

## Science in America.

The following passage taken from the opening address of Professor Sir William Thomson, on assuming the chair of the section of physical science at the Glasgow meeting of the British Association, will be read with interest as showing the impression made upon an English student of Science by our progress in discovery and practical science:

"Six weeks ago, when I landed in England after a most interesting trip to America and back, and I became painfully conscious that I must have the honor to address you here today, I wished to write an address, of which Science in America should be the subject. I came home indeed vividly impressed with much that I had seen, both in the great exhibition at Philadelphia and out of it, showing the truest scientific spirit and devotion and originality, the inventiveness, the patient, persevering thoughtfulness of work, the appreciativeness, and the generous open-mindedness and sympathy from which the great things of Science come.

"I wish I could speak to you of the veteran Henry, generous rival of Faraday in electromagnetic discovery; of Peirce, the founder of high mathematics in America; of Bache, and of the splendid heritage he has left to America and to the world, in the United States coast survey; of the great school of astronomers which followed—Newton, Newcomb, Watson, Young, Alvan Clarke, Rutherford, Draper, father and son; of Commander Belknap, and his great exploration of the Pacific depths by pianoforte wire, with imperfect apparatus supplied from Glasgow, out of which he forced a success in his own way; and of Captain Sigsbee, who followed with the like fervor and resolution, and made further improvements in the apparatus, by which he has done marvels of easy, quick, and sure deep sea soundings in his little surveying ship Blake; and of the admirable official spirit which makes such men and such doings possible in the United States naval service.

"I would like to tell you, too, of my reasons for confidently expecting that American hydrography will soon supply the data from tidal observations, long ago asked of our government in vain by a committee of the British Association, by which the amount of the earth's elastic yielding to the distorting influence of sun and moon will be measured; and of my strong hope that the compass department of the American navy will repay the debt to France, England, and Germany, so appreciatively acknowledged in their reprint of the works of Poisson, Airy, Archibald Smith, Evans, and the Liverpool compass committee, by giving in return a fresh marine survey of terrestrial magnetism to supply the navigator with data for correcting his compass without sight of sun or stars. I should also tell you of 'Old Prob.'s' weather warnings, which cost the nation \$250,000 a year, money well spent, say the western farmers, and not they alone; in this the whole people of the United States are agreed, and though Democrats or Republicans playing the 'economical ticket' may, for half a session, stop the appropriations for even the United States coast survey, no one would for a moment think of starving 'Old Prob.'; and now that 80 per cent of his probabilities have proved true, and General Myer has, for a month back, ceased to call his daily forecasts probabilities, and has begun to call them indications, what will the western farmers call him this time next year? The United States naval observatory is full of the very highest Science, under the command of Admiral Davis.

If, to get on to precession and nutation, I had resolved to omit telling you that I had there, in an instrument for measuring photographs of the transit of Venus shown me by Professor Harkness (a young Scotchman attracted into the United States naval service), seen, for the first time in an astronomical instrument, a geometrical slide, the verdict on the disaster on board the Thunderer, published while I am writing this address, forbids me to keep any such resolution, and compels me to put the question: Is there in the British navy, or in a British steamer, or in a British land boiler, another safety valve so constructed that, by any possibility, at any temperature, or under any stress, it can jam? and to say that if there is, it must be instantly corrected or removed. Can I go on to precession and nutation without a word of what I saw in the great Exhibition of Philadelphia? In the United States government part of it, Professor Hilgard showed me the measuring rods of the United States coast survey, with their beautiful mechanical appliances for end measurement, by which the three great base lines of Maine, Long Island, and Georgia were measured with about the same accuracy as the most accurate scientific measures, whether of Europe or America, have attained in comparing two meter or yard measures. In the United States telegraphic department I saw and heard Elisha Gray's splendidly worked-out electric telephone, actually sounding four messages simultaneously on the Morse code, and clearly capable of doing yet four times as many with very moderate improvements of detail; and I saw Edison's automatic telegraph delivering 1,015 words in 57 seconds—this done by the long-neglected electro-chemical method of Bain, long ago condemned in England to the helot work of recording from a relay, and then turned adrift as needlessly delicate for that.

"In the Canadian department I heard 'To be or not to be'—'there's the rub,' through an electric telegraph wire; but, scorning monosyllables, the electric articulation rose to higher flights, and gave me passages taken at random from the New York newspapers: 'S. S. Cox has arrived' (I failed to make out the S. S. Cox), 'The city of New York,' 'Senator Morton,' 'The senate has resolved to print a thousand extra copies,' 'The Americans in London have resolved to celebrate the coming Fourth of July.' All this my own ears heard spoken to me with unmistakable distinctness by the thin, circular disk armature of just such another little electromagnet as this which I hold in my

hand. The words were shouted with a clear and loud voice by my colleague judge, Professor Watson, at the far end of the line, holding his mouth close to a stretched membrane, such as you see before you here, carrying a little piece of soft iron, which was thus made to perform in the neighborhood of an electromagnet in circuit with the line motions proportional to the sonoric motions of the air. This, the greatest by far of all the marvels of the electric telegraph, is due to a young countryman of our own, Mr. Graham Bell, of Edinburgh and Montreal and Boston, now becoming a naturalized citizen of the United States. Who can but admire the hardihood of invention which devised such very slight means to realize the mathematical conception that, if electricity is to convey all the delicacies of quality which distinguish articulate speech, the strength of its current must vary continuously, and, as nearly as may be, in simple proportion to the velocity of a particle of air engaged in constituting the sound?

"The Patent Museum of Washington, an institution of which the nation is justly proud, and the beneficent working of the United States patent laws deserve notice in the section of the British Association concerned with branches of Science to which nine tenths of all the useful patents of the world owe their foundations. I was much struck with the prevalence of patented inventions in the Exhibition; it seemed to me that every good thing deserving a patent was patented. I asked one inventor, of a very good invention: 'Why don't you patent it in England?' He answered: 'The conditions of England are too onerous.' We certainly are far behind America's wisdom in this respect. If Europe does not amend its laws (England in the opposite direction to that proposed in the bills before the last two sessions of Parliament), America will speedily become the nursery of useful inventions for the world. I ought to speak to you too of the already venerable Harvard University, and of the Technological Institute of Boston, created by William Rogers, brother of my Glasgow University colleague, Henry Rogers, the Cambridge of America, and of the Johns Hopkins University of Baltimore, which with its youthful vigor has torn Sylvester from us, has utilized the genius and working power of Roland for experimental research, and, three days after my arrival in America, sent for the young Porter Poinier to make him a Fellow. But he was on his death bed in New York, 'begging his physicians to keep him alive just long enough to finish his book, and then he would be willing to go.' Of his book, 'Thermodynamics,' we may hope to see at least a part, as much of the manuscript and kind and able friends to edit it are left; but the appointment of a fellowship in the Johns Hopkins University came a day too late to gratify his noble ambition. But the stimulus of intercourse with American scientific men left no place in my mind for framing or attempting to frame a report on American Science."

## THE LATEST NEWS FROM THE SUN.

There are not many persons living who, with the reverend Director of the Observatory of the Roman College, can lay claim to have minutely examined the face of the sun every day for the past ten years. Father Secchi, moreover, as an astronomer is the peer of Lockyer, Huggins, or Young, and as such his conclusions are worthy of the highest respect. The new edition of his work on the sun, which has lately been published in Paris, embodies the results of his most recent investigations, as well as of those which have extended over long periods of time, and hence it may be regarded as one of the latest dicta of Science regarding the physical constitution of our luminary.

Father Secchi's theory of the sun spots is that they are phenomena of eruption. They result from the upheavals which take place in the solar mass, and form, in the photosphere or luminous envelope, cavities more or less regular, surrounded by brilliant projecting ridges. The depth of these cavities rarely exceeds 3,600 miles—generally it is less—and the hollows themselves are filled with dark vapors which absorb and so cut off the luminous rays emitted by the strata beneath. The physical constitution of the solar mass, and the true nature of the incessant motion of which it is the seat, have been little understood. Now, however, we are in possession of a spectroscopic method of distinguishing the different currents which cross and mingle, of discerning the jets of hydrogen and of incandescent metallic vapors, and observing the rose-colored protuberances which formerly could not be studied, except during a total eclipse, when the bright light of the radiant disk was intercepted. Father Secchi has determined the closest relations between the spots and the protuberances seen on the solar edge.

If the results of a series of observations of solar rotations be considered, it appears that the spots, the most brilliant faculae, and the eruptive protuberances (those which contain metallic vapors) appear as a rule in similar regions on the solar disk, that is to say, in the two zones near the equator and comprised between the 10th and 30th parallels of latitude, and that the majority of these phenomena occur at the same epochs. When a number of individual observations of spots and protuberances are thus compared, this conclusion is often at fault; but this is to be expected, because the protuberances can be seen only on the edge, while the spots and faculae are visible on the face, of the sun. On the other hand, the parallelism of the three orders of phenomena becomes manifest when the results are considered in the aggregate. Moreover, whenever a considerable protuberance rises on the oriental side, it is almost certain that a spot will appear next day in the same place.

Father Secchi therefore considers that without doubt the spots and protuberances are correlated phenomena, and that the spots are a secondary effect of the eruptions which are

revealed to us by the protuberances. It is necessary, however, to note that the latter do not always appear to be true eruptions, as they are often simple jets of incandescent hydrogen which rise from the photosphere like fires from a forge. Such flames cannot produce the absorbent vapors which form the spots. Hence a distinction must be made between eruptive protuberances characterized by the presence of metallic vapors, and hydrogen protuberances where such vapors are not manifest; but, the author adds, traces of the metallic spectroscopic lines are almost always discernible at the base of the hydrogen jets. The difference between the two kinds of protuberances, therefore, while existing, is not clearly defined. Often the metallic lines of the protuberances are visible on the solar disk, and are prolonged as far as the nucleus of a spot near the edge, affording irrefutable evidence that the metallic vapors have their origin near the nucleus. Beyond the 40° parallels, true spots and eruptions are rarely encountered.

The eruptions are probably violent crises produced by chemical combinations which occur at a certain depth below the solar surface. The cooled products of the reactions unite in thick clouds, like those clouds arising from sulphur volcanoes, which fall by virtue of their weight when condensed, and bury themselves in the luminous envelope, while they in turn are quickly invaded by the ambient matter of the photosphere. From all sides tongues of fire penetrate the interior of the spot, and, joining it together in places, divide it into segments. These luminous filaments give to the penumbra its radial structure, and then, becoming as it were dissolved in the obscure mass, lose their brilliancy by cooling. The spot then assumes quite a regular rounded form; a period of calm succeeds the fierce effervescence and the tumultuous and discordant movements which characterize the formative processes. Above the dark nucleus, less intense emanations occur of short and slightly luminous flames, in which the spectroscopic is no longer able to recognize the lines of metals. Then, little by little, the spot diminishes and finally totally disappears.

This theory is believed to account for all the phenomena hitherto observed; and it will be seen that Father Secchi is no adherent of the whirlwind theory, which he somewhat brusquely dismisses as a "fiction destitute of all reality." Out of several hundred spots which he has closely observed he says that but seven or eight show a spiriform structure. This even disappears in a day or two, and often the rotary movement, after becoming slower, is rendered in the opposite direction. The motion, he affirms, is no essential property of the spots.

The physical constitution of the sun, our author sums up as follows: The sun is formed of a fluid incandescent mass, enveloped in a highly luminous photosphere, above which there is yet an atmosphere of less density. The photosphere is a fiery mist, probably of gases which have become luminous through the effect of high temperature and high pressure. Immediately above this, a very thin envelope of metallic vapors mixed with those of hydrogen is encountered. This is the chromosphere, and its thickness is from 10 to 15 seconds of arc. Beyond the chromosphere again there is a vast envelope composed of hydrogen and of two unknown substances which produce the yellow spectrum line D<sub>2</sub> and the line 1,474, and to one of which the name "helium" has provisionally been given. During total eclipses of the sun, the outer envelope becomes visible and produces the phenomenon of the corona. Finally the vast eruptions throw forth jets of hydrogen to heights equal to one fourth the solar diameter, 324,400 miles, and with such tremendous velocity that it is believed that the hydrogen may at times leave the sun and pass into the interstellar space.

## Look Out for Him.

A correspondent from Springfield, Mo., sends us a receipt signed R. Allen, for one year's subscription to the SCIENTIFIC AMERICAN.

The writer states that the person to whom he paid his \$3.20 was a modest, retiring sort of an individual, and represented himself to be a special correspondent of the paper. It is likely that the same party has swindled others out of their money, in Springfield and other places in the vicinity.

We warn our friends in all parts of the country against subscribing and paying money to any one unknown to them, on our account. No traveling agents are employed; and if any stranger claims to be an authorized agent for soliciting subscriptions, denounce him as a swindler wherever you find him, and keep your hand on your pocket so long as the person remains.

## Naval Engineer Corps Gazette.

September 29. Chief Engineer John B. Carpenter and Assistant Engineer C. P. Howell were detached from the United States steamship Alaska, and placed on waiting orders.

Passed Assistant Engineer Julien S. Ogden has been ordered to duty at the Navy Yard, New York.

October 4. Chief Engineer O. H. Lackey was ordered to duty as member of the board at Annapolis, Md., for the examination of midshipmen for promotion to the grade of ensign.

Passed Assistant Engineer Robert Crawford has been ordered to temporary duty at the Naval Academy, Annapolis, as an instructor in the department of steam engineering.

FOR the protection of workmen handling lead and mercury compounds, M. Melsens, of Paris, France, recommends small daily doses of iodide of potassium. This salt, he says, dissolves the lead or mercurial compounds, and effects their removal.