PHYSICS

Classics of Science: The Safety Lamp

In explaining the phenomenon responsible for the safety lamp, Sir Humphry Davy gives the following experiment, easily done in any laboratory: "If a piece of wire gauze sieve is held over a flame of a lamp or of coal gas, it prevents the flame from passing it, and the phenomenon is precisely similar to that exhibited by the wire gauze cylinders; the air passing through is found very hot, for it will convert paper into charcoal; and it is an explosive mixture, for it will inflame if a lighted taper be presented to it, but it is cooled below the explosive point by passing through wires even red hot, and being mixed with a considerable quantity of air comparatively cold."

ON THE SAFETY LAMP for Preventing Explosions in Mines, Houses Lighted by Gas, Spirit Warehouses, or Magazines in Ships, etc., with some Researches on Flame, by Sir Humphrey Davy, Bart, London, 1818.

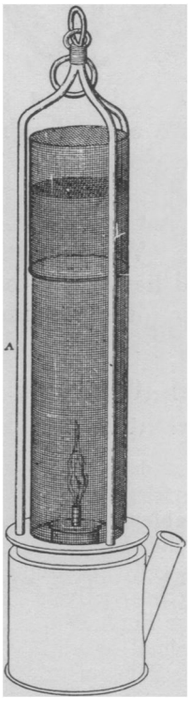
Light In Fire-Damp

In this communication I shall describe a light that will burn in any explosive mixture of fire-damp, and the light of which arises from the combustion of the fire-damp itself.

The invention consists in covering or surrounding a flame of a lamp or candle by a wire sieve; the coarsest that I have tried with perfect safety contained 625 apertures in a square inch, and the wire was one-seventieth of an inch in thickness, the finest 6,400 apertures in a square inch, and the wire was one-two-hundred-and-fiftieth of an inch in diameter.

When a lighted lamp or candle screwed into a ring soldered to a cylinder of wire gauze, having no apertures except those of the gauze, or safe apertures, is introduced into the most explosive mixture of carburetted hydrogen and air, the cylinder becomes filled with a bright flame, and this flame continues to burn as long as the mixture is explosive. When the carburetted hydrogen is to the air as 1 to 12, the flame of the wick appears within the flame of the fire-damp, when the proportion is as high as 1 to 7, the flame of the wick disappears.

When the thickest wires are used in the gauze it becomes strongly red hot, particularly at the top, but yet no explosion takes place. The flame is brighter the larger the apertures of the gauze, and the cylinder of 625 apertures to the square inch, gives a brilliant light in a mixture of 1 part of gas from the distillation of coal and 7 parts of air. The lower part of



Sir Humphry Davy's Safe Lamp

the flame is green, the middle purple, and the upper part blue.

I have tried cylinders of 6,400 apertures to the square inch, in mixtures of oxygen and carburetted hydrogen, and even in mixtures of oxygen and hydrogen, and though the wire became intensely red hot, yet explosions never took place; the combustion was entirely limited to the interior of the lamp.

In all these experiments, there was a noise like that produced by the burning of hydrogen gas in open tubes.

These extraordinary and unexpected results lead to many enquiries, respecting the nature and communication of flame, but my object at present is only to point out their application to the use of the collier.

All that he requires to ensure security, are small wire cages to surround his candle or his lamp, which may be made for a few pence, and of which various modifications may be adopted, and the application of this discovery will not only preserve him from the fire-damp, but enable him to apply it to use, and to destroy it at the same time that [it] gives him a useful light.

Sir Humphry Davy was born in Cornwall, December 17, 1778, and died in Geneva, May 29, 1829. In 1798 he began his first scientific work as superintendent of the newly established Medical Pneumatic Institution at Bristol. In 1801, at the age of 23, he was appointed by Count Rumford to a position in the Royal Institution, and here he for many years gave those lectures for which he was so famous. Here he performed many experiments on chemical substances and the new force of electricity, and trained Michael Faraday, who carried on the work to such brilliant achievements. Davy's work on explosive mixtures of gases, resulting in the invention of the safety lamp, was performed in 1815, at the age of 37. The lamp was not patented, and Davy spent a great deal of energy getting it adopted in the mines of Great Britain, from purely humanitarian motives. The illustration reproduced here is from his book which describes the lamp and recounts many instances of its successful use under conditions which would otherwise have been disastrous.

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HYGIENE

Physics and Physiology

By G. N. Lewis

We see no limit to the interesting and useful results that will inevitably come from a further application of the methods of physics and chemistry to the physiology of animals and plants. Yet the belief that even an infinite succession of such investigations would ultimately lead to a comprehensive understanding of vital phenomena seems to be one of those illusions, like the *ignis fatuus* of the mechanistic philosophers, which blind our eyes to many interesting trails that should tempt the scientific explorer.

Perhaps our genius for unity will some time produce a science so broad as to include the behavior of a group of electrons and the behavior of a university faculty, but such a possibility seems now so remote that I for one would hesitate to guess whether this wonderful science would be more like a mechanics or like a psychology.

* * * *

We have the "nature fakers," who make animals think and act just like men, and there are the others, who regard the swarming of bees as a sort of chemical reaction. I do not know which of these two extremes to regard as the more futile, for both extrapolations go far beyond what is now justifiable. Yet the attempt to bridge this vast gulf is a legitimate aim of science.—Quotations from *The Anatomy of Science—Yale University Press.*

Science News-Letter, December 3, 1927