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THE GREAT CANTILEVER BRIDGE OVER NIAGARA RIVER.

This double track railroad bridge, completed within the past few days, was designed to connect the New York Central and Michigan Central Railroads. It is located about 300 feet above the old railroad suspension bridge, spanning a chasm 870 feet wide between the bluffs and over 200 feet deep. The banks of the river are formed of masses of broken rocks and immense bowlders reaching up to within about 60 feet of the level land.

As the foaming rapids at this point rendered it impossible to build piers in the river or erect temporary supports, it was necessary to design a structure which could be erected without such false work; to attain this end a bridge of the cantilever type was adopted which would be self-supporting during erection. The principle of the cantilever is that of a beam supported at or near its center, with arms extending both ways, one arm being held down by an anchorage or counterweight so that the load on the overhanging arm produces an uplifting force in the opposite end which is resisted by the counterweight. The designs of this structure were worked out jointly by C. C. Schneider, chief engineer in charge of the work, and Edmund Hayes, engineer of the Central Bridge Works.

The structure consists of two immense steel towers, 132 feet 6½ inches high, resting on stone piers 39 feet high. Each of these towers supports a cantilever 395 feet $2\frac{5}{16}$ inches long. One end of each tower rests upon an abutment at the edge of the bluff, while the other end extends out over the river. The shore ends of the cantilevers are anchored to the abutment masonry or anchorage piers, and both river arms are connected by an intermediate span of 120 feet which is suspended from the extreme ends of the river arms. The total length of the bridge proper is 910 feet 4⅝ inches between the centers of the anchorage piers; the clear span between towers being 470 feet. The height from surface of water to base of rail is 239 feet.

The towers are braced steel structures, containing four columns each, which are made up of plates and angles riveted together, braced with horizontal struts and tie rods. The batter of the columns at right angles to the center line of the bridge is 1 in 8, and parallel to the center line 1 in 24.

The trusses are two in number, 28 feet apart between centers; the various members being connected with steel pins 7½ inches, 6¾ inches, and 5⅜ inches in diameter, turned accurately so as to fit the bored pin holes within $\frac{1}{64}$ of an inch. The depth of the cantilever trusses over the towers is 56 feet, and at the shore ends 21 feet, and at the river ends 26 feet. The lower chords and centerposts are made of plates and angles riveted together and latticed, the intermediate posts being of 12 by 15-inch channels, latticed. The upper chords of the cantilevers are 8-inch eye bars, the shore arm having a compression member 18 inches deep composed of plates and angles packed between the chord bars. The shore ends of the cantilevers are attached to short links, oscillating on pins anchored to the abutment masonry, which serve as anchorages and also as rockers to allow for expansion and contraction of the shore arms produced by changes of temperature. Expansion joints are also provided for at the connection of the intermediate span with the river ends of the two cantilevers.

The material used in the superstructure is steel and wrought iron. Towers and heavy compression members, such as lower chords and center posts, are of steel, as are all pins. All tension members are of double refined wrought iron. The only use made of cast iron is in the pedestals on the masonry and in filling rings; the castings at the top of the towers are all steel. All materials were carefully inspected at the mills, and none was allowed to go into the structure without being properly tested and found to possess the strength, elasticity, etc., called for by the specifications.

The floor beams are 4 feet deep, of wrought iron, riveted between the vertical posts and made of plates and angles. There are four lines of longitudinal stringers, resting on top

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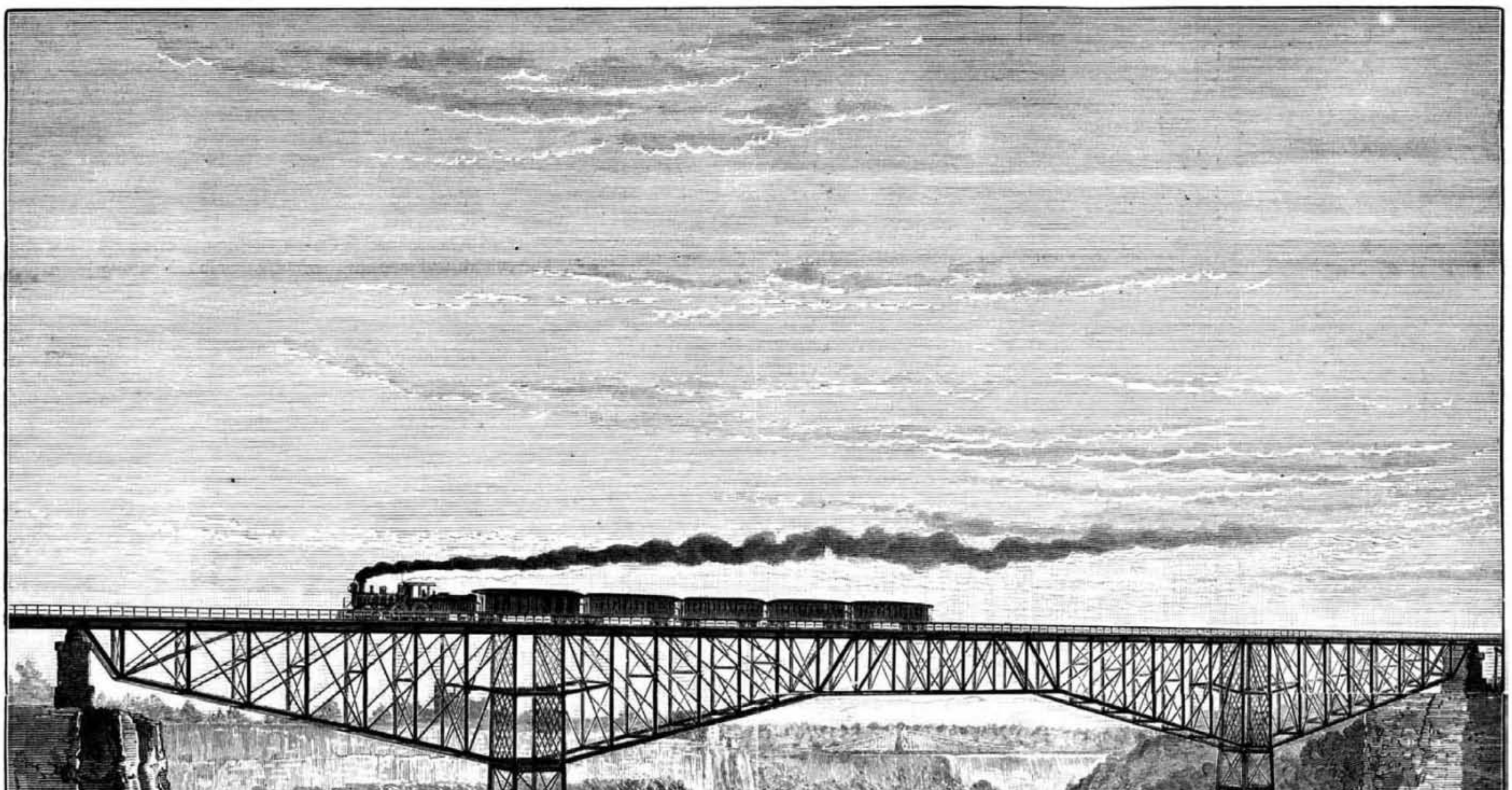

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(*Continued from first page.*)

of the floor beams; these stringers are plate girders 2½ feet deep. The track consists of 9 by 9-inch ties of white oak, spaced 18 inches between centers, every other tie projecting to support a plank walk and hand railing, making the width of the floor 32 feet. The guard timbers are 8 by 8 inches of white oak. The hand railing consists of cast iron posts, 6 feet apart, and four longitudinal lines of 1¼-inch gas piping.

All masonry is built of Queenstown limestone, in courses of 2 feet rise. The piers supporting the towers are 12 feet square under coping, and have a batter of one-half inch to the foot; each pair of piers is connected by a wall 3 feet 9 inches thick on top, and battering the same as the piers. These piers are on foundations made by excavating and blasting the rock on the banks of the river until a suitable bed was reached, consisting of layers of huge bowlders. The pits were filled with beton Coignet to a depth of about 8 feet, thereby forming beton blocks of 20 by 45 feet under each pair of piers.

The anchorage piers are 11 by 37½ feet under coping, with a batter of one-half inch to the foot. They rest on a platform consisting of twelve iron plate girders, 2½ feet deep and 36 feet long; under these girders are eighteen 15-inch I-beams, through which the anchorage rods pass in such a manner as to distribute the pressure over the entire mass of masonry. Each anchorage pier contains 460 cubic yards of masonry, weighing 2,000,000 pounds. As the maximum uplifting force from the cantilevers under the most unfavorable position of the load is only 678,000 pounds, it will be seen that this upward force is amply counterbalanced.

One of the most interesting features of this important work is the erection of the river arms of the cantilevers. After the towers were built the shore arms of the cantilevers were erected on false work in the usual way; after the shore arms had been placed in position and anchored down to the anchorage piers, the river arms were built out from the towers toward the river, one panel or section at a time, by means of great traveling derricks designed and constructed specially for the purpose and provided with steam power. After one panel had been built and its bracing adjusted, the traveler was moved forward and another panel erected. Thus the work progressed until the ends of the cantilevers were reached. The intermediate span of 120 feet was so designed, with bottom compression members, that it, too, could be built out from the river arms of the completed cantilevers until the middle panel was reached, which was accurately fitted to close the remaining gap between the two sides. The fixed connections between the intermediate span and the cantilevers were then removed to allow the expansion joints to act.

The structure is proportioned to carry, in addition to its own weight, a freight train on each track at the same time, weighing one ton per lineal foot, with each train headed by two 76-ton consolidation engines, with a factor of safety of 5. The wind bracing has been proportioned for a pressure of 30 pounds per square foot, on a surface twice the area of one face of the truss, plus area of floor system, plus the area of side of train taken as 10 feet vertical height.

The contract for the entire work, including foundations and masonry, was awarded to the Central Bridge Works, of Buffalo, N. Y., of which Gen. Geo. S. Field is the manager, and Edmund Hayes the engineer. The engineering force on the work was made up as follows: C. C. Schneider, chief engineer; A. R. Trew, first assistant engineer; J. A. Bell and B. F. Betts, assistant engineers; J. B. Trew, rodman; W. F. Zimmermann and Jacob Jung, inspectors; S. V. Ryland, superintendent of erection for the Central Bridge Works.

The engraving represents the bridge as seen from the American bank of the river, looking toward Niagara Falls, which can be seen under the center span.

Fireproof Rolling Stock for Railways.

It seems strange that we should hear the strongest advocacy of building railway cars of iron and steel from way out in Colorado, where, it is urged, the natural resources in coal and iron would enable such an industry to be prosecuted, even in competition with the work of Eastern rolling mills and machine shops. It is, however, only one of the many reminders constantly forcing themselves upon the attention of how great our country is and how wonderful are its resources. It is predicted that it will not be many years before Colorado will be "able to produce steel cheaper than any other State on the continent." But as yet, their soft coals are got out and marketed at a price which is some thirty-three per cent above that ruling at Pittsburg. Their ores may be of the most excellent description, and easily obtainable, but the coal also will have to come down, before our Western friends can look forward to doing a manufacturing business in the way of making iron and steel railway cars, although it is intimated, in this connection, that the Denver and Rio Grande Company intend ordering an experimental sleeper made entirely of steel plates and bars.

IN some of the large saw mills in the Northwestern lumber districts a small appliance is attached to the trimmer, which automatically stamps the name of the company or mill on every board that passes over the trimmer.

Manufacture of Straw Goods.

The *New York Hatter and Furrier* contains an article on the past and present manufacture of straw goods in America, from which it appears that the straw business as a manufacturing enterprise in America started with Fisher & Day, at Wrentham, Mass., in 1804.

Statistics give the number of bonnets made in 1837 as 4,000, with a value of $12,000. In 1845 the value of braid made in Milford was $12,500, while the value of bonnets produced had decreased to $1,500. In 1875, with only one manufactory, the capital invested had increased to $30,000, and the value of the goods to $190,000, employing in the production 16 males and 168 females. These figures are said to be much below the present plant and worth of goods, with three establishments, employing some 600 people, both male and female.

Relatively the same increase in the volume of business can be noted in other towns where the industry was started in the early days, and nearly all have contributed in a large degree to bring it up to its present condition as an important factor in industrial history. Twenty-five years ago, the following towns were credited with a production in straw goods valued as below:

Amherst	$32,000
Medfield	60,000
Mansfield	110,000
Medway	100,000
Franklin	405,000
Palmer	10,000
Munson	120,000
Middleboro	25,000
Upton	250,000

All in Massachusetts. Foxboro was producing 2,000,000 hats and bonnets, whose value is not given.

The civil war marked a new era in the making of straw goods, as it did in many other lines of industry. In 1870, the number of establishments in the United States was 75, with employes numbering over 14.000, all but about 2,000 being females; Massachusetts had 39 shops, employing 1,113 males, 10,000 females; New York, 18 shops, and 518 males and 886 females; Connecticut, 3 shops, with 225 males and 755 females. Since that time the business has grown in the places mentioned, and secured a firm footing in other localities, especially in Philadelphia, Baltimore, Chicago, Milwaukee, and the State of New Jersey. There are very few of the places noted as pioneers in the manufacture of straw goods that do not carry it on to-day, Medway, Mass., being an exception. Holliston, Framingham, and Westboro, Mass., are places not mentioned above, where, especially in the two latter, straw serves as a large and important item in the enterprise and general prosperity.

The output from the New England shops last year is set down at 14,000,000 hats, and from factories west of New England nearly as much more, making in all from 25,000,000 to 30,000,000 hats as the annual production of the country. This, with the large number of hats made over in the repair shops, gives a supply probably equal to a straw hat for every individual in the United States. In the estimates above, however, the velvets and felts which some of the shops make for ladies' wear are included, but men's, except straws, are not taken into account.

Spider Life Wonders.

In a lecture at the Lowell Institute, Professor Wood dealt with the phenomena of spider life. The female is larger and much fiercer than the male, who while paying his addresses is in constant peril, frequently losing some of his legs. In one tribe the female is 1,300 times as large as the male. The spider's thread is made up of innumerable small threads or fibers, one of these threads being estimated to be one two-millionth of a hair in thickness. Three kinds of thread are spun: One of great strength for the radiating or spoke lines of the web. The cross lines, or what a sailor might call the ratlines, are finer and are tenacious, that is, they have upon them little specks or globules of a very sticky gum. These specks are put on with even interspaces. They are set quite thickly along the line, and are what, in the first instance, catch and hold the legs or wings of the fly. Once caught in this fashion the prey is held secure by threads flung over it somewhat in the manner of a lasso. The third kind of silk is that which the spider throws out in a mass or flood, by which it suddenly envelops any prey of which it is somewhat afraid, as, for example, a wasp. A scientific experimenter once drew out from the body of a single spider 3,480 yards of thread or spider silk—a length a little short of three miles. Silk may be woven of spider's thread, and it is more glossy and brilliant than that of the silk worm, being of a golden color. An enthusiastic entomologist secured enough of it for the weaving of a suit of clothes for Louis XIV.

Top Dressing for Lawn.

Instead of top dressing a lawn with stable manure every fall, and then raking it off in the spring, as is the usual custom, writes a correspondent, try sowing broadcast in the fall 300 pounds to the acre of finely ground raw bone meal and an equal weight of refuse salt from the pork or beef packing establishments, and 150 pounds of gypsum (land plaster). Then scatter on the surface at least half an inch of good, rich, black soil, sow at the rate of two bushels of blue grass seed to the acre, and give it a thorough raking and then roll it, and you will have no further trouble with your lawn, no matter how dry the seasons may be.

A Seventh Sense.

Sir William Thomson, the eminent Professor of Mathematics in the University of Glasgow, in his inaugural address as President of the Midland Institute at Birmingham, broached the idea of the existence of a magnetic sense. This sense he called the seventh sense, to distinguish it from our other six senses—namely, those of sight, hearing, taste, smell, heat, and force. He said that, in speaking of a possible magnetic sense, he in no way supported that wretched, groveling superstition of animal magnetism, spiritualism, mesmerism, or clairvoyance, of which they had heard so much. There was no seventh sense of a mystic kind. Clairvoyance and so on was the result of bad observation chiefly, somewhat mixed up with the effects of willful imposture, acting on an innocent and trusting mind.

If there was not a distinct magnetic sense, it was a very great wonder that there was not. The study of magnetism was a very recondite subject. One very wonderful discovery that was made in electric magnetism was made by Faraday, and worked out very admirably by Foucauld, an excellent French experimenter, showing that a piece of copper, or a piece of silver, let fall between the poles of a magnet, would fall down slowly, as if through mud. Was it conceivable that, if a piece of copper could scarcely move through the air between the poles of an electric magnet, that a human being or living creature, in the same position, would experience no effect? Lord Lindsay got an enormous magnet, so large that the head of any person wishing to try the experiment could get well between the poles; and the result of the experiment was marvelous, the marvel being that nothing was perceived.

Sir William Thomson, however, was not willing to admit that the investigation was completed. He could not but think the quality of matter in the air, which produced such a prodigious effect on a piece of metal, could be absolutely without any perceptible effect whatever on a living body. He thought the experiment was worth repeating; and it was worth examining whether or not an exceedingly powerful magnetic force was without perceptible effect on a living vegetable or animal body. His own speculations had led him to conclude that there might be a seventh or magnetic sense; and that it was possible an exceedingly powerful magnetic effect might be produced on living bodies that could not be explained by heat, force, or any other sensation.—*British Medical Journal.*

Burdette's Lectures to Young Men.

Robert J. Burdette, the facetious editor of the Burlington *Hawkeye*, has been lecturing to large audiences in different parts of the country, and in his amusing style he imparts to the rising generation some wholesome advice. The following is from one of his lectures:

"Be somebody on your own account, my son, and don't try to get along on the reputation of your ancestors. Nobody knows and nobody cares who Adam's grandfather was, and there is not a man living who can tell the name of Brigham Young's mother-in-law." The lecturer urged upon his hearers the necessity of keeping up with the every-day procession, and not pulling back in the harness. Hard work never was known to kill men; it was the fun that men had in the intervals that killed them. The fact was, most people had yet to learn what fun really was. A man might go to Europe and spend a million dollars, and then recall the fact that he had a great deal more fun at a picnic twenty years ago that cost him just 65 cents. The theory that the world owed every man a living was false. The world owed a man nothing. There was a living in the world for every man, however, providing the man was willing to work for it. If he did not work for it, somebody else would earn it and the lazy man "would get left." There were greater opportunities for workers out West than in the Eastern cities, but men who went out West to grow up with the country must do their own growing. There was no browsing allowed in the vigorous West. An energetic man might go out into the far West, and in two or three years possess himself of a bigger house, a bigger yard, a bigger barn, and a bigger mortgage than he could obtain by ten years' work in the East. All young men ought to marry, and no young men should envy old men or rich men. In conclusion, Mr. Burdette said that a man should do well whatever he was given to do, and not despise drudgery. The world wants good shovelers, teamsters, and laborers, but it does not want poor lawyers, poor preachers, or poor editors.

A New Method of Obtaining Pulp.

G. Archbold macerates wood or straw, cut into suitable pieces, in dilute milk of lime, after twelve hours introduces them into a suitable digester, and saturates with sulphurous acid, the pressure amounting to four or five atmospheres. In two hours the material is so loosened up, that after washing with water and further treatment under pressure with 3 per cent chloride of calcium and half per cent aluminum sulphate dissolved in a little water, the stuff obtained without any further operation has the appearance of cotton, and can serve for the manufacture of fine qualities of paper.

RECENTLY some valuable experiments in photographing the larynx and soft palate at the instant of singing have been made. A powerful electric light was thrown into the throat, the subject then sang a note, and the actual position of the vocal ligaments, uvula, etc., was photographed instantaneously.

Petroleum—How Obtained and Piped.

An interesting pamphlet, entitled "Manual of Petroleum," published by the Financial News Association, in this city, gives the following:

The petroleum bearing rock is a sandstone existing in irregular shape, whose extent and form are found only by experimental boring. This rock lies on a level, and is from 5 to 30 feet thick, varying in the different fields. The depth to which a boring has to be made to reach it depends on the topography of the overlying country. The deepest wells are in the Bradford, which is the largest field. Some wells there are over 2,000 feet deep, while about Oil Creek they do not penetrate to more than a third of this depth. The earlier theories were that petroleum existed in crevices or fissures of the underlying rock, but it is now established that it permeates the entire bed of sandstone, the forcing power for the flowing well being furnished by the pressure of gas. After the well has been flowing a considerable time this pressure diminishes, and with the final escape of the gas pumping has to be resorted to. No one can attempt to predict how long a well will last, nor how soon it will give out. Some wells have been pumped for years, and others have failed entirely within a few weeks, and the quantity of oil afforded varies from less than a barrel to over 4,000 barrels a day.

HOW THEY GET OIL.

In boring for oil a wooden derrick of plank and boards is erected. It is usually 20 feet square at the base, 60 to 70 feet high, with the corners so arranged that the top is about 3 feet square. Here rests a heavy piece which holds the pulley over which the 2-inch drilling cable works. In the less elevated localities it is necessary to drive pipe to prevent the caving in of the well and the influx of water. This pipe is of wrought iron, 8 inches in diameter, and is driven in 17 foot sections by a heavy maul erected in the derrick. Since it is to guide the drilling tools, great care is taken to keep it straight. The engine, usually of 15 horse power, is placed near the derrick, 12 feet from the center of which is placed the "Samson" post, a heavy piece of timber, 20 inches square and 12 feet high, the top of which is prepared to receive the walking beam. This beam tapers slightly each way from the center. It is about 15 inches square, and of such a length that when properly balanced on the "Samson" post one end is over the middle of the derrick floor. To this end is fastened the cable and drilling tools, which weigh some 3,000 pounds, and the other end derives power from the engine, giving the beam a rocking motion, which lifts and drops the tools. They are lowered and drawn by the aid of the "bull" wheel and shaft.

An 8-inch hole is drilled below the veins of fresh water, which are shut off by a wrought iron casing tube, 5½ inches in diameter, lowered in sections 18 feet long. After the necessary length of casing is introduced, the size of the hole is lessened to 5½ inches, and this size continues down till the well is completed. After oil is struck the tubing pipe, of 2 or 2½ inches diameter, is let down inside the casing, and a seed bag dropped in between the tube and the casing. This bag is of leather and is filled with flax seed. When it becomes saturated with water it swells and makes a water-tight joint, so that no water can get below it. Four men, two drillers and two blacksmiths, are required to sink a well, and the cost runs from 75 cents to $1.50 per foot. The rock, pulverized by the blows of the drill, is removed by use of the sand pump. This is a heavy metal tube, 6 feet long, which is rapidly lowered with every 6 feet of progress, the drilling tools being first withdrawn. The sand pump has a valve in the lower part, which closes and retains the contents until the surface is reached.

TORPEDOING A WELL.

The process of "torpedoing" a well is resorted to when the well shows signs of giving out. A tin shell filled with a couple of gallons of nitro-glycerine is dropped down and exploded, bursting the rock at the bottom. The effect of this is generally to at once largely increase the yield for the time being.

THE PIPE LINES.

The storage and transportation of petroleum is in the hands of two companies, whose pipes cover the entire field of Pennsylvania, and convey it to reservoirs hundreds of miles distant. The largest of these companies, the United Pipe Lines, is controlled by the Standard Oil Company. These lines are six in number; two run from Olean to Communipaw, on New York Bay; another runs to Buffalo, one to Cleveland, one to Pittsburg, and the sixth to Milton Station, on the Reading road. Its pipes, in the aggregate, are over 3,000 miles long, and its owns over 600 tanks with an aggregate storage capacity of 20,000,000 barrels. The nucleus of this great system existed prior to 1876, when there were several short lines under different organizations. Between 1876 and 1879 they were all absorbed by the Standard Oil Company.

The other company is the Tidewater Pipe Line Company, controlled by Messrs. F. B. Gowen and James R. Keene, which connects the Bradford field with Tamanend Station, on the Reading Railroad. This was started in 1879, and altogether handles but about one-seventeenth of the business transacted by the United Pipe Lines.

The Pipe Lines not only connect the various fields with the market points, but also the fields with each other.

In dealing with the producer the Pipe Lines send a man to the well when the tank there is full. With his measuring rod he takes a gauge of the oil in the tank, and runs the oil off into the connecting arm of the Pipe Line by means of a stop cock. When he finishes, he measures the depth of the oil that still remains in the tank, and makes out a certificate, giving the depth of the oil in the tank at the beginning of the run, and its depth after running off the oil. One copy of his certificate is given to the producer and another is sent to the head office of the Pipe Lines. The books are kept there, and an entry is at once made, giving the producer credit for just the number of barrels run off, less three per cent deducted for waste.

The producer receives certificates in lots of 1,000 barrels each for just what oil he is entitled to, which are good anywhere for just that much oil, or its value, save that when a holder wants the oil it represents delivered, he is required to pay twenty cents a barrel for pipage and a further charge of fifty cents per 1,000 barrels per day for storage. No storage charge is, however, made against the producer for the first thirty days. These certificates are subject to a double storage charge if not returned to the company for renewal within six months of their date.

It is not to be supposed that the Pipe Lines stand the loss which occurs when a tank takes fire. This loss is assessed on all the oil in store, each holder of an acceptance being taxed his share. The loss from this source is, however, very trifling.

The Pipe Lines convey the bulk of the oil to terminal points, but not all. A considerable quantity is conveyed by pipe to convenient stations, and then shipped by rail in the oil tank cars so familiar to the sight and olfactories of the tourist.

The Pipe Lines work by gravity where that is possible; and where it is not, pumping engines are set up and the oil is forced through the pipes.

The oil that is carried by the Pipe Lines is crude petroleum. The refining necessary to fit the oil for its commercial uses is done principally at Cleveland, Buffalo, Oil City, Pittsburg, and in the vicinity of New York city. The bulk of the petroleum exported is refined oil.

The Corn Crop.

A Milwaukee grain dealer has just published an estimate on the yield of corn this year, compiled from official returns and other reliable sources of information, from which it appears that the total crop slightly exceeds that of last year, and is the largest ever raised in the United States, excepting 1880. The total amount this year is put at 1,621,100,000 bushels. The United States Department of Agriculture, in its October report, placed it at 1,617,025,100 bushels, or only a little over three millions less than the Milwaukee estimate. The total crop of 1880 was 1,717,435,000 bushels, or 96,435,000 more than this year's. Following is the tabular statement of yield by States:

State.	Bushels.	State.	Bushels.
Maine	800,000	Arkansas	34,000,000
New Hampshire	800,000	Tennessee	75,000,000
Vermont	1,800,000	West Virginia	15,000,000
Massachusetts	1,200,000	Kentucky	75,000,000
Rhode Island	300,000	Ohio	70,000,000
Connecticut	1,200,000	Michigan	25,000,000
New York	20,000,000	Indiana	100,000,000
New Jersey	10,000,000	Illinois	170,000,000
Pennsylvania	40,000,000	Wisconsin	25,000,000
Delaware	4,000,000	Minnesota	20,000,000
Maryland	16,000,000	Iowa	165,000,000
Virginia	35,000,000	Missouri	190,000,000
North Carolina	35,000,000	Kansas	190,000,000
South Carolina	15,000,000	Nebraska	90,000,000
Georgia	36,000,000	California	3,000,000
Florida	4,000,000	Dakota	6,000,000
Alabama	32,000,000	Other States and Territories	5,000,000
Mississippi	30,000,000		
Louisiana	15,000,000		
Texas	65,000,000	Total	1,621,100,000

How Stumps are Blasted Out.

A correspondent of the Ohio *Farmer* gives his experience and some practical directions on this subject, as follows:

"Last spring I sent to Indiana and hired a man to come and blast out stumps. I paid 42½ cents per pound for the powder, and 15 cents for each stump taken out—he to furnish caps and fuse. The stumps were mostly white and burr oak, from 20 to 40 inches in diameter, and had been cut from six to twelve years. Sixty-seven of the worst were taken out at an expense of 68 cents per stump. There were only three or four failures in the whole lot. As they were blown into pieces, it was much less work to pile and burn them than when taken out in the ordinary way. "I bought material and took out nearly 200 smaller stumps at an expense of about 20 cents each. It took me about ten or fifteen minutes to prepare a blast. I used a two-inch auger on a five-foot shaft for boring under the stump. A crow bar will do in soft ground; those who follow the business use a two and a half inch auger. The charge should be put as nearly under the center of the stump as possible.

"It is not very dangerous to use, as fire will not explode it. The cap is placed in the cartridge, and is connected by a fuse. You light the fuse, which in one or two minutes explodes the cap. The concussion of the cap, which is equal to 500 pounds, explodes the dynamite or Hercules powder. Eight or ten rods is a safe distance if you are facing the stump, or you can easily dodge chunks if any come toward you.

"It will not pay to use it very extensively on green stumps, as it will take from three to eight pounds per stump, and will not give very good satisfaction at that."

The Shoeing of Horses.

At the recent meeting of the American Street Railway Association, the following was reported on the above subject. The hoof of the horse in its natural state is adapted only to the soft and yielding soil; and so when we wish to put them to practical use upon common roads and paved streets, it becomes necessary to protect the foot from the unnatural wear they become subjected to. The practice of protecting the hoof in some manner dates back for centuries, and from the rude devices then used we have come down to the present day, in which many forms of shoes are made, all of which have their claims to superiority.

In selecting the shoe the kind of foot should be considered; but as a rule, in our judgment, a flat shoe that will leave the foot in the most natural state, allowing the frog to receive a portion of the weight or blow, is preferable, particularly for the forward foot; the natural formation of the frog being of a soft, spongy growth with elastic properties, would seem to be made for that purpose.

As a rule, horses coming fresh from the pasture have sound and healthy feet with broad frogs, and we should so adapt the shoe as to retain the natural formation as near as possible.

Too much care cannot be used in preparing the foot for the shoe. The frog should never be cut; the shell requires more or less cutting. The shoe should always be fitted to the foot and not the foot to the shoe, as is often done.

Corns, the most prevailing disease we have to contend with, appear in the angle of the foot near the heel; and are caused by the shoe not being concaved enough, or allowing them to remain on long enough for the shoe to become embedded into the heel, and often is the result of unskillful shoeing.

Moisture we believe to be essential to the preservation of the foot. The railroad horse stands on the floor about twenty hours of the twenty-four, and consequently the feet get very dry; therefore we would recommend the application of water frequently, not only to supply the natural moisture, but for cleanliness.

In shoeing the horse the workman should bear in mind that he is protecting the foot from the unnatural wear, and that it is only for that purpose; therefore all prejudice as to opinions of how it should be done should be laid aside. The horse commences life with sound feet, but too many of them are ruined by unskillful shoeing, and thus brought to comparative uselessness at a time of life when they should be in the prime of their power.

The Health of the Army.

According to the report of the Surgeon-General of the Army for the year ending June 30, 1883, the diseases of the respiratory organs stand first in numerical importance, and of these 64 per cent are catarrhs of the upper air passages. Extremes of variation in temperature will account in part for the frequency of these diseases, but to a larger extent insufficient ventilation of barracks and dormitories, as well as irregular and unequal distribution of artificial heat during cold weather, must be held responsible. Wounds, injuries, and accidents stand second on the list of causes impairing the effectiveness of the army. The large number recorded in this class may probably be attributed to the use of troops in mechanical and laborious employments which form so large a proportion of the soldier's duties. As an indication of the peculiar hardships to which our troops are exposed, the rates of admission for wounds, accidents, and injuries are 122 per thousand higher than those reported for the German army, and 142 per thousand higher than the decennial rate of the British army. It is interesting to note that the colored troops make a particularly favorable showing in the small number of admissions for alcoholism and its results, exhibiting, as they do, a rate of only 4 per thousand to a rate of 76 per thousand of mean strength among the whites. On the other hand, in diseases of the nervous system they have an unexplained preponderance.

The Origin of Cholera.

A correspondent thus writes to the *Brit. Med. Jour.*, October 6, 1883:

"I have no work to refer to, but, if I remember rightly, butyric acid, when taken internally, produces symptoms like cholera; and the acid is formed when dead animal matter is left for some time in water. If this be right, then, as the Ganges and the Nile have presented the conditions favorable for the formation of the acid, may not some of the cholera near both rivers be accounted for? A great outbreak of cholera occurred in Shanghai in 1863, after the Taeping rebellion, and when the rivers contained numerous dead bodies."

Hot Water for Colds.

Dr. George R. Shepherd, Hartford, Conn., says, in respect to the use of hot water as a remedial agent in the treatment of inflammation of the mucous membranes, "I have used hot water as a gargle for the past six or eight years. In acute pharyngitis and tonsillitis, and in coryza, or cold in the head, if properly used in the commencement of the attack, it constitutes one of our most effective remedies, being frequently promptly curative. To be of service it should be used in considerable quantity (a half pint or a pint at a time), and just as hot as the throat will tolerate. I have seen many cases of acute disease thus aborted, and can commend the method with great confidence."

A Grand Observatory on the Mediterranean.

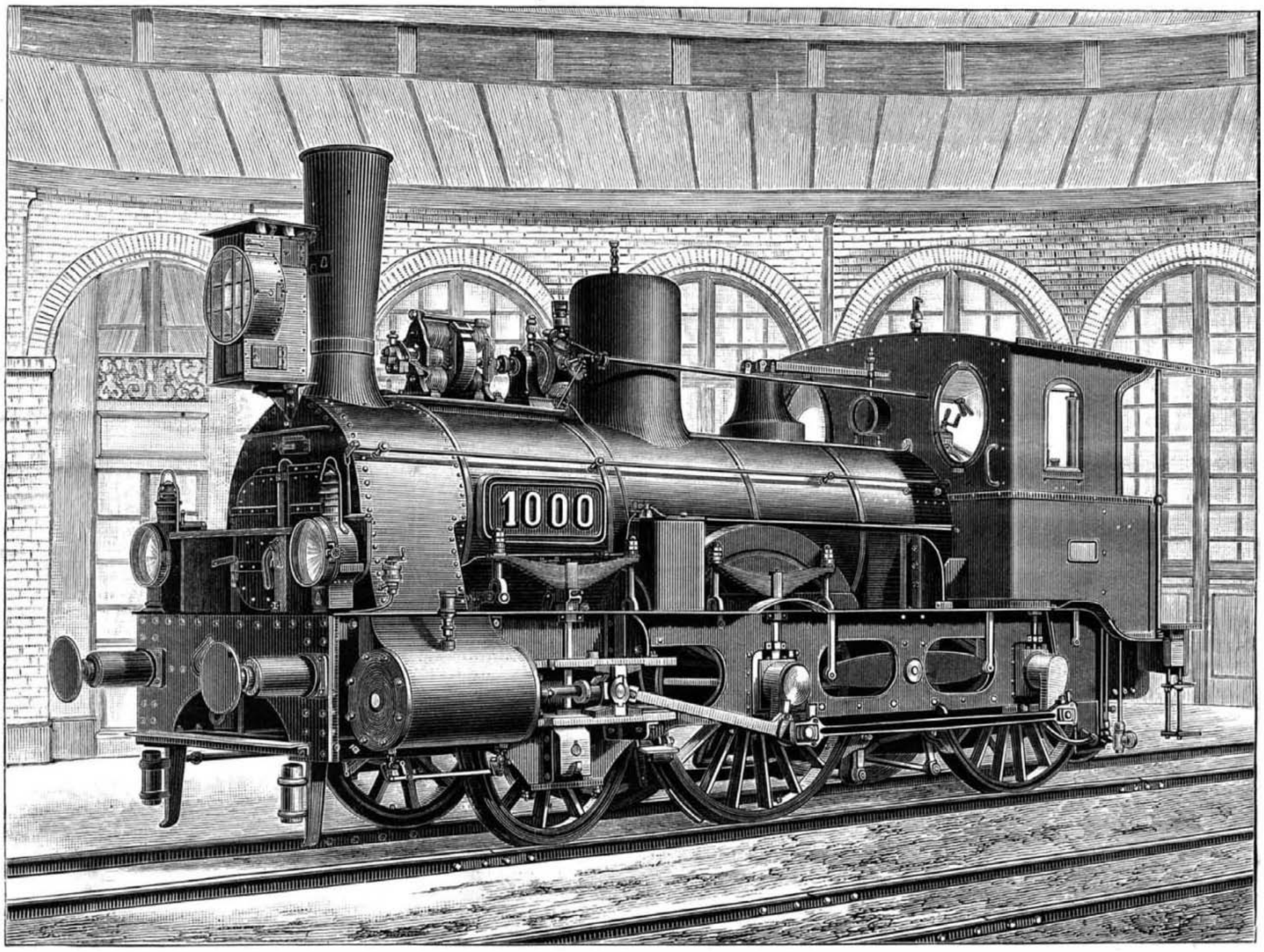
The readers of the SCIENTIFIC AMERICAN SUPPLEMENT will remember that some time ago (No. 327) appeared an illustration and description of a new observatory that was in process of construction at Nice, France, by a wealthy Continental banker. The London *Times* has recently published a more detailed account of this observatory, from which we extract as follows: One of the finest observatories in Europe is now almost completed at Nice, and the work of observation has already commenced, under the able direction of M. Perrotin, the French astronomer who conducted the expedition to Patagonia for the observation of the Transit of Venus. The importance of this new undertaking may be judged of from the fact that more than £80,000 has already been spent upon it, and the total cost, when all is complete, will not fall far short of £120,000. This great enterprise is due entirely to the munificence of M. Bischoffsheim, of Paris. France, it is well known, has fallen somewhat behind the age in the matter of astronomical observatories, whether public or private.

In England, America, Russia, and other countries they are far more numerous than in France; and the establishment of the observatory at Nice is consequently considered a patriotic work which will help to redeem the reputation of France in the world of science. The site is admirably selected on the crest of a hill to the east of Nice, dominating the Valley of St. Roch, and commanding a magnificent panoramic view of the entire town, the basin of the Paillon, and the innumerable mountains that rise on either side to shelter the flower gardens and the orange and olive groves that lie at their feet. The central building is the library, a capacious and luxuriously furnished hall, with sweet scented pine wood shelves, bearing the literature in all languages devoted to the one subject of study; while the walls outside are decorated with handsome mosaics, inscribed with the names of Laplace, Arago, and Leverrier.

On both sides of the library are the houses of the astronomers, distinguished by elegance and comfort. In the Director's office telephonic communications connect every part of the establishment. The two largest instruments are the great and the small equatorial, each, of course, placed in a building of its own, with a revolving cupola roof. The smaller of these telescopes is now in working order. It measures 7 meters in length, and the objective 18·38 centimeters in diameter. Both the body and the lenses were made in Paris. The cupola of wood and copper opens and shuts and revolves with the greatest ease, one man alone sufficing to set the whole of this large dome in motion, and this without any fatiguing effort. The larger equatorial telescope will cost for the instrument alone £14,000. This monster, which can only be compared to a 100 ton gun, is 18 meters in length, and the diameter of the object glass is 76 centimeters; yet it can be moved with the slightest touch of the hand and follows with ease every movement of the planets. When in working order it will be one of the sights of Europe. Until the telescope now projected for the Observatory of Pultawa at St. Petersburg is completed, it may be considered, we are assured, the finest instrument of its kind. The building destined to hold this giant is a formidable quadrangle of Turbiæ stone, and though the heights of Turbiæ are within sight of the observatory, and but a few miles away, the mere stones required for the wall around this telescope cost £6,000. Altogether, this one telescope, the cupola through which it can command the sky, and the building it occupies will cost about £40,000. The town of Nice can now boast of an institution that will render its name as familiar among astronomers as it is to those who study the climatic treatment of disease.

LOCOMOTIVE ELECTRIC LIGHTS.

In our paper for November 10, we gave illustrations of a traction engine carrying an electric machine for generating light and a tower for the use of the light. We herewith illustrate another special application of the electric light in its use upon railroad trains for brightly lighting up the road ahead of the locomotive. Upon certain lines, on which the track may become easily obstructed, such a light is of great importance, and is capable of rendering great services.



LOCOMOTIVE WITH ELECTRIC HEAD LIGHTS AND ELECTRIC MACHINE.

In order to permit of the adaptation of the electric light to a locomotive it has been found necessary to have recourse to a regulator of special construction, and one capable of operating well while submitted to the jarring that attends such an engine.

The regulator of Messrs. Sedlaczek & Wilkulill is of this nature. It has been derived from an apparatus, now old, constructed in 1856 by Messrs. Lacassagne & Thiers.

In this lamp, which we have heretofore illustrated, the upper carbon being fixed, the lower one was pushed into a tube by a column of mercury that rose slightly every time the arc became too large.

The entrance of mercury into the tube that carried the lower carbon was regulated by the current itself in the following way: The slightly elevated reservoir that contained the mercury communicated with the carbon holder tube through a rubber tube that was held between the core of an electro-magnet and its armature. This electro was traversed by the current from the lamp, and, as long as the intensity was normal, its attraction upon its armature kept the rubber tube closed and prevented the mercury from flowing. But when the arc elongated the armature fell, and the mercury pushed the carbon up until the former intensity was established again.

Our illustration, which is from *La Lumière Electrique*, shows a locomotive with the dynamo machine arranged just back of the smokestack. By a lever extending to the cab the engineer starts or stops the electric machine, and so lets on or shuts off the head lights.

A Curious Electric Phenomenon.

On his ground at Espeluy, Count De Las has a locomotive that runs a thrashing machine. While standing near the belt and holding over him an umbrella to shield himself from the sun, the Count chanced to touch one of the iron braces that supported the ribs of the umbrella, and suddenly felt a very perceptible spark upon his hand. On the following day, he says, I repeated the experiment, and obtained at two centimeters' distance very frequent sparks that formed an almost continuous current, whose intensity increased with the rapidity of the motion.

When the rapidity of the engine was great there was heard a crackling of strong sparks which were leaping from the belt to the boiler, although we could not see them on account of the strong sunlight in the middle of the field. How is this phenomenon to be explained? Could it be attributed to the development of electricity obtained by evaporation, which was the basis of the Armstrong electric machine? No, because the boiler of this machine must be mounted upon large insulated columns. Here, on the contrary, the locomotive, through its iron wheels, communicated directly with the earth, and the latter, which was certainly quite moist, increased its conductivity. The explanation that appears probable to me is the following: The belt was not sufficiently taut, and, in order to increase its adherence to the rim of the fly wheel, it was thickly besprinkled with resin. But, despite all this, the adherence was not perfect; there was friction between it and the fly wheel, and, in this rotary friction, just as happens in the electrophorus, the two fluids separated. The metallic frame work of the umbrella operated as a condenser, and, since the belt was 10 meters in length and 20 centimeters in width, it presented a superficies of 2 square meters, upon which a large quantity of free fluid was capable of accumulating. I had not, upon the spot, a means of verifying the kind of electricity, but I think that I can assert that it was resinous.—*J. M. Folache, in La Nature.*

[The "phenomenon" would seem *curious* only to those who do not know about the electricity of machine belts; belt electricity is within the experience of most mechanics, and nothing beyond the ordinary appears to have occurred in the Count De Las' case. Also the allusion to Armstrong's machine and the electrophorus indicates that J. M. F. is not a very competent witness on electrical matters.—EDS. SCIENTIFIC AMERICAN.]

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THE Treasurer of the immense colony of South Australia says that the population is only 300,000.