



The 7th World Congress on Particle Technology (WCPT7)

## Andrew Jenike: A True Visionary in Particle Technology

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### Abstract

This year marks the centennial of the birth of Andrew Jenike. At the age of 39 he made a momentous decision -- one that influenced and affected his life and indeed thousands of people around the world. His decision was to devote his life to the study of the design of bins and hoppers for storage and flow of bulk solids. Jenike was truly a visionary. He developed a theory to fulfil a practical need, and he approached his work with enthusiasm and focus not unlike famous inventors like Thomas Edison. Indeed he changed the way we design and build storage vessels for solids in a very revolutionary way. As Reg Davies once said, "As scientists and engineers, rarely do we accomplish something that changes the way people think and behave to such a degree that our name becomes synonymous with its application. That's Jenike".

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Selection and peer-review under responsibility of Chinese Society of Particuology, Institute of Process Engineering, Chinese Academy of Sciences (CAS)

- *Keywords:* Jenike; silo design; mass flow

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April 16, 1953 -- 3:15 in the afternoon. Andrew Jenike, a 39 year-old mechanical and structural engineer, is celebrating his birthday in Salt Lake City, Utah. Facing a mid-life crisis, he has just made a momentous decision -- one that will influence and affect his life, and indeed thousands of people around the world.

Jenike was born in Poland in 1914 and graduated from Warsaw Polytechnic Institute with a B.S. in Mechanical Engineering in 1939. Upon graduation he entered the Polish Army where he served with distinction as an officer in

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the Second World War. Soon after entering the army, the country of Poland was being overrun by the Nazis and the Russians. One day, as he relayed this story to me in one of our numerous conversations, he found himself at the top of a hill. Advancing on one side of the hill were the Nazis, advancing on the other side of the hill were the Russians. His unit commander said it was time to leave, so he fled on foot through Eastern Europe and eventually ended up in England. He found employment there and attended the University of London where in 1949 he received his Ph.D. in Structural Engineering. While in England he also met and married a lovely British girl with the delightful name of Una. They immigrated to Canada and then to the United States, eventually settling in Salt Lake City. Along the way he worked for several engineering design firms as a mechanical and structural engineer. Two sons, Michael and Ian, were born.

As Jenike approached his mid- to late-30's he began getting restless. He wanted to do something unique, something that would set himself apart, something that would be worthwhile. He started by reading and collecting articles on every conceivable subject, going to the library every night and every weekend. He put the information he collected into a series of folders arranged by topic. Eventually he had identified about 40 different topics. He constantly poured over these folders, trying to decide which topic would be the right one for him. Where could he make a significant contribution?

Finally, on April 16, 1953 at 3:15 in the afternoon -- his 39th birthday -- he made his decision. The topic he chose was the design of bins and hoppers for storage and flow of bulk solids. Up to that time, design of this equipment was mostly a black art. Most hoppers were either  $45^\circ$  or  $60^\circ$ , because those were the common triangles that all engineers carried around with them. No one gave much thought to the material being stored. After all, it's "just a bin."

Once he made his decision, he promptly went out to the garbage container at the apartment building where he and his wife were living and threw away box after box he had collected on every other topic that he considered. He wanted nothing to interfere with his decision, no looking back.

He approached the National Science Foundation and other groups for funding. They told him that while they thought his work was a worthwhile area of research, he would have to have some affiliation with a college or university before they could fund him. Since he was living in Salt Lake City, he went to the University of Utah with the following proposal: If you will put me on your staff, I will get all of the funding. It won't cost you a penny. They accepted the deal, and he spent seven years there developing basic theories and test equipment. He set forth design procedures in two famous University of Utah Engineering Experiment Station Bulletins 108 and 123, the latter probably the most cited work in the field today.

One key contributor to Andy's success in developing the basic theories of solids flow came from an unlikely source. While on a trip back to his native Poland, he came across a Polish translation of Sokolovskii's now famous book, *Statics of Soil Media*. At the time this book had just been published in Russian and had not been translated into English. Jenike immediately recognized that Sokolovskii's concept that soil stress could vary directly proportional to the distance from a point fit nicely with some crude bin pressure measurements that he had conducted using water-filled diaphragms. This gave rise to his Radial Stress Field concept.

During his period at Utah, Jenike had a number of graduate students working for him. The key one among them undoubtedly was Jerry Johanson. In 1962 Jerry finished his Ph.D. and went to U.S. Steel Research. Andy decided that the time had come to enter full time consulting, so he moved his family to Winchester, Massachusetts. Four years later Jerry joined him and formed the company, Jenike & Johanson.

I was fortunate to start working for Andy the summer between my undergraduate and graduate programs. The company was still headquartered in the basement of Andy's house. After grad school I joined the company full time, and 44 years later I'm still there.

Andy let nothing stand in his way when he set his mind to it. He was a first class engineer and mathematician, spending years studying such subjects as continuum mechanics and advanced plasticity concepts with people like Dick Shield at Brown. Andy was a very hard worker, working late into every night and most weekends to achieve his goal. He was also a frugal individual, but very compassionate with his employees. For relaxation he enjoyed jogging and mountain climbing.

Jenike lectured extensively around the world, authored or co-authored over 50 publications, and worked as a consultant for 25 years. Almost every significant technical paper written in the past 50 years having to do with bulk

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