

The Origin of the Bunsen Burner

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Question

When and where did Bunsen propose his famous burner?

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Answer

The famous laboratory gas burner associated with the name of the German chemist, Robert Wilhelm Bunsen (figure 1), was first described in detail in 1857 in the second of a series of papers on photochemistry written by Bunsen in collaboration with the British chemist, Henry Enfield Roscoe (1833-1915) (1), though the burner in question had actually been in use in Bunsen's Heidelberg laboratory since 1855 (2). Proposals for laboratory gas burners date back at least to the 1820s when gas lighting first began to appear in the larger cities and towns of Europe. One such device was described by Michael Faraday (1791-1867) in the 1827



Figure 1. Robert Wilhelm Bunsen (1811-1899).

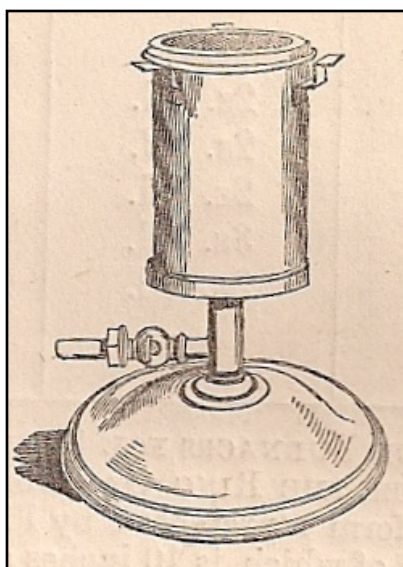


Figure 2. A typical gauze burner (10).

edition of his book, *Chemical Manipulation* (3,4) and both Dolch (5) and Kohn (6) have also described a number of pre-Bunsen laboratory gas burners.

In his autobiography, Roscoe claimed that Bunsen's burner was based on a modification of a laboratory gas burner, known as a "gauze burner," that Roscoe had brought to Germany from England and which was in common use the laboratories at University College London (7, 8). As implied by its name, before being lit, the gas and air were mixed in a cylindrical metal chamber (figure 2) having a wire screen or gauze top, in order to prevent (in keeping with the principles of the Davy safety lamp) the danger of a flashback. Unfortunately, the resulting flame was diffuse, relatively cool, and suffered from excessive flickering and coloration, due to contaminants on the metal screen.

An examination of the paper by Bunsen and Roscoe shows that their primary motive in using the new burner (figure 3) was to obtain a virtually color-

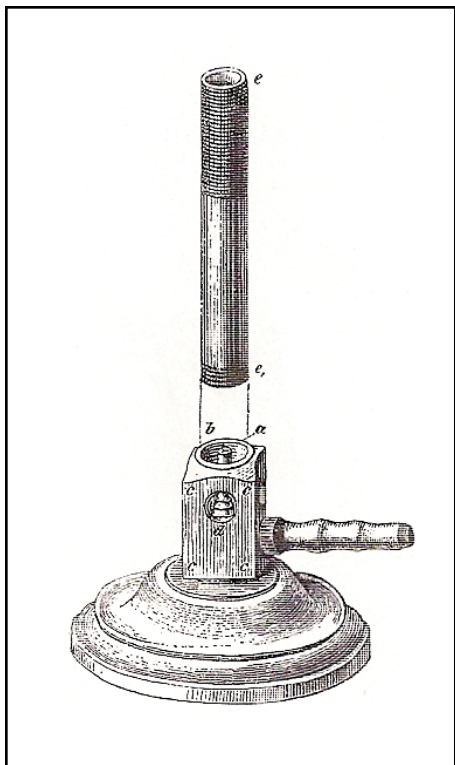


Figure 3. Bunsen's original burner (1).

less, soot-free, flame of constant size which could be used to establish photometric standards. This was accomplished by having the premixed air and gas issue from a long narrow tube or barrel under positive pressure before being lit (9). If the width and length of the tube are properly selected, the flame will not propagate down the tube and the necessity of using a wire safety screen is eliminated. A side benefit was that the burner also provided a hotter, more concentrated flame for conventional laboratory use. By the end of the 1860s, laboratory gas burners had largely displaced the older charcoal furnaces that had dominated chemistry for most of its recorded history.

Literature Cited

1. R. Bunsen, H. E. Roscoe, "Photochemische Untersuchungen," *Poggendorff's Ann. Chem. Phys.*, **1857**, 100, 43-88. Reprinted in W. Ostwald, M. Bodenstein, Eds., *Gesammelte Abhandlungen von Robert Bunsen*, Vol. 3, Engelmann: Leipzig, 1904, pp. 19-56, and in W. Ostwald, Ed., *Photo-*

chemische Untersuchungen von R. Bunsen und H. E. Roscoe (1855-1859), Erste Hälfte, Die Klassiker der exakten Wissenschaften, Nr. 34, Engelmann: Leipzig, 1892. The diagram of the burner appears as figure 6 of this paper.

2. These burners were made by the university's instrument maker, Peter Desaga, based on a simplified version of Bunsen's original design. Priority claims by the Berlin firm of Julius Pintsch (1855) and by the lighting engineer, R. W. Elsner (1856), were successfully contested by Desaga. See P. Desaga, "Ueber den neuen Gasbrenner welchen sich Eisner patentiren liess," *Dinglers poly tech. J.*, **1857**, 143, 340.

3. M. Faraday, *Chemical Manipulation: Being Instruction to Students in Chemistry on the Methods of Performing Experiments of Demonstration or of Research with Accuracy and Success*, Phillips: London, 1827, p. 107.

4. W. B. Jensen, "Michael Faraday and the Art and Science of Chemical Manipulation," *Bull. Hist. Chem.*, **1991**, 11, 65-76.

5. P. Dolch, "100 Jahre Bunsenbrenner - einer chemisch-geschichtlich Studie," *Österreich. Chem. Zeit.*, **1955**, 56, 277-285.

6. M. Kohn, "Remarks on the History of Laboratory Burners," *J. Chem. Educ.*, **1950**, 27, 514-516.

7. H. E. Roscoe, *The Life and Experiences of Sir Henry Enfield Roscoe*, Macmillan: London, 1906, pp. 51-52.

8. Bunsen biographer, Georg Lockemann, incorrectly suggested that Roscoe had shown Bunsen either an Argand burner or a burner based on Faraday's original design. Though a gauze burner is in fact a modified Argand burner, there is no hint in Roscoe's account that he was even aware of Faraday's earlier burner. This questionable speculation was repeated in G. Lockemann, "The Centenary of the Bunsen Burner," *J. Chem. Educ.*, **1956**, 33, 20-22.

9. T. E. Thorpe, "On the Theory of the Bunsen Lamp," *J. Chem. Soc.*, **1877**, 31, 627-642.

10. J. J. Griffin, *Chemical Handicraft: A Classified and Descriptive Catalogue of Chemical Apparatus*, Griffin & Sons: London, 1877, p. 87, item 920.

Do you have a question about the historical origins of a symbol, name, concept or experimental procedure used in your teaching? Address them to Dr. William B. Jensen, Oesper Collections in the History of Chemistry, Department of Chemistry, University of Cincinnati, Cincinnati, OH 45221-0172 or e-mail them to jensenwb@ucmail.uc.edu