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Farnovision

Remembering Philo T. Farnsworth -
The Inventor of Television

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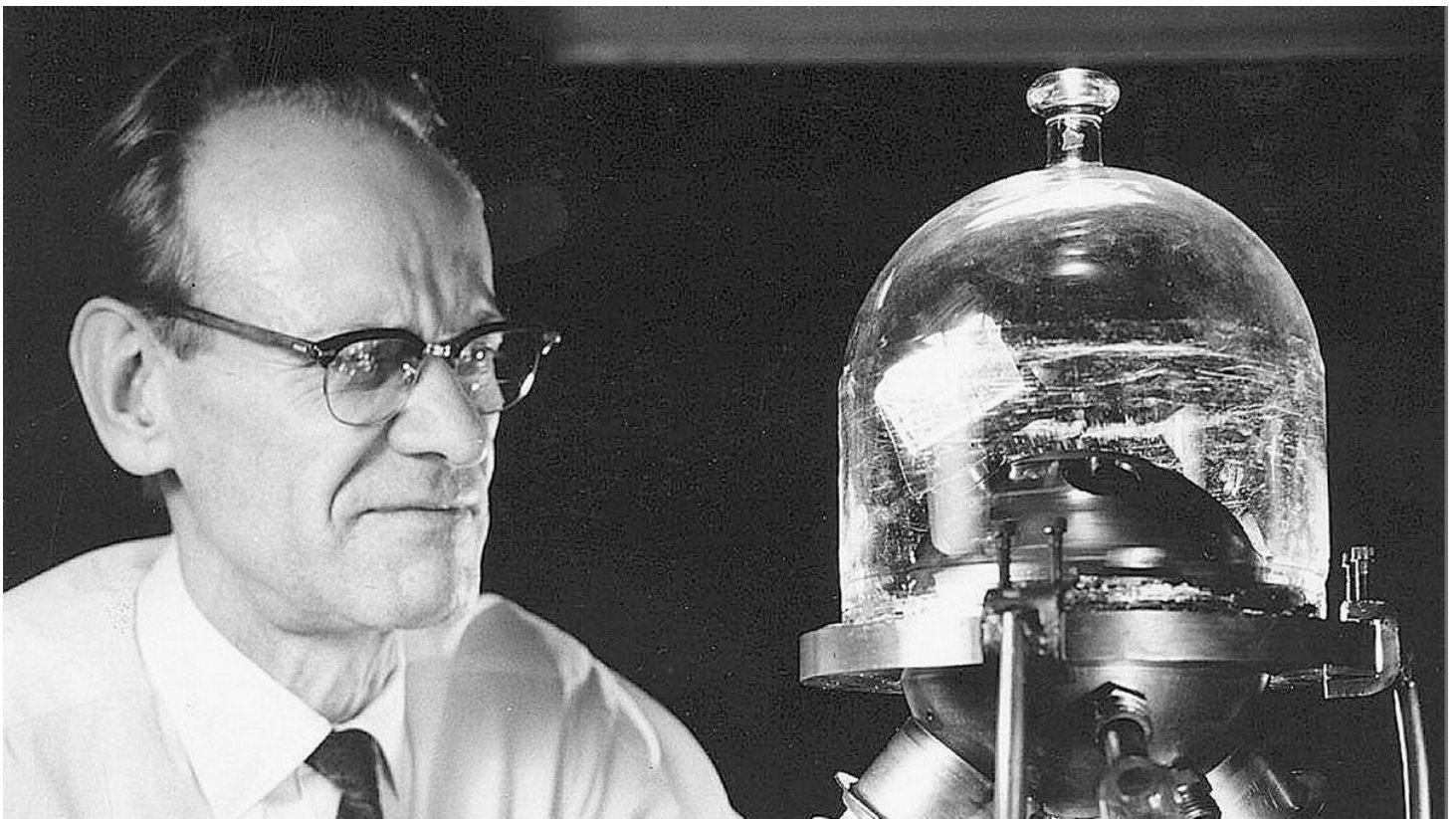
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Chapter 19



That's All I Need to See

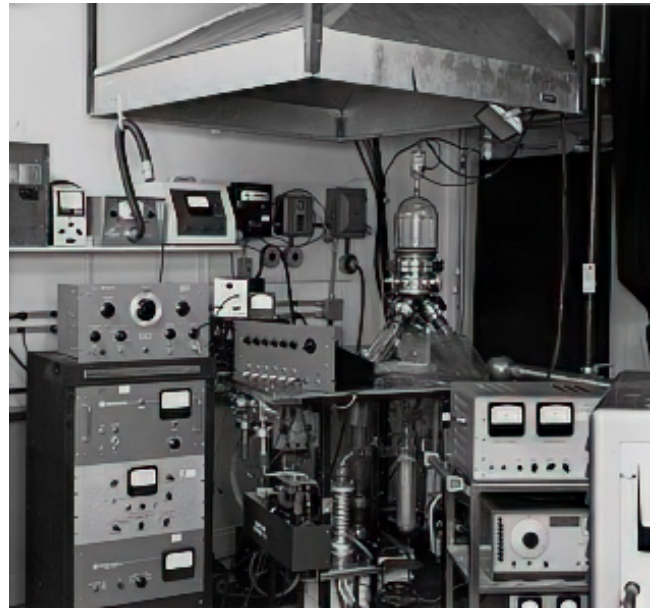
"No real progress is made unless real leaps of faith are made."

—John V. C. Nye

That the Fusor worked—that it produced fusion—was indisputable from that day in October 1960 when deuterium fuel was first admitted to the reactor chamber. Whether the Fusor was ever effectively reconfigured to produce a self-sustaining reaction remains a mystery.

Based on this initial success, Farnsworth again proposed to the ITT management that the entire fusion operation be moved to the type of facilities he felt he needed to push the envelope of his experiments.

He knew that in order for the Poissor—the plasma ball at the heart of the reaction—to achieve its greatest efficiency, it would have to be operated at power levels beyond what was safe to work with in the basement of the ITT facility in Fort Wayne. Again, ITT refused his request, leaving Farnsworth in a quandary: Though he had succeeded in producing substantially more fusion than any other experiments anywhere in the world, the ITT people were not satisfied. They wanted to see more substantial results. To produce more fusion, Farnsworth needed better facilities. But ITT would not give him better facilities until he demonstrated that he could produce more fusion.



The basement lab on Pontiac Street

But in a conciliatory gesture, ITT relocated the fusion lab to new quarters at the rear of the first floor of the Pontiac Street plant. This was still not the kind of environment that Farnsworth felt he needed, but it was an improvement, providing an exhaust hood, residual gas analyzers, and a power supply capable of 100kv (kilovolts). The entire operation occupied one relatively small room. To shield the workers, the Fusor itself was eventually placed on a hydraulically-operated elevator that could lower it into a hole fourteen feet deep that was dug through the floor of the basement. Farnsworth had wanted to operate his Fusor in an entirely separate location; ITT put it in a pit.

The Fusor underwent at least two major redesigns, called "Marks." The first October 1960 model was dubbed the "Mark I—mod. 0" (Mark one, modification zero). Each minor modification was given a new number. Complete redesigns were given a new Roman numeral. In 1961, the Fusor Mark I went through a few variations and in 1962 was replaced by the Mark II

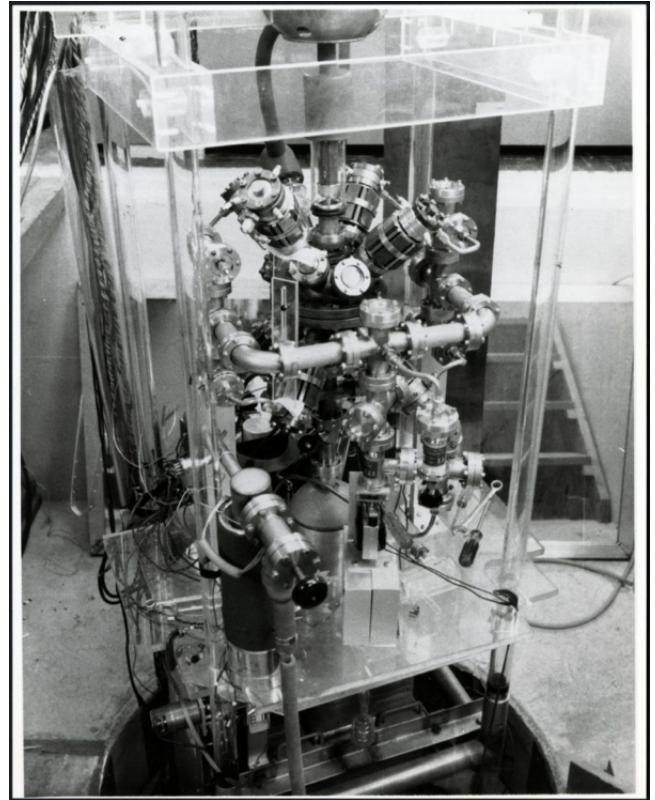
went through a few variations, and in 1962 was replaced by the Mark II.

With each new redesign, the neutron counts—the measure of just how much fusion the Fusor was producing—increased steadily, if gradually. Neutron counts are reported in exponential increments, as in 10^5 or 10^6 ; Farnsworth's first important goal was a neutron count of 10^9 —that is a one followed by nine zeroes, or one billion neutrons per second. The Fusor approached this level in steady increments with each redesign and modification.

During 1962 and 1963, strange and startling things began to occur in the course of Farnsworth's continued fusion experiments—events of an epic nature suggesting that there was much more going on inside the Fusor than mere neutrons could account for. These unexplained incidents suggest that the Fusor was much closer to the goal of self-sustaining, breakeven fusion than anybody present realized or the written record reveals.

One such event is described in *Distant Vision*, Pem Farnsworth's biography of her husband:

As Phil put the equipment through its paces, he increased the power input beyond levels of previous tests. The degree of nervous tension in the lab was already high, as it always was when the Fusor was being tested. Phil sat at the controls, slowly adding power ...75 kilovolts ...80 kilovolts ...then 90 and 95. Not a word was spoken, and all eyes turned toward Phil as the power went past 100 kilovolts. Suddenly, there was a terrific power surge, a loud crack like a high-powered rifle, and a lightning-like electrical discharge in the pit. Fearing the worst, all hands abandoned their posts and bolted for the door—except Phil, who sat calmly watching his gauges, quite certain that everything was under control.^[i]



The Mark II Prime fusor, ready to be lowered into 'The Pit' for testing

What is most noteworthy about this particular event is the reaction of the various witnesses. While Farnsworth remained comfortably at the controls, the rest of his staff beat a hasty retreat from the

room. That's just one reason why events of this nature came to be known as "runaway."

Farnsworth's own composure throughout the episode suggests that the experiment was under control and *not* running away. To the contrary, the discharge suggests that the experiment had reached an important threshold, something akin to an airplane breaking the sound barrier—precisely the sort of outcome that would warrant further observation.

The reaction of Phil's co-workers reflects the ambiguity that festered within the Pontiac Street lab. This was truly a corporate laboratory. The environment was very unlike the atmosphere Phil had created around him in San Francisco and Philadelphia. In those days, Phil empowered all his men with the spirit that they were working *with* him, not *for* him, and they returned that spirit in the manner that they responded to his initiatives. Tobe Rutherford, Arch Brolly, Cliff Gardner, Russ Varian ...they all understood where Phil was going, and often anticipated his next moves. Those men were always *right there with him*.

That kind of camaraderie was clearly absent at Pontiac Street. Maybe the work was easier in the earlier days. Maybe this nuclear stuff was just too far out on the frontier for anybody lacking Phil Farnsworth's unique vision to grasp. In any event, Phil never got the sense that these men were up to speed on the critical aspects of his approach to fusion. Yes, they seemed to work well *with* him, but the fact was they worked *for* ITT. They may have been co-workers on Phil's quest for fusion, but they were beholden to their employer, and Phil was never certain of ITT's motives or its commitment to his fusion work.

Whatever his misgivings about his working environment, Farnsworth continued to improve the Fusor through 1962 and 1963, seeing steady increases in the neutron counts with each modification.

Another remarkable event took place in the latter months of 1963, which has been reconstructed from interviews with members of the Pontiac Street team.^[ii] A verbal account from engineer Fred Haak described an occasion when he, George Bain, and another engineer named Jack Fisher were preparing the Fusor for a metered run that would be conducted the next day. There was no instrumentation on the Fusor during the setup. As was often the practice, the workers were putting the Fusor through its paces to make sure its systems were all functioning when, according to Fred Haak, the Fusor in the pit "just lit up and went crazy." George Bain killed the power immediately but the Fusor did not shut down—it actually continued operating, as an increasingly bright light emanated from the pit. After this spontaneous operation had continued for at least 30 seconds—perhaps a minute—a "pop and a hiss" indicated that the stainless steel reactor vessel had been breached, releasing its vacuum, at which point the reaction finally ceased and the Fusor cooled

breached, releasing its vacuum, at which point the reaction finally ceased and the Fusor cooled down.

Jack Fisher, one of the engineers on the fusion project, later related the story to Steve Blaising, another engineer who was not present at the time. Blaising was in charge of monitoring all the radiation-detecting equipment in the lab. That included “dosimeter” badges worn by all the personnel and also placed in strategic locations around the lab and in the actual Fusor pit. As soon as Blaising heard Jack Fisher’s story, he grabbed all the radiation badges and sent them off for a reading. Typically, the badges would show almost zero exposure with each monthly reading, but this report came back indicating that the radiation badges were completely saturated, with reading levels completely off the scale. In other words, when the Fusor went off on its own on this occasion, the radiation readings suggest it produced substantially more fusion than on any previously measured occasion. Unfortunately, the lab’s neutron counters were not in place, so there was no way of knowing exactly what level of neutron flux was attained, nor whether the Fusor might have approximated breakeven.

What is most revealing about this incident is that, even though the reactor vessel was damaged and took some weeks to repair, the incident was not recorded, nor reported to any of the higher-ups at ITT. The workers were apparently afraid that the ITT management might arrive at the conclusion that the work was too dangerous and shut it down—a move that might have cost them their jobs.^[iii] Whether or not that fear was justified, the evidence certainly suggests that the Fusor was capable of much more than any of the written records would indicate.

What we do have are lab notes and records telling us that on February 7, 1964, the Fusor called “Mark II Mod 2” surpassed Farnsworth’s immediate goal, recording a neutron count of 1.35×10^9 . These notes also state that “the upper limit [was] fixed not by the capability of the device, but only by the radiation tolerance of personnel in the vicinity,”^[iv] again reflecting the inadequacy of the facilities that ITT was willing to provide. Nevertheless, at this level the operation was “completely stable and could be controlled and repeated.”^[v] These notes confirm that the Fusor was a very reliable device, that the experiments were very successful—and that the facilities were woefully inadequate for testing at the levels Farnsworth believed further success would require.

The curious confluence of these events lends some credence to the notion that the Fusor was just beginning to demonstrate its inherent potential—albeit in an occasionally unpredictable manner—during the winter of 1963 – 64. So it seems ironic that ITT would begin at this time to grow impatient with its nuclear energy project.

This impatience is most keenly expressed in ITT’s insistence that Farnsworth add more “certified” personnel to the project—meaning an individual with more recognized credentials in the field of

personnel to the project, meaning an individual with more recognized credentials in the field of nuclear physics. We know that throughout this period, ITT kept looking to the Atomic Energy Commission for some kind of validation. The ITT management was well aware that the AEC was providing substantial funding for other lines of fusion research, and felt as if ITT was having to use its private funds to compete with publicly-funded experiments elsewhere around the country. Feeling that ITT was also entitled to some share of public money, management resolved to populate the operation with the sort of institutionally certified "experts" that the AEC seemed to favor in its funding.

Furthermore, the corporate executives who were being asked to finance this work clearly did not understand what they were getting into. Not only was nuclear energy well outside the purview of what was ostensibly a telecommunications and electronics company, but the research they were funding was well beyond their ability to keep up with Farnsworth's actual thinking. If they "got" it, it really didn't fit in, and even if it did fit in, they really didn't "get" it. Little wonder that the tenor of life at Pontiac Street began to change come the spring of 1964.

Harold Geneen, CEO of ITT. Not a fan of Fusion.

Farnsworth's advocate among the ITT management, Fritz Furth, tried to forestall the inevitable, but not even Furth could withstand the board's insistence that the project be given more scientific cachet. He implored Farnsworth to seriously consider adding some "lettered" personnel to his staff. Fortunately, a suitable candidate surfaced in June, 1964 when Robert L. Hirsch arrived in Fort Wayne with a newly minted doctorate in nuclear physics from the University of Illinois. Hirsch brought with him a keen interest in electrostatic fusion, which he had investigated during his graduate studies, and a personal resolution to make fusion his "life's work." [\[vi\]](#)

With the ink barely dry on his doctoral thesis, Bob Hirsch was determined to make a mark for himself with his first job. He wasted no time asserting his own interpretations of the Farnsworth approach to fusion and putting his own imprimatur on the Fusor design and experiments.

With Hirsch's arrival, "The Admiral," as Fritz Furth was fondly addressed, found himself juggling Hirsch's and Farnsworth's differences of method and personality. Farnsworth began to harbor suspicions regarding the motives of the brash young Ph.D. and felt that Hirsch was moving too fast in directions he was not really sure of. [\[vii\]](#) Though their relationship appeared congenial on the surface, the underlying tension mounted when Hirsch had constructed, at some considerable expense, a concrete "cave" in which to conduct his own Fusor experiments. Some say that this

expense, a concrete "cave" in which to conduct his own Fusor experiments. Some say that this development created an atmosphere of constructive competition within the workplace. Others say it produced an environment rife with friction and mistrust.

Farnsworth continued to conduct tests with the Fusor and by 1965 believed he was tantalizingly close to his elusive goal.^[viii] One nagging obstacle had the entire team stumped. Once the Poissor formed and began producing meaningful amounts of fusion, a layer of positively charged particles—a "virtual anode"—would form around the reaction, making it difficult for new fuel to find its way into the center of the reactor chamber. The various team members such as Gene Meeks, George Bain, and Bob Hirsch each had his own ideas about what was causing the problem and how they might get around it. Phil often looked at what his colleagues were trying and just shook his head.^[ix] Whatever it was, they just didn't get it, either.

Phil believed all along that the so-called problem of the virtual anode—this "force field" that kept new fuel from reaching the artificial star—was actually one of the predictable properties of the Poissor, an elegant controlling feature that naturally kept the reaction from running out of control or burning itself out. He had some ideas of his own about how the effect could be manipulated so that the formation of the virtual anode would not snuff out the reaction, but would in fact work to the advantage of the entire process. This was very much on his mind when he came home early one day. Pem noticed a curious look of suppressed excitement on his face. Phil was unusually quiet during dinner; Pem finally asked him what was on his mind.

Robert L. Hirsch and Steve Blaising with the "dessert cart" version of the "Hirsch Meeks Variation" of the Fusor

"We made a run today. I didn't dare take it up as far as I wanted to, but I want you to see this."

Pem drove Phil back to the lab, which she described as dark and empty, in a moment that plays like a scene from a Steven Spielberg movie as they negotiated their way past the night watchman.

Once inside the dimly lit lab, Pem noticed that the Fusor itself was still resting at the bottom of its hydraulic pit where it had been tested earlier in the day. Phil gestured her toward a seat where she could observe the various meters that monitored the functions within the Fusor. Pem focused her attention on the meters, and Phil took his position at the power supply and started turning the

attention on the meters, and Phil took his position at the power supply and started turning the rheostats that applied voltage and current to the Fusor. Very gradually over the course of several minutes, he increased the power.

Pem recalled, "Not knowing what to expect, and with chills running up and down my spine, I kept my eyes glued to the needle Phil told me to watch, reporting its position to him as it climbed the scale. At first, the needle settled in a position about three-fourths of the way up the scale."

Then Phil tweaked the power supply slightly, and the needle shot all the way up the scale, pegging itself at the extreme value. "It's gone off the scale," Pem called nervously to Phil.

At that, Phil quickly pulled back on the power. And then, "the most amazing thing happened: the needle just stayed right where it was. All power had been cut off to the Fusor, but that needle just stayed stuck ...for a period of at least a half a minute after Phil had shut it off."

When the needle finally started fading back toward the zero mark, Pem turned to Phil, who was now staring at the meter as intently as she was. She waited for Phil to tell her what it meant.

Phil finally broke the silence, saying quietly, unemotionally, "That's it. I've seen all I need to see. Let's go home." [\[x\]](#)

After that unexplained event, Farnsworth began withdrawing from the day-to-day work around the fusion lab, practically becoming a spectator in his own project. Steve Blaising later recalled one occasion when Phil was at the lab, when some dignitaries from the Franklin Institute were on hand for a demonstration of the Fusor.

Farnsworth, the Admiral, Bob Hirsch, and others were gathered in Hirsch's cave lab that morning in 1965. The visitors asked questions about the principles on which the Fusor worked. "Phil started to explain inertial containment," Blaising recalled, "and used the expression 'electron return time.' One of the visitors cut him off in a very caustic voice and said, almost condescendingly, 'where do you get *that*?' And the Admiral said, 'Well, Phil has some expressions that are only meaningful to himself.'"

Before Phil could explain any further, the Admiral turned to Hirsch, saying "Perhaps Bob better explain this to you." From his position near a control console, Steve Blaising watched as Hirsch took over the proceedings. Turning toward Phil, Blaising could see "the deep hurt in Phil. His head drooped, his chin fell nearly to his chest in silence. If you ever kicked a dog, well, that's how Phil looked."

Farnsworth stood motionless and quiet for about one minute. Then, unnoticed by all but Steve Blaising, Phil stepped back to the rear of the cave room and slipped out the door.

About an hour later, the Admiral asked Blaising if he'd seen Phil. Calling the guardhouse at the gate, Steve learned that "Mrs. Farnsworth had come by and picked him up a little while ago." Farnsworth had left the building.[\[xi\]](#)

Phil Farnsworth returned to the Pontiac Street lab only one more time, a few days later. He assembled with Fritz Furth, a mathematician named Hans Salinger, and his patent attorney George Gust, and gave them what they needed to file the Fusor patent.

Philo and Pem ca. 1970 at their home near Salt Lake City, Utah.

Want more? [***Then buy the damn book!***](#)

[i] Ibid., p. 295.

[ii] Accounts of the Pontiac Street activities by Richard Hull, postings to the Fusor.net website:

http://www.Fusor.net/old-boards/intranets.com/history_news/msg-9631.html

[iii] This concerns regarding the job security of the lab workers came to light during interviews with Gene Meeks and Steve Blaising in July, 2001; Schatzkin Audio 2001 Archives.

[iv] Farnsworth, pp. 296.

[v] F.R. Furth and R.L. Hirsch, *Unsolicited Proposal To Perform Basic Physical Research In the Inertial Containment of Ionized Gases*; 1967, ITT Industrial Laboratories Sec. 3. p. 2.

[vi] Interview with R.L. Hirsch March 2002; Schatzkin Audio Archives

[vii] Farnsworth/Schatzkin 1976 Audio Archives

[viii] The sentiment that the Fusor experiments were "close" to their ultimate goal was echoed by Gene Meeks. Interviewed in July 2001, Gene said, "we were close... very close ..." before the project was terminated in 1968. Schatzkin 2001 Audio Archives.

[ix] Farnsworth/Schatzkin 1976 Audio Archives

[x] Farnsworth, *Distant Vision* pp. 309-310.

[xi] Blaising interview July 2001, Schatzkin Audio Archives; also Richard Hull, *End of Philo Farnsworth at ITT*; http://www.Fusor.net/old-boards/intranets.com/history_news/msg-9837.html