J. J. Thomson inspecting electron tubes in 1923 with Frank Jewett, the first president of Bell Labs. (Courtesy AT&T Archives and AIP Niels Bohr Library)

Among its leading scientists was Frank Jewett, then working in the engineering department of its Western Electric Division. In 1902 he had earned a Ph.D. in physics from the University of Chicago, doing his research under Albert Michelson and befriending Robert Millikan. Harboring a hunch that the electrical discharges in evacuated tubes might serve as the basis for a suitable repeater, Jewett approached his old chum, who in 1911 sent one of his brightest graduate students, Harold Arnold, to Western Electric. Here was a young man steeped in the new thinking, who had just spent several years measuring the charges of individual electrons on oil droplets.

When de Forest demonstrated his audion to Western Electric scientists and engineers in October 1912, Arnold was present. He diagnosed the blue haze as due to the recombination of gas molecules that had been ionized by energetic electrons. Then he solved its problems by use of high vacuum, an oxide-coated filament, and other modifications dictated by a superior understanding of the electronic discharge. (A similar development occurred simultaneuosly at General Electric, but it lost the ensuing patent fight to AT&T, which had wisely purchased the appropriate rights to de Forest's patents.)

Within a year Western Electric was making "high-vacuum thermionic tubes" that served as active elements in excellent telephone repeaters. At the grand opening of the Panama-Pacific Expositon held in San Francisco on January 15, 1915, Alexander Graham Bell inaugurated the nation's first coast-to-coast telephone service, talking to his former assistant Thomas Watson in New York. Recalling this event in his autobiography, Millikan observed that "the electron—up to that time largely the plaything of the scientist—had clearly entered the field as a patent agent in the supplying of man's commercial and industrial needs."

Thus convinced of the value of scientific research in an industrial setting, Western Electric incorporated its engineering department as a separate entity—the Bell Telephone Laboratories—in 1925, naming Jewett its first president. The very next year, as an outgrowth of their research on the performance of vacuum tubes (also called electron tubes), Clinton Davisson and Lester Germer established the wave nature of electrons, which had been predicted a few years earlier by Louis de Broglie. For his pivotal work on electron diffraction, Davisson was to share the 1937 Nobel Prize in physics with the British scientist George Thomson, son of J. J.

Quantum mechanics soon explained the behavior not only of electrons in atoms but of the large ensembles of them that swarm about freely within metals. Based on the theoretical work of Enrico Fermi and Paul Dirac, Bell Labs physicists eventually figured out why an oxide-coating worked so well on tungsten filaments of vacuum tubes. It helped to lower the work function of the