OBSERVATIONS ON THE GOLD FIELDS OF VENEZUELA AND GEOLOGY OF THE STATE OF GUAYANA, READ BEFORE THE LYCEUM OF NATURAL HISTORY OF N. Y., BY R. P. STEVENS, NOV. 2D, 1868.

Reported for the Scientific American.

Venezuela is divisible into three grand hydrographical basins, each of which represents distinct geological eras and holds its respective gold field.

The first, and oldest known, is the hydrographical basin of the Caribbean sea, and is separated from the Orinoco basin by the Coast Range of mountains. This range is the prolongation eastwards of the Cordillera Occidental, and geologically, is of the same age as that of the main Andes; viz., miocene tertiary—that is to say, these mountains are understood to be of several ages in their uplifts, the later being as late as the beginning of the tertiary. Fossils indicating this position have been found at Carupano, Maturin, and other points on the main land and on the Island of Trinidad, according to R. L. Guppy. The central axes of these mountains are metamorphic, and probably metamorphose palaezoic. Gold, silver, copper, lead, and other ores are found in their rocks.

In the absence of positive data, and reasoning by analogy from other portions of this range, the auriferous veins are as late in time as the Silurian, according to Prof. Forbes.

The hydrographical basin of the Orinoco is filled with much older rocks; viz., crystalline mainly, so far as known to our party, they are gneiss and gneissoid, save in the vicinity of Ciacoa, where tertiary obtains, no other rock has been seen. Some of our party have spent three years in this valley and we have crossed it in six different directions from the Orinoco, and below the falls we have not observed any other rock.

A section from the Orinoco, from the Village of Las Tablas southwards to the summit of the Imitaca Range reveals only gneissoid rocks.

Gold has occasionally been found in the streams flowing from these mountains, also along the Caroni, the largest southern affluent of the Orinoco, and along the Piraguay, a tributary of the Caroni, no valuable gold veins or deposits have ever been discovered. These rocks seem to conform to the general law; viz., to be barren of productive gold veins. (The West Canadian veins have not yet disproved this law). The Essequibo hydrographical basin is the true gold-bearing portion of the rocks of Guayana. So far as known the rocks of this basin are as follows: Gneiss on its northern rim (Imitaca Mts.); a few leagues south are low ranges of quartz and porphyry, Santa Cruz, Charapa, and Chagunemul Mountains. On their flanks are seen homblendic, silicious, and argillaceous slates. Gneiss with domes, or vast expansion of quartz veins succeeds. As we progress southward these domes of quartz form a very striking feature of the landscape. They are more abundant east of the Caroni river and south of the Imita mountains than any other portion of the country visited. They are always in sight. One is constantly winding around them or crossing some low portion of them. Sometimes their out-cropping rocks remind one of a distant cemetery with its slabs and monuments of white marble. One dome we have named "The Cemetery." The gneiss decomposes and then presents a mottled appearance, red, purple, greyish, and white in color. Dykes of granite, or more properly, syenite, appear at intervals. Approaching the valley of the Yuruary river—the northern affluent of the Essequibo—bands of white and light drab limestone are seen with the gneiss, and near Guasipati a band of itacolumite appears.

After crossing the Yuruary river, hills and low mountains of metamorphosed or semi-crystalline hills rise a thousand or fifteen hundred feet above the valley.

These mountains trend N. N.E. or S. S.W. They are composed of the following rocks: Brecciated schists, altered sandstones, quartz, and porphyry, a local rock of the aluminous family known as blue stone, and talcose schists. The porphyry in many instances is but a highly metamorphosed condition of the more silicious portions of talcose rocks. Talc and blue stone is the country rock of the gold veins of this portion of the Essequibo basin. Beside the rocks already described, there lie between the sources of the Yuruary and the Caroni a low range of hills running north and south which are composed of very black gnessoid schists and more solid rock dissimilar to the grayish gneiss of the Imitaca. These are older in geological time than the Imitaca, for the latter trend east and west and about upon them, while these trend north and south.

In order of time the following I suppose from present observations to be correct:

First, The black gneiss mentioned.

Second, Gray gneiss, quartzite, homblendic, and other slates, limestone and itacolumite, and all rocks trending east and west.

Third, The metamorphic rocks of the Morcupio, Ignan, and all rocks trending northeast and southwest south of the Yuruary river.

To return to the Essequibo basin. I have said that this is the true gold field of Guayana. As yet but very little is known of it. This basin is ninety leagues long, north and south, and eighty east and west, and for the most part densely covered with tropical forests and destitute of inhabitants, save a few uncivilized aboriginals who live along the banks of its streams.

Gold has long been known to be found along the head waters of its streams, in the Parima, Tucumacare, and other mountains. An English company commenced operations upon the Essequibo, above the junction of the Cuzuni, penetrating from Georgetown, British Guiana. Carlos Seigert, a German mining engineer, has descended the Yuruary to the Cuzuni, and descended this stream to the Puebla of Areobica, and reports gold quartz along both streams. The Mocupio valley has been worked since 1854 and has been only penetrated four miles. The Iguana has been touched only in a still smaller portion. Only this and no more do we know of this gold field.

In the Mocupio valley gold is found under the following modes or conditions.

First, In the sands and gravel beds of the streams of the valley.

Second, In paydirt beds on bed rock in the alluvial of the valley, and in the clays derived from the breaking down and and decomposition of the country rock of the veins.

Third, In quartz veins under different conditions as follows: *a*, in pure white quartz in granules and nuggets; *b*, in rusty and ochraceous quartz invisible to the naked eye; *c*, in thin bluish and greyish threads and films of talc in the quartz; *d*, in crystals of sulphide of iron mechanically mixed with the pyrites; *e*, attached to the walls of decomposed and removed crystals of pyrites; *f*, in the ochre resultant of such decomposition; *g*, in thin, film-like scales on the face of fissure walls; *h*, in masses cementing fragments of gangue rock together.

Fourth, in the foot and hanging walls of veins the "cascajo" of the country.

There are two systems of veins, one running northeast and southwest, the other east and west. In both of these there is a variation of from ten to thirty degrees. Which of these systems is the oldest we have not yet determined.

In the present stage of our investigations we consider this gold field with its metamorphosed rocks to be older than the palaeozoic, older than the talconic, older than any on the west coast of South America or on the North American continent.

S.

Food Estimated in Horse-powers.

Dr. Frankland has made some researches into the calorific values of food. From the calorific value of any article of food it is assumed that its working energy in the human body may be correctly estimated, on the basis that heat required to raise one pound of water one degree of Fahrenheit represents a mechanical force sufficient to raise 772. lbs to the hight of one foot. This can readily be reduced to horse-powers. Who knows but that articles of food may be estimated by the coming grocer upon this method. Imagine a farmer taking his butter to market, and being asked by the would-be purchaser, how many horse-powers of butter he has to sell; how many horse-powers of cheese he has in his wagons. Or fancy Mrs. Malone asking said grocer "how chape he can sell a quarther of a horse-power o' whishky to a poor woman that hasn't any cow?"

But joking aside, Dr. Frankland's computations are valuable. The following table embodies some of their results:

ACTUAL ENERGY *of Ten Grains of the Material in its Natural Condition, when completely Burnt in Oxygen, and when Oxidized into Carbonic Acid, Water, and Urea, in the Animal Body.*

	Per cent of water in material.	LBS. LIFTED 1 FT. HIGH — When burnt in oxygen.	LBS. LIFTED 1 FT. HIGH — When oxidized in the body.
Butter	15	14,357	14,357
Cheshire cheese	24	9,187	8,613
Oatmeal	15	7,9.3	7,769
Wheat flour	15	7,788	7,591
Pea meal	15	7,778	7,456
Arrowroot	18	7,731	7,731
Ground rice	13	7,535	7,424
Yolk of egg	47	6,761	6,532
Lump sugar	19	6,616	6,616
Grape sugar	20	6,476	6,476
Entire egg	62	4,708	4,507
Bread crumb	44	4,409	4,246
Ham	54	3,915	3,317
Mackerel	71	3,537	3,187
Lean Beef	71	3,098	2,818
Lean veal	71	2,594	2,314
Guinness' stout	88	2,123	2,123
Potatoes	73	2,002	1,969
Whiting	80	1,787	1,563
Bass's ale	88	1,530	1,530
White of egg	86	1,325	1,138
Milk	87	1,306	1,241
Carrots	86	1,040	1,026
Cabbage	89	858	830

It will be understood, of course, that to obtain these results in the animal body the materials must be completely absorbed, and fully oxidized into carbonic acid, urea, etc.

Estimated in this manner, it may be said that a daily subsistence diet of 2 ozs. of dry nitrogenous food, and 13·2 ozs. of dry carbonaceous, calculated as starch, and a daily working diet of 6 ozs. of nitrogenous matter, and 26 ozs. of dry carbonaceous, have the following mechanical energies:

	LBS. LIFTED 1 FT. HIGH — When burnt in oxygen.	LBS. LIFTED 1 FT. HIGH — When oxidized in the body.
Subsistence diet	6,319,783	6,307,078
Working diet	13,349,405	13,511,290

But the actual working power of the human body does not approach this. In fact, although a man's daily labor has a very large range, as from 300,000 foot-pounds when lifting dung into a cart to 1,500,000 foot-pounds when pushing or pulling horizontally, yet the average is not above 1,000,000 foot-pounds, as will be seen from this diagram:

KIND OF LABOR.	AM'T OF WORK in foot-pounds.	AUTHORITY.
Bricklayer's laborer carrying bricks	1,627,200	Mayhew.
Coal whipping	1.293,600	"
Ascending Faulhorn	1,074,931	Wislicenus.
" "	933,746	Fick.
Treadmill	1,008,000	Mayhew.
"	861.156	Ed. Smith.
Turning a winch	837,760	Coulomb.
Pedestrians (20 miles a day)	792,000	Haughton.
Paving and pile driving	788,480	Coulomb.
Porters carrying loads	732,480	"
Shot drill punishment	694,400	Haughton.
Average	967,614	

And even when we add the calculated internal work of a man's body, as the beating of the heart and the movements of respiration, the total of it does not much exceed 1,500,000 foot-pounds a day:

	FOOT-POUNDS.
External work or actual labor	967,614
Work of circulation (75 beats a minute)	497,880
Work of respiration (15 a minute)	98,064
Total ascertainable work per day	1,563,558

It is evident, therefore, that a large portion of our food must escape digestion and absorption; indeed, the thermotic power of the food actually consumed daily, as estimated by the carbonic acid exhaled and the urea secreted, is not more than sufficient to raise the temperature of 10,000 pounds of water 1° of Fahrenheit. This is equal to a force of 7,720,000 pounds lifted a foot high; so that the ascertainable work of the food is about one fifth of its actual energy, the rest of the power being consumed in molecular movements within the animal body. Helmholtz asserts that the external work should be a fifth part of the mechanical force of the digested food; but labor must be well applied to develop this proportion of its energy.

LUNAR ASSISTANCE.

Suppose for a moment, that we are all transported to the bottom of the sea, there to occupy a position analogous, in respect to the waters of the ocean, to the position we hold in the lowest portion of the atmosphere. How can we form any idea of the tides that ebb and flow above us? Our only way of obtaining cognizance of the fact would be to measure the thickness of the mass of water over head, by means of some instrument analogous to the barometer.

Let us now go up again to the surface of the earth—to the bottom of the aerial ocean which covers the whole earth. The same observations, made with the barometer, acquaint us with the existence of tides in the atmosphere. But here we have a continuous ocean, whose oscillations, restrained by no barrier, are not amplified by confinement in a narrow channel, as happens in the oceans of waters, through the resistance which continents oppose to their movements. We have, moreover, an ocean consisting of a fluid incomparably less dense than the waters of the sea. Taking these circumstances into consideration, we find that the periodical variations of pressure, due to the tides of the atmosphere, ought to occasion, in the hight of the barometric column, variations amounting, at most, to the fiftieth part of an inch!

What, now, of lunar influence upon the weather? Daily observations show that, in the same place, the hight of the mercury in the barometer may vary a quarter of an inch or more, without any great disturbances ensuing. If the tides in the atmosphere, caused by the moon, have any share in these variations, it must be so very small that certainly it cannot authorize weather prophets to found their predictions upon changes of the moon.

But if the moon will not enable us to foretell rain or sunshine, she does help us to fix historical dates and to correct our ancient chronology.

In an eclipse of the sun, the moon screens the sun, either totally or in part, from certain portions of the earth's surface. Here it is total or annular; there, it is only partial; further on, not a trace of it is witnessed. In an eclipse of the moon, on the contrary, the rays of the sun are totally or partially intercepted from the moon by the earth's interposition; and this privation of light is seen in the same way from all points of observation.

The ancients (who had nothing like so precise a knowledge of the moon's movements) were unable to predict eclipses of the sun. They foretold lunar eclipses only; basing their predictions on the fact that these eclipses are reproduced almost periodically, presenting the same characters and the same intervals between each other, every eighteen years and eleven days. It therefore suffices to have observed and registered all the eclipses of the moon happening during that period, to be able to announce with certainty the eclipses which were to occur during the period following. Now, on the contrary, with the much more exact information which we possess, not only of the moon's motions but also of the sun's, we are in a position to calculate and announce a great many years and and even centuries beforehand, both the general circumstances of lunar and solar eclipses, and also all the peculiarities which the latter will present at any given spot on earth. In like manner, by a retrospective examination, we can give an account of all the circumstances accompanying ancient eclipses in this or that locality.

Eclipses of the sun are somewhat more frequent than those of the moon. But as a solar eclipse can never be visible over so large a portion of the earth's surface as a lunar eclipse, it follows that, for any one given spot, solar eclipses are least numerous. And if, instead of noting all solar eclipses, we only reckon those which are total, we shall find that at the same spot, they are very far from numerous. We may even say that, for any determinate locality, total eclipses are veritable rarities. In Paris, for instance, only one was seen during the whole of the eighteenth century—the eclipse of 1724. In the nineteenth century there has not been, nor will there be one. The Londoners were five hundred and seventy-five years without one total eclipse—from the year 1140 to 1715; and since 1715 they have witnessed no similar spectacle.

If history mention a total eclipse of the sun as having been observed at a given spot, without giving the precise date of the observation, that date may still be determined by the exact knowledge we now possess. Recurring to the epoch to which the phenomenon belongs, we successively pass in review the different solar eclipses which occurred during a lapse of years of such extent, that we are certain it must comprise the year in which the eclipse in question was observed. By proceeding in this way we shall generally find that, out of all those eclipses, there is only one corresponding to that recorded in history; because that one only can possibly have been total at the spot where the observation was made. We shall thus get, not merely the year, but the day and even the hour of the observation.

Take an example. Herodotus relates (book i. § 74), "After that, the Lydians and the Medes were at war during five consecutive years. In this war the Medes frequently vanquished the Lydians; the Lydians also often beat the Medes. On one occasion they even fought by night. Now as the

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war continued with equal chances on either side, in the sixth year, one day when the contending armies were engaged, it happened that, in the midst of the strife, the day was suddenly changed into night. Thales of Miletus had foretold this phenomenon to the Ionians, indicating the exact year in which it actually did take place. The Lydians and the Medes, beholding night suddenly interrupt the day, put an end to the combat, and thought only of settling the terms of peace."

The eclipse here referred to is known as Thales' eclipse. The various authors who have mentioned it have assigned to it very different dates, from the 1st of October, 583 B. C., by Scaliger, to the 3rd of February, 626 B. C, by Volney. Professor Airy, by proceeding as indicated above, and taking advantage of the most recent data respecting the lunar movements, has decided that this eclipse occurred on the 28th of May, 584 B. C.

Between the earth there exists one grand difference. The earth has an atmosphere; the moon has none. She has no clouds, snows, nor dews—contrary to the theories of the elder astronomers. Kepler and Galileo held the moon to be encompassed with a heavy and elastic atmosphere: alleging, among other proofs, that the moon sometimes disappears in a clear sky, so as not to be discoverable by the best glasses (of that day): little stars of the fifth and sixth magnitude remaining visible all the time.

Kepler says he has observed this phenomenon twice—once in 1580, and once in 1583. Hevelius did the same in 1620. Riccolus and other Jesuits, at Bologna, and many people throughout Holland, observed the like on the 14th of April, 1642. And yet at Venice and Vienna, the moon remained all the while conspicuous. On December 28, 1703, there was a total obscuration of the moon, which must not be confounded with an eclipse. At Arles, in France, she first appeared of a yellowish brown; at Avignon, ruddy and transparent, as if the sun were shining through her. At Marseilles, one part was reddish the other very dusky; " andat length, although in a clear sky, she wholly disappeared." Here it is evident, they say, that as the colors appear different at the same time, they do not belong to the moon herself, but are occasioned by an atmosphere around her, variously disposed in this and that place, for refracting these or those colored rays.

Lord Rosse's telescope has stripped the moon of her atmosphere, leaving us still enveloped in ours; and we have only to observe what is daily passing before our eyes to understano the changes which the atmosphere has produced on the solid crust of our globe. The hollows are filled up and smoothed over by sedimentary deposits brought down by rains; the relief of our surface is gradually worn down. The moon is as as a medal fresh from the mint; the earth is as a shilling which has sustained the effects of passing for years and years from pocket to pocket.—*All the Year Round.*

The Loom and the Anvil.

In confirmation of what we urged last week, the Augusta, Geo., *Constitutionalist* very truthfully remarks, that " the best allies of the South are near at home. They are the plow, the loom, and the anvil. They are the implements of industry in all the departments of labor. The strong arms of industrious laborers are the true redeemers of our land from depression and impoverishment. Those who are willing to work and to make labor respectable and respected, are the practical patriots of the emergency.

" Nor need it be feared that Gen. Grant will bring his influence to bear against the material prosperity of the Southern States. As a war measure he aided in desolating the South with fire and sword. But since the war he has expressed no sentiment of vindictiveness against our section. There is reason to believe his sentiments are not hostile to us. At the time of the surrender he manifested a liberal spirit toward the army and people he had conquered. He has at no time since indicated a change of temper."

MANILLA cigars are made by female children and adults. The mode of making the cigars differs materially from that employed in this country. The tobacco passes through a dozen hands. After the filling and wrapers are assorted, one set of girls select the filling and arrange it in proper order, another set trim the wrappers, a third roll the wrappers about the filling, while a fourth stand by with their fingers in a pot containing paste or mucilage manufactured from a plant which grows in luxuriance on the island. At a proper time a girl, with a dexterous wipe, applies the gummy substance to the edge of the leaf, and the operator, by a peculiar twist of the wrist, brings the edge down upon the cigar, and casts it into a basket on the opposite side of the table. There are eight manufactories in Manilla, enploying twenty-five thousand women and girls, whose wages average seven cents per day.

HOW TO TAKE CARE OF TEETH.—We think it safe to say that a majority of people pay too little attention to their teeth; and the result is that dentists find plenty of employment, and numerous are the diseases of the teeth and gums. The teeth should be cleansed at least twice a day with a soft tooth powder (precipitated chalk is the best) and a little soap. Unless this care is taken tartar is liable to form upon them, and if suffered to accumulate it causes inflammation and absorption of the gums and gradual loosening of the teeth, which can only be prevented by observing the above simple practice. When tartar, which is a deposit of salts of lime and organic matter from the saliva, is allowed to accumulate it becomes hard and can only be removed by the scaling instruments of the dentist.

THE Welsh puddlers and other operatives at the Tredegar Iron Works, Richmond, Va., are on a strike in consequence of an attempt to reduce their wages.

Correspondence.

The Editors are not responsible for the opinions expressed by their correspondents.

Keeping Boilers Clean---Surface Blowing-off.

MESSRS. EDITORS:—Being a subscriber to your paper and enjoying its benefits, I thought I would send you my experience in cleaning boilers. I have charge of a large boiler and engine, and have tried various ingredients to take off the scale but without much success till this summer, when, changing my exhaust pipe, I put a tunnel on the top of the pipe to catch the water, and conveyed it by a half-inch gas pipe to the reservoir from which I fill my boiler after blowing off. The result is that the two last times I blew off I was bothered with the blow-off pipe clogging; especially the last time, when the pipe clogged under forty pounds pressure, so that I had to turn the plug several times before I could get the boiler empty. When empty I opened the mud pipe and found it full of scale from all parts of the boiler, some of the pieces being a quarter of an inch thick.

The boiler is now almost perfectly free from scale, and what little there is is loose and will blow off the next time I empty the boiler.

I have used the same water that has always been used in the boiler, and I attribute the loosening of the scale to the oil that I use in oiling the cylinder, incorporated in the exhaust water, which I use only when filling the boiler after blowing off. I expected when I tried it that the boiler would foam but was disappointed.

I have a surface blow-off. I took some 2-inch pipe and cut it in lengths so that I could get it through the man-hole, and had $\frac{1}{4}$-inch holes bored in half of its circumference, and laid the pipe lengthwise of the boiler on pieces of iron about two inches above the flues fastening it with wire. I run the end through the front of the boiler with 1-inch pipe and attach a globe valve. I have it blowed off five or six times a day and the amount of dirt that is blown out is incredible. The boiler is five feet in diameter with ninety-four 3-inch flues, and I use Lake Erie water. G. L. B.

Rochester, N. Y.

[The experiment of our correspondent is one which we recommend to all our readers who have to feed their boilers with " hard" water. Save the drippings of the exhaust pipe, the condensation of the safety valve blow-off, and that from the cylinder, and use the water thus obtained to fill the boiler after blowing off. The result will be surprising in its effect in loosening scale. For this reason—the change of quality of water—our Sound boats are seldom troubled with scale, as at each end of the route fresh water is used to fill the boilers.

The idea of a surface blow-off pipe is one we can also highly commend, having employed a similar device with good results several years ago.—EDS.

Old Fashioned Lathes.

MESSRS. EDITORS:—In your issue of October 21st, W.W. T. wants a rule for "old fashioned lathes of four gears." Here is one. Suppose nine threads are to be cut and the leading screw four to the inch. Select any two wheels, say 50 and 60 teeth; then to find the other two, put them in the form of a fraction, thus $\frac{50}{60}$; reduce them to their lowest terms, $\frac{50}{60}=\frac{5}{6}$ The number of threads to be cut and number on the leading screw are to be put in the same way, thus, $\frac{9}{4}$; multiply the first by the last, thus, $\frac{5}{6}\times\frac{9}{4}=\frac{45}{24}$, the product being the two wheels sought, one of which is put on the live spindle and the other one the screw. The live spindle being the denominator, the wheel of 24 teeth is placed on it; the denominator of the other pair, 60 teeth, comes next, working in the 24, the numerator of the first pair; 50 teeth is next, and the numerator of the last, 45 teeth, on the screw. Then we have them this way: Spindle, 24; inside of stud, 60; outside of stud, 50; screw, 45. W. D. YOUNG.

Pittsburg, Pa.

Oiling Harness.

MESSRS. EDITORS:—Having seen numberless processes in your valuable paper for preserving and cleaning harnesses, I would like to add my experience to the list if worthy the space it occupies.

In the first place, I subject the harness to one or two coats (as the leather may need) of lamp black and castor oil, warmed sufficient to make it penetrate the stock readily. Then I make about two quarts of warm soap suds and with a sponge wash the harness. When dry, rub it over with a mixture of oil and tallow, equal parts, with sufficient lamp-black to give it color, or, what is better, prussian blue, which gives it a new and fresh look. This compound should be applied sparingly and well rubbed in, which can be quickly done and will leave a smooth and clean surface.

The advantages I claim for this process are these:

First, By saturating the stock in the first place with oil, the soap and water are prevented from penetrating it in the process of washing. When leather is permitted to absorb water or soap it has an ultimate tendency to harden it.

Second, When the harness is washed *first* (as is generally the case) the water repels the oil; consequently in the one case you have the oil inside of the stock, and in the other you have the soap and water.

Third, By oiling first it softens the dirt, so that it can be washed off in at least one-half the time required when washed before oiling, and also saves the " scraping" process which defaces the grain of the leather.

Fourth, It will remain soft much longer from the fact of its being penetrated with oil.

Fifth, The whole process can be accomplished without the delay of waiting for it to dry.

Consequently the harness can be oiled and cleaned in much less time, will remain soft longer, wear longer, and look better than when cleaned by the old method. And I consider these reasons of sufficient importance for every one having a harness to give this method a fair trial. E. D.

Stoughton, Oct. 23, 1867.

Expansion of Ice.

MESSRS. EDITORS.—In the SCIENTIFIC AMERICAN of the 11th inst., I noticed an article on the Expansion of Ice. Several years ago my attention was called to this subject by Prof. Faraday, who said that water expanded at the freezing point, but said it was still a mystery and it seemed to me to be in contradiction to the laws of nature to make cold expand water when it contracted everything else. Therefore I set to work to see if possible what was the cause. I have felt deeply interested on the subject, and tried experiments, searched philosophy, watched for all that was said or written on the subject, read Dr. Tyndall's lectures to see if he, with all his vast store of knowledge and deep philosophy, gave an explanation of it; but I was disappointed, as I found nothing which appeared to meet the demands of the case. And now as the subject is under discussion in England, I thought I would give you some of my observations on the subject. I had no means of testing the matter, but watched the changes and appearances of water when being frozen; and I always found that there were myriads of little bubbles continually rising to the surface. When the water was in a vessel, these small bubbles would make their appearance on all parts of the vessel, small at first but continually increasing in size as the freezing went on, until they become large enough, or rather I suppose light enough, to rise to the surface; these would come to the top, burst, and disappear if the ice had not formed over the surface, but as soon as the top was covered with ice, they could not escape, but come up and touch the under side of the ice and there remain. The water around them would be frozen in turn leaving these air cells there, which are seen in all ice and give it a honey-comb appearance, leaving it lighter than the same bulk of water before frozen and causing ice to float on the top of the water. The only thing now is to show how these air cells are produced, for it is evident to my mind that the water does not increase in bulk nor yet the ice, but that they are forced apart by the expansion of this air contained in the cells. As a liquid is being changed to a solid it throws off heat, and I incline to think this heat is what enters the air (which all water contains) and thus it becomes expanded and may expand sufficiently to burst the ice.

There is also another agent (electricity) which is excited by the condensation of water or ice. This powerful fluid would itself be sufficient to burst the ice and any vessel which might contain it. Is it not more reasonable to think this air is expanded than that cold the condenser of every thing else should expand water and ice because it gives that appearance? I hope these remarks may be of some interest to some of your readers, and lead to further investigations.

Tarrytown, N. Y. C. D. SUTTON.

[We have given place to our correspondents views; but will add that the question now in dispute is not whether water expands when freezing. It is whether ice *after it is ice* expands or contracts as the temperature is diminished.—EDS.

Solidification of Water by Pressure.

MESSRS. EDITORS:—I noticed in the SCIENTIFIC AMERICAN of October 28, an article on solidifying of water by pressure and sounding of the ocean.

An experiment was made some years ago (by whom I do not recollect) in regard to the pressure of water at a given depth. A large bottle was procured, with a tapering cork so fastened that it was impossible to come out. It was then sunk to a depth of 3,000 feet; and, after a short interval, drawn to the surface, the cork was found to be forced into the bottle, the bottle filled with water, and the cork forced back into the neck of the bottle perfectly tight. And that, with some other events, has given rise to the theory that bodies, after sinking to a certain depth, remained suspended in the water—the pressure of the water on all sides being equal. The principal question is, Is there an equal pressure of water at any given depth? If so, that is if there is an equal pressure at a given depth, the theory of suspension is possible as well as probable.

Waterford, Minn. J. S. NICHOLS.

[Our correspondent seems to be ignorant of the truth that, at any point beneath the surface of a liquid, the pressure is equal in all directions. Bodies do not sink by virtue of the pressure of the medium through which they sink, but by virtue of their superior gravity. The bottle experiment is an interesting one in many points of view, but we cannot see that it bears in any way upon the subject of the solidification of water by pressure.—EDS.

Prime Numbers---A Prize.

MESSRS. EDITORS:—I will give one thousand dollars to the first person who, within one year from date, will give a correct rule for detecting prime numbers. Said rule must apply to all prime numbers to their utmost extent.

Biddeford, Me., Nov. 9, 1868. GEORGE S. MCINTIRE.

[We can assure our correspondent, in advance, that he may rest perfectly secure in the possession of his thousand dollars—mathematicians, ancient and modern, have worked long and hard at this problem, but, like the perpetual motion, it won't go.—EDS.

IN tempering metals an exact series of experiments has proved that the following colors are produced at the temperatures given: Very pale yellowish by 430°; pale straw, 450°; yellow, 470°; brown, 490°; mottled brown, 510°; purple, 530°; bright blue, 550°; blue, 560°; dark blue, 600°.

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