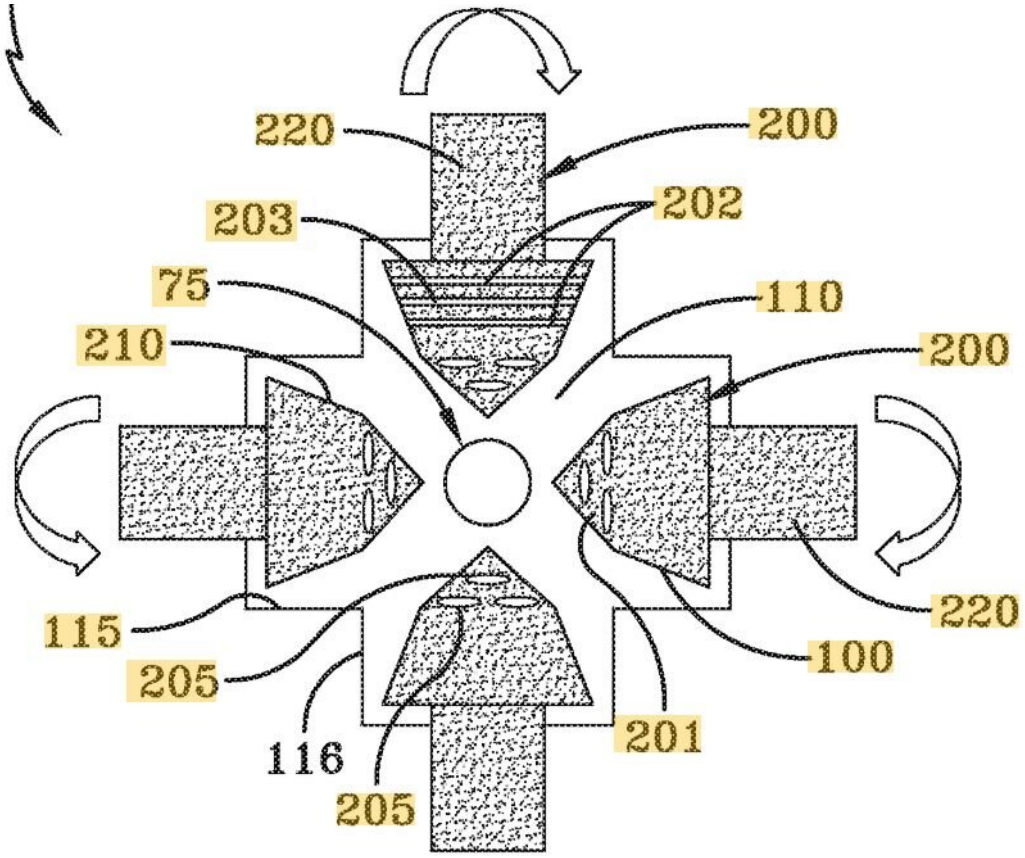
Patent talk: Plasma compression fusion device ignites curiosity over nuclear fusion

October 16 2019, by Nancy Cohen



The patent application for a "Plasma Compression Fusion Device" was applied for in March last year. It read, "Application filed by US

Secretary of Navy." The patent application was published in September this year. Under discussion is a compact fusion reactor.

The focus is on a compact nuclear fusion reactor that measures between 0.3 to 2 meters in diameter. As of October 15, the application status was listed as pending. The inventor named in the patent application was Salvatore Pais.

As described in *The War Zone*, the reactor could "pump out absolutely incredible amounts of power in a small space."

In a Statement of Government Interest section, the patent stated that "The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without payment of any royalties thereon or therefor."

The patent named the three primary methods of confining plasma in order to make ions fuse: gravitational confinement, inertial confinement and magnetic confinement..."All these methods of plasma confinement have grave issues, such as an extremely large size (commensurate to that of an aircraft carrier) requirement, plasma instabilities for tokamaks, and power losses and short confinement times for magnetic mirror/cusp machines."

The patent went on to state: "None of these confinement methods to date have been able to achieve break-even fusion reactions, namely the condition for fusion power output to equal the power input, let alone achieve the ignition condition whereby a fusion plasma burn is self-sustained, without need for external power input. As a result, there is a need for an effective plasma compression fusion device, which creates an energy gain."

Reactions to the patent news were dramatic. *The War Zone* described the

patent application as potentially revolutionary. *Popular Mechanics*: "The Navy's Patent for a Compact Nuclear Fusion Reactor Is Wild," said the header, and the subhead read, "The designs seemingly stretch the limits of science."

Jennifer Leman wrote that "No one has yet been able to mass produce or control large quantities of fusion energy, so designs for the reactor seemingly stretch the limits of science." To create fusion energy, scientists have to build "instruments that can contain gases that will reach temperatures of hundreds of millions of degrees in order to compel atomic nuclei to slam together at high speeds and create a superheated plasma."

Brett Tingley and Tyler Rogoway took up a full discussion about the patent in *The War Zone*. They wrote that "it remains challenging, to say the least, to engineer systems that can contain temperatures of hundreds of millions of degrees Fahrenheit and extremely high pressures. Most of the world's 'successful' fusion reactors are currently only able to maintain plasma discharges for periods of time measured in minutes or even seconds. "

Laboratories seek to develop the 'Holy Grail' of power generation: nuclear fusion and some laboratories are going even further with attempts to create compact reactors "small enough to fit inside shipping containers or even possibly vehicles," said the two.

Current reactors are approximately the size of a building, said Leman.

Tingley and Rogoway reported that "several private firms have been developing their own compact fusion reactors in recent years, and the government-run Chinese Academy of Sciences has claimed to have made significant progress in developing fusion reactors that could one day be capable of producing revolutionary levels of energy."

It might seem easy to dismiss the patent ideas as wild but at least the exploration raises a conversation about future possibilities. "Developing a viable source of nuclear fusion energy—the same reaction that powers the sun—has long been seemingly unattainable. This technology, by all accounts, is a long shot. But it would completely revolutionize how we power our world," said Leman.

The *Popular Mechanics* article like a number of others highlighted the plus points. It doesn't emit greenhouse gases or leave behind harmful byproducts such as nuclear waste—unlike nuclear fission. In fact, its sole byproduct is helium: an inert, extremely useful gas.

The War Zone report said that "nuclear fusion would be a massive improvement over fission in that it produces much lower levels of radioactive waste and greenhouse gases, does not require enriched nuclear material that could be used to produce weapons, has a far lower risk of meltdown, and can be powered by more sustainable fuel sources."

This would be a suitable place to bring in *ExtremeTech*'s Joel Hruska, who agrees that (1) Fusion power has been the Holy Grail of clean energy for decades and (2) the US Navy has a patent application discussing a compact fusion reactor design that *would* revolutionize the world—if it works.

Hruska wrote that "the author is claiming his invention can yield gigawatt-level energy from kilowatt input, or terawatt output with megawatt input. It would be a momentous achievement for us to get megawatt-level output from a smaller number of megawatts of input at this point. Granted, patents are allowed to look forward towards what they expect will be achievable in the future, but again, it's not clear where these improvements are coming from." Hruska's parting verdict was "Clear as mud."

The War Zone also noted that "the extent to which this patent represents an operable, functioning, or even feasible technology isn't clear." But wait, their assessment grew more straightforward. "To be frank, we at The War Zone have no idea what is going on here."

The patent filing's abstract described "A plasma compression fusion device which includes a hollow duct and at least one pair of opposing counter-spinning dynamic fusors. The hollow duct includes a vacuum chamber disposed within the hollow duct. Each dynamic fusor has a plurality of orifices and an outer surface which is electrically charged. In combination, the pair(s) of dynamic fusors create a concentrated magnetic energy flux and electromagnetic radiation within the vacuum chamber, whereby the concentrated magnetic energy flux compresses a mixture of gases that are injected through the orifices to the vacuum chamber such that a plasma core is created, and the to electromagnetic radiation heats the plasma core, while produced magnetic fields confine the plasma core between the dynamic fusors, such that when an additional mixture of gases is introduced into the plasma core through the orifices, an energy gain is created."

More information: Plasma Compression Fusion Device, patents.google.com/patent/US20 … ntor:(Salvatore+Pais