language or refined rhapsodies on rural life and scenes, but in natural vigorous words Bettesworth—that was the name of the labourer—gives his opinion upon sundry persons, places and things he has known. The ethnographer will here and there find descriptions of country customs and remedies which will interest him.

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.*]

Relative Velocity in Streams.

IN your review of the report of M. Vallot from his observatory on Mont Blanc (p. 31) you speak of his finding that a stream ceases to increase in speed in a channel of greater incline than 3 in 100 as something unexpected.

For more than twenty years I have contended, in repeated publications, that friction against the bed increasing progressively from the middle to the margin divides every stream longitudinally into two halves, which roll spirally toward each other. This spiral being determined by the friction, its helix rises with the speed, or the increased friction depending on the speed, which in turn depends on the slope of the channel. It follows that beyond a certain speed the stream loses all the momentum gained by its fall in beating with the two outward-moving undercurrents against the channel walls. In this way the stream attains its kinetic equilibrium. If glaciers are plastic or viscous bodies, they, too, must obey the same laws.

Louisville, Kentucky, U.S.A. D. T. SMITH.

Change of Pitch of Certain Sounds with Distance.

IN NATURE of December 12 (p. 129), Mr. F. M. West describes an observation made while walking up and down the platform of a railway station. The pitch of the sound caused by the steam escaping from an engine rose as he retreated from it and fell as he drew near to it.

As I gave the explanation of the same phenomenon in *Les Archives Néerlandaises* (Arch. Néerl. Livre jubilaire, November 1901), I may be permitted to give a summary in these pages.

The pitch will not only rise by retreating from the engine, but also by bringing the ear nearer to the ground. The pitch is due to reflection of the sound from the platform itself, for when a large board is laid down on the ground between the engine and the observer, the pitch will be heard to rise when the board is raised.

It is clear, therefore, that the pitch can be caused by interference of the direct and the reflected sound-waves, a phenomenon wholly similar to Lloyd's experiment with light-waves. As in Lloyd's experiment the elementary colours of the white light are separated in space, so here the different pitches of sound will predominate in different points of space, and a sort of sound-spectrum will be formed.

A mathematical examination enables us to analyse the irregular vibration of a noise during a short time, according to Fourier, into a series of harmonic vibrations. Moreover, it can be proved by calculation that the interference of the direct and the reflected sound-waves must cause at any spot a series of (impure) pitches to be heard. The wave-lengths of these pitches must be 1/1, 1/2, 1/3 . . . of the difference of distance travelled over by both sounds.

An experimental examination, made at the platform of a railway station, has shown me that the pitch of the noise of an engine fully agrees with the theory, so far as the impurity of the pitch permitted an exact experiment to be made.

When the noise of a waterfall or rustling trees is perpendicularly reflected by a wall, Baumgarten has observed the change of pitch in the vicinity of this wall (Müller-Pouillet, "Lehrbuch der Physik," i. p. 732). The above-mentioned result is also applicable in this case. In the neighbourhood of a waterfall I obtained experimental results perfectly agreeing with theory. D. VAN GULIK.

Apeldoorn, December 15.

CHEMICAL INSTRUCTION AND CHEMICAL INDUSTRIES IN GERMANY.

JUST now, when men of science and educationists are continually directing attention to the superiority of German educational and industrial methods, especially in the domain of chemistry, a report published among the "Miscellaneous Series" of the Foreign Office is most apposite, and should be studied by all who are truly interested in the educational and commercial welfare of the nation.

The object of the report, which is compiled by Dr. Frederick Rose, His Majesty's Consul at Stuttgart, is "to show to what extent the German chemical industries have benefited by the sums expended by the German States on chemical instruction." A perusal of the contents of this highly interesting and instructive report shows us that the German technical high schools or polytechnics differ *in toto* from those of the United Kingdom. They are, in fact, more like our University colleges, *e.g.* Owens College and Mason College (new University of Birmingham). The older Universities in Germany began to study chemical technology about the middle of the seventeenth century. They thus laid the foundation-stone of the present-day industrial chemistry for which the country has become famous. As trade and chemical industries gradually advanced, the Universities were found inadequate to train the greatly increased number of chemists who were required. The polytechnics (now called technical high schools) were consequently founded. These are, without exception, products of the nineteenth century. One must not, however, lose sight of the fact that it is only within the last two generations that the technical high schools have assumed such prominence. They had first to learn what was required of them if they were to exert a really beneficial effect upon the welfare of the country. On p. 8 of the report the following words appear, which we trust some of our technical educationists will take to heart:—

"The study of architecture, engineering and chemistry at the technical high schools left, at the beginning, much to be desired, as the erroneous opinion prevailed that it was not necessary for the students to devote themselves to the study of scientific works, but rather to acquire a certain practical aptitude in superficial manipulation. . . . Later on, however, it was clearly perceived that the scientific foundation laid during the scientific courses at the technical high schools formed the soundest basis for the practical experience to be gained during professional life."

In the British polytechnics the teaching staff have no social status, and the scale of remuneration depends entirely upon the governing body, who have usually great difficulty in making both ends meet. But in the Prussian technical high schools, which are under the direct control of the State, the members of the professional staff possess the rank of full State officials, and the salaries are regulated according to certain fixed limits. Indeed, so deeply is the German Emperor convinced of the importance of technical education that he has caused the directors of the Prussian technical high schools to be admitted to the Prussian Upper House, while a short time ago at the centenary of the Berlin Technical High School he conferred upon the Prussian technical high schools the right to confer a new degree of Doctor of Engineering, thus practically raising the technical schools to the level of the Universities.

Before the students are allowed to pass into the technical high schools they must show that they have obtained a preliminary education of a very high order. Whilst it is no unusual thing in our polytechnics to find students who have absolutely no knowledge of the merest elements of arithmetic and who are quite unable