a curious phenomenon in connection with this high tapping, viz., the frequent difficulty of coagulating the latex.

One lecturer, Mr. J. B. Carruthers, deals with the possibility of rubber for pavements for roadways, and mentions the rubber pavement under the archway leading to Euston Station, which was laid down in 1881. In 1902 the pavement was found to have worn down to ⅝ of an inch in the thinnest places. This rubber pavement cost less than three times as much as wood or asphalt, but the life of wood or asphalt was four years, and the life of a rubber pavement twenty years. The book is well illustrated throughout, and there are some interesting maps of Ceylon, Perak, &c., showing lands under rubber or alienated for rubber. L. C. B.

Some Modern Conditions and Recent Developments in Iron and Steel Production in America. By Frank Popplewell. Pp. x+119. (Manchester: University Press, 1906.)

THIS report contains an account of a visit to the iron and steel-producing centres in the United States from September, 1903, until April, 1904, made by the author as Gartside scholar of the University of Manchester. It comprises an introductory sketch of the metallurgy of iron and steel, some general considerations on the extent of the American industry, and descriptions of the raw materials used, of the production of pig iron, and of the manufacture of steel and of rolled steel products, and, lastly, some notes on American labour and education.

The author employed his time well, and has given a clear idea of modern conditions. The important subjects of the Steel Trust, organised labour, and railway transport are not touched upon, and the report suffers from the disadvantage that progress is so rapid in America that in the interval that has elapsed between the visit and the publication of the report many important changes have been effected which have rendered some of the information collected antiquated, and much of the interest has been impaired by the publication of reports by later visitors, notably in the German work by Dr. H. Levy, and in papers written by members of the Iron and Steel Institute who took part in the New York meeting of that society. Thus there is no mention of the most interesting novelty in blast-furnace practice, namely, Mr. Gayley's desiccation of the blast by a preliminary chilling of the air before its admission to the cylinder of the blowing engine, nor does the index refer to the Talbot continuous steel-making process which, first used at Pencoyd, has proved surprisingly economical in this country. Mr. Popplewell gives, however, a clear exposition of the results of specialisation in production, of the development of ore-handling machinery, and of the general use of the charging machine, features that characterise American practice. He shows, too, that the colossal blast furnace with huge yield due to high-blast pressure, regardless of consumption of steam and boiler coal, is giving place to a blast furnace of more modest dimensions, with a maximum height of 80 feet or 85 feet, for the treatment of fine ores.

The impression derived from reading Mr. Popplewell's report is that many of the most striking developments, admirable as they are, were designed to meet special wants, and are not necessarily applicable in Great Britain. Thus, to give one example, the enormous stock piles called for by the intermittent navigation of Lake Superior are not required in districts where supplies arrive continuously throughout the year.

LETTERS TO THE EDITOR.

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The Positive Charge Carried by the α Particle.

IN a letter in NATURE (August 2, 1906) I gave an account of some experiments which I considered proved that the α particle as initially expelled is not charged, and I also gave an account of the same work in a paper read before the British Association at York last August. Although I have no reason to doubt the accuracy of the experiments published in my letter, I do not now consider them sufficiently conclusive, as some recently published researches on the α particle have to be taken into account in their interpretation. I refer chiefly to a paper published by Rutherford shortly after my letter (*Phil. Mag.*, October, 1906, p. 348), in which the view is put forward that the α particle carries two atomic charges.

Now the reasoning in my letter was based on the assumption, then held universally, that the charge on the α particle was the indivisible single atomic charge, and it was not necessary at that time to contemplate the possibility of any intermediate condition existing between the α particle charged and uncharged. But it is clear that if, as Rutherford considers probable, the α particle carries a multiple charge, the results I published in my letter do not by themselves suffice to prove that the α particle as initially expelled is uncharged, for it might possess a fraction of its final charge initially, obtaining the remainder and becoming correspondingly easier to deviate magnetically in its passage through matter. This is, of course, a contingency not contemplated in my original conclusion.

I had hoped long ere this to submit this point to an experimental test, which is simple enough to do by varying the strength of the field. But I very much regret I have no longer the essential facilities necessary to carry on the investigation, particularly the means of obtaining a steady supply of liquid-air, and there does not appear to be any immediate prospect of my being in a position to repeat the experiments. The question at issue is a somewhat fundamental one in the relations of electricity and matter, and, of course, cannot be finally settled by any one series of experiments, but only after long-continued and frequently verified observations. But I can neither continue the investigation nor even repeat the experiments I have already made, so nothing remains but to withdraw what I have already published. FREDERICK SODDY.

The University, Glasgow, February 26.

The Rusting of Iron.

IN NATURE of February 21 (p. 390) appears a letter from Prof. Wyndham R. Dunstan in which he represents me as having concluded "that carbonic acid is essential to the rusting of iron, and that rusting does not occur in its absence." As such a general statement, without reference to the context of the paper to which Prof. Dunstan refers, may prove misleading, I shall be obliged if you will allow me to point out that the main and incontrovertible conclusion drawn from experiments extending over a prolonged period is that iron does not undergo oxidation in presence of oxygen and water. If, however, a minute quantity of acid (either carbonic acid or *any other acid capable of attacking iron*) be present, the metal is first converted into ferrous salt, which subsequently oxidises to rust. Samples of iron which contain such impurities as sulphur, phosphorus, and carbides may give rise to free acids when in contact with water and oxygen, and under these conditions rusting may be expected to occur, even if carbonic acid be rigorously excluded.

Prof. Dunstan does not inform us if he adheres to his definitely expressed views "that iron, oxygen, and liquid water are alone necessary for the rusting of iron to take place," and that "hydrogen peroxide is a necessary intermediate product of the chemical change involved in rusting," but he confines himself to stating again that acid potassium chromate, a substance which destroys hydrogen