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SCIENTIFIC AMERICAN SUPPLEMENT

No. 1089

For the Week Ending November 14, 1896.

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THE INCREASED CONFIDENCE IN BUSINESS CIRCLES.

There is a growing feeling that the tide of our commercial fortunes has turned and that the ebb which set in three or four years ago has brought us to a low water mark from which we shall see a flow of steady prosperity. As we go to press there are pleasant tidings of industrial establishments being started on full time, of others which have been long silent resounding with the busy hum of activity. Wholesale houses are sending out their travelers and conditional orders are being set in execution. One can hear a great sigh of national relief go up that the tremendous tension of the past few months is over, and there is a very distinct quickening of the national pulse and a general spirit of expectancy of good times to come.

How far these hopes are justified, how early will be their fulfillment, we do not undertake to say; but we wish to remind our readers that if the good times are to be permanent they must come in a natural way, and not as the result of any artificial aid therefore evanescent stimulus. There is a tendency in the daily press to push the thing along faster than is natural or expedient. The sick man must learn to walk before he can run. The credit of the country has been prostrated even to the point of death, and we must not expect that it will recover its full strength and virility in a day. Indeed, the past commercial history of the country shows that recovery is very slow; and it takes very little to give the patient a serious relapse. If we refer back to a period of which the present is strongly suggestive—the year 1873—it was not until the year 1880 that the country had fully recovered from its depression; and while we do not for a moment suppose that prosperity will be so belated in the present case, we do not believe that we are going to move at a bound from the one extreme to the other. Nor would it be desirable. "Boom times" are in some respects very bad times. Better a steady, legitimate growth than a hasty, artificially prompted, hothouse sprouting.

The nation has been learning valuable lessons during the last few years of depression, and we shall do well to make the present hour of restored confidence a starting point for a fresh growth in wealth and power whose motto shall be "make haste slowly."

THE REVOKING OF THE CYANIDE PATENTS.

Elsewhere in this issue we republish a statement which appeared in the New York Sun regarding the recent canceling of the cyanide patents by the High Court of the Transvaal Republic. The news will come as a great surprise to the mining world at large, and there will not be a corner of the earth where refractory gold is recovered by this very successful process—and it is at work in every quarter of the globe—where the revoking of these patents in the Transvaal gold fields will not produce a decided sensation.

The Sun is of the opinion that the result of this decision will be that "nowhere in the world will the users of the process continue to pay royalties, but will fight and overthrow the patents everywhere," and that the ruling of the Transvaal court "will result in immense additions to the world's stock of gold within a few years." We think, however, that this is overestimating the weight which a judgment of the Boer court will carry, especially when it is remembered that the parties who will be most seriously hurt by the decision are Utlanders and Englishmen. Not that we think the Boer court would intentionally give a decision at variance with the evidence; but in a suit of such magnitude as this we think that, in view of the recent strained relations of the Transvaal Republic, the mining companies of the United States and Australia will accept with some reserve the recent decision at Pretoria.

Moreover, there are certain historical aspects of the case which would make us hesitate to believe that the Transvaal judgment will be repeated in this and other countries. If this delicate and highly scientific process was elaborated before the year 1866, it was years ahead of its time, and appeared before there was any urgent demand for it. It is only in comparatively recent years that the attention and efforts of the mining world in general have been directed to the working of very low grade ores. In the earlier periods, prior to 1866, gold mining was carried on in the rich alluvial deposits and in the workings which lay comparatively near the surface. The "free gold" apparatus—the pan, rocker, battery plates, etc.—gave place to the various chlorinating chemical processes for working refractory ores, long after the period in question; and it was not until the year 1890 that Mr. Macarthur, in a paper read before the Society of Chemical Industry, described the steps by which he had arrived at his final invention of the cyanide process, the announcement being made at a time when the mining world was ripe for it, and looking eagerly for a solvent of gold which would have more affinity for gold than for the sulphides, and for a method of recovering the gold from the solution. The story of the discovery of this process, as told by Mr. Macarthur, shows that, whether there had been a previous discovery by another party or not, the final result in this case was arrived at as the result of patient search carried out on scientific lines.

The contest over the validity of the cyanide patents raises again that old question as to who should be the beneficiary of a valuable invention: the party who outlines a device and never puts it into working shape—perhaps because he does not realize its value, or perhaps because he is indifferent to it—or the man who produces the same invention as the result of an intelligent effort to fill a public want, and having proved his theory, labors until he embodies the theory in a machine or a process of real commercial value.

Howe held his sewing machine patents by the decision of Judge Sprague as being an inventor of the latter type; and the world at large honors Bessemer, but has forgotten Kelly.

We cannot agree with the writer in the Sun that the annuling of the cyanide patents would "result in immense additions to the world's stock of gold within a few years;" for behind such a statement lies the assumption that the present output is limited by the existence of the patents. So far from this being the case, the cyanide process has greatly increased the output of gold by enabling the miners to recover millions of ounces which were formerly rebellious against any existing form of treatment. The removal of the royalties would increase the mine owners' dividends by the amount of the royalties, but it would have no effect upon the output.

In this respect these patents, like all patents, have had a stimulating effect upon industry; they have recovered for the use of commerce and the arts millions of the precious metal, which, but for the patents of Mr. Macarthur, would now be lying in the tail heaps.

ANOTHER COMPARISON OF UNITED STATES AND BRITISH RAILROADS.

In a recent issue we drew attention to a comparison of American and British railroads by the Engineer, in which the editor reached the consoling conclusion that, as regards the construction of their track, English engineers have nothing to learn from American practice. We now notice that Engineering has recently made an interesting comparison of English and American roads based upon the Board of Trade returns and Poor's Manual, which is marked by a candor and impartiality which the Engineer would do well to emulate when speaking on matters pertaining to this country.

During the past year 270 miles were added to the total mileage of the British railways, as against 1,628 miles in America. This Engineering considers to be relatively greater for Great Britain "when the respective area and necessities of the two countries are considered;" but we think that, if the more just basis of the respective area and population per square mile be taken, it will be found that the 1,628 miles is relatively greater than it appears. There is no doubt but that, during the years of prosperity previous to 1893, the railroads were built faster than the necessities of the country called for them, and during the past few years there has been but little demand for fresh construction. The efforts of the management have been directed to betterment and repairs, and a large amount of capital has been expended in relaying the track with heavier rail, replacing wooden bridges with steel and stone structures and building better stations and yards.

In a comparison of capitalization we show to advantage. In the Eastern States contiguous to and including New York this amounts to $125,000 per mile; in the Pacific States it varies from $50,000 to $60,000 per mile, whereas in Great Britain it is as high as $236,400 per mile. These high figures for Great Britain are to be put down to the very costly nature of the construction, especially in the large cities, which boast of magnificent terminal stations, approached by high level viaducts which have been built at a large cost for land and damages. As an offset to the high capitalization of British roads it is pointed out that they earn 3·95 per cent on their liabilities, as against 2·94 per cent earned in the United States.

It is pointed out that, while the cost of construction of British roads is double that of the United States, their receipts per mile of railroad are "more than three times greater—$19,220, against $6,170." At first sight this is a comparison which will be more satisfactory to British railroad interests than to our own; but, as Engineering very fairly points out, these receipts are the smallest for the United States and the largest for Great Britain for many years past. Our contemporary furthermore says: "Of course the conditions in the two countries are so very different that no very useful deduction can be made from comparison of the results," and in the case in point this is specially true. There are long stretches—many thousands of miles—of railroad in America which are merely connecting links between habitable and cultivable districts, which are laid over barren deserts, and which contribute practically nothing to the per mile earnings of the roads. There is nothing of the kind in England, and in any comparison on a basis of average per mile earnings we must necessarily stand at a great disadvantage.

In the United States one-fourth of the receipts come from passenger traffic; in Great Britain, one-half. It is claimed that "British railways work more economi-

cally; 56 per cent of the gross receipts being absorbed in expenses, as against 70·37 per cent in the United States." This is explained by the fact that "much of the gross revenue in the States goes in commissions and equivalents." In Great Britain the net receipts per mile are $8,500 and in the United States $1,830 per mile.

It is in the record of freight traffic that the United States shows the most impressive figures, the largest, indeed, on record. There were 763¾ million tons handled against 334 million tons in Great Britain. Each ton in the United States was hauled on an average 116 miles at 0·839 cent per ton, and the receipts per freight train mile were larger in this country, being $1.57 against $1.44½ in Great Britain. This agrees with the well understood fact that our system of handling freight in long cars keeps down the ratio of non-paying to paying load as compared with the English system of using short four-wheeled trucks. Then, moreover, the train crew expenses are lighter as the result of employing more powerful engines to haul heavier trains. The American locomotive is earning $29,000—a result obtained by dividing the receipts by the number of locomotives—and the British locomotive earns $22,500. Against this it is pointed out that Great Britain has a larger stock for the length of its lines; the United States having one locomotive for each 4·8 miles of line and Great Britain one for each 1·13 miles. But it is to be borne in mind that the long stretches of comparatively unproductive road that occur in the Western States call for a light locomotive service, and thus materially reduce the number in service per mile in any comparison with such a thickly settled country as Great Britain.

The return to capital was 2·94 per cent in the United States and 3·95 per cent in Great Britain. The bonded debt in this country, however, called for about 4¼ per cent, and so the average dividend on share capital was but 1·59 per cent. In 1883 it was 2·75 per cent. On the other side of the water the holders of ordinary shares received an average of 3·80 per cent.

In a general way it may be said that it is early as yet to judge of the productiveness of American railroads, especially in the West and South, where they have been built in anticipation of the growth of these countries in population and manufactures. It was wise to call a halt; and during the few years' breathing spell which we are sure to see there will undoubtedly be a steady increase in the dividends and general prosperity of American railroads.

Prof. Goodyear's Discoveries.

Prof. William H. Goodyear is well known as a writer on art topics, and he has recently made a series of remarkable discoveries of the utmost importance regarding the mediæval buildings of Italy. In 1870 Mr. Goodyear began his researches and later embodied the results in an essay. His attention was first attracted to the subject of curves and other refinements in mediæval architecture by noting the slope of the first cornice of the Pisa cathedral. Such phenomena had been noticed, but were laid to the settling of the building.

"Not knowing," he says, "what the slope in the cornice meant, or how it got there, I went around the city looking at the walls and buildings. Finally I came across a little church known as San Stefano Outside the Walls, and I noticed a cornice with large arches at one end and constantly diminishing ones toward the other. It occurred to me that I should go inside that building. I did so, and found a tremendous scheme of dropping arches—all in a little village church that is never visited by foreigners. It gave me the hint that something of the kind was going on in Pisa cathedral."

Mr. Goodyear at once saw that the phenomena could not be accounted for by the settling of the foundations. He determined to visit Byzantine and Romanesque edifices in other parts of Italy, to ascertain if these architectural peculiarities were confined to Pisa. In 1895 he led the Brooklyn Institute Survey to Italy, and the conclusions he arrived at after a prolonged series of the closest and most accurate investigations and surveys were that:

"The mediæval builders used curved lines, leaning façades, bulging cornices, the dropped arch, rising pavements and convergence of walls, with somewhat different effects as demanded by the time and the occasion, but all to one common purpose, viz., to deceive the eye by playing on the sense of perspective. Of the fine lords and ladies, the substantial burghers and their wives, and the laboring folk who passed in and out of church doors, few, if any, knew that 'things were not what they seemed'; that the mighty proportions of the edifice and the dim vastness of the interior could be attributed to the Brobdignagian tricks of the architect, and that where reverence was deepest and awe most profound, their illusion was doing its most perfect work. Yet such was the case. Moreover, this art of perspective building was not the invention of the Christian centuries, though Christian builders may have carried it to a high degree of development. It has not been found markedly in Gothic structures. It reached its acme in the Romanesque, and particularly in that portion of the Romanesque which drew inspiration directly from Byzantine sources. Thus it was in some measure the child of the Greek style, that style which gives us the curvilinear refinements of the Parthenon and the subtleties of the Temple of Theseus. And to go back to the mother of civilization, it would seem that the Greeks themselves owed their knowledge of the style to the Egyptians, who, on the other hand, appear in certain instances to have transmitted it direct to Italy."

The result of Mr. Goodyear's researches is being published in the Architectural Record, of New York. He had the rare honor to be invited to go to the Liverpool meeting of the British Association for the Advancement of Science, as the guest of the Association. He took with him the entire Brooklyn Institute exhibit of photographs and surveys, which were placed on exhibition in Liverpool. The six hundred and twenty-five photographs are very interesting, showing curves in plan and elevation in many mediæval and some Renaissance buildings. The photographs read in connection with drawings, giving the floor plan and elevation, make a most interesting and important showing and with Mr. Goodyear's studies would make a splendid monograph. He has delivered a series of lectures on his discoveries since he returned from Liverpool, before the Brooklyn Institute.

The Production of Pulque in Mexico.

The United States consul-general at the city of Mexico says, in his last report, that it is impossible to separate in thought the average Mexican and pulque. No drink has a stronger hold on any nation than this on the Mexicans, and by Mexican is meant all classes in Mexico other than the Spaniards. Pulque is not the drink of the Spaniard or those of Spanish descent; they drink champagne, claret, sherry, and other imported wines. Among the peons, men, women, and children drink pulque with the same freedom that water is used in Europe. The pulque plant is indigenous to Mexico, often growing wild on the uplands, where—for months and years at times—no rain falls; and it is also largely cultivated in the most careful manner on the llanos de Apam, a large area of plains lying about 60 miles from the city of Mexico. In Spain a plant is found, called pita, somewhat akin to the pulque plant, or Mexican maguey, yet differing so much in its general features that it may be termed a distinct genus. The juices of the pita are unused in Spain, which fact plainly separates it from the family of plants in Mexico. The plants are transplanted when two or three years of age with much care, then cultivated in fields especially prepared for this purpose. Nature requires the plant to be "milked" when the liquid is ready to flow, else the superfluity of juices will cause the growth of a large stem from the center of the plant, shooting up some 15 or 20 feet, putting out branches at the top, which blossom in a cluster of yellowish flowers. These branches are symmetrical, and the effect is like a lofty branch candlestick. When the pulque is first extracted—before the process of fermentation sets in—it is sweet and scentless, and in this state is preferred by beginners. The fermentation takes place in tubs made for the purpose, and to aid or expedite the process, a little madre pulque is added, which hastens the chemical change. At times its fermentation is retarded by a cold spell at the vats, which prevents its transport to the city for a day or two. The city of Mexico has a population, it is said, of 350,000, and at least 250,000 of these use pulque, in preference to water or any other drink. It has been stated that 75,000 gallons of pulque are consumed daily in that city. The stock must be renewed daily, or else it becomes dead and insipid, though, it is said, a certain powder has been discovered which will prolong its life through the second day. The liquid ferments rapidly and strongly, and the casks are left uncorked to prevent explosion. The plant grows eight years before maturity, when the liquid is extracted. In the growth of the plant, a central bulb is formed for its coming juices. This is scooped out, leaving a cavity large enough to hold a few quarts. This cavity is made in the bottom and middle of the plant. The juice exudes into this cavity, and it is taken out daily by being sucked into a long necked gourd, on the siphon principle, by the Indian laborers, and then poured into the tubs and then removed to the vats. The outlay on each plant up to maturity is calculated generally at about 8s., and the return is from 30s. to £2, according to the size of the plant. Its producing life is about five months, and each plant is supposed to yield from 125 to 160 gallons of liquid within that time. The immense fields within a radius of 75 miles of the city of Mexico are planted and cultivated with great care and precision, as there is nothing grown in Mexico that pays better than pulque. Fields of it present an attractive appearance, planted in almost geometrical regularity, extending almost beyond the vision, until the rows seem to concentrate in one plant and into one point at the extreme end. The plants are wholly independent of rain and storm and are of a beautiful deep green color. It is said that as much as $1,000 a day are paid for carriage on the special trains for transporting this liquid into the city of Mexico. The tax on pulque is collected at garritas or gates, before its admission to the city, and then the liquid is distributed in the barricas and pigskins on special carts held in readiness for that purpose. Consul Crittenden says that nothing presents a more ridiculous appearance than one of these pig or hog skins containing about 20 gallons, when being taken round and through the city, the legs sticking out full to the toes of liquid. This is a convenient mode of handling the pulque, as, by simply removing a string from one of the feet, the contents are drawn out. The culture of the maguey in the republic of Mexico is unquestionably increasing very largely; but it would be a mistake to draw the conclusion that arable land is therefore withdrawn from the cultivation of cereals and vegetables. Careful observation will convince everyone that the haciendado only plants the maguey in large areas, where nothing else will grow; and nothing is more common than fringes of maguey, like hedges, around fields of wheat and corn; but where the whole expanse of land is covered with maguey it is because the soil is too poor to produce anything else. The principal regions for the cultivation of the maguey are the arid limestone chain of hills; and here, in many places, the hole for the insertion of the young plant is made with a sort of crowbar with a sharp point, used principally in the extraction of tepatate, the chief building material of the Mexican capital. It is used to aid the young plant by inserting some good soil into the hole. These young plants are suckers, which the mature maguey throws out on all sides, and which have to be removed before the heart is tapped for the sweet sap, which is the agua miel, or honey water of the pulque.

When the laborers draw the sweet sap with their rude siphons, made either of a gourd or a calabash and a hollow horn tip, they discharge the contents into a pig or goat skin swinging at their backs. The agua miel at this stage is like green water in appearance. Some carbonic acid is formed, and it becomes milky, and resembles in taste very good cider. The amount of carbonic acid contained is so great, and the decomposition so remarkably rapid, that in a few hours it would become vinegar, if not closely watched. To prevent this, the pulque dulce, or sweet pulque, is poured into a tinnacal—an ox hide strapped to a square wooden frame, and capable of holding a considerable amount of the liquid. These tinnacals are of various sizes to meet the emergencies of the situation. To the sweet pulque is added an equal proportion of milk, and then a slight dose of infusion of rennet. This is not enough to coagulate it, but sufficient to induce a slight amount of putrescence, as in cheese. The putrid odor and flavor of pulque, as sold in the pulquerias, is due to the rennet alone; for the belief that this is caused by the flavor of the pig skin, in which it is brought to market, is entirely without foundation. From the tinnacal it is poured into hogsheads, by means of pigskins, and it is transferred to the barrels of the vendors from the hogsheads of the haciendado by means of the same skins. In both instances the pulque remains in the skin barely more than a few seconds or minutes before the transfer. The rennet added in the tinnacal is the real cause of the putrid flavor and taste of pulque, and this is removed in private families by means of a chemical substance of a perfectly innocuous character, and some housekeepers add white sugar, and others the juice of oranges. It is a regrettable fact that, in the pulque shops, the beverage is made intoxicating to a maddening degree by the addition of marihuana. The government has made, and is making, every effort to stop the sale of this noxious compound. Consul Crittenden says that the number of deaths from fights in pulquerias in Mexico is incredible. Those whom the poison does not madden it stupefies, and in every great festival, particularly when there are public displays of fireworks, the police have hundreds of persons to look after, who are absolutely helpless from drinking drugged pulque. The leaves of the pulque plant are long and pointed, with prickles along the edge. Sometimes these leaves are very large, and the bunches of them, springing from the common stock, are enormous. The bruised leaves are made into a common paper—rather a tough, stiff, and hard paper—and they are also used in their natural state as a protecting thatch for the roofs of the common huts or houses occupied by the peons. A kind of thread is also made from the fibrous texture of the leaves, and a rough needle and pin are made from the thorn, and from the root a cheap and palatable food is made. It is not, therefore, a matter of surprise that the peon class think very highly of the pulque plant in Mexico.

ACCORDING to Die Natur, elaborate arrangements are being made in Portugal to celebrate the 400th anniversary of Vasco da Gama's discovery of the sea route to India. The 8th, 9th and 10th of July, 1897, are to be made national holidays and a number of expositions and congresses are to be held at Lisbon, including agriculture, ethnography, fisheries and hydrography. The event will also be celebrated by the Geographical Society of Vienna, before which an address will be made by Prof. Wilh. Tomaschek.