DOBEREINER'S HYDROGEN LIGHTER

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Before the invention of matches, the "Dobereiner Hydrogen Lamp" was an ingenious device that furnished an instantaneous flame. Used somewhat like a present-day cigarette lighter, it gave, at the push of a finger, a flame that could light a candle or a wood splint. From its introduction in 1824 until the widespread use of friction matches (1) in the 1840s, the hydrogen lighter was a household and laboratory appliance. Johann Wolfgang Dobereiner (2) had made the curious observation that a jet of hydrogen gas flowing into spongy platinum caused the platinum to become so hot that it ignited the hydrogen stream. The application in a rapid lighting device was possible because the apparatus design allowed a self-regulating on-off control of the chemical reaction releasing the hydrogen.

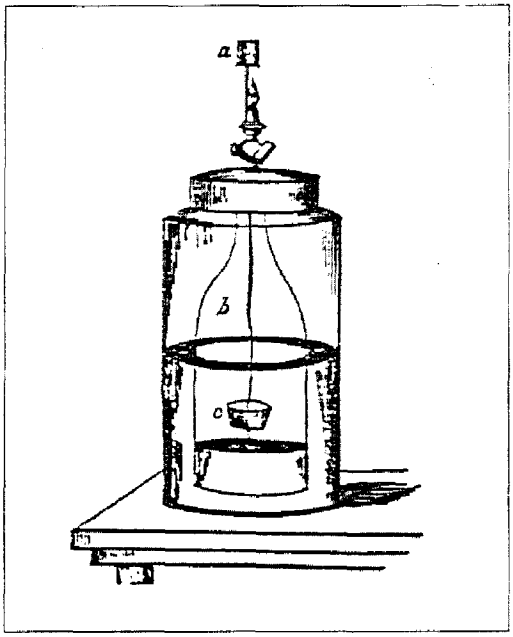

Figure 1. Dobereiner Hydrogen Lamp (See Ref. 3)

The inner glass tube (b) was open at the bottom and cemented air-tight into the brass cover, so as to connect with the external stopcock (3). The outer glass vessel was filled with dilute sulfuric acid. A piece of zinc (c), suspended in the acid on a brass or platinum wire, allowed the generation of hydrogen gas, which rose to the top of the inner vessel. With the stopcock closed, the gas pressure would push the liquid below the zinc and the reaction would cease. To obtain a light, the stopcock would be opened, and the hydrogen stream would contact the spongy platinum (a) and quickly ignite, the flame being emitted through (a). As long as the stopcock was open and the gas pressure released, the acid would rise to contact the zinc and continue to produce more hydrogen. Closing the stopcock would extinguish the flame, and gas pressure would again push the acid off the zinc, the reaction being stopped.

When Dobereiner demonstrated the ability of spongy platinum to ignite a jet of hydrogen before a scientific gathering in Halle on September 18, 1823, Berzelius declared it the most astounding discovery of the time. About 20,000 Dobereiner lighters were in use in Germany and England by 1828. Dobereiner realized little profit, however, because he held no patent for the invention (4). It should be noted that a hydrogen generating vessel similar to the above design, but without the platinum ignition part, was in use before 1823 (5). Dobereiner merely adapted that apparatus to his platinum ignition discovery.

The hydrogen lighter must have been common in the United States, too, because it appeared, in a variety

of construction designs, in many 19th-century textbooks (6). One design even featured a spring lever stopcock handle, making it thumb-controlled when held in one hand (7). A quaint 1839 American children's chemistry book presented the hydrogen lighter as a common household utensil, even used by young children (8):

> And how shall we make some hydrogen?
> Why you have made it many a time.
> When?
> Have you not often lighted a candle from the glass jar on my table?
> Yes; but did I make hydrogen then?
> That jar contains some water and sulphuric acid mixed, and that piece of metal that you see hanging by the wire is zinc.

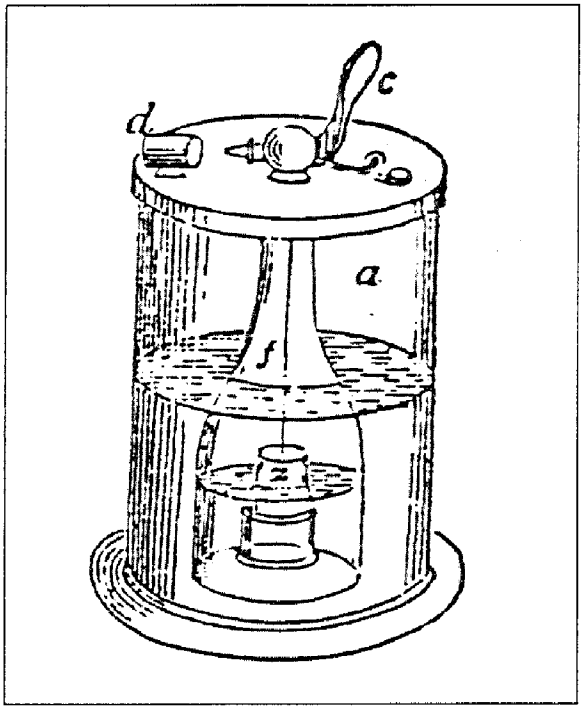

Figure 2. Thumb Action Lamp (see Ref. 7)

Following that quotation there was a diagram of the jar with further discussion of how it worked. The sulphur(sic) chapter of the same book included an added comment: "our hydrogen jar is quite as convenient as matches. Yes: it has not the unpleasant odor of matches, while it is as cheap, if a light is often wanted (8)." [See also Ref. 1.]

The size of the Dobereiner jar is unclear, but a contemporary American science apparatus catalog advertised three sizes, priced at $2, $3, and $4 (9). While no mention of safety is found in any reference to the apparatus, one wonders whether there were accidents from hydrogen explosions or acid spills.

The hydrogen on-off control of the Dobereiner lamp will be recognized as a forerunner of the Kipp gas generator, common in laboratories until metal gas cylinders became the typical source of supply. Indeed, an 1831 design of the Dobereiner lighter was remarkably similar to the Kipp apparatus (10). The Kipp generator, sometimes as tall as two feet, is still found in some current laboratory supply catalogs.

Even after the availability of matches, the Dobereiner lamp continued to be used for laboratory demonstrations until late in the 19th century. Some should have survived, but the author is unaware of any. Readers who know the location of any specimens should notify the author or editor.

REFERENCES AND NOTES

1. Sulfur tipped splints were in use from the turn of the 19th century, but an existing flame (from flint, steel, and tinder box), was required to ignite them. Various other methods for chemical fire were troublesome—requiring sealed containers for dangerous phosphorus or concentrated sulfuric acid bottles into which chemically tipped matches were dipped. The first practical friction matches, called "lucifers," were produced in England in 1827. Various compositions for the striking head were developed during the 1830s and 1840s. Matches were not common in the United States until the 1840s and even later on the frontier. For a history of matches, see M. Crass, "A History of the Match Industry," *J. Chem. Educ.*. **1941**, *18*, 116, 277, 316, 380, 428.
2. acy at the University of Jena, Germany, is best known for his "triads," which contributed to the systematic classification of the elements and the development of the periodic table. For biographies, see Ref. 4.
3. J. Hyatt, *The Elements of Chemistry*, Clark, Austin & Smith, New York, 1856, 47.
4. C. Gillispie, Ed., *Dictionary of Scientific Biography*, Charles Scribner's Sons, New York, 1971, Vol. IV, 133-135; W. Prandtl, "Johann Wolfgang Dobereiner, Goethe's Chemical Adviser," *J. Chem. Educ.*, **1950**, *27*, 176-181; W. Schultz, "Dobereiner and the University of Jena," *Chemistry*, **1972**, *45*, 10-11.
5. W. Brande, *A Manual of Chemistry*, George Long, New York, 1821, 77.
6. rdson and Lord, Boston, 1827, 151; J. Webster, *A Manual of Chemistry*, Richardson and Lord, Boston, 1828, 118;

B. Silliman, *Elements of Chemistry,* Hezekiah Howe, New Haven, CT, 1830, Vol. I, 206, 243; J. Stockhardt, *The Principles of Chemistry*, John Bartlett, Cambridge, MA, 1851, 73; D. Wells, *Wells' Principles and Applications of Chemistry*, Ivison, Phinney, and Co., New York, 1863, 206; W. Hooker, *Science for the School and Family. Part II. Chemistry*, Harper and Brothers, New York, 1864, 129; and E. Youmans, *A Class-Book of Chemistry*, D. Appleton, New York, 1864, 195; In two texts, however, the hydrogen lighter was attributed to Gay Lussac: W. Johnson, *The Scientific Class-Book*, Part II, Key and Biddle, Philadelphia, PA, 1863, 37; J. Pelouz and E. Fremy, *General Notions of Chemistry*, Lippincott, Grambo, and Co., Philadelphia, PA, 1854, 33, 44. No confirmation of this claim was found in biographies of Gay Lussac.

7. B. Silliman, *First Principles of Chemistry*, Peck and Bliss, Philadelphia, 1850, 241.
8. [J. Hyatt], *First Lessons in Chemistry, by Uncle Davy*, American Common School Union, New York, 1839, 37, 46.
9. B. Pike, *Pike's Illustrated Descriptive Catalog of Optical, Mathematical, and Philosophical Instruments*, The Author, New York, 1856, Vol. 2, 87.
10. J. Comstock, *Elements of Chemistry*, D. F. Robinson, Hartford, CT, 1831, 126.

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