water against his bedroom door till he went to sleep. I was once told, when on a salmon inspection, that a certain miller could sleep so long as the continued whirr of the mill wheel was going on, but directly the noise stopped he awoke.

The deepest sleep is always just before dawn. It is, I believe, probable that some change takes place at this time in the atmospheric condition,as the hour just before dawn is selected by savages to make their attack, and it is at this time also, I believe, that a great proportion of children are born. When staying at a country house, unfortunately, the visitor not accustomed to country sounds gets often woke up. The abominable cocks begin their horrible crowing, called, in Herefordshire, "cock shoot." I recollect on one occasion, after the wretched cocks had gone from the fowl house to feed, I fell asleep, and then there came a most awful cry of agony; in fact, the farmer killed a pig under my window—enough to wake anybody. This pig was most vociferous, but as he was immolated in honor of my arrival, I could not say much.

My monkeys always get sleepy when the gas is lighted in my study, where I and my monkeys always sit. This room was once called by the servants the "Master's room"; but I found out lately, by accident, that they now call it the "Monkey's room." This is Darwin going backwards!

Dogs, likewise, will sleep at night if they can; cats, I observe, are sleepy in the morning, the reason being that the wretches have been out all night, and, of course, feel very seedy in the morning, and doubtless their heads ache sometimes; and it serves them right if they did, considering the row they make, fighting and caterwauling! I have strong reasons to think that my own black cat is president of a free and easy club, for they hold their meetings among the ruins of the Colosseum at the back of my house. This a regular "cattery." All the stray cats in the Regent's Park and the neighborhood come here to arrange family matters; sometimes they come into a back cellar where I keep skeletons, casts, etc., and kindly supply me with a fine lot of kittens, which I convert into skeletons,' casts, etc. I confess I do not know how to get rid of caterwauling cats. Will any one tell us?

I now venture to suggest a new but simple remedy for want of sleep. Opiates in any form, even the *liquor opii sedat.*, and chlorodyne, will leave traces of their influence the next morning. I therefore prescribe for myself—and have frequently done so for others—onions: simply common onions raw, but Spanish onions stewed will do. Everybody knows the taste of onions; this is due to a peculiar essential oil contained in this most valuable and healthy root. This oil has, I am sure, highly soporific powers. In my own case they never fail. If I am much pressed with work,and feel I shall not sleep, I eat two or three small onions, and the effect is magical. Onions are also excellent things to eat when much exposed to intense cold. Mr. Parnaby, Troutdale Fishery, Keswick, informs me that, when collecting salmon and trout eggs in the winter, he finds that common raw onions enable him and his men to bear the ice and cold of the semi-frozen water much better than spirits, beer, etc., The arctic expedition, just now about to start, should therefore take a good stock of onions. Finally, if a person cannot sleep, it is because the blood is in his brain, not in his stomach; the remedy, therefore, is obvious: call the blood down from the brain to the stomach. This is to be done by eating a biscuit, a hard boiled egg, a bit of bread and cheese, or something. Follow this up with a glass of wine or milk, or even water, and you will fall asleep, and will, I trust, bless the name of—*Frank Buckland, in Land and Water.*

ANILINE colors can be used to impart to paraffin candles most beautiful red, purple, and violet tints.

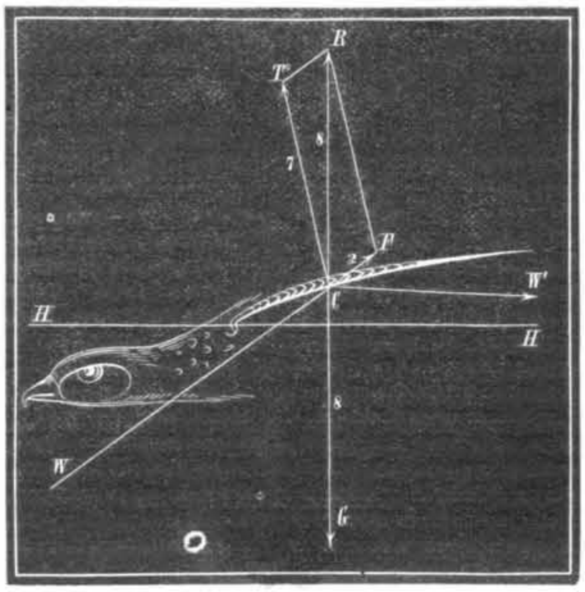
Correspondence.

The Flight of Birds.

To the Editor of the Scientific American:

The ability (possessed by some birds) of hovering or remaining fixed over a given point during the prevalence of a breeze, and that, too, without any apparent motion or exertion, has ever been a fruitful theme for speculation. Some regard it as a phenomenon beyond the penetration of the human mind, while others refer it to the positive and negative forces of electricity, to the fact that the bones of the bird are hollow, or to some other cause. The most recent publication pertaining to this subject is an elaborate work by J. B. Pettigrew, M. D., who has long been regarded as an authority in the old world. Though one hundred pages are devoted to "progression through the air," I think only one reference is made to the subject of hovering. On page 115, he informs us that the hawk, when hovering, sustains his body "by the action of his wings." But the *modus operandi* and mechanical principles involved are not explained. Neither is it possible to deduce them from the results of any of his experiments. It is to be regretted that the learned gentleman was not a little more explicit on a point that is quite as remarkable as anything relating to the subject of which he treats.

I submit a solution on simple mechanical principles, which illustrates not only how a bird may remain fixed in a current of air, but explains other equally well known facts, namely, how it can rise or fall in a vertical line, or move ahead or back, to the right or left, in a horizontal line, and that, too, without the expenditure of muscular force other than may be necessary to keep its body poised in a proper position. It is based on the fact that the course of the wind over the surface of the earth is not always horizontal, but sometimes inclined upward. That becomes evident when we reflect that winds are caused, primarily, by unusual heat in the air in a given locality, causing it to rise, and giving the surrounding air a tendency to rush in to fill up the space, the same cause imparting both an onward and an upward movement. This may be illustrated on a small scale by a burning gas jet, which heats the air, causing it to rise. If the air in the room be permeated with smoke, or any substance by which its motion can be discerned, it can be seen that, as the air rushes in to feed the flame, the smoke moves with an upward inclination. If this be not true of winds (under some circumstances at least), how is it possible to account for sand being carried by wind into a second story window, or the cinders of a volcano 1,000 miles out to sea, or a stick of timber, one foot square and twenty feet long, being raised from the ground and carried a long distance through the air during the passage of a tornado? These results could not be produced by horizontal air currents. With this understood, we have but to apply the law relating to the parallelogram of forces in order to comprehend the annexed sketch, illustrating various mysterious movements in the flight of birds. H H' represents a horizontal line, C G a vertical line, and C the centers of gravity and of resistance, which coincide. W C represents the direction in which the wind is blowing, and C W', the direction in which it is reflected from the under surface of the bird's wing. The resulting pressure or thrust of the wing will be at right angles to its surface, or in the direction of the line, C T.



Another force is brought to bear on the bird. It is the force of the wind against its body, and is exerted in the direction of the line, C F. This force we will suppose to be to the thrust of the wings as 2 to 7; yet it is not essential just what the ratio is. The resultant of these two forces, C F and C T, will be exerted in the direction of the line, C R. If the wind be blowing so as to produce a force of 2 ozs. in the direction of the line, C F, the line, C T, will represent a force of 7 ozs., and the line, C R, 8 ozs., that being the comparative length of the lines forming the parallelogram, C F R T. This resultant force, C R, being exerted in a vertical direction, and the weight of the bird being 8 ozs., there will be an equilibrium between the two forces, and the bird will remain suspended as in hovering.

Should the wings of the bird be expanded so as to present more surface, or should the wind increase in force, then the resultant force will be greater than 8 ozs., and the bird will move upward in a vertical line; but if the wings are contracted so that the force of the wind on them is diminished, and the resultant force is less than 8 ozs., then the bird will descend in the same vertical line.

Should the angle which the wings make with a horizontal line be increased, the direction of the resultant force, C R, will not coincide with a vertical line, but will incline forward of it, and the bird will move forward in a horizontal line. The movement will then correspond to that of a close-hauled vessel sailing near the eye of the wind, the weight of the bird serving as a fulcrum, and corresponding to the keel or centerboard of the vessel.

If the angle of the wings be diminished so that the direction of the resultant force inclines aft of a vertical line, the bird will move backward in a vertical line, provided that the magnitude of the resultant force be 8 ozs.

If the body and wings of the bird be careened to the right, so that the direction of the resultant force inclines to the right of a vertical line, the bird will move to the right in a horizontal line; but if the bird be careened to the left, then the motion will be reversed. It will be seen from the above that the movement is dependent on two conditions, namely, the ability of the bird to control the amount of the resultant force by increasing or diminishing the expanse of its wings, enabling it to rise and fall in a vertical line, and, secondly, its ability to control the direction of the resultant force by altering the inclination of its wings, whereby it is enabled to move to any point of the compass in a horizontal line. By a proper combination of those conditions, an infinite variety of evolutions and manœuvers can be performed, but an explanation of these is more complicated.

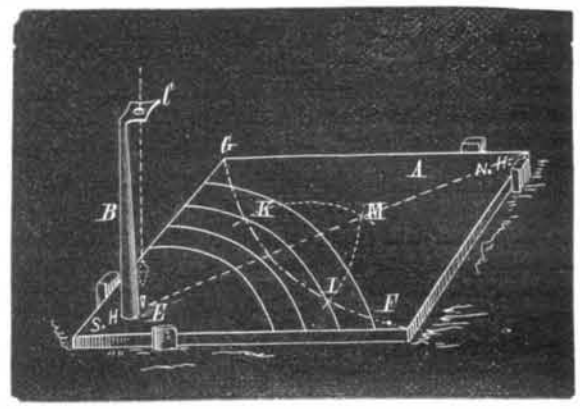
The sketch is not intended to be in proportion or to represent positions accurately, but only the general application of principles. F. G. FOWLER.

Bridgeport, Conn.

Finding the Meridian.

To the Editor of the Scientific American:

I have used for the above named purpose, while surveying the experimental line for the original Pacific Railroad thirty years ago, a simple expedient, of which I send you a sketch. A is a board about two feet square, placed level on the ground and secured by pegs; near the southerly corner a



staff, B, is raised perpendicularly. On the top of B is placed in a slit a piece of tin, C, having a small hole in it; this tin is placed nearly at right angles with the rays of the sun at noon. A plumb line is passed through the hole in the tin, and the point, E, is marked. From this as a center, a number of concentric lines are marked on the board. Towards noon, the sun's rays, passing through the hole in the tin, C, will pass over the board from F to G, as shown by the dotted line. If, before noon, the point be marked where the shadow crosses one of the concentric lines, say at I, and again where it passes the same line after noon, at K, and if a perpendicular be raised from the points, K and I, at M, then a line drawn from E through M gives the correct meridian.

Thus any person can lay out the true meridian; and the variation of the compass from the true north can be ascertained with the greatest nicety, a point of the highest importance to surveyors, as the variation of the needle is, in most places in our western States, an uncertain quantity.

JOSEPH A. MILLER.

[For the Scientific American.]

THE PALMS OF THE AMAZONS.

BY PROFESSOR JAMES ORTON.

Palms, bananas, and ferns are the three forms of special beauty peculiar to a tropical forest. Of these, the first give the most striking, as well as the most graceful, feature to the landscape. The elegance of the tall, slender stem, rough with the scars of fallen leaves, but branchless and symmetrical as a column, and the luxuriance of the feathery or fan-like foliage tossed out of the summit, compel admiration which no amount of familiarity tends to diminish.

It is usually supposed that the palms tower over all the other trees, their crowns standing so far above the surrounding vegetation as to give Humboldt's idea of "a forest above a forest." Along the sea coast and river banks, this is true; but within the virgin forest, the loftiest palms rarely exceed the average hight of the exogenous trees. The highest may measure 130 feet, while the Brazil nut tree stands 200 feet.

Palms have a wonderful development of the organs of fructification, a single individual bearing half a million of flowers. Yet the number of trees representing a species is not in proportion. This is mainly due to the fact that the fruit is frequently aborted, or forms the food of hosts of animals, insects, birds, and mammals. Even man depends upon the palms for many important products—wood and leaves for habitations, bark and leaves for cloth and cordage, buds and fruit for food. The Indians call the mirití the "tree of life."

At the beginning of this century, only twenty-three species of palms were known to the scientific world. Now, mainly through the labors of Humboldt and Bonpland, Spix and Martins, Poeppig, Wallace, Spruce, Wendland, and Griesbach, in the new world, and of Blume and Griffith in the old, we distinguish nearly 600 species. These belt the earth between the latitudes of New Zealand and South Carolina. Humboldt was right in calling South America the most beautiful portion of the palm world. Certainly it yields to no continent in exuberance and variety. Europe has but one species, and Africa comparatively few; India is the only rival. There are 273 American forms, and probably 75 of these are peculiar to the Amazonas.

Palms have small power of migration: and it does not appear that any species is able to cross the ocean without the aid of man. They are distributed between the sea shore and the altitude of 11,000 feet. A few species range from the roots of the Andes across the whole plain to the Atlantic; but many are restricted to certain tributaries—to the Lower Amazons, the Solimoens, or the Marañon. Palms are far more abundant on the east than on the west side of the Andes, and the species are entirely distinct.

The following are the most important palms observed in ascending the Amazons and its chief affluents. The first two are fan-leaved; all the rest have feathery leaves.

Mirití, so called in Brazil, the Achuál of Peruvians, the *Mauritia flexuosa* of science, is the most universally distributed palm in the valley, abounding from the shores of the Atlantic to the altitude of 3,000 feet on the Andes of Peru, Ecuador, and New Granada. It is distinguished from all others by having both fan-shaped leaves and scaly fruits. It is a social palm, forming groves along the low shores at the mouths of tributaries and about swampy lakes. It is always a conspicuous object, the smooth stem often rising one hundred feet, and bearing enormous spreading leaves and clusters of egg-shaped, reddish fruit, resembling pine cones. The epidermis of the leaves furnishes a useful fiber, the orange pulp of the fruit is eaten by the Indians or made into wine, and the farinaceous pith yields a kind of sago.

Bombonâje, or *Carludovica palmata*, the young, unexpanded leaves of which are so largely used at Moyobamba and Guayaquil in the manufacture of Panama hats, is called a palm, but is more properly a screw pine. It has no stem; the leaves are long, slender petioles, springing from the ground. The leaves are about two feet long, fan-shaped and four-parted, each segment being again ten-cleft; so that when folded in venation, each segment on its own rib, there are eighty layers in a young leaf. It occurs only on the slopes of the Andes. (See engraving on this page.)

Assaí, or *Euterpe oleracea*, is very common, and is the first palm, after the miritì, which arrests the attention of the traveler. Its tall, straight, slender stem, rising from 75 to 100 feet, its curious cabbage top (a long cylindrical leaf sheath), and its arched, plume-like foliage, eight or nine feet long, trembling in the gentlest breeze, give a peculiarly picturesque feature to the views on the Lower Amazons. Its leaves consist of 78 pairs of leaflets. The tree grows on moist soils from Pará to Teffé.

Paxiúba of Brazilians, the huacra-pona of Peruvians, and the *iriartea exorrhiza* of botanists, is equally abundant at the mouth of the great river and in the moist valleys of the Andes. It is easily recognized by its buttressed stem, that is, supported on a cone of emersed prickly roots resembling the spokes of a half opened umbrella, so that the tree looks as if standing on stilts. It is about forty feet high. (See engraving on page 354, vol. XXIX.)

Barrigúda, called tarapóto in Peru, is the *ireartea ventricosa*. It is distinguished from all other palms by a curious swelling midway up its trunk. It is a solitary palm, rising from 60 to 100 feet. It is also buttressed, the cone of roots sometimes standing twelve feet high. The leaves, usually six in number, are eighteen feet long. It grows on lands not inundated, and ranges from the Rio Negro to 5,000 feet on the Andes.

Piassába is a species of *Leopoldinia*, which furnishes the valuable piassába of commerce, exported to England for the manufacture of brooms and brushes, but used on the Amazons for cables, for which it is admirably fitted, being durable and light, not sinking in water. The fiber in young plants is nearly five feet long, in old trees not two. The tree is about thirty feet high, and bears thick, large leaves fifteen feet long, with sixty pairs of leaflets. The stem is stout, and covered with a pendulous, brown, hairy beard, which is the fiber used. It is found only far up the Rio Negro.

Bussú, or *manicaria saccifera*, common about the mouth of the Amazons, looks at a distance like a rigid plantain, bearing immense, stiff, simple leaves, of a pale green color, and twenty-five feet long by six feet wide. The stem is not over twelve feet high.

Baccába, or *œnocarpus distichus*, is a stately, elegant tree, sixty feet high, with a straight, smooth stem, and a flattened crown of a dark green color. The leaflets are numerously and strongly plicate. The large bunches of oily fruit, weighing thirty pounds, are used, like those of the assaí, in making a beverage. The baccába grows on the Brazilian Amazons. Another species, called patanâ, is a giant among the palms, standing from 80 to 100 feet, with leaves nearly half that length. The veins of the leaves furnish the Indians with the needle arrows for their blow guns.

Jupatí, or *raphia tædigera*, is famous for its long, shaggy leaves. which measure from forty to fifty feet. It is the only fruited palm in America that has pinnate leaves. It belongs to the lower part of the Amazons.

Pupúnha, or peach palm, *bactris gosipaës*, is one of the most beautiful and useful of palms, growing generally in clusters from sixty to ninety feet high, and thickly armed with prickles. Its numerous, curling, drooping leaves, seven feet long, have from sixty to seventy pairs of leaflets pointing in all directions. Under the deep green vault hangs the huge cluster of fruit, yellow and red when ripe, about seventy-five in number, and making a load for a strong man. It is nowhere found wild, although an undoubted native, but is seen in cultivated spots along the whole river. The Peruvians call it pisho-guayo. Many other species of *bactris* occur, but they are all dwarf palms, and form a considerable portion of the undergrowth in recent forests.

Tucúm of Brazilians, cambíra of Peruvians, is the *astrocaryum vulgare*, a common forest palm, with a stout trunk from fifty to sixty feet high. The closely set leaves stand erect, broom-like, at the head of the stem. From the cuticle of the fronds are made the strongest mats, hammocks, nets, and twine on the Amazons.

Jauarí, belonging to the same genus as the last, is one of the commonest palms along the banks of the Middle and Upper Amazons, and the clustered, rather slender, but very prickly stems, about thirty feet high, contribute to give a forbidding and monotonous aspect to the low, inundated, sandy shores. It bears an excessively hard nut.

Murumuru, another *astrocaryum*, abounds particularly along the banks of the Marañon. It rarely exceeds fifteen feet in hight, but it carries a graceful head of long, pinnate leaves, and formidable spines. A spiny relative, on the Lower Amazons, is significantly called munbáca, or "wake up!"

Inajá, or *Maximiliana regia*, is a fine feathery palm, quite common in the primitive forests along the whole river, but most conspicuous up the Rio Negro, where it is called cocurito. Its large spathe is used as a readymade basket. The stem is of moderate hight, and the leaves, in circles of fives, spread slightly, forming an open vase.

Yâgua, the *attaba Humboldtiana*, upon which the great German traveler said Nature had lavished every beauty of form. The smooth, ringed, slender stem rises from twenty to forty feet high, and its leaves, about six in number and over thirty feet long, spring almost vertically into the air, but arch over at the ends. The pinnæ are arranged vertically, not horizontally as in other palms, and number some two hundred pairs in a single leaf.

Urucurí, or *attaba excelsa*, common to the Brazilian Amazon, has a smooth, columnar stem, nearly fifty feet high, and broad leaves with symmetrical, rigid leaflets. The fruit is burnt for smoking rubber. Another species, the stemless curuá, grows on the Tapajos and Negro, and its fruit contains milk.

Cocoanut, the well known *cocos nucifera*, is limited to the Atlantic end of the Amazons, and must be cultivated. As far inland as Manãos it grows, but will not fruit.

Ivory palm. There are two species of this so-called palm, the *phytelephas macrocarpa*, or polo-ponto, and the smaller *p. microcarpa*, or yarína, both growing along the east side of the Andes; and both are different from the Guayaquil species, which has a high trunk. The seeds yield the vegetable ivory of commerce.

THE SCREW PINE OF THE AMAZONS.

Our engraving exhibits a characteristic specimen of the tropical vegetation of South America. Palm-like as the foliage is, the plant is one of the screw pines, contained in

STEMLESS SCREW PINE (*Carludovica humilis*).

the order *pandanaceæ*. The specimen, being of dwarf growth, is altogether different from the climbing varieties, to which its obvious aerial roots would indicate its close relationship. The leaves are of a fine dark green; and the flowers, which are inconspicuous, are of the monœcious tribe, having the stamens and pistils on separate flowers on the same plant

Toughened Glass.

About seven years since, M. Francois de la Bastie, a French engineer, after long and patient investigation into the subject, discovered a simple means of rendering glass practically unbrittle, and at the same time of preserving its transparency. Broadly stated, it consists in heating the glass at a certain temperature and plunging it while hot into a bath consisting of a heated oleaginous compound. There are, however, many conditions in connection with the details of the process upon which a satisfactory result depends, and the neglect of any, even in a slight degree, constitutes the difference between success and failure. Thus, the glass may be underheated and will not be susceptible to the effect of the bath, or it may be overheated and it will then lose its shape, or, again, it may be rightly heated and yet be spoilt in the course of transference to the bath. Moreover, the oleaginous constituents of the bath and their temperature have an important bearing upon the ultimate result. These and numerous other points of detail have all been satisfactorily settled by M. de la Bastie, who has designed furnaces and baths by means of which his toughening process can be carried out practically without fear of mischance. The time occupied in the actual process of tempering is merely nominal, for directly the articles are brought to the required temperature they are plunged into the bath and instantly withdrawn. The cost of tempering, too, is stated to be very small.

The physical properties of the material become altered in a very remarkable manner. To this singular fact we can testify, from the inspection of a number of toughened glass articles at the offices of Messrs. Abel Rey and Brothers, 29 Mincing lane, the representatives of M. de la Bastie in England. In these articles, which consisted of watch glasses. plates, dishes, and sheet glass, both colored and plain, neither transparency nor color is affected at all, and the ring or sound only slightly. These articles, some of them being exceedingly thin—were thrown indiscriminately across a room against a wall and fell spinning on the deal floor. Water was boiled in a saucer over a fire and the saucer was quickly removed to a comparatively cold place, and was unaffected by the sudden change of temperature. One corner of a piece of glass was held by the hand in a gas flame until the corner became exceedingly hot, but the heat was not communicated to the other portion of the glass, neither was it cracked from unequal expansion. A comparative experiment was then made with a piece of ordinary plate glass and a similar piece of toughened glass, in order to show their respective powers of resistance to fracture from the force of impact by a falling weight. In each case the glass was about 6 inches square, and was placed in a frame, the weight being dropped upon its center. With the ordinary glass, a 2 ounce brass weight, falling on it from a hight of 12 inches and 18 inches respectively, did no damage, but at 24 inches the glass was broken into several fragments. With a thinner piece of toughened glass, no impression was made by the same weight falling from hights ranging from 2 feet to 10 feet, the weight simply rebounding from off the glass. An 8 ounce iron weight, tried at 2 feet and 4 feet respectively, gave similar results. Upon the hight being increased to 6 feet, however, the glass broke. But here another singular result was produced; instead of breaking into about a dozen pieces, as did the ordinary glass, it was literally smashed to atoms. The largest fragments measured half an inch in length and breadth, and these were easily reduced by the fingers to atoms varying in size from that of a pin's point to that of a large pin's head. The lines of fractures in the fragments presented to the eye the appearance of irregular lace work, and these lines were, moreover apparent to the touch, but more palpably so on one side of the glass than the other. Which of the two sides was the one that received the first impact of the blow, we were not able to determine. Another peculiarity is that the edges of the fractures are by no means so sharp, and therefore capable of causing incised wounds, as are those of ordinary glass. It would seem that the toughened glass possesses enormous cohesive power; but that if the equilibrium of the mass is disturbed at any one point, the disturbance or disintegration instantly extends throughout the whole piece, the atoms no longer possessing the power of cohesion.

Of the practical nature of M. de la Bastie's unique discovery, there can be no question whatever, nor can there be any doubt of its value in the arts, sciences, and manufactures. The applications which suggest themselves are innumerable; and above and beyond the usefulness of the process with regard to articles of domestic use, come important considerations affecting the applied sciences, especially in connection with chemical manufactures and similar industries, where a material, alike uninfluenced by the action of heat or acids, has been so long and so vainly sought for—notably in connection with vitriol chambers in the manufacture of sulphuric acid, and for piping in chemical works. For the present there remains one purpose to which toughened glass cannot be so easily applied, and that is to window glazing in odd sizes, inasmuch as it cannot be cut by a diamond or other ordinary means. Our glaziers will therefore have a respite, but we cannot give them much hope that it will prove a long one, as experiments of considerable promise are being conducted with the view of solving this problem. Moreover, the glass can be cut to the proper sizes before toughening if desirable. The glass, however, is readily engraved, either by fluoric acid in the usual way, or by Mr. Tilghman's elegant sand blast process. It can be easily polished, and it can also be cut by the wheel, as for luster work and the like.—*London Times.*

American Geographical Elevations.

As geographer in the Rocky Mountains Expedition under the charge of Dr. F. V. Hayden, Mr. Jas. T. Gardner found it necessary to fix upon some datum point to serve as a base for the reckoning of altitudes, and met with a first difficulty in the different altitudes assigned to Denver, Colorado, they diverging between 200 and 300 feet. To eliminate the error, he undertook the "reconstructing of all possible lines of level from the ocean to the Rocky Mountains, using only official reports by engineers, and checking them by personal examinations of their note books and working profiles whenever practicable." The following are a few of the levels ascertained

	feet.
Mean level of Lake Ontario above mean tide level	249·99
" Lake Erie	573·08
" Lake Huron	589·99
" Lake Michigan	589·15
Low wa'er in Ohio at Cincinnati	440·00
Cairo city base, ordinary low water	291·23
Saint Louis directrix	429·29
Omaha, low water base of U. P. R. R.	977 90
" depot grounds	1,060·40
Denver, Col., O.P.&K.P.R.R. passenger depot	5,196·58
Cheyenne, U. P. passenger depot	6,075·28
Golden, Colorado	5,728·98
Ogden, Utah, depot track	4,303·30
Pike's Peak	14,148·66

The level mean tide at Albany, N. Y., above mean tide at New York city, was taken at 4·84 feet, as ascertained by the Coast Survey. A few others of the hights ascertained are:

	feet.
Quebec. mean tide level	15·37
Montreal, summer water level	30·00
Lake Champlain, mean level at Whitehall	100·84
Pittsburgh, Pa., low water in river	699·20
Louisville, Ky., low water above Falls, about	404·00
New Albany, Ind., low water in 1857	379·75
" depot of L. N. A. & C. R. R.	451·75
Rock Island, Ill., high water in Mississippi in 1852	566·68
Terre Haute, Ind., high water in Wabash	485·55
" ordinary water	467·45
Mount Lincoln, Colorado	14,296·66