minimum. The worked-out exercises show that the mode of working is easy of apprehension and leads to correct results. A merit of the book, for frequent use, is that it is handy in form and very clearly printed.

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. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.*]

The so-called "Bunsen-Pump"

PROF. ROSCOE, *President* of the Chemical Society of London, in enumerating the works of his friend Prof. Bunsen, says, in NATURE of the 28th ult. ("Scientific Worthies," vol. xxiii. p. 600):—

"To him we are also indebted for the apparatus for accelerating filtration, the 'Bunsen-pump,' together with all its appliances, now employed in every laboratory."

This assertion requires correction. The pump used by Prof. Bunsen for accelerating filtration was invented by me, and not by Prof. Bunsen, as would appear from the use of his name in connection with it. I described the construction of the "WATER-air-pump" distinctly and plainly in the *Journal* of the Chemical Society of London for January, 1865, under the title, "Researches on the Vacuum: I. The Instruments" (not the instrument, as some will read), and I sent a copy of this paper to Prof. Bunsen, inscribed with a suitable allusion to our former relationship as pupil and teacher, during the spring of 1865. Three years later Prof. Bunsen published his paper, "On the Washing of Precipitates," in which he described again my pump, *but unfortunately omitted to quote my paper of* 1865.

The following is a translation of Prof. Bunsen's own words:—

"To create the difference of pressure for filtration one cannot employ any of the air-pumps commonly used, especially not the mercury-air-pump, as the liquids to be filtered contain not unfrequently chlorine, sulphurous acid, sulphuretted hydrogen, and other substances, which would destroy the metallic portions of the apparatus. I therefore employ a water-air-pump constructed of glass on the principle of Sprengel's mercury-air-pump, which for all chemical purposes is, as I believe, preferable to every other apparatus for air rarefaction, where it suffices to push the rarefaction no further than to a pressure of mercury from 6 to 12 millimetres" (*Ann. Chem. Pharm.*, 1868, vol. cxlviii. p. 277).

The peculiar stress laid here on the uselessness of mercury-air-pumps, and on the fact that chlorine attacks mercury, combined with the omission of all reference to my paper, where both *water and glass* are mentioned, gave to Prof. Bunsen's description of the instrument a colour of originality which Prof. Roscoe (and with him many others) thinks right to support and to perpetuate by calling it the "Bunsen-pump."

As this misnomer has been already the subject of a disclaimer from Prof. Bunsen (NATURE, vol. vii. p. 241), of remonstrances both from myself (vol. vii. p. 241), from Prof. Frankland (vol. xiv. p. 74), and from others, I am sorry to see that Prof. Roscoe should continue to use this designation, which is intended to honour an "*employer*" of the instrument, which hurts the feelings of its inventor and deprives him of his only reward—the satisfaction of being credited with having placed a useful servant at the disposal of science and industry.

If any other inventor less eminent than Prof. Bunsen had made the omission which I have pointed out with much reluctance, no one would persist in giving his name to my child, nor (reversing the case) would anybody speak of a pump as "Sprengel's pump," if I had received from Prof. Bunsen the paper of 1865 and said in 1868, "I therefore employ a water-air-pump constructed of glass on the principle of Bunsen's mercury-air-pump." H. SPRENGEL

Savile Club, London, May 7

[I have read the foregoing note of expostulation from Dr. Sprengel, and I regret that I have hurt his susceptibilities. That Dr. Sprengel first enunciated the principle both of the water- and of the mercury-air-pump no one can doubt. But that Bunsen devised a water-pump suitable for filtration there can be as little doubt. Hence in speaking of a "filter-pump"—as every chemist knew I was doing—as contradistinguished from an "air-pump," I conceive that I am justified in using the words "Bunsen-pump."—H. E. ROSCOE.]

Tide-Predicting Machines

THE recent discussions respecting tide-predicting machines have called to mind a very old invention of my own, which, although originally designed for a different purpose, seems to me capable of solving the required problems with all attainable accuracy.

I communicated to the British Association at Cambridge in 1845 "A description of a Machine for finding the Numerical roots of Equations and Tracing a variety of useful Curves." An abstract of that paper may be found at pages 3, 4, of the *Transactions* of the sections. About the same time I lithographed for private distribution a more detailed account of the proposed machine, illustrated by diagrams. It begins with the remark that "Persons engaged in testing theory by experiment have frequently derived great assistance from mechanical contrivances, which give rapid and near approximations without the trouble, in every separate case, of going through tedious multiplications and additions. The proposed machine would be capable of giving values of $\Sigma\{b \cos(n\theta + \alpha)\}$, or of tracing the curve $\rho = \Sigma\{b \cos(n\theta + \alpha)\}$."

At page 2 it is shown how it was proposed to trace the curve $\rho = a + b \cos(n\theta + \alpha)$. It is then remarked that, in the same way, it would be possible to trace the curve $\rho = a + b \cos(n\theta + \alpha) + b_1 \cos(n_1\theta + \alpha_1) + b_2 \cos(n_2\theta + \alpha_2)$, &c. Then follow a variety of suggestions for the practical use of the instrument, and at page 7 there are the following suggestions for the construction of a machine:—

"As toothed wheels cannot be employed to turn the circles (A_1), (A_2), &c., I have made use of a combination of the endless screw and toothed wheels so that the error of the wheels is almost destroyed. *H* (Fig.) represents a handle attached to an axis on which are mounted toothed wheels t_1 t_2 t_3 . . . which gear with the wheels T_1 T_2, &c., mounted on separate axes, each having a portion of a very accurate screw. These act on the circumferences of the circles (A_1) (A_2), &c., and cause them to revolve uniformly, as in Ramsden's dividing engine, &c." The large diagram shows four of these (A) circles, each of which gives one term, $b \cos(n\theta + \alpha)$, and these terms are summed by the help of a chain, such as is used to wind up watches, passing over pulleys carried by frames free to oscillate in parallel directions. I inclose copies of the lithographed description of the instrument.

May 9 F. BASHFORTH

Sound of the Aurora

IN NATURE, vol. xxiii. p. 484, one of your correspondents speaks of the sound of the aurora as "crackling," or as that of "the flickering of blazing fire," while another describes it as like the "rustling or switching of silk." On Monday, April 12 last, there was an electric storm here, and at 7 p.m. when I walked home (the blazing lightning leaving but *momentary intervals* of darkness), I heard all round me the constant crackling or rustling of blazing flames. Towards the north-west across a low arc near the horizon pale sheet lightning swayed quickly to and fro. There was no rain at the time, that came heavily afterwards. The sound of flames was close round me, and others had the same experience. No one I can find has ever seen lightning so completely fill the air or heard such strange sounds. F. C. CONSTABLE

Karachi, April 25

Meteorological Bibliography

I AM compiling a classified bibliography of meteorological science, and being desirous of rendering it as full as possible, I should feel much obliged if you would intimate to meteorologists that by sending copies of their papers to me they would do much towards helping on the work. The publication of this bibliography has already commenced in "The Scientific Roll."

6, Kent Gardens, Ealing, W. A. RAMSAY

An Optical Illusion

THERE is an exquisite optical phenomenon of which I (and doubtless many others too) would be glad to see a really scientific