

day, it went a little above 2 feet 4 inches; to-day, however, it has fallen three or four lines. I have a tube which remains fastened day and night in the same spot, in order to make these observations. I think, however, that it will be better not to publish these latter at present but to wait until Pascal's book has come out.

I wish also that you would try to light a fire in your vacuum, and that you would observe whether the smoke goes up or down, and what shape the flame has. One can make this experiment by putting a little sulphur or campher at the end of a thread in the vacuum,* and then setting it on fire through the glass by means of a mirror or burning glass. I cannot make this experiment here because the sun is not warm enough, and I have not yet been able to get the tube adjusted with the bottle. [i. e. the vacuum bulb.—C. A.] I am astonished that you have kept this experiment, as Pascal says, to yourself for four years without having ever said a word to me about it, and that you should not have begun to try it before this present summer, for as soon as you mentioned it to me I judged that it was a matter of importance, and that it might be of great service in verifying what I have written on physics.

COMMENTS ON THE PRECEDING LETTER.

By G. MONCHAMP.

Such is this "lost" letter of Descartes so interesting in the history of science, and wherein he reveals so clearly his own character, his relations with Pascal, his desire to be kept informed of all the novelties in science, and, what is still more remarkable, his fear of announcing *a priori* ideas that might be contradicted by experiment, or, if confirmed, his fear of being suspected of having predicted them after having first tried them experimentally.

We remark also that Descartes states that he had recommended Pascal to determine by experiment whether the mercury rose as high when on the top of a mountain as when at the bottom. Pascal, at the time when Descartes wrote to him about making this observation, had not yet done so, but, on the 15th of November, 1647, he had asked his brother-in-law, Périer, to try it at Clermont. We see here that Descartes claims the idea of this experiment as his own, at least he states that he suggested it to Pascal. The latter had pretended that the idea came spontaneously from himself. This letter from Descartes, added to other documents, proves that Pascal was mistaken.

According to the obvious meaning of the letter above given, it would seem clear that on December 13, 1647, Descartes not only did not know that Pascal had written to his brother-in-law requesting him to make the experiment on Puy-de-Dôme, but he did not even know that he had any intention of so doing. On the other hand Pascal, in the text which he himself gives of the letter of November 16, 1647, to his brother-in-law, states very clearly that Father Mersenne had communicated this intention to Descartes. He says:

Upon this assurance (that you will oblige me by making this experiment on the Puy-de-Dôme yourself) I have led all our friends in Paris to look forward to it, and among others *Father Mersenne who has already pledged himself by letters that he has written on this subject to Italy, Poland, Switzerland, Holland, etc., to inform the friends whom he has made in those countries.*

We see also by this "unpublished" letter that Descartes was the first to add a graduated scale to the barometer and to undertake regular observations with it.

Pascal seems not to have known about the variations in height of the mercurial column, when kept in the same locality, until after the publication of the experiment on Puy-de-Dôme (which took place September 19, 1648). He did not communicate anything about it to Périer until shortly after that time, as stated by the latter:

After I had made the experiment on the Puy-de-Dôme, as above related, Mr. Pascal wrote me from Paris to Clermont where I then was, that not only the change of location (that is to say of altitude) but also the changes of weather at the same place, according as it is more or less cold or warm, wet or dry, causes different elevations and depressions of the mercury in the tube.

* The vacuum chamber was apparently a large bulb blown at the upper end of the barometer tube.

Périer afterward says that he began making regular observations, that he compared them with others made in distant places at the same time, etc. In a word, he speaks and acts in the manner indicated by Descartes, as is shown by our letter and by other letters that have been recently discovered.

We know that on the death of Mersenne (September 1, 1648,) Roberval, the friend of Pascal, seized upon the letters from Descartes to Mersenne which were found in the cell of this monk.

The letter of Descartes on the barometer seems to have been afterward passed from one person to another, for M. Tannery has, it seems to us, demonstrated that it was not revised by Lahire, who had, however, come into possession of those letters left by Roberval in 1675, the year of his death.

In a word, we are led to believe that Pascal in this present case also profited by Descartes.

Finally we will recall that at the beginning of his little pamphlet, Pascal says:

It is now about four years since the glass tube was first tried in Italy. * * * This account of the experiment having been sent from Rome to Father Mersenne, a monk in Paris, he published it in France in 1644, to the great admiration of all the scientists.

This sentence explains the astonishment expressed by Descartes when he says to Father Mersenne, toward the end of his letter:

I am astonished that you have, as Pascal says, kept this experiment to yourself for four years without having said a word to me about it, and without having begun to try it until this summer.

This omission on the part of Mersenne, who was ordinarily very communicative, is partly explained by the failure of the attempts made by him to renew the experiment of Torricelli. Pascal wrote to M. de Ribeyre on this subject as follows:

Father Mersenne tried to repeat it in Paris, and not having made a complete success, stopped it and thought no more of it. Afterwards, going to Rome on some other business, he found out exactly how to do it, and returned with full instructions. The news of this having reached us, in 1646, at Rouen, where I was at the time, we made this Italian experiment following the memoir of Father Mersenne.

These two accounts by Pascal do not entirely agree, and neither of the two contains the exact truth.

Mersenne returned from Italy in July, 1645, tried the experiment again with M. Chanut, and they both tried to reproduce the phenomena, but again failed. Mersenne then had recourse to Petit in September, 1646, and this time he was successful. (*See Adam, "Pascal and Descartes."*)

It is, nevertheless, astonishing that Father Mersenne should have waited almost a year longer without informing Descartes of the great scientific news which had come from Italy. Could Mersenne have positively concealed from Descartes his experiment of 1646?

The manuscript of the letter which we have reproduced seems to have been lost. Notwithstanding the searches recently undertaken, it had not yet been found in 1898, and we do not know that it has been since.

"TULE FOG."

In our search for local meteorological terms not widely known, but sometimes worthy of broader usage, we have come upon the expression "tule fog" as used by Mr. McAdie in a recent number of the Report of the California Section.

According to the botanical dictionary "tule" is a species of bulrush occupying large areas of swamp and overflowed bottom lands in California. Of course, therefore, we infer that "tule fog" is meteorologically equivalent to fogs over marshes and swamps, or the fogs of the lowlands and the valleys. It is essentially due to the cooling by radiation during clear nights. At first the vegetation cools by its own radiation; then the adjacent air cools by contact with the

leaves and branches; after this cool air has settled quietly to the ground it cools still further by its own radiation and by contact with the cooling grass and leaves until fog is formed; the particles of fog then cool by their own radiation and thus the layer of cold air grows upward and the fog grows higher and higher until a little after sunrise.

Observers who look down upon such marshes and valleys from elevated stations would do well to keep a record of the depth of the accumulated layer of fog by noting the points that are still uncovered at its upper edge.

THE "GRAN CULTURA" IN PUERTO RICO.

As the term "Gran Cultura" has no single English equivalent and must, therefore, be bodily transferred from Puerto Rican usage into local English, we take pleasure in publishing the following letter explaining the meaning of the term:

LUQUILLO, PUERTO RICO, Dec. 11, 1899.

Dr. GEDDINGS,
Weather Bureau, San Juan.

DEAR SIR: In reply to your question as to the generally accepted translation of the expression "Gran Cultura," I can only tell you we never have used anything here except the two words themselves. There are two or three ways of applying them, but they all work out to the same end and mean, literally, the canes planted during the autumn of one year (say 1898) for grinding early in the second season after (or say in 1900). It may have some reference also to the fact that such canes very naturally get much more cultivation than those of shorter growth. However, I can only reiterate, it is as customary for us to speak of "Gran Cultura" when speaking to others than Spanish speaking people, as it is to apply to any general English term, and I have never heard anything else down here. In comparing with other West Indian islands it might not apply, as we do not all grind at the same season.

Yours, very faithfully,

ARTHUR C. HANSARD.

SCIENTIFIC ASSISTANTS.

The following extract from pages 64-67 of the Report of the Secretary of Agriculture for the year ending June 30, 1899, illustrates the difficulty that has been experienced by every bureau and division in this great Department and in none more so than the Weather Bureau. The steps that have been taken by Secretary James Wilson to secure men having the requisite special education must commend themselves to every one, and will, we hope, stimulate the development of the land grant and agricultural colleges, and also tend to bring their best graduates on to Washington for further study and a broader field of usefulness.

The great prosperity of the country at the present time has resulted among other things in a largely increased attendance upon our universities, colleges, and other institutions of learning. When we consider that half the people of the United States are occupied in producing from the soil directly, that about three-fourths of our exports to foreign countries come from the soil, and that the \$600,000,000 balance of trade coming to the United States during the last two fiscal years has been, to a great extent, the price of farm products, it is somewhat remarkable that so very little attention is given to the education of half the people of the nation and their preparation for their future life work.

The beautiful valleys of the mountain and Pacific coast States are being injured to a considerable extent by the injudicious use of irrigating waters. The pasture lands of the public domain west of the Missouri River are being rapidly destroyed by injudicious grazing. The wheat-growing area of the country, where crops are grown continuously, are refusing to yield as they did when first brought under cultivation, and from the Dakotas to the Pacific we find systems of fallowing in operation and crops of wheat being taken once in two years, indicating the rapid destruction of the plant food in the soil.

The people cry aloud to this Department for help. We have gone repeatedly, but in vain, to the Civil Service Commission and had them advertise throughout the country for soil physicists in order that we might cooperate with the people regarding the deterioration of their soils. All the older sections of the United States have injured their

soils by injudicious management. A knowledge of plants, their life history, the diseases to which they are subject, their relations to the soil, the climate, the food necessary so their best development, is so scarce among us that plant physiologists and pathologists can not be found by advertising for them.

Animal husbandry is very little understood, and in most of the educational institutions of the country sufficient instruction is not given to make it better understood, yet, from this source we make our most profitable sales to foreign countries. The Biological Survey and other divisions have also to train the men to do their work. When the Department requires the assistance of men educated along these lines it is necessary to educate them in its own scientific divisions, under the direction of its own scientists. When it has trained such men until they become expert and stand at the head of their specialties in the United States (and in many cases in the world), then wealthy institutions take them away by offering higher salaries, interfering with the work of the Department along the lines mentioned, which is so necessary to the producers of the United States.

To meet some of these difficulties and avoid in future their frequent recurrence, I have arranged with the Civil Service Commission to make a register of the graduates of the land-grant colleges of the United States (those endowed by Congress to educate the young farmers of the country). From this registration the scientific divisions of the Department select young men who will assist the division scientists in their work, and have opportunities for post-graduate study and for better preparing themselves along the lines of applied science, whereby the producer is helped by the scholar. We pay these young men no more than we pay a laborer, and much of the work they will perform in the divisions could be performed by skilled laborers.

Slight inquiry into education along the lines of agricultural science will show that there is no university in the land where the graduate of an agricultural college who has been studying along the lines indicated can take post-graduate work. The scientific divisions of the Department of Agriculture come nearer furnishing the necessary facilities than can be found elsewhere. If two or three young men come to each of our scientific divisions and study along the lines of the application of science to production in the field, the stable and the farm factory, the Department will in a few years have a force from which it can not only fill vacancies when wealthy institutions take away trained men, but be able to supply the agricultural colleges, experiment stations, and other scientific institutions in the land with men of superior scientific attainments in these branches.

By this new departure the Department is merely arranging to meet the imperative demands of the producers of the country for help to solve the problems that are beyond their education and their means. The Congress of the United States, in providing for the endowment of agricultural colleges and experiment stations, did more for the agriculture of the country than has been done by governmental agency for the people of any nation. Congress could not endow these institutions with teachers trained in the applied sciences relating to the farm, but Congress has built up the Department of Agriculture and encouraged the development of the foremost scientists known in their several specialties. The step we have taken toward bringing the brightest students of the agricultural colleges to prosecute their studies under the supervision of scientists in this Department is one step necessary to complete the educational system.

Something no doubt remains to be done at the other end of the educational line. The education of the young farmer in the district and high schools should be such as to help him toward the agricultural college. The other educational institutions of the country have done their work well, but so abundantly that the college graduate upon leaving college is not sure of employment that will give the salary of a brakeman on the railroad. Only a very few of those who upon leaving college must earn their livelihood through their literary education are sure of incomes equal to that of a locomotive engineer. The great unexplored field for the educator is along agricultural lines. Half of the people of the United States are interested in it. The prosperity of our country as a nation among nations depends upon it.

I hope to have the approval of Congress in this effort to provide for the higher education of the graduates of the agricultural colleges by appropriations sufficiently considerate to justify the very moderate expense that will be entailed.

BAROMETRIC CORRECTIONS AND REDUCTIONS.

On January 1, 1900, the Weather Bureau will adopt several modifications of previous usages, dictated by the needs of the service and looking to the simplification of records. A knowledge of these new rules will be useful to all who use our data, and therefore we reprint the following extracts from Instructions No. 139 of December 2, 1899:

After January 1, 1900, a specific elevation above sea level will be adopted for each station, and for purposes of record