Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

TERMS.

One copy, one year $3 00
One copy, six months 1 50
CLUB RATES { Ten copies, one year, each $2 50 . . 25 00
CLUB RATES { Over ten copies, same rate, each . . 2 50

TO BE HAD AT ALL THE NEWS DEPOTS.

VOL. XXVII., No. 21. [NEW SERIES.] *Twenty-eighth Year.*

NEW YORK, SATURDAY, NOVEMBER 23, 1872.

Contents.

(Illustrated articles are marked with an asterisk.)

NEW DISCOVERIES CONCERNING TERRESTRIAL HEAT.

The older treatises and text books on physical geography state that the temperature of the earth's crust, at the limit where the yearly oscillations of summer heat and winter cold are no more perceptible, is everywhere equal to the mean temperature of the locality. This statement is only approximate to the truth, and sufficed as long as the investigations were made in the rough manner which distinguished many of the experiments and observations of the beginning of this century. The example, however, of several conscientious observers of that time who applied the most scrutinous criticism in regard to the results obtained, has later influenced the great majority of the investigators of the present day. No longer content with approximations, they wish to come to positive numerical data; and among other corrections which were the result of the modern refined methods of experimenting, are those in regard to the relation of the temperature of the earth's crust to the mean temperature of the spot.

Considering the matter *a priori*, from a theoretical point of view, it is evident that if the interior of the earth has a temperature of its own far above that of the surrounding space, which is a fact beyond dispute, this heat must influence its surface, and raise its temperature beyond that produced by the solar radiation alone; in fact, the heat of the earth's surface must be equal to the sum of the terrestrial and solar thermic intensities; and if this be so, the temperature of all portions below its surface, beyond solar influence, must be somewhat higher than the mean temperature of the localities.

This is now found to be actually the case where the observations have been made with proper scrutiny and care. Alexander von Humboldt was, in 1817, the first who gave a clear and comprehensive view of the distribution of solar heat on the surface of the earth, by his ingenious method of drawing lines of equal mean temperature over the terrestrial maps; these are called isothermic lines, and they were founded on long continued observations in sixty different localities. It is to the great credit of that glorious investigator that, after all the later labors and corrections attempted during the last half century, no essential change has been made in these curves as first laid down by him. The latest isothermic maps, published by Dove in 1865, were founded on the observations made on 900 different localities.

Quite recently such lines have been drawn representing the distribution of terrestrial heat under the earth's surface, beyond the solar influence; these are called isogeothermic lines, and, of course, cannot be drawn across oceans, but only on the land. When drawing both the isothermic and isogeothermic lines on the same map, considerable deviations are perceived, contrary to the thus far established ideas of their coincidence. So it is found that, near the tropics, or where the yearly mean temperature is from 60° to 70°, or in other words, between the isothermic lines of 60° and 70°, the isogeothermic lines coincide nearly with the isothermic lines, having only slight local deviations; that between the tropics where the mean temperature is from 75° to 80°, the temperature of the corresponding isogeothermic lines is slightly lower; but that beyond the Tropic of Cancer in the northern hemisphere, the isogeothermic lines of the same temperature lay considerably north of the isothermic lines, or in other words that the temperature of the isogeotherm is considerably above that of the isotherm for the same spot. So in the United States, the yearly isothermic line of 50° runs through Philadelphia due west, and, after crossing the Rocky Mountains, continues in a northwestern course through Salem, Oregon, to our Pacific coast, while the isogeothermic line of the same temperature runs through Boston and Chicago, where the isotherm is only about 45°. In Europe and Northern Asia, the difference is still more striking; however, around the Mediterranean sea, there is only a slight difference, while in Ireland a perfect coincidence of the isothermic and isogeothermic lines takes place, undoubtedly due to the Gulf stream, raising the temperature of the air to that of the terrestrial heat. In Germany, on the contrary, and especially in Russia, the differences are very great, being as much as 9° or 10°; that is, while the yearly mean temperature of the air is, for instance, in Moscow, 38°, the temperature of the earth is 46°, while in Tobolsk, Siberia, where the mean temperature of the air is 29°, the temperature of the soil, at a depth whereto the winter frosts and summer heat do not penetrate, is 41°.

It is scarcely necessary to mention that these data constitute a most important contribution to the right understanding of many otherwise obscure facts. Our elevated mountain tops have a low temperature, not because they reflect solar rays to all sides, but because they have lost terrestrial heat by radiation long ago; and their interior temperature has descended so low that the solar rays cannot impart heat sufficient to reach the melting point of the snow. So Schlagintweit found that the mean temperature at a hight of 10,400 feet on the side of one of the peaks of the Great Glockner in the Alps was 20° Fahr.; but the temperature of the ground below the influence of solar heat was 32°. Lower down along those same mountains, where the temperature of the ground is 20° higher, the mean temperature of the air is also 20° higher, and is, in this way, raised above the freezing point by the addition of terrestrial heat. This is in fact the case everywhere on our earth's surface; and, if this internal heat were withdrawn, the whole terrestrial surface would be changed to the same condition as the lunar surface, on which the intense cold is simply a result of the absence of internal heat, lost by radiation ages ago in the same way as our mountain tops have lost it, even between the tropics, and are covered with perpetual snow. Our highly elevated plateaux have not suffered such a loss, being less exposed to loss by radiation than the more isolated mountain peaks and ranges, while the moon, by being 50 times smaller than the earth and not protected by a non-conducting atmosphere, has lost the greater portion of its own internal heat long ago.

DRAWINGS FOR THE PATENT OFFICE.

The rules of the Patent Office are now very strict in regard to the character of drawings furnished for patents. They are required to be done on "Bristol board," in India ink, size of sheet 10×15 inches, one inch margin, as few lines as possible. All lines must be clean, sharp and solid, not too fine nor crowded. Every line and letter must be absolutely black. Shading to be very sparingly used, and line shading alone permitted, brush shading and colors being wholly excluded. The light is always supposed to come from the upper left hand corner. There are a variety of other regulations about the lettering and placing on of titles, all of which are strictly enforced. The reason why the Patent Office is so very particular, as to the mode in which drawings are presented, is to secure facility and legibility in their publication. The drawings are now reproduced and printed by the photo-lithograph process. This involves, in the first place, the production of a perfect photographic glass negative from the drawing, and the clearer, blacker the lines of the drawing, of course the better will be the negative and the resulting prints. From the negative a print in chromatized gelatin, on paper, is made, which print is transferred to stone, then inked and printed in the press like all lithographs.

At present the Patent Office produces three negatives, of different sizes, from each drawing, and three different editions of the prints are issued, one of very small size for the *Official Gazette*, one of medium size for bound volumes of patents, and one of large size for attachment to the patents when issued.

LACK OF INTEREST IN ENGLAND FOR THE VIENNA EXPOSITION.

It seems that Americans are by no means the only people who are lacking in interest as participators in the Vienna Exposition. The *London Standard*, of a recent date, contains quite a lengthy communication from a correspondent, in which we find the following:

"Not one inventor or owner of special goods has ever patented his goods in Austria. When his patents are infringed by their being copied, the Austrian Courts invariably decide so as to cancel the patent, and always favor piracy. * * * The experience of the Paris Exposition to inventors was one of universal disaster, on account of the very unjust French laws on patents and trade marks, with which it is impossible for exhibitors to comply. In the windows of thousands of shops in Paris and Vienna you see both English and American inventions that were copied at the Exposition in Paris, and the inventors and manufacturers have been astonished to find their inventions patented by Frenchmen and other continental people before the inventors took their patents. The inventors rested under their exposition protection certificates, and just at the close of the Paris Exposition they took their patents. Many of them, soon after the Exposition was closed, found their goods being manufactured by the French, and when the real inventor came to demand his rights, the Frenchman showed his patent to be several months the oldest."

The letter then goes on to say that the Austrians are pursuing a similar course, and the law of the country, as now enacted, "is only an entanglement and deception, for under it no foreigner has ever succeeded, no matter how valuable his invention or how simple his case. * * Under the Austria patent law there is no provision by which a case can be completed, and the infringer can keep the case open during the entire life of the patent."

The writer states that but a short time since an attempt was made in Vienna to palm off inferior cutlery upon him as the manufacture of the Sheffield "Rodgers," which, on close examination, he found to be marked "Rodger" with the "s" left out. Owners of military goods are specially cautioned not to exhibit, as neither Austrian, German nor Russian laws afford the least protection, while it is a fact that the Austrian Minister of War has declined to exhibit Austrian war material.

A strong protest against the course of officials of the English Government, in advising inventors and manufacturers to contribute to the Vienna Exhibition, concludes the letter.

Our readers will recognize the above as confirming the views heretofore expressed by us on the subject. England, we learn, has appropriated but 6,000 pounds sterling to meet the expenses of adequate representation, but some of the papers are calling for a larger sum. It is not likely that a further amount will be forthcoming when the true state of the case is fully brought to the notice of the English people and Government. We trust that our next Congress will follow a similar course, and withhold all appropriations for the Exposition until the oppressive laws of Austria are modified or repealed.

THE DETERMINATION OF HIGH TEMPERATURES BY SOUND.

At a recent meeting of the Lyceum of Natural History in this city, Professor Mayer, of the Stevens Institute of Technology, delivered an interesting discourse upon the determination of high temperatures in furnaces by sounds; describing some original researches of his own, and illustrating his remarks by several effective experiments. In order to understand Professor Mayer's conclusions it is necessary to briefly review the laws of vibrations in elastic media. If a tuning fork be set in motion, its vibrations are transmitted to the air, and the latter vibrates in unison, making the same number of movements per second, whether 500 or 50,000. To comprehend the reason, said the speaker, imagine a sphere of delicate membrane containing air of the same elasticity as that which surrounds it. Suppose this sphere to contract and expand, say one hundred times per second; for each expansion there will be a corresponding condensation of the shell of air next to the surface of the globe; the air being elastic, this condensation is transmitted to the shell of air which envelopes the first shell, thence to another beyond, and so on. Conversely, if the sphere contract, a rarefaction of its immediate envelope of air takes place, which rarefaction is also transmitted outwards, each succeeding shell diminishing in density in turn. These motions, of course, are mere undulations, similar to waves of water, or of light in its passage through ether, the air taking up the form of the vibrations, transmitting it to the ear, whence it passes to the brain and is perceived.

A tuning fork, when vibrated in regular motion, leaves, when its point is drawn over the surface of a piece of smoked glass, a sinuous curve. This curve is a symbol of the condition of the air, and from it, if highly magnified and suitably divided, formulæ can be deduced. Suppose this sinuous line to be as represented in Fig. 1, and bisected by the horizontal line. Then the curves A, B, B′, etc., above the line, are those of condensation, while those C, C′, C″ are curves of rarefaction. Now, if we could physically see the particles at the points A and B, in the air, we should see them swing as it were together, while, if we compared those at A and C, we should see them move in opposite directions to each other. We thus might detect the particular phase of vibration surrounding sounding bodies. A wave length is that length of air which embraces all phases of vibration when a sound traverses it. To prove the above experimentally, two tuning forks of precisely the same note may be used. If one fork be sounded and then stopped, the other will continue its vibrations, being set in motion by the air. If now fork 1 be placed at any point to represent A in our Fig. 1, and fork 2 at a point corresponding to B, and if we vibrate fork 1, we shall find that similar prongs in both forks vibrate together. That is, while the right hand prong of fork 1, moves to right, the same prong in fork 1 will move in the same direction. But if we place fork 2 at C in the opposite phase of the wave, then opposite prongs will vibrate, or the right hand prong of fork 2 will move in unison with that on the left of fork 1, and *vice versâ*. If we could arrange a revolving mirror to reflect beams of light thrown from small mirrors on the prongs, we should find in the first case two curves side by side, like rails on a track; but in the second instance, the curves would be directly opposite to each other.

Professor Mayer then proceeded to explain the apparatus which he had provided for actually observing the above motions in the air. It consisted of an organ pipe, in the center of which was a hole closed by a membrane. Over the latter a small box was placed, into which gas entered through a pipe and leading out of the box was another tube terminating in a small flame. The air in the organ pipe, the medium in the tube, the lecturer stated, and the membrane will vibrate together, and the flame will be caused to jump up and down at the rate of 256 vibrations per second. If while the flame is at rest, we look at its reflection in a revolving mirror, it will appear as a band of light. But if the note of the organ pipe be sounded, the air in the same will cause the membrane to vibrate, this motion will be transmitted to the flame, the image of which will now not be a band, but a series of serrations like saw teeth. The Professor then showed the experiment very clearly and satisfactorily. Now, he continued, let us bear in mind that these teeth in the mirror are the vibrations of the point A in Fig. 1. Here is