BRITISH MANUFACTURING INDUSTRIES: ACIDS, ALKALIES, SOAP, AND MINOR CHEMICAL PRODUCTS: OILS AND CANDLES: GAS AND LIGHTING

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EDITED BY

G. PHILLIPS BEVAN, F.G.S.

II.

ACIDS, ALKALIES, SOAP, AND MINOR CHEMICAL PRODUCTS,

By Professor Church, M.A., F.C.S (The Agricultural College, Cirencester).

OILS AND CANDLES,

By W. Mattieu Williams, F.C.S., F.R.A.S.

GAS AND LIGHTING,

By R. H. Patterson, F.S.S (late Metropolitan Gas Referee).

SECOND EDITION.

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1877.

PREFACE.

The object of this series is to bring into one focus the leading features and present position of the most important industries of the kingdom, so as to enable the general reader to comprehend the enormous development that has taken place within the last twenty or thirty years. It is evident that the great increase in education throughout the country has tended largely to foster a simultaneous interest in technical knowledge, as evinced by the spread of Art and Science Schools, Trade Museums, International Exhibitions, &c.; and this fact is borne out by a perusal of the daily papers, in which the prominence given to every improvement in trade or machinery attests the desire of the reading public to know more about these matters. Here, however, the difficulty commences, for the only means of acquiring this information are from handbooks to the various manufactures (which are usually too minute in detail for general instruction), from trade journals, and the reports of scientific societies; and to obtain and systematize these scattered details is a labour and a tax upon time and patience

which comparatively few persons care to surmount. In these volumes all these facts are gathered together, and presented in as readable a form as is compatible with accuracy and a freedom from superficiality; and though they do not lay claim to being a technical guide to each industry, the names of the contributors are a sufficient guarantee that they are a reliable and standard work of reference. Great stress is laid on the progressive developments of the manufactures, and the various applications to them of the collateral arts and sciences; the history of each is truly given, while present processes and recent inventions are succinctly described.

BRITISH MANUFACTURING INDUSTRIES.

THE MANUFACTURE OF ACIDS.

By Prof. Church, M.A., F.C.S., The Agricultural College, Cirencester.

I. Oil of Vitriol, or Sulphuric Acid.

The importance of this manufacture can hardly be exaggerated. Sulphuric acid is used in so many arts and processes, that its extensive production and employment in a country may be taken as a measure of the degree of civilization. Of the useful materials which are obtained by the use of this acid I may mention, as well-known examples, soda, soap, chloride of lime, and glass. But, in fact, the employment of this acid is essential to the preparation of countless matters useful in metallurgy, in dyeing and calico-printing, in medicine, &c. To such uses of sulphuric acid I shall have repeated occasion to refer in the following pages.

Although the common process in use for the preparation of oil of vitriol (another name for sulphuric acid) has been carried on for upwards of a century, it is neither the original method of making this substance, nor is it one simple and easily understood. The

original oil of vitriol was really distilled from a kind of "vitriol," the name given to certain salts or compounds containing a metal, derived from sulphuric acid. Such vitriols are—blue vitriol, or sulphate of copper; white vitriol, or sulphate of zinc; and green vitriol, or sulphate of iron. This last compound has long been employed at Nordhausen, in Saxony, for the preparation of a remarkable kind of oil of vitriol, which fumes in the air, and is much denser than the ordinary sort. As it is extensively used for dissolving indigo, in preparing certain baths for dyeing blue, I will briefly describe its manufacture here, before speaking of the more complex operations involved in the preparation of ordinary sulphuric acid.

The green vitriol is first of all dried, to remove most of the water of crystallization: at the same time a considerable quantity of oxygen is absorbed from the air, and thus in the subsequent distillation, less sulphurous acid gas (sulphur dioxide, SO_2) is given off and lost, since some ferric sulphate is formed. The next step is to heat the dried green vitriol in small fire-clay retorts, with charges of about 2½ lb. apiece. The first distillate consists of weak sulphuric acid containing some amount of sulphur dioxide, and is thrown away. Then the receivers, each containing about an ounce of water, or of common sulphuric acid, are luted on to the retorts, after the heat has been raised and white fumes of sulphuric anhydride begin to appear. The distillation proceeds for twenty-four to thirty-six hours, while four repetitions of the process with fresh charges are requisite before the

distilled acid attains the requisite strength of 1·88 to 1·92 specific gravity. The acid thus made fumes in the air, is generally of a pale brown colour, and has the approximate composition of 1 molecule of sulphuric acid and 1 of sulphuric anhydride (or H_2SO_4, SO_3). It is twice as effective in dissolving indigo as ordinary oil of vitriol, and is, unlike that acid, usually free from lead, but always contains traces of iron.

Experiments have recently been made to produce fuming sulphuric acid by modified and improved processes. As the value of this powerful solvent becomes more appreciated, its manufacture will no doubt be carried on in this country.

Common Oil of Vitriol.

The whole of the vast quantity of sulphuric acid manufactured in Great Britain is prepared by a process of French origin, invented by a calico-printer of Rouen, and improved by the eminent chemist Chaptal. The earliest sulphuric acid works were erected by Dr. Roebuck, of Birmingham, who introduced the process about the year 1746, and then built the first "lead chamber," for carrying it on at Prestonpans, near Edinburgh. The chemistry of the process is not yet thoroughly understood, but the conditions of a successful manufacture can be easily fulfilled. It must be premised that sulphuric acid cannot be made at once by the direct union of the three elements which it contains. If this were the case, nothing more would be needed than to burn sulphur in the presence of an ample supply of atmospheric air and of steam. But in