

# This Week's Citation Classic

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Hall H T. Ultra-high, high-temperature apparatus: the 'Belt.' *Rev. Sci. Instr.* **31**:125-31, 1960. [Chem. Res. Dept., General Elec. Res. Lab., Schenectady, NY]

**The 'Belt' simultaneously generates pressures and temperatures sufficiently high to transform graphite to diamond. It created a new industry and is used to manufacture about 50 million carats of industrial diamond per year. [The *SCI*<sup>®</sup> indicates that this paper has been cited over 200 times since 1961.]**

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"The 'Belt,' rejected by management as an unworkable idea, came into being because an intimidated former farm boy mustered enough courage to circumvent company procedure and have one built.<sup>1,2</sup> Trouble followed! The first Belt cost about one thousand dollars, while about one hundred thousand dollars had already been spent on the 'official' but unsuccessful idea for an apparatus to make diamonds. Stepping on others' turf and winning is not well accepted by the losers.

"The Belt is valuable because it generates pressures and temperatures high enough to convert graphite to diamond. In use around the world, belts produce about 50 million carats of industrial diamond valued near \$105 million each year. The Belt has been at the heart of an industrial revolution in the abrasives industry and has also created a new field for scientific research.

"The Belt was patented in the US and a dozen foreign countries. I received \$25 for this invention, a small raise in pay, minor recognition, and

broken promises. Hurt and rejected, I quit the company for whom I had maintained a one-sided love affair since the age of nine and became a university professor.

"The first synthetic diamonds were made in the Belt. This feat attracts more public attention although it is obvious that the Belt had to come before the diamonds.

"Two of the several awards recognizing my work are the American Chemical Society's 1972 Gold Medal for Creative Invention for 'being the first to synthesize diamond,' and the American Institute of Chemists' 1970 Chemical Pioneer Award for my 'role in the synthesis of diamonds which resulted in the creation of a new industry.'

"The Belt was a company secret from 1953-1960, and a US Government secret from 1955 to 1960. Not being able to publish during these seven years of secrecy was a major frustration. I lived in constant fear that others would publish first since visitors from outside the General Electric Research Laboratory, Schenectady, New York (where this work was done) had seen the Belt before company officials recognized its importance. Also, the first GE press release on diamond synthesis in February of 1955 showed revealing pictures of the device.

"Scientists had tried to make diamonds since about 1790. Nobel Laureates P.W. Bridgman and H. Moissan worked a lifetime attempting to develop a device capable of generating a sufficiently high pressure and temperature without success.

"Belt/Diamond patents have been litigated worldwide. In South Africa GE vs. deBeers was carried to the Supreme Court and ended in an out-of-court settlement wherein deBeers paid GE a rumored \$8 million. The patents are very important because manufactured diamond is vastly superior to natural diamond for most industrial uses."

1. Nassau K & Nassau J. The history and present status of synthetic diamond: parts I & II. *Lapidary J.* **32**:76-96; 490-508, 1978.
2. Hall H T. Personal experiences in high pressure. *Chemist* **47**:276-9, 1970.