

REVIEW.

Coal-Tar and Ammonia. By **George Lunge**, Ph.D., Professor Emeritus of Technical Chemistry in the Federal Technical University, Zurich. Fifth and Enlarged Edition. Parts I. and II., Coal-Tar; Part III., Ammonia. London: Gurney and Jackson, 1916. Price £3 3s.

Seven years have passed since the last edition of Professor Lunge's treatise on Coal-Tar and Ammonia appeared, and this period has witnessed great extension in the production and use of coal-tar, the commercial realisation of new processes of obtaining ammonia, and—towards its close—the opening up of fresh sources of aromatic hydrocarbons to meet the insatiable demand for their nitrated products as the most potent agents for the destruction of man and his handiwork. Professor Lunge has essayed to cover this seven years' progress in the coal-tar and ammonia industries by a considerable enlargement of his treatise, which is now bound in three volumes comprising in all 1,658 pages. He has excised a little obsolete matter and he has rewritten a few paragraphs, but for the most part his mode of revising his treatise for this new edition has consisted in inserting here and there new paragraphs, the matter of which sometimes is rather inconsistent with that of the older context. The net result of this procedure has been—in the writer's view—the production of an unwieldy treatise, the contents of which lack co-ordination and cohesion as well as conciseness. The work no longer is worthy of Professor Lunge's former great repute as an authoritative guide to the branches of industrial chemistry with which it deals.

Many concrete instances might be cited from each of the three volumes in support of this harsh judgment of the present status of the work as a whole, but it will suffice, before passing on to the analytical problems discussed, to refer to Professor Lunge's treatment of one fundamental question. It is now common knowledge that the character or composition of the volatile products of the carbonisation of coal is determined by the conditions of carbonisation rather than by the precise nature of the coal carbonised. The greater part of the volatile products of the carbonisation of coal are evolved from the particles of coal as they reach, in turn, a comparatively low temperature, and it is the secondary effect of heat on these primary volatile products which determines the character or composition of the gas and tar which are the ultimate products. The extent of this secondary effect depends not simply on the temperature of the retort or containing vessel itself, but on the rate of passage of the volatile products through it and the degree of baffling by heated surfaces to which they are subjected. If we could measure the maximum temperature which each particle of vapour or gas attains before it escapes from the retort or oven, we should be in a good position to predict what the final products yielded by it and its neighbours would be. As matters stand, however, we know merely the temperatures of the retort walls and different zones of the charge of coal, and it is only by increasing or retarding the rate of flow of the vapours and gases primarily evolved, so that their contact with these more or less highly heated objects is more

or less prolonged, that we can influence seriously the temperature which the vapours and gases themselves attain, and can thereby determine the nature of the ultimate products. Given a retort of a particular size maintained at a certain high temperature, the temperature which the volatile products evolved from a contained charge will attain will be affected almost solely by the *quantity* of hydrocarbon matter which there is in the contained charge. If that hydrocarbon matter is, say, four times as much in one instance as in another, either by reason of the charge consisting of four times as much of the same coal, or by reason of its consisting of the same quantity of a coal containing four times as much "volatile matter" or hydrocarbon, it is fairly obvious that the vapours and gases evolved will travel through the retort in the first instance at not less than four times their rate of passage in the second instance. When the difference in the amount of hydrocarbon matter in the charge is obtained by increasing the weight of the charge inserted (the kind of coal being unaltered), it is clear that the free space in the retort for the passage of the evolved vapours and gases is correspondingly reduced, and hence individual particles of these vapours and gas must on this account also make a more rapid passage through and out of the retort. A fully-charged retort therefore gives much less opportunity to the vapours and gases to approximate to the temperature of its walls than does one only one-quarter filled with the same coal. In this lies the rational explanation of the relative freedom from naphthalene and other high temperature products, of the tar and gas produced from fully charged gas retorts or coke ovens.

Professor Lunge, however, when discussing in his second chapter the causes of differences in tars, virtually ignores these fundamental considerations, but gives several pages of less relevant data on the influence on the tar produced of the temperature of the retort, of the shape of the retort, and of the quality of the coal. These data in many instances would be useful provided they were correlated by the author with the general principles underlying carbonisation, but in the present work they stand as so many unconnected items. They are even in several cases wrongly quoted. Thus, on p. 42, Professor Lunge gives figures purporting to be taken from A. Schäfer's text-book ("Einrichtung und Betrieb eines Gaswerkes"). First he quotes average temperatures for the horizontal retorts in certain settings at Mannheim, but he gives as an alternative temperature for the middle retorts a figure which is in reality the mean of the temperatures of the outer and middle retorts. The same mistake occurs in his next quotation for certain inclined retort settings at Mannheim. The third quotation from the same source refers, according to Professor Lunge, to a "coke-furnace," which the reader will probably take to be a translator's mistake for coke-oven. Reference to Herr Schafer's book, however, shows that the figures given really refer to "Coze" settings of inclined retorts. The want of care with which Professor Lunge's quotations are made is again demonstrated on the next page, where he gives a table showing only the calorific and illuminating powers of gas distilled from gas coal (from Saxony) at different temperatures, and proceeds to say that the table proves that with rise of carbonising temperature calorific values are increased. The table shows (quite correctly) the reverse. It may be surmised that Professor Lunge wished to show that with rise of carbonising temperature the multiple of calorific power by gas-yield increased, but he quotes

neither the gas-yield nor that multiple, and draws an inference which is palpably false.

These instances, from two consecutive pages, of the slipshod work embodied in the latest edition of "Coal-Tar and Ammonia," might be multiplied indefinitely, but they serve to show that it can be used safely as a work of reference only by the specialist who will descry the errors with which it teems. A reader not thoroughly well acquainted with the technical literature of the gas, coal-tar, and ammonia industries may well be seriously misled if he relies on this work for guidance.

The writer is unable to form a much more favourable opinion of the utility of the book to the analytical specialist. In the section on "Testing of Tar on a Small Scale or in the Laboratory," very little guidance is given to the public analyst, who now frequently is called upon to make a simple assay of coal-tar on behalf of his local authority which probably buys large quantities of tar for the surface dressing of roads. Many crude tars, and not a few modern refined tars, give endless trouble in a small-scale distillation unless the heating of the flask or retort is conducted with a view to breaking up incipient frothing and spurting, yet Professor Lunge contents himself with quoting Watson Smith's directions, which were excellent for the coal-tars of their date—viz., 1887—but need supplementing in order to be applicable to the more troublesome high-temperature coal-tars of later years and the carburetted water-gas tars which were then unknown in Europe. The only useful hints of later date are given under the heading Estimation of Water, and are quoted from Payne, who in 1903 described precautions which he had found valuable, and which, in principle, are now generally followed in tar-testing in this country.

Again, nothing useful to the analyst is said as to English methods of taking the viscosity or consistency of tars for road-dressing and for preparing tar-macadam, though, thanks to the pioneer work of—amongst others—Brigadier-General H. P. Maybury, first as County Surveyor of Kent, and later as Engineer and Manager of the Road Board, this country is much in advance of the rest of Europe in the application of tar in road-making and repair. The success of tar treatment of road stone or road surfaces is well known here to depend primarily on the use of tar of appropriate consistency or viscosity, and failures—especially of tar-macadam—may constantly be traced to a fault in this respect. The Engler viscosimeter and similar instruments are really useless for comparing the consistencies of the heavier grades of road tars, and Lunge's immersion tar-tester has obvious defects as a standard instrument. The carefully standardised Hutchinson viscosity gauge, which is now so widely used in this country for controlling the consistency of road tars, does not appear to be properly appreciated by Professor Lunge, as he gives merely a bare reference to the number of Hutchinson's patent. But he even ignores English methods of using and testing road tars to the extent of making no mention of the Road Board Specifications for Tar and Pitch, which are now incorporated in the Engineering Standards Committee's Specifications.

The ignorance of English practice and methods which these examples display would be excusable in a foreign work, written primarily for the technical men of another country and merely translated into English. But Professor Lunge's "Coal-

Tar and Ammonia " purports to be an original standard work, written by him in the English language, and since it is much more bulky and costly than its counterpart in the German language (which he has prepared with the aid of Dr. Köhler), it is not unfair to expect in it some account of modern English standards and methods of testing tar. The expectation will, however, be realised in very few sections of the treatise.

In some respects the volume on *Ammonia* is less disappointing than the two volumes which deal with *Coal-Tar*, perhaps because methods and uses differ less in various countries with *ammonia* than with *coal-tar*. There is no other work on *Ammonia* which is quite so authoritative and comprehensive, but there is too much patchwork about the present edition to make even this volume of Professor Lunge's handbook an ideal technical work of reference. Further, so long as the treatise retains its present pretensions and size, there is no sufficient reason why the volume on *Ammonia* should be so closely attached to the volumes on *Coal-Tar* as to have a common index and be sold only with them. It is always troublesome to have to take down a second volume for the index of the volume in one's hand, and with a little compression, which would be wholly to the benefit of the treatise, Professor Lunge's "*Coal-Tar*" could be published in one volume complete with index, and his "*Ammonia*" in a second volume with separate index—as, indeed, is the case with the German counterpart of the handbook. The form of the present work makes it cumbersome in use and involves an unfair drain on the pocket of the reader who is interested in *Coal-Tar* or in *Ammonia*, but not in both.

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