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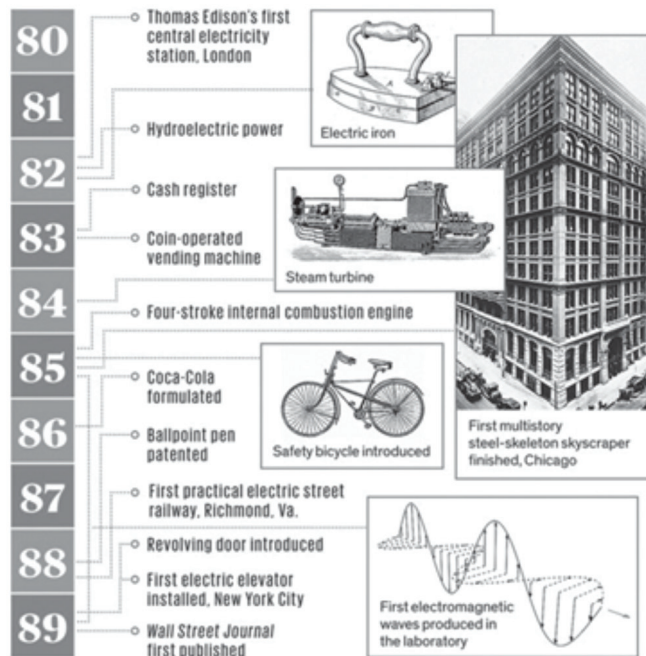
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## INVENTIONS THAT MADE OUR MODERN WORLD HOW THE 1880S CREATED OUR MODERN WORLD

According to the worshippers of the e-world, the late 20th century and the two opening decades of the 21st century brought us an unprecedented number of profound inventions. But that is a categorical misunderstanding, as most recent advances have been variations on two older fundamental discoveries: microprocessors and exploiting radio waves, part of the electromagnetic spectrum. More powerful and more specialized microchips are now running everything from industrial robots and the autopilots of jetliners to kitchen ranges and digital cameras, and the most popular global brand for mobile communications has been using ultra high-frequency radio waves.

In fact, perhaps the most inventive time in human history was the 1880s. Have any two sets of primary inventions and epochal discoveries shaped the modern world more than electricity and internal combustion engines? Electricity alone, without microchips, is enough to make a sophisticated and affluent world (we had one in the 1960s). Yet a microchip-governed e-world is utterly dependent on an electricity supply whose fundamental design remains beholden to thermal- and hydropower-generation systems, both of which reached the commercial market in 1882 and still provide more than 80 percent of the world's electricity. And we aspire to make it available at least 99.9999 percent of the time, so that it can serve as the cornerstone of everything electronic.

## HOW THE 1880S CREATED OUR MODERN WORLD



The miraculous 1880s

Add to that the feats of Benz, Maybach, and Daimler, whose success with gasoline-fueled engines inspired Rudolf Diesel to come up with a more efficient alternative just a decade later. By the end of the 19th century we also had conceptual designs of the most efficient of all internal combustion engines: the gas turbine. And it was in the 1880s when Heinrich Hertz's experiments proved the existence of electromagnetic waves (produced by oscillation of electric and magnetic fields), whose wavelengths increase from very short cosmic rays to X-rays, ultraviolet, visible, and infrared radiation, and to microwaves and radio waves. Their existence had been predicted by James Clerk Maxwell decades earlier, but Hertz made the practical opening onto our wireless world.

But the 1880s are also embedded in our lives in many smaller ways. Over a decade ago, in *Creating the Twentieth Century*, I traced several daily American experiences through mundane artifacts and actions that stem from that miraculous decade. A woman wakes up today in an American city and makes a cup of Maxwell House coffee (launched in 1886). She considers eating her favorite Aunt Jemima pancakes (sold since 1889) but goes for packaged Quaker Oats (available since 1884). She touches up her blouse with an electric iron (patented in 1882), applies antiperspirant (available since 1888), but cannot pack her lunch because she has run out of brown paper bags (the process to make strong kraft paper was commercialized in the 1880s).

She commutes on the light rail system (descended directly from the electric streetcars that began serving US cities in the 1880s), is nearly run over by a bicycle (the modern version of which—with equal-sized wheels and a chain drive—was another creation of the 1880s), then goes through a revolving door

(introduced in a Philadelphia building in 1888) into a multistory steel-skeleton skyscraper (the first one was finished in Chicago in 1885). She stops at a newsstand on the first floor, buys a copy of the Wall Street Journal (published since 1889) from a man who rings it up on his cash register (patented in 1883). Then she goes up to the 10th floor in an elevator (the first electric one was installed in a New York City building in 1889), stops at a vending machine (introduced, in its modern form, in 1883), and buys a can of Coca-Cola (formulated in 1886). Before she starts her work she jots down some reminders with her ballpoint pen (patented in 1888).

The 1880s were miraculous; they gave us such disparate contributions as antiperspirants, inexpensive lights, reliable elevators, and the theory of electromagnetism— although most people lost in their ephemeral tweets and in Facebook gossip are not even remotely aware of the true scope of this quotidian debt.