Lewis Latimer: The Shadow Behind the Light Bulb

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A Man Named Lewis Latimer

At the peak of the late 1800s, the post-civil war period saw many scientific discoveries foundational to technology today. Notable among these breakthroughs was the invention of the incandescent light bulb, attributed to the famous Thomas Alva Edison,[6] along with his less-known African American collaborator, Lewis Howard Latimer.

At a time when illustrious scientific minds such as Thomas Edison and Hiram Maxim raced towards new heights of innovation, Latimer's knowledge of physics and electrical engineering and his contributions to induced electrical output proved invaluable. During a season of explosive change in American culture, Latimer's fabulous rise from the son of a slave to remarkable inventor is one of many historical gems not told often enough. Yet it is also a story whose details have fallen through the cracks of history in shards and pieces. This circumstance can also be seen in the cases of other high-impact late-nineteenth and twentieth century African-American scientists such as Katherine Johnson,[15,17] Dorothy Vaughan,[10] and Ronald McNair[23,24] in which details of their stories have been lost—less meticulously documented and consequently less known than their merits warrant. As a result, the existing records of Latimer are scarce and in somewhat poor agreement on important specifics concerning his relations to the early electric lighting industry, greatly inhibiting the accessibility of his story to broader audiences.

The purpose of this letter is to present to broader audiences an accessible, encompassing, and well-supported representation of Lewis Latimer's contributions to the invention of the everyday light bulb.

Latimer, from Desk Clerk to Draftsman

Born in Chelsea, Massachusetts, on September 4, 1848, Latimer was the youngest of four to George and Rebecca, who had escaped from slavery in Virginia six years before his birth.[5,9,11] In 1864, seven years following the famous Dred Scott case,[8] George Latimer went into hiding, fearing the return of slavery, leaving sixteen-year-old Lewis to falsify his age and enlist in the United States Navy to support his mother and siblings during the Civil War.[4,5,9] After an honorable discharge, he took up a humble desk position at the Crosby and Gould patent law office, where he taught himself mechanical drawing and drafting by observing the work of the firm draftsmen, mastering the art of using rulers, compasses, and drawing-to-scale.[4,5] While records do not unanimously agree on Latimer's level of formal education—some suggesting he

received training at Phillips Grammar School in Chelsea,[14] while others insist he had no formal training and was largely self-educated,[1,5] there is no doubt of Latimer's profound skill in physics, mechanics, and design. As a desk clerk, Latimer observed that since all the drawings were done by hand and in ink, it was very important that a draftsman not make mistakes.[3] As a result of this mindset and diligence, he was able to hone a profound attention to detail and a thoughtfulness that made the menial office boy stand out even among experienced professionals. Recognized for his talents and quick wit, Latimer was soon promoted to draftsman, from $3.00 per week as an office boy to $20.00 per week.[1,4,9] As an accomplished draftsman, Latimer was integral to a number of revolutionary projects, including work with Alexander Graham Bell on the design of the telephone[4]. Before long, Latimer became directly involved with Hiram Maxim and Thomas Edison in the booming field of incandescent lighting physics.

Latimer as an Expert in his Field

In 1880, Latimer was first sought as an assistant manager and draftsman by Hiram Maxim at the U.S. Electric Lighting Company. Maxim was Edison's primary competitor in the race towards harnessing electrical energy for lighting. Years later, Latimer was recruited by Edison at the Edison Electric light Company, a group later known as the de facto "Edison Pioneers," a distinguished group of people deemed responsible for creating the electrical industry.[2] Latimer was the only person of African ancestry in the organization when it was officially formed on January 24, 1918.

The details surrounding Latimer's work with Thomas Edison and Hiram Maxim, as available through modern channels, are highly controversial. Some sources make no mention of his scientific prowess, remarking only on his activity as a patent clerk.[6,13] Other sources insist that Latimer was a scientific equal and forerunner on these research teams and records are far too deferential to Edison individually. These scholars speculate the deference was likely a reflection of the times when big ideas couldn't possibly be ascribed to non-white people.[5,19] However, substantial evidence exists for one of Latimer's contributions: the integration of the carbon filament into the 1879 design credited to Edison.[1,5] The filament was able to better regulate electrical discharge because of the natural durability of carbon, significantly lengthening the lifetime of the bulb for practical use.[2,7] While working with Edison, Latimer wrote the time's most thorough book on electric lighting, the 1890 *Incandescent Electric Lighting: A Practical Description of the Edison System*. For this work, Latimer was formally acknowledged as one of the charter members of the Edison Pioneers.[2,18] Latimer was a highly valued member of the Edison Pioneers as made clear by his colleagues in a documented tribute to Latimer at the time of his death in 1928. The tribute reads,

> We hardly mourn his inevitable going so much as we rejoice in pleasant memory at having been associated with him in a great work for all people under a great man. Broadmindedness, versatility in the accomplishment of things intellectual and cultural, a linguist, a devoted husband [to Mary Wilson, married in 1873] and father, all were characteristics of him, and his genial presence will be missed from our gatherings.[2]

In 1929, on the 50th anniversary of Edison's pre-carbon filament design of the light bulb and heralded invention of electric light, Latimer's two daughters were guests of honor of the Edison Pioneers' annual meeting. However, by the time the 75th anniversary was celebrated in 1954, no mention of Latimer was made.[2]

Latimer on Electrical Energy and the Carbon Filament

In his book, *Incandescent Electric Lighting: A Practical Description of the Edison System*, Latimer recounts the physics that lay the foundation for induced electric lighting.[12] Latimer had a mastery for his craft and a gift for teaching, said to have even shared his passion with his siblings and slave-raised mother before her death in 1910.[25] Published in 1890, this book was extremely popular as it presents how an incandescent lamp produces sustainable light in an easy-to-comprehend, conversational style. In this text, Latimer describes that although complex, the electric generator is possible to understand.

To the compliments of his colleagues as quoted above, Latimer's style of communication and sophistication of language was unique for its time, shown further in his book. He explains that the same force responsible for shifting a needle around on a smooth table as a magnet waves over it can also induce electrical current in a copper wire.[12] With the same perception and observation skills honed while watching the office draftsmen from afar, Latimer intuitively applied the basic concepts electromagnetism; a term coined by Danish Scientist Hans Christian Oersted in the 1820s[21] and rigorously formalized by Scottish scientist James Clark Maxwell in the 1860s.[16] The central idea that Latimer aims to communicate in his work is the function of the electric generator: to convert the mechanical energy imparted to it into electrical energy.

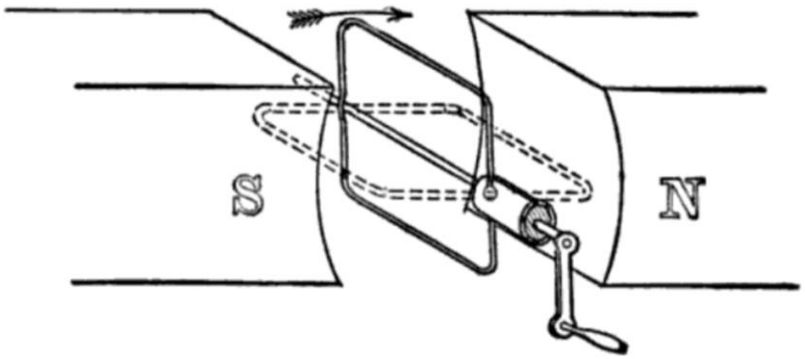

Fig. 1. Latimer's diagram of a working apparatus for mechanical energy conversion to electrical energy output: A crankshaft wire loop between two poles of a magnet.[12]

Although some sources reduce Latimer's partnership with Edison and Maxim to an administrative patent clerk,[13] the level of detail with which Latimer writes on the physics and mechanics of the incandescent bulb suggest a much more integral role. Shown in **Fig. 1** is a diagram in Latimer's publication; a loop of wire mounted on a rotating shaft between the two poles of a horseshoe magnet. By turning the shaft rapidly between the two poles, where the magnetic field lives, an electric current can be generated in the loop of wire, effectively converting mechanical energy into electrical energy to be used for the light bulb. With this figure, Latimer is intuitively describing what we now know as *magnetic torque*, a relationship

between a force, an electric current, and a magnetic field all acting perpendicularly to each other. This same principle is at play in modern electric motors: when current is passed through loops of wires in a perpendicular magnetic field, the field exerts a twisting force on the wires, which in turn rotates the shaft; an example of the reverse conversion, from electrical energy to mechanical energy.[22] Desire for control over these conversions in powering lighting systems inspired Latimer to modify Edison's original designs with one of his own: the carbon filament bulb.

While Edison is widely considered the "Father of Electricity" for his developments in electrical engineering, including a preliminary light bulb, his model was far from the finalized product for which he receives recognition. In truth, even though its platinum filament delayed melting, the original light bulb only burned for a few short hours[6]. It was clear that for practical use and longevity, changes to the burning filament were necessary. Some claim Edison tested thousands of materials for filament manufacturing before happening upon the best one[6] while others call it a sheer stroke of genius.[20] In fact, an overwhelming amount of evidence suggests it was on the shoulders of Latimer's physical intuition and sound methodology that the famed giant stood upon.[1,4,5,9,19]

In *Incandescent Electric Lighting: A Practical Description of the Edison System,* Latimer describes the causes of the problem from two practical stand points: (1) a combustible material requires oxygen to burn, and (2) the light bulb burns out because the filament gets too hot, and electric materials tend to get too hot when they conduct more current than they can sustain. So, in addition to pumping air out of the bulb, Latimer also suggested that, "while the copper and platinum wires readily conduct the current, the carbon filament offers a great deal of resistance to its passage."[12] Well known in modern science, particularly in the context of nanotube technology, carbon is one of the best thermal conductors and dissipators.[26] Carbon can not only conduct heat well (making the bulb very hot) but it is also one of the best materials at dissipating energy in the form of heat and light, thus this new bulb is described *incandescent.*

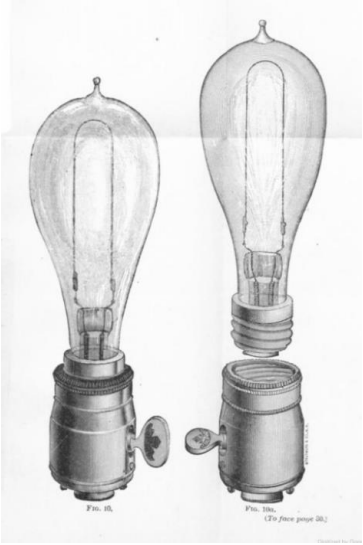

Fig 2. Early model of the incandescent bulb.[12]

Lewis Latimer, a Man Worth Remembering

Although some details of his history may be lost to time, a cohesive narrative of Latimer's journey as a Black scientist during a tumultuous period in a highly transformative field can still be gathered, recognized, and appreciated. From the son of slaves to accomplished intellectual, Lewis Latimer's story has the power to inspire not only people of color, but all members of the scientific community and society at large. In a culture that can praise the proud and promising as easily as it can cast the silent to the wayside, this letter is a call to the academic world to take heart and remember and lift up the shadows behind other intellectual lights.

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This letter is a dedication to all those who came before me and those who will come after.

References

1. Bennett, E. (2005). Latimer, Lewis Howard. *African American Studies Center*.

2. Brodie, J. M. (1995). *Created equal: The lives and ideas of Black American innovators* (1st ed.). New York: Quill.

3. Center, S. (2018, February 07). Innovative Lives: Lewis Latimer (1848-1928): Renaissance Man. Retrieved August 16, 2020, from https://invention.si.edu/innovative-lives-lewis-latimer-1848-1928-renaissance-man

4. Fouché, R. D. (2000). Latimer, Lewis Howard (1848-1928), engineer and inventor. *American National Biography Online*.

5. Fouché, R. D. (2013). Latimer, Lewis Howard. *African American Studies Center*.

6. H. (2017, May 19). Edison's Lightbulb. Retrieved August 16, 2020, from https://www.fi.edu/history-resources/edisons-lightbulb

7. Haskins, J. (1994). *One more river to cross*. New York: Scholastic.

8. Edison's Lightbulb. (2017, May 19). Retrieved August 18, 2020, from https://www.fi.edu/history-resources/edisons-lightbulb

9. Jones, I. (2007). Latimer, Lewis. *African American Studies Center*. Oxford University Press, Oxford, England

10. Jr., J. F., & Vaughan, D. (1996). The Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA. *Contemporary Sociology, 25*(6), 727.

11. Judd, M. (1998). Lewis Latimer: African American Inventor, Poet and Activist. *OAH Magazine of History, 12*(2), 25-27.

12. Latimer, L. H., Field, C. J., & Howell, J. W. (1890). *Incandescent electric lighting. A practical description of the Edison system*. New York: D. Van Nostrand.

13. Lewis Howard Latimer. (2020, August 11). Retrieved August 16, 2020, from https://en.wikipedia.org/wiki/Lewis_Howard_Latimer

14. Lewis Latimer. (n.d.). Retrieved August 16, 2020, from https://ethw.org/Lewis_Latimer

15. Loff, S. (2016, November 22). Katherine Johnson Biography. Retrieved August 16, 2020, from https://www.nasa.gov/content/katherine-johnson-biography

16. Maxwell J.C. (1998) Fundamentals of electromagnetism. In: Griffiths H., Smith B.L. (eds), Modern Antennas. Microwave and RF Technology Series, vol 12. Springer, Boston, MA

17. May, S. (2016, December 30). Who Was Katherine Johnson? Retrieved August 16, 2020, from https://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/who-was-katherine-johnson-k4

18. MIT Program. (n.d.). Retrieved August 16, 2020, from https://lemelson.mit.edu/resources/lewis-h-latimer

19. Mock, B. (2015, February 12). Meet Lewis Latimer, the African American who enlightened Thomas Edison. Retrieved August 16, 2020, from https://grist.org/climate-energy/meet-lewis-latimer-the-african-american-who-enlightened-thomas-edison/

20. The Myth of Isolation. (2018, October 30). Retrieved August 16, 2020, from https://casefoundation.org/blog/the-myth-of-isolation/

21. Oersted, H. C. (2017). Hans Christian Oersted. *The Tests of Time,* 153-157.

22. OpenStax. (n.d.). Physics. Retrieved August 16, 2020, from https://courses.lumenlearning.com/physics/chapter/22-8-torque-on-a-current-loop-motors-and-meters/

23. Ott, T. (2019, July 25). Ronald McNair. Retrieved August 16, 2020, from https://www.biography.com/astronaut/ronald-mcnair

24. Robinson, A. J. (2005). McNair, Ronald. *African American Studies Center*.

25. Visit. (n.d.). Retrieved August 16, 2020, from https://lewislatimerhouse.org/visit/

26. Zhang, G., Jiang, S., Zhang, H., Yao, W., & Liu, C. (2016). Excellent heat dissipation properties of the super-aligned carbon nanotube films. *RSC Advances, 6*(66), 61686-61694.