polates in others crude statements which render them ridiculous, he does an injustice to the authors to whom he acknowledges his indebtedness, and he shirks responsibility by saying that "these notes do not lay claim to originality." Could anything be more misleading than the following description of sun-spots on p. 148? "They seem to rise suddenly to a great height, cool, and then sink back into the photosphere. They are due to uprushes of incandescent hydrogen, and are identical with the red flames seen during an eclipse." And the figure that accompanies this text cannot be a sun-spot at all, but must be something else inserted by mistake. Another blunder occurs on p. 59, where a section of an intermittent spring is shown upside down. The figures are mostly very coarse and poor, especially the moraines on p. 62, the section through a cinder cone on p. 89, and one of a volcano on p. 90; whilst the two figures of ocean bottoms on pp. 102 and 103 give a very wrong idea of their nature. There is, of course, a deal of information in the book, but no attempt is made to give it interest. In fact, although the author is a teacher of physiography, it is very evident from his work that he has not paid attention to the practical side of his science, or verified any of the phenomena he essays to describe. As a book of reference the work before us is untrustworthy; and as a work for students of elementary physiography it is useless and much to be condemned.

Thomas Sopwith, M.A., C.E., F.R.S.; with Excerpts from his Diary of Fifty-seven Years. By B. Ward Richardson, F.R.S. (London: Longmans, Green, and Co., 1891.)

MR. SOPWITH died in 1879 at the age of seventy-six. He was not eminent as an original scientific investigator, but he was a man of great vigour and freshness of mind, and had won the affection of a wide circle of friends by his genial and happy temper. For many years he resided at Newcastle as an engineer and railway surveyor. Afterwards he removed to Allenheads, where he served as the chief agent of Mr. T. W. Beaumont's lead-mines in Northumberland and Durham. Dr. Richardson's book will recall Mr. Sopwith vividly to the minds of his friends, and it contains many things which will be of interest even to readers who were not personally acquainted with him. During the long period of fifty-seven years he kept a diary regularly; and of this, of course, Dr. Richardson has made liberal use. The extracts show that Mr. Sopwith studied closely the currents of scientific opinion, and formed his own judgment about them in a shrewd and independent spirit.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Electric Transmission of Power.

YOUR article of the 1st inst. on the International Electrical Exhibition (p. 522), says: "In those days (before 1879) two wrong notions misled people—the one, that the maximum efficiency of a perfect electromotor could be only 50 per cent.; the other, quoting the remarks of Sir W. Siemens, 'in order to get the best effect out of a dynamo-electric machine, there should be an external resistance not exceeding the resistance of the wire in the machine.'"

These two notions are really one: the first follows by immediate inference from the second.

Your article says a little further on: "At the British Association in 1879, Prof. Ayrton exposed the fallacy of assuming that 50 per cent. was the maximum efficiency theoretically obtainable from an electromotor. . . . This was perhaps the first time that it had ever been suggested that the efficiency in electric transmission of power could be more than 50 per cent."

This is a mistake as to historical fact. Many years ago, I am not sure of the date, but it was long before the dynamo was invented, I had some conversation with the late Prof. Joule about mechanical equivalents and motive power, in which he told me that an electromotor (worked, of course, by a voltaic battery) had shown a very high percentage of efficiency—I think he said 79 per cent., and I am sure it was far above 50. I said, "How is that compatible with Ohm's demonstration that the efficiency of an electric circuit is at a maximum when the resistance of the battery is equal to that of the rest of the circuit?" to which he replied, "The maximum effect, in Ohm's theorem, does not mean the maximum work done by the oxidation of a given quantity of zinc, but the maximum effect obtainable from a given surface of zinc plates." "I see," said I, "just as in the case of the steam-engine, the problem of getting the maximum of useful effect from a given weight of coals is a different one from that of getting the maximum of power from a given area of piston."

This appears to be an instance of a truth being grasped by one of the great masters of science long before it passed into general teaching. And it is also an instance of a truth being so mistaken as to mislead: Ohm's law was evidently understood to bear a significance that it did not really bear.

Belfast, October 13. JOSEPH JOHN MURPHY.

[That Joule had clear and correct views regarding the efficiency of an electromotor driven by a voltaic battery was pointed out some years ago, being mentioned, for example, by Prof. S. P. Thompson in his book on "Dynamo-Electric Machinery." But in the paragraph quoted by Mr. Murphy from NATURE of October 1, the expression "electric transmission of power" had reference to the combination of apparatus exhibited at the lecture in question—had, in fact, the meaning usually attached to this expression, viz. the employment of a dynamo to convert mechanical energy into electric energy at one end of a pair of wires of some length, and the employment of a second dynamo at the other end of the wires to convert the electric energy back again into mechanical energy.

Now, not only would it have been somewhat difficult to foretell what would be the combined efficiency attainable by the employment of two dynamos as generator and motor, at a period "long before the dynamo was invented," but even down to 1879 no one had succeeded in practically transmitting power by means of this combination with an efficiency of as much as 50 per cent. over a distance of even one mile.

The only direct-current dynamo in common use at that date was the series-dynamo, and that machine, as is well known, differs radically in its behaviour from a voltaic battery. For while it is when a voltaic battery is developing a very small current that it gives power most economically to the outside circuit, the series-dynamo, when only a very small current is passing through it, develops practically no electromotive force, no power, and therefore has a very low efficiency. Hence, although electricians were undoubtedly mistaken in fancying that there was a theoretical limit of 50 per cent. in the efficiency when two dynamos were employed in the transmission of power, neither the error, nor its correction, were of that obvious character in 1879 that one might imagine from reading Mr. Murphy's letter.—W. E. A.]

Rain-making.

IN 1883 I published in NATURE (vol. xxviii., p. 83) an account of some experiments which I made to explain the curious phenomenon commonly seen at the Bocca of the Solfatara of Pozzuoli: paper or brushwood is kindled near the fumarole, and the action of the flame, even when its duration has been very brief, is observed for some time after in the relatively great increase of cloudy vapour that appears to roll out of the Bocca and to rise from the surrounding minor fumaroles. According to Prof. Arcangelo Scacchi, this increasd condensation of vapour is due to the carbon dioxide produced in the combustion; this gas causing condensation from the highly saturated medium in the same way as fumes become visible when concentrated hydrochloric acid is exposed to ordinary air. My experiments of 1883 tend to show that not only carbon dioxide, but (in accordance with the views of Dr. Aitken on the formation of cloud or mist) the increase of solid corpuscles made to float in