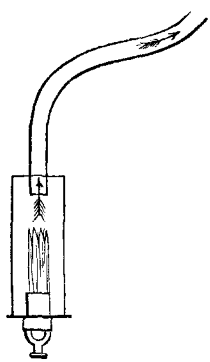
modified, and may be either sustained or diminished at pleasure; the light is increased, and additional safety from accidents is obtained, as in the event of any leakage from the pipes, or from a gas-cock being inadvertently left open, the gas, instead of mixing with the air of the room and becoming explosive, would be carried off by the metal tubes.

Professor Faraday.

Professor **Faraday** illustrated the principle of the invention by several experiments; first demonstrating that if a lighted taper was applied to the top of a lamp chimney, it would be instantly extinguished, or a glass jar held over it would be immediately filled with air, in which a light could not burn nor any animal exist. If a portion of lime water was poured into the jar it became turbid in appearance, owing to the precipitation of the carbonate of lime, formed by the combination of the carbonic acid with the lime. The sulphurous and sulphuric acids also contained in the water, resulting from the combustion of coal gas, were injurious to metals and to articles of furniture. He then explained that at his suggestion, the gas-lights of the chandelier in the Library of the Athenæum, were ventilated by tubes dipping into the lamp glasses, Fig. 3, and conjoining at a short distance above into one central pipe, which carried away all the burnt air from the room.

Fig. 3.



This first application had demonstrated the correctness of the theory, and had induced modifications which had been described in the paper.

The **Professor** then stated that his attention had been directed to the subject also by the disadvantages attendant upon the want of ventilation in the lanthorns of Lighthouses, as in consequence of the condensation of the products of combustion upon the windows, the intensity of the lights was diminished to a serious extent, and the quantity of carbonic acid in the lanthorns was at times so great that the keepers could with difficulty enter them. This was illustrated by an experiment, showing the difference between allowing combustion to give its products to the air of a room, and carrying off those products freely to the exterior.

A short wax candle was placed burning on a plate, a glass jar put over it; and the upper aperture of the jar closed by a globular cork through which was passed a piece of glass tube, about half an inch in diameter and twelve or fourteen inches long: the tube descending to the top of the candle flame, and being placed just above it. Under these circumstances, plenty of air passed into the jar between its edges and the plate, and out by the tube, to supply all that was needed for combustion, and to keep the glass chamber clear: therefore, in that position it would burn for any length of time, and the jar remain quite bright. But on moving the cork a little, so that the tube should no longer be over the flame, all these results changed, though the airways remained exactly as before. The candle then gave the products of its combustion to the general air of the glass chamber, which immediately became dull, from the water deposited upon it, the air itself was deteriorated, the light grew dim, and in a few minutes it went out; but if that was prevented, by the tube being again placed over it, signs of recovery appeared, the light resumed its former brightness, and after a short time even the dew disappeared from the glass, demonstrating how indispensable a perfect ventilation was for lighthouses: on which subject the Professor promised a communication.

Mr. Bethell remarked that the inner chimney appeared to become dim after the light had burned some time. Mr. Bethell

Professor Faraday explained that this might arise from several causes; he apprehended it was chiefly occasioned by the action of the sulphur in the coal gas upon the ingredients of which the glass chimney was composed. In oil lamps the same effect was observed, but not so speedily as with coal gas. The Trinity House suffered much by it, and had made experiments on various qualities of glass for the chimneys of the lamps of lighthouses. Chimneys formed of mica would not be so affected, but they were not so transparent as glass. Professor Faraday.

Mr. Bethell said that the Bude light, as now used in the House of Commons, was constructed somewhat on the same principle as had been described in the paper, except that the current was directly upward, which rendered the application of two chimneys unnecessary: perfect ventilation was obtained by it. Mr. Bethell

Professor Faraday said that the Bude light, as proposed to the Trinity House, was an oil lamp, supplied with oxygen by an appa- Professor Faraday.

ratus for generating it. In lighthouses, it was indispensable that the lamps should be so arranged that the lights should consume only a given quantity of oil, and retain an unvarying degree of brightness for a given time, which was now four hours, at the end of which time they were trimmed. It was found that with the Bude light, the quantity of oil consumed was greater, and the lamps required trimming in two hours, in consequence of the wicks charring; these circumstances rendered the system inapplicable to lighthouses. Subsesequently, five of the Bude-light lamps had been referred to him by the House of Commons for experimental purposes, and his observations upon them were of the same nature.

Mr.Bethell Mr. Bethell explained, that in Mr. Gurney's present "Atmospheric Gas-burner," the supply of oxygen alluded to by Professor Faraday was not used.

Mr. Snow Harris. Mr. Snow Harris inquired whether the action of carbonic acid, to which the term "poisonous" had been applied, was to be considered as positive or negative. How was it to be viewed in its connexion with the circulation of the blood and with the process of respiration?

Professor Faraday. Professor Faraday replied, by quoting from the work of Dr. Marshall Hall,* that "It was first distinctly stated by Sir Humphrey Davy, that in inspiration and during the pulmonic circulation, the double function was performed of—1st, the absorption of oxygen, and 2nd, the exhalation of carbonic acid, by and from the circulating blood, a doctrine from which another doctrine flows, *viz.*, that, during the systematic circulation, the oxygen absorbed is continually undergoing the transition into carbonic acid." The general conclusion from his experiments was, "That respiration was a chemical process, the combination of phosoxygen (oxygen) with the venous blood, and the liberation of carbonic acid and aqueous gas from it." †

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* "The Gulstonian Lectures for 1842," pp. 8, 12, and 40.

† Mr. Edwards, in his work, "De l'influence des Agens Physiques sur la Vie," 1824, p. 465, observes, "L'oxigène qui disparait dans la respiration de l'air atmosphérique est absorbé en entier. Il est ensuite porté en tout ou en partie, dans le torrent de la circulation. Il estremplacé par une quantité plus ou moins semblable d'acide carbonique exhalé, qui provient en tout ou en partie, de celui qui est contenu dans la masse du sang. En outre, l'animal respirant de l'air atmosphérique, absorbe de l'azote; cet azote est porté en tout ou en partie, dans la masse du sang. L'azote absorbé, est remplacé par une quantité plus ou moins équivalente d'azote exhalé, qui provient en tout ou en partie du sang.

"Voila quatre points fondamentaux:

1°. L'absorption de l'oxigène qui disparait;
2°. L'exhalation de l'acide carbonique expiré;
3°. L'absorption d'azote;
4°. L'exhalation d'azote."

Professor Graham, in a note to Dr. Hall, says, "If an animal were to breathe atmospheric air to which carbonic acid were added, in proportion to this addition, the evolution of carbonic acid from the blood would, in my opinion, be impeded; the passage of the carbonic acid outward, at all from the blood, depending upon the comparative absence of that gas from the air taken into the lungs."

In treating of "asphyxia," Dr. Hall says, "The absorption of oxygen, or the evolution of carbonic acid, or both, are impeded or interrupted in every case of asphyxia. From the want of oxygen the blood is deficient in stimulus; by the presence of carbonic acid it is positively poisonous."

It appeared from the researches of physiologists, that the presence of a certain proportion of carbonic acid was necessary to stimulate the action of the heart, and regulate the circulation of the blood; that nature kept up the proper supply for this purpose, but that any excess was prejudicial.

Acting upon this principle, Dr. Payerne had brought forward a proposition for purifying the air in a diving-bell, so that without using the air-pump the diver might remain under water for four hours, or even longer. This was, the professor believed, accomplished by decomposing the carbonic acid, absorbing the carbon, and eliminating the oxygen, and not by generating oxygen, as had been generally imagined.

No. 626. "On the Formation of Embankments for Reservoirs to retain Water." By Robert Thom, M. Inst. C. E.

Formation of Embankments

After describing a model, designed to show that the proper slope for reservoir embankments, should not be less than three to one on the water-face, and remarking that waves act more severely on the pitching or paving of the inner face, in proportion to the steepness of the slope, the author proceeds to describe in detail the mode of forming embankments. The foundation is excavated to such a depth as is found firm and capable of preventing the passage of water, then spreading alternate layers of puddled peat, or alluvial earth and gravel, and beating them together with wooden dumpers, until they are completely mixed; the slopes are covered with a puddle made with small stones or furnace-cinders mixed with clay, so as to prevent the possibility of moles or other vermin penetrating into the embankment. He condemns the practice of forming embankments with puddle-trenches, and refers to many reservoirs made by him at Greenock, Paisley, and elsewhere, the banks of which have stood the test of time without having any puddle-trenches in them, and parti-