

# Peter R. Swann

## 1935-2013

Materials scientist, *in-situ* TEM pioneer; optimized ion-beam milling; founded Gatan



1980

Peter Roland Swann was born Feb. 4, 1935, in Somerset, England and received his primary education as a scholarship student at Dulwich College in London. In 1960, he earned a Ph.D in metallurgy and materials science at the University of Cambridge, UK. He was a Senior Scientist at US Steel Corporation from 1960 to 1966. After a short time at the University of Göttingen, Germany, he returned to the UK, at the University of London and Imperial College London, where he was Full Professor, doing pioneering work in environmental TEM. While in the UK, he and brother Rex founded Gatan, Inc. After moving to the US in 1978, he served as Gatan's CEO, retiring in 1995. From 1993 until his passing on July 14, 2013, he lived in Jumby Bay, and made important contributions to Antigua, West Indies. He continued involvement in electron microscopy during his retirement, giving a talk as late as 2011, at the 3rd International Workshop on Remote Electron Microscopy and *In-situ* Studies.

### Publications

Dr. Swann had more than 53 publications and 25 technical notes in the fields of metallurgy, materials science and electron microscopy. Because of his concentration on instrument development, he wrote more patents than traditional scientific papers. He very often published short technical papers in the meeting Proceedings of (EMSA and MRS).

### Honors

Eight medals and prizes, including:  
 Beilby Gold Medal of the Royal Chemical Society (1975)  
 Robert Lansing Hardy Gold Medal of the American Institute of Metallurgical Engineers  
 Distinguished Scientist Award from the Microscopy Society of America (1997)  
 MSA fellow (2009)  
 Member of the Joint British Committee for Electron Microscopy  
 Member of the Council of the Royal Microscopical Society.  
 Editorial Advisory Boards of Philosophical Magazine's Communication on Physics.



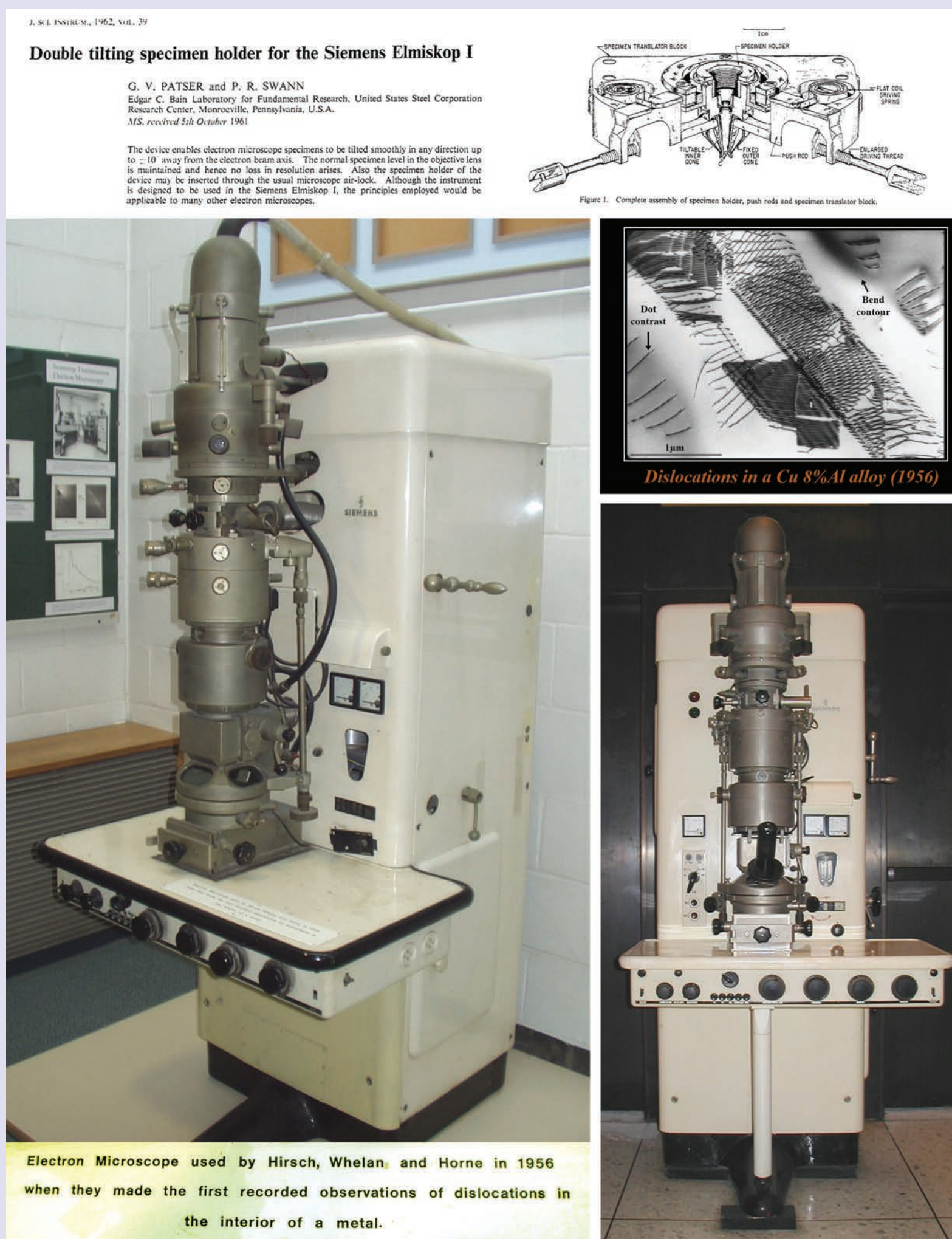
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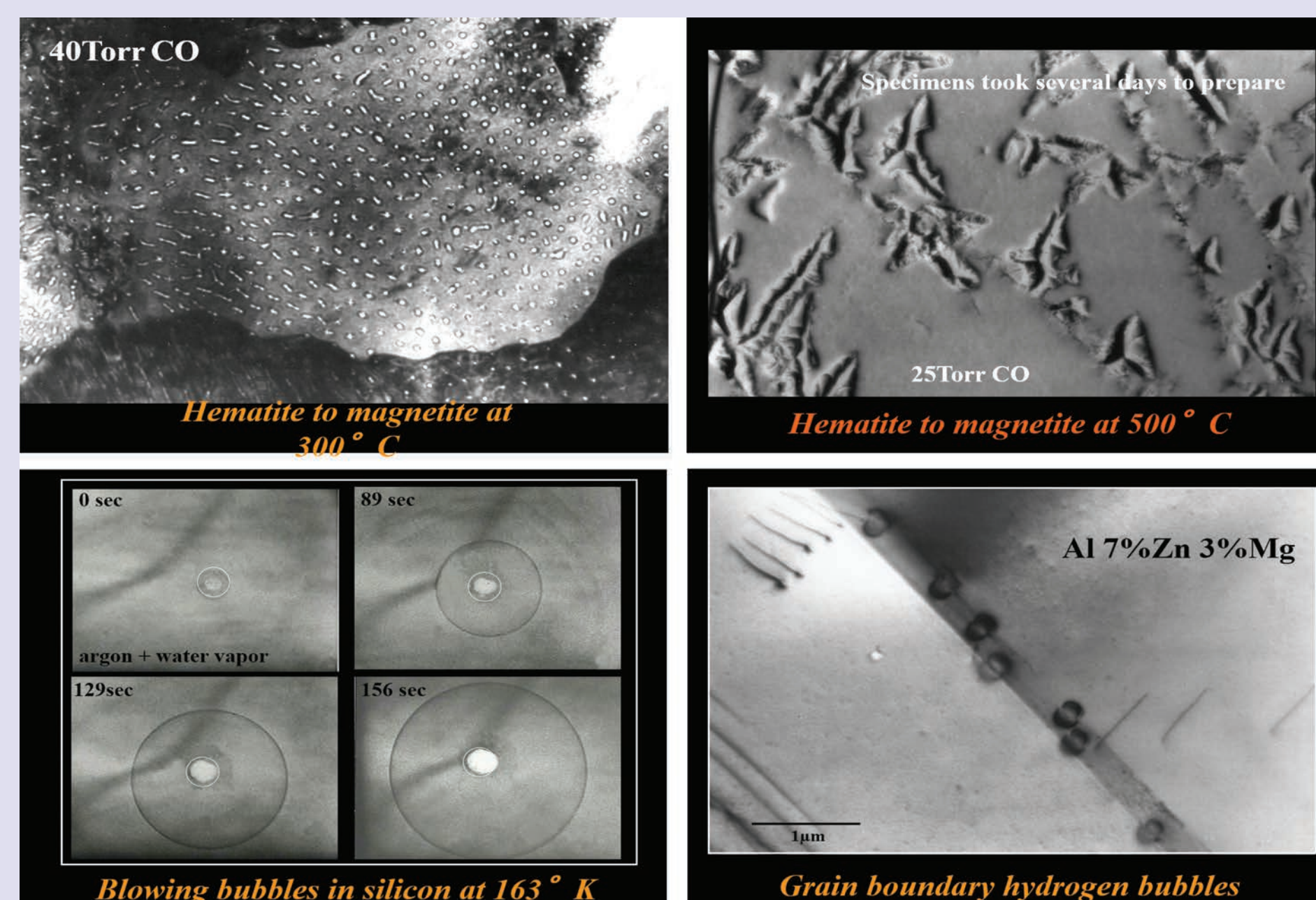
Peter Swann received a PhD in metallurgy and materials science from the University of Cambridge, UK, in 1960. In 2013, his first wife, Britta Dwyer, visited his former environment, shown in the upper row. Note the door labelled "HVEM" at the right. Center is the octagon room where Peter shared office space with Alan Baker and Bob Fisher, at whose suggestion Peter went to US Steel, from 1960 to 1966. Bottom: "Cambridge reunion" in Sonoma, California during the 2011 FEMMS meeting (l to r: Richard Leapman, Peter Nellist, Ondrej Krivanek, John Spence, Peter Swann, Archie Howie, Steve Pennycook).



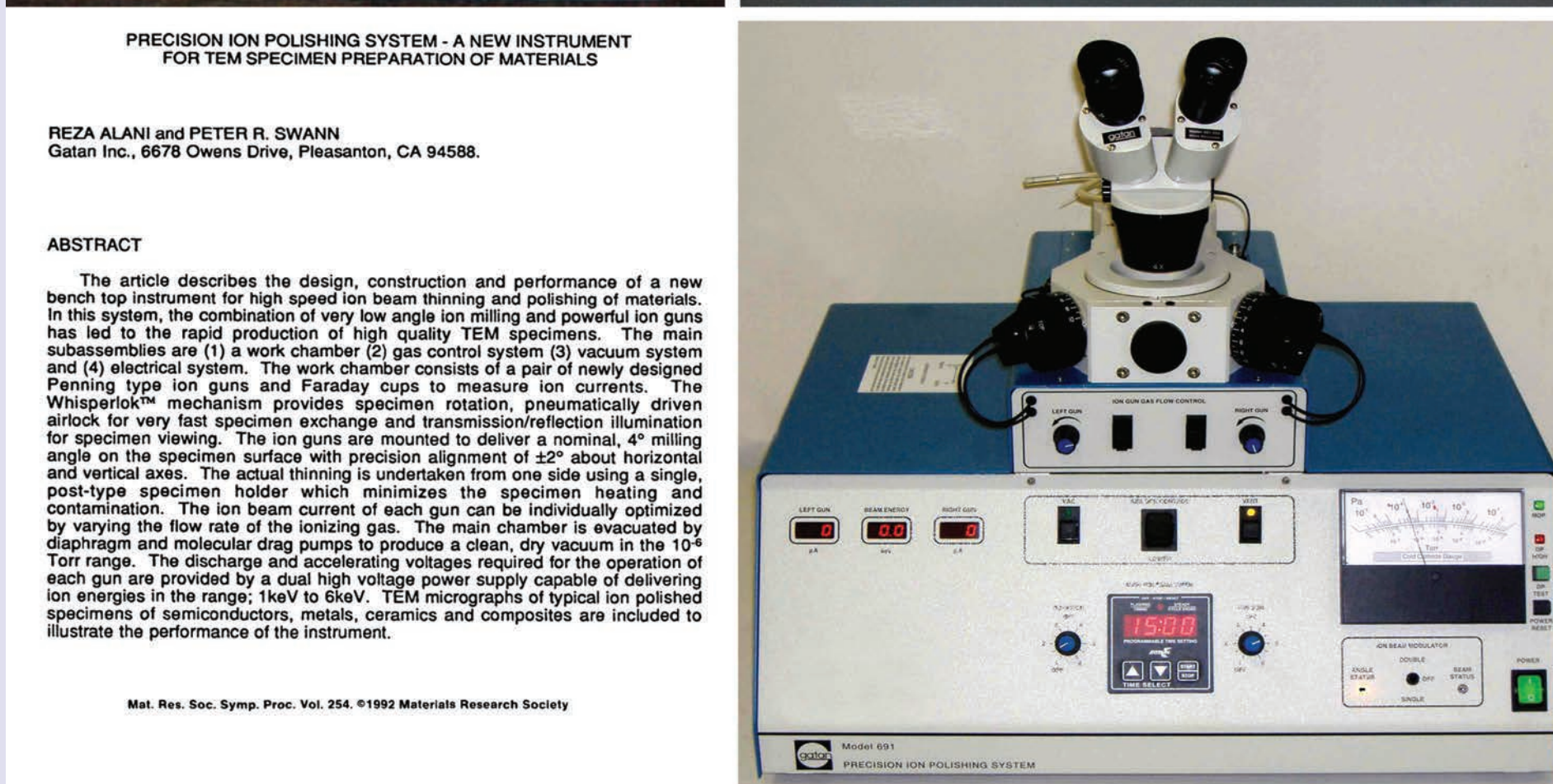
As described in a comprehensive paper (Swann, 1978) specimen holders made by Gatan for the EM-7 included heating, cooling and straining holders of both single and double-tilt configuration (most of which still exist at Albany). Note the representations of a young Peter "flying" in a holder at upper left (and "sleeping" in one at upper right in the previous figure). An early sketch of a holder tip is also shown.



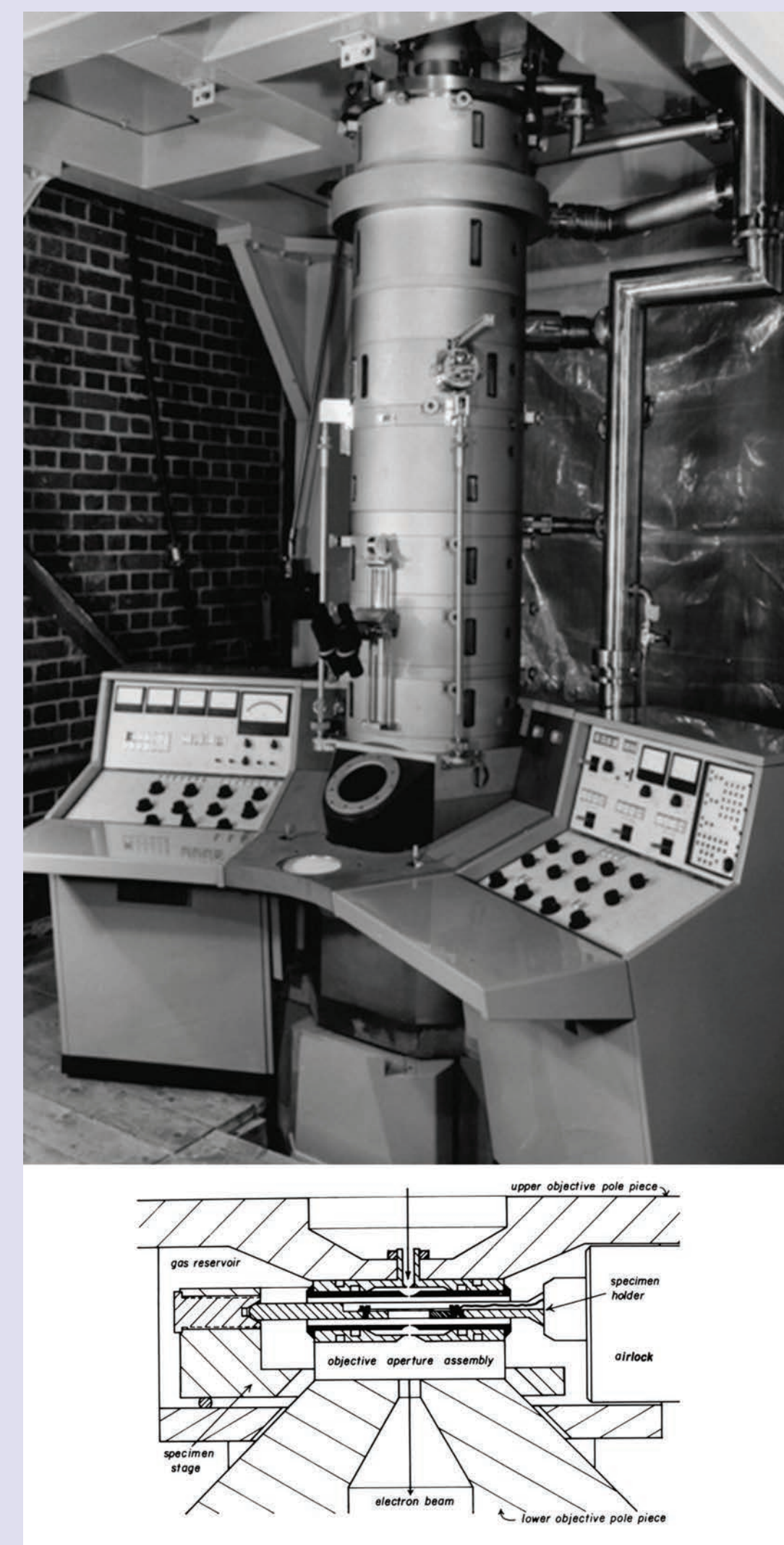
While at US Steel, Peter designed a double-tilt stage for a Siemens Elmiskop I, the premier TEM at the time, on which dislocations in metals were first seen, in 1956, at Cambridge. Along with his brother Rex (who still has a mechanical engineering business near Pittsburgh), Peter formed Gatan in 1964, with initial support to build stages for Siemens TEMs.



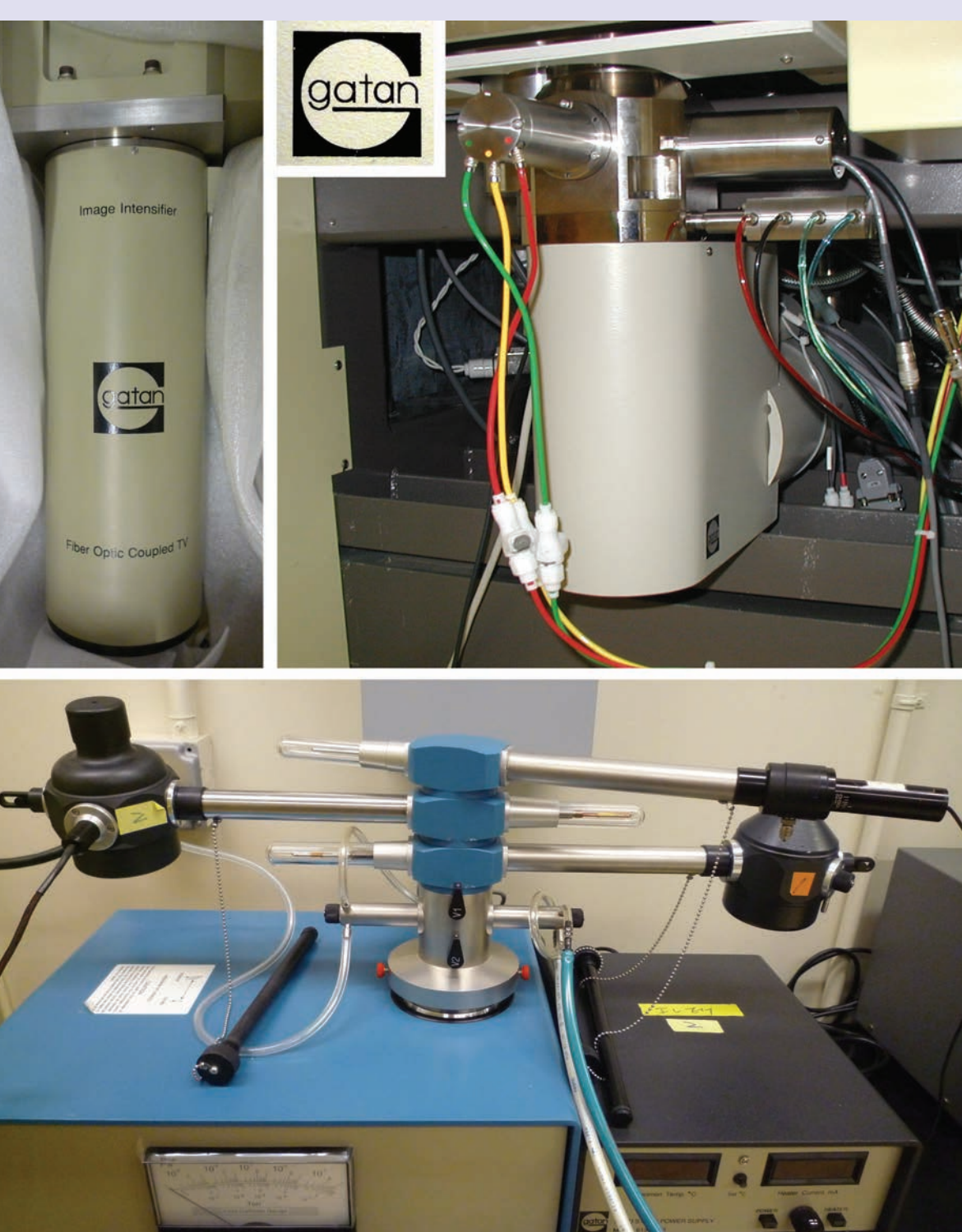
This figure shows some of the many ETEM results from Gatan holders in an EM-7 HVEM. These are from Peter's retrospective powerpoint presentation given at Carnegie-Mellon University on June 11, 2006, entitled "The early days of million-volt electron microscopy, 1961 to 1978".



In 1995, Peter retired from Gatan to Jumby Bay, Antigua, West Indies. He was chairman of the Jumby Bay club, and from 1993 to 1998 he was Chairman of the Board of Jumby Bay Island Company. He contributed his scientific expertise in design, building and operation of Jumby Bay's infrastructure. He was a founder and, from its beginning in 2001 until 2009, he was Chairman of the Board of The Island Academy International School at Picadilly, W.I. (shown here). The Island Academy is a K-13 institution designed to meet the needs of both the Antigua/Barbudan and expatriate communities, which is now qualified as an International Baccalaureate Programme World School.



After a brief stint at the University of Göttingen, Peter moved back to the UK, where he led a research team in environmental TEM from 1966 to 1978. Starting as the Central Electricity Generating Board Professor of Materials Science at the University of London, he became Full Professor at Imperial College, while at the same time he was chief designer at Gatan. The AEI (later Kratos) EM-7 HVEM (an early version built for Coslett on the left and a later version, still in operation at Albany, on the right) could be configured with a large objective-lens pole-piece gap, in which a differentially-pumped environmental chamber (lower left) could be installed. This enabled any sort of side-entry specimen holder to be used for ETEM. The specimen airlock is shown at lower right, along with the Dewar for a Gatan anticontaminator used for low-temperature work.



In 1978 Peter resigned from his Chair at the University of London to become CEO of Gatan Inc., the first company in the world to design and manufacture accessories for electron microscopes. First (and still) located near Pittsburgh, in 1983, Gatan opened their R&D facility in Pleasanton CA, and Ondrej Krivanek was hired as Chief Scientist responsible for electron optics design. Later the same year, Gatan GmbH, the German subsidiary, was opened, followed in 1988 by Gatan UK. Represented here are three of the most wide-spread Gatan products. Upper left: The Model 622 camera, a pioneering and highly successful TV-raster camera for surveying and imaging specimens electronically (a line of development that is now represented by the groundbreaking K2 Summit direct-electron detector). Upper right: Gatan Energy Filter (GF), mounted under a Gatan brightfield/darkfield STEM detector on a JEM-4000FX TEM. The GF and PEELS systems, designed under Krivanek, are by far the most widely used EELS/EFT/STEM systems, along with comprehensive EELS analysis software and the EELS Atlas of Krivanek and Ahn. The software for image capture and data analysis, Digital Micrograph, is ubiquitous on TEMs of all makes. Bottom: two Model 626 cryotransfer specimen holders, parked in a Gatan dry-pumping station. The 626 holder was an evolution from the first-ever cryotransfer holder, designed by Swann. The 626 was very important in opening cryo-TEM to the wider EM structural biology community, and still is used in a great many laboratories.

Peter pioneered in using ion beams to micro-machine samples for TEM, and he led development at Gatan in this technique for many years. Gatan became the leading supplier of such equipment, making a major impact in the semiconductor-device field.

First came the Model 645 Precision Ion Milling System (upper left), which included imaging by secondary electrons or secondary ions. In 1979, Gatan introduced its first major product for the electron microscope market, the Model 600 DuoMill (upper right), a high-precision ion-milling system used to thin a specimen to electron transparency so that it could be successfully viewed in an electron microscope. This was followed in by the Model 691 Precision Ion Polishing System (lower panel), which underwent continued upgrades (e.g more-powerful and precisely positioned ion guns and chemically-assisted milling); upgrades still continue today. A series of patents on ion milling were granted to Peter in the 1990s

### Selected publications

- Patser, GV and Swann PR (1962) Double tilting specimen holder for the Siemens Elmiskop I. J. Sci. Instr. 39:58-59.
- Swann, P.R. (1978) Specimen devices for *in-situ* experiments. Proc. ISEM IX, Toronto, Vol.2, 319-329.
- Burgner RP, Krivanek OL and Swann PR (1982) EELS of gasses in the electron microscope. Proc. 40th EMSA meeting, 650-651.
- Kraus B, Krivanek OL, Swann NT, Ahn CC and Swann PR (1986) Performance of Newicon and CCD real-time observation systems. Proc. Xlth Int. Cong. Electr. Microsc, Kyoto, 455-456.
- Swann PR, Jones JS, Krivanek, OL, Smith, DJ, Venables, JA and Cowley JM (1987) UHV conversion of a 300 kV high-resolution electron microscope. Proc. 45th EMSA meeting, 136-137.
- Lundquist TR, Alani R and Swann PR (1988) Reducing focused ion beam charging effects on insulators by heating: A practical method for TEM specimen preparation of nonconductors. Ultramicroscopy 24(1):27-36.
- Alani R, Jones J and Swann PR (1990) Chemically assisted ion beam etching (CAIBE): a new technique for TEM specimen preparation of materials. MRS Proc. 199:85-86.
- Alani R and Swann PR (1991) Precision ion polishing system - A new instrument for TEM specimen preparation of materials. MRS Proc. 254:43-44.
- R. Alani and P.R. Swann (1991) TEM Specimen preparation of individual SiC/C composite (SCS-6) fibers. Proc. 49th EMSA meeting, 1104-1105.
- Alani R, Harper and Swann PR (1992) Ion thinning of TEM cross sections under beam switching control. Proc. 50th EMSA meeting, 394-395.
- Alani R, Mitro RJ and Swann PR (1997) An updated ion polishing system for TEM specimen preparation of materials. MRS Proc. 480:263-264.

### Selected patents

- Specimen elevator for an ion milling machine; 4272682; June 9, 1981
- Anti-drift device for side entry electron microscope specimen holders; 4703181; October 27, 1987
- TV system for transmission electron microscopes; 4739399; April 19, 1988
- Multiple specimen cryotransfer holder for electron microscopes; 4797261; January 10, 1989
- Anticontaminator for transmission electron microscopes; 4833330; May 23, 1989
- Specimen cooling holder for side entry transmission electron microscopes; 4950901; August 21, 1990
- Specimen heating holder for electron microscopes; 4996433; February 26, 1991
- Chemically-assisted ion beam milling system for the preparation of transmission electron microscope specimens; 5009743; April 23, 1991
- Specimen holder and apparatus for two-sided ion milling system; 5472566; December 5, 1995
- Rotatable wide angle camera and prism assembly for electron microscopes; 5536941; July 16, 1996

### Acknowledgements

- Ondrej Krivanek: A memorial appreciation and material, some via the Swann family, which was used in some of these illustrations.
- Gatan, Inc. website.
- Pittsburgh Tribune website.