THE IRON RING

Henry Petroski

Last year, *Yale* magazine published an article on the rebuilding of engineering in New Haven. That newsworthy development was an about-face for the institution, because only two years earlier Yale University's president, Benno Schmidt, had targeted engineering, among other programs, for drastic restructuring and major faculty reductions. As it turned out, Schmidt himself became a casualty of his own plan, which led to the naming of a new president, Richard Levin, who in turn announced an institutional commitment to rebuilding Yale's leadership in engineering education and research. Levin also made a clear statement about the broader importance of his decision: "As technological change shapes the world in which we live, a university that aims to educate leaders for our nation and for the world must nourish the study of engineering and applied science."

It is interesting to speculate on what may have influenced the quick about-face on engineering at Yale. When Schmidt announced a reduction in engineering, D. Allan Bromley (now the new dean of engineering) was on extended leave in Washington, D.C., serving as chief science and technology advisor to the Bush administration. In that capacity, he naturally crossed paths with many influential engineers, some of whom must have suspected as soon as they met Bromley that he had to be a kindred spirit, even if they knew nothing of his background or politics.

The small thing that marks Bromley as an engineer is evident in the striking full-page, full-color portrait of him that accompanies the article in *Yale*. But what is it in his appearance that the cognizant observer sees? Bromley is dressed fashionably in a dark suit, a striped shirt with a white collar and cuffs, and a red bow tie—colors that are echoed dramatically in the large abstract painting behind him. In front of the bold background, the dapper Bromley stands as the image of control and self-assurance. His somewhat askew bow tie and slightly misfolded breast-pocket handkerchief offset the serious expression on his face. His left hand is all but hidden in his pants pocket, but his other hand, projecting out from just the right amount of cuff to balance the white of the handkerchief, holds his metal-rimmed glasses, sharply defined against his dark suit jacket. This could all describe any confident leader, but in holding his glasses thus, Bromley displays on his little finger the one thing that marks him as an engineer, and it is the presence of the ring that very well might have prompted other engineers in Washington to see Bromley as more than just another well-dressed political appointee. This unpretentious ring would have signaled to knowledgable engineering leaders that Bromley would fully appreciate their assertions that Benno Schmidt's and Yale's treatment of engineering was "insulting to the profession" and that something had to be done.

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The Iron Ring Ceremony

Bromley's Canadian roots explain the iron ring. He was born in 1926 in the tiny village of Westmeath, in northeastern Ontario. At Queen's University, he majored in engineering, graduating in 1948. In addition to receiving his diploma, he participated with his classmates in a private, little-publicized event known as the Iron Ring Ceremony, at which he would have recited the Obligation, an oath of professional standards and honor. The ring that Bromley received at that ceremony was made of wrought iron, and over time it rusted so badly that he replaced it with the stainless-steel version that he now wears. The portrait of Bromley shows his ring fitting tightly on his right little finger, suggesting that he does not remove it often, if at all. The ring's presence further suggests that Bromley is right-handed and continues to think of himself an engineer—by tradition the Iron Ring is worn on the working hand but only as long as one remains a part of the profession.

The Iron Ring Ceremony has its origins in the early 1920s, when H. E. T. Haultain, a professor of mining engineering at the University of Toronto, wished to improve the image of the profession by instituting a ceremony similar to that in which young doctors take the Hippocratic Oath. After graduating from Toronto in 1889, Haultain's experience in the mining industry in Europe and British

Columbia gave him firsthand experience with conditions that he thought called for instilling a strong sense of high ethical standards in young engineers. The conditions Haultain lamented were widespread by the early part of the 20th century, as the adoption of codes of ethics by professional societies and the institution of professional registration during the period attest. He wished a personal and formal inducting ritual for young engineers who had not yet fully encountered the real world, and so he wrote to Rudyard Kipling asking him to compose the words for a ceremony.

Kipling had by then long been the literary hero of engineers, having published such pieces as the short story "The Bridge-Builders" in the Christmas 1893 edition of the *Illustrated London News* and having published the poem "The Sons of Martha" in 1907. "The Sons of Martha" is rooted in the Gospel text of Luke (10:38–42), in which Christ, visiting the house of Martha, approved of her sister Mary sitting and listening to him teach rather than helping Martha, who was busy serving everyone. Kipling identified engineers with Martha and her children, who continued to do the chores necessary to keep a household running rather than sit at the Lord's feet and listen to his wisdom, as did Mary, and presumably her sons and daughters. The opening stanzas of the poem convey its tone:

> The Sons of Mary seldom bother, for they have inherited that good part;
> But the Sons of Martha favour their Mother of the careful soul and the troubled heart.
> And because she lost her temper once, and because she was rude to the Lord her Guest,
> Her Sons must wait upon Mary's Sons, world without end, reprieve, or rest.
>
> It is their care in all the ages to take the buffet and cushion the shock.
> It is their care that the gear engages; it is their care that the switches lock.
> It is their care that the wheels run truly; it is their care to embark and entrain,
> Tally, transport, and deliver duly the Sons of Mary by land and main.

Although some later engineers would read Kipling's poem as condemning engineers to being second-class citizens compared to managers, those of Haultain's generation were pleased to take "The Sons of Martha" as their defining text. Kipling's response to Haultain's invitation was to draft, in consultation with Canadian engineering groups, the secret "Ritual of the Calling of an Engineer" that contains the Obligation, by which engineers eschew poor workmanship and "honourably guard" the reputation of the profession. Each participant in the ceremony is able to frame and exhibit a personal copy of the Obligation, but the content of the Ritual is otherwise to be "neither for the public nor the press." To make the prohibition enforceable, the text was copyrighted.

Figure 1. D. Allan Bromley in his *Yale* portrait. (Photograph courtesy of Michael Marsland, Yale University Office of Public Affairs.)

The Material of the Ring

The first Iron Ring Ceremony was held at the University of Toronto in 1925, with the first rings made of "hammered iron" that Kipling called "cold." Although some say the writer used the latter adjective because the structural material did not forgive the mistakes of engineers working in it, another poem of his puts it in a different and more positive context:

> Gold is for the mistress—silver for the maid!
> Copper for the craftsman cunning at his trade.
> "Good!" said the Baron, sitting in his hall,
> "But Iron—Cold Iron—is master of them all!"

The iron ring's circular shape has been said to symbolize the continuity of the profession and its methods, and the circle is also an appropriate symbol of the engineering design process, which is iterative and can seem hopelessly vicious and self-referential to the uninitiated. Tradition has it that the rings are fabricated from the wreckage of some catastrophic engineering failure, and Bromley believes that his original ring came from the remains of the Quebec Bridge, which collapsed during construction in 1907. That bridge, whose 1,800-foot main span was to be the largest cantilever structure in the world, collapsed under its own weight because of an error in the design engineer's calculations. The bridge was redesigned, but it suffered a

second accident in 1916, when its center span fell while being hoisted into place, further embarrassing the engineering community. Finally, in 1917, the bridge was completed and stood across the St. Lawrence River as a symbolic gateway under which European immigrants sailed into Canada. The bridge stands today as still the longest cantilever span in the world and as a reminder to Canadian engineers to take care with their designs and to persevere in the face of adversity.

That iron rings were made from the wreckage of the Quebec Bridge is apocryphal, because the bridge was made not of wrought iron that could easily be hammered into a faceted band, but of steel. In fact, the original rings were made by war veterans participating in an occupational-therapy program in a Toronto veterans' hospital, using common iron-pipe stock, and such stock remains the standard material. Whatever its origins, however, the ring is rich in symbolism that is varied and effective. The persistent story of the ring's coming from wreckage and being worn on the drawing and writing hand serves as a constant reminder of the fallibility of an engineer and the consequences of error. As the facets of the original rings wore down with age, so it was suggested with experience do the rough edges disappear from a young engineer's mind, leaving a more integrated wisdom. Bromley, who had gained his earliest engineering experience in Canada's hydroelectric-power industry and extended it later at Yale, where he helped engineer the creation of an experimental-physics laboratory, had clearly earned the right to replace his rusting iron ring with a stainless-steel one.

Whatever the material of the original rings or of the most recent ones, the tradition of the Iron Ring is firmly institutionalized. The Ritual of the Calling of an Engineer was originally endorsed in 1922 by seven past-presidents of the Engineering Institute of Canada, who formed the Corporation of Seven Wardens charged with the administration of the ritual. Local groups called Camps came to be established, each with seven wardens who are practicing engineers. Camp 1 was established naturally at the University of Toronto, and to date 24 Camps have been established across Canada, with an estimated 200,000-plus engineers having been obligated in English and in French. In this 70th-anniversary year of the Ritual and its propagating organization, they remain independent of any university or other Canadian institution.

Order of the Engineer

In time, the Iron Ring Ceremony came to be known among engineers in the United States, and in the early 1950s Lloyd Chacey, an Ohioan, wrote to the Wardens about extending the ceremony beyond the Canadian border. Although copyright was said to be among the impediments to such a move, it is easy to imagine that the Canadians did not wish to dilute the proud and growing tradition that was uniquely theirs. Correspondence continued, however, and in 1962, Homer Borton and Brooks Earnest, two officers of the Ohio Society of Professional Engineers, were invited to participate in the Canadian ceremony, thereby gaining a model for establishing their own. By the mid-1960s, a group of Ohio engineers was pursuing the establishment of an Order of the Engineer.

The late 1960s were especially trying times in America, and engineers were often attacked as proponents of war and enemies of the environment. The political climate encouraged engineers to circle their wagons around the profession, and the disruptive atmosphere on campuses and in political arenas generally made it difficult to forge any initiatives. In 1970, however, an incident of student unrest at Cleveland State University prompted some engineering-student leaders to look for a means of asserting some more positive values. Dean Burl Bush, who had been working with Borton and Earnest in trying to establish a ring ceremony, described the idea to the engineering students. Within three weeks, the students had used a metal lathe to turn some rings out of stainless-steel tubing and had organized the first steel-ring ceremony in the United States. It took place on June 4, 1970, and some 170 engineering seniors and faculty members participated.

With this precedent, other Order-of-the-Engineer ceremonies began to be held, with the earliest ones taking place around Ohio. The local chapters were known as Links, and the ceremony was clearly modeled after the Canadian one, but without the benefit of the authorship of a Kipling. In 1972, the custodians and administrators of the Canadian Ritual inquired into the workings of the new Order of the Engineer and, after inspection of the manual and ring used, concluded that "they do not infringe on the Corporation's copyrights or patent." The chief warden then conveyed the corporation's pleasure at the reference to the Canadian Ritual in the newer American ceremony. He also conveyed to the members of the order wishes of "every success in their endeavor to advance the feeling of fraternity" among engineers.

By the mid-1980s, the fledgling steel-ring ceremony had taken place in more than 30 states, with tens of thousands of young and old engineers having recited the Obligation. Nevertheless, it remains rare today to encounter an engineer in the United States who wears a little-finger ring. When one does meet up with such an engineer, he or she is still most likely to have been educated in Canada. But wherever they practice, the hundreds of thousands of engineers who do wear the iron or steel ring on the little finger of their working hand do thus daily remind themselves and their colleagues of their obligation to society and their dedication to the profession. Although most of these sons and daughters of Martha spend their lives working thoughtfully and carefully in the background on

the furniture and machinery of civilization, they all wear their rings as constantly and proudly as Allan Bromley did in Washington and as he now does as dean of engineering at Yale.

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