tailed work.' In addition, the list contains analyses of more than 800 springs, and, wherever possible, the temperature, volume, and character of each spring are given. Only those who have done similar work can appreciate the amount of thankless drudgery involved in this useful paper.

## LETTERS TO THE EDITOR.

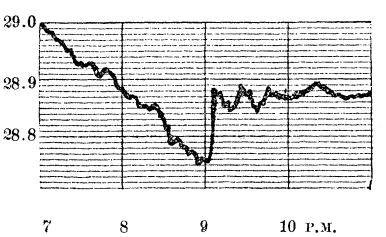
**** The attention of scientific men is called to the advantages of the correspondence columns of* SCIENCE *for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.*

*The editor will be glad to publish any queries consonant with the character of the journal.*

*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### Barometer exposure.

About noon of Feb. 18 the barometer at Blue Hill observatory began to fall rapidly, and continued to do so until about 9 P.M. During this fall the wind steadily increased in velocity, and between 8 and 9 P.M. was blowing almost a hurricane. Immediately after 9 P.M. the hurricane-like roar of the wind suddenly ceased. Glancing up at the observatory barograph, I saw that it was rapidly rising, and within two or three minutes had risen more than a tenth of an inch. The barograph is of the Draper pattern, and multiplies three times. The accompanying diagram is a copy of the part of the barograph trace on Feb. 18, showing the rapid rise in pressure referred




to. There was thunder and lightning for about an hour preceding and following this sudden rise.

The following are the wind-velocities in miles per hour for each five minutes as obtained from a Hahl anemograph: —

| Time (P.M.) | 8.30 | 8.35 | 8.40 | 8.45 | 8.50 | 8.55 | 9.00 | 9.05 | 9.10 | 9.15 | 9.20 | 9.25 | 9.30 | 9.35 | 9.40 | 9.45 | 9.50 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Velocities (miles) | 65 | 60 | 64 | 69 | 71 | 69 | 65 | 31 | 36 | 48 | 35 | 15 | 18 | 30 | 37 | 36 | 33 |

After 9.50 the velocity varied but little for several hours. It is seen that between 9 and 9.05 P.M. there was a sudden decrease in the wind-velocity of about 35 miles, coinciding with the sudden rise in pressure; and, furthermore, each of the less-marked fluctuations of the barograph curve following this is connected inversely with corresponding variations in the wind's velocity.

The change in wind-velocity was evidently connected with the rise of the barograph at 9 P.M.; and the question presents itself, Was the rise of the barograph evidence of an actual existing difference of pressure in the atmosphere, or was it a merely mechanical effect of the wind sucking the air out of buildings while the wind-velocity was high, and allowing it to flow in again as the wind-velocity decreased?

From what we know of the connection of wind-velocities with barometric gradients, it would be anticipated that such a difference of pressure in the atmosphere as would cause a rise of the barometer at any point to the extent of a tenth of an inch in a minute or two, would give rise to an enormous increase in wind-velocity. But, instead of finding the increased wind-velocity with the rise of pressure, there was just the opposite: hence the inference is, that the rise of the barograph was due to the decreased wind-velocity relieving the stress on the air in the building.

On examining the barograph trace obtained by Professor Davis at the Harvard laboratory, ten miles north of Blue Hill, it is found that an almost identical and equal jump of the barograph curve occurred within a few minutes of the rise at Blue Hill; so that, whatever the origin of the rise, it was evidently due to some general cause acting similarly over a comparatively large area.

The observations of the signal service taken all over the United States at 10 P.M. show that there existed at that time a large cyclonic storm central-north of Lake Superior. The circulation of the wind, as well as the bending of the isobars, also give undoubted evidence of the existence, at the same time, of a small secondary over New England.

An explanation of the sudden decrease of wind-velocity hence suggests itself. Previous to 9 P.M. the vicinity of Boston was on the outer edge of the secondary, where the isobars were greatly crowded and the wind-velocity high; but at 9 P.M. it suddenly entered the progressing central area of the secondary, where the pressure was more uniform, and the wind-velocity immediately decreased. This explanation necessarily involves the assumption that the pressure in the vicinity of Boston was lower after 9 P.M. than preceding it, and the apparent rise was merely a subjective effect due to the wind. No other assumption seems to me reasonable, especially when we find at 10 P.M. the wind over a small area circulating around and centring in toward southern New England.

H. Helm Clayton.

Blue Hill meteor. observ., March 25.

### On certain electrical phenomena.

I hasten to acknowledge that I unintentionally misrepresented Dr. Shufeldt in one sentence of my letter in *Science*, No. 213. I was wrong in affirming that he stated that he had never observed such exhibitions in Washington; for what he really said was, that he had never observed them as far as his own person was concerned.

I hope Dr. Shufeldt will be equally ready to admit that he has misrepresented me in his reply to my remarks (*Science*, No. 216), where he has omitted the essential part of one of my sentences, and altered the remaining part, even going so far as to include the 'mangled remains' in quotation-marks. Any one who will take the trouble to examine my first letter will see that what I really advised him to do was to *critically examine* his facts, "possibly eliminating a

few of them," etc. Everybody will understand the meaning of the sentence, which was, that a close examination of what he had assumed to be facts might lead to the rejection of a part thereof.

But it is also perfectly plain that all of this has really no bearing on the point at issue. It is always easy to quibble about words and phrases, while it is not always easy to avoid error in observation or erroneous deductions from correct observations.

If Dr. Shufeldt's observations and conclusions are correct, they are of the highest importance, and they must be subjected to the most searching examination before acceptance. I must still confess that there is much that is mysterious to me in his account of his sensations and observations. I do not understand what he means by saying, "My entire system seems to become thoroughly charged with this animal electricity." His "sense of the most profound relief," etc., in the case of the mulatto girl, is a mystery to me. His inability to use any other than a rubber penholder, and the statement that "even then the constant passage of the electricity is exceedingly exhausting during most of the time," are hard nuts for me to crack. In short, the whole matter hinges upon the question with which my first letter closed, — "Is man one of the extremely small number of animals having specialized electrical organs?" for only in that case is the expression 'animal electricity' properly applicable. In that letter I gave reasons for the belief that all such phenomena, the existence of which was certainly established, were nothing more than cases of accidental electrification by well-known methods and under long-recognized conditions; that under similar conditions no differences among individuals could exist; that such electrifications had been known for a long time, and that no extension of well-established principles was needed for their explanation.

To this statement nothing need be added until Dr. Shufeldt, or some one else, shows that it is insufficient to account for observed facts.

T. C. M.

Terre Haute, March 27.

## A sensitive wind-vane.

In the last number of *Science*, under 'A sensitive wind-vane,' the statement 'The notation is the same as,' etc., should be 'The notation is opposite that,' etc. H. ALLEN.

Washington, D.C., March 25.

As suggested by Mr. Allen in his interesting letter in *Science*, No. 216, it is important first to determine what is meant by a sensitive vane, and still more important, in my judgment, to determine what kind of a vane is wanted in meteorological observations. I have experimented a good deal with both the long, heavy vanes, and those which are short and light. Neither variety, as ordinarily constructed, is satisfactory. I have more than once seen two large 'standard' vanes, on the roof of the office of the chief signal officer in Washington, sullenly staring each other in the face, while a very light breeze held a short and very light vane nearly at right angles to both of them. Such performances are confusing, to say the least. But it seems to me not impossible to have one vane which shall satisfy all the requirements. The desired conditions are to be met with in what is known as the *dead beat* galvanometer. In this, the needle under the action of a steady current, whether strong or feeble, moves to its proper position, does not go beyond it, and does not vibrate about it. This is brought about by making use of a force opposing the movement of the needle, which increases with the angular velocity of the needle, and is zero when the needle is at rest. Something of the same kind ought to be accomplished, and I think may be, for the wind-vane. The force opposing the motion of the vane should increase with its velocity, and *should be zero when the vane is at rest.* If the latter condition is strictly satisfied, it will be infinitely sensitive: the slightest breeze will move it, but the opposing force will prevent violent oscillations. Such a vane will be somewhat slow in its movements, and may not respond to extremely rapid fluctuations in the direction of the wind, through only a few degrees; but I do not believe meteorologists will consider this a serious objection. What is wanted is a vane which will be steady in a high and somewhat varying wind, and which can be controlled by the slightest movement of the atmosphere. About two years ago I suggested what appeared to me to be a solution of the problem. It was to use a small and extremely light vane, so as to reduce ordinary friction to the lowest limit, and then to 'deaden' its motion by means of a liquid damper. This might be applied at the extremity of the axis of the vane produced below the roof, or at any points in that axis. A fan attached to the axis, and moving in a closely fitting vessel of oil or other suitable liquid, would afford almost any desired degree of stability.

Some steps were taken towards the construction of such a regulator, but I do not think it has ever been completed. Possibly the same method may have been experimented upon by others. T. C. M.

Terre Haute, March 27.

## A question for economists in regard to value.

Will not economists undertake to make some agreement as to what the meaning of the word 'value' is to be in scientific discussions? That a uniform meaning be given to this word is most essential to an intelligent discussion of an economic subject.

As an instance of the necessity of such an understanding, see the last number of *Science* ('Professor Marshall on the unit of value'). In that the professor evidently assumes that the market-price of commodities is their 'value.' Yet we all know that the price of a thing may be greater or less than its 'value' or worth. In order to establish a 'unit of value,' the professor proposes a plan whereby the variations of prices of commodities shall be averaged, and that plan implies that a dollar (money-unit) shall be established whose weight shall be increased or decreased from time to time as the average commodity price increases or decreases. All this is a matter of *money* and *price*, and not *value*. The real thing to be determined is what is *value*, and then a measure may be designed for it.

At present there is among economic writers a great confusion in the use of the word 'value.' Some, as Professor Marshall, use it as meaning price (market-price); some, comparative utility; some, exchange value; some, cost of production in terms of human labor; and some, "the average amount of socially requisite labor measured by time" involved in the production of the article. I hold that this last is the