

rubber] is possible," he says.

Although Shoham, Koenig and others expect to put the first-generation robot rubber on the job in a year or so, nagging questions will become more important later on. Changing a piece of sandpaper on a wooden block, for example, is a cinch for people but more like a Herculean task for a robot. Also, the rubbing machine's vibrations could "confuse" the force sensor, causing the robot to apply improper forces to the piano case. Circumventing such problems might involve designing robot-friendly finishing tools, Shoham says.

Each of the 3,000 pianos Steinway completes in a year spends almost two years in the factory. The instruments cost plenty, too — over \$8,000 for the least expensive upright and more than \$53,000 for a special-order Walnut Concert Grand. Automated manufacturing makes many foreign imports less expensive, says Ling. For example, in a span of 2½ years, Yamaha — once known mostly for its motorcycles — mass produces about as many pianos as Steinway has built in its entire 135 years of existence as a U.S. company — about 500,000.

If Shoham's robot rubber produces human-hand-quality finishes while trimming production time and cost, Koenig says he will look to hire other robotic hands. He adds, however, that human touch will always be the most essential ingredient of the Steinway sound. □

Books

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The Art of Geology — Eldridge M. Moores and F. Michael Wahl, Eds. Presents 250 full-color photographs in 70 photoessays written for nonscientists. The essays explore the unusual and interesting views geologists have encountered in their work around the world. Readers travel from the valles marinaris on Mars to the great thrust faults in Spain to the inclusions inside a diamond. Geol Soc, 1988, 140 p., color illus., hardcover, \$37.50.

Black Mischief: Language, Life, Logic, Luck — David Berlinski. In this second edition, the author has added a table of contents and sectioned his work into definable chapters to aid the reader. Berlinski covers the fields of behavioral psychology, linguistics, Neo-Darwinian evolutionary theory, artificial intelligence and economics in this anecdotal potpourri of scientific thought and the people who shaped contemporary science. The first edition was published by Morrow in 1986. HarbraceJ, 1988, 353 p., paperback, \$17.95.

Doctors and Diseases in the Roman Empire

— Ralph Jackson. Examines, for the general reader, the history of medical practice and the emergence of Roman science. The author, a curator at the British Museum, points out the similarities and fundamental differences in the concepts, techniques, instruments and drugs of classical and modern medicine. Since written records of the period are scarce, illustrations and photographs of objects depicting medicinal practices abound in the book. U of Okla Pr, 1988, 207 p., illus., hardcover, \$27.50.

Infinite in all Directions

— Freeman J. Dyson. Based on the Gifford Lectures this scientist gave at Aberdeen, Scotland, in April and November 1985. "Part one," says Dyson, "is about life as a scientific phenomenon, about our efforts to understand the nature of life and its place in the universe. Part two is about ethics and politics, about the local problems introduced by our species into the existence of life on this planet." Originally published in hardcover in 1988. Har-Row, 1989, 321 p., paperback, \$8.95.

Planets Beyond: Discovering the Outer Solar System

— Mark Littmann. As *Voyager 2* data about Uranus, Neptune and Pluto become available, what is known or suspected about these outer planets becomes increasingly important. This book tells the general reader who discovered these planets and how; what we know of their makeup, orbits and moons; and about the spacecraft that gather these data. Many useful tables, chronologies and a glossary of terms end the book. Wiley, 1988, 286 p., color/b&w illus., hardcover, \$22.95.

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