THE NEW GOLD FIELDS.

No expedition since the war, says the *Science Record* for 1875, has attracted more attention or excited more interest than the one which left Fort Abraham Lincoln, Dakota, on the 2d of July, 1874, to explore the Black Hills. This region of country, lying in the southwestern part of Dakota, and extending some distance into Wyoming, and slightly indenting Montana, has, until now, in its interior, been entirely unexplored by the white man. Previous expeditions have skirted the hills, but never penetrated them, and we have been dependent on the reports and traditions of the Indians for the little we have known of them. The hostility of the Indians has defeated any attempts to explore the country by civilian parties.

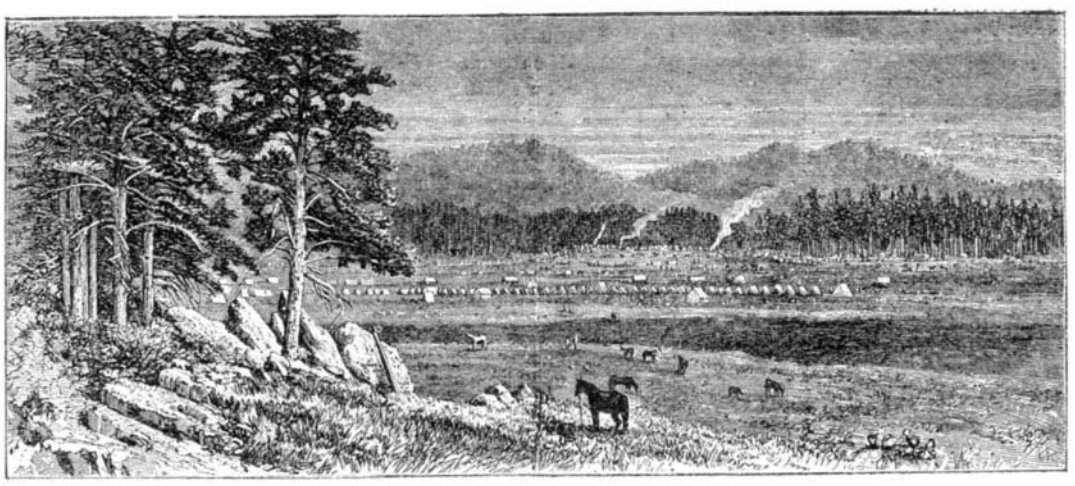
The present expedition was entirely a military one, and consisted of ten companies of the 7th cavalry, two companies of infantry, and three pieces of artillery, in all about 700 soldiers, with the addition of a train of 120 wagons, and about as many teamsters, the whole under command of Major General George A. Custer. The scientific corps consisted of Colonel William Ludlow, U.S. Engineer Corps; W. H. Wood, assistant; Professor N. H. Winchell, geologist; Professor N. H. Winchell, geologist; Professor A. B. Donaldson, assistant; George B. Grinnell, palæontologist; L. H. North, assistant; Dr. J. W. Williams, chief medical officer, botanist.

The expedition reached the Black Hills about the 20th of July, after a march of eighteen days, mostly over an arid, treeless, desert country. General Custer, in spite of the prophecies of his Indian guides, who declared the thing impossible, succeeded in penetrating to the very interior of the hills with his wagon train; and by sending off detachments of cavalry here and there, has succeeded in exploring and mapping the hills through their entire length and breadth. The country is found to be of great scenic beauty, as shown by our illustration, and is luxuriant in vegetation, abundant in game, timber, and good water. Thousands of acres of fertile land invite settlement. The country, however, is a part of the Sioux reservation, and cannot be opened to the whites until the government shall make some satisfactory arrangement with the Indians.

On the 31st of July gold was discovered along the banks of a creek, on which the expedition was encamped, the best pans yielding from five to ten cents' worth of gold, equivalent to fifty dollars a day to the man, if the yield should prove as good as promised.

Our camp view of the principal park in the hills gives some idea of the size of the expedition. This site was selected for the permanent camp, and from this point detachments radiated for several days.

Many expeditions to this region have been organized, and numerous persons have been induced to deposit small sums of money for outfit, fees, preliminary expenses, etc. It should, however, be known that the military authorities will maintain the rights of the Sioux Indians, and will prevent any attempt, on the part of white men, to commence mining operations within their territory. The specious advertisements for miners and adventurers to start immediately to the Black Hills gold fields should therefore be avoided.



THE NEW GOLD REGIONS.—BLACK HILLS.

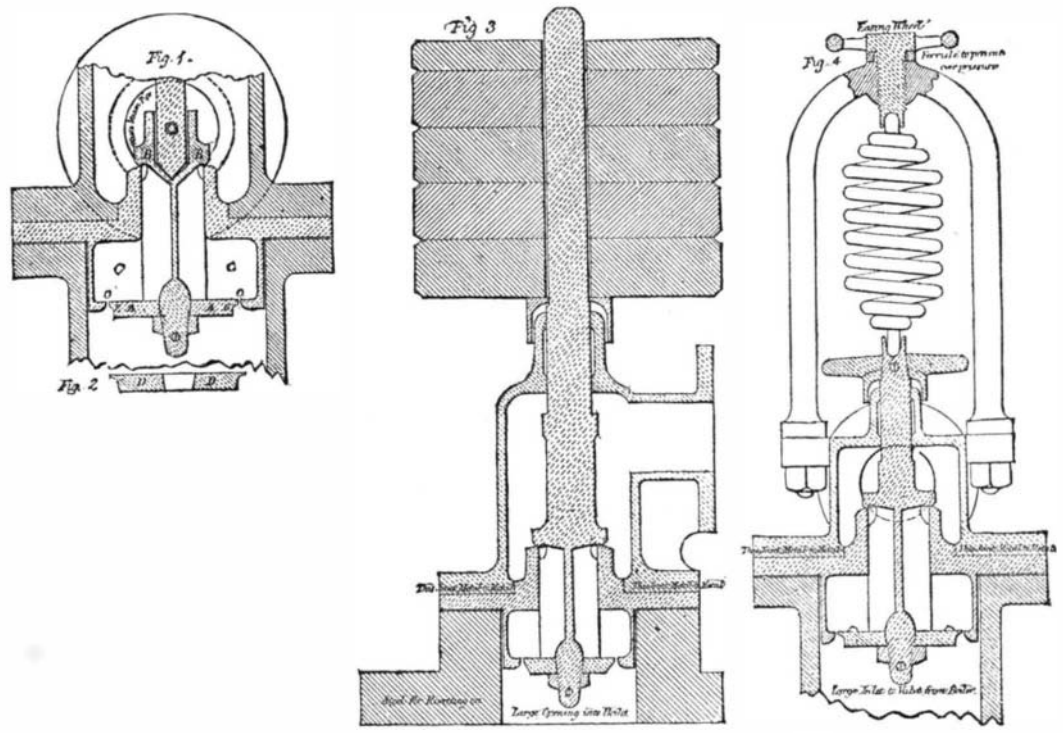
IMPROVED SAFETY VALVE.

Our engraving shows a new form of safety valve for marine use, from which the steam is led away and blown into the sea without any increase of pressure being necessary. It is the invention of Messrs. D. Cockburn & Son, of Port Eglinton, near Glasgow, Scotland, and three forms of it are shown in the illustration (for which we are indebted to *Engineering*); but a description of Figs. 1 and 2 will serve to explain the whole. This valve, which is $1\frac{5}{16}$ inches in diameter, was applied to the boiler of the steam yacht Griffin, this boiler being worked at 60 lbs. pressure, and having three furnaces containing 50 square feet of fire grate area. The steam escaping through the valve was not discharged freely into the atmosphere, but was led down through a pipe and discharged through the vessel's side below the water line.

Notwithstanding this arrangement of the discharge, and the large fire grate area, this valve was found capable of preventing any accumulation of steam pressure beyond that to which it was loaded. The manner in which this result is obtained is as follows: Referring to Fig. 1, it will be seen that the safety valve proper, B B, is an ordinary valve with feather guides and bearing upon a narrow flat seat. Below the flange carrying the seat of the valve is formed a chamber, C, and the feathers of the valve are prolonged downwards so as to carry a disk, A A, which nearly fits an opening formed in the bottom of the chamber, C. The result of this arrangement is that, on its way to escape through the valve when the latter is lifted, the steam has to pass through the narrow annular space, O O and in doing so, it becomes wire-drawn, causing the pressure in the chamber, C, to be less than the boiler pressure. The upper side of the disk, A, is thus, as soon as the valve opens, exposed to a less pressure than the lower side, and thus the valve, as it lifts, is assisted in opening by the excess of pressure on the under side of the disk, A.

The disk, A, has a thickness equal to the lift of the valve, and its periphery is turned to such a form as to increase the annular area, O O, as the valve rises, the ratio of this increase varying according to the way the valve is loaded. In the case of the valve fitted to the Griffin, the bottom disk was originally made as shown at D, Fig. 2; but this form, although suitable for a spring-loaded valve discharging into the atmosphere, was found not to give sufficient lifting power to overcome the resistance of the water in the case of the discharge below the water line. In this latter case it was found that, when the valve commenced to rise, a good deal of power was required to set in motion the water in the pipe, and hence a disk was applied having the edge formed as shown at E E, Fig. 1. This form was found to answer perfectly, as we have already stated. While speaking of this silent discharge, we may mention also that it was found necessary to fit to the pipe an air valve opening inwards to prevent the waste steam pipe, etc., from being filled with water when the blowing-off of the steam ceased.

Of the remaining figures, Fig. 3 shows one of these valves loaded with dead weight, and in this case it will be seen a different form of relieving disk is employed; while Fig. 4 shows a spring-loaded valve. Of course other modifications can be arranged to suit various circumstances. Altogether the valve is a very simple one, and it appears in the recent trials to have shown an efficiency which entitles it to special attention.



COCKBURN'S EQUILIBRIUM SAFETY VALVE.

BRITISH iron rails have ceased for the time to be an article of American consumption. About $6,500,000 worth of British rails were imported in 1874, but they were all, or nearly all, steel. The change is very great and sudden, for in 1872 our imports of British rails amounted to $24,000,000, and in 1873, to $12,000,000. Notwithstanding the great fall in iron since 1872, the decrease in quantities is no greater than that in values, which is owing to the fact that last year we imported only steel rails, which will last a great many years, while in 1872 we imported the cheapest and poorest iron to be found in England.

Sleep, and How to Procure It.

We read of Bismarck that "his old foe *insomnia* still tenaciously clings to him. He passes whole nights waking. At morning dawn, slumber, if not sleep, comes at last, but the day finds him weary and unfit for work, yet with mountains of work to get through." Having paid considerable attention to this important question of being able to procure sleep, I venture to record what I know about it.

The human frame cannot do without sleep. I believe the reason is that the mysterious property—for want of a better name we call it "vital energy"—gradually leaks out during the day. During sleep, the machinery of the body, especially the brain, becomes recharged with it. The cause of not being able to sleep—I write now of people in good health and hard workers with their brains—is that the brain cannot, so to speak, "go down," but it continues to act, more or less. My father, when writing the Bridgwater Treatise, had his own way of working. He was an excessively busy man during the day, and had only the night hours in which he could write. He generally dined at seven o'clock, and immediately after dinner went to sleep for two or three hours. He then got up, and worked on till two or three in the morning. Just before retiring to rest, he took some light pudding, or a sandwich, with cocoa or milk. Thus he always slept well, as the blood was diverted from the brain to the stomach.

I have no hesitation in saying that the proper thing to do is to go to sleep immediately (or at least very soon) after the meal of the day. All animals always go to sleep, if they are not disturbed, after eating. This is especially noticeable in dogs; and the great John Hunter showed by an experiment that digestion went on during sleep more than when the animal was awake and going about. This is his experiment: He took two dogs and gave them both the same quantity of food. One of them was then allowed to go to sleep, the other was taken out hunting. At the end of three or four hours he killed both these dogs. The food in the stomach of the dog which had been asleep was quite digested; in that of the one which had been hunting the food was not digested at all.

This fact, I think, shows the advisability of going to sleep immediately after eating. This ignored fact always occurs to my memory when I see old gentlemen nodding over their wine. Nature says to them: "Go to bed." They will not go to bed, but still Nature will not allow her law to be broken, so she sends them to sleep sitting in the chairs. People therefore who feel sleepy after dinner ought to dine late, and go straight to bed when a sleepy feeling comes over them.

Most good folks, however, do the worst possible thing imaginable; they retire altogether into the drawing room, and then to make matters worse, they drink tea and coffee. Now I regard tea and coffee when taken at night to be poison to certain constitutions. It is very well in the morning, but it is very bad at night. The reason why tea and coffee should not be taken at night is that the one contains an alkaloid called theine, and the other contains an alkaloid called caffeine. These two alkaloids taken into the system stimulate the brain and do not allow it to go to rest. I speak of this matter from experience. If I take thoughtlessly a cup of of tea or coffee after five o'clock in the evening, going to bed about eleven, I cannot go to sleep; and if the brain does fall asleep, the alkaloid will wake it up in about an hour or two. Sleeplessness, therefore, is usually caused by tea or coffee, though strange to say that tea and coffee actually send some people into sound slumber.

I well recollect the late Dr. Wilberforce, then Bishop of Oxford, telling my father, then most actively engaged as Dean of Westminster, of his patent way of going to sleep. It is better than the oldfashioned prescription of watching sheep jumping through a hedge one after another, ships sailing out to sea, etc. The Bishop's prescription was to repeat very slowly the vowels A E I O. In doing this, they were to be faintly pronounced with each inspiration and expiration. It will be found easy to do this without moving the lips, but the vowel U must not be pronounced, for to do this the muscular action of the lips necessarily takes place, and sleep comes not. I advise my readers to try this plan.

I once heard of a midshipman who complained that he could not sleep at night because there were no waves dashing against the sides of the ship. To this noise he had so many months been accustomed that he could not sleep without the familiar sound. He asked his mother to dash pails o;

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.

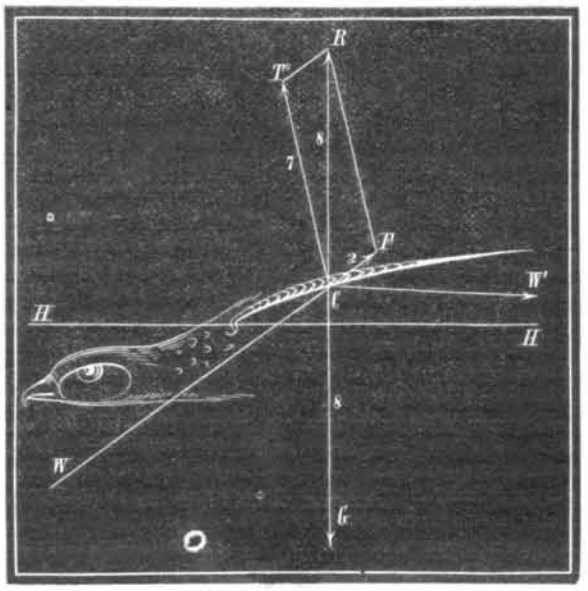
Correspondence.

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.

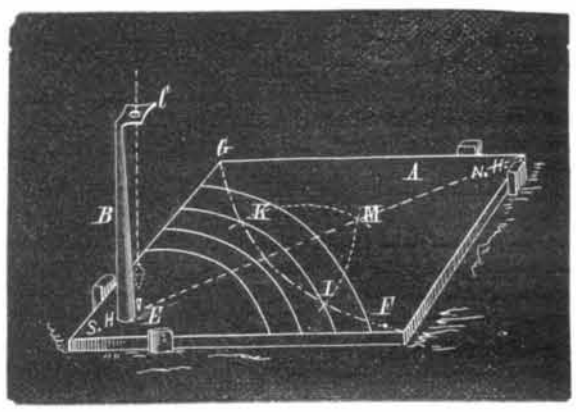
F. G. FOWLER.

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 miritĭ 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 Martius, 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.

Miritĭ, 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