Coincidences

February 25, 1991 HTH

Ernest L. Wilkinson brought me to Brigham Young University from the General Electric Research Laboratory located in Schenectady, New York in August of 1955. I was 35 years of age at that time.

He offered me a full professorship and the choice of one of two positions: Dean of Science and Engineering or Director of Research and Creative Endeavor. Although the Deanship was more prestigious, I chose the latter to be more challenging and more suited to my own talents and disposition.

But the salary offer was disappointing. He said, however, that I would be free to earn additional income from consulting and related means.

I had only been at BYU for a few months when General Electric (GE) invited me to consider a consulting contract with them. I met them in Detroit, where they were attempting to build an industrial diamond manufacturing facility based on my Belt apparatus (U.S. Patent No. 2,941,248).

This is the device that could generate the ultra high pressures and temperatures required to transform graphite into diamond. Although I was the inventor of the device, GE owned it as a consequence of my employment contract. Incidentally, GE has produced more than $25 billion dollars worth of industrial diamond in my Belt apparatus.

In addition to inventing the Belt, I invented the first process for turning the graphite into diamond (U.S. Patent No. 2,947,608). Again, GE became the owner of this and other related inventions that came from my work. I received no other compensation, other than my salary, for attaining this goal—an achievement that had eluded scientists for over 150 years.

In Detroit, I discussed a number of problems with them including a verbally outlined contract agreement. Following the technical discussions, one had to come down to the bottom line: how much was I to be paid, on a daily basis, for my consulting services.

Those of you who know me well, Ida-Rose in particular, realize that I am no an aggressive soul and stand timid in the face of authority. But something providential happened to me that day that changed my life.

When asked how much I expected for a daily consulting fee, I abruptly asked them a question.

At this point, I must digress to provide background before going further.

I first made diamonds on December 16, 1954. Short depictions of my efforts have appeared in several scientific journals and books. I have tried to describe my feelings on that day and the quote below is what was written in the American Institute of Chemists Journal, *The Chemist:*

> I soon advanced into pressure-temperature territory far beyond that known to man before…These extreme conditions were thought to be more than sufficient to cause the direct transformation of graphite to diamond, but the sought for change would not occur. I attempted many hundreds of indirect…approaches over a period of about one year but to no avail, and was becoming discouraged.

> Then one wintry morning, I broke open the sample cell after removing it from the belt. It cleaved near a tantalum disk used to bring in current for resistance heating. My legs began to tremble; my heart beat rapidly; my knees weakened and no longer gave support. My eyes had caught the flashing light from dozens of tiny triangular faces of octahedral crystals that were stuck to the tantalum and I knew that diamonds had finally been made by man.
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> After I had regained my composure, I examined the crystals under a microscope. The largest, about 150 microns across [approximately one sixteenth of an inch], contained triangular etch and growth pits such as I had observed on natural diamonds. The crystals scratched sapphire and other hard substances, burned in oxygen to give carbon dioxide, and had the density and refractive index of natural diamond. A few days later, an x-ray diffraction pattern unequivocally identified the crystals as diamond.

This first successful experiment contained iron sulfide and graphite at a pressure of about 900,000 pounds per square inch simultaneously with a temperature of about 2800 degrees Fahrenheit (F). Steel melts at about 2200 degrees F. Iron sulfide, reacting with tantalum, had formed a liquid alloy that catalyzed the transformation of graphite to diamond.

Persistent trial and error experiments plus serendipity, or perhaps providence, led to the means for transforming graphite into diamond.

In February of 1955, GE announced that diamonds had been made at the GE Research Laboratory. It was immediately front-page news on most of the industrial world's newspapers. The GE advertising department was elated. They calculated the free advertising to be worth about eight million dollars.

But GE did not reveal a thing concerning the details of the Belt apparatus or the process for making diamond. This did not set well with the scientific community because there was no information given that would enable another scientist to duplicate and confirm that the experiment was successful.

Subsequently, GE managed to keep the information secret for six years. This hurt me professionally because I was not allowed to publish my work in the scientific journals.

C. Guy Suits, Director of the research laboratory, had received a number of calls from nationally renowned scientists complaining about the lack of information. These scientists were important enough that management sought a way to surmount the issue.

They hit upon the idea of having Professor Percy W. Bridgman of Harvard University come to the lab as a consultant. He would be sworn to secrecy but would be allowed to see everything. Then he would write an article for a scientific journal whereupon he would verify that diamonds had indeed been made at GE and that he had seen the equipment and process procedures.

You need to know something concerning Professor Bridgman's background to know why GE wanted him. He started work in high-pressure research at Harvard University in 1905 and published his last paper in this field in 1950. His published works were voluminous but were generally not published in refereed scientific journals. Nevertheless, he deservedly received the Nobel Prize for his efforts in 1948.

Bridgman wanted, most of all, to make diamonds. Some insights into this come from one of the few graduate students that ever worked for the professor. The graduate student was David T. Griggs. He stated the following in a 1954 article;

> It was my privilege to work in Bridgman's laboratory during the period when working pressures were increased from 20,000 bars to 100,000 bars [290,000 pounds per square inch to 1,500,000 pounds per square inch]. As each new apparatus was readied for trial, I noticed Bridgman would become secretive and brusque. During the first run, visitors were not welcome. I subsequently learned that, in each case, *graphite* was the first substance tried.

Another former graduate student, George Kennedy, told me that he hid in a ventilating shaft and watched Bridgman attempting to convert graphite to diamond.

It is now known that Bridgman attained a maximum of only 1,000.000 pounds per square inch. Additionally, he was never able to combine high pressure with high temperature, a necessary condition for making diamond.

GE management contacted the Nobel Laureate to see if he would consult. They found that Bridgman was a consultant for Dupont but he would see if Dupont would release him from his contract. The Dupont Company agreed and Bridgman eagerly came over to GE.

On his first visit to the GE lab, management instructed me to show him everything and make diamonds for him. This I did. I wanted to talk with this famous person but he seemed distant and uncommunicative. He paced slowly around my lab with his hands behind his back and his head lowered. When not pacing, he just sat at one of our desks without doing much of anything.

My impression was this: after seeing an invention, it is very easy for one to say, "Well that was simple, I could have thought of that." That would have been particularly true for Bridgman because of his many years of experience in the field. It seemed to me that he was figuratively "kicking himself in his pants" for not doing what I did.

A few months later, Bridgman's article appeared to tell the world that diamonds had indeed been made at GE.

Well, after this detour, let's go back to Detroit where the matter of my daily consulting fee needed to be determined. Please recall that when they asked me what I wanted, I replied with a question.

Completely out of character for me, I asked, "What are you paying Bridgman?" They coughed and their jaws dropped. The spokesman said that it was company policy to never reveal that kind of information. But having gone this far, I somehow took courage and pressed them. Finally they said that he was getting $200.00 per day. I was really into it now. Without hesitation, I said, "I want $300.00."

There was some throat clearing after which they indicated that they would need to go to the upstairs office and talk to the top boss. They came right back down again and said that they agreed to the daily fee and, of course, my travel expenses.

A few weeks later, I received GE's written contract. It was not at all what we had verbally discussed in Detroit. It had no end of unacceptable strings tied to it. I

showed it to Harvey Fletcher, Sr. and he advised me not to sign it. I didn't. GE was miffed and we parted.

Several years later, a vice president from GE's head office in New York City visited with me in Provo to get me back in the GE folds. The offer was good but I was now well settled in our beautiful Utah Valley with all its attendant benefits for our family and respectfully declined.

I felt that the Detroit exercise was providential: *I had discovered my worth.*

Truthfully, if I had been my normal self, I would have said that $50.00 per day would have been just fine. On the basis of a normal 22-day working month, it would be $1100.00. That was considerably more than my BYU salary.

Well, from here I went on to do some consulting work for several large corporations and government agencies—about 50 in all.

Among the government agencies that I consulted for was the National Bureau of Standards. On one occasion, they asked me to participate on a thermodynamics board of experts at Cape Canaveral relating to some rocketry problems. I arrived at my hotel on a cold, rainy night. At the hotel desk, I was informed that the hotel was seriously overbooked and they were asking single men to share the same room (where there were double beds) with guests that were booked to arrive later that night. I reluctantly agreed and, being tired, went directly to bed and slept soundly all night.

When I awoke the next morning, there was a shirtless man standing at the wash basin with a bottle of booze in one hand, a razor in the other, and a burning cigarette on the toiletry shelf—definite symptoms of an alcoholic. He turned around. We recognized each other and were dumbfounded at the coincidence! We talked of former times, mostly about the old days at the University of Utah chemistry department.

What we didn't talk about follows. While pursuing my PhD studies at the university, some of my fellow students who smoked and drank decided it was time for Trace (what many people called me) to "get with it." They tackled me, threw me to the ground, and tried to pour a bottle of beer down my throat.

The man in my room was one of them.