disputes all of this is from Dr. Todd Rider from MIT. In 1994, Dr. Rider did his doctoral work on "Fundamental Limitations on Plasma Fusion systems not in Thermodynamic Equilibrium". With painstaking exactness, that only a physicist could do, Dr. Rider showed that these devices have a very small chance of working. In fact, Rider argued that if the material inside the device thermalizes, it will fail. There are three main problems:

1. If the electrons and ions in the center get a bell curve of energy, then only a small portion of the population will have enough energy to fuse. Most of the material in the center will slow down, and dilute the kinetic energy the ions need to fuse.

2. Every time an electron and ion pass by one another, an X-ray is generated. X-ray cooling will cool off the material in the center, killing your fusion rate.

3. If the Polywell fuses deuterium and tritium (one of the easiest thing things to fuse), neutrons will be generated. Neutrons can damage everything.

Dr. Riders work was published in 1994. Dr. Bussard went public with his results in 2006. What in effect has happened since then is a debate. Many people in the fusion community reject Bussards claims as bogus. Dr. Riders work is very theoretical, and is only really understood by the top theoretical physicist in the world; a very small group of people. Bussards' claims are hard to swallow because little is known about the work. Bussard was banned from publishing his work for 11 years by the navy, before he went public.

Conclusion:

The polywell, something which could be the greatest invention in human history, is having its fate being determined by a very scant amount of information. Bussard believed that the Polywell could replace all fossil fuels on this planet, could make electricity as cheap as air and could power mans' exploration into the stars. It was shown the device could burn up nuclear waste and end global warming. This is not something we need to take lightly. This is something which needs to be researched absolutely. If it is not going to work, we better be damn sure of it.

Epilogue:

Bussard died in October 2007. In early 2008, the Navy re-assembled a team under Dr. Richard Nebel to continue the work. Results have been kept secret. In August 2008, the team finished their study and sent the results for peer review. In September 2008 the work was moved to the naval air weapons facility in China Lake, CA. In January 2009, the Navy pre-solicited two more contracts. In April 2009 the Polywell received 2 million dollars in funding. In June 2009 the US navy confirmed that contracts were now in existence for the next Polywell prototype: "…based on the results of WB8 testing, and the availability of government funds the contractor shall developed a WB machine (WB8.1) which incorporates the knowledge and improvements gained in WB8. It is expected that higher ion drive capacities will be added and that a "PB11" reaction will be demonstrated…" In September 2009, the navy awarded 7.8 million to Energy Matter Conversion Corp for further research. Results are expected April 2011.