as two pounds of fiber, but the average is not more than a pound: on indifferent soil much less.

Several grades of fiber are derived from different parts of the leaf stalk, the edges yielding the finest. The fiber, which lies next the surface, is stripped off by hand in broad bands, and then softened by being drawn backwards and forwards between a broad bladed knife and a block of wood. One worker cuts up the stalks, strips off the leaves, and attends to the supply: the second, frequently a boy, spreads out the strips of fiber; the third draws them under the knife. The coarse fiber is called *bandala*; the finer, *lupis*. The former is chiefly used for ships' rigging; the latter is employed in weaving. The three finer grades of lupis are further softened before weaving by being pounded in a rice mortar. Generally the first or finest sort is worked as woof with the second as warp, and the third as warp with the second as woof. The fabrics so woven are nearly as fine as the *nipis de piña*. For purity, flexibility, and color, the finest of these banana stuffs are said to compare with cambric as cardboard does to tissue paper. According to Jagor the finest stuffs require so great an amount of dexterity, patience, and time in their preparation, and are consequently so expensive, that they cannot compete with the cheap machine-made goods of Europe. Their fine warm yellowish color also is objected to by European women accustomed to linen and muslin strongly blued in the washing. By the rich half castes, however, who understand the real goodness of their qualities, they are highly appreciated. In the regions where abacá is cultivated, the entire dress of both sexes is made of coarse banana cloth called guinára. For foreign markets, still coarser and stronger fabrics are prepared, such as crinoline and stiff muslin, used by dress makers

It is as an article for exportation, however, that the fiber is of the most importance commercially. In 1871 over 600,000 cwt. were exported, nearly three fourths coming to this country. It is very largely used in the manufacture of paper.

THE ORIGIN OF MOUNTAINS.

Mountains have been explained by two widely different suppositions. One is that they are due to sediments deposited under water from the erosion of a wasting continent, which by upheaval have become mountains. The other is that they are due to uplifts, as the result of lateral pressure caused by shrinkage of the earth's interior. For the last fifteen years or more, these conflicting views have each been held by geologists of undisputed authority; and "when doctors disagree, who shall decide?" is the old question which remains still unanswered. This uncertainty in all moral reasoning, when we have to balance probabilities, is a great source of discomfort to the youthful student; and in perhaps no department of human inquiry is this more true than in the field of Science, for what is highly probable today may be shown in the light of advancing Science to be highly improbable tomorrow. And in reply to the oft-repeated question of the young student: "What is the use of learning as truth today what may be rejected as error tomorrow?" it may be said that all the successive theories of advancing Science are stepping stones which may eventually lead to the undoubted truth. We see use in taking the first faltering and ill-advised steps in any avocation, though we soon reject these for others more conducive to the end desired.

Without attempting a decision, we propose in this article only to state some of the main points in the arguments *pro* and *con*, and leave all to decide for themselves as to which is the more reasonable.

We would naturally conclude that, if mountains are due to lateral pressure, they would be formed by the uplifts or elevations of the earth's crust. But this is seldom the fact, for several reasons. According to Professor Dana, many if not all mountains have their origin in the bending down of the crust. As the crust subsided, the trough was kept full of water, which continually deposited sediment. This deposition about kept pace with the rate of subsidence. In this manner, many of our mountain ranges were, in the earlier ages, taking the initiatory steps in the process of mountain making. As the crust subsided and was covered to a great depth with an accumulation of eroded material, it would be weakened by the earth's internal heat. An addition of several thousand feet of sediment to the surface would bring a given degree of heat so many thousand feet nearer the surface. This would often be sufficient to soften or melt the sustaining crust, which would then yield before the lateral and vertical pressure combined, and cause the crusts on the sides of the trough to fold over and approach each other above it, thus crushing the sedimentary beds into a narrower space, with the necessary result of elevating the crushed and folded strata in the middle.

The Appalachian chain illustrates the fact that one mountain system may be formed by several successive depressions, accompanied with the deposition of eroded material. Professor Hall attributes the cause of mountain making to sedimentary accumulations, which, by their weight, are sufficient to cause a depression in the crust. Thus, by the addition of 40,000 feet of sediment, the crust would sink the same number of feet. Then, by a subsequent elevation of the crust, the accumulated strata would be raised into a mountain, independent of lateral pressnre. He just reverses the idea of Dana, by making the subsidence a consequence of sedimentary accumulations, instead of the accumulations a consequence of subsidence. To this Dana objects, because "the earth's crust would have to yield like a film of rubber to have sunk a foot for every added foot of accumulation over its surface, and mountains would have had no standing place."

Another reason why the elevations due to lateral pressure do not produce the high mountains appears in the fact that, when a series of strata is sharply bent upwards—forming an anticlinal—the outer strata are fractured and strained apart, while the strata which are bent downwards—forming a synclinal—present to the surface a firm and compact mass. This can be clearly shown by making a sudden bend in a walking stick. The fibers of the outer curve will be torn asunder, leaving a splintered and ragged surface, while on the inner curve they will become unusually dense and firm. The fractured edges of the anticlinal curve are in a favorable condition to be worn away by water, while the compact surface of the synclinals, though forming the valleys, where the greatest amount of running water would act upon it, suffers but little erosion. The consequence is that the elevated strata are worn away even below the level of the original valleys, and the latter become the elevations. This can be proved by noticing that the strata visible on the sides of most valleys and hills are not parallel to the sides, but are nearly at right angles to them.

The mountains formed by depressions of the crust were far more common in the early history of sedimentary deposit, for the crust was then comparatively thin, and hence more yielding to lateral pressure. But after the crust became thickened beneath by the cooling of the earth, and more rigid by the accumulation of strata above and by previous plication and solidification, the mountains formed were largely due to uplifts of very wide extent carrying the stratified deposits with them. Our Rocky Mountain system was formed by these uplifts in the tertiary age, and it is probable that coral island subsidences in the Pacific Ocean accompanied the continental elevations.

The adherents to the accumulation theory—among whom are Hall and Hunt on this continent, and Scrope and Lyell in Europe—have noticed that, in mountainous districts, the elevations are less than the aggregate thickness of the strata, while in non-mountainous sections the hights correspond to the thickness of the strata. If the latter were equally true in mountainous districts, the Appalachian Mountains would attain a hight of forty thousand feet. Mr. Hall holds that these barriers are due to original deposition of materials, and not to any subsequent forces breaking up or disturbing the strata of which it is composed; and that upheavals and contortions of strata are only accidental and local. In this view he is sustained by Montlosier and Jukes. He also claims that the direction of mountain elevations is determined by accumulations along the sides of oceanic currents or shore lines. Dana, on the other hand, considers the northeast and northwest trends of most of the mountain and shore lines on the globe to be the result of cleavage in the earth's crust, and to indicate lines of weakest cohesion, like cleavage planes in crystals.

The accumulation theory supposes that, after a vast amount of material has been deposited in successive strata under water, a great continental upheaval brings the whole mass high and dry above the water line; and the present mountains are the stratified deposits which have escaped denudation by the action of frosts and floods. We have good illustrations of this process of erosion in the Missouri River valley, where the elevated land is being constantly washed away, forming deep ravines and abrupt ridges, and is carried into the muddy Missouri, and deposited in the deltas at the mouth of the Mississippi, thus adding constantly to the territory of Louisiana. As Egypt is said to be a gift of the Nile, so Louisiana is a gift of the Missouri. The effects of erosion, on a small scale, can be seen on the sides of deep railroad cuts, where miniature mountains and valleys are formed by the washing of water as it runs down their slopes.

Professor Le Conte opines that these opposing theories result from the loose use of the word mountain. He treats the whole subject under the two heads of mountain formation and mountain sculpture, and claims that the true mountain chain, or the convex plateau which constitutes it, is due only to foldings of the crust, and that those elevations which are left by the erosive action of water are not mountains, but simply sculptured continental elevations.

The effect of shrinkage and of erosion can be fairly seen on a small scale by the following artificial contrivance: Take a well filled bladder or toy rubber balloon, and cover it completely with several successive coatings of tallow, glue, plaster of Paris, or other substances that will harden after they have been put on in a plastic state. These will represent the stratified crust. Then by withdrawing some of the air from the bladder, which will answer to contraction of the nucleus, the crust will become rigid, furrowed, and fractured by lateral pressure, like the crust of the earth. Now by allowing a well regulated stream of water to flow over the surface of this, we can see many of the phenomena of erosion, like those apparent on the earth's surface.

Sir Charles Wheatstone.

This distinguished inventor died in Paris, France, on the 20th of October last. He was born at Gloucester, England, in 1802, and in early youth was engaged in the manufacture of musical instruments. With the object of improving upon these, he was led to study the laws of sound; and thus imbibing a strong taste for physical science, he proceeded to the investigation of the phenomena of optics and subsequently of electricity, on the velocity of which he published papers in 1834, detailing many very striking and new experiments. In the same year he was appointed Professor of Experimental Philosophy at King's College, London.

Previous to this time William Fothergill Cooke, in Heidelberg, Germany, had completed his first telegraphic invention, based on the electrometer form, had followed it with two mechanical telegraphs, and soon after came to England to introduce the telegraph system on railroads. His efforts at first pointing towards success were, however, nullified by a pneumatic signal apparatus, to which the railway people gave preference; but instead of being disheartened by his failure, the inventor began new experiments, regarding which he sought the advice of Faraday. The latter referred him to Wheatstone, and then, in 1837, began that partnership which has sent the names of the two inventors to posterity, indissolubly linked. It was Wheatstone's great learning, combined with Cooke's inventive genius, that evolved the succeeding discoveries in the telegraph. "Mr. Cooke," says Brunel, "is entitled to stand alone, as the gentleman to whom this country is indebted for having practically introduced and carried out the electric telegraph as a useful undertaking, promising to be a work of national importance; and Professor Wheatstone is acknowledged as the scientific man, whose profound and successful researches have already prepared the public to receive it as a project capable of practical application."

Invention now rapidly followed invention: the first was a discharger and secondary circuit to be applied to Cooke's original alarm; then combinations of all the various improvements; then a new mechanical telegraph, Wheatstone's work; then another telegraph, having a revolving index hand on a fixed dial, a new device of Cooke's; besides others, all devices of remarkable ingenuity, and the subjects of several patents in England. On the 12th of June, 1837, the inventors received their first English patents, and on the same date obtained an American patent on the electro-magnetic telegraph. This, however, was of no benefit to them, as the apparatus was never practically employed in this country, Professor Morse's instrument, as is well known, being the chief one in use from 1844 to 1846.

Wheatstone was a Fellow of the Royal Society, and twice received the medal of that association for his discoveries. Both himself and his co-laborer Cooke received the honor of knighthood in recognition of their public services.

SCIENTIFIC AND PRACTICAL INFORMATION.

POPPY RED FOR ARTIFICIAL FLOWERS.

Thin cotton tissues are brushed over with a mixture of corallin lake ground up with water and thickened with gum, 75 grains of calcined magnesia per quart being added before use.

NEW PERFUME.

The local committee in Tahiti have sent to Paris the odoriferous bark of a yet undetermined plant, known over the Society and Pamotons islands by the name of *marie*. It can be advantageously employed in the preparation of the perfume known as new-mown hay.

SOLIDIFIED MILK.

A sample of condensed milk, weighing about 1 cwt., has been exhibited at the rooms of the Society of Arts, London, and an interesting experiment made thereon. This mammoth piece of solidified fluid was prepared by Hooker's process. It had been exposed to the action of the air for four years and three months, yet its quality was still so excellent that in a few minutes it was resolved, by churning, into good fresh butter. The trial was only one of a series made at the International Exhibition, South Kensington, and elsewhere. In each case the same satisfactory results were obtained.

QUADRUPLEX TELEGRAPHY IN INDIA.

It will interest our readers, says the *Indian Daily News*, to learn that quadruplex telegraphy—that is, the art of sending four messages, two in each direction, simultaneously, by means of one wire—has this week been accomplished on the Madras Railway Telegraph. The system which Mr. Winter, the telegraph engineer, invented in March last, proved perfectly successful on eighty miles of line, and its extension to lines of greater length is simply a question of additional condensers and battery power. The principle of sending two messages simultaneously in the same direction, on which this quadruple system depends, was successfully worked between Salem and Madras on April 16, but unfortunately other duties prevented Mr. Winter's carrying out the duplexing of this principle until the last few days.

THE WESTON LOCOMOTIVE.

A new engine, built by the Baldwin Locomotive Works of Philadelphia, has been put on the Boston and Albany Railroad for trial. A saving of fuel of generally over 30 per cent is claimed. This is effected by means of a peculiar firebox. In most locomotives, the long flues or pipes connecting the furnace with the smoke stack are directly opposite the door, and much of the fine coal is caught by the draft as soon as thrown into the furnace, and comes out of the smoke stack in the form of dust and sparks. With this boiler, however, the invention of a man named Weston, a firebrick arch over most of the furnace keeps down much of the fine stuff, and what does escape has to pursue a zigzag course through a consuming box—where the particles are stopped, and even the smoke is consumed—in front of which are the flues, only six feet long instead of a dozen, as in an ordinary engine. This much for economy of fuel; and to provide still more for comfort, the smoke stack contains an arrangement by which what few sparks do get that far are carried off to the ground by pipes running beneath the engine. The locomotive is higher than most, and is extremely well proportioned. This is rather a small one, having a cylinder 16 inches in diameter, with a stroke of 22 inches, and driving wheels five feet in diameter. H. B. Klinger, who has it in charge, has been running it on the western end of the road, and comparing its work with that of the company's engines, with an average saving of 46 per cent in fuel.