DISCUSSION.

Mr. R. S. Hutton and Mr. W. Murray Morrison (*communicated*): In the June issue of the *Electro-Chemist and Metallurgist* we find a note to the effect that M. Adolphe Minet's paper on "The Electric Furnace" will be published in the July issue.

It is unfortunate that discussion on this paper was not possible at the Faraday Society meeting, at which it was presented and taken as read, or that its publication in the Society's organ could not be postponed until such discussion could take place. Under these circumstances we think it advisable to communicate a few remarks on the paper in the hope that they may be published along with it.

We do not wish in any way to seem ungrateful for the trouble which the author has obviously taken in the preparation of this paper, and we feel that it is particularly from France that such a communication is welcome. We regret, however, that M. Minet should have dealt with his subject in a manner which, to say the least of it, is somewhat misleading to those desirous of following the course of development of electric-furnace work.

The difficulties of presenting an accurate historical sketch of any branch of scientific or technical activity are undoubtedly great, and are complicated by controversial and side issues. M. Minet has not altogether avoided controversial points, and has omitted, or only briefly mentioned, many of the well-established landmarks of development, thus presenting an erroneous view to those not familiar with the history of the electric furnace. True, he states that he wishes to mark only "certain historical points"; but surely this is all the more reason that such points should be those of special merit.

In the paragraph headed "First Period" (Laboratory Furnaces), which period, by the way, in the author's view, extends from 1808 to 1886, we are seriously informed that Borchers in 1880 "produced some calcium carbide."

In the "Second Period" (Industrial Furnaces) we find the name of Minet associated with the electrometallurgy of aluminium as closely as that of Hall and barely second to that of Héroult.

Again, under the heading, "Development of the Industrial Applications of the Furnace," we are told that "Borchers and Acheson perfected their first furnace." The former is well-known as Professor at the Technical High School at Aix-la-Chapelle, but this is the first occasion, we imagine, on which his name has been linked with that of E. G. Acheson, who has done so much towards the *industrial* application of the electric furnace. The name of Borchers is again singled out in connection with sodium and other furnace applications, to the exclusion of inventors whose processes are not only better known, but which are also industrially applied on a large scale.

Goldschmidt, we are told, "invented aluminothermit," whereas the honour of invention as distinguished from the credit of development belongs rather to Vautin.

In a communication dealing with the development of the electric furnace it is surprising to find the name of that indefatigable investigator, Henri Moissan, barely mentioned, one of the few references to him being to the effect that particulars of some of his work can be found in Minet's *Traité d'Electrometallurgie*. Turning to the "Bibliography," it is a further disappointment to find that the author has not taken advantage of the seven pages allocated to this portion of his paper to give a better collection of references. The omissions are serious and far too numerous to admit of recapitulation, as are also mistakes, such as ascribing several important inventions to patent

agents instead of to the real inventors. This latter peculiar error also finds its way into the "Classification."

There are many minor errors in the paper in addition to these larger ones which we have called attention to, specifically or otherwise; this note must not, therefore, be taken as anything approaching an exhaustive criticism.

In conclusion we may remark that of M. Minet's previous communications Germany has succeeded in obtaining one with a very similar title, but which has an advantage over that presented to the Faraday Society in possessing a very large number of illustrations (*Elektrochem. Zeitschrift*, 1903, June and following numbers).

We feel that we have said enough to attain the object we had in view—that of warning the possible student against acceptance of all the author's statements.

This type of paper is too apt to be filed and referred to in future years as accurate.

M. Adolphe Minet (*communicated reply*): I have, in the first place, to thank the Faraday Society for the kind reception which they have given to the first portion of my general study on Electric Furnaces. After the reading of this first communication it was decided to postpone the discussion until the autumn, in order to give the author an opportunity of completing his study and illustrating it. Mr. Hutton and Mr. Morrison, however, impatient to save as quickly as possible from the errors of the author those who are interested in the development of the electric furnace, have not deemed it advisable to wait until the time fixed for the open discussion before sending in their remarks.

Is it indeed so certain that the author is responsible for errors so grave as to falsify the ideas which should be current to-day on electric furnaces and their development, and that Messrs. Hutton and Morrison therefore have good reason for raising so quickly their cry of alarm?

I beg of Mr. Hutton and Mr. Morrison to be good enough to read again very carefully this first part of my study, and, above all, to note that I myself have warned the reader against possible omissions which forgetfulness can so easily be responsible for in a very short introduction to so vast a subject.

I have undertaken the present study in order to help to establish the questions connected with electric furnaces on a firm basis, and, in addition, in order to *correct* a certain number of errors which have been current during the last six years, and not to propagate *new* errors.

Being one of the oldest electrometallurgists living—my first experiments date from 1873—one cannot refuse me a certain measure of experience in a subject which I have discussed so often and, moreover, with such careful impartiality for the last twenty years in journals and in books. This reason should compel the reader to follow me with perhaps a little more confidence than that which Messrs. Hutton and Morrison permit themselves.

To deal now with the specific points raised by my critics, I have not put forward as a fact characteristic of the "First Period" the production by Borchers in 1880 of calcium carbide; I merely wished to say that this German investigator studied during that period several types of resistance furnaces, and incidentally he produced calcium carbide without, however, pushing his experiments in this direction to the extent Wöhler, Travers, Maquenne, and Moissan carried theirs before Willson and Bullier emphasised its industrial importance and prepared it on a large scale.

In the "Second Period" I simply said that the electrometallurgy of aluminium was worked out by Hérault, Hall, and Minet more or less simultaneously, each in his own way, reserving for future communications

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fuller developments of these questions. For the moment I shall not enter into controversy on this subject.

In the "Third Period," if I have associated the name of Borchers, whose work has up to now been confined within the walls of the laboratory, with that of Acheson, whose discoveries are mostly industrial, it is because the furnaces conceived by these physicists are of the same type; but each of them, in future developments of my work, will form the subject of a special paragraph.

Messrs. Hutton and Morrison appear to me to be very severe on Borchers; I know that the latter has many detractors, but he ought in reality to be looked upon as an investigator of merit, whose work is increasing in value every day, and who will doubtless in time take the high rank among metallurgists which he is aiming at. Similar observations apply to M. Moissan, who likewise possesses enthusiastic admirers as well as irreconcilable opponents; it is along the middle path that the truth is to be found, and that the reader will find in the section of my future work which I hope to devote to the researches of that *savant*.*

It is the custom to cite the name of Herr Goldschmidt to the detriment of all others, when speaking of aluminothermit. This is, perhaps, a mistake; but it is equally wrong to cite that of Mr. Vautin in disparagement of that of Herr Goldschmidt. A later examination of this matter will reveal more clearly the proportion of merit which rightfully belongs to each of these two engineers.

Without waiting to see the end of my study, Messrs. Hutton and Morrison prefer that which appeared in 1903 in the *Elektrochemische Zeitschrift*, on account of the illustrations included in the latter. I have no reply to make to this statement.

In conclusion, Messrs. Hutton and Morrison in their criticism have not mentioned either a new name or a new application among the names of authors and applications which I have doubtless omitted. Their criticism is of such a kind that if my study were to end here, the reader would only derive, from the fact of the appearance of this criticism, one single item of real profit; namely, that the name of Vautin should be substituted for that of Goldschmidt when treating the subject of aluminothermit from the historical point of view.

* Mr. Edward Arnold is on the point of publishing an English edition of a work of M. Moissan that has already appeared in France and Germany: *Experimental Researches with the Electric Furnace*.