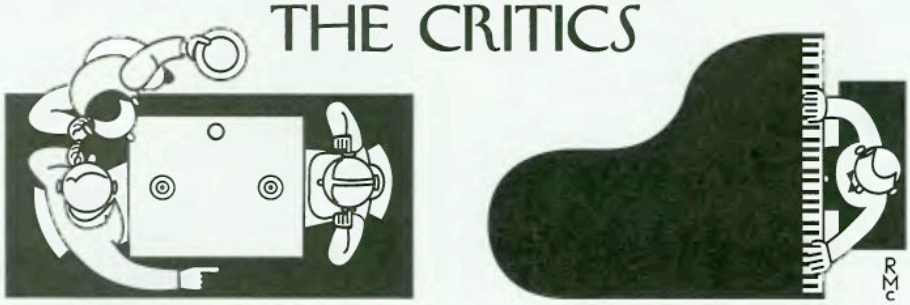


A CRITIC AT LARGE

THE TELEVISIONARY

Big business and the myth of the lone inventor.

BY MALCOLM GLADWELL

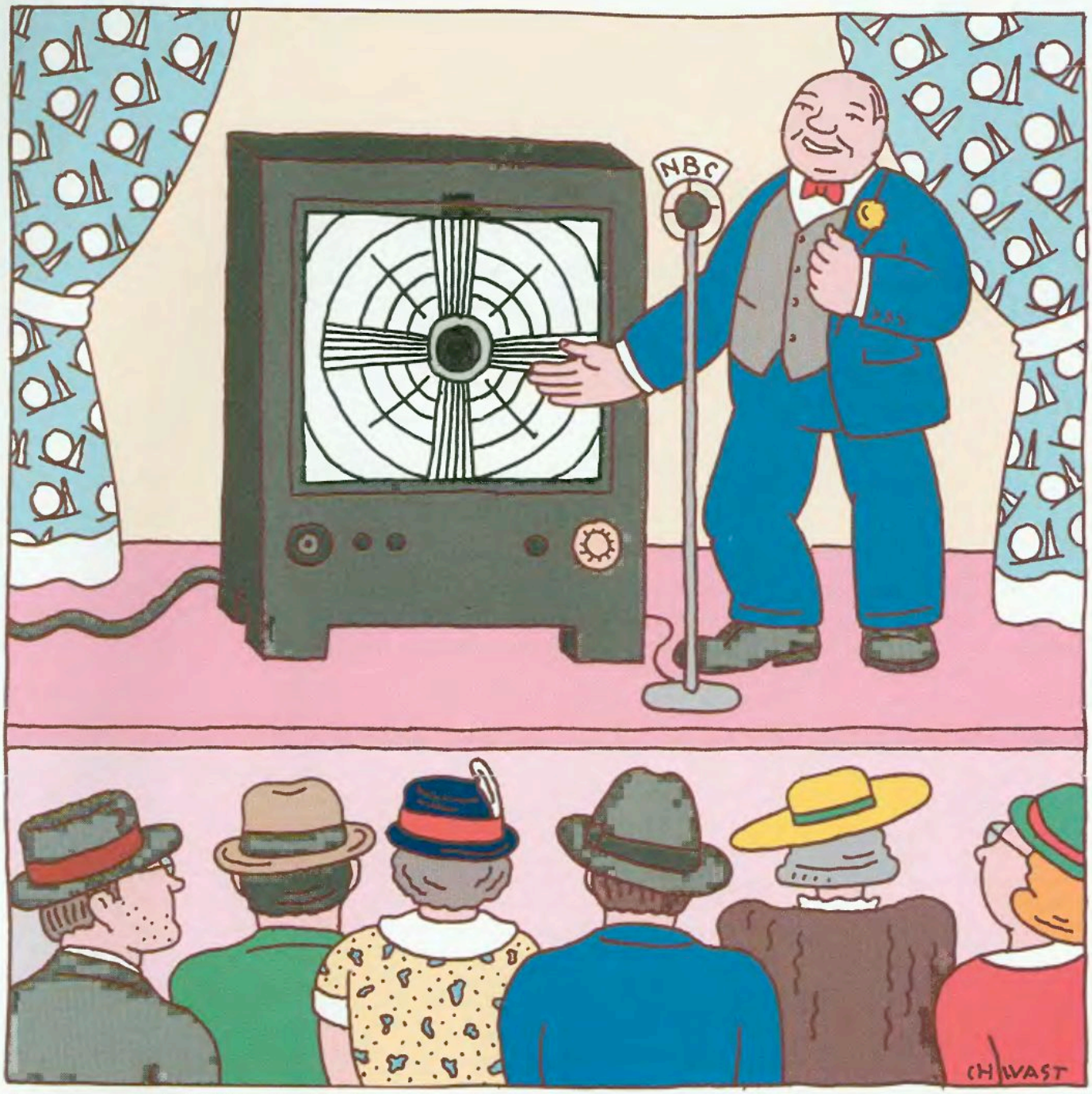
Philo T. Farnsworth was born in 1906, and he looked the way an inventor of that era was supposed to look: slight and gaunt, with bright-blue exhausted eyes, and a mane of brown hair swept back from his forehead. He was nervous and tightly wound. He rarely slept. He veered between fits of exuberance and depression. At the age of three, he was making precise drawings of the internal mechanisms of locomotives. At six, he declared his intention to follow in the footsteps of Thomas Edison and Alexander Graham Bell. At fourteen, while tilling a potato field on his family's farm in Idaho, he saw the neat, parallel lines of furrows in front of him, and it occurred to him—in a single, blinding moment—that a picture could be sent electronically through the airwaves in the same way, broken down into easily transmitted lines and then reassembled into a complete picture at the other end. He went to see his high-school science teacher, and covered the blackboard with drawings and equations. At nineteen, after dropping out of college, he impressed two local investors with his brilliance and his conviction. He moved to California and set up shop in a tiny laboratory. He got married on an impulse. On his wedding night, he seized his bride by the shoulders and looked at her with those bright-blue eyes. "Pemmie," he said. "I have to tell you. There is another woman in my life—and her name is Television."

Philo T. Farnsworth was the inventor of television. Through the nineteen-thirties and forties, he engaged in a heroic battle to perfect and commercialize his discovery, fending off creditors and predators, and working himself to the point of emotional and physical exhaustion. His nemesis was David Sarnoff, the head of RCA, then one of the most powerful American electronics companies. Sarnoff lived in an enormous Upper East Side mansion and smoked fat cigars and travelled by chauffeured limousine. His top television researcher was Vladimir Zworykin, the scion of a wealthy Russian family, who wore elegant three-piece suits and round spectacles, had a Ph.D. in physics, and apprenticed with the legendary Boris Rosing at the St. Petersburg Institute of Technology. Zworykin was never more than half a step behind Farnsworth: he filed for a patent on his own version of electronic television two years after Farnsworth had his potato-field vision. At one point, Sarnoff sent Zworykin to Farnsworth's tiny laboratory, on Green Street in San Francisco, and he stayed for three days, asking suspiciously detailed questions. He had one of Farnsworth's engineers build the heart of Farnsworth's television system—the so-called image dissector—before his eyes, and then picked the tube up and turned it over in his hands and said, ominously, "This is a beautiful instrument. I wish I had invented it myself." Soon Sarnoff himself came out to Green Street, swept imperially through the laboratory, and declared, "There's nothing here we'll need." It was, of course, a lie. In the nineteen-thirties, television was not possible without Philo Farnsworth's work. But in the end it didn't much matter. Farnsworth's company was forced out of the TV business. Farnsworth had a nervous breakdown, and Sarnoff used his wealth and power to declare himself the father of television.

The life of Philo Farnsworth is the subject of two new books, "The Last Lone Inventor," by Evan I. Schwartz (HarperCollins; $24.95), and "The Boy Genius and the Mogul," by Daniel Stashower (Broadway; $24.95). It is a wonderful tale, riveting and bittersweet. But its lessons, on closer examination, are less straightforward than the clichés of the doomed inventor and the villainous mogul might suggest. Philo Farnsworth's travails make a rather strong case *for* big corporations, not against them.

The idea of television arose from two fundamental discoveries. The first was photoconductivity. In 1872, Joseph May and Willoughby Smith discovered that the electrical resistance of certain metals varied according to their exposure to light. And, since everyone knew how to transmit electricity from one place to another, it made sense that images could be transmitted as well. The second discovery was what is called visual persistence. In 1880, the French engineer Maurice LeBlanc pointed out that, because the human eye retains an image for about a tenth of a second, if you wanted to transmit a picture you didn't have to send it all at once. You could scan it, one line at a time, and, as long as you put all those lines back together at the other end within that fraction of a second, the human eye would be fooled into thinking that it was seeing a complete picture.

The hard part was figuring out how to do the scanning. In 1883, the German engineer Paul Nipkow devised an elaborate and ultimately unworkable system using a spinning metal disk. The disk was punctured with a spiral of small holes, and, as it spun, one line of light after another was projected through the holes onto a photocell. In 1908, a British electrical engineer named A. A. Campbell Swinton suggested that it would make more sense



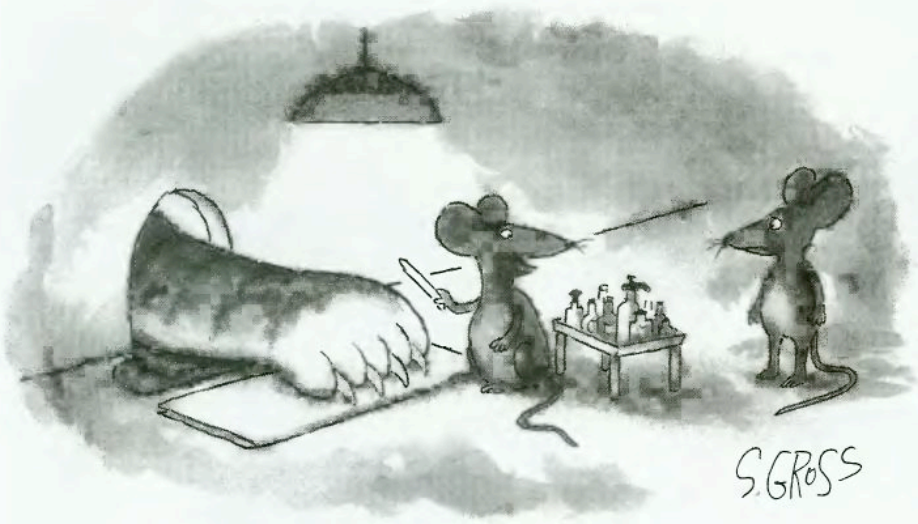
In a ceremony at the 1939 World's Fair, the head of RCA, David Sarnoff, effectively claimed Farnsworth's invention as his own.

SEYMOUR CHWAST

to scan images electronically, using a cathode ray. Philo Farnsworth was the first to work out how to do that. His image dissector was a vacuum tube with a lens at one end, a photoelectric plate right in front of the lens to convert the image from light to electricity, and then an "anode finger" to scan the electrical image line by line. After setting up his laboratory, Farnsworth tinkered with his makeshift television camera day and night for months. Finally, on September 7, 1927, he was ready. His wife, Pem, was by his side. His tiny television screen was in front of him. His brother-in-law, Cliff Gardner, was manning the television camera in a room at the other end of the lab. Stashower writes:

> Squaring his shoulders, Farnsworth took his place at the controls and flicked a series of switches. A small, bluish patch of light appeared at the end of the receiving tube. Farnsworth lifted his head and began calling out instructions to Gardner in the next room.
>
> "Put in the slide, Cliff," Farnsworth said.
>
> "Okay, it's in," Gardner answered. "Can you see it?"
>
> A faint but unmistakable line appeared across the receiving end of the tube. As Farnsworth made some adjustments, the line became more distinct.
>
> "Turn the slide a quarter turn, Cliff," Farnsworth called. Seconds later, the line on the receiving tube rotated ninety degrees.
>
> Farnsworth looked up from the tube. "That's it, folks," he announced with a tremor in his voice. "We've done it—there you have electronic television."

Both Stashower and Schwartz talk about how much meaning Farnsworth attached to this moment. He was a romantic, and in the romance of invention the creative process consists of two discrete, euphoric episodes, linked by long years of grit and hard work. First is the magic moment of conception: Farnsworth in the potato field. Second is the



"Every Thursday I do her nails."

• •

moment of execution: the day in the lab. If you had the first of those moments and not the second, you were a visionary. But if you had both you were in a wholly different category. Farnsworth must have known the story of King Gillette, the bottle-cap salesman, who woke up one morning in the summer of 1895 to find his razor dull. Gillette had a sudden vision: if all he wanted was a sharp edge, then why should he have to refashion the whole razor? Gillette later recalled:

> As I stood there with the razor in my hand, my eyes resting on it as lightly as a bird settling down on its nest, the Gillette razor was born—more with the rapidity of a dream than by a process of reasoning. In a moment I saw it all: the way the blade could be held in a holder; the idea of sharpening the two opposite edges on the thin piece of steel; the clamping plates for the blade, with a handle half-way between the two edges of the blade . . . I stood there before the mirror in a trance of joy. My wife was visiting Ohio and I hurriedly wrote to her: "I've got it! Our fortune is made!"

If you had the vision and you made the vision work, then the invention was *yours*—that was what Farnsworth believed. It belonged to you, just as the safety razor belonged to King Gillette.

But this was Farnsworth's mistake, because television wasn't at all like the safety razor. It didn't belong to one person. May and Smith stumbled across photoconductivity, and inspired LeBlanc, who, in turn, inspired Swinton, and Swinton's idea inspired inventors around the world. Then there was Zworykin, of course, and his mentor Boris Rosing, and the team of Max Dieckmann and Rudolf Hell, in Germany, who tried to patent something in the mid-twenties that was virtually identical to the image dissector. In 1931, when Zworykin perfected his own version of the television camera, called the Iconoscope, RCA did a worldwide patent search and found very similar patent applications from a Hungarian named Kolomon Tihany, a Canadian named François Henrouteau, a Japanese inventor named Kenjiro Takayanagi, two Englishmen, and a Russian. Everyone was working on television and everyone was reading everyone else's patent applications, and, because television was such a complex technology, nearly everyone had something new to add. Farnsworth came up with the first camera. Zworykin had the best early picture tube. And when Zworykin finally came up with his own camera it was not as good as Farnsworth's camera in some respects, but it was better in others. In September of 1939, when RCA finally licensed the rights to Farnsworth's essential patents, it didn't replace the Iconoscope with Farnsworth's image dissector. It took the best parts of both.

It is instructive to compare the early history of television with the development, some seventy-five years earlier, of the sewing machine. As the historian Grace Rogers Cooper points out, a sewing machine is really six different mechanisms in one—a means of supporting the cloth, a needle and a combining device to form the stitch, a feeding mechanism to allow one stitch to follow another, a means of insuring the even delivery of thread, and a governing mechanism to insure that each of the previous five steps is performed in sequence. Cooper writes in her book "The Sewing Machine":

> Weisenthal had added a point to the eye-end of the needle. Saint supported the fabric by placing it in a horizontal position with a needle entering vertically, Duncan successfully completed a chainstitch for embroidery purposes, Chapman used a needle with an eye at its point and did not pass it completely through the fabric, Krems stitched circular caps with an eye-pointed needle used with a hook to form a chainstitch, Thimmonier used the hooked needle to form a chainstitch on a fabric laid horizontally, and Hunt created a new stitch that was more readily adapted to sewing by machine than the hand stitches had been.

The man generally credited with combining and perfecting these elements is Elias Howe, a machinist from Boston. But even Howe's patents were quickly superseded by a new round of patents, each taking one of the principles of his design and either augmenting it or replacing it. The result was legal and commercial gridlock, broken only when, in 1856, Howe and three of the leading sewing-machine manufacturers (among them Isaac Merritt Singer, who gave the world the sewing-machine foot pedal) agreed to pool their patents and form a trust. It was then that the sewing-machine business took off. For the sewing machine to succeed, in other words, those who saw themselves as sewing-machine inventors had to swallow their pride and concede that the machine was larger than they were—that groups, not individuals, invent complex technologies. That was what Farnsworth could not do, and it explains the terrible turn that his life took.

David Sarnoff's RCA had a very strict policy on patents. If you worked for RCA and you invented something patentable, it belonged to RCA. Your name was on the patent, and you got credit for your work. But you had to sign over your rights for one dollar. In "The Last Lone Inventor,"

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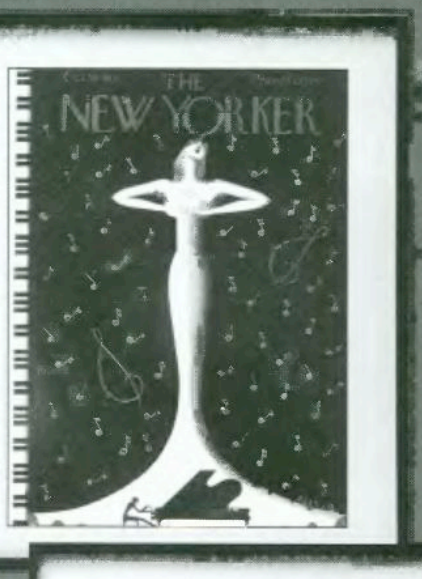

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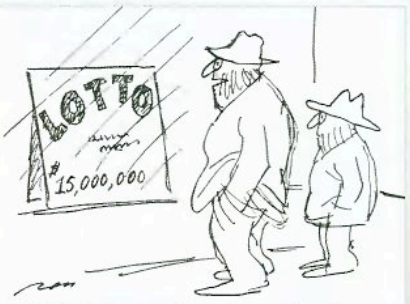
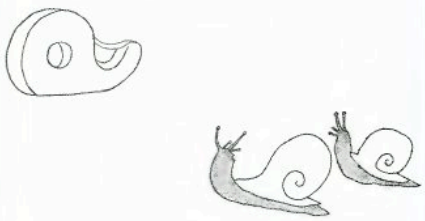


"Winning is crucial to my retirement plans."

A. Ross, 1993 (Actual Size 11" x 14")

"Fenwick, Benton & Perkins. How may I direct your call?"

Bill Woodman, 1998 (Actual Size 11" x 14")



"I don't care if she is a tape dispenser. I love her."

Sam Gross, 1996 (Actual Size 11" x 14")

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Schwartz tells the story of an RCA engineer who thought the system was so absurd that he would paste his one-dollar checks to the wall of his office—until the accounting department, upset with the unresolved balance on its books, steamed them off and forced him to cash them. At the same time, Sarnoff was a patient and generous benefactor. When Zworykin and Sarnoff discussed television for the first time, in 1929, Zworykin promised the RCA chief that he would create a working system in two years, at a cost of a hundred thousand dollars. In fact, it took more than ten years and fifty million dollars, and through all those years—which just happened to coincide with the Depression—Sarnoff's support never wavered. Sarnoff "hired the best engineers out of the best universities," Schwartz writes. "He paid them competitive salaries, provided them with ample research budgets, and offered them a chance to join his crusade to change the world, working in the most dynamic industry the world had ever seen." What Sarnoff presented was a compromise. In exchange for control over the fruits of invention, he gave his engineers the freedom to invent.

Farnsworth didn't want to relinquish that control. Both RCA and General Electric offered him a chance to work on television in their laboratories. He turned them both down. He wanted to go it alone. This was the practical consequence of his conviction that television was *his*, and it was, in retrospect, a grievous error. It meant that Farnsworth was forced to work in a state of chronic insecurity. He never had enough money. He feuded constantly with his major investor, a man named Jesse McCargar, who didn't have the resources to play the television game. At the time of what should have been one of Farnsworth's greatest triumphs—the granting of his principal patents—McCargar showed up at the lab complaining about costs, and made Farnsworth fire his three star engineers. When, in 1928, the Green Street building burned down, a panicked Farnsworth didn't know whether or not his laboratory was insured. It was, as it happened, but a second laboratory, in Maine, wasn't, and when it burned down, years later, he lost everything. Twice, he testified before Congress. The first time, he rambled off on a tangent about transmission bandwidth which left people scratching their heads. The second time, he passed up a perfect opportunity to register his complaints about RCA, and launched, instead, into a sentimental account of his humble origins. He simply did not understand how to play politics, just as he did not understand how to raise money or run a business or organize his life. All he really knew how to do was invent, which was something that, as a solo operator, he too seldom had time for.

This is the reason that so many of us work for big companies, of course: in a big company, there is always someone to do what we do not want to do or do not do well—someone to answer the phone, and set up our computer, and arrange our health insurance, and clean our office at night, and make sure the building is insured. In a famous 1937 essay, "The Nature of the Firm," the economist Ronald Coase said that the reason we have corporations is to reduce the everyday transaction costs of doing business: a company puts an accountant on the staff so that if a staffer needs to check the books all he has to do is walk down the hall. It's an obvious point, but one that is consistently overlooked, particularly by those who periodically rail, in the name of efficiency, against corporate bloat and superfluous middle managers. Yes, the middle manager does not always contribute directly to the bottom line. But he does contribute to those who contribute to the bottom line, and only an absurdly truncated account of human productivity—one that assumes real work to be somehow possible when phones are ringing, computers are crashing, and health insurance is expiring—does not see that secondary contribution as valuable.

In April, 1931, Sarnoff showed up at the Green Street laboratory to review Farnsworth's work. This was, by any measure, an extraordinary event. Farnsworth was twenty-four, and working out of a ramshackle building. Sarnoff was one of the leading industrialists of his day. It was as if Bill Gates were to get in his private jet and visit a software startup in a garage across the country. But Farnsworth wasn't there. He was in New York, trapped

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there by a court order resulting from a frivolous lawsuit filed by a shady would-be investor. Stashower calls this one of the great missed opportunities of Farnsworth's career, because he almost certainly would have awed Sarnoff with his passion and brilliance, winning a lucrative licensing deal. Instead, an unimpressed Sarnoff made a token offer of a hundred thousand dollars for Farnsworth's patents, and Farnsworth dismissed the offer out of hand. This, too, is a reason that inventors ought to work for big corporations: big corporations have legal departments to protect their employees against being kept away from their laboratories by frivolous lawsuits. A genius is a terrible thing to waste.

In 1939, at the World's Fair in New York City, David Sarnoff set up a nine-thousand-square-foot pavilion to showcase the new technology of television. The pavilion, shaped like a giant radio tube, was covered with RCA logos, and stood next to the Perisphere Theatre, the centerpiece of the fairgrounds. On opening day, thirty thousand people gathered to hear from President Roosevelt and Albert Einstein. The gala was televised by RCA, beamed across the New York City area from the top of the Empire State Building. As it happened, Farnsworth was in New York City that day, and he caught the opening ceremonies on a television in a department-store window. He saw Sarnoff introducing both Roosevelt and Einstein, and effectively claiming this wondrous new technology as his own. "Farnsworth's entire existence seemed to be annulled in this moment," Schwartz writes:

> The dreams of a farm boy, the eureka moment in a potato field, the confession to a teacher, the confidence in him shown by businessmen and bankers and investors, the breakthroughs in the laboratory, all the years of work, the decisions of the official patent examiners, those hard-fought victories, all of those demonstrations that had come and gone, the entire vision of the future. All of it was being negated by Sarnoff's performance at the World's Fair. Would the public ever know the truth? . . . The agony of it set off sharp pains in his stomach.

Finally, later that summer, RCA settled with Farnsworth. It agreed to pay him a million dollars for the rights to his main patents, plus royalties on every television set sold. But it was too late. Something had died in him. "It's come to the point of choosing whether I want to be a drunk or go crazy," he told his wife. One doctor prescribed chloral hydrate, which destroyed his appetite and left him dangerously thin. Another doctor prescribed cigarettes, to soothe his nerves. A third prescribed uppers. He became addicted to the painkiller Pantipon. He committed himself to a sanitarium in Massachusetts, where he was given a course of shock therapy. After the war, his brother died in a plane crash. His patents expired, drying up his chief source of income. His company, unable to compete with RCA, was forced out of the television business. He convinced himself that he could unlock the secrets of nuclear fusion, and launched another private research project, mortgaging his home, selling his stock, and cashing in his life insurance to fund the project. But nothing came of it. He died in 1971—addicted to alcohol, deeply depressed, and all but forgotten. He was sixty-four.

In "Tube," a history of television, David E. Fisher and Marshall Jon Fisher point out that Farnsworth was not the only television pioneer to die in misery. So did two others—John Logie Baird and Charles Francis Jenkins—who had tried and failed to produce mechanical television. This should not come as a surprise. The creative enterprise is a hazardous journey, and those who venture on it alone do so at their peril. Baird and Jenkins and Farnsworth risked their psychological and financial well-being on the romantic notion of the solitary inventor, and when that idea failed them what resources did they have left? Zworykin had his share of setbacks as well. He took on Farnsworth in court, and lost. He promised television in two years for a hundred thousand dollars and he came in eight years and fifty million dollars over budget. But he ended his life a prosperous and contented man, lauded and laurelled with awards and honorary degrees. He had the cocoon of RCA to protect him: a desk and a paycheck and a pension and a secretary and a boss with the means to rewrite history in his favor. This is perhaps a more important reason that we have companies—or, for that matter, that we have universities and tenure. Institutions are not just the best environment for success; they are also the safest environment for failure—and, much of the time, failure is what lies in store for innovators and visionaries. Philo Farnsworth should have gone to work for RCA. He would still have been the father of television, and he might have died a happy man. ♦

"Last time I told him you were here, he seemed to be getting increasingly interested."