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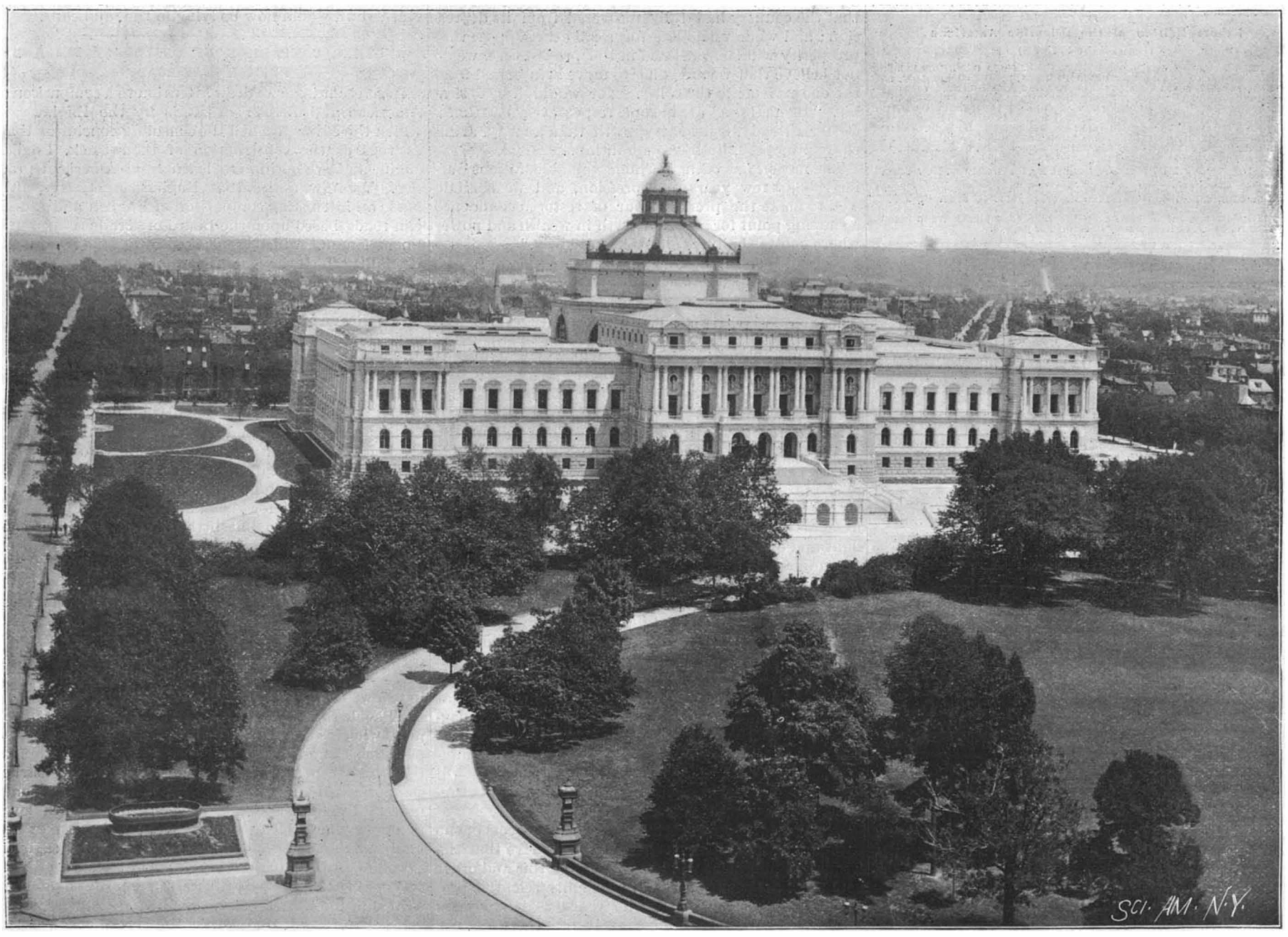
THE GREAT SCAFFOLDS OF THE CONGRESSIONAL LIBRARY, WASHINGTON, D. C.

Washington, the capital of the United States, is rapidly, in its memorials of art and technology, becoming what it should be, a representative city of the United States. At one time it was little more than a conglomeration of comparatively poor buildings, with a few magnificent specimens of architecture scattered over its area. At present it is losing this character and the fine buildings are becoming more and more numerous, crowding away the poorer ones. This applies as well to the private as to the public buildings, including some beautiful residential structures in the more fashionable quarters of the city. Meanwhile, the federal and district government are adding to the architectural adornment of the city. First among the new erections is the Congressional Library, a veritable literary palace, a building of whose beauties much has been written and which is now to a great extent the lion of Washington. In it we have a beautiful Italian Renaissance building of granite, of a most substantial description, 470 feet by 340 feet in area, and, therefore, covering about 3½ acres of ground, with all four sides fronting on streets, and making it, what is somewhat of a rarity under the conditions of modern civilization in our cities, a building with all sides architecturally treated. We reproduce a beautiful photograph of the library taken from the direction of the Capitol, which shows the general character of the building. It is constructed of granite for the exterior, with the most lavish use of various marbles for the interior and with the most elaborate system of sculpture and decoration. It is impossible to give an adequate idea of the building within the limits of our space. It is three stories in height, with four interior courts, comprising extensive stack rooms, as well as reading and assembly rooms. It is the best lighted library in the world, having nearly 2,000 windows. Of fireproof construction, with the most modern lighting, heating, and ventilating equipment, it represents as much a sample of modern engineering as it does of architecture.

The sculpture of the building is at once emblematic and instructive, the keystones of many of the window arches carrying carvings of human heads—types of thirty-three races of men, made from drawings now in the National Museum.

The roofing throughout is of sheet copper and the exterior of the dome is gilded with pure gold leaf, the latter costing about $3,800; gold leaf is used on the dome not only for decorative purposes, but also to provide a more durable covering than painting and to avoid the necessity for frequent renewal.



THE NEW CONGRESSIONAL LIBRARY, WASHINGTON, D. C.

The main feature of the interior is justly described as the reading room, which is a nearly circular hall one hundred feet in diameter and one hundred and twenty-five feet high, surmounted by the dome. Here Tennessee, Numidian and Siena marbles are used for the columns carrying the dome.

Our principal cuts show the method adopted for giving access to the interior surface of the dome. The concave portion is enriched with architectural stucco work in high relief, including cherubs, birds, rosettes, flowers, faces and geometrical designs, while near its top are paintings by the famous American artist, Edwin H. Blashfield. Two special revolving scaffolds were constructed for the use of the artists, decorators and workmen.

To provide the scaffold for the treatment of this area involved a somewhat difficult problem, which was met most satisfactorily by the structures, one of which is shown in our illustration.

Each scaffold approximated to what may be termed a rotating template. At the apex of the dome was established a pin or journal carried by a massive scaffolding of 8 inches by 10 inches and 10 inches by 1 inch beams. This pin was 3¾ inches in diameter and represented the pivot about which the scaffold rotates. This took care of its upper end. Its lower end carried two rollers or wheels 18 inches in diameter tread measure and about 15 feet 3 inches apart. The axes of the rollers were set horizontally and radially normal to the base circle of the dome. They were connected rigidly by a 6 inch by 6 inch angle iron. From the central pin to the rollers two trusses were carried, each truss, therefore, lying in a separate meridian plane of the dome. One section shows the elevation of one of these trusses.

These two trusses, whose horizontal projection would represent, therefore, a triangle, were rigidly braced together; the wheels at the bottom rested on a circular railway carried around at the base of the dome, so that the entire great structure could be pulled around by simple tackle, operated by workmen. The two trusses were built of angle iron, riveted to splice plates; the lower chord is of a $\frac{5}{16}$ inch angle iron, 3½ inch × 3½ inch; the upper chord of ⅜ inch angle iron, 6 inch × 6 inch. The space between the upper and lower chords, besides the braces, was crossed by horizontal angle irons which acted as floor beams and were planked over. This gave five separate floor spaces, 6 feet apart. To the upper chords and to the protruding end of the floor beams, slotted plates were secured by bolts which carried a scribing guide of angle iron bent to the arc of a circle 49 feet 2 inches in diameter, which gave the template of the profile of the dome.

The main rollers on which the scaffold was partly carried rolled upon a circular track. A circle of iron

(Continued on page 364.)

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NEW YORK, SATURDAY, NOVEMBER 14, 1896.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 1089

For the Week Ending November 14, 1896.

Price 10 cents. For sale by all newsdealers.

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 and 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 $1.44¼ 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.

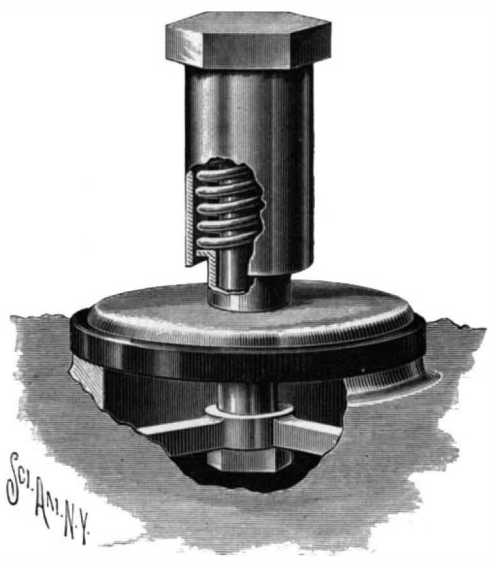
The United States consul-general at the city of Mexico says, in his last report, that it is impossible to separate in thought the average Mexican and pulque. No drink has a stronger hold on any nation than this on the Mexicans, and by Mexican is meant all classes in Mexico other than the Spaniards. Pulque 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.

AN IMPROVED PUMP VALVE.

The illustration represents a valve of strong and simple construction, in which the valve disk is held to its place by an inclosed spring, whereby, in case the spring breaks, the pieces will be confined and not liable to injure the working parts of the machinery on which the valve is used. The improvement has been patented by George Parker, of Whiting, Ind. (box 102). The valve disk is made with a hub consisting of a thin cylinder flanged at its outer end, and the hub slides on a fixed valve stem, while surrounding the valve stem and attached to its outer end is a casing which receives in its open end the flanged end of the hub. As may be seen in the broken away portion of the engraving, a spring coiled on the stem within the casing presses on the flanged end of the hub. The space between the valve stem and the casing also forms an air chamber or cushion pocket which gives easy movement and assists in the quick closing of the valve.



PARKER'S PUMP VALVE.

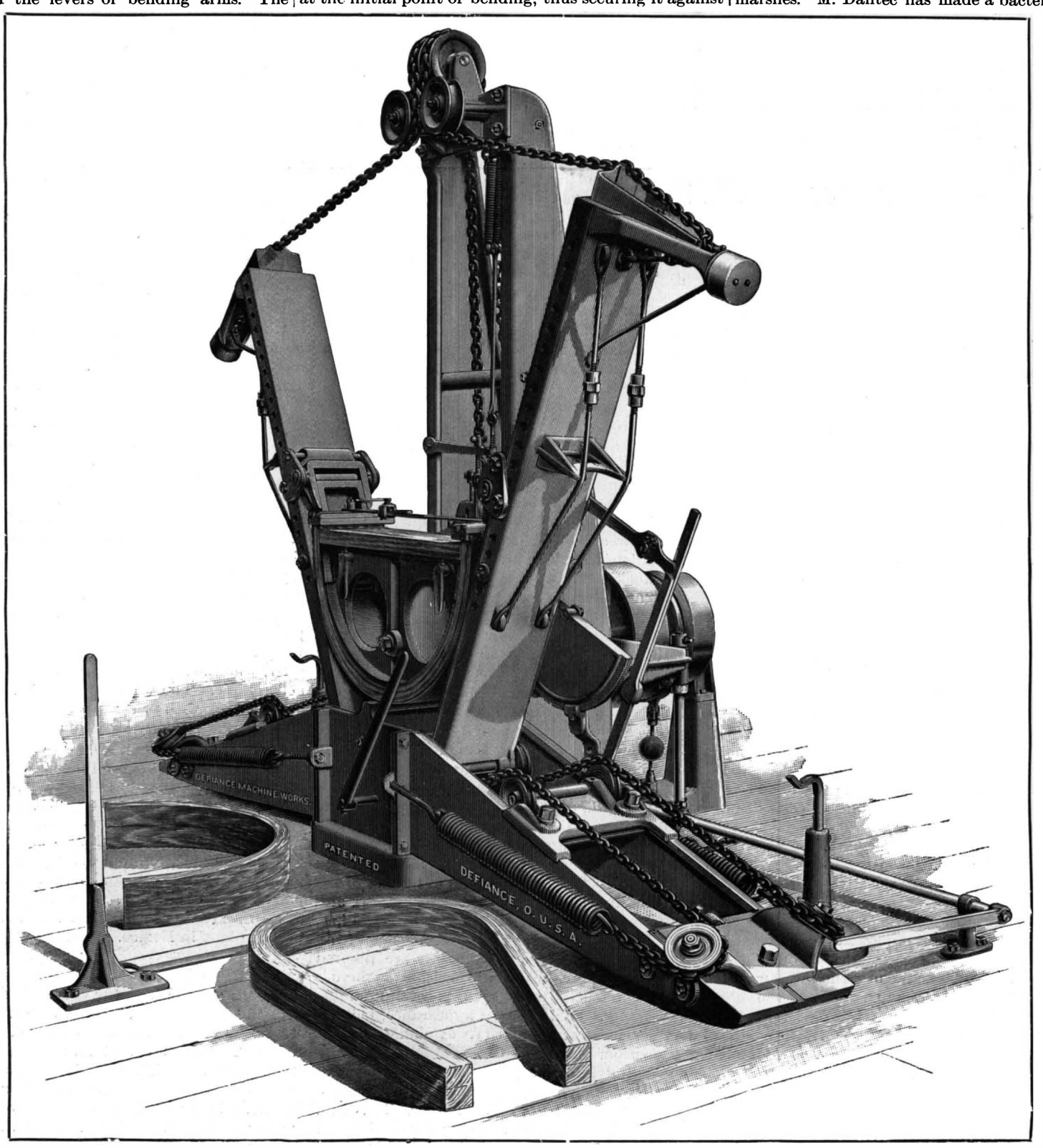
AN IMPROVED WOOD BENDING MACHINE.

The engraving represents a machine capable of bending the lightest fellies used for carriage wheels up to the heaviest work required for farm wagon, truck and artillery wheels, bending hard wood as large as 5 inches in thickness and 12 inches in width, with adjustments to accommodate changes from 24 inch to 72 inch circles. The machine is made by the Defiance Machine Works, Defiance, Ohio. The frame is 9 feet 9 inches high, and the floor space necessary to accommodate it is, length 14 feet, greatest width 6 feet, lesser width 4 feet. A foundation of masonry is not required under the machine, as an average floor well supported is sufficient.

The machine embodies a new feature in the application of power, the object being a drastic longitudinal stress upon the timber to be bent, which is secured by means of an elastic cable railway held taut by four powerful springs which are capable of exerting an aggregate energy of six thousand pounds. Upon this railway roll the trucks by which are carried the inner or lower ends of the levers or bending arms. The levers or bending arms form a level table when down, and are covered with a master strap to receive the straight material. They are of cast iron, made hollow and strongly re-enforced by trusses. The head blocks mounted upon their upper surfaces are furnished with an automatic, eccentric releasing device to release the augmenting end thrust which occurs during the process of bending. The cable chain which operates the bending arms of levers is fastened to their outer ends, passing over the sheaves at the top of the frame downward to a drum on which the chain is wound.

The chain drum is driven by a powerful worm screw and gear. To the outer end of the screw shaft two frictional clutch pulleys are fitted, one used for running the bending levers up, and it is driven with a 6 inch belt, the other with a 4 inch belt for backing the arms down, and they should revolve in opposite directions.

The forms for the bending of fellies are of cast iron turned true and with a collapsible section at each end of the arc to secure the easy removal of the stock after bending, and enabling the use of stock about 9 inches shorter than can be bent with an ordinary form, which effects a large saving in material. A wooden cap is used on top of the form, which is of the same length as the diameter of the form, and it is always taken off with the bent wood, requiring one cap for each batch of timber bent, and it must be left in until the batch of timber is cold and thoroughly set, so as not to spring when the shackle is taken off. The forms are held on a sliding head stock, having a vertical movement by means of which the timber can be firmly held at the initial point of bending, thus securing it against fracture on the outer arc and preventing it from retreating from the form at that point. After the operation of bending is completed the machine can be set to run down to the position for the succeeding operation and automatically arrested. The capacity of this machine is sufficient to bend about 2,500 fellies about 1½ inches, or about 1,200 wagon hounds in ten hours, and other classes of work in proportion.



A 12 INCH AUTOMATIC RIM AND FELLOE BENDING MACHINE.

X Rays and the Aurora Borealis.

The following abstract of a note on this subject in L'Electricien, Paris, appears in the Electrical Review: "A series of experiments of the greatest interest, relative to the action of a powerful magnetic field upon the cathodic rays in Crookes or Hittorf tubes, has been undertaken by Mr. Birkeland, who has published the results thereof in the Elektroteknisk Tiddskrift, of Christiania. These experiments show that in such a field the cathodic rays are considerably deflected in the direction of the lines of force, and may even be concentrated upon the surface of the glass to such a degree as to cause the fusion of the latter. Much more than this, they clearly prove that the rays that emanate from one and the same cathode fall in groups whose physical constants are connected by some definite law, just as are the frequencies of the different tones emitted by a rod in vibration. These researches present some importance as concerns the theory of the aurora borealis. As well known, Mr. A. Paulsen, the learned director of the Meteorological Institute of Copenhagen, claims that the aurora borealis owes its origin to the phosphorescence of the air produced in the upper regions of the atmosphere. Mr. Birkeland puts forth the idea that terrestrial magnetism may be the cause of such phosphorescence, which becomes intensified in the vicinity of the terrestrial poles."

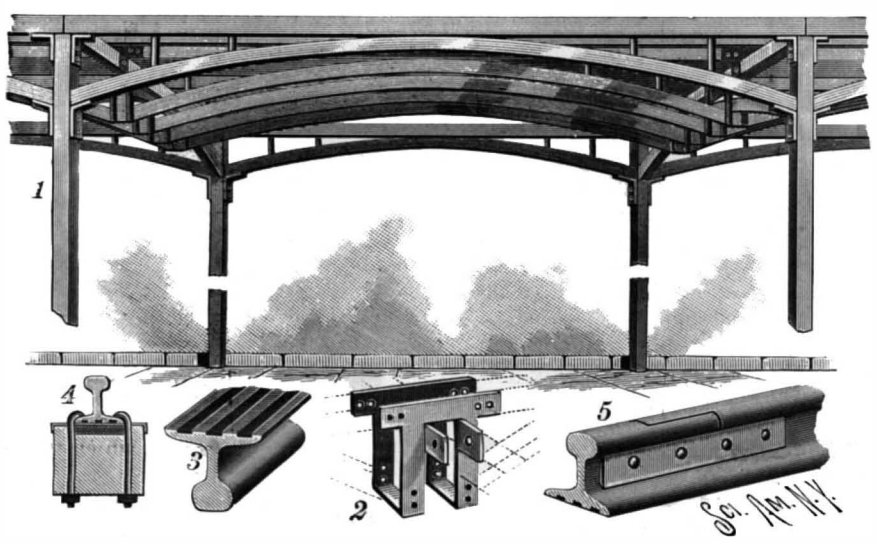
The Bacteriology of Arrow Poison.

The natives of the New Hebrides render themselves a terror to their enemies by using poisoned arrows, the tips of which they smear with earth from certain marshes. M. Dantec has made a bacteriological study of these poisoned arrows, and finds that their fatal properties are due to the presence, in the earth with which they are smeared, of two deadly germs—a septic vibrion and the microbe of tetanus. The first of these produces death from malignant edema in twelve to fifteen hours. In cases in which a septic vibrion has lost its virulence, the tetanus bacillus which is present proves equally, although less speedily, fatal. This observation of M. Dantec proves the incorrectness of the former theory that the tetanus bacillus is derived from a horse, since this animal is unknown in the New Hebrides Islands.—Modern Medicine.

A THIRTY knot torpedo boat destroyer, the Capitan Orella, built by the Lairds for the Chilean government, made an average of 30·17 knots on her trial trip on the Clyde.

AN IMPROVED ELEVATED RAILWAY STRUCTURE.

A construction designed to combine lightness with strength in the building of elevated railways, while interfering as little as possible with the light of stores and dwellings, and in which provision is made for the deadening of the sound, is illustrated in the accompanying engraving, and has been patented by David D. Toal, of No. 151 Avenue B, New York City. Fig. 1 is a longitudinal view, in perspective, of the improved structure, Fig. 2 showing supports of the interior arched beams and Fig. 3 a bottom view of one of the rails, in which lead cushions are applied. Fig. 4 represents the fastening of the rail to its bed and Fig. 5 shows the meeting ends of rails, made with interlocking tongues. The uprights are designed to be placed as near as possible to the curbing, and thus take but little room from that provided for the ordinary street traffic, and each pair is connected by a straight transverse tie beam supported by an arch beam, longitudinal arch beams also connecting the successive uprights to make a thoroughly braced and trussed structure. The sleepers or track beams are laid longitudinally, and each one is braced and supported by a longitudinal arch beam. In the bottom face of each rail are grooves filled with lead, as shown in Fig. 3, and preferably the entire upper face of each sleeper or track beam is covered by a sheet of dead metal, to obviate jar and noise. Instead of the usual spikes, bolts are employed to attach the rails to the track beams or sleepers, as shown in Fig. 4. The arch beams are designed to allow for expansion and contraction, and the entire structure, including the sleepers or track beams, is of metal. It is claimed that



TOAL'S ELEVATED RAILWAY STRUCTURE.

with this construction the cars may be run over the center of the street without being objectionable to the residents or those doing business along the line of the road, and that any desired speed may be obtained without danger, whether steam, electricity, cable, or other means of propulsion are employed.

Largest Brandy Still.

The largest brandy still in the world is at El Pinal vineyard, in San Joaquin County, not far from Stockton, says the San Francisco Call. Part of it has been built about four years and the other part was finished only a short time ago. As is well known, El Pinal vineyard has always made a specialty of brandy and sweet wines. It was the intention of the proprietors to do this when they went into business, and for that reason they had the largest still built that was ever put up. That was, as has been stated, about four years ago, and even then it was ahead of anything in existence. It could produce more brandy in twenty-four hours than any other still in the world, and it has not been surpassed since. But even that was not enough to supply all the alcohol needed in their business, so another still was built and made to work in connection with the original one. The two are really one still, as they are used, and have about three times the capacity of any other still in the world.

This enormous machine is located in a building by itself, and part of the year is kept running day and night. It is very complicated in its workings, so that a description of that part of it cannot be attempted here. It will be sufficient to state that the grape juice or wine is pumped from vats to a tank on top of the hill. From there it simply passes through a series of heated chambers in the form of a vapor and comes out in the shape of brandy.

It can be tested in the different chambers and the change noted. In the first chamber it is little more than warm wine, and it gradually gets stronger and stronger until it is sharp to taste. From the time the wine leaves the tank until it comes out as grape brandy only ten minutes is occupied. In the old method of distilling it used to take about three hours.

In appearance the largest brandy still in the world is simply a conglomeration of tanks, pipes and boilers. The capacity of this still is enough to make a person wonder what becomes of all its products. When running full time it can convert 15,000 gallons of wine into brandy in a day. This will make 4,000 gallons every twenty-four hours, or enough to keep about 40,000 men in a state of intoxication during that time. In a month there would be enough of brandy on hand to intoxicate 1,700,000 men, or about the entire population of New York. But, as it happens, very little of this brandy is sold as brandy. It is used to fortify sweet wines, so that they will be in condition to keep until ready to send to market. The alcohol acts as a preservative of the grape juice the same as it would of anything else. It keeps it from turning sour.

A GIANT TRICYCLE.

In this age of "big" things one is always prepared for the construction of mammoth engines, ships, buildings and public works, and the rage for the superlative seems to be universal. It has even invaded the bicycle world, where at least one would think size and weight were at a discount, and. moved by its inspiration, a New England firm has produced the colossal—no other word justly describes it—tricycle shown in the accompanying engraving.

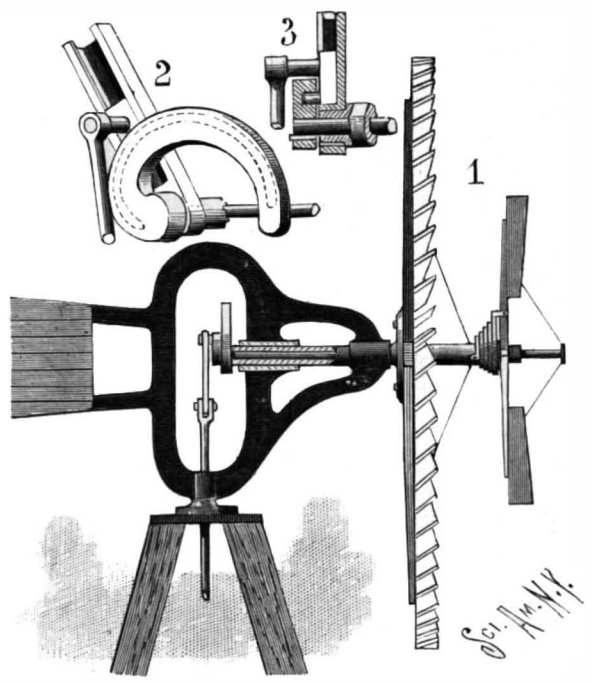
It is driven by eight men, which is, it is true, only two more than are mounted on a sextuplette; but whereas the latter weighs approximately as much per man as an ordinary single machine, the tricycle weighs about 300 pounds to the rider, the total weight, with the men mounted, being about a ton and a half. The front wheel is six feet, and the rear wheels are eleven feet in diameter. The frame consists of two parallel trusses which are arranged side by side and finish at the front in a cross truss to which the steering head is attached. The steering is done by one man. Each side wheel is driven by the four riders which are nearest to it, and a curious feature in the machine is that it is geared down instead of up. This was rendered necessary by the great dead weight which had to be moved. Even if the crank sprockets and the wheel sprockets had been the same size, the gear would have been 132, whereas it has been geared down to 54. The left hand chain and sprockets can be clearly seen in the engraving. The total length of the machine is 17 feet.

The tires are pneumatic tires, made exactly in the same way as the ordinary Vim roadster tire, and they are, therefore, single tubes. This "Jumbo" among cycles has been put to practical test on the roads, having been ridden from Boston to Brockton, Mass., a distance of 25 miles, and from there to Concord, N. H., 125 miles distant. We can realize that it has found its proper field of work when we are informed that it has done duty in many torchlight parades, political and otherwise.

It should be mentioned that the front tire is eleven, and the rear tire eighteen inches in diameter, the latter being about half an inch thick on the tread. The large wheels have spokes half an inch in diameter, and the small wheel spokes are one-quarter inch diameter.

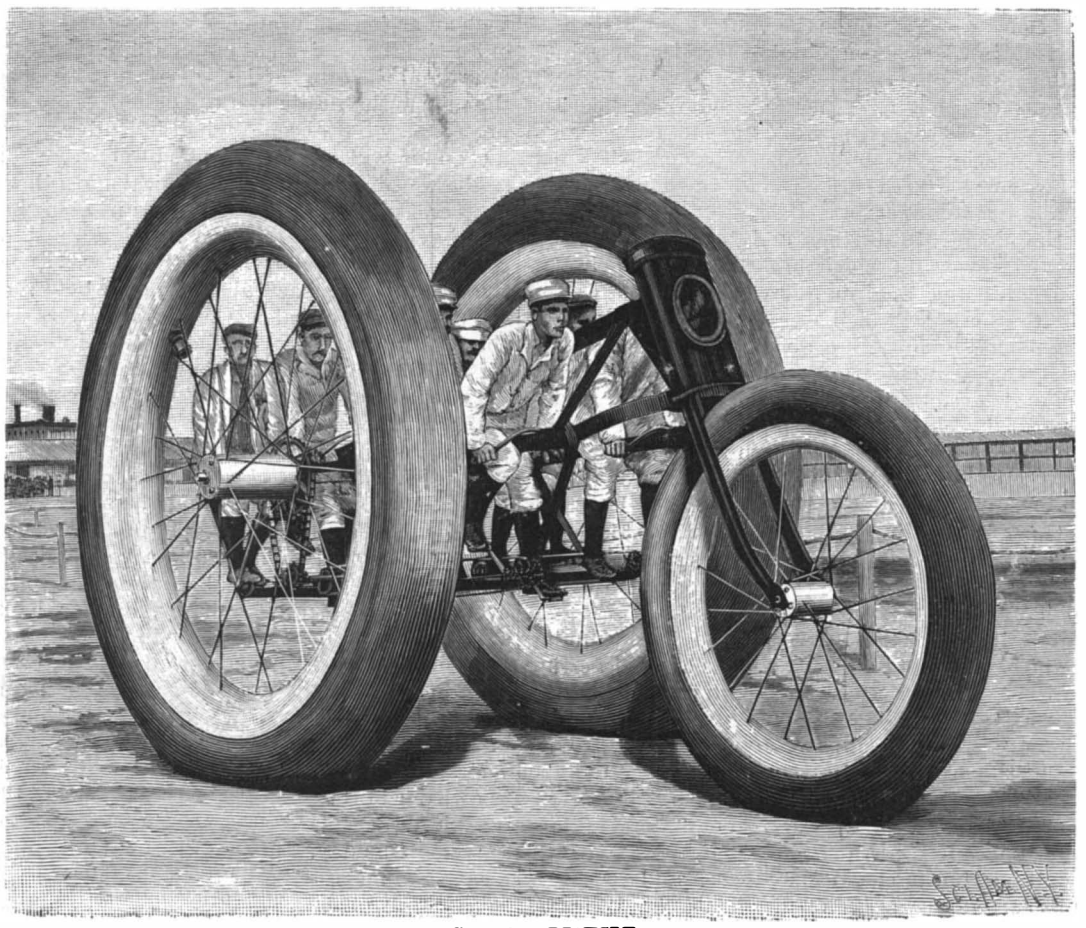
A WINDMILL POWER TRANSMITTING GEAR.

The illustration represents a gear of strong and simple construction for regulating the length of the stroke according to the force of the wind, and transmitting the power of the windwheel to a pump or



HOFFNER'S WINDMILL POWER TRANSMITTING GEAR.

other machinery without much friction. The improvement has been patented by William C. Hoffner, of Prospect Park, Cal. The windwheel has a hollow shaft journaled in suitable bearings on the windwheel frame turning on the upper end of the tower, in the usual manner, and on the shaft is a crank arm in which slides a block carrying a wrist pin engaged by a pitman connected with the upper end of the pump rod, as shown in Fig. 2. The position of the sliding block and the wrist pin changes according to the wind, the stroke being less during a light wind than in a heavy wind, and a full stroke being given only during a strong wind. To regulate the position of the block, it is provided with a pin located below the wrist pin, and which, as shown in Fig. 3, projects into a cam groove in a cam on a shaft mounted in the hollow windwheel shaft, and carrying at its outer end a small windwheel, a spring being interposed between the hub of the small wheel and that of the large one. This spring has an adjustable tension, and is strong enough to offset the power of the small wheel in an ordinary breeze, the wrist pin then remaining in an innermost position, but with an increased force, to rotate the small wheel faster than the large one, the cam is moved to shift the sliding block and the wrist pin outwardly, thus lengthening the stroke of the pump rod. As the wind diminishes the spring pulls the small wheel back, and the cam draws the sliding block inwardly to shorten the stroke, which is thus automatically regulated, according to the force of the wind.



A GIANT TRICYCLE.

The Cyanide Process Patents Declared Void in the Transvaal.

Word was received recently by the N. Y. Sun that the High Court at Pretoria, the capital of the South African Republic, had declared void the Macarthur-Forrest patents for the cyanide process for the recovery of gold. This decision was given in a suit brought by the combined gold mine owners of Johannesburg and the Transvaal. The information came in this cablegram to Lawyer C. W. Truslow, of the Mills building.

Throughout the gold bearing regions of the world there lie millions of tons of auriferous rock in which is held more wealth than man ever knew, but in particles so small that, rich as the rock might be, the gold could not be caught by any of the processes which could be used with economy until the cyanide process was introduced. Formerly mercury was the great agent for catching and fixing gold. In the placer mines, where nature had placed nuggets and grains of gold in the beds of streams or old alluvial deposits, often not even mercury was needed. These are the mines where the lonesome miner with no tools but his pick and shovel and a pan could wash out a fortune sometimes in a few weeks or months, for nature, in breaking up the goldbearing rocks by her slow but rude processes and washing them down toward the sea, had carried away all the smaller grains of gold and left the bigger ones to stay snuggled away among the pebbles and sand, holding themselves there by their own weight.

Then in many parts of the world, and notably in a large part of our own gold mining districts, when man began to attack the rock that holds the precious yellow metal he found it sprinkled through the quartz in grains which mercury could easily reach and hold. These are the goldbearing rocks which furnish such pretty specimen pieces, gilt with yellow splashes or shining with big grains of pure gold. Great stamps crush the rock to powder, and from this the shining quicksilver quickly chooses the golden harvest, makes a union with it, and holds it for the miner until it is driven off by heat, condensed, and saved to do its work over again.

In other parts of the world, however, where the riches of the earth are as great as or greater than those just mentioned, the inexperienced man would never discover that there was a particle of gold in the rocks. Instead of the pinhead grains which catch the light and betray themselves by their glitter, there is in these rocks only a powder of gold so finely divided that nothing but a microscope will disclose it. In other mines these two kinds of grains are together. Grind up one of these rocks and mix the powdered stone with mercury. The mercury will grasp what gold it can, but much will elude it. If you have ever taken a bit of quicksilver and watched its movements you can understand why this is so. Wherever it has a chance the liquid metal gathers itself all together and draws its sides up into rounded forms as if shunning contact with all earthly dross. Shake it into bits, and no matter how finely divided it may be, each bit will become a rounded atom. So, no matter how well mixed the mercury may be with the goldbearing dust from the crushed rock, its little globes will draw away from the jagged interstices of the crushed stone and leave in those spaces the gold. While gold could be picked up in placer mines, men would not bother even to crush the richest of rocks, but, as the other sources of wealth became scarce, they attacked the solid quartz. With big profits coming in from these the miner gave little heed to the smaller particles of gold, but let them flow away in tailings. In some few places attempts were made to work by more economical methods, but it needed the discovery of the wonderful mines in the Transvaal to force the development and adoption of methods which would catch the finest bits of gold which nature had hidden in her storehouses.

As the Boers fled further and further away from the hated town life which interfered with their pastoral delights, the English followed them nearer and nearer to the land which is said to have contained King Solomon's mines. In about 1884 the gold mines in the Transvaal were discovered, and every day since then has seen a bigger output from them, until to-day the output of gold from there is as great as or greater than the entire output of gold from America.

The export of gold from the Transvaal through Natal had reached the great sum of $9,259,525. In 1891 it was $14,507,350, and in 1892 it reached $22,396,545. Last year it was nearly double this enormous sum. A great part of the increase was due to the introduction of the cyanide process.

Up to 1891 the reduction works had been running upon the old plan, stamping up the rock, and getting out of it what gold was coarse enough to be taken out by quicksilver. All the rest ran off with the tailings, and hundreds of thousands of tons of ready ground rock were shoveled away as refuse from the stamping mills until there were hills of it at every mill and a hidden fortune in every hill. Every ton of these tailings contained about $2 worth of pure gold in powder so fine that nothing but a chemical process could gather it from its surroundings. It was at this time that the two Scotchmen, Macarthur and Forrest, took out patents all over the world for the cyanide process of gold recovery. They were so early in the field in the South African Republic that their first patent—the one for dissolving the gold from its ores by the use of a dilute solution of cyanide of potassium—was only the forty-seventh patent issued by the newly organized Boer republic. Their second patent, which covered a process of recovering the gold by passing the cyanide solution over zinc shavings in long tanks, was only number seventy-two of the South African Republic's patents.

In the two processes referred to lies the key to the whole of the system. The beginning of the process is to mix the finely ground rock with a weak solution of cyanide of potassium. No particle of gold can elude this, and in the course of one to three days the whole of the precious metal is dissolved. In the second process the zinc shavings are placed in shallow tanks and these tanks are loaded with the cyanide solution. As the solution flows along the gold is precipitated upon the zinc, and then it is recovered as metallic gold by sublimating the zinc by fire. Shrewd men were among the Outlanders who were running the mines at Witwatersrand, Barberton, Klerksdorp, Potchefstrom, and Malmani.

Here it was that Cecil Rhodes and his coadjutors had gained a foothold and were reaping fortunes out of the earth, paying John Hays Hammond, the American mining engineer, a fortune every year for his skillful services. Many other Americans were in the mines and dozens of Englishmen, who were reaping fortunes.

These, in fact, were the interests which built the town of Johannesburg, and afterward led in the abortive attempt of Captain Jameson and the party of Cecil Rhodes to capture Johannesburg and declare an independent Transvaal government.

These men saw the vast possibilities of the new process and began to use it at once. Recent tables show that since January, 1891, the output of gold recovered by this process has been steadily increasing, until in August, 1895, the production by all other processes being 140,000 ounces, or about $2,800,000, the production by the cyanide process alone was 60,000 ounces, or about $1,200,000 for the month. In 1894 the mills produced 1,405,282 ounces of pure gold in the Witwatersrand district, and the cyanide process produced in the same district 618,480 ounces. In that single year 2,847,378 tons of tailings and 18,351 tons of concentrates were put through the process. These yielded more than $10,000,000 worth of gold with an apparent profit, over the cost of the process, of about $7,375,000.

This seems to indicate that the miners ought to have been well satisfied, but there was a serious drawback to their happiness. The African Gold Recovering Company, which controlled the Macarthur-Forrest patents in the South African Republic, didn't let any one use the process without the payment of big royalties.

These payments varied with individuals, but they were so large that they amounted to millions of dollars every year, and it became a common saying in the Transvaal that the invention had benefited the inventors a great deal more than it had the miners.

The miners made efforts to get reductions of the royalties, but no agreement was reached. Then they determined to fight, and a peculiar feature of the Boer republic's laws opened the way for a direct action. This was by an application to the Attorney-General to have the patent set aside because of a lack of novelty.

The Attorney-General appointed James Hay to bring such an action at the miners' expense in the High Court of Justice, the equivalent of our United States Supreme Court and the court of last resort. It was asserted by the miners that, although the patentees of the cyanide process may have been original inventors, the chemical facts upon which it was founded were known long ago to the world, appearing in chemical and other publications and mining works, and that any skilled metallurgist having this knowledge could do just what was claimed by them as new. Further, it was asserted that the same thing had actually been done before, although not upon a large scale. Commissions were issued for the taking of testimony in the United States, Australia, New Zealand and England in the case.

The most important field was in this country, where Mr. Truslow was employed to find the evidence for the miners and Walter W. Williams for the patentees. Walter W. Edmunds, of this city, took the miners' side of the testimony as commissioner, and Edward Kent that for the patentees.

Mr. Truslow began his work a year and a half ago, and it led him to examine almost every chemist of note, every college or public library, and to look into all sorts of trades where gold is used for evidences of what he knew was true. One curious instance will show how difficult was the work of getting testimony. One of his assistants in this work was Prof. Henry Wurtz, of this city.

Mr. Wurtz was positive that he himself had had knowledge of the main facts years before, but he could not place the time nor the way in which this could be proved. One day, while he was searching the libraries for general facts, and near the end of the work, he came upon a copy of the American Journal of Science and Arts, published in New Haven in 1866, and there, in an article written by himself, was a statement which covered the whole matter. Up in the Astor Library was found much which bore upon the matter, and as many of these books could not be duplicated and none borrowed, photographs of the needed pages were made. This work alone cost $1,500. Many experts were examined on both sides.

Rossiter W. Raymond was on the witness stand for twenty days for Mr. Truslow's side. It was shown by his testimony and that of William H. Adams, John Williams, Henry Wurtz, and others, that the process had actually been used in places here, and in one instance a quarter of a ton of ore had been so treated in 1885. The process was not needed here at that time, because most of our gold is coarse enough to work by the cheaper quicksilver method.

Since that time, however, fine grain ore has been found, and it is said that there is much of it in the country. The Mercur mine of Utah uses the Macarthur-Forrest process, and was sued by them a while ago, but it made a settlement privately.

The hearings in this country were finished in September, 1895, and the testimony and exhibits were put in a tin lined box, and this was sent as a registered letter by mail to Pretoria. It made the biggest registered letter ever sent through the United States mail. The package was as big as an ordinary dry goods case, and the postage was $187. It went from the New York post office. The biggest letter before that had cost about $40 postage. The case was heard by the High Court of Justice at Pretoria just before Jameson's raid in December of last year. As far as the South African gold fields are concerned, the decision throws the process open to the public.

It has been attacked and the patents overthrown in Austria, and the belief of the opposing lawyers now is that nowhere in the world will the users of the process continue to pay royalties, but will fight and overthrow the patents everywhere. This means much to the gold miner, and probably will result in immense additions to the world's stock of gold within a few years.

Embossing on Glass by Tinfoil Stencils.

The stencil may be cut out of thin sheets of metal or cardboard, in the same manner as for wall decorations, etc. If varnish colors are employed, lay them on as evenly as possible through the perforations in the plate, and harden afterward in a stove or oven. The metallic preparations used in glass staining and painting are also available, but require firing in a muffle or china painter's stove. For the process called embossing paint the portions of glass left uncovered by the spaces in the stencil plate with Brunswick black, dip or cover with hydrofluoric acid, wash in clear water, and remove the black ground. Every part that was covered will then present a polished, even surface; the remainder will have been eaten into by the acid. If the raised parts are to have a frosted appearance, rub them with a flat piece of marble moistened with fine emery and water. For putting patterns or lines on glass with a wheel there are two methods, one followed by glass cutters and the other by the engraver on glass. For the first mentioned rough in the pattern with an iron mill supplied with a trickling stream of sand and water, smooth out the rough marks on a wheel of York or Warrington stone, polish on a wooden wheel of willow or alder powdered with pumice, and finish on a cork wheel, with putty and rottenstone. The engraver cuts in and roughs the pattern with copper wheels, aided by emery of various degrees of fineness and olive or sperm oil, and polishes the portions intended with leaden disks and very fine pumice powder and water.—Pottery Gazette.

Effects of Molecular Bombardment.

Some years ago W. Crookes published the fact that diamonds phosphoresce of various colors when submitted to molecular bombardment in a vacuum tube under the influence of the secondary current from an induction coil, and it was also observed that the diamonds became discolored under this treatment, while in course of time they became black on the surface. This superficial blackening cannot be removed by ordinary cleaning methods, though polishing with diamond powder removes the discolored layer. Becquerel having shown that long digestion of graphite in a warm mixture of potassium chlorate and strong nitric acid converts it into graphitic oxide, while diamond remains unaffected, some discolored stones from Crookes' experiments were subjected to this treatment on the supposition that the superficial blackening might be due to conversion of diamond into graphite. This was proved to be the case, the whole of the black stain being removed from diamonds that had been specially bombarded in a vacuum tube for five hours, after digestion in the acid mixture for three days, while comparison of the stones with similar ones that had not been darkened seemed to show that the cleaned specimens had acquired extra brilliancy. A curious fact is that some of the historic specimens, preserved in a vacuum tube, appear less dark than they were some years ago, so that it is just possible the graphite formed may be ultimately reconverted into diamond.—Chemical News.

Correspondence.

Connections for Magneto Telephones.

To the Editor of the SCIENTIFIC AMERICAN:

Your reply to query No. 7,007, G. G. Y., has been shown me. As I have had, in connection with other parties in this place, practical experience with a telephone circuit, I take the liberty to make you a statement of what our experience has been, and a few suggestions, which I think will assist any one who is desirous of establishing an inexpensive and fairly satisfactory telephone circuit, that can be used without danger of infringing any patent. We have had sixteen magnetos and thirty-two standard Bell telephones in use, as you suggest, in series. We did not get, when the number of sets was first brought up to twelve, results that were satisfactory, until we had applied cut-outs for the telephones, the resistance of the coils interfering with both the service of the magnetos and rendering it difficult, for those who had weak ones, to call satisfactorily, as well as the telephone service. After applying a variety of simple cut-outs to all the magnetos, we were able to increase the number to sixteen. For the most convenient use (unless automatic cut-outs have already been applied), I favor a style of burglar alarm (usually applied to windows) which always has the circuit closed, unless it is pressed, set either in the floor, just below the magneto, where the circuit can be broken by pressing it with one's foot, or, if in a carpeted room, it may be set into a small block of suitable wood that will not disfigure the carpeting, and fastened to the floor with screws, so that it may be easily removed when occasion may require. The wires leading from this should be connected with the two binding posts of the magneto that the telephone cord is attached to, and will keep the telephones out of circuit except when they are in use, when the knob should be pressed. Wire of good size should be used if the circuit is a long one, and copper is preferable to iron. Unless a set of instruments is located in a noisy place, very good service can almost always be had. The resistance of the extremely fine wire with which the coils are wound interferes very much with satisfactory service, while that of No. 14 galvanized iron or No. 16 hard drawn copper is not sufficient to interfere seriously on a line several miles in length.

C. C. CAPRON.

Cotton Seed Industry in the South.

BY EDWIN LEHMAN JOHNSON.

The magnificent opportunities which exist at the South for making and building of homes by immigrants, for the profitable investment of capital, and the practical application of the arts and sciences, are now so well known to reading and observant men that it is almost a waste of time to call attention to detailed conditions in the South.

If any one is skeptical on the subject, he need only look at the small population per square mile, the fertility of the lands, the climate, the small cost of living, and the numerous natural advantages and resources of the South to see that a condition must necessarily exist there more favorable for comfortable living for the frugal and industrious poor, for accumulation of wealth for the intelligent small capitalist, and for the doubling of fortunes for those already wealthy, than in any other part of the United States to-day.

Instead of dealing, therefore, with the general subject, I wish to give a practical illustration of one of the lines of future development of the South, which is characteristically Southern and with which I happen to be very familiar from a long business connection.

In short, I wish to point out where a practically inexhaustible source of wealth exists in a product of which the general public outside the South knows almost nothing. I allude to what is familiarly known in the South by the name of cotton seed hulls. The name itself belittles the character and value of the product to such an extent that one is almost tempted to turn away from it in disappointment, without investigation, on simply hearing it mentioned.

"Hulls" is a term we associate in our minds with husks, or the outer covering of some valuable nut, fruit, or grain, which serves the purpose nature intended it for, of protecting and preserving the kernel, but which in itself, for all purposes of commerce, is worthless.

While such in part is the definition, such is not the character of "cotton seed hulls." It bears more the relation of bran to wheat than of husk to kernel; but even this description is not adequate; for the hull of the cotton seed both in weight and value bears a much more important relation to the kernel of the seed than bran does to wheat.

The hull comprises 45 to 50 per cent of the weight of the seed. As turned out by the oil mills, this article consists of little capsules, more or less broken up, of which the outer or convex part consists of a closely adhering short cotton fiber, comprising about 25 to 33⅓ per cent of the weight; and the inner, or concave part, of a tough, dark brown shell of mucilaginous matter resembling the covering of apple seeds. This is not quite all, for these fiber-covered and broken capsules capture and retain, during the oil mill processes of hulling and separation, however well performed, a portion of the kernels in a finely divided state. The proportion of the kernel thus caught, and forming a real portion of the hulls as marketed, varies from 1½ to 5 per cent and is rich in oil and nitrogenous matter.

In the dry, loose and somewhat matted condition in which the hulls are usually seen, they present a very unpromising appearance, but years of experience have demonstrated conclusively that they form a perfect and entire feed for cattle. It is only for the purpose of rapidly fattening cattle that other more highly concentrated feed stuffs, generally cotton seed meal, are added to the hulls.

There are now annually "crushed" in the oil mills of the South about 1,500,000 tons of cotton seed, giving a product of hulls of about 675,000 to 700,000 tons. There are annually grown and passed through power gins, to obtain the 8,000,000 to 10,000,000 bales of cotton which are annually marketed, an additional quantity of 2,500,000 to 3,500 000 tons of cotton seed which are not as yet hauled out to the oil mills, which are generally located at some distance from the gins and plantations.

The total seed crop is by weight twice as great as the cotton crop. If all these seed were manufactured, the weight of the hulls might be taken, speaking roughly, as equivalent to the weight of the cotton, or if put up into 500 lb. bales like cotton, as 8,000,000 to 10,000,000 bales of hulls—the same quantity as the cotton crop. This gives the present productive limit of this useful article and makes it pretty certain that, with such a large seed and hull supply not now worked available as new mills are opened, no great or rapid advance in the price of hulls need be expected.

Owing, as already stated, to their unpromising looking appearance and unfortunate name, for long years no attempt was made to dispose of the hulls commercially; and until about ten years ago, when the experiment was made of feeding them to cattle, they were literally thrown away or burned for fuel at the mills.

This article has had the hardest kind of a fight against ignorance and prejudice to find its way into profitable consumption; but such intrinsic merit has it that to-day, out of 300 or more oil mills in the South, I do not know of a single one that is burning its hulls. A considerable supply of crude potash, in which the hulls are rich, was taken away when these ashes were no longer obtainable.

In many States, particularly Texas, many thousand head of cattle are annually fed, and with the addition of cotton seed meal are fattened upon cotton seed hulls. Much of the Chicago dressed beef shipped all over the country in refrigerator cars is simply concentrated cotton seed hulls. The price at which hulls sell is far below their intrinsic value as a feed stuff and varies from $2.50 to $5 per ton at the mills, though as high as $10 per ton has been paid for it in some cases when the demand unexpectedly exceeded the supply, when the mills were not running, and this is about its real value. I believe that every dairy in or about the cities, like Memphis, Altanta or New Orleans, is now feeding its milch cows on cotton seed hulls.

Competent chemists figure that 90 per cent of the value of the hulls is available for fertilizer after being used for feed. Hulls are little known or used outside the South, but there is a new enterprise at Memphis, the Tennessee Fiber Company, working under letters patent, that is successfully taking the hulls from the oil mills and concentrating, in more suitable form for shipment, the nutritious portion of the hulls, which is termed "cotton seed bran," and separating the lint for use of paper makers and packers, which is turned out in small compressed bales.

Having now shown what cotton seed hulls really are, their value, their great actual and numerous possible production, we are prepared to consider the merits of this article as a wealth producer. It will first be necessary to say something in regard to the location of the cotton oil mills. Though some of the large cities, like Memphis, Atlanta, Houston, New Orleans, have more than one mill each, they are, as a rule, very widely distributed over the Southern States, and generally in the towns which vary in population from 2,500 up. The average price at which cotton seed hulls can be obtained at the mills is about $3.25 per ton. Their intrinsic value as a feeding stuff is about $10, say $8. The average freight from the South to the New England and Middle States is about $6 per ton. It could hardly be possible, therefore, unless under exceptional circumstances, to use cotton seed hulls in their ordinary form outside the South.

From the fact that the oil mills are located in the towns and cities, and that the lands near them have been cultivated longer and more closely than those at a distance, thus being more in need of fertilizers, it is evident that the most profitable use to be made of the hulls is by farmers or stock raisers on the lands near the oil mills. A farmer, therefore, located on land which needs fertilizing, near an oil mill, who also raises cattle or keeps a dairy, and who has a market ready to his hand for his farm products, is prepared to make an astonishing profit upon this article.

Estimating the cost of freighting to the farm at 75 cents per ton, the average cost of the hulls at the mills at $3.25 per ton, and the intrinsic value of the hulls as compared with other feed stuffs or fertilizers as only $8 per ton, the farmer will make a profit of $4 per ton on every ton of hulls he consumes. If we add to this 90 per cent of the intrinsic value, which percentage the chemists allow for it after feeding, he would have $11 per ton as the total profit, or $7.60 per ton as the net profit over and above other feeding stuffs and fertilizers. It is difficult to conceive of any situation in which a farmer could be placed in populous territory in the United States where he starts out with conditions so favorable to success, or where he has a finer opportunity of producing wealth from using an undervalued product which can be had in practically unlimited quantity. Add to this that such lands as have been described can be had at a very low price, because of their more or less worn condition and also because of the present general depreciation in real estate, the probability of a large profit from the enrichment of the land, and the unearned increment from the probably rapid growth of all Southern cities in the near future, and it is scarcely possible to point out any better illustration which the South offers of her many and great opportunities than is contained in this long despised and still greatly undervalued article cotton seed hulls.

They All Do It.

The wanderer had returned after many years, and was inquiring about his old friends.

"Brown," he said, "is in the wholesale clothing business, I believe."

"Wholesale clothing and bicycles," corrected the native. "The firm carries a side line of bicycles, you know."

"And Jones has a grocery store, I'm told."

"Yes. Full line of groceries and Bull Run bicycles. He's the agent for the Bull Run wheel."

"Smith went into the manufacturing business, didn't he?"

"Oh, yes. He got interested in a sewing machine manufactory, and a little later they took up bicycles and are doing a rushing business. I understand they have a capacity of over a hundred wheels a day."

"And what's White doing?"

"He's the agent of a famous gunmaker, and is doing well. Sells all kinds of guns, pistols and bicycles."

"And Johnson?"

"Oh, he's a manufacturing jeweler, and he turns out a mighty good wheel, too."

"Billings, I suppose, is still in the furniture business?"

"Yes; but I understand that he turns out a better bicycle than he does desk or bureau."

The returned traveler began to betray some surprise.

"Is—is Wilson still in the livery business?" he asked with some hesitation.

"Certainly, but he devotes most of his time to the little bicycle repair shop in the rear of his stable."

"Ah, there goes old Bones, the sexton. The old fellow is—"

"Oh, he's agent for an automatic pump for inflating tires."

"Is there any one who isn't in the bicycle business?" asked the returned traveler sadly.

"I don't think of any one just now," replied the native. —Chicago Post.

Employer's Liability—Machinery.

The Supreme Court of Minnesota held, in the recent case of Harris vs. Hewitt, that where a servant has knowledge of the defective instrumentality furnished for his use by the employer, and gives him notice thereof, and the employer promises that it shall be remedied, but neglects to do so, and induces the servant to remain in his employ, and the servant is subsequently injured by reason of such defect within the time fixed when such defect was to be remedied, or within which time it might reasonably be remedied, the employer is liable if the instrumentality was not so imminently and immediately dangerous that a man of ordinary prudence would have refused to longer use it, and that the question of contributory negligence by reason of such use by the servant after such notice and promise of repair is not one of law, but of fact to be settled by the jury.—Bradstreet's.

The German Kite Balloon.

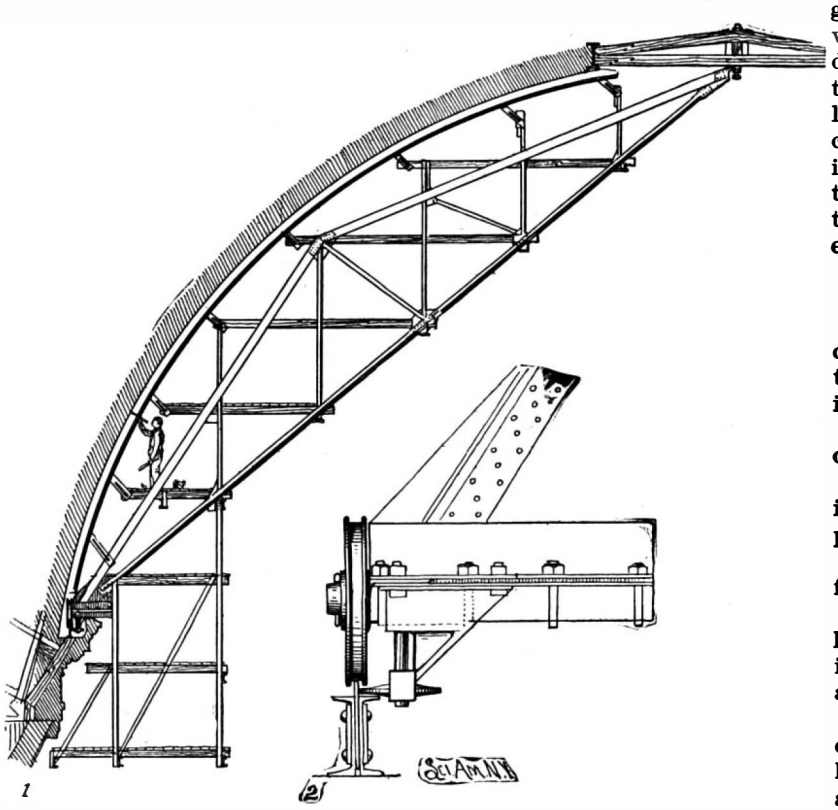
Experiments have just been made in Berlin with a so-called "kite balloon," invented by a German officer. The principal part of the balloon has a cylindrical form, widening out below so as to form a kind of rudder or tail, which is intended to steer the cylindrical part in a certain direction. The balloon is surrounded in the usual way with a net, to which the car is attached. Some twenty yards above the large balloon is a small aerostat, in the shape of a "kite," which serves to indicate the direction of the wind in the upper strata of the atmosphere. The experiments have given quite satisfactory results.—L'Avenir Militaire.

THE GREAT SCAFFOLDS OF THE CONGRESSIONAL LIBRARY, WASHINGTON, D. C.

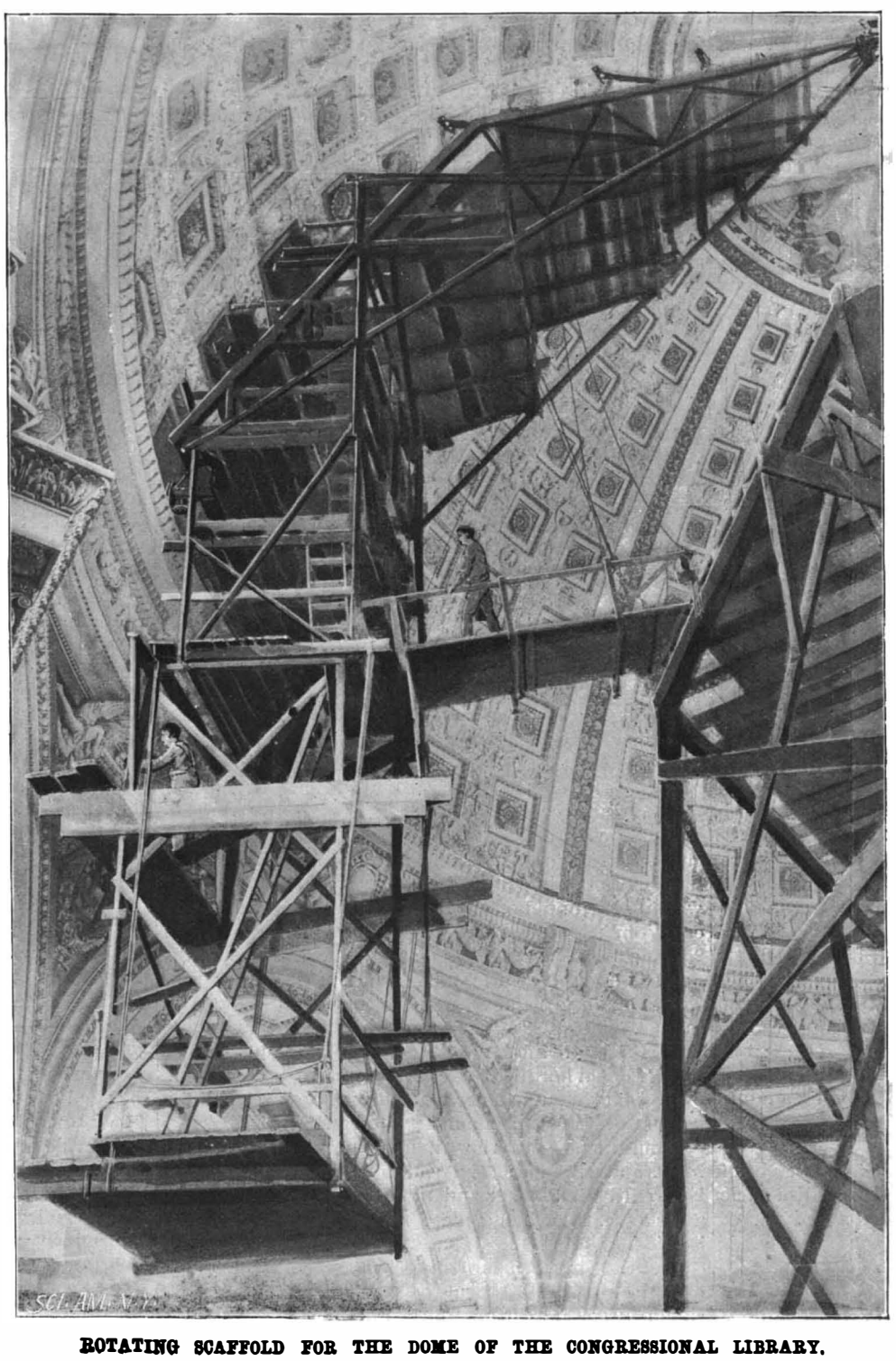
(Continued from first page.)

beams, 9 inches high, was carried around the dome, and projecting from it was a 1½ inch plate, which acted as a rail. The roliers were flanged, so they could not, under any circumstances, run off the track; and, in addition to the flange, in order to secure the utmost accuracy of movement, two horizontal guide wheels, 8 inches in diameter, were provided, which bore against the inner side of the circular track. Thus the rotation of the great structure was effected with almost mathematical accuracy, enabling the dome to be verified at every point, in addition to providing most perfect scaffolding for building. A vertical scaffolding was built up in the center of the hall and dome, reaching well up to the apex, so as to give a convenient access to the top.

Our thanks are due to Mr. Bernard Green, superintendent of construction and engineer, for courtesies received in connection with this subject. The two rotating scaffolds, while in use, proved all that could be desired, and were one of the most interesting features of the constructive operations.



ELEVATION OF THE ROTARY SCAFFOLD OF THE CONGRESSIONAL LIBRARY.



ROTATING SCAFFOLD FOR THE DOME OF THE CONGRESSIONAL LIBRARY.

Color Screen Making.

Color screens are now indispensable in advanced photographic work, and F. E. Ives, of Philadelphia (Photographic Journal, xx, 315), recently gave a useful practical demonstration of the making and testing of such screens before the Royal Photographic Society. The best method, he thinks, is to coat patent plate glass with gelatin and, when the film is dry, immerse the plate in an aqueous solution of the dyestuff until a sufficient quantity is absorbed, then dry again and cement to another piece of patent plate glass by means of Canada balsam, so as to protect the film from dust and injury. Unless special facilities are available, however, it is easier to prepare the screens with collodion films. The patent plate glass selected should have plane surfaces as near parallel as possible. This may be "flowed" with plain collodion, then with an alcoholic solution of the dyestuff, drained on blotting paper and allowed to dry spontaneously. Or better, the dyestuff (such as brilliant yellow or "uranine") may be dissolved in the collodion before coating the glass. To make eight ounces of the colored collodion, take four ounces of a clear alcohol solution of the dyestuff and forty grains of "cotton." Shake together until the "cotton" is thoroughly soaked, then add an equal quantity of ether. Coat two pieces of glass with this collodion and, when dry, cement them face to face with Canada balsam with the thick edge of one film opposite the thin edge of the other. The effect of this precaution is to keep the depth of color in the screen more uniform. The application over the films, before cementing them together, of a thick varnish made by dissolving mastic in benzol is useful in preventing punctures by dust or grit. After the excess of balsam has drained out and been cleaned off the edges with paper dipped in methylated spirit, the edges should be bound with strips of gummed paper, as in the case of lantern slides.

Cross Lighting.

Some traditions die hard, being accepted without examination by nine persons out of ten and by all who are in or under authority, and, like officials generally, opposed to or suspicious of innovation. Among these is the belief in the hurtfulness of cross lighting. This method of lighting would seem only to be held injurious in schools, for in our own houses we are only too pleased if we can have windows on two or more sides of a room. Even in Germany, where statistics and experimental investigation pervade every department of administration, and where in each detail the executive is guided by an order in council somewhat inappropriately called an "Erlass," find we cross or double lighting still expressly condemned. Yet Cohn and Förster, Javal and Ferrand, Rumbold and a royal commission on school construction have urged the groundless nature of the prejudice.

Provided always that the eyes are not dazzled and that no shadow falls on the reading or writing, it is impossible to have too much diffused daylight or its artificial equivalent. The loss of intensity with increasing obliquity of the rays of light is acutely felt in wide rooms, especially when not high in proportion, on the side opposite the windows; whereas if there be windows or lights on each side, the intensity of illumination is equalized and its total amount doubled. It is only necessary that that coming from the right should be naturally or artificially the weaker, as by having the windows north and south or by filling those on the right with clouded glass. Windows in front are always objectionable, but light from behind, if not so strong as to cast a shadow, can but serve to increase the illumination derived from the proper quarter. As Cohn and Förster long since pointed out, reading or other work demanding clear but effortless vision is in the open air, when the sky is overcast, a real luxury. Under these circumstances the light is ample but shadowless; it comes from everywhere, but from no one quarter more than from another. The most perfect artificial illumination conceivable is that obtained by Hrabowski's arrangement of hemispherical milk glass reflectors with prisms and mirrors by which the light of an electric arc lamp is diffused equally throughout the building, though the source is hidden from view. The light is photometrically equal to that of a clear summer day and as free from color; it is almost shadowless and is, in fact, superior to daylight in not being liable to fluctuations, although its intensity can be regulated at will.—The Lancet.

Fuse Wires.

Prof. W. M. Stine, in a summary (American Electrician) of practical conclusions on the subject of fuse wires, gives the following:

1. Covered fuses are more sensitive than open ones.

2. A fuse wire should be rated for its carrying capacity for the ordinary lengths employed.

3. On important circuits fuses should be frequently renewed.

4. Fuses up to five amperes should be at least one and one-half inches long, one-half inch to be added for each increment of five amperes capacity.

5. Round fuse wires should not be employed in excess of thirty amperes capacity. For higher currents flat ribbons of four inches and upward should be used.

His experiments have shown that for large fuses a multiple fuse is more sensitive than a single one. A one hundred ampere fuse may be made by taking four wires of twenty-five amperes capacity. Too much emphasis has been doubtless placed on the position of a fuse. Unless it be long and quite heavy, its carrying capacity is practically the same, whether it be placed vertically or horizontally.

Experience seems to show that the best alloy is one of lead and tin, the lead being considerably in excess. If too much lead is used, the fuses deteriorate rapidly and coat with the white film. A leading question now is the automatic circuit breaker versus the fuse wire. Both these devices are excellent in themselves, but each requires judgment in selection and use. The automatic circuit breaker is to be preferred for switchboard, use and motor service. Large fuses should be avoided, as they are both filthy and dangerous. Relegated to the back of the switchboard, the flying molten metal fouls the bus bars and connections, besides coating the board with a sooty deposit. A circuit breaker placed in plain sight on the front of the board is to be preferred in all cases. For lighting circuits it is doubtful if any simpler and better device than the fuse wire can be used. In spite of all that has been said against it, when properly used and taken care of, it leaves little or nothing to be desired; yet there is nothing about the plant that is more dangerous when ignorantly or carelessly used.

AN explosion of acetylene gas occurred September 12, in a restaurant at Lyons, France, causing a great amount of damage to the building and the neighboring buildings, while five persons were injured. The fire underwriters submitted a report on the case to an expert, who gave the opinion that the acetylene system may be accepted if an additional premium is charged, and the apparatus installed outside the building or in an unoccupied and well ventilated place.

A BALANCED LOCOMOTIVE.

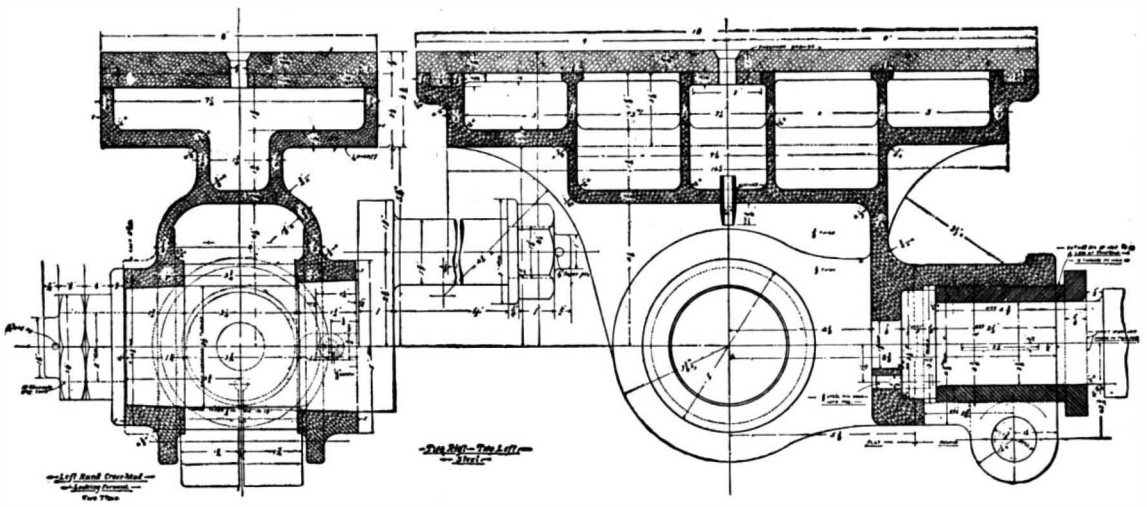
The up to date locomotive is the result of a long process of evolution, in which is embodied the results of many years of painstaking experiment. Considering the many arbitrary limitations of size and weight to which it is subject, it is as perfect a piece of mechanism as can be found anywhere to-day. There is one important particular, however, in which the locomotive shows a defect, which, in these days of high speed, has become very marked, and is causing locomotive engineers to do a lot of hard thinking.

We refer to the difficulties of counterbalancing.

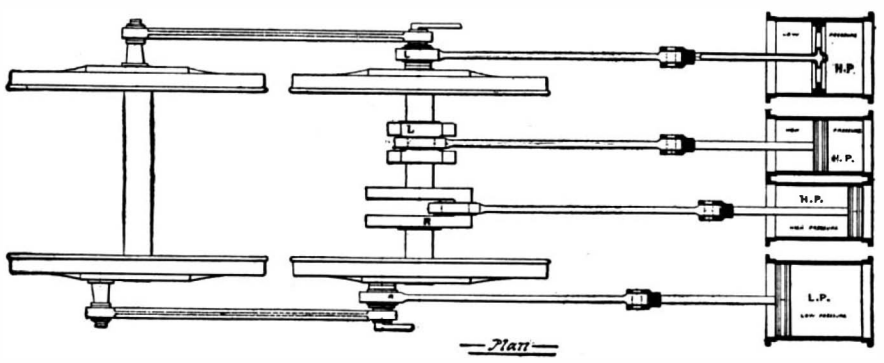
Now, at the risk of telling our readers something that they know already, we will explain that the violent oscillations which occur in a locomotive when it is running at high speed are largely due to the rapid motion of the various parts of. its engines. This motion is of two kinds—revolving and reciprocating. The revolving motion occurs in the cranks, coupling rods and (as it is usually reckoned) the rear half of the main rods; the reciprocating motion in the front half of the main rods, the crossheads, piston rods, and pistons. Now it is evident that when the heavy coupling rods, crank pins, etc., weighing many hundreds of pounds are attached to the wheel a foot or so from the center, they will throw it out of balance as it revolves, producing a disturbing moment about the center.

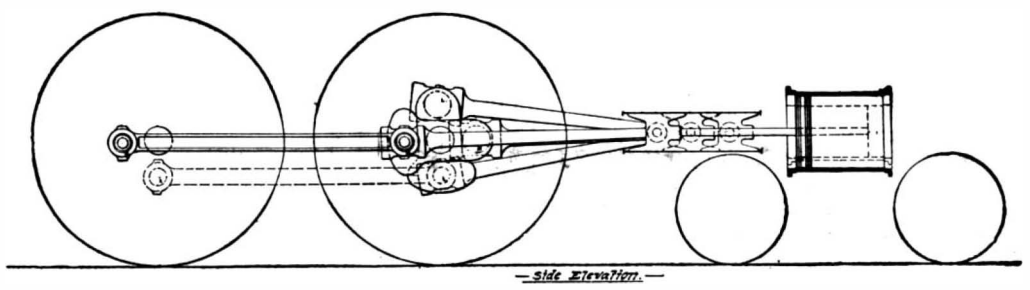
To restore the equilibrium it is necessary to place some weight in the wheels on the opposite side of the center to the crankpin, and this can be done so accurately that the balance will be practically perfect. So far, so good; but when it comes to balancing the reciprocating, back and forth, motion of the pistons, crossheads, etc., a dilemma arises. For while it is possible to counterbalance these parts by placing additional weight in the wheels opposite the crankpins, so that their forward momentum shall be balanced by the backward momentum of the weights, and vice versa, there will be a vertical disturbance of the balance of the wheels which will be exactly equal to the momentum of these added weights. The effect of this "excess balance," as it is called, will be to cause a violent vertical oscillation of the locomotive. On the upward half of the revolution the momentum of the excess weight will tend to lift the wheel, on the downward half to depress it. So powerful is this action that wheels have at times been lifted clear of the track, and the downward momentum has had the dynamic force of a blow, bending the steel rail at every revolution. On the other hand, if the reciprocating counterbalance be left out altogether, the same "hammering" effect is set up in a horizontal direction by the back and forth momentum of the reciprocating parts. This communicates a violent vibration to the whole train, which at high speeds becomes extremely uncomfortable. The locomotive builder is thus placed "between the devil and the deep sea;" and in his dilemma he has taken the only course left open to him, and compromised the matter by counterbalancing only one-half or two-thirds of the reciprocating parts as seems best (or least bad) in his judgment.

Evidently the only satisfactory way to secure perfect counterbalancing is so to arrange the working parts in the locomotive that the revolving parts shall be coun-

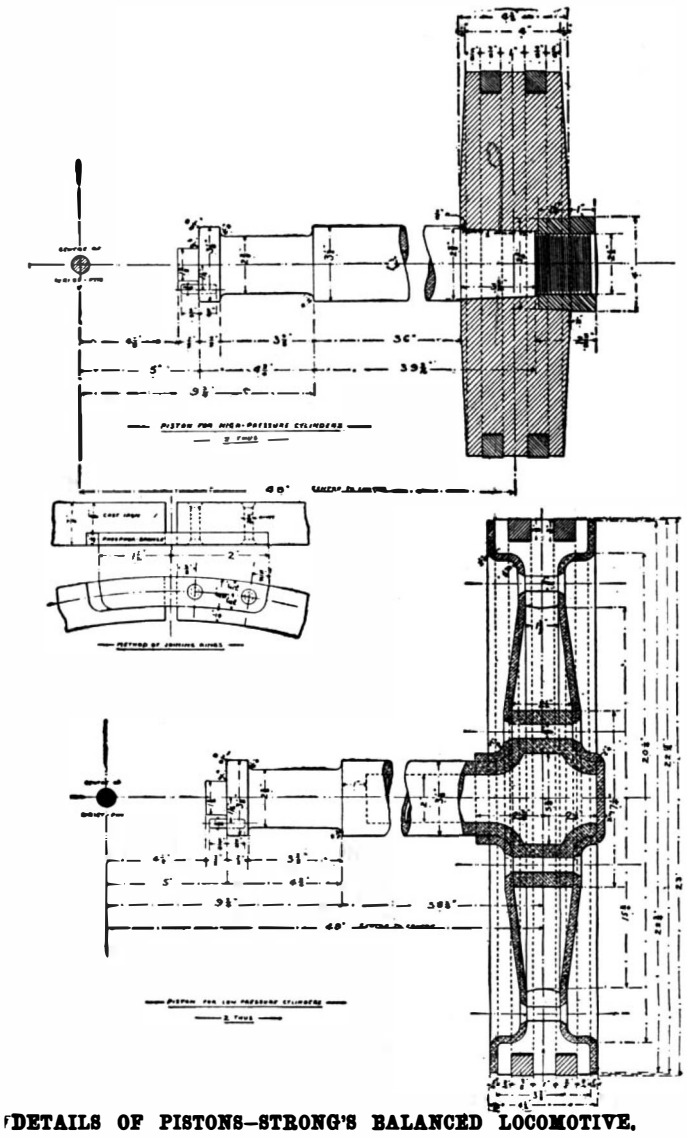


DETAILS OF CROSSHEAD—STRONG'S BALANCED LOCOMOTIVE.

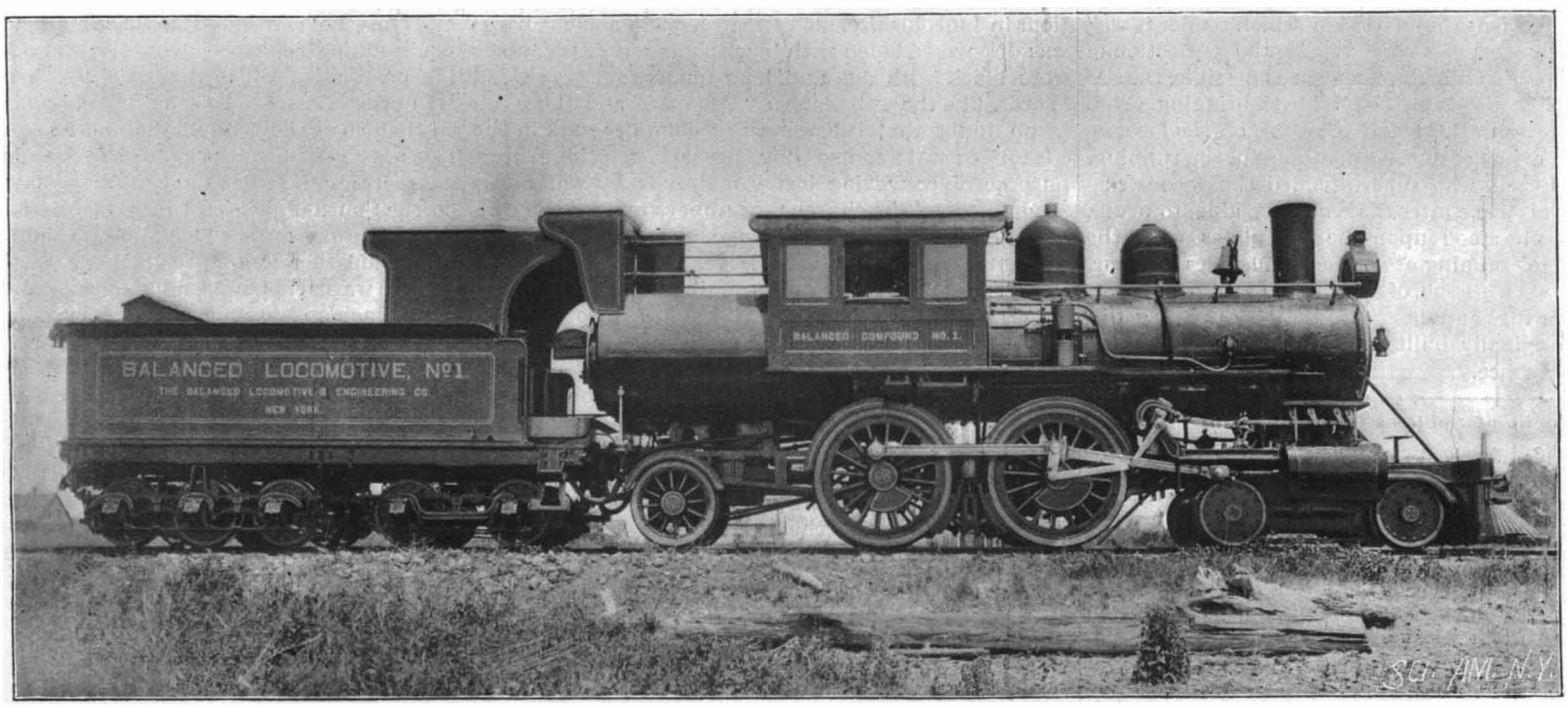




ARRANGEMENT OF PISTONS, RODS, AND CRANKS—STRONG'S BALANCED LOCOMOTIVE.



DETAILS OF PISTONS—STRONG'S BALANCED LOCOMOTIVE.



THE STRONG BALANCED LOCOMOTIVE FORMERLY THE A. G. DARWIN.

Two 16 inch high pressure cylinders; two 23 inch low pressure cylinders by 24 inch stroke; 68 inch drivers; heating surface, 1,680 square feet; steam pressure, 170 pounds; weight of engine, 120,500 pounds.

terbalanced by revolving parts and the reciprocating parts by reciprocating parts throughout the complete revolutions of the wheels.

The locomotive which is shown in the accompanying illustration has been designed on these lines. The general outlines will be familiar to many of our readers, who will recognize it as the famous A. G. Darwin, one of the Strong locomotives which attracted much attention some half dozen years ago. The frame, wheels, boiler, and tender are the same; but here the likeness stops. In place of the former 19 inch cylinders there is a compound engine with four cylinders, which are arranged in pairs on either side of each side frame, as shown in the plan view. On the inside of the frames are two 16 inch high pressure cylinders and on the outside are two 23 inch low pressure cylinders. The cranks for the former are turned in the main drivng axle, and the low pressure cylinders are connected to outside crank pins in the usual way. The cranks of each pair of high and low pressure cylinders are set at 180°, so that the low pressure crank pin is moving forward when the high pressure crank axle is moving backward, and vice versa. In this way the reciprocating parts of each pair of cylinders are made to counterbalance each other, and a locomotive is produced whose center of gravity is constant, whether she be running or at rest. The pair of cranks on one side are placed at the quarter stroke to those on the other side. In order to make the reciprocating parts of the adjacent pair of high and low pressure cylinders exactly counterbalance, Mr. Strong has designed a special form of low pressure piston and rod. As shown in the drawing, both piston and rod are hollow, the piston being formed of two dished steel plates, the end of the hollow piston rod being flanged out and fitting into shoulders on the inside of the steel plates to which it is riveted. At the periphery the plates are riveted to an annular ring in which the customary grooves are cut for the piston rings. The high pressure piston and rod are made solid and equal in weight to the low pressure piston and rod. The weight of the reciprocating parts is further reduced by using a hollow crosshead of very light design, as shown in the accompanying drawing.

The revolving parts are balanced by placing weights in the wheels in the usual way, except that the counterbalances are placed at the same distance from the center as the crank pin, instead of at the circumference of the wheel. Mr. George S. Strong, the designer, claims that better results are obtained by this arrangement, inasmuch as the balancing is perfect at all speeds.

The valve gear, which is an adaptation of the well known Walshaert gear, so largely used in Europe, is designed to give an equal lead at all points of cut-off. The valves are of the gridiron type, working vertically, and they are operated from the outside crankpin, which is seen in the illustration attached to the main driver. Motion is given by a connecting rod which is attached to a crank arm on the link shaft. The links have a fixed point of revolution, the blocks sliding in the links instead of the links on the blocks. The motion is thence transmitted to the rocking shafts of the valves, which will be seen located above the cylinders. The gear which is seen midway between the link blocks and the valves is operated from the crosshead and imparts the necessary lead and lap to the valves. The chief advantage claimed for this arrangement of valves and valve gear is that by providing large port areas (in this case as high as 11 per cent of the piston areas) the steam has a very free admission and exit to and from the cylinders, and wire drawing, that most fruitful source of loss at high speed, is prevented.

Altogether, the balanced locomotive, as it is called, presents many features of design which render it well suited to heavy express service. As the perfection of the balance renders a high piston speed possible, the size of the driving wheels may be reduced, bringing a consequent increase in the tractive power of the locomotive. As an evidence of the smoothness of the running, Mr. J. W. Beach, who superintended the reconstruction and trial trip, states that he was able to read a newspaper as he stood upon the foot plates when the locomotive was running at a speed of 70 miles an hour. In the next week's issue of the SUPPLEMENT we shall give full drawings and description of the A. G. Darwin as she was originally built, together with some details of her performance.

The Treatment of Snake Bite by Calcium Chloride.

The Indian Lancet for August 16 publishes the following abstract from the Semaine Médicale: Phisalix and Bertrand reported the result of experiments with calcium chloride in cases of snake bite at a recent meeting of the Académie des Sciences. Its therapeutic action is not, as Calmette thought, due to the formation of some substance neutralizing the poison, or to its entering the circulation and there destroying the poison as it would in a test tube, but it depends simply on its local effect: it destroys the poison locally, causes the tissue to slough, and so prevents absorption of the toxic material. Hence it is concluded that the injections of calcium chloride must be made deep at the actual spot where the fangs entered, and that they are useless if made in any other part.

Recent Archæological News.

"Grave goods" is the comprehensive term now used in England to describe what archæologists find in stripping ancient tombs. In the Carthage cemetery this year 120 tombs have been found and opened by Father Delattre, some Greek vases with figures of animals being among the grave goods.

An act of official vandalism has been perpetrated at Spalato, in Dalmatia, the great palace of Diocletian. The beautiful Romanesque tower on Roman foundations at the entrance of the emperor's mausoleum has been torn down, and a new tower is rising in its stead, into which capitals and sculptured stones of all dates from the third century to the twelfth are being built.

Henry Brest, through whom the Venus de Milo came into the hands of the French in 1818, has just died, over a hundred years old, on the island of Milo, where he had married a Greek woman. He happened to be on the spot when the peasants first dug up the statue, and, struck by its beauty, induced them to keep the discovery secret, notified the French consul, and arranged for the delivery of the statue to the crew of the French man-of-war that came to Milo to carry it away.

At Mycenae a vaulted chamber similar to the so-called Treasury of Atreus, the Treasury of Orchomenos and other structures, which are now known to be tombs, has been discovered. The wonderful discoveries which Schliemann made in these tombs, in which, as he thought, he found the remains of Agamemnon, will be remembered; and the present one has the advantage over nearly all the others known, of being practically intact, the fall of a huge mass of earth in early times, says the American Architect, having protected it from spoliation.

Among the recent finds of the French expedition in Babylonia, which has been and is still working at Telo, are a number of dated cuneiform tablets of Sargon the First and of his son Naram-Sin. These have now reached Constantinople, and within the last two months have been submitted to the examination of Monsieur Heuzey, director of the Museum of the Louvre, and of Prof. Hilprecht, who has been retained by the Turkish government to decipher and classify the objects found by both expeditions. By this important find, all questions as to the mythical character of Sargon are put an end to, and he is shown to have been a real person. The contents of the so-called Oman tablet are definitely decided to be historical and not mythical.

Mr. Newberry tells of the labors of the Egyptologist in making out inscriptions, and in the Academy he writes that when obtaining a complete copy of the great tomb of Rekhmara he spent "six months' hard work on ladders and by candle light." The Necropolis of Thebes has been investigated by Champollion, Roselline, Wilkinson, Lepsius, Ebers, Brugsch Pasha, but its wonders have not yet been by any means exhausted. Mr. Newberry has devoted his attention to the private tombs, and many of these have inscriptions and pictures of great interest. Access to them was difficult, because they were inhabited by the fellahin. In one tomb was found a record of the engineer employed by Queen Hatshepsut, who superintended the cutting of the two great obelisks at Karnak.

The special wealth of the Fen country of England in churches of the highest class, some of them almost cathedral-like in dimension, far exceeding the needs of the sparse agricultural population now around them, must impress us with something like astonishment when we remember that building materials, whether stone or timber, were necessarily brought from less watery districts. In the course of some drainage operations in Lincolnshire, many years ago, an ancient barge was discovered laden with blocks of stone. Its timbers were black with age and long immersion, says Good Words, like the well known "Fen oak," and there can be no doubt that it had been accidentally sunk in the "leam" or watercourse, dug, perhaps, for the express purpose of conveying heavy materials by water carriage to one of the churches or abbeys in course of construction five or six centuries ago.

A novel anthropological discovery was made recently three miles from Waynesburg, in the southwestern corner of Pennsylvania, says Nature. A laborer, while plowing, struck a number of stones, which proved to be graves of a character different from any heretofore discovered. Twenty vaults were found, each twenty-seven inches long, seventeen inches wide, and twelve inches deep, and each covered with a stone forty-two inches long, three inches thick, and twenty-eight inches wide at the head, thirty inches in the widest and twenty-four inches in the narrowest part. The stones were six inches below the surface of the ground. Each vault contained a skeleton of diminutive size, doubled up so as to occupy only eighteen inches of space, with the heads all in an unnatural position, and all facing the south. Under each skull was a turtle, placed as if for a pillow; and in many of the graves were skeletons of birds. The graves were arranged in the segment of a circle of almost four hundred feet in diameter. Many bone beads were found in the graves, but only one piece of metal, a small crescent shaped copper ornament.

Science Notes.

The preservation of the remains of the famous walls of Antoninus, between the Firths of Clyde and Forth, built in 140 A. D., has been occupying the attention of the "National Trust for Places of Historic Interest or Natural Beauty." The Secretary of State for Scotland has visited the remains and it is believed that steps will be taken to preserve them.

A series of fêtes have been celebrated at Alais, in the center of the great mulberry and silkworm district of France, in commemoration of the services rendered by Pasteur to sericulture. A statue of Pasteur was unveiled during the celebrations; and a solemn service was celebrated in the cathedral in commemoration of the first anniversary of his death, which occurred on September 28, 1895.

Analysis of food is enlisting the services of Roentgen rays for the discovery of adulteration. A recent communication from M. Ranvez speaks favorably of the new method. In pictures so obtained of powdered materials thinly scattered on a sheet of glass, the presence of any of the mineral adulterants commonly used is plainly visible, on account of the rays not being able to penetrate them.

L'Industrie Electrique gives the following simple rule for converting Fahrenheit to Centigrade degrees. Subtract 32 degrees and divide by 2; then add to this $\frac{1}{10}$ of itself, and, if further accuracy is desired, $\frac{1}{100}$ more. For instance, if it is required to find the number of Centigrade degrees corresponding to 72 degrees Fahrenheit, subtract 32 and divide by 2, giving 20; adding $\frac{1}{10}$ more gives 22, and, for greater accuracy, another $\frac{1}{100}$ gives 22·2. The method is not as simple when applied to the reverse calculation, but possesses some interest.

The "International Cloud Atlas" may be purchased of MM. Gauthier-Villars et Fils 55 Quai des Grandes Augustins, Paris, for 14 f. a copy, says Science. The "Atlas," which contains 28 views, is now the official cloud atlas of the world, and the illustrations in it are the types to which all cloud forms must hereafter be referred. It is the work of the International Cloud Committee, appointed by the International Meteorological Conference held at Munich in 1891, and the standard types now adopted were selected from over 300 photographs collected from all parts of the world.

The influence of moisture on vegetation has been found by M. Edmond Gain to vary greatly at different periods in the growth of the plants. As a rule, water is urgently needed when the first leaves are appearing, then little is called for until just before blossoming, when a large supply is demanded. The fruit is best perfected in comparative dryness. Very few plants require constant moisture, and in all experiments tried the plants that were watered at the two critical seasons of first growth and the beginning of blossoming did as well as those that were constantly watered. Moisture in the soil favored increase in the number of fruit, seeds and roots, while dryness tended to promote greater size and perfection of seeds and tubers.

What appears to be an example of a new class of phenomena was shown at the meeting of the British Association by Prof. Liebreich, of Berlin, says the English Mechanic. He advanced as a deduction the general proposition that liquids, in proportion as they were placed in confined spaces, acquire, by equilibric reactions, the properties of solids, and that friction in such fluids has a bearing of considerable importance on chemical reaction. One of the experiments was that of sinking a piece of nickel attached to a float in water, and drawing it down to the bottom of the vessel by magnetic attraction. Prof. Liebreich showed that the float did not again rise quite to the surface, and this he attributed to friction in the fluid. He made a kindred experiment with two kinds of glycerine, one kind of which slightly reduced specific gravity. By means of a specially constructed apparatus he showed that the lighter liquid did not rise quite to the surface of the heavier, if permitted to percolate through it.

According to Dr. James Croll's estimate, the ice sheet at the South Pole is at this age several miles in thickness, its upper surface being above the line of perpetual snow, and therefore not capable of melting away during the warm eras succeeding glacial periods. Further, when such an enormous mass of ice is again incrusted about the earth's surface, as some geologists believe may be the case in the process of time, the consistent supposition is that as soon as it begins to yield once more to the influences of a milder atmosphere, as its counterpart did long ages ago, the same process of flooding great areas of the earth will be repeated, and the same remarkable evidences of the presence of seas and oceans that no longer endure will be left behind. The theory entertained by Alfred R. Wallace is much to the point, namely, that as a past glacial age was melting into the tertiary period, the seas in the northern hemisphere covered a much larger area than now, and extended across central Europe and parts of western Asia, and the Arctic Ocean was likewise enlarged. It is well known, by geological evidences not admitting of any question, that the lowlands of Europe were submerged and that the Baltic, Caspian, and neighboring seas were simply a part of the vast Atlantic Ocean, instead of being landlocked waters as they are now.

PAPUA, ITS INHABITANTS AND RESOURCES.

BY HAROLD AVERY.

In 1511 the Portuguese navigators D'Abreu and Senam discovered the great island of Papua, and, while the English and Dutch hold it in divided possession, it remains to this day practically an unknown land. This is due principally to the resistance of the fierce mountain tribes, who resent every intrusion and will permit no exploration they can possibly prevent. They do not build below an elevation of one thousand feet, and as the country is mountainous, rising in many peaks above the snow line, they have hitherto succeeded in repelling investigation of the interior.

Such places as have been visited are reached by rough paths over coralline limestone whose interstices are filled with red clay; and where the clay is more plentiful the tropical vegetation forms an absolute barrier to advance. If the explorer should endeavor to advance over the rocky path, he is soon disabled by the cuts and scratches inflicted by the needlelike points of the jagged rock, which cut their way through the stoutest shoe leather. An occasional bamboo stake driven into the path and sharpened is used by the natives to protect their villages or satisfy a feud; and woe to the unwary foot that it pierces, for the wound is slow to heal.

The people of the coast are open to intercourse, industrious, and of cheerful temperament. Most of their villages, like the ancient and modern lacustrine villages, are built for protection on piles, connected by a gangway of like construction with the shore. That at Humboldt Bay, on the north coast, is the largest and best known. The general religion is belief in a deity who returns the souls of the dead to the bodies of the next born descendants of the same sex. No reverence or sacrifice is paid to the deity, who is a conception of nature possessing the personal attributes common to a primitive form of ancestor worship.

The village we illustrate is situated at Port Moresby, the English station on New Guinea, opposite the Australian port of Albany on Cape York. The houses are from seven to ten feet above the water, with walls generally four feet high, the high pitched roof being fitted with an enormous shutter, which is raised and propped from within to admit light and air and for the escape of smoke. The house frame is of bamboo, the walls of palen pith and the thatch of pandanus leaves. The floor is made of bamboo laths, covered with palen pith slabs, and laid with matting, often of elegant design. A cooking place with a hard-baked red clay floor is reserved at one end.

The inhabitants are Papuans, a well formed, sooty black race, with a great mop of frizzled black hair, large mouth, projecting brows, prominent nose with large nostrils, thick ridge, and apex pointing downward. Their loud voices, eager, rapid utterance, incessant vital motion, and absurd antics, proclaim a common origin with the negro, and distinguish them from the silent, impassive Malay. The hair and twisted beard of the men is stained with red clay, and ornaments of shell, tin plated wooden combs and rooster's feathers are used in their elaborate coiffures. Armlets of plaited grass and anklets of brass and shell relieve against their dead black skins in startling contrast. A loin cloth completes the costume. In appearance they surpass the women; though neither are so repulsive as some school books declare. The women are more fully, though less fancifully, costumed than the men, wearing a mat of plaited cocoa fiber that extends from the waist to the knees, brass or shell earrings, kangaroo teeth necklaces, combs with two forks admirably suited to their frizzly hair, armlets and anklets.

The chief industries are fishing and the cultivation on the nearest shore of rice, sago, and yams. There is some making of matting, baskets and boxes, and pottery. Their surplus products are exchanged for ornaments, nets from Great Bay, betel and arrack; these articles being brought by traders on their way to Numatatte, in boats built at the island of Ké. These boats, of from twenty to thirty tons, compare favorably with European craft of the same size, though they are built without a nail, of planks and ribs joined with wooden pegs and rattan.

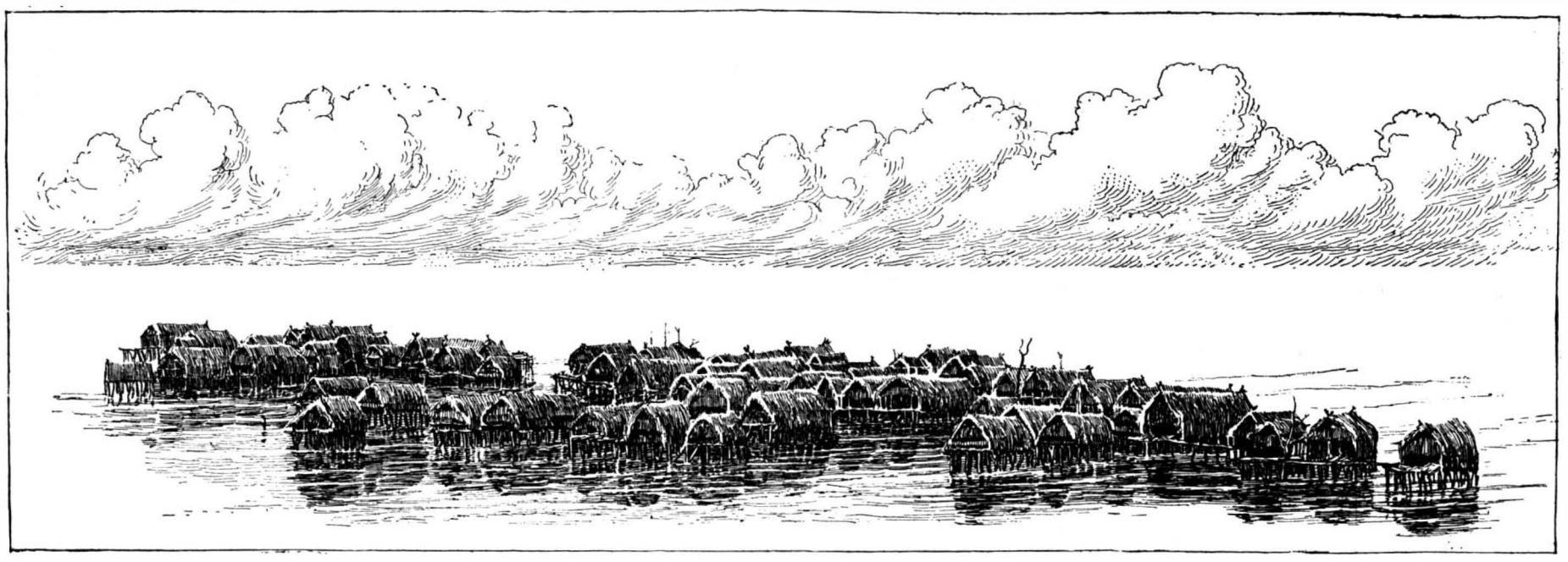
But three tools are used in their construction—an ax,

A PAPUAN FEMALE.

an adz and an auger. They are low and broad in the middle, rising with graceful lines to a beak at bow and stern, which is ornamented with a plume of marabout feathers. When a trader appears, his craft is surrounded by the entire male population in dugouts and outriggers, each individual shouting his offer, and accompanying it with ridiculous antics and grimaces. The basis of exchange is arrack (Java rum), one-half gallon of which is reckoned equal to one day's work at fishing or rattan cutting; no money is used. When this nectar of the Papuan enters a home, every occupation is dropped, and the family devotes all its attention with enthusiastic energy to its consumption. Their efforts never flag while the rum lasts or strength remains. The resulting stupefaction lasts for days; but on recovery the family cheerfully proceeds by persevering industry to acquire the means of procuring more. Arrack is without a rival as the most villainous intoxicant known, and its only competitor in the affections of the Papuan is roast wild pig. Together, they are simply irresistible.

Such are the races to whose custody the ransom of an empire is consigned. Rich treasure stored within the hills, vast forests of ebony, and a virgin soil of unusual richness await release from the dominion of a people who know neither their value nor their use.

Iron, coal and lime are known to exist. The volcanic nature of part of the mountain ranges indicates the probable presence of precious metals and stones. Ironwood, canary, and sandalwood grow with tropical fertility. Bananas, palm sugar, besides the products already mentioned, invite the miner, the manufacturer and planter. If a tithe of the enthusiastic devotion to exploration of the polar regions had been devoted to the equator, this island with an area equal to Austria-Hungary, scenery like Switzerland and a climate equal to Mentone, would be one of the garden spots of the earth.



A PAPUAN COAST VILLAGE.

Changes in Cave Dwelling Animals.

"The influence of environment upon organisms is nowhere more striking," says Science, "than in the case of animals which find themselves accidentally lost in caves and which succeed in accustoming themselves to the situation in spite of its difficulties. M. Armand Viré gives some notes on his observations in the Comptes Rendus. The principal difference in the situation consists in the absence of light and in the rarity of animal prey. The eye always becomes atrophied to a degree which varies with the species and also with the individual; there is sometimes a difference between the two eyes of a single individual. The eyes are to a certain extent replaced by other organs of sense; the antennæ of the Campodes become, in some individuals, twice as long as usual, and sometimes longer than the entire body. The tactile hairs with which the body is covered obtain an exaggerated development, and in the crustaceans sometimes even invade the ocular globe. Hearing does not seem to be accentuated, but the sense of smell is very acute, and a bit of tainted flesh becomes invaded in a very few minutes with a large colony of animals. The organs of digestion become very considerably modified in those species which are naturally carnivorous, and in two Staphylins the mandibles were found to be completely atrophied. Every animal is more or less completely depigmented; but those which had no trace of color remaining began to have numerous little black spots disseminated over the whole body after they had been kept for a month in the light, and these spots were particularly abundant in those parts (antennæ and claws) which had been accidentally lost and were in course of restoration."

Chromate for Preventing Boiler Incrustation.

A. Rubricius, an Austrian chemist, recommends a new method for the prevention or removal of boiler incrustation which has furnished remarkably good results since about one year that it has been in use at Anina and other localities in Austria-Hungary. To the feed water there is added a mixture consisting of 90 per cent of soluble chromates and 10 per cent of soda. These salts transform the more or less soluble carbonates contained by the water into soluble chromates which settle in the shape of slime without adhering to the walls of the boiler, and the latter can easily be cleaned by washing.

The beneficial effect of the process will be felt even in the case of boilers which are already lined with thick layers of incrustation, for these will be gradually reduced and transformed into slime. On an average one-tenth of an ounce of the mixture should be added to 35 cubic feet of water. For an ordinary boiler three to four ounces per day would be sufficient. Where water with very high lime contents is being used, the dose should be increased a little; the exact quantity needed can easily be determined by a preliminary test. —Oesterr. Zeitschr. f. Berg und Huettenwesen.

RECENTLY PATENTED INVENTIONS.

Engineering.

GENERATING STEAM.—Edgar A. Ashcroft, London, England. This invention is for a method of and apparatus for applying the heat of slag, etc., for the generation of steam, the slag being supplied to the boiler heating chamber spread out in a thin layer, so that its continued accretions will afford large and renewed heat radiating surface, while the convection of heat from the exposed surface is assisted by air currents passed through in a continuous cycle. The fire box is similar to that of a vertical boiler, but with a hearth at the bottom instead of a grate, and the boiler is inclosed in an annular flue space within a brickwork setting, the main body of the boiler being surrounded by vertical flues, and a central tube, through which the hot material is supplied, leading through the steam dome to the fire box. The boiler is held in a setting arranged above a track, beneath which is a tunnel.

GAS ENGINE DISCHARGE VALVE.—William Burger, Delphos, Ohio. This valve is designed to so control the outlet from the cylinder that the latter may be repeatedly charged with explosive mixture before ignition, the charge being retained in case of failure until proper ignition takes place. The spring-pressed exhaust valve has a longitudinally channeled stem on which is a casing provided with a port, a piston in the casing being adapted to be acted on by pressure passing through the channel and port from the cylinder, while a block carried by the piston is adapted to be engaged by the actuating mechanism for the valve stem.

Railway Appliances.

FREIGHT CAR.—James M. Peet, Allegheny, Pa. To provide for the safety of trainmen who have to walk from one end of a train to the other, and also afford means for readily operating the couplings from a platform, this inventor provides for a side platform, to extend the entire length of the car body. This platform is just wide enough for one to walk on, is made in sections, and is hinged to the car, so that it may be turned down and the car run close to a platform to facilitate loading and unloading. At the ends of the car are transverse platforms, and along the sides and ends are handrails, the improvement obviating the necessity of walking upon the car roof.

HANGER FOR BRAKE BEAMS.—Ephrem Marcotte, Las Vegas, New Mexico. This invention relates to car trucks, and provides a bearing having a U-shaped metallic yoke and a block fitted in the yoke and forming with it an opening for the hanger arm, the bearing being secured by a bolt to the end sill of the car. The bearing can be cheaply made, and is not liable to get out of order.

Miscellaneous.

BICYCLE.—John J. Naregang, Leesport, Pa. To facilitate the adjustment of the tension of the driving chain, and the removal of the chain and the rear wheel from the frame, this invention provides a frame union or joint piece to connect the rear forks, there being in the union a lengthwise slot in which an adjusting screw and nut are engaged to adjust the axle, there being a guide washer for the screw and a clamp nut working in contact with the washer.

BICYCLE.—Edwin Y. MacKenzie, Kingston, Jamaica. This invention provides an attachment to take the place of the ordinary pedal, by means of which increased leverage may be obtained in going up hill or to make a higher speed. The pedal is eccentrically pivoted on its shaft, and secured to and extending from the outer end of the crank arm is a ratchet having at each end teeth and a central plain portion, while a spring pawl pivoted on the longer end of the pedal is normally held in engagement with the teeth on the ratchet bar. The pedal operates in the ordinary way during the upward movement of the crank, but when the latter has passed the center the ankle is bent until the pawl engages the outer teeth of the ratchet, forming a practical extension of the crank arm. When the extra leverage is not required the pawl does not engage the teeth and the pedal acts like an ordinary pedal.

VEHICLE DRIVING GEAR.—Frank W. Haviland, New York City. Two patents have been granted this inventor for improved gears arranged to propel the vehicle independently of the running wheels, and at the same time prevent slip and loss of power, an independent friction surface being applied to utilize the weight of the vehicle to increase friction and overcome inertia and resistance. In combination with the running gear swinging wheels are adapted to alternately engage the ground or track, there being means for operating the wheels and simultaneously swinging one wheel out of contact with the ground when the other is swung into contact. There are also segmental guides in which the boxes of the propelling wheels have movement, the guides being fixed and curved in the direction of the wheels which they govern.

CART.—Thomas Hill, Jersey City, N. J. This is a vehicle more especially designed for street cleaning purposes, to collect the sweepings and deliver them to a wagon or directly to the dump. The cart body is provided with trunnions engaging open bearings on the cart frame, mounted to swing in the side wheels as the fulcrum, the trunnions being above the fulcrum. The cart has three wheels, and may be conveniently pushed about by one man, and the load readily dumped, the cart body being easily removed from its wheeled support, or lifted back into normal position.

VEHICLE BRAKE.—Clark Snow, Oxford, Ala. This is a brake of such construction that when set to a bearing against the wheels the setting mechanism automatically locks the brake in set position, the power of the brake being substantially greater as the resistance of the wheel increases. The releasing mechanism readily frees the wheels from the brakes, and the brakes, when released, are held perfectly clear of the wheels. The brake may be operated from either the side, front or rear of the vehicle, and may be applied without injury to either the running gear or to the body of any form of vehicle.

GATE.—Alva H. Barnhill and Thomas I. Thurman, Altoona, Kansas. This is a tension gate of which the hinges on the swing post are out of vertical alignment, and the swing bar and latch bar are connected by wires which pass through intermediate vertical bars, while a tension bar pivoted to the lower end of the swing bar extends to and beyond the latch bar, where it engages with a keeper. The arrangement is such that the tension of the wires raises the gate as it is opened and gives the gate a strong tendency to close.

FRUIT PICKER'S BASKET.—Augustus M. Denig, Riverside, Cal. This invention provides a basket or can designed to facilitate the handling of picked fruit without danger of bruising it, the receptacle having diverging sides which increase its capacity toward the bottom. It also has two hinged bottom sections and straps connected with their free ends, while stops on the sides engage with the outermost ends of the straps. In emptying the receptacle the bottom sections are swung downwardly to permit the fruit to pass out with the least possible liability of being bruised.

REELING MACHINE FOR PAPER, ETC.—William H. Waldron, New Brunswick, N. J. According to this improvement, a winding roll is journaled in sliding bearings to move toward and from a driving roll, one of the bearings receiving the journal of the winding roll eccentrically, there being means for turning the bearing to shift the end of the winding roll transversely to the direction of the slideways. The machine is thus adapted to automatically correct any uneven winding caused by the length of the sides or selvedge of the paper or fabric to be reeled.

COLLECTING GASES.—Francois G. Waller, Delft, Netherlands. This invention provides an apparatus for collecting gases or vapors, for making analyses thereof, consisting of two communicating tanks, in one of which is a float carrying a siphon automatically controlling the flow of liquid from the tank, while the other tank has a filtering gas inlet pipe and an outlet pipe communicating with the first tank. The variations in pressure in the space containing the gases have very little influence on the mean composition of the separated sample.

PRODUCING MUSIC ROLLS.—James B. Tracy, Meriden, Conn. To from the perforated rolls used in instruments to produce the desired tones, either pneumatically or by the aid of cylinders, combe, star wheels, etc., this inventor has devised an apparatus in which a perforated pattern sheet and the sheet to be perforated are passed together over a perforated tracker board during the operation of reciprocating punches whose movement is controlled by slides, there being a bellows for each punch. The arrangement is such that a large and cumbersome stencil is not required to actuate the punches, one of the ordinary music sheets passed over the tracker board pneumatically controlling the punches to form new sheets or rolls.

MANIFOLD SALES BOOK.—William D. Bates, Grafton, North Dakota. Pairs of crossed bands connect the covers of this book to form a double hinge, and the upper end of a pad is placed such distance from the upper pair of bands that the leaves when folded outwardly will be engaged thereby. The pad comprises sales slips with which alternate duplicate slips, a transfer sheet being inserted between a sales slip and its duplicate. At the end of a day's work the duplicate slips can be readily taken out, and when the pad is used up a new one is easily inserted.

ENVELOPE.—Alexander McL. Chalmers, Nanaimo, Canada. This envelope has extension flanges on three of its flaps, the extensions on the opposite flaps being folded and gummed on their front faces and the extensions on the other flap being gummed on their rear faces. The extension flanges on the back of the envelope are adapted to be conveniently taken hold of by the receiver to tear open the envelope without danger of injuring its contents.

BROOM ATTACHMENT.—John S. Williams, Krebs, Indian Territory. This is a spring wire clamp formed of two sections sliding one on the other, bifurcated arms being secured to the sections, and there being slides on the members of the arms whereby the sections can be adjusted by moving the slides up or down. The clamp may be readily adjusted on the brush portion of a broom to bind the straws more or less tightly together, rendering the broom adjustable for any kind of work, as carpet sweeping, scrubbing, etc.

FIREPROOF DOOR.—George Fox, II, New York City. This door has a sheet metal centerpiece whose sides are covered by layers of fireproof material, a wooden facing covering each layer, while a layer of fireproof material is passed around the edge of the door, with a strip of sheet metal covering. A fire on either side of the door may burn off one face without disturbing the position of the parts on the other side of the door, which is made to have the appearance of an ordinary wooden door.

BABY CARRIAGE.—John A. Johnson, Hoquiam, Washington. This is a carriage which may be readily converted into a cradle, a crib, a high chair, or a rocking seat, the various changes being quickly and conveniently made and the carriage being as light and durable as an ordinary carriage. It has a seat and a foot portion pivotally connected to each other, a foot rest resting on the foot portion when the latter is held at an angle to the seat, and in front and rear chambers of the body are rockers to be held within or below the sections to which they are applied. The entire body is seated in a skeleton frame, to which the running gear is attached.

FOLDING BED.—Robert J. Stuart, New Hamburg, N. Y. Connected with the front portion of a stationary head board are legs on which the bed is fulcrumed, a latch pivoted at its center on the head portion of the bed having a weighted end opposite the latch end, while a keeper bar connected with the legs is adapted to be engaged by the latch when the bed is in elevated position. A curtain to conceal the bed may be attached to a curved rail extending forward from the top of the stationary head board.

MANGLE.—John A. Jackson and George S. White, Toronto, Canada. This is a device which may be operated with but little power, by turning a crank, and may be readily set on a table for use or hung up or stored away in small space. It has an upper and a lower roller between which the articles to be pressed are passed, the upper roller shaft being pressed down by coiled springs whose pressure may be readily regulated, while the lower roller shaft is journaled on anti-friction rollers, reducing the friction to a minimum.

CLOTHES LINE HANGER.—Jacob H. Burlich, New York City. According to this improvement, an arm is pivoted to the window casing or a similar support and carries on its free end a pulley over which passes the clothes line, a locking lever for locking the arm in position also forming a guide for the clothes line. This hanger permits the user to hang clothes on the line within a room and then move the line with the clothes on it out into the yard on leaving the clothes to dry.

SCRAPER.—George E. Richardson, Pomona, Mich. In a frame carried by a loosely mounted axle on suitable driving wheels, according to this improvement, are journaled two shafts carrying a pinion at each end, in which mesh rack bars fixed to a suspended scoop, the arrangement being such that, by means of levers within easy reach of the driver, the scoop may be elevated at the front and depressed at the rear for dumping the load. The scraper may be backed up wherever the load is to be deposited, and the load dropped without requiring rehandling.

COMPOSITION FOR PAVING.—Timothy Cotter and Thomas H. Walker, Kansas City, Mo. These inventors have devised a composition for paving which may be moulded into any desired form and laid directly down in blocks or flags, or spread and tamped, or rolled directly on streets, sidewalks, driveways, etc. It is made of coal tar pitch, coal tar, hydrate of lime, oil and sand, in specified proportions and after a manner described, and is designed to be sufficiently strong to resist cutting and wear during the heat of summer, and have sufficient elasticity when frozen to give or bend slightly, without fracture, under pressure.

WEIGHING MACHINE.—Richard H. Taylor, Westport, Conn. This machine has a series of beams to support the weighing platform, the beams having segmental concentric faces with which are connected bands to support the beams and connect them with the support for carrying the platform, while a band also connects the beams with the weighing beam above the platform. The arrangement is such as to afford a very sensitive platform scale, and one not liable to get out of order with great wear.

WEIGHING OR MEASURING MACHINE.—Samuel P. Mackey, Ridgefield, Washington. For grocery and other stores, this invention provides a machine adapted to handle oils, sirups, etc., and solids which pour easily, as spices, powder, shot, etc. It has a receptacle which, when placed in connection with a source of supply, automatically shuts off the supply when a certain quantity or weight of material has been received, relieving the dealer from the necessity of close attention in weighing or measuring quick-flowing articles, or from the need of waiting for slow-flowing materials.

SCUTTLE HOLE PROTECTOR.—Adolf Gauzenmüller, New York City. A downwardly dropping door, according to this invention, has hinged connection with a frame, and is held closed by locking devices, while a cord attached to the door passes over pulleys on the under side of the frame. Should the scuttle be removed, the protector effectually prevents access from the roof to the chamber or apartment beneath, although the scuttle hole may be quickly and conveniently opened to substantially its full extent when desired.

TOOTH BRUSH.—Edward H. Hamilton, Poona, India. According to this invention two tooth brushes are so combined as to be used as a single brush, to simultaneously clean the teeth on both the back and front surfaces. The two brush backs are placed at angles to one another, their bottom faces having opposite inclinations, and the backs are connected by a bridge which may be of spring material if desired, the backs thus forming a partially separated V-shaped trough, in which are arranged bristles of different lengths, the shortest in the upper row and the longest in the bottom row.

GARMENT STRETCHING FRAME.—Albert E. Phelps, Irvington, N. Y. To prevent woolen garments from shrinking when being washed, this inventor has devised a simple and inexpensive frame composed of two plates having openings for holding garment receiving wires, having arms slidably connected to the main portions, while expansive springs engage the arms and body, all of the parts being preferably made of galvanized iron.

PUZZLE.—Dallas Du Bois, Montclair, N. J. A game board having circular openings is an accompaniment of this puzzle, some of the openings being grouped around an oblong opening, and rings are adapted to be passed through the openings, and from one opening to another, the rings having a transverse cut and beveled ends. The rings may be readily slipped over each other and moved from point to point in the board without being removed from it.

Designs.

FEATHER DUSTER.—Israel B. Cohen, New York City. This design pertains to the shape of the head or base of the handle, which is made up of cones having the appearance of being nested, all approximately of the same diameter, and with the inner or lower one merging smoothly into the lines of the handle.

SAVINGS BANK.—Joseph F. Langton, Waltham, Mass. This design affords a miniature representation of a castle, in which a large tower is surrounded by smaller towers.

BORDER FOR SILVERWARE.—Charles D. Graff, New York City. Two design patents for borders have been granted this inventor, in one of which a foliated scroll is intertwined with an oak branch bearing acorns, while the other is a relief representation of a branch of roses with intertwined rococo scrolls, sprigs of forget-me-nots extending from some of the scrolls.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

REMINISCENCES OF AN OCTOGENARIAN OF THE CITY OF NEW YORK. 1816–1860. By Charles H. Haswell. New York: Harper & Brothers. Pp. xii, 581. Price $3.00.

Haswell's "Engineer's Pocket Book," now in its sixty-first edition, is a book that is familiar to all engineers and to many thousands of the more studious among mechanics, but it is not known to an equally wide circle that its author was, as far back as 1838, the chief engineer of the second steam war vessel of our navy, the Fulton the Second, which made one trip to the West Indies and back, and had a speed of fifteen miles an hour in the smooth water of New York Bay. It is pleasant to record that this worthy octogenarian, now eighty-seven years of age, not only bears the weight of his years with a strength and buoyancy of feeling which would do credit to one much younger, but has given us, in his "Reminiscences," a book which cannot fail to be welcomed by every genuine New Yorker. And more than this, it gives us a highly valuable realistic picture of life in the leading American city during the first half of this century, before the introduction of many of the modern conveniences. It seems that in 1819 the use of ice for domestic purposes was unknown, but the Humane Society issued a warning against the too free use of cold water, although the coldest water was that drawn from street wells. Lottery drawings were also publicly held, according to law, in front of the City Hall, and Aaron Clark, who had kept a lottery office, was elected Mayor in 1837. Tobacco chewing was, apparently, as much of a nuisance in the early part of the century as it is at present, but cigarettes were unknown and cigar or pipe smoking in public was very rare. The completion of the Erie Canal in 1825 is fully noted, when a flotilla of canal boats came in stately procession from Buffalo to Sandy Hook, and "water from Lake Erie, from the Mississippi and Columbia Rivers, and from the rivers of twelve foreign countries, was solemnly poured into the Atlantic." In lieu of means of more rapid communication, the start from Buffalo was signaled to New York by guns placed at suitable distances apart, the signals being similarly returned; the times between the first and last guns from lake to sea and from sea to lake again were an hour and twenty-five minutes each way. The book has numerous illustrations, and nearly every page is crowded with interesting incidents, and no one, whether a New Yorker by birth or adoption, can fail to be interested in Mr. Haswell's book, and no library should fail to procure a copy.

THE ELEMENTS OF PHYSICS. A college text book. By Edward L. Nichols and William S. Franklin. Vol. II. Electricity and Magnetism. New York: Macmillan & Company. Pp. 272. Price $1.50.

The first volume of this series treated of mechanics and heat, and the third is devoted to sound and light. Its authors are teachers of the branches of physics elucidated, one being a professor in Cornell University and the other at Iowa Agricultural College, and the information given is largely stated in the style of mathematical formulæ, designed to correspond with the "increasing strength of mathematical teaching" in university classes. It is apparent, therefore, that the book will have but a limited degree of usefulness for those who are inclined to "skip" algebraic equations or lack familiarity with the calculus, although, for teachers and advanced students, it will doubtless prove of material value.

THEATER FIRES AND PANICS. Their Causes and Prevention. By William Paul Gerhard, C.E. New York: John Wiley & Sons. Pp. 175. Price $1.50.

Although this is not distinctively a book on theater planning and construction, it is certain that any architect having such work in hand, and every theater owner and manager, should carefully consider the data, the very valuable suggestions, and the practical reasoning, to be found in this volume. The details given of twelve prominent theater fire calamities of this century are truly appalling, especially when it is considered how easily, in each instance, any loss of life or property might have been avoided, by the observance of what should have been only elementary precautions. On such subjects there are too few publications tending to the enlightenment of the public. Two valuable papers, by the same author, on theater fires and their prevention, appeared in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 982 and 983.

POOR'S MANUAL OF THE RAILROADS OF THE UNITED STATES. 1896. New York: H. V. & H. W. Poor. Pp. 124, xxi, and 1670. Price $7.50.

This publication, now in its twenty-ninth year, is simply invaluable to all who wish to obtain the bottom facts about the present condition, growth, business combinations and management of our vast railroad system. Each succeeding volume has more and more justified the appreciation in which the work has been held from the first by all discerning investors and others who have need of complete information in this line. The Manual this year embraces statements of 4,399 corporations, including 2,040 steam railway companies and 1,208 street railway companies. It also has statements of 143 industrial corporations and of the debts of 1,008 States, counties, cities, and towns. The net increase of mileage for all railroads in the United States during 1895 was 1,627 miles, and the total length of track laid up to the first of this year was 180,955 miles. Poor's Directory of Railway Officials, formerly published as a separate volume, is this year incorporated with the Manual. It gives lists of officers, master mechanics, purchasing agents, etc., of operating railroads in the United States and Canada, and of the chief railroads in Mexico.

Business and Personal.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7015) W. J. B. asks: 1. Under separate cover I send a sample of a bug which we found in pearl barley. Please give me its name and a preparation with which to kill them. A. The specimen represents the common granary weevil (Calandra granaria), one of the most injurious enemies of stored grain, both in this country and abroad. It attacks grain of all sorts, and is partial apparently to pearl barley, as it is often reported in this grain. See page 279 of a pamphlet on "The More Important Insects Injurious to Stored Grain," which the Department of Agriculture, Washington, D. C., will send you on application. The best remedy for granary insects is bisulphide of carbon, and you will find an account of how to use it on page 293. Answer by Mr. L. O. Howard, Entomologist, United States Department of Agriculture. 2. What is the best book for beginners in the electrical subject, which gives rules for the calculation of the electric motor, etc.? A. Dr. Sloane's "Arithmetic of Electricity," $1 by mail.

(7016) G. S. A. asks: Please inform me what to use to keep belts from slipping. Is resin injurious to belts? A. Beeswax is the best application for keeping belts from slipping. Rub the pulleys or the inside of the belt with a piece of wax. It needs but very little.

(7017) M. J. S. asks: 1. What is meant by open and closed circuit work in connection with batteries? A. An open circuit battery is one adapted for occasional or intermittent work only. Such a battery must be inactive when the circuit is open, and must have the property of depolarizing itself so as to be ready for use when needed. It may be very quickly polarized in use without detracting from its availability. A closed circuit battery must not be easily polarized when in use, and may, and often does, polarize when not used. 2. What is best form of battery (primary) for electroplating with gold, silver, copper and nickel, and about how many cells of a given size would be required to work five to ten gallons of silver solution? A. There are many batteries which will answer. The copper sulphate, Daniell and gravity and the Smee are often recommended. For full description of batteries see our SUPPLEMENT, Nos. 157, 158, 159, 792; for electroplating see Nos. 310 and 436. 3. Does cyanide in plating solutions attack asphaltum varnish? A. No. 4. How thick can a copper or silver deposit be made? A. As thick as desired.

(7018) Typo asks: 1. How can one tell direction to run a dynamo, of whatever make? A. The commutator cylinder must be turned away from the ends of the brushes if copper ones are used. If carbon brushes are employed, it can be run either way, but proper lead must be given the brushes. 2. Post to attach load wire and return wire, whatever the style of dynamo and position of its posts. A. While dynamo is running immerse the ends of the wires in copper sulphate solution. Copper will at once be deposited on the load wire. 3. What rules govern, if there is any danger to the plating generator in using too small a bath of solution or piece of work, with machine run at highest speed it was built for? A. There is no danger to the machine.

(7019) L. A. B. says: Please give me, through your paper, a recipe for a cement that will stick glass together, and be acid proof, something that will make a good photo. bath tray of clear glass, prisms, etc. A. A cement which, according to Dr. Wagner, is proof against even boiling acids, may be made by a composition of Indiarubber, tallow, lime, and red lead. The India rubber must first be melted by a gentle heat, and then 6 per cent to 8 per cent by weight of tallow is added to the mixture while it is kept well stirred; next dry slaked lime is applied, until the fluid mass assumes a consistence similar to that of soft paste; lastly, 20 per cent of red lead is added, in order to make it harden and dry. 2. For bisulphide of carbon prisms, Mr. Lewis M. Rutherfurd, who has had much experience in this subject, employs a cement of glue and molasses. The surfaces must be perfectly clean; they are then warmed and dusted with a fine camel's hair brush, and placed in contact. A hot and fluid mixture of glue and molasses is then applied around the edges, and penetrates by capillary attraction. It must be left a day or two to harden, before preparing the next side. A ground stopper was also rendered tight by a little molasses. (See Silliman's American Journal, March, 1865.) Marine glue is also employed, and we suppose that the cement from glycerine and litharge may be.

(7020) L. B. says: Please give me through your valuable paper a remedy to cure asthma. A. The most popular remedies for this disorder are those used by inhalation.

	Drachms.
Grindelia	8
Jaborandi	8
Eucalyptus	4
Digitalis	4
Cubebs	4
Stramonium	16
Potassium nitrate	12
Cascarilla bark	1

The ingredients should be in fine powder, and thoroughly dry before mixing. The composition is used by burning from one-fourth to one-half teaspoonful, and inhaling the smoke. The nitrate of potash is dissolved in water, and the powder moistened with it and dried.

(7021) Dr. H. asks: In what number or numbers of your publications can I find a recipe for a grease-proof cement for glass? It must withstand a considerable degree of heat. A. The hardest cement is produced by triturating 50 grm. (grammes, not grains) of litharge with 5 cubic centimeters of glycerine; if more glycerine is used, the mass hardens much more slowly and imperfectly. The small proportion of glycerine, however, makes it impracticable to prepare large quantities of the cement at a time. For this purpose it will be necessary to take more glycerine. . . . The most favorable results are obtained by adding 2 volumes of water to 5 volumes of glycerine (s. g. 1·240). Six cubic centimeters of this liquid are incorporated with 50 grammes of litharge. This mass requires a shorter time than any other proportions to produce a hard cement, ten minutes only being required to harden moderately, while after two hours it becomes harder than any mixture containing glycerine and litharge alone; but after a few days the latter compound (prepared without water) overtakes the former in hardness, and remains so. If it is desired to produce a cement which rapidly hardens and still have considerable firmness, it is advisable to use water with the glycerine.

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October 27, 1896,

AND EACH BEARING THAT DATE.

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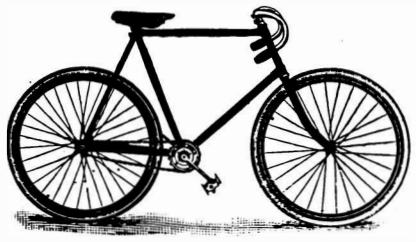

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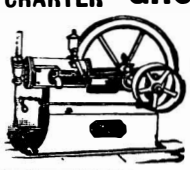

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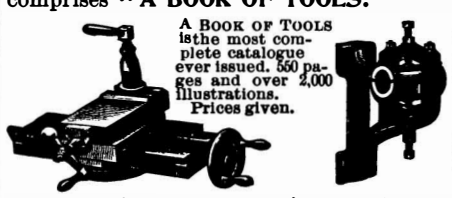

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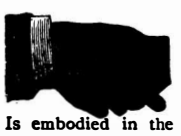

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