Langley spoke briefly of the progress of invention, particularly during the last ten years. Professor William P. Trowbridge, of Columbia College, New York, read a paper on "The Effect of Technical Schools upon the Progress of Invention." The next paper, entitled "The Invention of the Steam Engine," was by Professor Robert H. Thurston, the director and professor of mechanical engineering in Sibley College, Cornell University. The paper was an elaborate history of the steam engine from the time of its invention down to the present time. Captain Birnie, of the Ordnance Bureau, read a paper prepared by Major Clarence E. Dutton, U. S. A., on "The Influence of Invention upon the Implements and Munitions of Modern Warfare," and Professor F. W. Clarke, of Ohio, the chief chemist of the United States Geological Survey, read a paper on "The Relation of Abstract Scientific Research to Practical Invention, with Special Reference to Chemistry and Physics." It is impossible, in the space this week at our command, to give any adequate abstract of these valuable papers, the most interesting portions of which we shall endeavor to give in a future issue.

At the meeting on the evening of April 10, Prof. Alexander Graham Bell presided, and the following papers were read: By William T. Harris, United States Commissioner of Education, on "The Relation of Invention to the Communication of Intelligence and the Diffusion of Knowledge by Newspaper and Book;" by Professor Otis T. Mason, of Virginia, the curator of the National Museum, on "The Birth of Invention;" and by Dr. John S. Billings, curator of the Army Medical Museum, on "The American Inventions and Discoveries in Medicine, Surgery, and Practical Sanitation."

Among the views forming a portion of our first page illustration are representations of a number of curiosities in the way of models and machines, which have been collected and placed on exhibition in the lecture hall of the National Museum. One of these is the identical press at which Benjamin Franklin worked in London. Another represents the water clock, one of the oldest and clumsiest of time pieces, in connection with which is shown a modern chronoscope, measuring time to the five-hundredths of a second. The first life-saving car made by Joseph Francis is also shown, and a model of the plow used by Prof. Morse in laying the first telegraph line. An original model of Davenport's electric motor and circular railway dates back to 1837, and another exhibit is that of the cylinder of the Stourbridge Lion, one of the first locomotives built for traffic in the United States.

Our portrait of President Harrison is from a recent photograph by Charles Parker, 477 Pennsylvania Avenue, Washington.

At the special reception to inventors and manufacturers in the rotunda of the Patent Office on Wednesday evening, there was a large and brilliant gathering. All was ablaze with light and color where the receiving party stood, rich hangings, festoons of flags and diadems, and other forms of incandescent lights contributing to the effect.

During the progress of the congress several meetings were held looking to the organization of a permanent National Association of Inventors and Manufacturers of patented articles, to secure co-operation in matters tending to the improvement of the patent system, that "organized effort may be made to remedy existing defects and provide against danger in the future." On the evening of April 10 such an organization was completed, and a constitution and by-laws adopted. Dr. Gatling, the inventor of the Gatling gun, was chosen president, and Gardner R. Hubbard, of Washington; Professor William A. Anthony, president of the American Institute of Electrical Engineers; Thomas Shaw, of Philadelphia, and Benjamin Butterworth, of Ohio, were elected vice-presidents.

Sensitive Galvanometer.

At a recent meeting of the Royal Scottish Society of Arts at Edinburgh, Dr. R. Milne Murray described and exhibited a reflecting galvanometer for physiological work. The instrument was an astatic galvanometer of the Thomson type, with special modifications. One of these was that the mirror was placed between the two systems of needles, instead of being attached to the upper system. But the principal modification was the mode of damping adopted so as to secure aperiodicity. The filament which carried the needles and the mirror had attached to its lower end a light vane, spade-shaped, which just dipped into an adjustable cup of oil, so that when the needles were deflected, the capillary attraction of the oil from the vane brought the system readily to a standstill. Dr. Murray claimed for his galvanometer great sensitivity, a high figure of merit, and a remarkable degree of aperiodicity.

THE electric street cars which for the past year have been run on the Fourth Avenue street railway, this city, and which were propelled by storage batteries carried on the cars, have been withdrawn. Reason, litigation over the patents.

Correspondence.

Life Saving Telephones—A Good Suggestion.

To the Editor of the Scientific American:

I read with much interest the article in the SCIENTIFIC AMERICAN of February 21, about the United States life saving service, and it was a surprise to me to see that the surfman, patrolling the shore, not having better means by which to communicate with his station. If I understand the article right, he will have to run to the nearest station as soon as he sees a wreck, and report, which necessarily will take more or less time, and may mean many lives lost. That mode of operating seems to me to be crude and old fashioned and ought to be dispensed with, and in its place should be erected a telephone line, running close to the shore, with one or more patrol boxes, furnished with telephones, through which the watchman could report. Such a line would not necessarily be very expensive. A one wire system I think would be sufficient, supported on short poles. The life saving crew could be instructed how to keep the line in repair and one of the telephone companies ought to supply the instruments, free of charge, or at least at a nominal price, considering the humane purpose for which it is to be used. We see how well the signal system works in our large cities. How many millions of dollars' worth of property and how many lives have been saved by the fire alarm system, and likewise how efficient has the police alarm system shown itself to be, and I can see no reason why the same system couldn't be adopted on our life saving service. If this idea is new, I would like you to publish it. If not, throw it in the waste basket.

A. LARSEN.

27 Hastings Street, Chicago, Ill.

How to Cut Glass by Means of Heat.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of March 28, under Notes and Queries, I notice that J. B. V. asks how to cut a bottle off near the bottom without destroying the remainder. The answer given is: "File a notch, start a crack with a red hot poker, and lead it around." In "Experimental Science," by Geo. M. Hopkins, I notice a similar method, the only difference being that the author recommends giving the bottle a rotary motion inside a wire curved similarly to the bottle.

It may be due to my awkward manipulation, but I have never been able to obtain very satisfactory results with either method. If I make use of an iron sufficiently large and long to hold the heat well, I cannot guide it where I wish. If I make the iron smaller and shorter, so as to control its movements better, I either burn my hand or the iron is so small that it soon loses its effective power in producing unequal expansion, and requires very frequent heating.

To those of your readers who can produce good results with a hot poker I have nothing to say; but to those who, like myself, are unable to satisfactorily make use of the hot iron, I have a method to suggest that is simple, and with me has given very desirable results.

If a piece of quarter inch soft glass tubing be drawn out so that the bore be somewhat less than one-half a millimeter in diameter, and then attached, by means of the large end inserted into a piece of rubber tubing, to a gas spigot, a small flame, about one and one-half centimeters long and two or three millimeters in diameter, can be produced. By holding the piece of glass tubing as one would a lead pencil, with the point of the flame applied to the file scratch or an already started crack, one can lead a crack, not by long, irregular jumps, but gradually and accurately, in any direction he may desire.

This device, though very simple, has given me most excellent results, not only in cutting bottles and large glass tubes, but in cutting plate glass when a diamond cutter was available. I have found that a pointed flame, formed with a small opening and under the ordinary pressure of the gas, works better than a shorter and thicker flame, formed with a larger opening and with less pressure. The flame in the one case will be almost in the same plane with the tubing, if the glass tube be held horizontally or as a pencil would naturally hang in the hand, and its point can be applied at any angle. In the case of the flame formed from the larger opening, and with the gas pressure partially cut off, the flame will curve upward, and its point is with difficulty applied at most angles.

GEO. M. TURNER.

Auburn, N. Y.

Wooden vs. Metallic Ties.

To the Editor of the Scientific American:

In SUPPLEMENT, No. 789, February 14, 1891, in the article on "Preservative Treatment of Timber," the author draws a comparison between the expense of wood and metal ties, but omits several important factors. He proposes to treat the cheaper woods and increase the life, but overlooks entirely the fact that the wood which he considers, hemlock, or any other soft wood, will *wear* out before it rots, when not treated. It will not hold the spikes or support the rail for heavy traffic, as the rail works its way right down through it. He puts the price of oak ties at 70 cents, and the spikes cost 2½ cents per pound, and it takes 2 pounds per tie, and the spikes have to be renewed once during the life of the tie, making 10 cents for each tie.

With the large hewed Virginia ties of all thicknesses and widths it takes a day's work to remove, replace, spike, and properly tamp from seven to ten ties with slag ballast. A section boss here has, on the average, four men at $1.15 per day, and to this must be added 44 cents (one-fourth boss' wages), making $1.59, which at ten ties per day is .159 per tie.

Cost of tie in road .70 + .10 + .159 + .041 (second spiking) = $1.00. Many actually cost more, to say nothing of driving *all* spikes down in the spring, etc.

The writer fixes the life at 7 years. The dollar is to be lost in 7 years, or .143, nearly, per year, to which must be added interest at 5 per cent, making a yearly expense of .193 for the best ties; while for cheaper ones it is more.

Wood ties vary in thickness, and the water settles under these thick ones, causing the unpleasant act of "pumping," which makes the thickest tie the poorest support.

The steel tie is worth for scrap about one-third of cost, but we will count it as only paying for changing the tie and interest on cost of change. We received the estimate of some of the Mahoning Valley iron workers and rolling mill managers, and they estimate a tie of angle steel plate, with rail fastenings of a certain pattern taken as a basis, at 120 pounds, at a cost of $2.00.

Counting the life of the tie at 40 years (iron men say it will last longer) it would be a loss of 5 cents per year, to which must be added 10 cents interest, making 15 cents as the actual yearly cost of each tie. To those who think that 40 years is too long an estimate, we will say that it proves cheaper with a life of only 22½ years, as will be seen by division, making the yearly loss .0889 + .10, or .1889.

The figures given were obtained from railroad men.

F. F. MAIN.

Bristolville, Ohio, April 5, 1891.

An American Blast Furnace in England.

The new furnace which Palmer's Shipbuilding and Iron Company, limited, have put up at Jarrow-on-Tyne is virtually an American one, as regards its lines and method of working. It will, says *Engineering*, afford manufacturers evidence as to whether the American or Cleveland blast furnace practice is the more economical and satisfactory for the British producer, and thus its working will be looked upon with more than ordinary interest, as there is much controversy on the point in question. The furnace is an exact copy of the most recent one at the Edgar Thomson Works of Messrs. Carnegie Brothers, at Pittsburg—a furnace which has produced up to 2,500 tons per week of pig iron, which is more than double the output of our best hematite furnaces, nearly five times as much as an ordinary Cleveland furnace, and almost twelve times that of the average Scotch furnace. The new Jarrow furnace is 76 ft. 2 in. in height with a 20 ft. bosh and 11 ft. depth of well. It has four Cowper hot blast firebrick stoves, and is blown by a compound condensing engine having 100 in. blowing cylinders. In America it is not the practice to have one blowing engine to several furnaces as it is in England, but each furnace has its separate engine, and this will be the case with this new furnace. There are eight tuyeres made of bronze, the use of that metal for such a purpose being peculiar to America, and has till now not been adopted in our own country. The blast will be driven into the furnace at a pressure of about 8 lb. per square inch, in the United States the pressure is nearly 10 lb., whereas in Cleveland it is only 5 lb. to 5¼ lb. On this account the furnace must be expected to produce a good deal more iron in a given time than the ordinary British hematite furnace, for it is to be fed with hematite ore, but it will not come up to the largest records in the United States, seeing it will have to smelt a 50 per cent ore, whereas in America they use a 60 to 63 per cent ore, which is moreover much less refractory than the Spanish ore generally used here. When blowing at such a pressure something, of course, has to be done to preserve the brickwork from the extra heat, and the furnace is, therefore, encircled by rings of water tubing 64 in number, through which some 1,500 gallons of water circulate per minute.

Palladium Plating.

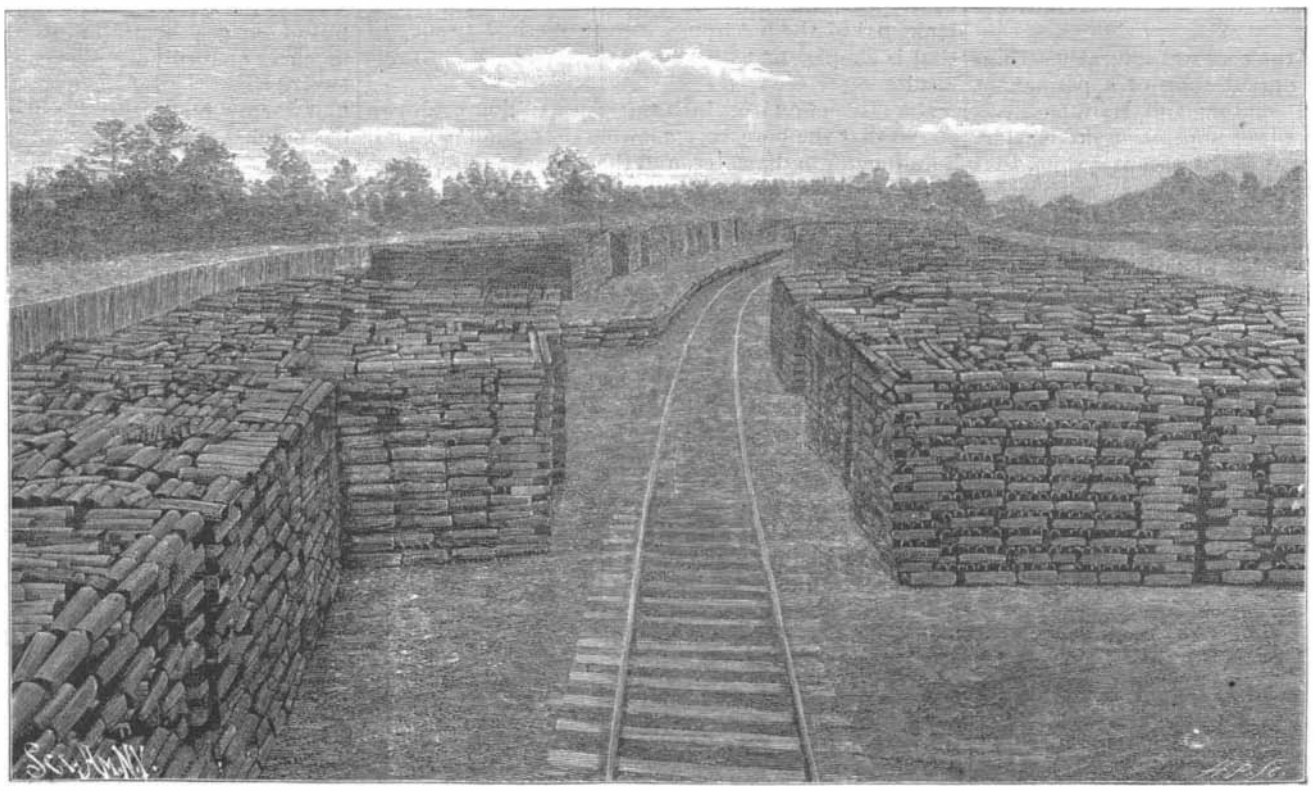
Palladium, which is a whiter, lighter, and more fusible metal than platinum, has of recent years been much used to plate watch movements, says the *Electrician*. According to M. Pilet, four milligrammes (about one-seventeenth of a grain) of palladium is sufficient to coat the works of an ordinary sized watch. M. Pilet recommends the following bath: Water, 2 liters; chloride of palladium, 10 grammes; phosphate of ammonia, 100 grammes; phosphate of soda, 500 grammes; benzoic acid, 5 grammes. This bath is suitable for all metals except zinc.

Education at the World's Fair.

Commissioner Harris is desirous that a single building be furnished at the Columbian Exposition, Chicago, of sufficient extent to contain and properly display all of the exhibits that belong to education. He says that at Philadelphia in 1876 not only the foreign exhibits were separated and scattered, but the exhibits of the several States were isolated from one another. The effect of the educational exhibit at Philadelphia consequently was very much weakened. But at the cotton centennial at New Orleans, the educational exhibits of the United States and of foreign nations, with a few exceptions, were brought together in the gallery of the government building. Those who inspected it pronounce it the best exhibit hitherto made of education. Undoubtedly it derived half its advantage from the fact that it was disposed and arranged under one supervision, and the whole of its material brought together in one place. Dr. Harris suggests there be organized in each State, as soon as possible, a committee with authority to take in charge all matters pertaining to educational exhibits. Such a committee may be provided for by the legislature, or appointed by the governor, or, in the event that neither of these arrangements is practicable, said committee may be organized by election from local committees formed in cities and towns, and in the educational institutions of the State. In whatever manner appointed, the committee should be thoroughly representative of all classes of schools and educational institutions, whether public, private, or denominational, and it should include State, county, and city superintendents, the officers of private schools and academies, presidents of colleges and universities, directors of institutions for the defective classes, etc. This proposition is most sensible, and should meet with a hearty response from all who wish to see our educational interests properly presented at this great exposition. Representatives from all the world will visit this great exhibit, and it is highly important that they should see what we are doing toward educating our children and youth.—*New York School Journal.*

HOW STOCKS OF PIG IRON ARE HELD.

Within the past two or three years there has grown up in this country a system, which had previously been successfully adopted in Scotland and England, by which the products of pig iron furnaces may be conveniently stored, when the demand for consumption is light, and the owners can obtain money thereon, proportionate to the value of the accumulating product, with which to keep their furnaces in operation during a dull season. This system as carried out by the American Pig Iron Storage Warrant Company includes the establishment of what is known as a "warrant" yard in close proximity to each large furnace, and convenient to the necessary transportation facilities. These yards are owned or leased by the company, and in charge of its special agent. When the production of the furnace is in excess of its sales, or the owners desire to hold the product for an anticipated better market in the future, such a yard not only affords a convenient storage place, but the iron, as received there, is inspected by an expert agent, and a warrant is issued for each lot, certifying its quantity and grade. These certificates, representing each so much iron of a defined quality, are readily negotiable in all the principal markets, after the same manner as the pipe line certificates representing petroleum, or any species of stocks or bonds. The owner, on pledge of such security, can borrow money at the most advantageous rates, and the certificates themselves are salable by transfer as so much iron.

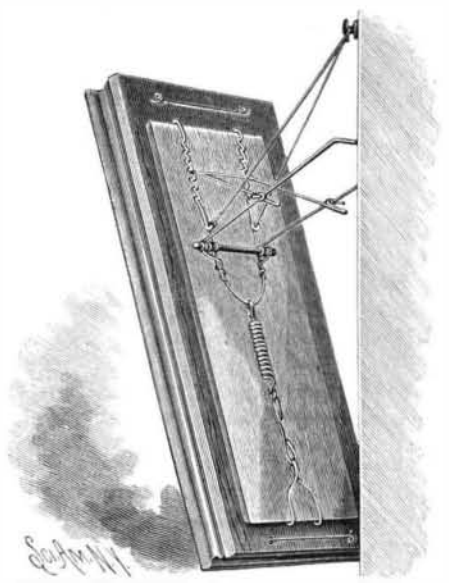


A PIG IRON STORAGE YARD, BESSEMER, ALA.

In the accompanying illustration we present a view, made from a photograph, of such a storage yard at Bessemer, Ala., containing over 12,000 tons of pig iron. The yard is about 120 feet wide and 600 feet long, and each 100 tons is piled in a solid block, forming a pile about twelve feet long, ten feet wide, and eight feet high, each block being well defined and plainly marked. The company has about twenty of these yards established at different furnaces in Virginia, West Virginia, Kentucky, Tennessee, Georgia, and Alabama, and other places. There was on storage at all of these yards, on April 1, about 55,000 tons, but the quantity was being reduced, as more iron was being taken out for consumption than was coming in from the furnaces.

A HANGER FOR PICTURE OR MIRROR FRAMES.

The illustration represents the application of a convenient and inexpensive device that may be quickly attached to mirror or picture frames of different sizes, to hang them at any desired inclination. It has been



RULON'S PICTURE FRAME HANGER.

patented by Mr. David G. Rulon, of No. 826 South Main Street, Monmouth, Ill. The wire suspending portion of the device extending across the back of the frame is coiled around a horizontal stay rod, and has a series of short return bends on the two limbs above the stay rod, forming ratchet racks, while a spiral spring forms a section of its length below the stay rod. Upon the end portions of the stay bar are wrapped the ends of a wire prop piece having ring eyes in its side members, such eyes being loosely engaged by the ends of a wire brace adapted to engage the teeth of the ratchet racks, thus holding the prop piece inclined outwardly from the frame as desired to give the proper inclination to the picture or mirror to which the device is applied. The frame is suspended by means of a strand of wire connected to eyes on the side limbs of the hanger, and when there are no ledges on the back of the frame with which to connect the device, short holder wire strips are secured in proper position near the top and bottom of the frame, with which the hooks at the ends of the hanger are brought into engagement.

IT is sometimes convenient for an engineer to be able to approximate the amount of condensation that will take place in pipes during a certain length of time. From many experiments made on the condensation of steam in wrought iron pipes when exposed to the open air, it is found that 1 pound and 6 ounces of steam per square foot of pipe's surface was condensed per hour when the difference in temperature between the steam and air amounted to 200°. As this is very nearly the difference of temperature usually found between the steam in the pipes and the air on the outside, this simple rule will give results sufficiently close for ordinary purposes.

What May be Patented.

The Washington *Chronicle* gives the gist of our patent laws in the fewest possible words as follows:

A United States patent will be granted to any person who has invented or discovered any new and useful art, machine, manufacture, or improvement thereof, not known or used by others in this country, and not patented or described in any printed publication in this or any other country, before his discovery or invention thereof, and not in public use nor on sale for more than two years prior to his application, unless the same is proved to have been abandoned.

In this connection the word "art" means the process or method of producing an old or new result. If a method of doing anything contains one or more new steps, the process is new and patentable.

The word "machine" means any device or thing by means of which a mechanical result may be produced, such as a pin, a churn, or a locomotive.

The word "manufacture" means a made-up article, such as furniture, clothing, harness, and the thousands of things which are offered for sale.

"Composition of matter" means a chemical compound of ingredients, such as hard rubber, liquid glue, medicine, etc.

Patents may also be obtained for designs for manufactures and works of art, for three, seven, and ten years.

Trade marks may be registered for any arbitrary sign or symbol which is not descriptive; the government fee is $25. Such marks are the exclusive property of the registrar for thirty years, and the time may be extended.

A "label" is any descriptive tag, print, or impression to be placed upon any article or its case, and it may be registered for twenty-eight years. The government fee for a "label" is $6; but if it contains any special mark or symbol, the office decides it to be a "trade mark" instead of a label.

Heavy Locomotives for the St. Clair Tunnel.

The approaches of the St. Clair Tunnel, connecting the Grand Trunk Railway of Canada with its line in Michigan, will have a grade of 105 feet to the mile, and a very heavy locomotive will, consequently, be required to haul heavy trains up the grade. For this purpose four extra large locomotives are being built by the Baldwin Locomotive Works, the heaviest ever built there, and, it is believed, the largest ever built in America. One of them, "No. 598," is already completed, is now at Port Huron, and in working order weighs 195,000 pounds. These locomotives are of the class known as tank locomotives, and have no tender. The tanks are on both sides of the boiler, and their capacity is 2,000 gallons. The space for the fuel, which is anthracite coal, is on the foot-board. There are five pairs of driving wheels, which are the only wheels, and they are 50 inches in diameter. The wheel base is 18 feet 3 inches. The cylinders are 22 inches in diameter and have a stroke of 28 inches. The boiler is of steel, $\frac{5}{8}$ of an inch thick, and is 6 feet 2 inches in diameter. There are 280 flues, $2\frac{1}{4}$ inches in diameter and 13 feet 6 inches long. The firebox is 11 feet long and $3\frac{1}{2}$ feet wide. The cab is placed on top of the boiler and midway between the ends. There are two sand boxes, one on the front of the boiler and one on the back, so that sand can be placed on the rails whether the locomotive is running forward or backward. There is a powerful air brake which operates on each driving wheel. There are headlights and steps at both ends, like those of a shifting engine. The locomotive will run on 100 pound rails. In its completed state the locomotive is too heavy for some of the bridges it will have to cross *en route* from the Philadelphia shops to the tunnel, so the cab, the tanks, side rods, and other parts will have to be taken off to lighten her weight and be shipped separately.

ONE of the features of the grand parade in Des Moines during the Iowa state fair was an electrically propelled buggy, the current being furnished by storage batteries.