for this; but later observers have contented themselves with upsetting all previous explanations, and confessing their own ignorance. It was understood, some time ago, that M. Arago had succeeded at length in deducing the facts from the undulatory theory; but his memoir, if ever published, I have unfortunately not seen. Some remarkable appearances, though not difficult to explain, offer themselves during a total eclipse of the sun, of which a very interesting description may be found in Hind's Solar System.

Gas Patents, by Henry Croft, D. C. L., Professor of Chemistry in the University of Toronto.

There is scarcely any branch of chemical manufacture which has attracted so much attention, and has been made the subject of such numerous patents as that of coal gas; we mention coal gas alone, for although various proposals have been made, and several carried into execution, for extracting a gas fitted for illumination from numerous other substances; such for instance, as oil, fats, rosin, bitumen, soap-suds, and even water, it does not appear that any one of them can take the place of that from which the gas was originally produced, viz., coal.

Whether we regard the convenience and utility of this illuminating principle, or the enormous saving of expenditure when its use is contrasted with that of all other ordinary combustibles, or the numerous useful applications which have been made; among the most interesting of which may be mentioned the singeing of calico and of thread, formerly effected by much more clumsy contrivances; we cannot but consider this branch of manufacture as one most deserving our attention and worthy of more especial notice.

Many improvements have been effected in various departments of this manufacture, as may be seen from the fact of there having been from sixty to seventy patents or specifications registered in the Patent Office up to the year 1850. Since that time many more have been entered, some of which will be briefly noticed in the present paper.

Although the general application of coal gas to the purposes of illumination may date from the commencement of the present century, yet the knowledge of its properties was obtained at a much earlier period. In letters written in 1688-9, by Mr. Clayton, Rector of Crofton, at Wakefield, in Yorkshire, addressed to Robert Boyle, and afterwards to the Royal Society, we find a tolerably accurate account of the method adopted by the author for preparing a gas from coal, and also of its properties more especially as regards its inflammability.

Between 1770 and 1780 various experiments were made by Hales and Watson on the production of an inflammable gas from coal and other substances, but the first, though unsuccessful, attempt at the application of such product to useful purposes seems to have been made by Lebon in France, during the years 1785-6. The substance employed by him was wood, which does not yield nearly so good a gas as common coal, a fact which may probably account for the failure of his experiments.

In the year 1792, Murdoch lighted his dwelling house with gas, and in 1798 a gas-work was established in the factory of Messrs. Bolton & Watt, with whom Murdoch was connected.

For some years subsequent only a few private factories were furnished with this valuable means of illumination. It was first applied to lighting streets in 1804, when Pall Mall in London was furnished with gas, to replace the clumsy and inadequate oil lamps, which all old residents in that city may remember. Since that period the use of gas for this purpose has become thoroughly appreciated and most widely extended.

Gas which may be applied to the purposes of illumination is frequently found in nature, exuding either from the soil, or rock or passing up with mineral waters. The holy fires of Baku, the, natural gas of Fredonia, (on Lake Erie,) the so called burning springs above the British Falls, and at Hamilton, the burning fountain of Dauphiné, as well as many others in various parts of the world might here be mentioned. The gas which is thus evolved is not, however, of the same nature as that obtained artificially from coal, although coal gas does, under certain circumstances, contain a very large proportion of the above mentioned compound, and a very considerable quantity in all cases. The evolution of this gas is not, therefore, to be taken as a proof of the existence of coal, although in the coal mines it is the substance which so frequently produces such calamitous accidents, being generally known by the names of fire damp, marsh gas, &c.* It appears that long before coal gas was employed in England, the Chinese were in the habit of employing the natural product for the purposes of illuminating and heating.

Before entering upon the improvements which have been effected in the manufacture, it may be well to describe, in a few words, the process as originally adopted, and the objects of its several parts. The coal being heated strongly in cylindrical iron retorts, gives off a mixture of various gases, together with certain oils, tar and water holding in solution several salts principally of ammonia. From these bodies the gas is purified, firstly,—by traversing a large tube or reservoir called the hydraulic main; and, secondly,—by passing through a series of pipes kept cool by a stream of water. The mixed gases are then conducted through the purifiers, which are large vessels filled with a mixture of lime and water; noxious gases, and some which are either not combustible or do not give out any great light when burnt are thus removed, and the so purified gas is then passed off into the gasometer or collecting vessel.

In each of the processes above described great improvements have been effected, while other contrivances have been attached to the factory, either for the purpose of improving the quality and illuminating power of the gas, or of rendering available, for technical purposes, the different products obtained during the process.

The improvements may be classified under three heads:

1st. As regards the quantity and quality of gas produced from a given weight of coal.

2nd. As regards the efficiency and economy of the purifying process.

3rd. As regards the illuminating power of the gas.

The quantity of gas produced depends principally upon the nature of the coal subjected to distillation, the finer cannel coal yielding as much as 18,000 cubic feet of gas for every 100 cubic feet of coal, while poorer kinds do not give more than 9000. The quantity will also depend, to a considerable extent, on the rapidity with which the coal is raised to a cherry-red heat; if the coal be damp, and the heat raised slowly, a large quantity of tar will be produced, much of which will distil off without producing gas. The quality of the gas varies with the duration of the process, during the first hour that substance which gives its strong illuminating power to the gas is found to the extent of 13 per cent., while at the end of 5 hours there is only 7 per cent., and at the end of 10 none at all, and the gas, consequently, when burning, gives out little or no light. Olefiant gas, (the illuminating principle) which burns with a brilliant white light,

* The explosion which occurred some few weeks since, in a well on Queen Street, Toronto, but which was fortunately not attended by any serious consequences, was undoubtedly owing to an escape of this gas from the bottom of the well.