

Random Walk

Keeping the Block Rolling

FOUR years ago *E&S* published an account by alumnus John D. Bush (BS '55) of his theory about how the Egyptians built the pyramids ("The Rolling Stones," October 1977). Not, he said, by 100,000 or so slaves being driven by whip-cracking overseers to haul the massive stones, inch by inch, up a pyramid's 8-degree incline. The Egyptians were probably a lot smarter than that, and, besides, they didn't have that large a labor force. Bush thinks they might have done the job using wooden cradles (which they knew about), lashing four of them around blocks of stone to make a cylinder. Such a device could have been parbuckled up an inclined plane by a relatively modest number of workers. He calculates that this technique would have enabled as few as a thousand men to raise all the blocks in the Great Pyramid in 20 years. No hordes of slaves were needed.

Bush's story was subsequently reprinted by *Science Digest* and *Smithsonian* magazines, and there have been a few other accounts, but the response from the archaeological world has been deafening silence. A logical next step for Bush



In this photo by Linda Glick, Caltech alumnus John D. Bush (between the ropes) is demonstrating his theory that the ancient Egyptians could have built the pyramids by lashing segment-shaped cradles around blocks of stone and then parbuckling them up a ramp.

seemed to be a public demonstration, and it took place on October 17 at the Boston Sand and Gravel Company in Charlestown, Massachusetts. Four wooden cradles were tied to the faces of a 2½-ton concrete block so it would roll like a drum, and a rope sling was hooked over an upright at the top of a 25-foot-long, 10-degree ramp. The ends of the rope were passed under the cylinder, across the top, and into the hands of six men, forming a parbuckle. With the song "Just Like a Rolling Stone" sounding out, the crew

took hold and began to pull. One minute, 32 and 29/100 seconds — and a little panting — later the block rested at the top of the ramp. To prove the feat wasn't an accident, the group did it again, bettering their first time by 3/100 of a second.

Consulting engineer Bush is encouraged by the success of his experiment, which seems to validate his theory. The pyramids *could* have been built this way. Maybe someday a lucky and/or perceptive archaeologist will find out whether they actually were.

Medals for Merit

AMONG tangible honors awarded to scientists for distinguished research are various badges, ribbons, medals, and other decorations. Over the years Caltech's faculty have received a great many of them. As a part of last fall's 90th birthday celebration, a small sample was assembled, which we show below with a chart coded for easy identification. Number one is the James Douglas Medal (American Institute of Mining and Metallurgical Engineers), awarded in 1940 to trustee Louis D. Rickerts. Numbers 2, 5, 6, 11, 14, 19, and 22

belonged to Theodore von Kármán. They are, in order: the first National Medal of Science; the first von Kármán Medal (AGARD/NATO); Timoshenko Medal (American Society of Mechanical Engineers); Ludwig Prandtl Ring (German Society for Aeronautics); Vincent Bendix Award (American Society for Engineering Education); Medal of the Royal Aeronautical Society; Daniel Guggenheim Medal (also ASME). Numbers 3 and 4 are Davy Medals (the Royal Society) presented to Arthur Amos Noyes. Robert A. Millikan earned nine of this group — numbers 7, 8, 10, 12, 13, 15, 17, 20, and 21 — which are, in order: his decorations

for becoming a Chevalier of France's National Legion of Honor; Franklin Medal (Franklin Institute); Faraday Medal (London Chemical Society); Medal of Honor (Roosevelt Memorial Association); Medal (ASME); Hughes Medal (the Royal Society); Nobel Prize Medal (Royal Swedish Academy); Matteucci Medal (Italian Society for Science); and the medal of the Society of Arts and Sciences. Numbers 9 and 16 were awarded to Alfred H. Sturtevant by the National Academy of Sciences; 9 is the Kimber Genetics Award, and 16 is the Carty Medal. Number 18 is a medal awarded to Thomas Hunt Morgan by the Institute of France.

