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A PUBLIC DRINKING FOUNTAIN.

We present herewith an engraving of an unusually ornate drinking fountain, presented to the people of London by the wealthy and charitable Baroness Burdett Coutts. The lower portion has a plan quatrefoil in shape, and is of polished Aberdeen granite, the four basins being each six feet four inches in diameter. These rest on detached shafts, thirty-six in number, of the same stone, the capitals being carved of Sicilian marble. The plinth whence these shafts spring rises four inches above the ground, and in it are four sets of drinking troughs for dogs, made of gun metal. These are supplied by the overflow from the upper basins, and between the troughs are placed standpipes to supply water for the use of the horses. There is a fountain in the center of each basin, and in the middle of the group is placed a canopied pedestal, six feet high and of three feet six inches span, with dolphins placed at the angles. From these flow the water for drinking. This pedestal is of Sicilian marble, and, a few inches above the general water level, is divided into four richly molded niches containing groups of figures and animals, the former holding vases, from which the basins derive their chief supply of water. Above the niches the pedestal becomes pedimented, and is enriched with crocketed pinnacles and terminals, so as to serve as an ornamental base for a lamp standard, which, at the hight of fifteen feet from the ground, branches into eight foliated bracket lamps. A larger and more ornamental lamp rises from the center of these, and terminates the composition, which is altogether twenty-four feet high.

The workmanship is, throughout, remarkably good. The metal work is fine and cleanly cast, and richly gilt, and the granite and marble work is some of the best which has been executed in London. Underneath the fountain itself is a roomy subterranean chamber lighted with gas, which contains all the pipes and valves that regulate the supply and discharge of the various water services.

This elaborate fountain is from the design of Mr. H. A. Darbishire. Of its beauty, our readers can judge for themselves; and the solidity of its construction and the genuine character of the decoration mark it as one of the most ornamental works lately erected in the fountain line. Its elegant design makes it an ornament to the locality in which it is placed; but its value must certainly be considered to consist in the useful purpose for which it was given to the public. It is only one of several handsome benefactions of the same charitable donor, whose enormous wealth could scarcely be employed in a more worthy manner.

PUBLIC DRINKING FOUNTAIN, REGENT'S PARK, LONDON.

Photo-Chemical Engraving.

It has been found by M. Merget and M. Gourdon—and, indeed, has been long known to physicists and chemists—that zinc covered, or in contact, with platinum or certain other metals, is readily acted upon by acids which have little or no effect upon pure zinc. If a plate of chemically pure zinc be plunged into sulphuric acid diluted with ten times its volume of water, it is but very feebly acted upon; but if partly coated with metallic platinum, by drawing a line with solution of tetrachloride of the metal across the plate, and then, after the complete reduction of the platinum salt by the zinc, the plate be plunged into the acid, the latter will be found to act energetically along the platinum line. This action is essentially electro-chemical.

If a plate of ordinary zinc, carrying an image in platinum, be plunged into an acid containing one part of sulphuric acid in two thousand parts of water, the metal will only be attacked when it happens to be in contact with the platinum, and an etching of any desired depth can thus be obtained.

But the production of a good image on the zinc is the real difficulty, and under this head we have yet little information. The plan pursued by M. Gourdon is to place a fixed and washed positive silver print on paper face downwards on the zinc, and then to moisten, first with ammonia and then with cyanide of potassium. A certain amount of the silver forming the image is thus transferred to the plate, which can then be etched by acid containing the one two-thousandth of its volume of sulphuric acid.

These and other experiments hitherto made do not appear to have been very successful, as half tones were not rendered; still the plan is not only interesting, but appears to contain the germ of a good and simple process of photo-chemical or electro-chemical etching, and is well worth the attention of those interested in this branch of our art. Before we close these remarks we may offer a suggestion which may aid in the solution of the difficulty. Any process depending on the solution of the silver of a print, and its subsequent deposition on the zinc by reduction from a liquid, could not be expected to produce satisfactory results; we would therefore suggest that the silver print should be toned with gold or with platinum, and, when washed and dry, exposed to the action of chlorine gas. Soluble chloride of gold or platinum and insoluble chloride of silver will be formed. The print should then be pressed into close contact with the zinc.

Now, since the chloride of gold or platinum carried by the print is deliquescent, we should expect that a sufficient amount of moisture would be absorbed from the atmosphere to enable the zinc to decompose the gold or platinum salt, and reduce upon its surface the noble metal, and so spreading or blurring of the image be avoided by limiting the action to the right place. By some

such plan, we should think it quite possible to obtain a tolerably sharp impression in gold or platinum on a zinc plate, and from a sensibly dry paper print, provided the action of the chloride in the first instance is properly regulated, and the pressure to which the print and plate are together subjected is sufficiently great.—*British Journal of Photography.*

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Contents.

(Illustrated articles are marked with an asterisk.)

LATENT HEAT.

According to the material theory of heat, there is a certain substance called caloric, which makes bodies that contain it hot, and causes them to become cold when it is withdrawn. It was observed, in converting solid bodies into liquids and liquids into vapors, that the bodies took up a great deal of heat that was not indicated by the thermometer, and on this account the heat of liquefaction or vaporization was said to be latent, a name that it retains at present. Though this heat cannot be shown by the thermometer, its existence can readily be proved. Water is a substance which can easily be made to assume the condition of a solid or a vapor, being called ice in the former and steam in the latter state. Suppose that we have a pound of ice, at a temperature of 32° Fah., and that we mix it with a pound of water at 212°, the ice will be melted, and we shall have two pounds of water at a temperature of 51°. Now take a pound of water at a temperature of 32°, and mix it with a pound of water at 212°; the resulting mixture of two pounds will have a temperature of 122°. Hence we see that the ice, in melting, has absorbed enough heat to raise two pounds of water through a temperature of 122 —51—71°, or one pound through 142°, and we say that the latent heat of the liquefaction of water is 142°. The latent heat of the vaporization of water can be determined in a similar manner by condensing a pound of steam at 212° with a given weight of water at a known temperature, and also by mixing a pound of water at a temperature of 212° with the same amount of water as was employed in the case of the steam, and observing the difference of temperature of the resulting mixtures.

Thus, a pound of water at 212°, mixed with ten pounds at 60°, gives eleven pounds at 74°. A pound of steam at 212°, mixed with ten pounds of water at 60°, gives eleven pounds of water at 162°. In other words, the steam, on being condensed, has given out heat (which was not previously sensible to the thermometer) enough to raise eleven pounds of water through a temperature of 162°—74°—88°, or one pound through 968°, and we say that the latent heat of the vaporization of water is 968°.

The mechanical theory of heat is now generally adopted; it considers that heat and work are interchangeable, and on this theory we shall be able to explain what becomes of the latent heat. All solid bodies are supposed to be made up of molecules, which are not in contact, but are prevented from separating by a force called cohesion. If a body is heated to a sufficient temperature the force of expansion becomes equal to that of cohesion, and the body is liquefied; and if still more heat is applied, the force of expansion exceeds that of cohesion, and the liquid becomes a vapor. But in each of these changes work is performed, and the heat that is supplied is converted into this work. For instance, if ice is at a temperature of 32°, and heat is applied, this is converted into the work that is developed in changing into water, and we say that heat becomes latent; and when water is at 212°, and we continue to apply heat, this is converted into the work that must be done in changing the water into steam. From this statement, it will appear that what is ordinarily known as latent heat would be more properly called converted heat, since it has been changed into work.

We can readily determine the amount of work that is performed in any given case, and will now show how the calculation is made. A unit of heat is the amount of heat required to raise a pound of water one degree in temperature. The mechanical equivalent of heat is the amount of work that is performed by the conversion of one unit of heat into work. This has been determined to be equal in amount to the work required to raise 772 pounds one foot high, or one pound 772 feet high. And as heat and work are mutually convertable, if a body weighing one pound, after falling through a hight of 772 feet, were to have its motion suddenly arrested, it would develope sufficient heat to raise the temperature of a pound of water one degree. Let us apply these figures to the work done in changing water into steam. Two kinds of work are here performed. If a pound of water at a temperature of 212° is converted into steam, the latter will have a volume of about 27¼ cubic feet. Suppose that the water is evaporated in a long cylinder, of exactly one foot cross section, open to the atmosphere at the top. Then when all the water has disappeared, we shall have a column of steam 27¼ feet high, which has risen to this hight against the pressure of the atmosphere. The pressure of the air being nearly 15 pounds per square inch, the pressure per square foot is 2,115 pounds; and the external work performed by the water, in changing into steam, will be an amount required to raise 2,115 pounds to a hight of 27¼ feet, or about 57,644 foot pounds. And since 772 foot pounds of work require one unit of heat, the external work will take up 57,644÷772—74·67 units of heat. But we have seen that the total number of units of heat required to change water into steam is about 968 (more accurately, 966·6); hence the internal work will be equal to an amount developed by the conversion of 966·6—74·67—891·93 units of heat into work; and this will equal 891·93 × 772—688,569 foot pounds.

We have received, of late, quite a number of inquiries on the subject of latent heat, and have endeavored in this article to present the matter in so broad a light as to answer all these questions. It is exceedingly important that those who are endeavoring to effect improvements in the economical working of prime movers should understand these things clearly, so that they can work intelligently, knowing in what direction improvements are needed. We shall probably refer to the use of the steam in a subsequent article.

FRENCH TELEGRAPHY AT THE EXPOSITION.

A correspondent of the New York *Evening Mail* writes to that paper from Vienna as follows:

"I am sorry we are not represented in telegraphic apparatus, as we have several things in America that would be worth seeing. The French telegraphic department is the best in the exhibition, and some of the inventions are exceedingly interesting. There is a machine that prints an autographic despatch, not chemically like the other autographic instruments, but on white paper with printers' ink. It cannot be described in writing, and so I will not attempt to say how it is made, except that there is synchronous action of two rollers; one may be in New York and the other in San Francisco, or in any two other places connected by a telegraph wire. A written message, a draft, a sheet of music, the portrait of a burglar, anything that can be drawn with a pen—not with a pencil—may be telegraphed from one end of the world to the other and reproduced with printers' ink on white paper, like that whereon the patron of the *Mail* reads this letter.

"Then they have a machine by which four operators can work over a single wire at once in one direction, just as one operator does with us; and by putting on four operators the other way, you can make the capacity of one wire equal to that of eight by the old system. We are now using in America a system by which a wire may be operated both ways simultaneously. The French machine is exactly four times ahead of us. They have, also, an electro-magnet that works over a hundred miles of wire."

It is evident that this correspondent is not fully posted in regard to the state of telegraphy in his own country.

The instrument first above described is the "autograph telegraph" of E. Lenoir of Paris. It is a modification of the Bakewell and Casselli instruments, invented years ago. The message to be transmitted is written on a prepared slip which is placed on a roller and turned, under a transmitting stylus. Every line in the original message produces a corresponding dot in ink on the paper at the other end of the wire. By turning the roller often enough and so repeating the transmission, the letters are dotted out at the receiving office. In an example now before us, done on the instrument described by the correspondent of the *Evening Mail*, each letter is composed of a number of dots and dashes, each representing a telegraphic-signal. In making the capital letter B, for example, some forty-two signals were employed. It is almost needless to say that instruments that involve the making of so many signals to form a single letter cannot compete in rapidity with the simple system of Morse, or the various printing instruments in common use here. The Lenoir machine is more of an electrical curiosity than a business machine.

In respect to the other instrument, by which it is alleged that eight operators can work at once on one wire, this is the invention of M. Meyer, and its capacity is greatly overrated. Mr. George B. Prescott, electrician of the Western Union Telegraph Company, during a recent visit to the continent, made an examination of this Meyer instrument. The capacity claimed for it by the inventor was only one hundred messages of ten words each per hour, which is slow work for eight operators.

The double system, referred to by the correspondent as in use here, is the Stearns duplex instrument, by which two operators may work in contrary directions over one wire. One hundred and forty-six messages have been sent per hour over a single wire by this system, using the Morse key. The American system is therefore about fifty per cent faster, although employing only two operators, than the Meyer French plan with eight operators.

The Stearns duplex system is only limited in its rate of transmission by the skill of the operators. The fastest operator has been able to reach a rate of 2,500 words per hour. Two operators having this ability would be able, by means of the Stearns instrument, to send over one wire 5,000 words per hour, or 2,500 words each way. A rate even higher than this has been experimentally obtained.

The above French telegraph instruments are not indicative of an advance or improvement over the devices in common use here. Simplicity in the instrumentation is the aim of the American telegrapher for ordinary work. Give him a Morse key and a sounder, and he is ready for instant work anywhere, from the lonely summit of Mount Washington to the crowded Babel of the stock exchange.

The observations of Mr. Prescott were that the French official consumes more time in preparing to transmit a message than is taken here to send a telegram across the continent.

ANOTHER ARCTIC EXPEDITION BEGUN.

The Tigress sailed from this port on the 13th of July *en route* for the arctic regions, in search of the remaining survivors of Captain Hall's expedition and his steamer, the Polaris. On the 15th of October, 1872, in latitude 80°02, this ill fated steamer became jammed in the ice; and in view of imminent danger, a large portion of her crew and provisions were got out upon the ice. Soon afterwards, in a heavy gale of wind, the ship broke adrift. The vessel was at this time destitute of boats, and was in a leaky condition, with thirteen souls on board. The persons left on the ice, after floating southward for several months, were finally rescued by a seal hunting vessel and carried to Newfoundland. The last they saw of the Polaris was on the 16th of October, when she appeared, under sail and steam, heading for a bay in Northumberland Island, a sheltered position where she anchored. It is supposed that here the Polaris was frozen in, as the ice in those regions commences to close in September; so that, if she remained any length of time at her anchorage, she must have been nipped hard and fast until the present month of July, when the breaking up of the floes begins. It is believed, therefore, that unless the ship managed to alter her position before being shut in, she could not move until about this time; and as her coal must of course be exhausted, she cannot have proceeded very far under sail alone. On these grounds, it is conjectured that, if the Polaris be afloat at all, little difficulty will be experienced in finding her.

The Tigress goes to Disco, Greenland, whither the Juniata, another United States vessel, has preceded her, having left New York some weeks ago, laden with provisions and coal. Starting from Disco, the Tigress will begin the important part of her cruise completely stocked, that is, with two years' rations for the forty souls composing her crew, and with all the coal she has room for, sufficient for twenty-two days full steaming. From Disco, the ship will proceed to Upernavik, where dogs, sledges, etc., will be taken aboard, and thence she will shape her course directly for Northumberland Island. If the Polaris is not where she is expected to be, and the search has to be protracted over the vast and dreary wastes in the neighborhood of the pole, there is little chance of the Tigress returning to civilization under a period of some fourteen months.

The Tigress was originally built for the seal-hunting service. She is a bluff bowed vessel, some 150 feet long by 30 feet beam. Her sides are very thick and solid, averaging from 24 to 30 inches through, and her bow is armored with plank and iron plating to enable her to resist the ice. Her motive power is a 60 horse vertical compound engine, and a two bladed propeller, capable of driving her, at best speed, about 7 knots per hour. The *personnel* of the expedition consists of Commander James A. Greer, U. S. N., commanding, Lieutenant Commander H. C. White, Lieutenants Wilkins, Berry and Sebree, two engineers, two ice pilots, one of whom is Captain Tyson of the Polaris, and a surgeon, besides about twenty-nine men, many of the latter being seal fishers and members of the former crew of the Tigress. The Esquimaux who were rescued from the ice go back home in the Tigress. This is the first arctic expedition which has sailed strictly in Government service and under military discipline.

AN AUSTRIAN FARMER'S ENTERTAINMENT.

The special correspondent of the SCIENTIFIC AMERICAN, United States Commissioner Professor R. H. Thurston, has arrived at Vienna, and our readers may shortly expect from his pen some interesting and practical letters concerning the great exposition.

Professor Thurston was lately invited, as one of a select company, to visit the celebrated farm of Herr Ritter Horsky von Horckysfeld, in Bohemia, 200 miles from Vienna, to inspect the methods and appliances of agriculture as there practiced. A special train conveyed the guests to Kolin, where they were received by their farmer host, whose farm is 5,000 acres in extent. His plows, cultivators, seeders, threshers, harvesters and other implements are numbered by scores, and are operated by hand, animals and steam power, according to the nature of the work required or the formation of the ground. The yearly products of the farm amount to $50,000, and the amount invested in machines and other improvements is $500,000. The proprietor has, among other concerns upon the farm, a beet sugar factory which cost $350,000. Briefly, the process consists in macerating

the beets in water, which dissolves out the sugar; lime is then added, forming saccharate of lime; carbonic acid is then introduced, which precipitates the lime, and the saccharine liquid is then evaporated in the usual manner.

One of the features of the occasion was a simultaneous trial of various agricultural implements. At a bugle signal given by the host, a crowd of operatives, boys, girls, men and women, with asses, mules, cows, horses and oxen, all started to work in strips over the appointed field. The scene was instructive and peculiar.

In the evening a banquet was given, and in reply to the toast of America, United States Commissioner Professor Horsford made an interesting speech in German. The toast to the ladies was answered by Professor Thurston in a very brilliant manner. At 10.30 P. M. the party returned to Vienna. We gather these particulars from an interesting letter in the New York *Tribune*.

Herr von Horckysfeld is 72 years of age, and is celebrated throughout Austria for his success as an agriculturist. The excursion party numbered 150 persons, and were entertained wholly at the expense of the venerable farmer.

THE USE OF ZINC.

Although the use of zinc as a component of brass and similar alloys was known to the ancients, it did not, for a long time, meet with any use alone. In consequence, the production of this plentiful metal was a limited one. At the beginning of the present century scarce 200 tuns of zinc were produced in all Europe, while to-day the total production is at least 125,000 tuns.

It would seem as if zinc, on account of its low melting point and its relatively great power of resisting the action of the atmosphere, were excellently well adapted to the manufacture of all sorts of things, but its brittleness restricted its use within narrow limits. In 1805 it was discovered, at Sheffield, that zinc heated to 212° Fah. lost its brittleness, and from that time forward zinc began to be used alone, and especially for roofing; but this use was soon abandoned on account of the difficulty of fastening the sheets, and has been but recently renewed. For a long time only large masses, like weights, were cast in zinc. This use was not nearly sufficient to consume the quantities of zinc which could be obtained in Silesia, and hence, in 1826, the Society for the Advancement of Industry in Prussia offered a prize for the discovery of a use for zinc, which should cause an essential and generally useful increase in the consumption of the metal.

The prize was won by Berlin. Krieger, the chief mining counselor, first ascertained that it was possible to cast hollow pieces as well as plates and solid masses, and he had a number of utensils made of zinc for his household, but did not extend it farther. It happened, however, that a friend of his, named Geiss, who was the proprietor of an establishment for making fine iron castings, was hunting around for a suitable material for casting large architectural ornaments, and the idea struck him of employing zinc. He had now found a material which melted at a low temperature, and which could be cast in molds of moist sand, which was easily worked when cast, and which, above all—for this is of the greatest importance in making very large pieces—could be easily soldered. Geiss, whose factory is still standing in Berlin, now began to experiment very zealously. Beuth and Schinkel also interested themselves in it, and Berlin very soon began to employ zinc columns, capitals, architraves, cornices, and similar pieces of architectural work. The road was now broken for zinc casting, and zinc foundries sprang up rapidly in Berlin and other large cities; the price of zinc, which had fallen to $1.50, soon rose to $4.50 and the production of zinc in Europe increased, as stated, from 200 tuns in 1808 to 60,000 tuns in 1858, and to 125,000 tuns at the present time.

This remarkable increase of production, not being followed by a decrease in price, shows that the employment of zinc for casting objects of general use has been kept up, and that its use has not been limited to architecture. As soon as it became known that zinc could be so readily employed for casting, it began to be used for chandeliers and the like, where it served a good purpose as substitute for the more expensive bronze. The introduction of this use of zinc is principally due to Spinn; Devaranne employed it for theater decorations, a use founded upon the power of polished zinc to reflect the light. Finally zinc was employed for making copies of large statues, which could thus be very cheaply produced. Geiss, at the very beginning, cultivated this use of zinc, but it first came into practical use when Hossauer introduced a process of depositing, upon the zinc structures, a layer of copper by galvanic action. When thus coated, they soon acquired the appearance of genuine bronze. This use of zinc is still quite general, as it enables persons of more moderate means to possess excellent works of art. They are made chiefly by Lippold and Geiss.

At present a great variety of articles are cast in zinc in Berlin; candlesticks and still smaller objects, chandeliers and gas brackets, statues and huge architectural pieces, whole monuments, and even pieces 30 or 40 feet high and weighing half a tun, are made of this metal. All this great variety can be made in the same establishment, for the operation is exactly the same with all. If we enter a zinc foundery, we see no huge contrivances; in the court yard we saw, perhaps, a copy of the colossal "Amazon," by Kiss, as large as the original, or perhaps a monument 20 feet high; we enter the works and find very small furnaces, small crucibles, and in fact only a small space for casting. The explanation of this is in the case with which zinc is soldered. Everything, however artistic, is cast in small pieces weighing not over ten pounds each, and then soldered together. For all such things the patterns only are kept; and when a cast is ordered a sand mold is made, the pieces cast separately, and soldered together and the joints finished off. In consequence of the small arrangements and fittings required by such founderies, their number in Berlin alone is quite considerable, there being about fifty in all. The majority of them, however, combine zinc casting with bronze casting; these are the manufactories of lamps, gas fixtures, and cheap substitutes for bronze ornaments.

The zinc founderies, in the narrower sense, whose chief productions are architectural pieces and duplicates of plastic works of art, employ about 300 hands. Berlin, where this industry originated and where it is conducted with truly artistic taste, still takes the lead therein.

SIMPLE TESTS FOR MINERALS.

One of the first tests to which a mineralogist submits a specimen is a test of hardness. Hardness is expressed in two ways: By the degrees from one to ten, or by comparison with familiar substances, which are able to scratch it or which it is able to scratch; so we must begin with a

SCALE OF HARDNESS.

1. Talc, laminated light green variety, which is easily scratched by the nail.
2. Gypsum, crystallized. Not easily scratched by the nail; does not scratch a copper coin.
3. Calcite, transparent. Scratches and is scratched by a copper coin.
4. Fluor spar, crystallized. Not scratched by a copper coin; does not scratch glass.
5. Apatite, transparent. Scratches glass with difficulty; easily scratched by the knife.
6. Orthoclase, white, cleavable felspar. Scratches glass easily; not easily scratched by the knife.
7. Quartz, transparent. Not scratched by the knife.
8. Topaz. Harder than flint.
9. Sapphire. Harder than flint.
10. Diamond. Harder than flint.

With a knife, piece of glass and a copper coin, the hardness is soon determined, and a clue to its name and value obtained.

The minerals which, like quartz, are not scratched by the knife are seldom of value as ores. Their principal uses in the arts are as ornaments, or in cutting and polishing: for example, diamonds, agates, beryls, garnets, topaz, tourmaline and corundum. The most remarkable exception to this is capiterite, an oxide of tin, with a hardness 6 to 7, infusible and insoluble, but which gives the blowpipe reaction for tin.

Ores of metals are usually heavy; and with a small pair of accurate balances, the specific gravity is easily taken. Suspend the mineral freely by a horse hair, from one end of the beam or scale pan, and weigh: next allow it to hang freely in a tumbler of water and weigh again; divide its weight in air by its loss of weight in water, and the result is its specific gravity.

The acid test is also easily applied. Effervescence indicates a carbonate, and is frequently some form of limestone. Iron ores usually dissolve in warm acid, especially if pulverized. So too most other ores of any commercial value are dissolved more or less rapidly by acids and heat.

GOLD AND PYRITES.

Gold and platinum occur in the metallic state and are dissolved only by *aqua regia*. Gold does not occur in large masses nor is it often crystallized. All these serve to distinguish it from iron pyrites, or fool's gold, of which so many specimens are sent to us for analysis. When pyrites are heated on charcoal before the blowpipe, they give off the well known sulphurous acid fumes and form a magnetic globule. Gold fuses. The specific gravity of gold is 15 to 19, that of pyrites 4·5 to 5; pure gold is scratched by a copper coin, pyrites are not easily scratched by the knife. Copper pyrites, chalcopyrites, are of a darker or brass yellow color, not so hard as iron pyrites, and dissolve in acid with a green or blue color.

TESTS FOR SOME METALS.

When gold is dissolved in *aqua regia*, the solution should give a purple color with protochloride of tin solution. Gold is also precipitated by sulphate of iron as a brown powder.

Silver dissolved in nitric acid gives a white precipitate with hydrochloric acid, which precipitate is soluble in ammonia. Mixed with carbonate of soda and heated on charcoal before the blowpipe, compounds of silver give white, brilliant metallic globules.

Lead also gives a white precipitate with hydrochloric acid, but it dissolves in boiling water. With bichromate of potash or iodide of potassium, a beautiful yellow precipitate is formed. Its compounds are very readily reduced on charcoal. Galena often contains silver, which can only be separated from the lead by an assayer.

Very dilute solutions of iron yield dense blue precipitates with yellow prussiate of potash. Since the acids sometimes contain iron, they should be tested first, and the solution greatly diluted. Ores of iron give characteristic black, brown or red streaks on unglazed porcelain.

Lime gives a precipitate with oxalate of ammonia. Barium is precipitated with lime by sulphuric acid.

Zinc and tin are not very difficult to reduce with a blowpipe, and the coatings formed give characteristic shades of green when moistened with nitrate of cobalt.

If our friends, who think they have discovered a rich ore of some sort, will take the trouble to apply the above simple tests, they will frequently ascertain for themselves that it is not all gold that glitters.

SCIENTIFIC AND PRACTICAL INFORMATION.

EFFECTS OF OPIUM.

In China, very few physicians employ opium for therapeutic purposes, though the drug plays an important part through its effects upon the customs and hygiene of the nation. In smoking opium, the taste at first is not unpleasant; but as is the case with tobacco, a person must become habituated to its use. The drug is prepared in a semi-fluid state and has a sweet oily flavor somewhat resembling rich cream. Smoking the substance for the first time, not over 130 to 150 grains per day can be used, as it is apt to cause violent vertigo, nausea, and headache. The first puffs render the smoker loquacious, then he becomes stupidly happy, and finally paleness and quick contractions of the face ensue. The sensations and dreams differ according to the temperament and nervous organization of the user. A deep sleep is generally produced lasting from two to three hours, during which time the pulse is low and very feeble. The physical effects are loss of appetite, extreme emaciation, and, frequently, idiocy.

THALLIUM FROM VESUVIUS.

Professor Palmieri has made many spectroscopic analyses of the sublimations of the fumeroles, or small holes on the crust of the volcano of Vesuvius through which vapors escape, and finds the metal thallium in most of them.

Thallium is the new metal discovered in 1861 by Dr. Crookes. In weight and appearance, it resembles lead. When burned in oxygen it yields a splendid green flame, and its chlorate, it is supposed, might be used in fireworks to advantage. Thallium is found in various mineral waters; its sulphate is very soluble in water.

IMPORTANT AFRICAN DISCOVERY.

A dispatch to the New York *Herald*, from the exploring expedition of Sir Samuel Baker in Africa, announces the discovery that the great lakes Tanganyika and Albert Nyanza are connected together, and communicate with the Nile, forming an inland sea seven hundred miles in length. Further, that vessels launched on the Nile above Murchison's Falls will be able to sail thence into and through the great lakes. This is a very important discovery, as it brings an immense and fertile portion of interior Africa into easy communication with the civilized world.

OZONE BY SLOW OXIDATION.

If a small quantity of petroleum benzine be placed in a large vessel and exposed to direct sunlight for a few days in summer, the vessel being frequently opened and shaken, the air in the vessel will contain ozone. The same change will take place in diffused daylight, or even in the dark and at a low temperature, but a much longer time is required. The slow evaporation seems to be the chief cause of this. This has been observed by Fudakowski, who published a full description of the oxidizing action of this active benzine in the "Proceedings of the Berlin Chemical Society."

HOW A SURGICAL DISCOVERY WAS ACCIDENTALLY MADE.

The *Aertzliche Hausfreund* is responsible for the following account of the cruel misdeeds of a brutal woman leading to the discovery of an important method of performing painless surgical operations.

A wicked stepmother placed a net upon the head of her eleven year old stepdaughter, and compelled her to wear it for two weeks continuously. On the 5th of March, 1872, the girl, suffering with headache, was brought to the clinic of Professor Dr. Dittel. Dr. Dittel made a careful examination of the head and found a deep furrow plowed into the head, at the bottom of which was the elastic cord of the net, covered with little caruncles. The poor girl died of inflammation of the cerebral membrane, and upon dissection it was found that not only the pericranium but also even the skull bones were cut through as if with a sharp saw. This proved what power is exerted by elastic cords, and since then Dr. Dittel has employed them for cutting off tissues and removing swellings and tumors. By this gentle means, the patient does not lose a drop of blood, suffers scarcely any pain, has no fever, and soon gets well. This method seems to have a great future in store for it. Many patients are so horrified by the sight of the dreadful knife that the date of their recovery is postponed by it, even if they do not faint quite away.

PROGRESS OF INSTANTANEOUS PHOTOGRAPHY.

During the recent naval review in honor of the Shah of Persia, at Portsmouth, Eng. a number of photographs were taken by means of dry plates, prepared by the use of the salts of uranium, after the process of Colonel Stuart Wortley. The steam vessels in motion, views of the ships with the men in the act of clambering into the rigging, yachts in full sail, all were produced in faultless perfection by the instantaneous exposure of the plates.

LA NATURE is the title of a new French illustrated scientific weekly, published in Paris. It is edited by M. Gaston Tissandier, a well known *littérateur* and *savant*, and enters a field, similar to that of the English periodical of like name, of popular science and the diffusion of recent and interesting industrial information. The journal is handsome in appearance, and in this wise rather above the standard of French newspapers; the two numbers received are well edted and entertaining.

NEW METHOD OF PROTECTING THE PLATES OF IRON SHIPS FROM CORROSION.—To prevent the corrosive action of bilge water upon the iron plates of iron ships, James Young has suggested and tried the use of lime, to neutralize the acid of the water. Actual experiment, continued for several months, shows that a small quantity of lime in the bilge water wholly prevents the corrosion of the iron plates.

A SUBSTITUTE FOR THE BELL CORD.

In a recent number of the *Engineer*, almost two entire pages, with engravings, are devoted to the illustration and description of Mr. S. A. Varley's electrical contrivance for giving a signal from a car of a train to the engineer of the locomotive. A bell and magnet, with a peculiar arrangement of levers, are employed, together with a device for indicating the compartment of the car where the signal was given.

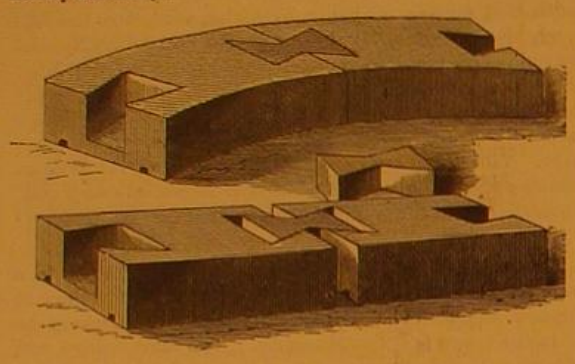
The reading of Mr. Varley's paper probably occupied an hour's time of the Society of Engineers.

There must be a defect either in the construction of British railway cars or in the moral status of British passengers; otherwise the use of the simple bell cord, so successfully employed on all American cars, would long ago have been introduced in England.

But it appears to be a fact, confirmed by actual experience on the British railways, that no sooner is a cord put on the cars than the passengers at once begin to amuse themselves by pulling it, sounding false alarms, bringing the train to a halt, and producing mischief in a variety of forms. The railway companies appear to be powerless to prevent this unauthorized pulling at the bell rope, and are obliged to discard its use altogether.

IMPROVEMENT IN BRICKS.

M. Emile Pavy has recently devised a connected brick, or rather, more strictly, a mode of combining bricks, for building purposes. The nature of the invention, as shown in our engraving, is readily understood. In the extremities of each brick are pressed or cut dovetail mortises which, when the former are placed end to end, come together. Into these portions a connecting piece of suitable form is slipped, which holds the bricks tightly together, mortar, at such points, being merely auxiliary.



The bricks may be made either square or curved and of any size. They are well adapted for constructing vaulting, each being formed to suit the shape of the arch and provided with a number of mortises proportionate to its size. The circular pieces may be used with advantage in the building of lighthouse or other towers. The *Chronique de l'Industrie*, to which we are indebted for our facts, says that the method has been used in France to considerable extent and with excellent results.

NEW SAFETY PUMP FOR SEA GOING STEAMERS.

Quite a valuable device, judging from what it is claimed to have done, has been invented for freeing sea going steamers from the excess of water taken in by leakage or through accidental injury. It is an attachment to the air pump, and consists of a pipe, of suitable dimensions, leading from the hold of the vessel to the top of the former and connected therewith with a valve. Water is taken up, through this conduit and on top of the air pump buckets, with every descent of the piston, and is discharged, with the condensed water and air, overboard through the usual channel.

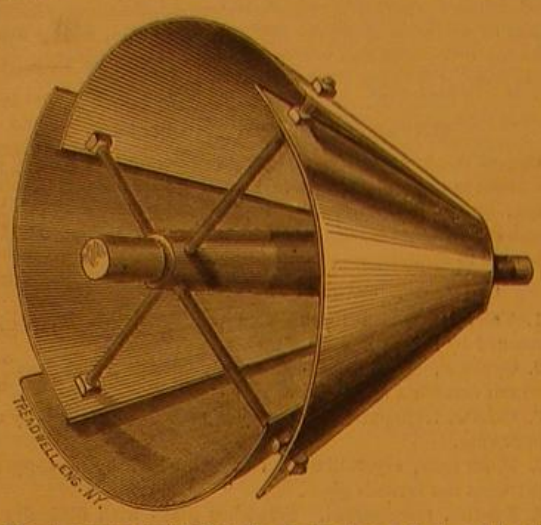
The inventor, Mr. Daniel Barnum, of No. 255 Halsey street, Brooklyn, N. Y., claims that the entire power of the air pump is thus utilized to clear the vessel, and this without interfering with the working of the engines. The arrangement has been placed in two vessels, in one of which, the Saratoga, after she had been pierced with quite a large aperture below the water line, it was, in connection with the other pumps, instrumental in keeping her afloat until repairs could be made. The ship in which the device was most recently placed is the Niagara, of the Old Dominion company's line, now lying at her wharf in this city in a damaged condition, from injuries received during a severe gale encountered during the passage from Bermuda to New York in February last. The storm, according to the statements of the officers, was so violent that the vessel was caused to leak and also to ship large quantities of water, so as to excite serious fears as to her safety. It is stated that, with the air pump attachment in operation together with the usual ship pumps, little difficulty was found in keeping the vessel free from water, so that her surviving the gale is largely ascribed to the efficacy of the former apparatus.

Mr. Barnum informs us that the device was patented as far back as 1858, but that he has met with much opposition to its introduction from the steamship owners and engineers, owing to their belief that it was impracticable. He considers the two cases above cited to fully prove its efficiency; and from the views expressed to us by officers of both vessels, there appears to be considerable foundation for his claims.

It is stated that alloys of nickel and German silver with from one to twenty grains of platinum are preserved from oxidation, and that aluminum bronze acquires a permanent brilliancy by the admixture of a small quantity of the precious metal.

IMPROVED PROPELLER.

Mr. E. C. Hubbard, of Green Bay, Wis., has recently invented the new propeller wheel illustrated herewith. The shaft is inclosed in a sleeve which terminates in a conical hub, to which are attached the curved and tapering blades shown. The sleeve is hollow, and, for the purpose of expelling the water more rapidly from the center of the wheel, is made tapering, or larger, at the end next the hub. The radial stays support the blades, and, by means of the nuts and screws, serve to adjust the size of the openings between them.



The inventor states that the device is not designed to disturb or displace the water, which, on the contrary, is drawn into or clasped by the wheel, and, when ejected, forms a powerful resisting force. In backing the motion is reversed, and a vacuum created inside the wheel. The inventor claims that his method is more powerful than the common screw and has greater speed. It is stated that it can retain a certain rapidity with 100 pounds of steam, while a screw would require 140 pounds. A new steam yacht, to which the invention has been applied, was recently tested at the Washington navy yard with very successful results, being propelled without the least jarring and with perfect smoothness. The dimensions of the propeller were 22 inches length by 30 inches diameter.

IMPROVED OX BOW.

This is a patented ox bow which, it is stated, does not require bending, and which may be made in parts of the country where timber suitable for the ordinary bow is scarce, without requiring much mechanical skill to make.

As shown in our illustration, the neck piece is made of metal with socket holes in its ends for supporting the straight pieces which are secured therein by means of screw bolts. The tenons may extend clear or only partly through the lower portion, which may be either solid or hollow, and of any form to suit the proper curve for the neck of the ox. Any kind of timber for the wooden, and any suitable material for the metallic, portions may be employed. This is quite a

convenient and economical device, which will doubtless be appreciated by farmers generally. Patented May 24, 1870. For further particulars, address the inventor, Mr. A. L. D. Moore, of La Grange, Fayette county, Texas.

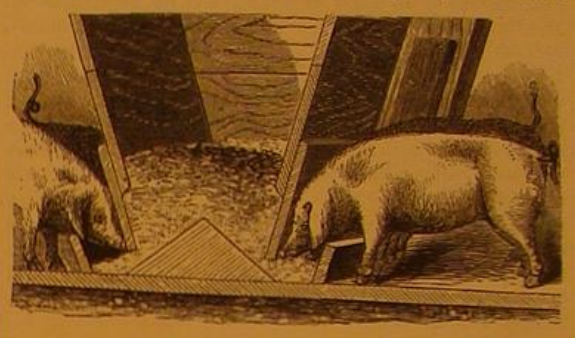
A Scientific American in Prussia.

An accident occurred the other day, says the *Pall Mall Gazette*, upon the Hartz mountains, the circumstances of which, as reported, are highly honorable to a young American concerned. This gentleman, Mr. Tatham, formed one of a party of student excursionists from the Prussian School of Mines. It proved nearly dark when they reached the chasm and looked down it. Unhappily one of the party, a German named Krăwel, somehow lost his footing, and was precipitated down the precipice, at the edge of which his companions were standing, into the depth below, where all sight of him was lost. His comrades dispersed in search of aid, but it proved too late to do anything effectual before night completely closed, and their dismay was increased greatly when they missed Mr. Tatham, who was supposed to have perished in a vain attempt to rescue Krăwel. At dawn the other students were on the spot with plenty of aid, and to their surprise saw the gleam of a fire, far below, in the chasm into which their comrade had fallen. It turned out that Mr. Tatham had managed to scramble down after the fallen man by the aid of bushes and rocks, and finding the object of his search, though terribly bruised, still alive and partly sensible, had tended him through the night, covering him with his own outer clothes, and keeping up a fire of sticks, both against the cold and as a signal for aid from above. Although the hight down which Herr Krăwell fell or more properly rolled, is reported to be over 200 feet, he had broken no limb, and was making a good recovery at the last accounts, thanks to Mr. Tatham.

PATENT PIG FEEDER.

This device has for its object to enforce, by physical means, upon the comprehension of pigs, a certain amount of neatness during meals, which experience has shown cannot be impressed upon their understandings by any source of argument however cogently or logically stated, in other words, it prevents them putting their feet in the trough. It also aims, by regulating the supply of food, to check those habits of gluttony of which no hog is able to divest himself, and which, as in case of the gaunt frequenter of New York boarding houses, may be traced to the chronic and unappeasable state of internal famine in which he exists.

Corn or other food is thrown in the receptacle, the sides of



which are inclined inwards. Upon the bottom a dividing bar, having sloping sides, is placed, between the surface of which and the lower extremities of the receiver openings are left closed, by movable slides. The latter can be moved up and down to enlarge or diminish the size of the orifices, through which the food passes to the troughs. It will be observed that by no amount of contortion can the hog insinuate himself into the latter vessels, for the reason that, through the outwardly inclined sides of the reservoir, a space is left only big enough for him to insert his head. Food is fed out as it is wanted and is, besides, kept in a cleanly condition. For this useful improvement in its table furniture, the porcine family is indebted to Messrs. J. H. McElrath and L. M. Houghton, of Princeton, Ill., who patented the same August 20, 1872.

The Palinurus.

At a recent lecture in this city before the Nautical School, Dr. Thoms stated an interesting theory to account for the loss of the steamship City of Washington. The disaster, he held, was caused by a deviation of the ship's compass, occasioned by the electrical condition of the atmosphere consequent upon the appearance of the aurora borealis during the voyage. He exhibited an instrument, called the palinurus, employed to detect and note the variations of a ship's compass during a voyage. The Lapland, which sailed from England only a day after the City of Washington, carried such an instrument, which showed that, during the appearance of the aurora borealis, her compass deviated $1\frac{1}{2}°$. This deviation, occurring as it must have done on the City of Washington at the beginning of her voyage, would cause her to diverge 20 miles from her course in every hundred, and she was only 150 miles out of her reckoning when wrecked.

Some of the witnesses examined during the recent government inquiry testified that they believed that the loss of the vessel was due to deviation of the compasses, caused by the iron and steel of which her cargo was chiefly composed.

The New Hotels of Chicago.

The splendor and large extent of the new hotels in Chicago may be judged of from the following: The Pacific hotel is 325 feet by 186; the Wilton carpet, of American manufacture, which covers the halls, is more than a mile long; there are twenty miles of wire in the house, 500 bedrooms, equal in size and quality from the first to the seventh floor, and it takes 218 servants to attend to the guests. There are six acres of carpeting. The whole cost of the establishment was $1,200,000, and the furniture cost, besides, $400,000.

The new hotel of Mr. Potter Palmer is almost ready for occupancy. Its cost will be $2,000,000, and it is claimed to be fireproof. All the floors, beams and rafters are of iron; patent tile partitions are used, and the marble decorations surpass anything of the kind in the world.

CHANGEABLE PLOW POINTS.—In regard to the suggestion of L. L. B., on page 383 of our volume XXVIII, P. F. B. writes to say that the idea has been carried out by T. Edmunds, who has patented the invention.

From the Fourth Annual Report of Charles V. Riley, State Entomologist of Missouri.]

THE PERNYI SILKWORM.

Attacus [*Antheræa*] *Pernyi*, Guér-Mén.—(*Lepidoptera, Bombycidæ.*)

This is an oak-feeding silkworm which has been introduced from northern China, and closely resembles *yama-mai*, published in the SCIENTIFIC AMERICAN, June 23, 1873. It was named after M. Perny, a missionary who, in 1850, sent it to France from Mandchouria, China. It has been cultivated in Europe with better success than has attended the culture of *yama-mai*; and in this country, the success with it has also been greater. It developes more rapidly than the *yama-mai*, and differs essentially from that species in being double brooded, and in passing the winter in the chrysalis state, like *cynthia* and our native species. This trait gives it a great advantage over *yama-mai*, as not only can more silk be produced, but we can more easily obtain sound eggs. It is also less affected by confinement indoors. Its cocoon is not so valuable, though ranking third best of the eight species treated of.

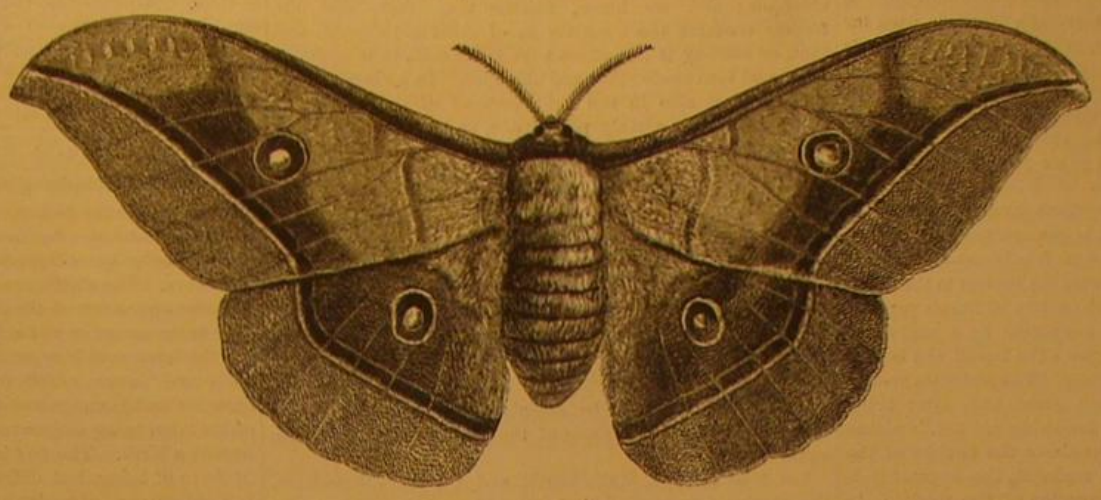


FIG. 1. THE PERNYI MOTH, FEMALE.

The egg (Fig. 2, enlarged and natural size) is of about the same size, form, and color. The worm in the first stage is of a chocolate brown, with the tubercles reddish and emitting reddish bristles. In the second stage it is yellowish green; in the third and fourth it becomes greener, while silvery spots begin to show at the base of the anterior tubercles. In the last stage it is of a dark green with a faint reddish lateral line over the stigmata; the head and legs are light brown with black spots, and the triangular anal mark is chocolate brown. In form and general appearance it resembles *yama-mai*.

The cocoon (Fig. 2) is suspended by a cord, which does not, however, materially affect its reeling properties, as it is attached only to the loose outer silk. The silk is yellowish gray, stout, brilliant, and valuable. It is almost twice as thick as that of *yama-mai*, and stuffs made of it are said to have the appearance and nature of mixed silk, cotton, and wool.

Fig. 2. Cocoon and egg of Pernyi silkworm.

The moth (Fig. 2, female) bears a striking resemblance to *yama-mai*, and varies nearly as much in color. The tips of the front wings are generally a little more curved; there is less black about the eye spots, the hind wings are less produced behind, so that their transverse band is more in a line with that of the front wings, and the ground color is usually darker and more uniform.

In China, the species is reared in the open air in a wild state, and also indoors on cut branches kept fresh by insertion in vessels containing water. In this country, Mr. Andrews obtained cocoons from the first brood of worms by the 4th of July; the moths began to issue three weeks later; copulation immediately ensued, and by the middle of August, or about ten days from the time of laying, the second brood of worms began to hatch. He also found that the worms would feed on beech and sweet gum.

Austrian Railway Cars.

The English passenger, when traveling in Austrian carriages, will notice with little comfort the heavy rattling and jingling that surrounds him, disturbing his night's rest and exciting his nerves in a painful degree. The cause of this is that but few of the means, long used in England to secure quiet running, have been adopted in Austria. The panels of the carriages are not made as in England of wood or papier maché, but of thin sheet iron, which can never be secured in such a firm manner as to prevent shaking, and which conducts the sound and the heat in a more disagreeable manner than the former materials, thus making the carriages hotter in the summer and colder in the winter. Besides, the frames consist in nearly all cases entirely of iron, this construction increasing the noise made by the moving of the chains, brakes, and the movable parts of the heating apparatus. Layers of india rubber between body and frame are seldom applied, and wooden disk wheels, which so greatly improve the easy running of the carriages, are practically unknown on Austrian railways, although we notice in the exhibition one carriage—a hunting saloon for the Emperor—which is fitted with them. Finally, the bad custom has been adopted of providing passenger vehicles with brakes fastened directly and rigidly to the body of the carriage, the play of the springs thus ceasing at once as soon as the brake is put on. An unbearable and, for the health of nervous passengers, often injurious rattling is thus produced, against which the passengers of our English railways would certainly protest. Unfortunately the press of Austria is often in the pay of the railways, the result being that it is impossible to get any complaints published.—*Engineering.*

Phenolcyanine.

This new substance is derived from phenol, and appears to me to possess considerable interest, from the analogies it presents with certain coloring matters derived from lichens, and inasmuch as it may perhaps throw some light on the constitution of indigo. It is obtained directly from phenol by dissolving the latter in alcohol, adding liquid ammonia, and allowing the mixture to remain for some weeks in a partially closed flask; but, in about fifteen days, when the liquid has become a rather dark green, twice its volume of water and one quarter of its volume of ammonia are added, and the mixture is left to itself for about six weeks. By this time the liquid has taken a very fine blue tint, very dark, and a certain quantity of phenolcyanine is found at the bottom of the vessel and adhering strongly to the glass. That which remains in solution can be collected by saturating the liquid with salt. The product is thrown on a filter, and the new substance dissolved in hot alcohol or benzol, from which it is obtained by evaporation.

Properties.—Thus obtained, phenolcyanine is a resinous substance of a very dark blue, nearly black, and showing metallic copper colored reflections like indigo. In alcohol, it forms a fine deep blue solution, in ether a reddish purple blue, and in benzol a reddish purple solution. Concentrated sulphuric acid dissolves it easily, forming a bluish green liquid; hydrochloric acid has little action; and nitric acid forms a nitrous compound very different from picric acid. Phenolcyanine is very slightly soluble in water, but dissolves in hydrated alcohol to which ammonia is added, and this solution can be considerably diluted with water. These alkaline solutions are deep sky blue by day, but of a vinous red by night or when a flame is seen through them. Acids redden these solutions, and alkalies bring back the blue, as with litmus. Nascent hydrogen reduces phenolcyanine, and renders it completely colorless; but when the solution remains exposed to the air in presence of ammonia, the blue color soon returns. A mixture of ferrous sulphate and lime does not destroy the color of phenolcyanine as it does that of indigo blue; so that the former rather resembles the colored derivatives of orcine than it does indigo. Phenolcyanine melts very easily, and can be partially volatilized in purple vapor; the remainder is decomposed, and leaves a porous charcoal.—*Dr. T. L. Phipson, in Chemical News.*

Stellar Photography.

Professor C. S. Sellack, of the Cordova University, Argentine Republic, says that the objects of the southern heavens are numerous and glorious. He has photographed some twenty star clusters, most of them in the constellation *Argo*, some in *Canis Major* and *Scorpio*. The cluster near *Carinæ Argus* gave a hundred and twenty-three stars on the photograph in the most favorable night. The *Pleiades*, the richest northern group, did not yield to Mr. Rutherford more than forty-five stars.

In a recent communication in the *American Journal*, he states:

The greatest difficulty in stellar photography is to make the image on the plate stationary during a long exposure. The steadiness is absolutely necessary for the production of circular images; the images must be circular, because in elliptically lengthened images the eye cannot fix the center with the sharpness required for the measurements. Employing even the most perfect clockwork, the steadiness of the image is affected by the effect of the atmospheric refraction, by the variations in the refraction produced by disturbances in the atmosphere, and by the increase of refraction dependent on the zenith distance.

The photographic image of stars is circularly spread by prolongation of exposure; this is principally the effect of the scintillating motion of the image, not of want of definition, as its amount depends on the state of the atmosphere. Bond has found the increase of the area of the image proportional to time. This admits the explanation of the scintillating motion as consisting of transversal vibrations round the central position in all azimuths, and with uniform velocity. When the state of the atmosphere produces a strong scintillating motion, the images of bright stars become very large by long exposures, and faint stars do not produce any impression. In great zenith distances, another obstacle combines with the increased scintillation the strong absorption of chemical rays by the atmosphere.

Petrified Tree Stumps in Colorado.

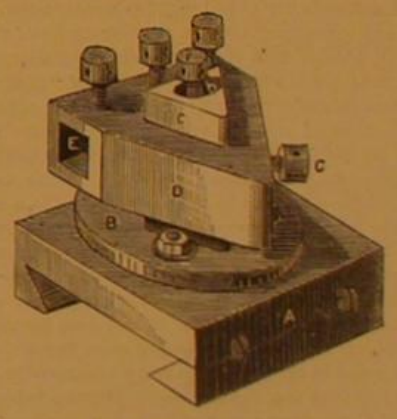
A correspondent of the New York *Sun*, writing recently from Colorado, gives an account of a visit to the famous petrifactions existing near the residence of Judge Castello, thirty miles west of Pike's Peak

Within a square of a half mile, there were thirteen of these petrifactions. All but one had been ruined by curiosity seekers. That one had evidently been a tree of gigantic size. It stood at the foot of a picturesque ledge of rocks. The stump arose from the soil to the hight of three feet, and it was at least ten feet in diameter. Though preserving the grain and even the color of the wood, it was a mass of solid stone. The heart of the tree bore a beautiful polish. The petrifaction was smooth and hard, and resembled the creamy whetstone that used to be so common in the East. It was more brittle, but it would sharpen a razor or a knife as quickly and as well as a whetstone. Where the sun had baked the wood dry and black before it was turned into stone, the color and the almost imperceptible cracks in the grain of the wood were perfectly preserved. Some of the splinters of the stump seemed to have been rotten before petrifaction, and presented a remarkable appearance. They were pure stone, but their edges were frayed, like the chewed end of a rattan, and the stone was so thready and limber that in some cases it might be used as a paint brush. Most, if not all, of the trees seem to have been spruce or pine, though the large stump looked like the Southern cypress. The gum or rosin exuded from their trunks is petrified. It sparkled in the sun like tiny dew drops. Occasionally, when pieces of the stone were cracked open, great flakes of petrified rosin were revealed. They encrusted the wood like frosted silver.

NEW TOOL HOLDER FOR THE SLIDE REST.

E. ELSMLIE SANO, C. E.

On the ordinary upper plate, A, of the slide rest, a circular



⊥ groove is turned for bolts to work in, for the purpose of fixing a round plate or turntable, B. From this turntable, a prism, C, projects of such a length as to suit the variety of work or the raising pieces that are generally used with the lathe. On this prism there is fitted a piece, D, which may be called the tool holder, with a horizontal square hole, E, of sufficient size to admit the largest turning tools that may be required, the tool being secured in the hole with binding screws in the usual manner. This tool holder is kept at the proper hight by means of a screw, F, working in a projection from the tool holder, a vertical hole being made down one of the faces of the prism for this projection to pass through, the point of the screw bearing on the bottom of this hole. It is best to keep this supporting screw as near to the tool as possible. By turning this screw, F, in or out, the tool is raised or lowered at pleasure; and when adjusted to the required hight, the holder is fixed in position by means of a binding screw, G, at the side. It will be seen that by this arrangement the upper sliding plate is never bent, however securely the tool may be fastened, as the bolts which work in the ⊥ groove merely bind together two flat surfaces. Then the tool may be moved horizontally to any required position without disturbing the hight, or the hight may be altered without otherwise disturbing the position of the tool. For the purpose of recording as well as assisting in placing the tool horizontally, the edge of the turntable is graduated. —*English Mechanic.*

A GENTLEMAN who has tried it says the best way to catch a rat, which has found its way into your room, is to lay a boot flat upon the floor, close to the mold board. The rat will run into the boot leg for protection, when he is readily captured.

A SPLENDID passenger depot is now in course of erection in Washington by the Baltimore and Potomac Railroad Company. The building is 137 by 510 feet, and located at the corner of 6th and B streets

ON THE MANUFACTURE OF VINEGAR.

BY PROFESSOR L. A. BUCHNER.

Much has been said and written about the formation of acetic acid and the manufacture of vinegar, yet a few observations upon the various theories and methods may be useful. In studying the conversion of alcohol into acetic acid, there is nothing more interesting than the process, first accurately observed by Döbereiner, where alcohol is converted into acetic acid by means of finely divided platinum called platinum sponge) or platinum black, or rather its oxidation by the condensed and chemically active oxygen in its pores. In my opinion, the simple apparatus devised by that celebrated chemist for demonstrating this change illustrates the formation of acetic acid better and makes it more intelligible than the cask filled with beech shavings, which is used for the rapid formation of vinegar, where the dilute spirits trickling over the shavings are converted, by the circulation of the air and a suitable temperature, into vinegar. Döbereiner's experiment must be considered as the fundamental experiment for representing the vinegar formation, and makes the operations which take place in this process very simple. A suitable modification of Döbereiner's vinegar apparatus, which was first described and illustrated in Schweigger's "Journal," vol. 63, is constructed as follows:

Enough alcohol, diluted with 4 or 5 volumes of water is placed in a large beaker glass to cover the bottom to the depth of half or three quarters of an inch; a strip of litmus paper is suspended in the beaker, being supported by a perforated glass cover, one end projecting above the top of the beaker while the other reaches to the bottom. The platinum sponge is placed on a little dish or watch glass, and, after being slightly moistened to prevent its becoming red hot, is placed on a glass support a short distance above the surface of the alcohol. The glass cover being replaced, the apparatus is gently warmed to cause the evaporation of the spirits. As soon as this is done the litmus paper begins to redden, thus showing the acid formation. The alcoholic odor is first converted into a pleasant smell of fruit, due to Döbereiner's so called oxygen ether, a mixture of aldehyde and acetal. In a short time, however, the odor of acetic acid is recognized, and the alcohol is soon all converted into acetic acid.

In order to account for the *role* which the platinum sponge plays in this instructive experiment, we must recollect that platinum in this state has the property of condensing oxygen in its pores and thereby increasing its chemical activity to such an extent that it is able to oxydize the alcohol and convert it into acetic acid. Döbereiner found that very finely divided platinum, prepared by precipitation, absorbed, on drying, 200 to 250 times its volume of oxygen without combining with it chemically, and that it condensed it with a force equal to a pressure of 800 to 1,000 atmospheres.

Döbereiner's experiment offers a very strong proof that the conversion of alcohol into vinegar is an oxydizing process which can take place without the presence of "mother," of vinegar germs (*mycoderma aceti,*) or of any other organisms. The rapid method of making vinegar from dilute spirits, introduced by Schützenbach, in 1823, rests entirely upon the same principle. The beech shavings, owing to their power of absorbing and condensing oxygen, act in a manner similar to the platinum sponge, but less energetically. Beside these, there are many other substances which act in the same manner, such as finely divided grape vine, grape stems, bits of wood charcoal, etc., all of which condense oxygen and are used to convert spirituous liquors into vinegar. In some countries it is customary to allow cider to trickle down a rope suspended in the open air to make vinegar of it. This process, no less than the Schützenbach process, depends on the action of the oxygen condensed on the surface of the decaying organic bodies.

Pasteur's latest experiments have proved beyond doubt that, in the conversion of fermented liquors into vinegar, in the manufacture of wine, malt, or beer vinegar, the vinegar germs generated in these liquors play an essential part. But, although the mother formed exerts this power, it certainly does not do it as a physiological or vital act, but works upon the same physico-chemical ground as the platinum sponge and the decaying vegetable fiber. Many suppose, with Pasteur, that, even in the rapid vinegar process, the vinegar is formed by germs or fungi, and that here too the shavings and charcoal act only in this way: namely, that *mycoderma aceti* are generated upon them. But this opinion is entirely upset by the observations made by the late Baron Liebig in Riemerschmied's vinegar works in Munich, which are among the largest and best conducted in Germany. In this manufactory, the dilute alcohol has no foreign substance added to it during the whole operation, and is acted upon only by the atmospheric air and the surfaces of the shavings and charcoal. When a fresh quantity of dilute alcohol is to be poured in, it is only mixed with some of the partially formed vinegar of the previous operation. Upon Professor Liebig's asking Mr. Riemerschmied about the action of *mycoderma aceti* in making vinegar, the latter presented him with a sample of beech shaving from the lowest layer of a vinegar generator which had been used in this way uninterruptedly for 25 years. No *mycoderma aceti* could be found on this shaving when viewed under the microscope, although it had become brown from the decay of the wood, but the structure was unchanged. This leaves nothing more to be wished for on the subject of the quick process in making vinegar.

In the conversion of alcohol into vinegar, we have to distinguish two stages in the action of the oxygen upon the alcohol. In the first place, the oxygen abstracts two atoms of hydrogen from a molecule of alcohol to form with it water; the aldehyde thus formed then takes up an atom of oxygen, whereby it is converted into acetic acid.

That the alcohol is not directly converted into acetic acid by the action of the oxygen, but that aldehyde is first formed, has been proved by several experiments. Döbereiner found that when 70 per cent alcohol was exposed to the action of the air and finely divided platinum, in his acetic acid apparatus above described, only long enough to begin to cause effervescence in chalk, and was then neutralized with pulverized carbonate of soda and afterwards distilled, a distillate was obtained, from which, on mixing with much powdered chloride of calcium, a large quantity of an etherial liquid separated, which he called oxygen ether. We now know, from the important works of Liebig, that this liquid consisted principally of a mixture of acetal and aldehyde; and we know, farther than that, that the former contains the constituents of ether and alcohol, and that, on heating it in contact with acetic acid, it is actually converted into acetic ether and aldehyde. In a vinegar manufactory, and also in the neighborhood of one, the same etherial smell is plainly perceptible, as is noticed at first when alcohol is oxydized by platinum sponge; and in vinegar from brandy, also, there is still some acetal or so called oxygen ether. When such vinegar is saturated with carbonate of soda, and evaporated for the preparation of acetate of soda, the whole laboratory is filled with this etherial odor.

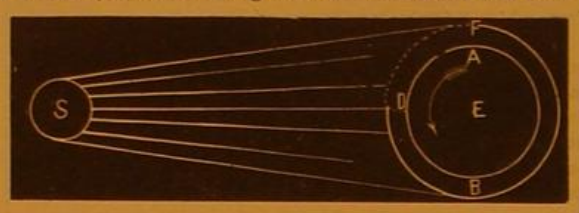
Correspondence.

Westward Movement of the Upper Atmosphere.

To the Editor of the Scientific American:

An explanation may be afforded of the prevailing east winds in the higher regions of the atmosphere, under the equator, in this wise:

Let S be the sun, E the earth, and A F the atmosphere, the earth revolving east in the direction of the arrow. The atmosphere, in passing from A to B, becomes expanded by the direct action of the sun's rays; but as this expanded air is carried rapidly eastward by the earth's rotation, the more expanded portion is always eastward of the meridian; but in passing further around, during the night and in the absence of the sun's rays, through radiation, it shrinks to its lowest limits just before sunrise, at the point, A; as it again comes under the direct rays of the sun, it begins to expand, and flows or falls back westward in the direction of the dotted line, by reason of the greater contraction and less resistance in that direction, and also as affected by the earth's rotation eastward. The expanded particles, as they ascend in currents from the surface of the earth into the upper regions of the atmosphere, are constantly falling back of the meridian, the earth as it were sliding eastward under them, causing them to impinge westwardly. These winds thus move northwardly until they encounter the expanded volume of the atmosphere, as it is again brought around from the east, and continue until equilibrium becomes restored there, when they begin to fall, and curve toward the poles, where a still greater shrinkage is constantly taking place; and as they move in this direction, they are carried northeastward or eastward, when they reach the middle latitudes, by reason of their equatorial momentum.



It will be seen, therefore, that these main prevailing currents of the atmosphere are put in motion, in the mode indicated by the unequal expansion and contraction of the atmosphere, as effected by the earth's rotation.

W, L. M.

The Rights of Authors and Inventors.

To the Editor of the Scientific American:

In your issue of July 5 occurs the following sentence: "The invention by an individual of a new device, by which his fellow men are benefited, does not entitle him, by any process of natural right or natural justice, to be a monopolist over his fellows, in respect to such article." Believing that the inventor is entitled to legal protection by right, and hoping to see his claims advocated as much in the name of justice as in the name of expediency, I beg leave to disagree with you in this particular.

What is the difference between intellectual and material property? Both are the direct offsprings of labor; both are beneficial to others besides the possessor; and both have no existence save that which is allowed them by the law. Then why not accord to both the same protection under the law? No one (unless it be a rank communist) will assert that the grain which the farmer has sown upon his own land and harvested by his own labor should become the common property of the whole community. Why? Because the inner consciousness of each and every man tells him that labor bestowed upon an object gives the strongest title to possession. If this be true, the claims of the author and the inventor to the proceeds arising from their respective callings are as incontestable as those of the farmer and the mechanic. After Noah Webster had passed long and weary years in perfecting his dictionary, than which no prouder tribute to the genius of industry can be found in the English language, would justice have denied him the ownership of that great work? After McCormick has devoted his time and his talents to the invention and the introduction of his celebrated reapers, the use of which adds so much every year to the national prosperity, shall we say that he has no right to the protection which he now enjoys? When we say this, let us also assert that the farmer has no right to the grain which he has cultivated, and the mechanic no right to the cart which he has constructed.

Although intellectual property should stand upon the same foundation with material property before the law, it does not follow that we should make patents and copyrights absolute and perpetual. There are no absolute and perpetual rights of property. All rights of property are subordinate to the national welfare. The interests of our country demand that the ownership which a citizen acquires in lands and tenements shall be subject to no limitations with respect to time. But this does not follow where an individual has obtained a monopoly over a particular article. When such is the case, the dictates of the national well-being require that the monopoly shall not become perpetual.

Roxobel, N. C. JOHN E. TYLER.

The Natural Rights of Inventors.

To the Editor of the Scientific American:

You reiterate the declaration that the right, termed patent, is not a natural one, but a species of tyranny, vested in a patentee only by sufferance, or by expectancy of a justifiable return. The distinction thus made is calculated to beget or foster opposition to the claims of inventors. Club rooms long since agreed to put a limit to the bold declaration, of our Declaration of Independence, that "all men are born free and equal," a man's birth being a matter of date sometime after his exit from the womb of nature, and the circumstances of his birth being as great sometimes as the circumstance of having a birth. The fact is men are not equal by birth or by force of being, but differ in endless individualities; and law at best can only seize on a few features to found a common law for the government of men, and must necessarily leave exceptions alone. Kings and princes therefore exist and bear names to suit the places they create by their life force. The inventors are the princes of a nation, and they create kingdoms in the aggregate world of mind.

To say, then, that patents are granted by sufferance, is not saying all. The whole proposition is: "Since nature has created certain men with uncommon abilities in certain directions, whose efforts if properly directed tend to elevate and advance the common weal, it is therefore the duty of wise governments to direct, employ, and compensate such men for the common good of mankind." There is no savor of tyranny about the matter. It is simply compensation, for value received, gratefully acknowledged and so directed as to be paid. Not paid, it is true, as it should be, but prospectively provided for.

The labor of the hand is paid for, not as a tyrannical exaction, but as an equivalent for work done. Thought, the director of the million handed Briareus, is entitled to a percentage of one multiplied by a thousand, not by force of tyranny but by reason of the greater result.

Besides, the stricture, being drawn on the brain of the inventor, conveys the impression that the claim of the inventor is piratical on the claims of common men, and leads public opinion to put the brand of Cain on the brow of the benefactor of his race. This is at variance with enlightened civil practice and justice. The inventor is known to be a different kind of character. He is not predaceous but benevolent; not greedy, but indulgent. He is the first born son of Brother Jonathan, and inherits his mother's weaknesses. This son is known to be out of money often, out at elbows as he is out of the world he lives in. He goes with a lien toward the future. Old Probabilities has no station out or up so far as the cyclone curve on which he moves. It sweeps by the present into other generations. If the government can employ his time, brain and heart, the nation of a better time will respond: Amen.

THEOPHILUS WEAVER

Steam Boiler Experiments.

Preparations are being made to institute a series of practical experiments at Sandy Hook, N. Y., to ascertain the causes of boiler explosions. As heretofore recorded in the SCIENTIFIC AMERICAN, an appropriation for this purpose of one hundred thousand dollars, was made by the last Congress. The board under whose auspices the experiments are to be conducted, consists of General D. D. Smith, Inspector General of Steamboats, Captain Low, Mr. John Mushaw, Supervising Inspector, of Baltimore, and Charles W. Copeland, M. E. of this city. The experiments are expected to begin about August 1. Several boilers are to be tested and exploded, and the experiments will probably occupy three months. A series of experiments are also to be made at Pittsburgh, under the supervision of General Smith.

To Harden Plaster Casts.

I make use of either a thin milk of lime or lime water, instead of ordinary water, and add to this about ten or fifteen drops liquid silicate of soda for every pint of fluid used; then thicken with plaster to a thick cream. Plaster thus prepared will set in about five minutes, dependent on the thickness of the cream. The addition of lime evidently prevents the formation of sulph. soda, reducing it to a caustic condition, and thus allowing the plaster to stand a very hot water, besides making it very hard. If, however, too much silicate is used, the soda will effervesce on the surface, and spoil the shurpness of the impression.—*J. F. W., in Dental Cosmos.*

THE GREAT EXPOSITION—LETTER FROM UNITED STATES COMMISSIONER PROFESSOR R. H. THURSTON.

NUMBER 2.

VIENNA WELT-AUSSTELLUNG, JUNE, 1873.

We have already reached Vienna, coming through from Glasgow by express trains, only stopping at London a few hours to complete our arrangements for continental travel, and spending one day in Paris and a part of a day in Munich, *en route*. We found the London hotels crowded with strangers and were compelled to take private lodgings, paying eight shillings for two rooms—a most exorbitant price for London. The races and other attractions of the season produce, for a few weeks in each year, this immense influx of visitors. Calling on a few friends and making a few purchases, we stored such portions of our *impedimenta* as were only necessary for the transatlantic voyage; and, in less than ten hours after our arrival in the great metropolis, we were on the rail again, and rapidly traveling toward Dover. We had a beautiful night and a smooth sea, and crossed to Calais in unusually short time. We were but about an hour and a half in making the passage from wharf to wharf. Under even these exceptionally favorable circumstances, however, the experience was by no means a pleasing one. The steamer was moderately fast, but had no other recommendation. Small, dirty, and crowded, without comfortable accommodation below decks for even the small number that the craft was capable of carrying, uneasy in the best of weather and in every way unfitted for such employment, these steamers are most discreditable to all concerned in their employment and management. We spent the greater part of the time, while crossing, on the forward deck; but, even with so smooth a sea, the spray was continually flying over us and besprinkling the tarpaulins covering the baggage, which was there piled in a huge mass without other protection. We were finally driven aft among the discontented passengers, who clustered in those spots which were most protected from wind and spray. Such shameful lack of accommodation, on an important line of travel, would certainly not be as long tolerated in the United States as it has been in the Dover and Calais route. There seems to be no certainty, even yet, that any of the well planned arrangements, proposed by Mr. Fowler and by other well known engineers, will be soon adopted. English capitalists seem to shrink from the expenditure of the large amount of money required for the prosecution of such schemes, even when proposed by competent engineers; although the proposition to construct a tunnel beneath the straits, and the even more chimerical plan (of Boutet) of bridging the channel, have met with some pecuniary encouragement.

PARIS

seems as gay and its people as vivacious as ever; and, except the sadly marred public buildings near the Tuileries and the ruins of the Louvre, there is little to remind the stranger that an empire has so recently been overthrown, and that this great country has seen its enemies passing in triumph through its capital, leaving it in the hands of even less scrupulous domestic foes. Still less does it seem possible that the party in power and the government which it sustains are resting upon a most uncertain foundation, and that another revolution may, at almost any moment, bring about another succession of terrible events.

The five months of siege and the seventy-three days of the reign of the *commune* have left their mark; but these battle scars are now rarely observed, and the greater part of them will soon be effaced. The loss of the library and collections of the Louvre, that of the splendid collection of tapestries, dating from the time of Louis XIV., of the civil records and of some few other treasures, cannot be repaired. On the whole, the city has suffered far less than might have been anticipated, and what Théophile Gautier calls "her invincible life" has already become as characteristically active and seemingly happy as ever. A few sad faces and a few quiet groups in the *cafés* are the only evidences, beside the ruins, which can be detected, of the terrible trials to which these people have been subjected.

A glance at a few of the public buildings and monuments, a drive along the banks of the Seine to view its beautiful bridges, a ramble in the *Jardin des Plantes*, which gave an opportunity to see something of the wonderful zoölogical collection, and a walk through the beautiful *Champs Elysées*, furnished pleasing employment for the greater part of a day; but we still found time to call at the

ECOLE CENTRALE DES ARTS ET MANUFACTURES,

to inspect the buildings, to learn something of the methods adopted in instruction, and to see the actual operation of the system in the class rooms and work rooms. The building is old, the class rooms rather dark and badly arranged, and the apparatus by no means what we had anticipated. The system of instruction is excellent. Our little party were unanimously of the opinion that young Americans need not desert their own country to enter here. We will endeavor to visit the *Conservatoire* on our return, and hope to see much more there of the French system of practical instruction.

Early next morning, we were off for Munich, and were all day riding through the heart of France—a beautiful and fertile country. The necessity of planting trees is better recognized here than at home; and, in all directions, as the train moved rapidly through the pleasant country bordering on the Marne and across to Strasbourg, long lines of flourishing trees indicated the position of the wagon roads or the boundaries of the fields. At Meaux-sur-Marne is a fine cathedral, several centuries old, where that noble French divine, Bossuet, officiated, and where he composed his still well known works.

Just beyond Meaux, we noticed a large and neatly designed frame house, forming almost as remarkable a contrast with the general architecture of the neighborhood as the old cathedral would be if seen in the heart of one of our western wooden cities.

From Epernay and Chalons-sur-Marne, the road passes through the champagne district, where is produced all of the real champagne, although, it is said, far less than is drank as champagne in the United States. The total production is stated at rather less than 15,000,000 bottles; and, of these, between 3,000,000 and 4,000,000 are sent to the United States. The country beyond Chalons becomes somewhat monotonous. The character of this road, and of its rolling stock, are more in consonance with American practice than the British. The road bed is good, but inferior to the English, and the carriages are, on the other hand, quite superior, being well supported, finely upholstered, roomy and comfortable. The speed, including stops, is not equal to either that of British or American trains. Between Paris and Strasbourg, it averages twenty-five miles an hour. The locomotives are powerful and very well built, but have, to an American eye, a rough and ugly appearance. Their working parts are very well made, however, and their performance is claimed to be satisfactory.

STRASBOURG

was reached in the evening; and thence to Munich, the night ride gave no opportunity of seeing the country or its people, until our stopping at Ulm, after sunrise, awakened us, and we were able to see its fine old cathedral, to obtain a glance at its fortifications, and to take our first look at the Danube, as we crossed to the new town. The old battle ground of Elchingen, where Ney gained such important advantage over the Austrians in 1805, is very near, and comes in sight as the town is left behind.

MUNICH

was reached in time for breakfast. It is an exceedingly pleasant and interesting city, and its noble buildings and splendid historical and art collections make it one of the most attractive of European towns. The finest bronze castings made in Europe are produced here, and Munich bronzes are the standard toward which Connecticut has so well approximated in producing the beautiful bronze doors of the Capitol at Washington. We stopped at Munich until late in the evening, and found time to see the more interesting portions of the city, and to visit a few of the more important of its institutions.

We were gratified by finding, in the public square, before the National Museum, and face to face with the statues of two Bavarian military heroes, statues of the great physicist Frauenhofer and of our own countryman Benjamin Thompson, who, having less commendable views in politics than in science, was compelled, during the revolutionary war, to leave his native New England village, and who, emigrating to France, attained distinction and became Count Rumford. His extraordinary talent was well exhibited by the crucial experiment by which he proved the falsity of the old molecular theory of heat. The fact that science belongs to the world, and not to any province, is pleasingly exhibited by the erection of this statue here.

The museum contains an extensive and extremely interesting collection of industrial products, and of the military accoutrements of all ages. The collection of clocks is wonderful for its extent and variety. Two of the most remarkable are encased in gold and silver and mounted on stands of most elaborate workmanship. They were constructed by the clockmaker Scheiner and Eichler the goldsmith of Augsburg, two hundred years ago. In several of the large chambers are specimens of those graceful and elaborate forgings which gained for the smith of two or three centuries ago high honors, and sometimes knighthood. Locks and keys, chests, images of animals, saws and various other tools, elegant tracery, doors and gates, and many wonderfully intricate shapes, which may be seen here, would puzzle the modern blacksmith in their reproduction. A screw vice, two hundred and fifty years old, precisely similar in general form to those which are still seen in all of our older workshops, but elegantly adorned with forged tracery, was a very interesting object. Those ancient smiths were wonderfully skillful workmen.

Among the arms, are a *mitrailleuse* model, and a breech-loading rifle, very old, but without date, and of a very creditable design. The former was made for Gustav Adolf, if the attached legend is correct.

A visit to the *Polytechnicum*, the polytechnic school of Munich, will always be remembered as one of the pleasantest events of our trip. This splendid institution is supported by the State. The building is more than 1,200 feet long, of stone, in the later renaissance style, and beautifully adorned. The collections in all departments are excellent, and, in that of mechanics and engineering, very extensive. The space available in this great edifice is already found too limited for twelve hundred students, and the plans are nearly completed for additional buildings, although this one is not yet finished.

From Munich, a continuous ride of twelve hours brings us to

VIENNA,

and the pleasing information that the United States section is rapidly assuming a creditable appearance encourages the belief that something interesting relating to it, as well as to the *Welt-Ausstellung* as a whole, may be found for the next letter. Our exhibitors are receiving compliments, we are told, from all quarters for the excellent character and the value of the articles which make up our modest contribution.

R. H. T.

The Hotchkiss Revolver Cannon.

The following is a translation, from the *Revue d'Artillerie* of June, 1873, of a report of the trial of the Hotchkiss revolver cannon at Satory, near Versailles, France:

Trials were recently made at the Polygon at Satory with a revolving cannon invented by Mr. Hotchkiss, and destined for the Italian Government. These experiments were for the purpose of testing the mechanical value of this engine. The new cannon has a caliber of 1·57 inches, and is essentially different from all other mitrailleuses presented up to this time, especially in firing a small cast iron shell with a percussion fuze, the effect of which must be terrible at long ranges.

A complete description of this cannon will be given later. At this time, I shall only give some details concerning the ammunition used. This ammunition is an explosive projectile attached to an iron cartridge. The cartridge case is made from a tinned iron tube, soldered, with one end turned down to form a cup. This cup or tube is reinforced in the interior by two iron cups, and fixed with three rivets on a large washer of sheet iron, which forms the head and is designed to withstand the pressures of the gases, and to give a hold to the extractor. The priming is fixed in the center of this head.

The cartridge shell will hold 3·5 ounces of powder. A thick felt wad is put between the powder and the projectile. In the cartridges fired at Satory, the powder charge was reduced to 2·8 ounces Austrian powder, and the room left was filled up with two washers of ordinary paper, placed on the powder and covered by a little cotton.

The projectile has a length of two and one half calibers, and a portion of its length is covered with brass, having cuts designed to be forced into the rifling. Its weight is 17·6 ounces, and it holds 1·4 ounces of powder. The cartridge, loaded complete and primed, has a weight of 28·2 ounces.

The projectile does not seem to be fastened tight enough in the cartridge case, as it can be taken out with a little effort with the hand, and it is feared that, in transportation of them in boxes, the projectiles might separate from the cartridge shells.

To avoid all chances of accidents, the cannon revolver was placed in battery about 325 feet from the butt, the projectiles being loaded and having their percussion fuses. Forty shots were fired. At the commencement of the trial, the fired cartridge shells did not drop out of the extractor regularly. This slight defect was remedied on the spot in a few minutes. After this, no difficulties or irregularities in the firing occurred. The cartridges were oiled previous to firing. The cartridge shells did not show any damage by firing, and can be reloaded and fired several times. One was found unsoldered, but was not broken, and acted perfectly as a gas check, and it could, like the others, be used again by being resoldered, which can be done without difficulty.

Only one misfire occurred, and the same cartridge was fired on the third trial after missing twice. There was also only one misfire with fuses. Generally, the projectiles passed through the board target and exploded on striking the ground. Only one projectile was exploded by striking the board of the target. One projectile broke in the barrel of the cannon; but this accident should not be attributed to the irregular working of the fuses, because the projectiles proved to have been badly cast and one sided, and left very weak by the hole being badly one sided.

Six shots were successfully fired in twelve seconds, by loading the cartridges one at a time. Then fifteen shots were fired in fifteen seconds in loading with cases in which a certain number of cartridges had been placed previously. The firing could be kept up for a certain length of time at the rate of sixty shots per minute, which gives thirty kilos (or about 70 pounds English) of cast iron fired in this time. The firing is very regular, and the sighting did not seem to vary to any noticeable extent.

The projectiles exploded into 12 to 15 pieces, large enough to kill at a certain distance from the exploding point. The butt piece does not generally break, although breaking lines have been prepared on it.

One inconvenience was the rapid brassing of the barrels which took place during the trial. It appeared at the first shots, and increased rapidly. Without any doubt, it is to be attributed to the bad quality of the brass from which the covering of the projectiles has been made.

Generally, the mechanism of the Hotchkiss revolving cannon seems to work surely and regularly, and the ammunition will do good service if the projectiles are more firmly attached to the carriage. The projectiles are difficult and delicate to make, and must necessarily be expensive. This cannon will, without any doubt, produce terrible effects at distances approaching those of field artillery, and the explosive quality of its projectiles assure to it a superiority over all other mitrailleuses, as its fire can be rectified by observing the explosions of falling projectiles.

A. JOUART,
Capitaine d'Artillerie.

PERILS OF BALLOONING.—Frank K. King is reported to have made a balloon ascension from Morristown, Vermont, on the 4th of July. When he had risen to the hight of nearly three miles he encountered a snow storm, which so loaded the top of the balloon that it was driven down, and he landed in a deep forest some eight miles distant. It took a searching party, of 500 strong, forty-eight hours to find him. He was discovered in a famishing and exhausted condition, but had sustained no other injury.

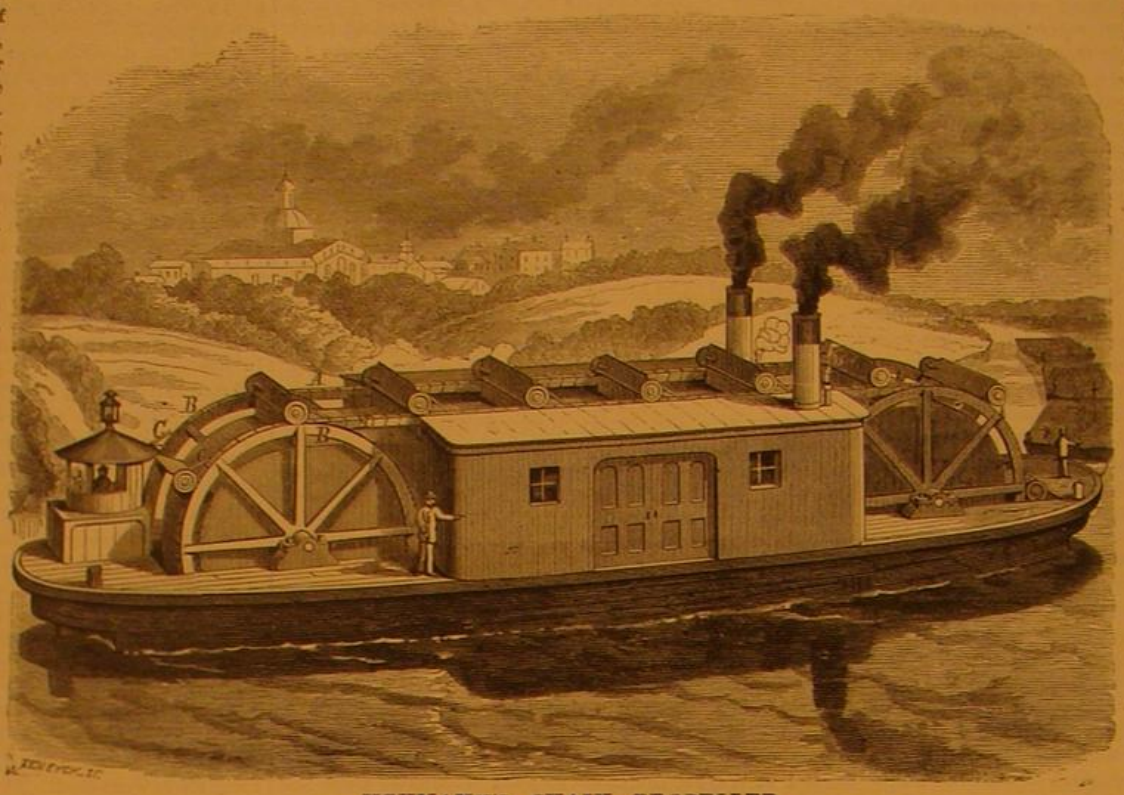
OF the eight Corliss engines in the Vienna exhibition, two come from Switzerland, one from Belgium, two from Germany, and three from Austria.

IMPROVED CHAIN PROPELLER.

In the novel mode of propulsion to which our illustration refers, it is claimed that a very large amount of bucket capacity is obtained, thus allowing of the use of a considerable percentage of power, and that the action of the device is such that it is suitable for canal as well as for river and lake navigation.

In the center of and lengthwise the boat, a channel is constructed, at either extremity of which are placed pairs of grooved wheels, B, their axles passing through the vessel at the points represented. To these axles, by means of a belt or other suitable contrivance, power is applied to cause the rotation of the wheels. Endless carriers, A, of wire rope, chain, or similar suitable material, pass over the wheels and support buckets attached crosswise and projecting at right angles. These buckets are as long and wide as the channel will permit, and are arranged as close together as necessary for obtaining the greatest effect upon the water. Braces, C, are attached near the outward edges of the buckets, and extend on to the carrier whereon they bear by a foot piece, their object being to support the buckets against the resistance of the water. The braces are not attached to the carrier, so that the latter bends freely around the wheels. The power may be of any preferred kind, and applied to either one or both wheels as desired.

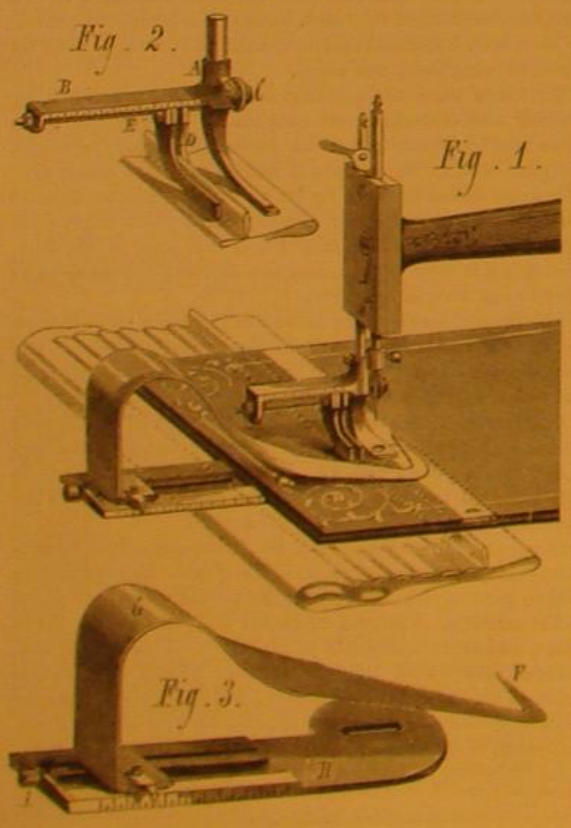
Patented through the Scientific American Patent Agency, Dec. 10, 1872. The inventor, Mr. John Neumann, is the originator of several other useful devices, and attained some celebrity several years ago by making a finely executed copper statue of Washington, entirely with the hand hammer. The work was exhibited, but unfortunately destroyed in the old Crystal Palace. Mr. Neumann may be addressed for further particulars at 159 South 9th street, Brooklyn (E. D.), N. Y.



NEUMANN'S CHAIN PROPELLER.

TUCKING ATTACHMENT FOR SEWING MACHINES.

The invention herewith illustrated is a device for forming and sewing tucks at one and the same operation, and also for insuring a perfect uniformity in parallel lines, in tucks and in spaces between tucks, in an expeditious manner. In its operation, the inventor states, it folds the fabric in form for a tuck, regulates the tension of the material while being sewed, maintains its uniformity in parallel lines, and secures the seam, all at one and the same operation.



In the engravings, Fig. 1 shows the apparatus attached to the machine, and Figs. 2 and 3 portions separated. A is the presser foot, the upper end of which is hollow and can be slipped on any cloth presser bar. This foot has a lateral arm, B, on which is an index plate; C is the head of a temper screw, by means of which the vertical guides, D, are adjusted laterally, with reference to the presser foot. The opening between these guides is more or less closed by means of two set screws, shown at E. F is the end of the horizontal guide, G, turned at right angles from its body and parallel with the side of the presser foot and vertical guides. The body of the horizontal guide is shaped as a loop, and works in a dovetail on the index plate, H, engaging with the temper screw, I. The slot represented in the shank of the index plate serves to secure it to the platform of the machine in the position shown in Fig. 1.

The index plate, H, is attached with the point, F, parallel to and drawn laterally by the temper screw, I, against the side of the presser foot, so that the needle will come near the inner corner of the angle. A set screw secures the presser foot with its attachments to the presser bar, and the vertical guides are laterally adjusted by the screw, C, to regulate the width of space between the tucks. By turning the temper screw, I, the horizontal guide is adjusted laterally for enlarging or diminishing the width of the tucks.

When all these adjustments are completed, the first tuck is turned by hand, feeding it to the needle, in the same manner as any other plain sewing, until the seam is finished. Then a piece of thin metal is shoved inside the tuck to distend it to its full width, so that it will appear as standing on its edge. The raw edge of the remainder of the fabric is made into a roll parallel with the tuck just distended, and passed through under the loop of the horizontal guide, G. The part of the cloth containing the tuck is next drawn out under and then over the outside of the right angled point, F, under the presser foot, and thence on until the tuck containing the guide can be introduced edgewise in the opening of the vertical guides, H. The machine being set in motion, the fabric is fed in the ordinary way to the needle; and when the same is ended, the thin metal strip is withdrawn and introduced in the tuck last made. The cloth is again drawn along until the strip or plate guide can be once more introduced between the vertical guides, and thus continuously until all the tucks are completed.

The right angled point, F, is in the tuck, being formed and sewed, and the fabric is stretched over and travels parallel with it. The thin plate rests in a tuck already made, stands edgewise in the vertical guide opening, and travels parallel at all times with the point, F, thus giving two fixed parallel guides in combination with the needle; thus, it is claimed, effecting perfect uniformity in parallel lines, in tucks, and in spaces between tucks.

To increase or diminish the width of the latter, the temper screw, I, is turned, thereby actuating the horizontal guide on the index plate, and moving the point, F, laterally from or to the presser foot until the desired width is obtained and noted on the index plate. The distance from the needle to the outer edge of the point, F, is the width of the tuck. To increase the width of space between the tucks, the temper screw, C, actuates the vertical guides, D, laterally from the needle and presser foot. When the desired width has been reached, it can be noted by the index on the lateral bar. The distance from the vertical guide opening to the needle is the width of space between tucks. The vertical guide opening can be closed or opened to suit any desired thickness of stuff by the screw, E. The plate guides are of any suitable material similar in thickness to the mainspring of a watch.

The inventor claims for this device cheapness and simplicity, and a sample of its work forwarded to us seems to be very neatly and accurately made.

Patented May 13, 1873. For further particulars regarding rights, etc., address the patentee, Mr. Eugene Bouillon, care G. Lavie, Box 1,093, New Orleans, La.

In one of the ancient Indian mounds in Oregon, examined by H. A. Chase, he found among a great variety of stone tools and implements, a hatchet or adze of brass, 4 inches long, 3 inches wide at cutting edge, and 2 inches wide at head. The aperture for the handle was through the side—like a hoe. It may have been obtained from the wreck of some ancient Japanese or Chinese junk; or possibly have been made from copper and zinc, ores of which exist in this neighborhood—Chetko river.

Machine for Charging and Drawing Gas Retorts.

A machine for this purpose has been for some time in successful operation at the Dublin (Ireland) gas works. It is by John Somerville, of that city, and consists of improvements on the Best and Holden machine.

The method of working is as follows: One man takes off the lids of the retorts of one row, the drawing machine moves opposite to one retort, sends in the rakes, at one draw brings out the coke, and then moves on to the next retort, and the charging machine comes up to the discharged retort and puts in the charge of coal. The scoop is made double, and forms two small scoops hinged together and discharging in opposite directions; so that, in turning, the coals are spread well over the surface of the retort thus utilizing the greatest amount of heating surface in the retort. As the retorts are charged, the man who preceded the drawing machine and took off the lids now follows the charging machine, closing the retorts. Two boys drive the machines, one man fills the coal into the hopper, and another attends to the taking off and putting on of the lids or doors. The platforms of the machines are now altered to the level of the row of retorts to be drawn and charged next, and those operations proceed as before. By these arrangements, the retorts are exposed to the action of the atmosphere a much shorter time than in the case of hand labor, as the stokers generally "slack out" ten or a dozen doors at once, and draw them all before charging any, thus leaving the first drawn retort a long time to the cooling atmosphere, whereas with the machine the retort is charged directly it is emptied, an advantage that must be appreciated by all gas engineers. The work of drawing and charging is done with a regularity that cannot be attained by manual labor; the retorts are supplied with the maximum quantity of coal they will take, and the quantity does not depend upon the caprice of a scoop driver. The coke must be raked out clean and a quantity cannot be left in, as is often the case with manual labor when the eye of the foreman is not on the men. The same quantity of gas is made on Saturday nights and Sundays as on any other day of the week, a result not often obtained with hand labor.

COMBINED CRADLE AND ROCKING CHAIR.

This invention may be termed a nurse power economizer, in that by its aid may be utilized the force developed by that natural see-saw motion which nurses invariably take up while crooning those peculiar and musically unwritable melodies which are supposed to act as powerful soporifics upon their infant charges. Instead of requiring the handmaiden or maternal parent to oscillate on an immobile chair and, at the same time, by a reciprocating motion of the foot actuate the rocker of the cradle, in the device herewith illustrated she is provided with a rocking seat attached directly to the latter, to which the undulatory motion of the body is thus transferred.

The back of the chair is hinged to the seat and consequently may be folded forward thereupon. The seat is attached to the standard, rocker, and arm of the outer side of the chair; and when the back is turned down flat upon it, both together may be shoved or telescoped into the cradle through an opening made in the rear end and below the slats. The upright portions of the chair then fit snugly up against the foot of the cradle. Suitable stops are secured to the back standard to prevent the back from falling too far to the rear when it is opened, and similar devices keep the seat from being drawn out too far. Patented February 4, 1873, by Mr. Ephraim Hamburger, of Detroit, Mich.

BARON VON LIEBIG.

A sketch of the life of the illustrious chemist and author, recently deceased at Munich, has already found place in our columns, so that in presenting the accompanying excellent portrait, reproduced from the pages of *La Nature*, we shall allude chiefly to the nature and importance of the discoveries by which his name has been rendered for ever famous.

A single illustration will render clear the fundamental idea which formed the basis of Liebig's labors in agricultural chemistry, and which he has developed through all his works. A field, for example, is cultivated and fertilized over a period of five years, and is required to produce successive crops of potatoes, wheat, clover, wheat again, and, during the last year, oats. The potatoes and wheat are sold; the clover serves to feed an ox, which similarly finds its way to market. Now it is clear that the potatoes and wheat contain phosphates and potash drawn from the soil, and that the ox has formed the constituents of his bones from similar matter in the clover. Consequently this total amount of mineral substance is absolutely withdrawn from the plot of land and not returned. Without doubt, in animal manure, a part of the phosphates in the wheat and oats will be regained if the latter be consumed on the farm; but of only a small fraction of the quantity will restitution be made, and therefore, if such a course be continued, the result will be impoverishment, and in the end sterility of the earth.

Against this system of cultivation, based on the production of manure, Liebig waged systematic war, pointing out in the strongest terms its despoiling nature, and stigmatizing it as "vampire agriculture." Not content merely with giving warning of the evil, he at once indicated a remedy, and first advocated the use, as fertilizers, of bones rich in phosphates. These he found resisted decomposition in the soil, and produced little effect; so he invented a mode of treating them before use with sulphuric acid, thus creating one of the most prosperous agricultural industries, the fabrication of superphosphates. The results at once obtained were marvelous. In England, the turnip crop doubled, and the employment of the new fertilizer became general; then it came into use in France, then Germany, and finally in this country. The consumption of superphosphates, however, increasing, bones failed to afford an adequate supply, and then the geologists, first Nesbitt in England and Delanoy in France, searched for and found new sources in the mineral deposits of the earth.

Liebig was an indefatigable worker, constantly advocating in his letters, his teachings, and his books, the necessity of utilizing the lost riches in sewage and waste refuse. He cited the example of China, which sustains a vast and dense population without importation of any fertilizing material for her land, and also of Holland and Alsace, where, by similar employment of waste, the soil is made to give abundant harvests, comparing both instances with the prodigality of English agriculture, for the sustenance of which vessels constantly are searching the world over for guano and similar materials. Liebig attached much greater importance to the mineral matters in manures than to the nitrogenous constituents, a view which involved him in many long discussions with English and French chemists, in many of which the extreme position, sometimes assumed by him, he found to be untenable.

To the precocity of Liebig's genius we have already alluded. At nineteen years of age he was a doctor of medicine, and at twenty one assumed a professorship in Giessen university. Two years later he founded his celebrated laboratory and school, which have since formed models for similar institutions throughout the world. If the motive which underlaid his writings can be expressed in a single sentence, we should say that it was the desire not only to be useful but to be useful immediately. Hence his works relating to practical agriculture, and hence the instruction written for the people and not for the *savans*. His was not the language of the theorist or student, addressed to his peers in learning, but rather the familiar argument or practical views calculated to interest the indifferent and forcibly enchain the attention of a general public. His attempts to base organic chemistry on the hypothesis of component radicals were not successful, and indeed, as Laurent remarked, seemed to be "the study of bodies which do not exist."

But where few have known the names of Kirchoff, of Bunsen, of Mayer, and of Helmholtz, the world has talked of Liebig; where the grand theories of the former need genius to insure their application, his plain words point the way to ready practice; and even though his labors, great as they are, be exceeded by the greater works of his gifted countrymen, still Justus von Liebig, his writings and his precepts, will be remembered and heeded even so long as man shall seek his sustenance from the bosom of his mother earth.

BARON JUSTUS VON LIEBIG.

PULVERIZED charcoal sprinkled over dressed poultry, after the animal heat is expelled, will preserve it from spoiling for some time in hot weather.

Augmentation of the Induction Spark.

Everybody is acquainted with the experiment which consists in placing in communication the two coatings of a Leyden jar with the two ends of the secondary wire of an induction coil. The length of the spar is reduced considerably, but the brilliancy and noise are, on the contrary, increased.

I wished to see the effect of large insulated metallic surfaces, placed in contact with the two ends of the secondary wire, the two surfaces being separated from each other, so as not to produce the effect of a condenser.

For metallic surfaces I took frames having each about eleven square feet covered with silk, doubled with paper, upon which had been fixed plates of tin. The spark burst between two insulated points, which can be made to approach or recede from each other at will.

So long as one or more plates of tin communicate with one of the poles only, the spark is in no way modified; but so soon as the other pole of the secondary wire is in contact with the plates of tin of the same surface as the first, the brilliancy of the spark increases and its length diminishes. The increase of the surface produces an increase in the brilliancy and the noise of the spark, and a new diminution in its length. If one of the metallic surfaces be greater than the other, the effect does not surpass that which two surfaces equal to the smallest produce.

The effect of the plate becomes more sensible by the drawing near of the points of the excitor, and the spark breaks out into a great number of tracks of fire; but if the distance of the points is reduced to about one and a half inches, the effect of the surface seems to disappear.

When in place of the large metallic plates, metallic wires or ribbons of tinsel are employed, three fourths to one inch in width, well insulated by means of glass supports or silk cords, we then obtain, by the use of equal surfaces, much more intense effects. Fifty-four yards of these metallic ribbons, placed in contact with each end of the secondary wire, making a total of 108 yards, greatly increase the brilliancy and the noise of the spark.

The stronger the induction, the more marked the effect; this is what I have proved lately, by means of a powerful apparatus, which M. Ruhmkorff has been good enough to place at my disposal. It is necessary to be careful, in order to obtain the greatest possible effect, to make the two ends of the metallic ribbon communicate with each point. If the ribbon be too long, it becomes necessary to establish a greater number of similar communications.

In general the effects are the much more intense when the insulated metallic surfaces are greater, more divided, and the different parts are more separated from each other.—*C. M. Guillemin, in Journal de Physique.*

Effects of Air upon the Condensation of Steam.

The conclusions which Professor Osborne Reynolds draws from a series of experiments are as follows:

1. That a small quantity of air in steam does very much retard its condensation upon a cold surface; that, in fact, there is no limit to the rate at which pure steam will condense but the power of the surface to carry off the heat.

2. That the rate of condensation diminishes rapidly, and nearly uniformly as the pressure of air increases from two to ten per cent that of the steam, and then less and less rapidly until thirty per cent is reached, after which the rate of condensation remains nearly constant.

4. That in consequence of this effect of air the necessary size of a surface condenser for a steam engine increases very rapidly with the quantity of air allowed to be present within it.

5. That by mixing air with the steam before it is used, the condensation at the surface of a cylinder may be greatly diminished, and consequently the efficiency of the engine increased.

6. That the maximum effect, or nearly so, will be obtained when the pressure of the air is one tenth that of the steam, or when about two cubic feet of air, at the pressure of the atmosphere and the temperature 60° F., are mixed with each pound of steam.

New Application of Electro-Plating.

Some three years ago, a working electro plater in London discovered a process by which a white metal having tin as its principal ingredient might be deposited by electricity upon iron and steel, as well as upon copper and brass. Most of our readers know that to plate steel and iron even with silver has hitherto been deemed impossible, without the intervention of copper as a coating; and the process of tinning thin sheets of iron so as to make them tin plates is a familiar one. But to cover any metal with tin by the use of the galvanic bath is new. The invention is now in practical operation in Victoria street, Birmingham, where the Electro Stanus Company, who own the process, have their works.

The salammoniac requisite in the making of tin plates, and which increases the disposition of the iron to rust, if only the air can get at it through the tiniest of imperfections, is not called for in this process. If the metal required to be coated should be rusty, it is cleansed in a bath of sulphuric acid very much diluted; and when it has been immersed in a pot of potash and water, it is free from all grease. Now chemically clean, it is fit for the plating vat. Here, hanging by copper wire from the metal bars which connect the battery with the opposite pole, the articles to be plated are hung in the solution, which, while it is not exclusively tin, may be practically regarded as tin. Immediately that galvanic action takes place, the article is filmed with the white metal, and according as it is desired that the coating should be thick or thin, the time during which it is kept in contact with the solution is long or short. The article removed, it is found that it possesses a dull white color that is made to acquire tolerable brightness by the application of the customary metallic brush moistened with a cleansing fluid. If a higher polish is required, then that may be obtained by the ordinary method of burnishing. The process has evidently a wide field of application.—*The Engineer.*

Our readers will find the description of a process analogous to this in the SCIENTIFIC AMERICAN of July 15, 1871.

The American Paper Trade.

During the year 1872 there were in operation in the United States 812 paper mills, owned by 705 firms, and of an estimated value of over $35,000,000. In addition to this actual value of mill property, there is to be added the usual working capital, twenty-two and a half per cent of the value of the mills, thus making the total capital invested in paper making throughout the country about $43,500,000. The mills employ 13,420 male and 7,700 female hands besides 922 children, or a total of 22,042 laborers, whose wages amount yearly to the large sum of nearly $10,000,000 dollars. Their product amounted last year to 317,387 tuns, valued at $66,475,825. The total number of engines running is 3,293, besides 299 Fourdrinier and 689 cylinder machines.—*Paper Trade Journal.*

Forthcoming Exposition in Brooklyn, N. Y.

The success of the fair held, in the very limited space at the disposal of the managers, in Brooklyn last fall has induced a committee of influential men in that city to announce a more extended display, to be held at the rink on Clermont avenue. Adjoining this building is the large armory and drill hall of the 23d regiment, and we understand that negotiations are in progress by which these rooms may be added to the available space.

Especial attention was bestowed last year on the formation of an art gallery, and the result was one of the best collections of paintings ever seen in the neighborhood of New York. It is to be hoped that the fair will be similarly fortunate this year.

It is intended that the exposition shall remain open for one month, commencing September 15.

Full information can be obtained at the offices of the exposition, 39 Fulton street, Brooklyn, N. Y.

ENGINEERING NOTES.

[Extracts from papers read before the American Society of Civil Engineers.]

At a recent meeting of the American Society of Civil Engineers in this city, Mr. Joseph Whitney, C. E., of Cambridge, Mass., read a paper on the subject of

LEAKAGES IN WATER PIPES.

He stated that some years since his attention was called to this matter in Cambridge, Mass., where for a considerable period the water supply had been gradually decreasing, thus causing much inconvenience and insecurity in case of fire. In a particular house, the water scarcely rose to the second story at night or day. After enquiry, a series of observations were made with siphon pipe and pressure gage to determine the cause, and were conducted in the morning, when the consumption was nearly nothing. Numerous very serious leaks were quickly found and closed; and thus, without any increase of size in the main, an additional head of 35 feet was secured, insuring a full supply to each house in the locality. By continued experiments upon the pipes throughout the city, nearly two hundred leaks, of from 1,000 to 2,000 gallons each per hour, were found. The necessary repairs were made, and thereby the average daily consumption per head was reduced from 85 to 35 gallons, which is not more than one half that in most cities.

Leakage of this character may exist a long time without being known; thus, it may start when the water is first let on, and the water find a passage through some blind channel into the sewer; it will not be seen at the surface unless that upward and outward is the easiest course.

It is quite probable that this subject concerns other cities, and furnishes a satisfactory reason for the great increase in the consumption of water, and the corresponding growing demand for supply, which more or less embarrasses public authorities.

It is said that in the city of New York the consumption is about one hundred millions of gallons *per diem*; if so, the speaker was sure at least fifty millions were wasted through unrecognized leaks into the sewers and surrounding rivers. In Boston, more than seventeen millions of gallons are supplied, where eight millions should suffice.

It is a fair presumption that one half these great amounts, being but waste, and a corresponding cost in the construction and operation of water works may be saved: surely examination, complete and exhaustive, should be made to determine whether this is presumption or fact.

Mr. T. F. Rowland, M. E., of Greenpoint, New York, presented a paper on the

ADAPTATION OF MECHANICAL POWER TO THE WORK OF CHARGING AND DISCHARGING GAS RETORTS,

in which it was proposed to take the coal from a pocket outside of the retort house, size, mix, transport and deposit it in proper quantities in the retorts and afterwards discharge therefrom the resulting coke into the coke barrows.

The apparatus consists, first, of an iron car, which transverses the retort house in front of a bench upon a railroad of twelve feet gage, and carries the mechanism for charging and discharging; and second, a series of buckets which, suspended from an overhead or "pendent" railway, conveys coal to the charging apparatus. The car is fourteen feet square, and is propelled by an engine and boiler upon it. It carries a meter which receives coal from the buckets and deposits it in the charger. The meter is a horizontal cylinder, divided longitudinally into three compartments or cavities, such that each will contain enough coal for one retort. It revolves intermittently at the base of a hopper or coal pocket, which receives the coal from the buckets, each cavity therein in turn being filled with coal and emptied by discharge into shutes, severally, in connection with the three scoops of the charger. These shutes are placed one above the other, and, as the meter revolves, are automatically opened and closed, so that the coal is discharged into each in succession. The edges of the meter cavities and of the throat of the coal pocket are armed with hard, sharp, steel blades to cut or crush fragments of coal which, lodging between the surfaces, might clog the machine.

The charger is a carriage travelling on the top of the car, transversely; its three scoops are placed one above the other at distances corresponding to the vertical measure between the retorts; they are D shaped, like the retorts, and have movable bottoms. When the scoops are filled, by a transverse movement of the carriage they are thrust forward into the retorts; the motion being reversed, the bottoms and then the scoops are withdrawn: thereby the coal is deposited evenly over the retort, and the scoops made ready for another charge.

The discharger is a carriage similar to the charger. The two are placed at opposite ends of the car, and the meter between them. By an automatic device, three hoes or rakes are simultaneously thrust into three retorts, dropped until they rest on the retort bottoms, and then withdrawn, whereby the coke is removed and discharged on to the retort house floor, or into coke barrows. One tier of retorts may be charged and the adjacent one discharged at the same, and in a very brief, time.

The pendent railway consists of two single parallel rails, ten feet apart, suspended from the retort house roof over the railroad before mentioned, and connected at the ends by semicircular rails, thus together forming an endless line, from which is suspended a series of coal buckets, attached to a flexible steel belt by which they are separated at uniform distances apart. The belt passes around horizontal drums, ten feet in diameter, and placed one at each end of and below the line, their vertical shafts being in the center of the curved rails. One of these drums is an idler; the other, that at the receiving end, is in a tower outside the retort house. In its periphery are two openings, diametrically opposite, which, by two inclined chutes, are connected with a fixed cylindrical hopper or reservoir for coal above. The buckets are vertical cylinders with one half of the upper part cut away, so that when they are in contact with the drums their axial planes coincide with the periphery. The space between the buckets on the belt is equal to one half the circumference of the drums.

When this apparatus is in motion, the buckets pass along the pendent railway; their openings are brought successively in contact with the openings of the drums, so that the coal conveyed by the inclined chutes from the reservoir drops through them, the quantity being regulated by valves in the chutes, worked automatically.

The buckets have hinged bottoms to drop downward, and are opened when passing over the coal pocket on the car, at the will of the operator, by releasing a catch; they are mechanically closed just before reaching the drum, where they are filled.

The coal in the yard, after passing between sizing and mixing rolls, is lifted to the reservoir over the drum by elevators, similar to those used at Messrs. Hecker's flouring mills in New York.

The several parts of this apparatus can be worked independently, and thereby accommodated to the varying demands likely to be made upon it.

Ancient Construction.

Explorations at Nineveh have shown that, except for paving purposes, stone rarely entered into the construction of the walls and buildings. They consisted of clay only, which had evidently been molded in the shape of bricks, and put together without the aid of mortar or cement of any kind. In the few examples in which stone was found to be employed the joints were made in the same manner, that is, by simple juxtaposition. Mortar and cement appear to have been rarely or never employed. The size of the stones was considerable, so that mere weight would, to some extent, render superfluous the employment of any adhesive substance at the joints. But this was not the case with the bricks, which were nearly of a square form, 1 foot 4 inches on the sides by 2 inches in thickness. The question which remains unsettled is: In what degree of consistency were these bricks at the time they were put together? Were they sufficiently plastic to adhere together, or were they wetted before being used, so as to soften the mere surfaces which were in contact? Upon this supposition there would be an appreciable difference between the appearance of the body of the bricks and that of the joints, which does not exist. There is nevertheless, a slight difference in color at these points, which looks like lines. The Assyrians had two varieties of baked bricks; the one was regularly shaped, with parallel faces, and the other of a trapezoidal form. These latter were intended for arches or vaults, and the inclination of the sides varied with the position which the particular brick was intended to occupy in the curve. The dimensions and proportions of the Assyrian bricks differ from those of modern manufacture. Those employed in paving were of two sizes. One class was 1 foot 4 inches by 1 foot 4 inches by 2½ inches in thickness, and the other 13 inches by 13 inches by 4½ inches thick. A peculiar feature in these old bricks is that they are, with few exceptions, covered with inscriptions in the cuneiform character. Two remarkable features in the construction of ancient cities were, first, that either the diagonals or the direction of the sides pointed exactly towards the cardinal points, and, secondly, the enormous thickness of the walls of the principal buildings. It is probable that astronomical reasons dictated the former of these, and climatic exigencies the latter. In the case of Nineveh, there can be little doubt of this, as the Assyrians were celebrated for their skill in astronomy, and their partiality for the science. The thickness of the internal walls is scarcely ever less than 10 feet, and that of some of the external varies from 16 feet to 25 feet. Some consideration must be given to the fact, with regard to thickness of the walls, that the mode of building them with bricks merely dried in the sun required this dimension to be disproportionately great.

In the building of their domes and vaults the Assyrians employed a more brittle description of brick than in their walls and pavements, and the joints were made by grouting them with semi-fluid clay. The *voussoir* shape of these bricks prove that the theory of the arch must have been known at that time, and some considerable progress made in the preparation of artificial stones. There is no evidence of timber being employed as a material of construction by the people under notice. It was used only in small quantities, and for the purposes of ornament. It seems that iron was altogether unknown as a constructive material. Copper was turned to account for the pivots or hinges of doors, and lead was also rendered serviceable. Enamelled bricks were common, and stucco was largely employed, as with us, for the double purpose of protecting the brickwork from the effects of the air, and hiding the roughness of the surface. There is one ceremony which appears to have existed at the time of the Assyrians, which is common to modern times as well. It is that of laying the first, or foundation, stone of a building. A recent French explorer, M. P. Place, discovered in a layer of fine sand underneath one of the monoliths of the gates of Nineveh, a variety of different objects in marble, agate, and cornelian, which were cut and engraved, and were, moreover, all pierced with a hole, as if they had originally formed part of a bracelet or necklace deposited at the laying of the stone as coins are deposited with us. While well versed in the practice of earthwork, brickwork, and even masonry, the Assyrians were totally ignorant of the art of construction considered in the light of an assemblage of pieces of timber or iron. They could heap up materials so as to cause the structure so composed to resist any outward force by its sheer weight or inertir, but they knew nothing whatever of the distribution of pressures, or how to proportion a structure so that it should be equally strong in all parts. Both the labor and the material were too abundant to call for economy in either one or the other.—*The Engineer.*

Steam Power on the Canals.

A correspondent, W. J. B., of Ind., expresses his belief that any means of propelling canal boats in which the water is used as a fulcrum would produce so great an agitation of the water as to prevent their use. He proposes two continuous rails on the bed of the canal, one for boats going in each direction. The boats are to be fitted with driving wheels in the center, with deep flanges, the axles of the wheels resting on frames which could be moved up and down in curves concentric with the main shaft of the engine. In addition to the weight of the wheel, pressure on the rail might be given by steam cylinders which would slightly raise the boat in the water. The boat could be guided by rudder wheel with flanges, which should also work in a frame, variable to suit the draft of the boat. Thus both wheels could be raised from the rail to allow the boat to be drawn by horses in the ordinary way.

"As to the power required, considering the great disadvantage under which horses work at the end of a long tow line, from the oblique direction at which the force has to be applied (this being also considerably augmented by the necessity of steering the boat from the tow path and running it obliquely through the water), the boats on the Erie canal, now drawn by two horses at 1½ miles per hour, would attain a speed of three or four miles per hour, by the means I have suggested and the application of the power of six or eight horses; and the cost of running canal boats, per mile, would be one third of what it is now.

But the consideration that must have the greatest weight is the increase of the freighting capacity of the canal. Almost any plan that certainly secures this must have the preference over all others, regardless of the cost of construction. When the plan I propose first occurred to me, it was seen that its cost would then be an insuperable objection, and, for the time, I let it rest; but at last my anticipations are realized, and now the cost should not, in my judgment, be any objection. The whole expense would not probably exceed five millions dollars for the entire length of the Erie canal. Generally I would think it best to drive piles, say 1,000 to the mile, for each track; and as five or six tuns is all each rail would have to bear, iron of forty pounds to the yard would be sufficient. Five tuns would give a traction force of 1,000 pounds, equal to the draft of twelve horses. My estimate of the power required is derived from the consideration of the great loss of power as usually applied in drawing boats by horses, and the unavoidable disadvantage of using paddle wheels, acting as they do against a yielding fulcrum. One may appreciate this loss of power by walking over a sandy road.

A boat necessarily drives the water to some extent ahead of itself; and then, if power is applied by wheels to force the boat forward, a depression in the water level at the boat must result, bringing the vessel nearer the bottom of the canal and materially increasing the draft. The boat is settled down into a trough, as it were, and is constantly climbing a hill that sinks or is driven before it. In the plan I propose, only the necessary swell in front of the boat is produced, and this is slightly reduced by the lifting of the vessel by the driving wheel being pressed down on the track on the bottom of the canal."

The Work of a Circular Saw.

Ninety thousand feet of lumber were recently sawn at the mill of John McEwan, Bay City, Mich., in 34½ hours, besides slabbing for a gang, with two sets of cutting teeth, 36 in each set, without sharpening in any way, each tooth cutting more than 1,200 feet of lumber. The saw never made an imperfect run, and the lumber was sawn much smoother than by any other method. The saw in question is five and a half feet in diameter and No. 7 gage. This, in all probability, is the greatest feat ever performed with a saw with the same number of cutting points without sharpening in any way, so says the *Lumberman's Gazette*. This saw is provided with J. E. Emerson's improved bits or teeth. Their points are alleged to be tempered so hard that they will cut glass; and they weigh less than one sixth of an ounce. The saw is a novelty in its way, very simple in construction, the bits being changed in about five to eight minutes and never working loose. The saw cuts six inches to each revolution, dropping from six to eight boards per minute. Manufactured by Emerson, Ford & Co., of Beaver Falls, Pa.

THE METALS OF THE SUN.—The latest researches by many distinguished physicists have shown that the following terrestrial elements are present in the vaporous condition round the sun:

1. Sodium.	6. Chromium.	11. Cobalt.
2. Calcium.	7. Nickel.	12. Hydrogen.
3. Barium.	8. Copper.	13. Manganese.
5. Magnesium.	9. Zinc.	14. Aluminum.
4. Iron.	10. Cadmium.	15. Titanium.

SELF PROPELLING FIRE ENGINES.—C. A. M., of Ohio, suggests that fire engines be fitted with cylinders containing compressed air sufficient to run the engine till steam is gotten up.

How to Improve the Appearance of Furniture.

Mr. G. J. Henkels, of Philadelphia, Pa., suggests that when the polish on new furniture becomes dull it can be renewed by the following process: Take a soft sponge, wet with clean cold water, and wash over the article. Then take a soft chamois skin and wipe it clean. Dry the skin as well as you can by wringing it in the hands, and wipe the water off the furniture, being careful to wipe only one way. Never use a dry chamois on varnished work. If the varnish is defaced and shows white marks, take linseed oil and turpentine in equal parts; shake them well in a phial and apply a very small quantity on a soft rag until the color is restored; then with a clean soft rag wipe the mixture entirely off. In deeply carved work, the dust cannot be removed with a sponge. Use a stiff haired paint brush instead of a sponge. The cause of varnished furniture becoming dull, and the reason why oil and turpentine restore its former polish, it will be appropriate to explain. The humidity of the atmosphere and the action of gas cause a bluish white coating to collect on all furniture, and show conspicuously on bright polished surfaces, such as mirrors, pianos, cabinet ware and polished metal. It is easily removed as previously directed. The white scratches on furniture are caused by bruising the gum of which varnish is made. Copal varnish is composed of gum copal, linseed oil, and turpentine or benzine. Copal is not soluble in alcohol as other gums are, but is dissolved by heat. It is the foundation of varnish, as the oil is used only to make the gum tough, and the turpentine is required only to hold the other parts in a liquid state, and it evaporates immediately after its application to furniture. The gum then becomes hard and admits of a fine polish. Thus, when the varnish is bruised, it is the gum that turns white, and the color is restored by applying the oil and turpentine. If the mixture is left on the furniture, it will amalgamate with the varnish and become tough, therefore the necessity of wiping it entirely off at once. To varnish old furniture, it should be rubbed with pulverized pumice stone and water to take off the old surface, and then varnished with varnish reduced, by adding turpentine, to the consistency of cream. Apply with a stiff haired brush. If it does not look well, repeat the rubbing with pumice stone, and when dry, varnish it again.

MOTHS IN FURNITURE.

The same author says: There are two species of moths which infest furniture. One is a large fly of silvery white color; the worm of the same is shaped like a chestnut worm, and is familiarly known. It rarely infests furniture. The other is a small fly of a dark drab color; the worm is about one fourth of an inch long, and tapering from the head to the tail. It was first observed by upholsterers about thirteen years ago. This fly penetrates a sofa or chair, generally between the back and seats of sofas, or under the seats, where the vacancy among the springs affords a safe retreat. It may make a lodgment in one week after the furniture is placed in the house. If such should be the case, in two months the worm will appear; and the continual process of procreation in a few months increases the number to thousands. This moth has no season. It destroys in winter and summer alike, and it is kept in active life by the constant heat of the house. We find at the same time, in the same piece of furniture, the fly, the worm, and the eggs; thus showing that they are breeding and destroying all the time. It does not eat pure curled hair, but fastens its cocoon to it, the elasticity of which prevents its being disturbed. The inside of furniture is used by it only for the purposes of propagation. The worm when ready for food crawls out and destroys the covering, if of woolen or plush material; and falling to the carpet, destroys it. It rarely cuts through plush from the inside, as it is of cotton back, but there are instances where the worms have cut up muslin on the outside back of sofas. There is no protection against them but continual care. New furniture should be removed from the walls at least twice a week at this season of the year, and should be well whisked all round, and particularly under the seats, to prevent the fly from lodging. This is an effectual preventive, and the only one known. Cayenne pepper, Scotch snuff, camphor, turpentine, and all other remedies for protection from the large moth are of little or no avail against the furniture moths. Saturation with alcohol will not destroy them when in a piece of furniture. If the furniture is infested, they may be removed by taking off the muslin from under the seats and off the outside ends and backs, where they congregate most, and exposing to the air as much as possible. Beat well with a whisk or the open hand, and kill all the flies and worms which show themselves. This done often will disturb them, and may make them leave the furniture, in their desire to be left in quiet. When the furniture is free from moths and is to be left during the summer months without attention, it may be protected by camphor in small bags or highly concentrated patchouli. The safest way is to have the furniture well whisked twice a week. If the moths attack the carpet, which they will first do under the sofas and chairs, spread a wet sheet on the carpet and pass a hot flat iron over it quickly; the steam will effectually destroy both worms and eggs. If furniture is delivered in a dwelling free from moths, the upholsterer's responsibility ends there and all rests with the housekeeper, as no tradesman can tell whether the moth will attack it or not. There are cases where the furniture has been in use ten or twelve years before being attacked. It would be as fair to hold the tailor responsible for the safety of clothing from moths as to hold the upholsterer responsible for the safety of furniture.

A STATUE of General Israel Putnam, by J. R. A. Ward, is being cast in Philadelphia, Pa.

DECISIONS OF THE COURTS.

United States Circuit Court---Northern District of New York.

FIRE ARM PATENT.

THE BERDAN FIRE ARMS MANUFACTURING CO. *vs.* E. REMINGTON & SONS.

WOODRUFF, *Judge:*

I have very grave doubts whether the so-called device described in and covered by the reissued patent upon which this suit is brought is patentable. The manner of constructing and securing the breech piece for a breech loading gun, which formed the subject of the original patent to Hiram Berdan, was, so far as appears in this case, an original invention. In procuring reissues of that patent the plaintiff, his assignees, have sought to secure to themselves a monopoly of a curved surface on the hinge of the breech piece, which was no feature of the invention in what were its distinguishing features, but which was an obvious mechanical necessity incidental to the application of Berdan's device, or to the application of any similar device, whenever the hinge pin is placed so high as to raise the surface of the hinge above the line of the barrel. Cutting away an obstruction to the introduction of the cartridge did not require invention—it was inevitable.

But my conclusion in this case does not rest on the doubt so expressed. I find as a fact established by the evidence that Berdan was not the inventor of the curve in the hinge, which is the subject of the patent sued upon.

His invention neither contained nor contemplated this feature in the breech piece. He did not contemplate placing the hinge pin so high as to render the curve necessary, nor did he give to the mechanics who, under his partial supervision, constructed the model of his actual invention, or the drawings from which his first gun was made, any instruction or suggestion embracing such a curve. The making of the curve in the hinge, when that gun was in fact constructed, resulted from a departure from Berdan's model by the workmen themselves, not by design, but through inadvertence. When the parts of the gun were completed and put together the workmen found that either by a departure in the working drawings (made by one of them) from the model, or by a departure in the gun from the working drawings, the hinge pin was raised so high as to interfere with the insertion of the gun barrel, and also to interfere with the insertion of the cartridge, and they, therefore, as a matter of judgment, cut it away. They did it not to obviate a difficulty necessarily incident to the use of Berdan's invention, but a difficulty created by the workmen themselves through an inadvertent error and departure from Berdan's contemplated position of the hinge pin. In short, he contemplated raising the hinge pin as high as, with the hinge in the ordinary or straight surface form, was conveniently practicable, and they made under his direction both model and drawing of his invention in that form; but when they made a gun they placed the pin so high as to create the obstruction above referred to, and they cut it away to cure the apparent defect.

In this Berdan was not consulted. He was not present when its necessity in that gun was discovered, nor was he present when it was done. Berdan did not invent it. If anything in the nature of invention pertains to it, that was done or made by the workmen without his knowledge.

The bill herein must be dismissed with costs.

H. M. Ruggles, for complainant.

Geo. Gifford, for defendant.

United States Circuit Court,---Southern District of New York.

BILLIARD TABLE DESIGN PATENT.

HUGH W. COLLENDER *vs.* WILLIAM H. GRIFFITH.—THE SAME *vs.* THE SAME.

These two suits were submitted together on the same proofs. The one suit is founded upon a patent for a design for a billiard table; the other upon a copyright of an engraving exhibiting a view of the same billiard table, with its ornamentation by carving, etc.

Judge Woodruff held substantially as follows:

It being shown that tables with the sides beveled inward from the top have been known before, a patent is void which claims the design of a billiard table thus constructed in order that the player may advance his foot farther under it.

It is a mere question of judgment, not invention, how far the bevel shall be carried, and a patent for the design of a billiard table is not rendered valid because a much deeper bevel is shown in it than has been used in other tables.

If a patent for a design covers the ornamentation shown in it, it is no infringement to use the principal figure without the ornamentation.

A person who publishes, by way of advertisement, an engraving of an article he has on sale cannot by copyrighting it prevent others who have an equal right to sell the article from using a similar engraving in advertising it.

The bills of complaint dismissed with costs.

NEW BOOKS AND PUBLICATIONS.

INDUCTIVE INQUIRIES IN PHYSIOLOGY, ETHICS, AND ETHNOLOGY, relating to subjects of recent research and speculation. By A. H. Dana. Price $1.25. New York: A. S. Barnes & Co., 111 William Street.

This volume contains fifteen essays, all of which are of much literary merit and show great and varied powers and high mental culture.

PRE-HISTORIC RACES OF THE UNITED STATES OF AMERICA. By J. W. Foster, LL.D., Author of "The Physical Geography of the Mississippi Valley," etc. Price $3.50. Chicago: S. C. Griggs & Co. New York: Mason, Baker, and Pratt, 142 Grand Street.

The lamented death of Dr. Foster gives a melancholy interest to this volume, which was published just before his decease. Like all his previous writings, it is clear and forcible in style, and bears in every page evidence of learning and research. It is the last contribution to a most interesting branch of study from one of the most capable of the scientific writers of this generation.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From June 27 to July 3, 1873, inclusive.

CARPET.—T. Crossley, Bridgeport, Conn.
CHAMPAGNE TAP, ETC.—W. L. Gront, Boston, Mass.
DISTILLING RESIN, ETC.—R. Lloyd, New Orleans, La.
ENGINE BRAKE.—O. Grüninger, New York city.
FIRE ARM.—W. R. Evans, Lynn, Mass.
INHALER.—C. D. Hunter, Marlborough, Mass.
LANTERN.—A. H. Cramp (of New York city), Willesden, England.
LOOM.—L. E. Ross, Providence, R. I.
MAKING MIDDLINGS.—G. T. Smith, Minneapolis, Minn.
NICKEL PLATING.—H. T. Brownell, Hartford, Conn.
PRINTING CARPETS, ETC.—T. Crossley, Bridgeport, Conn. (Two patents.)
PROPELLER, ETC.—B. T. Babbitt, New York city.
REAPER, ETC.—H. Lee, Beloit, Wis.
ROTARY PUMP.—L. Chapman, Collinsville, Conn.
SEWING MACHINE, ETC.—J. Ross, Philadelphia, Pa.
STEAM BRAKE, ETC.—J. F. Taylor, Charleston, S. C.
VALVE GEAR.—J. Tesseyman *et al.*, Dayton, Ohio.
WATER COLUMN.—J. N. Poage, Cincinnati, Ohio.

Recent American and Foreign Patents.

Improvement in Attaching Metal Caps to Glass, etc.

Cecil B. Jenkins, New York city.—This invention for attaching caps, lamp tops, covers, etc., to glass and porcelain articles consists of one or more metal disks, having slots from the center hole, forming elastic projections which impinge the glass or porcelain forcibly, by having the hole made in the disk slightly smaller than the object to which the cap or other article is secured, and hold better than the plaster fastenings now in use. This kind of fastening is cheaper than the plaster, and it has the advantage of allowing the taking off the cap or other article and putting it on at any time, without any more labor than is required to put on any ordinary loose metal cap.

Improved Whip Socket.

James H. Young, Newburgh, N. Y.—The object of this invention is to furnish for wagons of all kinds an improved whip socket, which firmly grasps the whip therein, so that the loss of whips and other annoyances arising therefrom may be prevented. Bunches of bristles extend radially from the circumference toward the center of the socket, leaving a suitable space in the center. The whip end enters easily therein and is tightly embraced by the bristles, which spread and offer sufficient resistance against the disconnection of the whip from the socket till taken out by the driver.

Improved Hunting Jacket.

Jean Garaud, New York city.—The object of this invention is to furnish to sportsmen a hunting dress to which a cartridge pouch is attached to the back in such a manner that the cartridges may easily and conveniently be carried and taken out for the purpose of loading the gun. The pouch may also be detached and carried on the shoulder. The invention consists of an additional lining on the back, with side openings and lapels for the attaching of the pouch, which is constructed with a leather strap, so as to be detachable.

Improved Ash Leach.

John W. Kernodle and Adam H. Haun, Lebanon, Ind.—This invention relates to means for the leaching of ashes so as to secure the lye without danger of fire, and consists in a metallic covered cylinder, scalloped at the ower end to allow the lye to flow therefrom, and a metallic inclined trough upon which it rests, and by which the lye is conveyed to a suitable receptacle.

Improved Lamp Chimney Supporter.

William Mears and Henry Davies, Newport, Ky.—The object of this invention is to construct a device by which the globes of side and center lamps of railway passenger cars may be easily changed without disturbing the lamps, for the purpose of cleaning the same or substituting new ones without delay. The invention consists of a cylindrical tube connected by brackets to the sides or top of the car, which tube incloses the sliding metallic chimney resting on the globe, and allows the same to be set to any desired position by means of wedge or spring clamp arrangement.

Apparatus for Burning Liquid Fuel and Generating Steam.

William T. Scheide, Tidioute, Pa.—A cylinder of suitable size and strength has in its center a combustion tube. This tube is open at the bottom, and is partially filled with broken fire brick, or other incombustible material. The annular space between is filled with water. In the combustion tube or chamber, liquid fuel, or any fuel that burns without leaving a solid ash, is used, and is introduced through a tube by means of a force pump. Air is forced in through a tube which surrounds the fuel tube. The fuel and air are forced into the fire chamber together and ignited. The current or currents produced are sufficient to force the entire products of combustion up from the bottom of the combustion tube and through the water, thereby generating steam. By this apparatus it is claimed that the entire heat generated is utilized. The incombustible material placed in the combustion tube tends to break the flame and protect the tube from the effects of heat.

Improved Heating Range.

John Lawlor, New York city.—This invention consists in a certain arrangement of dampers and deflecting plate with relation to compartments at the side of the air heating chambers of the range, whereby the direction of the currents of heated gases and other products of combustion may be controlled so as to increase the temperature either in said air chambers or in the ovens which are supported above the body of the range proper.

Improved Pantaloons.

Frederick T. Hoyt, Brooklyn, N. Y.—It is proposed, in this invention, to employ elastic straps on the pantaloons, at the back, for buttoning them to the jacket, to compensate for the increase in the length of the back when the wearer bends forward, and thus allow of fitting boys' pantaloons as nicely as those worn by older persons.

Improved Truss Bridge.

Daniel C. Bower, Troy, Ohio.—This invention has for its object to furnish an improved bridge. The lower and upper chords are made double, treble, or quadruple, according as less or more strength is required. In the spaces between the strands of the chords are placed dovetailed blocks, through which blocks pass the vertical rods to bind the chords to each other. The rods also pass through triangular blocks, against which the ends of the braces rest. The upper ends of the two central braces rest against the central block of the upper chord, and their lower ends rest against the blocks of the lower chord upon the opposite sides of the center of said chord. The braces upon each side of the central braces are placed parallel with said central braces, the upper end of each outer brace being directly above the lower end of the adjacent inner brace. By this construction, the bridge has no counter braces, and the weight is thrown from the center of the bridge from brace to brace to the abutments, so that the bridge cannot sag in the center.

Improved Rotary Stamp Canceler.

William Schacht, Brooklyn, N. Y.—The object of this invention is to furnish to brewers and others a convenient apparatus for canceling internal revenue and other stamps in a quick and expeditious manner, near the central part of the same. To the frame of the rotary stamp canceler is secured an ink receptacle, and below the same the inking roller. Directly above and parallel with the latter is the printing roller. The ink receptacle is provided with a narrow outlet at its lower end, opened more or less by means of a sliding gate. An ink distributer, of suitable material, is hung near to, and in contact with, the inking roller. The printing roller has side shoulders which, in connection with a pressure roller, carry the stamp strips through, so that the stamps will successively be canceled by the rotation of the roller. The lid has a recess slightly conical, from the inside toward the outside, for the insertion and adjustment of the changeable types for dates, etc. No cutting of the paper of the stamps is produced.

Improved Lamp.

Riverius Marsh, Flushing, N. Y.—This invention consists of a metal lamp top so constructed as to form an oil receiver or drip cup at the connection where the burner is attached, also an inverted collar for the attachment of the safety tube, and also a collar for attaching it to the collar or neck on the top of the glass reservoir, by screwing on or otherwise. A vent also is provided for the escape of the gas, all so as to form a strong, ornamental, and protecting detachable metal portion for the lamp.

Improved Binder for Loaded Wagons and Sleighs.

Jacob Paff, Lawrenceburg, Pa.—The object of this invention is to improve the means now in use for binding loads of lumber, logs, rails, and similar loading. The binder is placed on top of the load. The ring of a chain is attached to an arm and passed through the fork of the lever and around the load. A pivoted hook, when the lever is carried forward, now takes hold of the end of the chain. Then the lever is brought back, thus bringing the ends of the chain together and binding the load. If the chain is too long, it is brought within a slot in the hook, which holds it while a new hold is taken by the lever. To unbind the load the arm is raised, which allows the ring of the chain to slip off. When the load is bound, the chain is held by the slotted hook and the arm, so that the lever is reversed, and its small end may be used for raising the arm. This improvement does away with the old binding pole, and may be applied in one fourth of the time.

Improved Cooking Stove.

George McAdams, Vevay, Ind.—The object of this invention is to furnish a cooking stove, constructed in such a manner that the different parts may be easily packed and shipped, to be mounted by any tinsmith, and the parts exposed to the fire easily replaced. The oven is placed below the fire box, and supplied with a steady uniform heat around both sides. The invention consists in the combination of sheet and cast iron parts in such a manner that the front, back, and top plates are of cast iron, the side and bottom plates of sheet iron, the interior parts, also, being of sheet iron and cast iron, and connected by wedge strips of sheet or solid iron. The flues are arranged so that the draft carries the heat from the fire box around the oven and below the bottom of the same up the chimney.

Improved Circulating Valve for Fire Engines.

Charles A. Hague, Hudson, N. Y.—The case is attached to the discharge chamber of a fire engine by a screw, and a pipe is attached with the suction. When the pressure rises in the discharge by the shutting off of the escape, the water, acting on a small valve, lifts it against a spring and acts on the top, thus forcing down another valve and opening a passage through which the water escapes from the discharge to the suction, and thus relieves the pressure in the hose. The valve is held up, when not subject to water pressure, by a spring, and may be adjusted for different pressures or different pumps. This device is claimed to be more instantaneous in action than a relief valve.

Bracing and Reinforcing Legs of Chairs, etc.

George Francis Dawson, Washington, D. C.—This invention consists in a novel mode of bracing and reinforcing the legs of rotary chairs, by forming thereon heads, which are nicely jointed together and held by a flanged plate at top and bottom, together with a nut on the tubular screw socket.

Improved Boot and Shoe Sole.

Wendell Strasser, Taylorsville, O.—This invention relates to wooden soled shoes, for skating or walking purposes, and consists in a peculiar method of applying double nails in fastening the uppers of shoes to the soles so as to form, practically, a metallic thread, which makes the article of manufacture to all intents and purposes a sewn shoe.

Improved Potato Digger.

Henry M. Dowd, Saratoga Springs, and Willis W. Dowd, Jr., North Granville, N. Y.—An endless carrier has teeth or fingers arranged in rows across it, at suitable distances apart, for taking the potatoes from the scraper and carrying them up so as to deliver them into the hopper. The scraper or shovel consists of a straight wide plate of steel extending horizontally between the side pieces and transversely to the longitudinal direction of the machine, with the front edge sharpened and slanting downward considerably. The rear edge of the scraper has parallel bars attached to it, which are for allowing the earth raised up with the potatoes to fall back, while retaining the potatoes to be taken by the fingers of the carrier, which are caused to rise up between these bars. The side pieces, to which the scraper is attached at the ends, are extended rearward and upward so that the carrier works between them to receive all the potatoes forced up on the bars, and the lower edges constitute runners for gaging the scraper and maintaining it in the required position relatively to the carrier. By suitable arrangement of apparatus for raising and lowering the scraper and carrier, the scraper is raised vertically or very nearly so, and maintained horizontally. The truck wheels are made large to support the frame high enough to provide sufficient space under it for the raising of the carrier and scraper and holding them to be transported above the ground, so that the evener, to which the team is hitched, can be suspended below the frame, and yet be high enough to work properly. The draft is applied directly to the scraper and, through it and the suspending devices, to the truck; and a chain connection and the mode of suspending the evener and draft bar allow of the raising and lowering of the scraper and carrier, and also allow the scraper the freedom for swinging required while at work.

Improved Washing Machine.

Edwin S. Bliss, Richburg, N. Y.—This invention has for its object to furnish an improved washing machine of that class in which the clothes are washed by alternately saturating them and passing them between rollers by which the water is pressed out, carrying the dirt with it. The lower rollers revolve in bearings in the standards and the upper or pressure roller revolves in bearings which slide up and down in slots in the upper part of the standards. A bar, the ends of which fit into the slots, rests upon the tops of the bearings. Two elastic bars are arranged above the bar and connected with loops, the ends of which are pivoted to the outer sides of the standards. The pressure of the spring is regulated by moving the loops out or in upon the projecting ends of the spring bars. A guide apron or belt passes around the rollers. By suitable devices the machine can be quickly attached to and detached from the tub, and when attached will be firmly and securely held.

Improved Spinning Mule.

Thomas H. Rushton & Robert Tonge, Bolton, Eng.—The object of this invention is to simplify the gearing of hand and self acting mules for producing the after stretch and for giving motion to the front roller during the twisting at the head; also, to render self acting mules suitable for spinning fine numbers; secondly, in an improved arrangement of mechanism for locking the fallers and for unlatching the "long lever," forming parts of a self acting mule.

Improvement in Propelling Canal Boats.

William F. Miller, East Walpole, Mass.—This invention is an improvement in the class of canal boat propellers wherein a vertically adjustable wheel is arranged to run on the bottom of the canal, or a rail laid thereon; and consists in the connection of a locally fixed driving gear with the rotary vertically sliding driving shaft of the propelling wheel, and in the arrangement for throwing the mechanism by which the wheel is raised in and out of gear.

Improved Boot Jack.

Horace Arnot, Barclay, Pa., assignor to himself and G. W. Dickey, of same place.—The object of this invention is to furnish a boot jack, which takes hold firmly of the boot at toe and heel, and allows its easy pulling off. This invention consists of two jaws with inclined slotted parts, which grasp the heel by the action of the foot on a pivoted U-shaped rod frame guided therein.

Improved Broom.

John D. Bell, Wattsborough, Va.—This invention relates to the construction of brooms, and consists in a wooden handle with a tapered end, and a tubular socket for holding broom corn, or other material for the brush. In practice, the butts of the broom corn are inserted and closely packed in the socket. The tapered end of the handle is then forced down among them, thus wedging them between itself and the inner sides of the socket. When the brush needs renewal the screws which are used to secure the socket and handle together are removed, the handle withdrawn, and the stumps of the corn extracted. The socket is then refilled as before.

Improved Reversible Harrow Teeth.

George W. Hurst, Avon, O.—This invention consists in providing a harrow tooth with two arms or shanks, which, forming an angle with the tooth, are attached on different sides of the longitudinal bar of harrow frame, and thus brace it in two directions.

Improved Sawing Machine.

George Marshall, New York city.—This invention relates to an improvement in the mechanism for sliding the bearings of the saw mandrel in a ripping and cross cutting machine; and consists in the connection of the sliding carriage and its belting with a powerful foot lever and friction rollers, by which the saw can be moved and operated in both directions, and adjusted rapidly for the different purposes to which the machine is applicable.

Improved Combined Scissors and Tape Line.

Margaret J. Stubbings, Youngstown, O.—The object of this invention is to combine the common scissors or shears with a spring tape measure so that, by the increased convenience in handling and readiness of having both within reach, a very useful and practical instrument is produced. The invention consists in placing the center of the tape line case on the extended screw pivot of the scissors, so that both instruments can be used without interfering with each other.

Improved Kindling Wood Cutter.

Nicolas Sonnichsen, San Francisco, Cal.—This invention consists of a knife with a handle attached to a vertical frame, which is applied to some convenient place in the kitchen or other place, and has several step-like rests supporting the wood, which is split by the pressure of the knife upon it.

Improved Earth Auger.

Andrew Sorg & Samuel C. Bollman, Decatur, Ind.—The object of this invention is to construct an earth borer which serves at the same time as a receptacle for carrying up the ground from the bore hole. The invention consists in a cylindrical body or receptacle, with cutting teeth at the lower end, which is applied to the end of the bore shaft, and composed of two parts, the smaller of which is pivoted to the larger in such a manner that by suitable rope connection the pivoted part acts against the main part, embracing the earth between them, to be lifted out.

Improved Carving Machine.

Henri Thomas, Brooklyn, E. D., N. Y.—In this improved carving machine two centering holders are employed, one for holding the pattern and the other the work, on sliding beds arranged on quarter circular ways on the top of the table, which meet each other at the middle of the back of the table, and diverge therefrom to the front side. Above these are the tool and guide or dictator, which hangs vertically from their supports in the free ends of horizontal arms which are pivoted to a block over the table near where the ways of the holders meet, in such an arrangement that they traverse the work and pattern in the longitudinal axes of the center holders. The work and pattern traverse the paths in which the tool and guide swing, so that the requisite motions are obtained for the tools to act on all parts of any surface in the holders. Different sides or surfaces are presented by turning the work and pattern in the holding centers. The block to which the pattern and tool arms are pivoted is made to slide vertically on a support, with a screw under the control of the operator; the arms of the tool and guide are also at the control of the attendant by means of a sliding block to which they are connected, for being swung to move the tools, as required in the progress of the work; and the bed plates of the center holders are caused to swing forward and backward on their ways by a hand screw and a traversing nut, to which they are suitably connected.

Improved Mop Wringer.

James H. Newton, Paxton, Ill.—The object of this invention is to furnish, in connection with the mop in common use, an effective wringer, by which the cloth may be wrung dry without the use of the hands. The invention consists in the arrangement of the mop with rollers having spiral springs in their interior, in connection with a sliding piece and strings, by which the mop is drawn through the rollers and pulled back again for use by the action of the roller springs.

Improved Combined Furnace and Steam Generator.

Oliver W. Ketchum, Toronto, Canada.—This invention consists in a mode of producing a continuous combustion of fuel in the furnace of a steam generator (after ignition) by forcing one or more currents of air upon it. It also consists in conveying the heat and products of combustion (after passing through a horizontal flame chamber) to the water in the boiler by means of a pipe constructed so as to curve upward from the flame chamber above water mark, and return below water line, passing through the boiler horizontally and discharging into the water through pipe having perforations which increase in size and number toward the end. The invention also consists in providing the boiler on the inside with concave projections running through its length on both sides above the pipes referred to, and above the water line, so that the ebullitions of water above said pipes, and caused by escape of gas, are thrown back into the middle of boiler. It also consists in providing the dome of boiler with concave pieces of iron resting one upon the other, constructed with spaces between each and between the sides of dome, to act as additional deflectors.

Improved Animal Trap.

Jacob Merchen, Brookville, Ind.—The object of this invention is to furnish to farmers and others a mole trap, durable on account of the strong and substantial parts. The invention consists of two legs with a collar at each end, connected by a strong spring of plate metal. A piece of square metal is wedged between the smooth legs, so that the slightest touch will close the legs with strong force, capturing or killing the animal within reach.

Improved Package for Caustic Soda or Alkali.

Henry B. Hall, New York city.—This invention consists of a metallic cup of soft iron, lead foil, or lead and tin, or other alloys of lead, or the metal known as Crooke's patent foil, which is composed of lead and tin in strata, the lead being in the inside and the tin on the outside. In this the caustic alkali is poured in a liquid state, and inclosed and sealed by a cover of melted resin poured in after the alkali has solidified but before it has quite cooled, the resin being tempered to correct its brittleness; any other gummy substance capable of sealing the mouth of the cup airtight will answer as well.

Improved Combined Collar and Cravat.

Frederick D. James, Tamworth, N. H.—This invention has for its object to produce a simple combination of bow, cravat or neck tie, and collar, being more particularly intended for use on paper or part paper collars, though applicable to other kinds. The invention consists in constructing the collar with projecting flaps at the ends of its outer fold, for forming the base of the cravat, and with a projecting T flap at one end of its inner fold for forming the outer part of the collar, the T flap having several button holes to allow its parts to be fastened to the same stud by which the collar is held to the front of the shirt.

Improved Stave Machine.

Benjamin W. Warner, Rome, N. Y., assignor to himself and Albert E. Smith, of Utica, N. Y.—This invention consists of a pair of tapering and beveling cutters for tapering and beveling the edges of the stave, combined with the apparatus for sawing the staves from the bolts, and planing the sides in such manner as to bevel and taper the edges at the same time that the staves are sawed.

Improved Children's Carriage.

Francis Snyder, New York city.—This invention has for its object to furnish a combined perch and spring for a child's carriage, which, should the wheel strike an obstruction, will spring longitudinally, so that the body of the carriage will not be stopped with a sudden shock. The invention consists in bending the ends of the perch upward and inward into the form of the letter C, and pivoting the same to the toe irons attached to the carriage body.

Business and Personal.

The Charge for Insertion under this head is **$1** *a Line.*

Notes & Queries

E. R. would like to know how to soften pearl shells, and how to stain them in any color.

O. C. W. asks: Which is the easiest, to make steam with high water or with low water in the boiler?

P. asks: What is the best oil to keep patent leather from cracking?

D. & Co. ask: 1. Is hemp preyed upon by any insect? Is it offensive to insects other than its parasites; and if so, within what radius? Might it be made efficacious in protecting cotton from the ravages of the cotton worm? Could any other plant be utilized in this way?

J. M. R. asks: Why the images of objects, being reversed upon the retina of the eye, are yet apparent to us in their proper positions?

W. J. M. asks: How many gold fish can I keep in a tank holding 32 gallons of water, and how many plants will I need?

A. S. Jr. asks how to make the so-called scintillettes, or Japanese parlor fireworks.

Answers to Correspondents

J. K. S. can remove rust from steel articles by following the directions given on p. 26, vol. 25.—The process of polishing shirt bosoms, collars, etc., asked for by J. A. M., is given on p. 114, vol. 24.—A. W. can obtain Stölzel's work on metallurgy through any of the booksellers who advertise in our columns. The book, we believe, has never been translated into English.—E. S.'s query about preserving vegetables and fruits is too comprehensive to be answered in these columns. Apply to some one who is a preserver by trade.

E. B. G. says: 1. We have had two very dry seasons during 1871 and 1872, only a third or one half of our usual rain having fallen; consequently the wells became very low, and some entirely dry. When the ground froze, about November last, we had only five or six inches of water in our well. From that time, the ground being constantly frozen, the water began to increase; and at the time of the spring thaw, about the middle of March, the water measured five feet, and after the spring rains about six feet. How is the rise of water to be accounted for? 2. We have recently put up a 10 horse portable engine and boiler. I wanted the firebox end next the door (it was necessary to place it crossways of the shop, or athwart ship, in sea phrase,) but my partner says: "No, the firebox must be in the middle of the shop," thereby getting about five feet additional length of belt. Will that compensate for carrying the coal in and the ashes out? 3. I am boring out a cylinder of a steam engine that was originally 10 inch bore and 20 inch stroke, but it has been rebored so many times that it is now 11 inches inside; consequently the cylinder is only about five eighths of an inch in thickness, and, when finished, will probably be only half an inch in thickness. Will it be safe to run the engine so, and was the cylinder of an engine ever known to burst from the pressure of steam? Answers: 1. The well may be supplied from a distant source, which is subject to different climatic influences. 2. You do not send sufficient data to enable us to answer this question. 3. Cylinders have been known to burst when the engines were working. Your cylinder will be deficient in stiffness, and will have a tendency to become oval. You can stiffen it with bands, and it will then be safe for a reasonable pressure of steam.

C. G. van P. asks: 1. Is there any sheet metal more pliable and not much more expensive than galvanized iron, on which any design can be pressed with a drop press, to a hight of ⅜ inch, without cracking? It is to be used for roofing purposes. 2. What is the Francis metal, from which life boats are made? Answers: 1. Zinc possesses greater malleability and ductability than iron, and its price is less than that of galvanized iron. 2. The Francis life boat is constructed of corrugated iron.

T. P. asks: In arranging a dwelling warmed by hot air from a furnace, where should the ventilator be placed, near the floor or the ceiling? Or should the egress for vitiated air be at both points? Is it as well to take cold air for the furnace from the hall as from the outside of the building? Answer: A complete system of ventilation, to operate properly both in summer and winter, requires ventilating registers both at the floor and at the ceiling. In winter it is preferable to have the upper one closed, so that the heated air may not too readily escape, and the vitiated air be driven out of the lower one by the pressure of the warm air from the furnace. In summer, by opening the upper one, the warmed air will escape in that direction, and the fresh air be most prevalent at the lower part of the room, where it is most available for use. A similar duplex arrangement is desirable also in respect to the supply of air to the furnace. There should be a cold air shaft arranged to draw the pure air from the exterior of the house, and this should be the usual source of the supply; but on occasions of extreme cold weather, the heating of this very cold air may be beyond the capacity of the furnace, and it may then be admissible to feed the furnace from the interior air of the house, which may thus be warmed a second time; but the healthier way is to draw the air from the outside of the house.

J. W. S. asks (1) for a recipe for making matches. 2. Is the invention of the friction match patented? 3. Is not a steam engine that has no condenser called a high pressure engine? Answers: The mixtures actually used in the trade are kept secret, but the following recipes give some idea of the composition: Phosphorus 8 parts, dissolved in a sufficient quantity of bisulphide of carbon, glue 21 parts, peroxide of lead 24·4 parts, nitrate of potash 24 parts. Another contains phosphorus 3 parts, gum senegal 3 parts, peroxide of lead 2 parts, fine sand and smalts 2 parts. The following composition was recommended by Wiederbold: Chlorate of potash 7·8 parts, hyposulphite of lead 2·6 parts, gum Arabic 1 part. The latter are known as non-poisonous matches, being free from phosphorus. 2. Some kinds are, others not. 3. A high pressure engine has no condenser and carries over 15 lbs. of steam.

J. P. L. says: 1. Suppose a hot air engine is working the air at a temperature of 500° or 600°, and I inject a very small or proper amount of water in the cylinder with the hot air, at each stroke of the engine or piston, this water to be hot and forced in as a spray. Would it be beneficial as to power, or would it be liable to create any explosive or dangerous gases? 2. Why have not the various hot air engines met with success as moters? 3. At about what degree of temperature do the Roper and other hot air engines use the air? Answers: 1. The effect of injecting the water would probably be to cool down the air, without producing a corresponding gain. The air would need a much higher temperature, to form steam from the injected water. In any case, the injection of water into the cylinder of an air engine would have a bad effect; because an air furnace is much less efficient than that of a steam boiler, and consequently if steam were to be used, it would be better to form it in an ordinary boiler. 2. Air engines have been moderately successful, when working within the limits of temperature which the cylinder and valves can sustain. 3. The temperature of the air used in different forms varies greatly. Joule's engine uses air at 600° Fahr., and Wenham's, described in a late number of the SCIENTIFIC AMERICAN, employs air at a temperature of more than 1100°.

S. S. C. asks: What is phosphoric acid lime? Answer: The acid phosphate of lime has, in modern chemistry, the formula $Ca(H_2PO_4)_2$; in old chemistry $CaO,2HO,PO_5$. This is generally known as superphosphate of lime. When burned bones are treated with sulphuric acid, a portion of the lime is combined with the sulphuric acid to form gypsum, and the soluble superphosphate remains, which is employed as fertilizer and in making phosphorus. $Ca_3(PO_4)_2+2H_2SO_4=2CaSO_4+Ca(H_2PO_4)_2$.

A. asks: Can you inform me how (1) sulphate of nickel and (2) protochloride of tin are made? Answer: 1. Sulphate of nickel is easily prepared by dissolving the metal or its oxide or carbonate in dilute sulphuric acid. If it be concentrated by evaporation, it will crystallize in beautiful emerald green crystals. 2. Protochloride of tin is formed by dissolving metallic tin in hydrochloric acid. To avoid the formation of any of the bichloride, it is well to employ an excess of metal, and only a moderate heat.

J. B. asks if any quality of glass is or can be manufactured that will withstand heat and cold as well as cast iron, and which, when heated and cooled suddenly by water or otherwise, is no more liable to crack than cast iron? What other transparent substances are there that will bear sudden and great changes of temperature, and where are they found? Answer: We do not know for what purpose you wish to use the glass; but if very well annealed, it will probably stand the tests you mention. We do not give addresses in this column.

A. B. C. asks how to make a noon mark to obtain the correct time. Answer: See p. 154, vol. XXVII. The meridian can be obtained pretty nearly by suspending two plumb lines in an open field or on a house top, several feet apart, and placing them so that the two lines range with the north star. Of course, the sun is sometimes fast and sometimes slow.

S. C. says: Suppose that two upright tubular boilers are placed 30 feet apart, and connected with 2½ inches wrought iron steam pipe, and two horizontal tubular boilers 175 feet distant are also connected to same pipe. Each has its own steam gage and they are correct within 3 or 4 lbs. Why is it that we cannot fully equalize the pressure? To a certain extent we do; but the horizontal boilers will blow off at 75 lbs. on their gage, and the uprights will also blow off at the same time, but the gages on the uprights will indicate 95 lbs. Why is this? Answer: We cannot give a decided opinion, in a case of which we do not know more particulars than our correspondent has given in his letter. It may be, however, that the horizontal boilers steam much more rapidly than the upright, so that the steam issues with much greater velocity from the first, and backs up the pressure in the latter.

T. M. E. says: In your answer to J. E. P., who asked what the effect of putting two pumps to work on the same discharge would be, the conditions of both pumps being the same, you say: It will force more water through, increase the pressure, and throw the water farther. Does not the pressure depend on the weight of water in the column and the quantity of water discharged? Will not the pressure be the same on both pumps and consequently will not the motion be reduced to one half, each pump discharging one half the original quantity of water? Answer: Attaching a second pump, of exactly the same size and under the same conditions as the first, would be precisely similar to the effect produced by doubling the size of the first pump; and of course more water would be discharged, under these circumstances.

P. V. C. wants to know what power can be given to an electro-magnet that is about 18 inches across the poles; also what sized battery it will require, and what will be the probable cost of the chemicals to work it. Who has the best work on electro-magnetism, and what does it cost? Answer: A straight bar electro-magnet, with a core 18 inches long and 1 inch in diameter, with 200 feet of No. 16 insulated copper wire in the helix, and excited with the electricity from a single cell of a Grove's battery, would hold about 1¾ lbs. of wrought iron, placed in contact with either pole. One cell of Grove's battery will cost about $2.50. Mercury, nitric and sulphuric acids, sufficient to last two weeks, 50 cents. Davis' "Treatise on Magnetism" is well recommended.

S. S. asks: What is the strength of wrought iron shafting? We have now in operation a 3½ inches wrought shaft conveying 110 horse power. Is it large enough to give 160 horse power, or will a 4½ inches shaft be better? Will it be strong enough under all circumstances? The length of the shafting is 120 feet. Answer: You do not tell us the speed at which you desire to run the shafting. Send this and also the diameter of larrest pulley on the shaft, and we will answer your query. Neither the 3½ nor the 4½ inch shaft would be strong enough under all circumstances.

J. A. S. says: In the practical working of a small steam engine, that will do all our work with 40 lbs. of steam, I find that our wood fire will vary in spite of all we can do, so that we often have 80 lbs. steam blowing off at the safety valve, during a considerable portion of the time. This fact has raised the enquiry in my mind: Why not have a "governor" to do for the fire what the regular steam governor does for the engine, namely, keep it steady? But how? This led to the invention of a plan, or at least to a theory, which is to attach a pipe, to the safety valve pipe, that would discharge into the firebox, so that (when the gage was set, say at 50 lbs., and a fire going that would soon carry it up to 80, if not discharged) the surplus in the form of steam might be turned into the fire box; my theory is that it would check the fire just enough to lower the steam, and so soon as the steam was down to 50 lbs. the valve would close, and let the fire brighten up again; and so on continuously. Is the idea new or old, or a chimera? If you know it to be the latter, will you so inform me? If new and not absurd, what is your view of the invention? Answer: We should be afraid that the surplus steam would occasionally do its work too thoroughly, and put the fire out altogether. Ordinarily the common damper regulator is efficient in cases of this kind. Another plan that has been proposed is to place a pipe in the steam space of the boiler, that is supplied with water by the feed pump. This pipe is to have a number of small holes drilled in it, so that when the valve is opened a fine spray of water will be thrown upon the steam, and condense it.

C. E. C. says: I have water power sufficient for about 9 months in the year, and have a steam engine to use when the water gives out. The boiler (30 horse) I now have is not of sufficient capacity to drive the engine and do the other work required, but is large enough when I use water power. Shall I throw out the old boiler and put in a larger one (say 70 horse) or put a 40 horse boiler by the side of the old one, and use one when using water and both when using steam? Answer: We cannot give a definite opinion, without knowing the age and condition of the old boiler; but if it would be serviceable for some years, it would be best to retain it. We advise you to consult a reliable engineer, who will inspect your boiler, and can then tell you what is best to be done.

A. G. asks: 1. Why is it that a vacuum gage shows 26 lbs. or inches when the vacuum is only 13? 2. Why should the grate bars of a steam boiler be lower at the end next the bridge wall than at the front? Haswell says that they should be, but does not say why. Answers: 1. Mercurial gages were formerly used, almost exclusively, to indicate the vacuum. A column of mercury, one inch cross section and about 2 inches high (more accurately, 2·04 inches) weighs one pound. Hence it became customary to speak of "inches of vacuum," and spring gages are graduated to conform to this nomenclature. 2. Principally for ease and convenience of firing. In a long furnace, with a small door, it would be very difficult to keep the back of the fire in proper condition, if the grate bars were level.

G. E. R. says: 1. I have tried the formula for connecting rods given in your issue of May 24, but I cannot obtain the correct result. 2. How do you determine the length of a rocker arm for a locomotive? 3. How do you obtain the length of a lever for a rotary valve? Answers: 1. We will assume the following data: Diameter of cylinder—24 inches. Maximum steam pressure—80 pounds. Length of connecting rod between centers—7 feet. Applying the rule: Square of diameter of cylinder × steam pressure × square of length of rod is $576\times80\times49=2,257,920$, which ÷ 20,000 = 112,896. Fourth root of 112,896 = 3·26. 3·26 + ⅛ of 24 = 3·56 inches = about 3⅝ inches. This is the proper diameter for the rod at the center, according to the rule. 2 and 3. The lengths of arm will depend upon the relation between required throw or angular movement of valve, and given throw of eccentric. Thus, suppose the eccentric has a throw of 6 inches, and the valve must travel 4, the relative lengths of eccentric and valve levers will be as 6 to 4, or as 3 to 2.

A. K. says: 1. How can I make a glue for sticking leather or cork firmly to iron? 2. How can I make the best invisible ink? Sal ammoniac requires too much heat to bring it out. Answers: 1. See pp. 347 and 363, vol. 28. 2. There are several varieties of sympathetic inks. A very weak solution of green vitriol (or ferrous sulphate) is invisible until brushed over with a solution of yellow prussiate of potash or nut galls. The former produces a blue, and the latter a black. If the writing is done with a weak solution of chloride of cobalt, it is invisible when cold, and blue when warm. This ink possesses the advantage of becoming invisible every time it gets cold, and hence may be used for secret diaries as well as correspondence. This is due to the absorption of hydroscopic moisture when cold, which is expelled by heat. Common ink, bleached out by oxalic acid, can usually be restored by ferrocyanide of potassium, and thus alterations in legal documents are discovered.

G. W. M. H. asks: Does the frost all come out of the ground, or part come out and part descend into or be absorbed by the earth? Answer; The frost is not a substance, but only the effect produced by the absence of heat; it follows that, whenever heat enters the soil, it counteracts the effects previously due to its absence. The frost can be said to be annihilated. The opinion that frost goes down is due to the fact that frost is found at a distance below the surface where absent near the surface, and also that the earth sometimes freezes to a greater depth after a thaw sets in. Evaporation produces cold, although itself caused by hea

Mrs. O. asks: How can I take the colors out of my *organdie* muslin without injuring the fabric? Answer: We have found, by a series of experiments, that, although green resists the action of chlorine and other powerful bleaching agents, Castile soap and elbow grease will remove it, if you only persevere. Wash a few times with Castile soap, and bleach in the sun.

C. B. S. asks: What are barytes, what are they used, for and where are they sold? Answer: Barytes is chiefly employed for adulterating white lead. It sells for a low price, depending on the demand in a given section. Write to some dishonest paint manufacturer for his price. It is sometimes employed on wall papers and in dressing cotton goods.

J. H. P. asks for a freezing compound. Answer: We present several, from which he can select the one adapted to his use. 1. Pour muriatic acid upon pulverized Glauber salt. 2. Take 5 parts by weight of sal ammoniac, 5 parts saltpeter, 19 parts water. 3. Take 1 part common salt and 2 parts snow. 4. Take 2 parts chloride of calcium, and 2 parts snow or powdered ice.

T. asks: 1. Can paint brushes which have been dried hard with paint, or linseed oil in them be softened in any manner so as to fit them for use again? 2. Where can I procure a small quantity of the paper used for making stereotype molds? Answers: 1. If not too far gone, they can be restored by soaking in benzine or turpentine. 2. The process is not simple enough in practice for an amateur. It will be cheaper for you to buy more type than to get all the machinery necessary for any sort of stereotyping.

C. P. A. asks: Is there danger in using certain fluids in lamps, among which may be mentioned gasoline, benzine, and naphtha, combined with small parts of salt, sal soda, alum, etc. Answer: Our advice is against risking life and property by the use of any burning oil or fluid which is more explosive than gunpowder. General Van Bokkelen slept safely for a while over a mine of nitro-glycerin, and so you may burn naphtha and gasoline in safety for a while; but the explosion will come at some time in spite of alum or salt, and the damage will quite compensate for any saving of expense. Use good oil, or a tallow dip.

F. W. C. asks: 1. How can I determine the transverse strength of a bar of wrought iron, ¾ of an inch thick and 8 inches wide, supported at each end and built in masonry, so that it cannot move except in the direction of the pressure? The load is distributed over the whole length, which is 11 feet between supports. It is to support the thrust of an arch. 2. I have a turbine wheel of 25 inches diameter placed 21 feet above the water in the tail race. A tight iron tube, 30 inches diameter, leads to the tail race. The whole head and fall is 42 feet. Am I not losing much of my power? The wheel makers say not, but I am 9,000 feet above sea level; does not that make a difference? Answers: 1. The breaking load in pounds = 12 × coefficient for transverse strength × breadth in inches × square of the depth in inches ÷ length of clear span in feet. An average value for the coefficient of transverse strength is 2,400 pounds. Use from ⅓ to ¼ of the breaking strain for a safe working load. 2. Yes.

W. R. B. says: The principle of the caloric or hot air engine puzzles me. I cannot understand how the engine can force air into the heater against the same pressure which is applied to drive the piston of the engine. At the same time the area of the air pump is equal to that of the piston. For instance, in Wenham's air engine (illustrated in the SCIENTIFIC AMERICAN, page 370, vol. XXVIII) the same piston with an equal area forces air into the heater. Is not the resistance on the pump side of the piston, when the valves are open to communicate with the heater, equal to the power which is being applied on the under side of piston to drive the same? Why is there not an equilibrium (equal pressure on both sides), and why does not the machine come to rest? Answer: In the engine alluded to, the resistance on pump side, when the valves are open to communicate with the heater, is precisely the same as the pressure on the other side of the piston; and if this state of things were continuous throughout the stroke, the engine would stop. But as the volume of air on the working side of the piston, being highly heated, is greater than the volume of cool air that must be forced into the heater at each stroke, the engine, by means of the accumulated work in its fly wheel, is enabled to overcome the resistance.

F. B. says: I have a new engine, 24 x 48, high pressure, which gives excellent results; there are 3 tubular boilers, 4 feet diameter, with 42 four inch flues, 15 feet long, with good draft; we carry 80 to 85 lbs. steam, and make with this machine about 500 barrels flour per day easily. I have thrown out an old engine; it is a Babcock cut-off (built in Brooklyn, N. Y.) of 23 inches bore, 48 inches stroke; the cut-off is a nuisance. How much power would I gain if I were to attach the latter engine to the same shaft, carrying 70 lbs. or from 80 to 85 lbs. steam? I think, if I put this engine on, I would throw away the cut-off and make a plain slide valve engine. Answer: With the data furnished, we must give you an answer based on ifs and ands. If you work the old engine under the same conditions as the new (same piston speed, steam pressure, and point of cut-off), and if the old engine is in as good order as the new one, you should increase your power about 90 per cent.

A. D. W. asks how to deposit a thin film of lead on iron, either by galvanic or other process. Answer: We know of no such process. You might try dipping the iron when perfectly clean, or by the aid of a flux.

F. H. says, in reply to J. N. H., who asked if a turbine will give as good results for power as an overshot wheel: I run a 10 inch turbine, and it does as much work as an overshot wheel; the fall is 24 feet and about 50 cubic feet of water runs per minute. I generally run with ¾ gate, and I find that it works nearly as well with partial as with full gate.

MINERALS.—Specimens have been received from the following correspondents, and examined with the results stated:

B. F. B.—Iron pyrites, of no value, except for making sulphuric acid.

J. B. B.—Dark and light colored clays.

H. M. C. sends two specimens of micaceous hematite iron ore. We give a few of the characteristics which distinguish this valuable ore. Hardness, 5·5 to 6·5, scratches glass, not easily scratched by the knife. Specific gravity, 4·5 to 5·2; color, steel gray to iron black, streak, cherry red or reddish brown. When heated on charcoal in reducing flame, becomes magnetic. Soluble in muriatic acid.

G. F. H.—Crystals of magnetic iron ore, which attract iron filings. Its composition is 72 per cent iron, 28 per cent oxygen. When rubbed on unglazed porcelain, it gives a black streak.

S. M. P. and J. H. S.—Iron pyrites.

W. R. S.—Corundum, of little value.

S. C. and J. M. B.—The clays sent contain no silver.

J. L. M.—A silicate of alumina. It might be of use as a polishing material.

F. M. C.—The specimen has a few crystals of sulphide of iron on one side. The mass is also pyrites, of no value.

W. C. C.—Contains a little iron and manganese.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Patent Rights. By J. E. T., J. W. H., T. W., and J. E. W.
On Easterly Air Currents. By W. L. W.
On Car Ventilators. By F. S. C.
On Psychic Force. By J. M. C.
On the Truths of Nature. By J. M. B.
On Water Witching. By A. B.
On Soldering Irons. By J. A. F.
On Work. By H. E. P.
On the SCIENTIFIC AMERICAN. By J. E. E.
On the Cable Triumph. By H. C.

Also enquiries from the following:
A. O. W.—H. W. P.—M. G. R.—C.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

July 1, 1873,

AND EACH BEARING THAT DATE.

(Those marked (r) are reissued patents.)

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Bridge, truss, Clarke, Bonzano & Griffen 140,471
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