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 mirití, 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 spoken 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.

Yágua, 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.

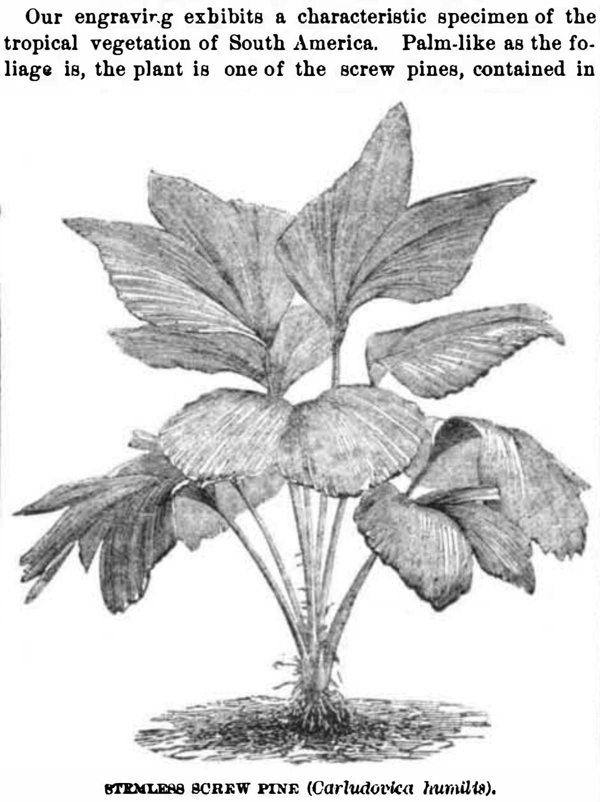
Urucurí, or *attaba excelsa*, common to the Brazilian Amazon, has a smooth, columnar stem, nearly fifty feet high, and broad leaves with symmetrical, rigid leaflets. The fruit is burnt for smoking rubber. Another species, the stemless curuá, grows on the Tapajos and Negro, and its fruit contains milk.

Cocoanut, the well known *cocos nucifera*, is limited to the Atlantic end of the Amazons, and must be cultivated. As far inland as Manâos 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 exbibits 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 water 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