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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.

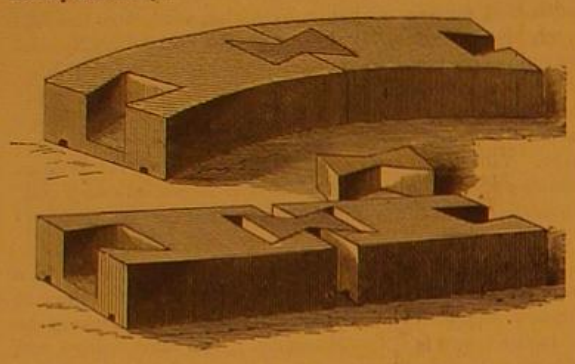
The reading of Mr. Varley's paper probably occupied an hour's time of the Society of Engineers.

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.

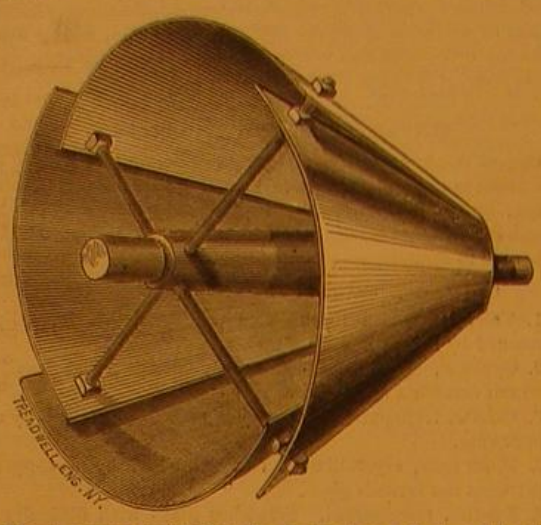
The inventor, Mr. Daniel Barnum, of No. 255 Halsey street, Brooklyn, N. Y., claims that the entire power of the air pump is thus utilized to clear the vessel, and this without interfering with the working of the engines. The arrangement has been placed in two vessels, in one of which, the Saratoga, after 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.

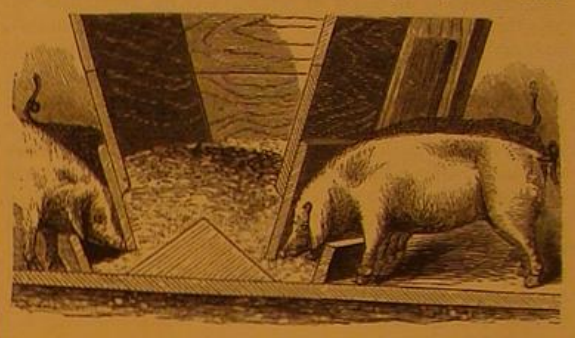
A Scientific American in Prussia.

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.

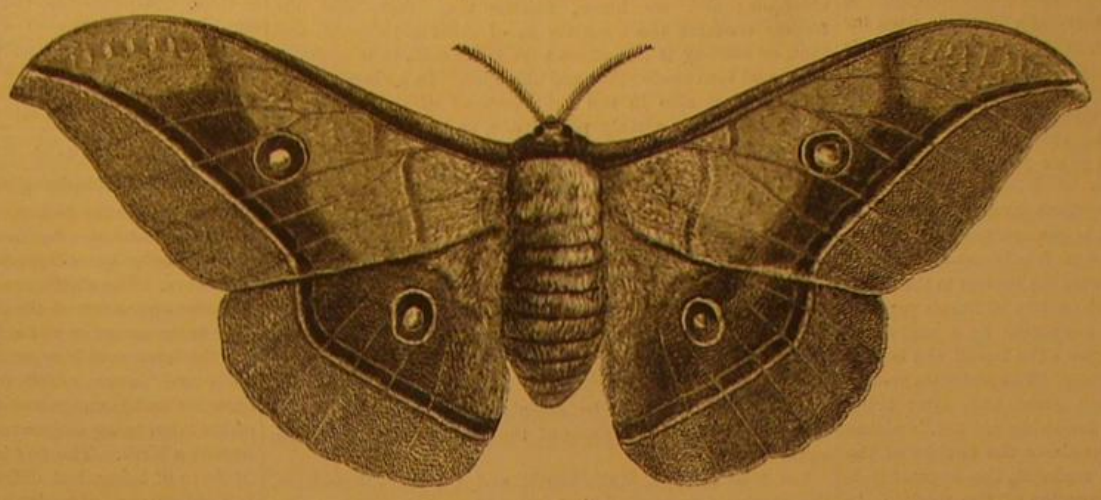


FIG. 1. THE PERNYI MOTH, FEMALE.

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.

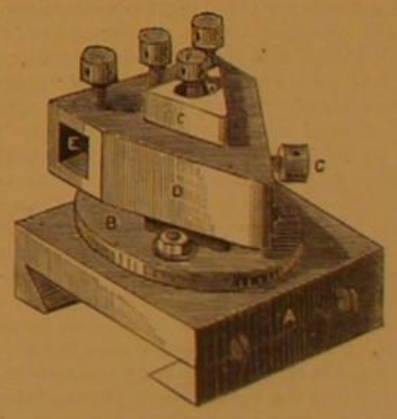
A correspondent of the New York *Sun*, writing recently from Colorado, gives an account of a visit to the famous petrifactions existing near the residence of Judge Castello, thirty miles west of Pike's Peak

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.

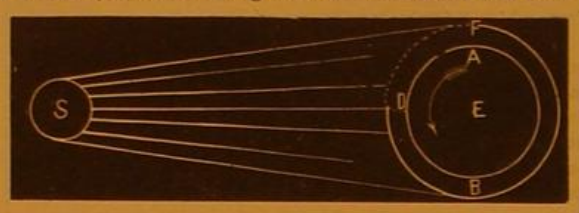
Correspondence.

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.

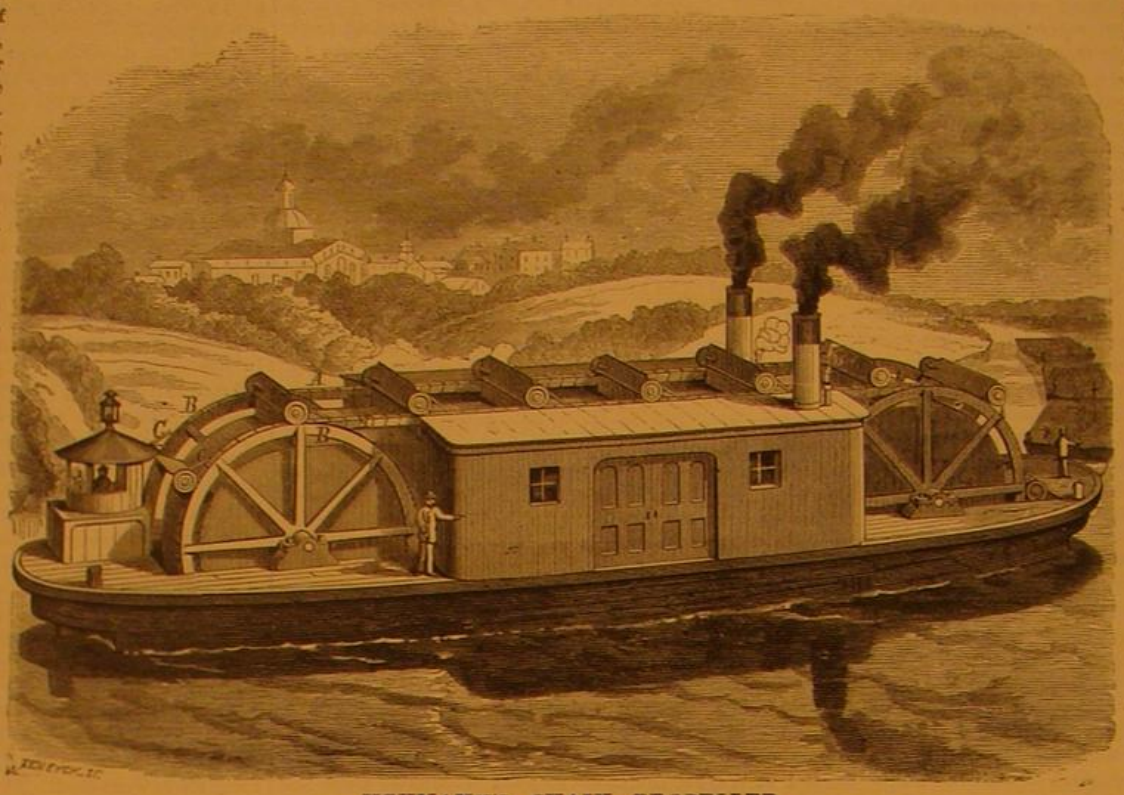
OF the eight Corliss engines in the Vienna exhibition, two come from Switzerland, one from Belgium, two from Germany, and three from Austria.

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.

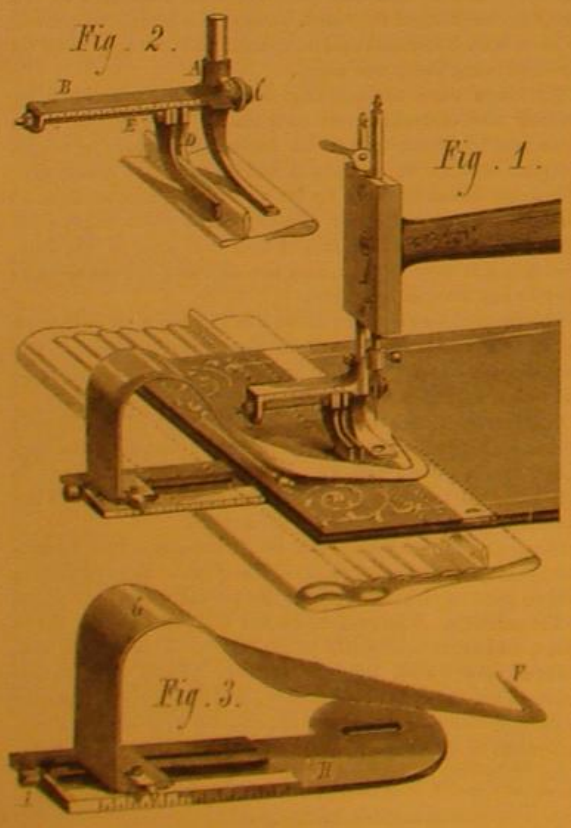
Patented through the Scientific American Patent Agency, Dec. 10, 1872. The inventor, Mr. John Neumann, is the originator of several other useful devices, and attained some celebrity several years ago by making a finely executed copper statue of Washington, entirely with the hand hammer. The work was 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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An deutsche Erfinder.

Diese große und thätige Classe unsrer Bevölkerung machen wir besonders darauf aufmerksam, daß unsre Firma durch ihre Verbindung mit Washington und den europäischen Hauptstädten, besondere Vortheile zur Erlangung von in- und ausländischen Patenten bietet.

Jeder Erfinder, gleichviel welcher Nationalität angehörig, ist durch die liberalen Patentgesetze der Vereinigten Staaten zum Patentschutz für Erfindungen berechtigt. Unsre Firma ist bereit, gestützt auf 26jährige Erfahrung, deutsche Erfinder jeder Zeit zu berathen und zu mäßigen Preisen rasch und pünktlich Patente zu erlangen.

Die Deutsche Section ist in den Händen fähiger deutscher Ingenieure, welche in der Office persönlich mit Erfindern verkehren werden.

Der „Scientific American" wird in seinen Spalten die bedeutenderen Erfindungen besprechen.

Correspondenz erbeten und prompt beantwortet. Pamphlete in deutscher Sprache werden auf Verlangen franco zugesandt.

Adressire:

Munn & Co.,
„Scientific American" Patent Agentur,
37 Park Row,
New York City

SCIENTIFIC AMERICAN

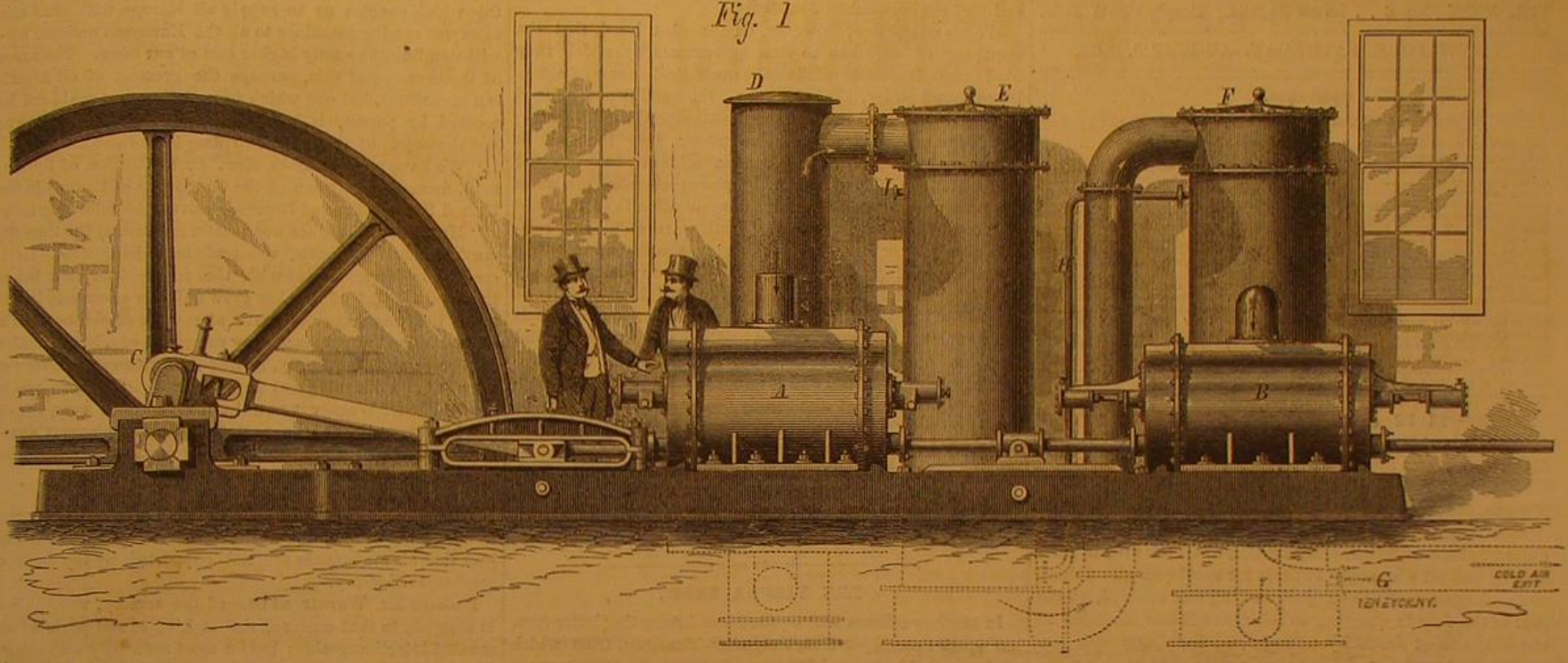
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXIX.—No. 6. [NEW SERIES.] NEW YORK, AUGUST 9, 1873. [$3 per Annum, IN ADVANCE

IMPROVED ICE AND REFRIGERATING MACHINE.

The various inventions which, during late years, have been devised for purposes of refrigeration, or for the manufacture of ice, may be divided into three principal classes: (1) Those in which evaporation is effected in a vacuum, the process being assisted by the use of an air pump, as in the ether machines of Messrs. Siebe, Tellier, and others. (2) Those in which air is first compressed and afterwards expanded, or, more generally speaking, those in which heat is adplied in order to ultimately produce cold, exemplified in the apparatus of Kirk of Glasgow, Mignot of Paris, and the Windhausen invention, to which the following description will more particularly refer. (3) Those in which cold is produced by the direct action of heat without the use of power, as in the case of refrigeration by the liquefaction and subsequent vaporization of ammonia, to which class belong the systems of Carré, Reece, Mort, and others of more recent date. In addition to the machines coming under the above heads, may be noted others employing freezing powders and different hydrocarbons, numbers of which, possessing various degrees of merit, exist both in this country and abroad.

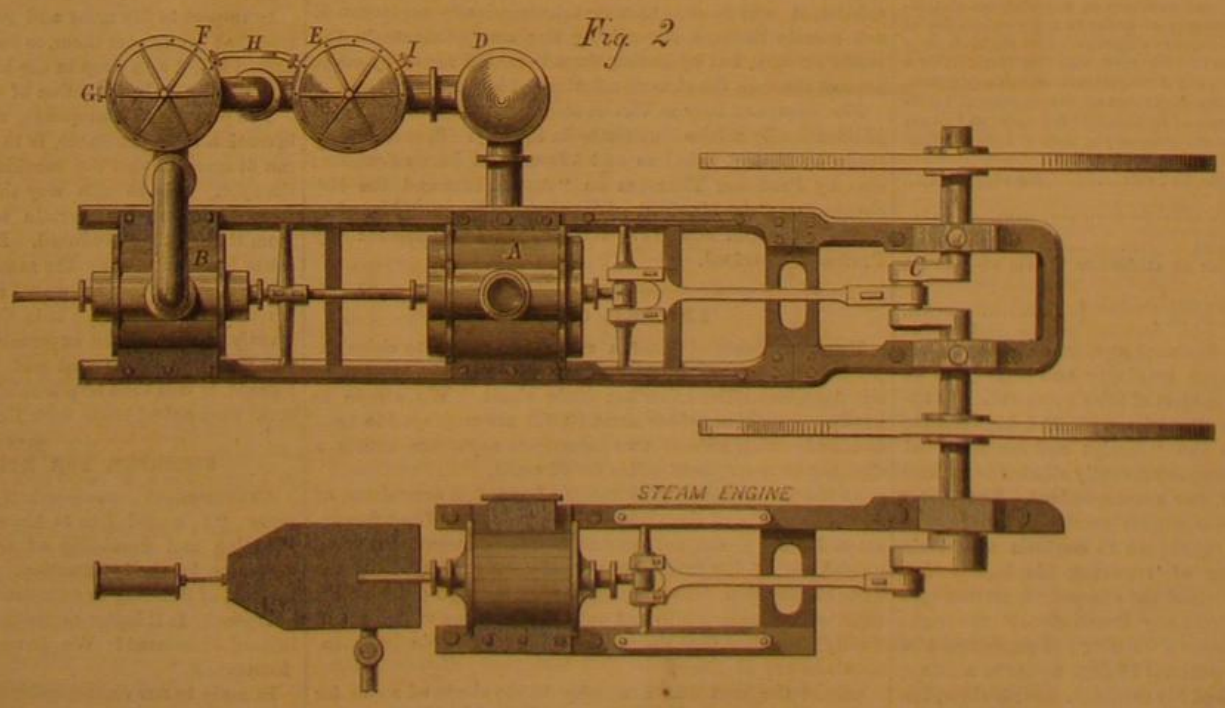
Fig. 1



THE WINDHAUSEN ICE AND REFRIGERATING MACHINE.

The Windhausen apparatus, which our engravings illustrate, was first patented in Germany; and in March, 1870, similar protection was obtained for it in the United States. It has already found general notice in our columns in connection with other devices of similar construction, and may be fairly considered as among the most successful machines of its class yet produced. The principle upon which it is based is one of the simplest in physics, namely, that the compression of the atmosphere generates heat, and its subsequent expansion, cold; an axiom too generally understood to need explanation here. The particular mode of its application in the present instance is, however, an important point; and, indeed, the entire efficiency of the device is claimed to rest upon the circumstance that, instead of cooling the air heated by compression by means of running water, and then conducting it directly to the space or apartment to be refrigerated, it is led into a chamber where dilation takes place. In brief, expansion is effected by the simultaneous action of the machine before the air is sought to be utilized.

Fig. 2



Our engravings present an elevation, Fig. 1, and plan view, Fig. 2. A is the compression cylinder, and B the expansion cylinder, both of which are worked simultaneously by power applied to the crank, C, by the low pressure engine shown in the lower portion of Fig. 2. Air enters in the direction of the arrow into the upper part of cylinder, A, which is of such dimensions that, at every move of the piston, nearly thirty-five cubic feet of air, or, as the former is double acting, twice that number, are compressed with every revolution of the engine. Thirty-six revolutions per minute, for example, compress 150,000 cubic feet per hour, and at a pressure, it is stated, of only 35 pounds per square inch, that is, reducing two and a half volumes of air to one volume. Supposing the air on entrance to be at 80° Fah., it is stated that, after compression, experiment proves its temperature to be 205°, indicating a gain, therefore, of 125°. Leaving the cylinder, A, the current enters the condenser, D, from which, in the direction of the arrow, it passes to a similar receptacle, E, thence down, as indicated by dotted lines in Fig. 1, to another cooler, F. Within these chambers, are arranged series of pipes through which the blast passes, and which are surrounded by a current of cold water which enters at G (dotted lines, Fig. 1), passes up through the cooler, F, through pipe, H, through the next cooler, and emerges at I. The effect of this water is to abstract a portion of the heat imparted by compression, reducing the temperature of the air to a few degrees above that of its natural state, the extent of this reduction depending upon the temperature of the water and the length of time the air is submitted to its action. An atmosphere is thus obtained which, although under two and a half compressions, is but slightly warmer than the ordinary air previous to treatment, while the expansive force and effect of a volume two and a half times larger is retained. Consequently, it is claimed that the 125° of temperature above noted are clearly gained.

In this condition the air enters cylinder B, where the expansion takes place under a gradually diminishing pressure, regulated by automatic valves worked by the simple expansive force of the compressed air itself. To dilate the latter to its normal volume, it is evident that the same amount of heat is required as was abstracted by the water; but this can only be partially returned by the small quantity of air within the expansion cylinder, so that a low degree of temperature is at once obtained. This is still further reduced with every movement of the machine, as the original air in the expansion cylinder becomes colder, or rather replaced by the cooled and compressed atmosphere. As the compression and expansion cylinders are simultaneously double acting, the latter receives its supply only from the former, so that the compressed air is expanded by one and the same process; hence, if 150,000 cubic feet are compressed in one hour, necessarily the same amount must be expanded in a similar time.

From the cylinder, B, the air escapes into the space to be refrigerated with great velocity, sufficient, it is stated, to be capable of conducting the current through channels two feet in diameter a distance of 300 feet from the exit aperture, the measured temperature of the air at the orifice being from 30° to 35° below zero Fah. It is also asserted that under a pressure of 35 pounds to the square inch, at 33 or 34 revolutions per minute, the machine has, with an inadequate supply of water, since its erection at New Orleans, produced a temperature of 54° below the Fahrenheit freezing point. The apparatus, it is claimed, will sustain a pressure of 85 pounds per square inch, or nearly six atmospheres, producing a most intense cold, scarcely susceptible of thermometrical measurement. Perfectly dry cold air is said to be formed, the contained moisture being condensed into snow and appearing at the exit orifice.

This machine, we are informed, has already received the

first prize at the Vienna Exposition. The apparatus now operating in New Orleans was built by Eygels, of Berlin, and was the first constructed on a large scale in Germany. The driving engine is 31x36, and works at from 50 to 55 pounds pressure. The patent right for the entire continent has been purchased by the Windhausen Ice Making and Refrigerating Association of North America. Further information may be obtained by addressing the President of the Company, Mr. J. Kruttschnitt, Lock Box 144, New Orleans, La.

Scientific American.

MUNN & CO., Editors and Proprietors.

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NEW YORK, SATURDAY, AUGUST 9, 1873.

Contents.

(Illustrated articles are marked with an asterisk.)

IS IT A DASTARDLY OUTRAGE?

EXECUTIVE DEPARTMENT, INTERNATIONAL UNION OF MACHINISTS AND BLACKSMITHS.

CLEVELAND, OHIO, July 21, 1873.

MESSRS. MUNN & CO:

Dear Sirs:—Enclosed please find a copy of an oath required by Messrs. Stearns, Hill & Co., of all the men in their employ and all who apply to them for employment. I think you will agree with me in pronouncing this attempt, on the part of the firm in question, to rob men of their liberties as one of the most dastardly outrages, on the rights and prerogatives of American freemen, ever attempted in this country since the ratification of the Declaration of Independence. I admired your criticism on the Joliet (Ill.) Iron and Steel Co., and send you the enclosed, feeling confident you will do the matter justice. I remain,

Respectfully yours, JOHN FEHRENBATCH.

The following is a copy of the paper referred to in the above letter:

APPLICATION FOR EMPLOYMENT.

STEARNS, HILL & CO.

I.....make this application for employment in the manufactory of Messrs. Stearns, Hill & Co., and in all good faith do declare, that I am not now a member of, nor will I, during any part of the time I may remain in the employ of said Stearns, Hill & Company become a member of any "Machinists' and Blacksmiths' Union," or any other society or association which assumes to control or regulate the relations existing between employers and workmen in any business whatsoever; and that I will not countenance or assist in any combination of workmen having in view any interference whatsoever with the business of said Stearns, Hill & Company, and I hereby agree with said Stearns, Hill & Company, that in case I have made any misstatements in this application, or in case I shall violate any of the conditions of the agreement herein contained, I shall forfeit to said firm of Stearns, Hill & Co., any and all pay that may be due me at the time of the discovery by them of such misstatement or violation of agreement.

Witness my hand and seal at Erie, Pa., this.....day of..... 187 .

.....L. S.

Erie County, ss.

Personally comes the above named.....who being duly sworn, deposes and says: That all statements by him made in the foregoing application are true.

Sworn and subscribed before me this.....day of.....A. D. 187 .

As the above documents instance another case of the oft recurring difficulties between employer and employee, we propose to make them the subject of brief comment. At the outset, it may be noted that there is no parallel between the "application" quoted and the "receipt and contract" of Joliet (Ill.) Iron and Steel Company recently alluded to in these columns, as intimated by our correspondent. The latter was an acknowledgment for a sum received, accompanied by an agreement by the workman to conform to certain conditions in consideration of receiving his legally due wages. These provisos released the company from damages for accident to the signer from any cause, gave it the right to discharge him at a moment's warning but prevented him from leaving his situation without 14 days notice in writing, under penalty of forfeiture of his earnings, and, besides, imposed other restrictions, *ex post facto* in operation, and hence clearly oppressive and unjust. In that case the employee was obliged to yield to a disadvantage to get his money after he had worked for it, and hence a moment's thought will show the circumstances to be entirely different from those now under consideration.

Enclosed with the letter of our correspondent is a printed hand bill addressed to the public. So far as we are able to understand its purport, it consists of an answer to statements made by Messrs. Stearns, Hill & Co., in relation to matters of internal regulation of their shops, subjects which to our mind are peculiarly the business of the above firm and not at all of the public. There are also some remarks about individual difficulties and recriminations, possessing no general interest, so that, in fine, from all the evidence before us, the trouble narrows itself down to the simple fact that Messrs. Stearns, Hill & Co., for doubtless good and, to them, sufficient reasons, have seen fit to exclude society men from their works. Now, we hardly imagine that the Union to which we are indebted for the above epistle or any other association will have the hardihood to deny that the firm has a perfect right to do exactly what it pleases with its own property and manage its affairs as it thinks best, so long as its doings are legally conducted and no unjust or oppressive measures are exerted. If a concern should decide to employ only society men, to the exclusion of all others, would not a "dastardly outrage" then be committed on the latter? And is not one party, if either, as much entitled to consideration as the other? Clearly we think the employers can exclude from their establishment whatever person or persons they choose, and the remarks of our correspondent, based on this grievance, in the usual exaggerated mode of expression common to the trades union harangue, are entirely misplaced and without substantial foundation.

We are of opinion, however, on the other hand, that the requiring of workmen to sign agreements by which they bind themselves to any definite or prescribed course of action is not sound policy. It is true that the hand is not obliged sign, and that he can refuse the situation as the alternative; but documents of legal form, no matter how innocent in tenor, are, by men possessing but vague ideas of the law and its restrictions, almost invariably misapprehended, just as in the present case the above form of application is stigmatized as "bond and mortgage" and "death warrant." The relation of employer and employee is very simple and requires no such formality; the former, if he wishes to exclude society men from his establishment, should inform himself fully as regards a hand before hiring him; and after arrangements are completed, the man can be easily made to understand that his first overture toward trade union fallacies will bring prompt dismissal and disqualification for re-employment. Documents of almost any description are sure to be seized upon by unscrupulous persons as a tangible basis for unfounded assertion. The mere fact of a paper existing is enough for them to exaggerate its purport in order to work upon the passions of the ignorant, and thus foment difficulties alike prejudicial to the interests of employers and employed.

THE VIENNA SHOW.

In another column will be found an interesting letter from our special correspondent, Professor Thurston, from which we learn that he has safely arrived in Vienna and commenced his examination of the great show. His first impressions of the display are here given, and we cannot refrain from remarking how completely the statements made, as regards American exhibits, accord with the views expressed by us before the opening of the Exposition. The United States section is but poorly filled, a fact under the circumstances to be expected; but there is unquestionably an overwhelming display of American inventions coming from the workshops of foreign manufacturers. Close imitations of even our locomotives, our correspondent tells us, are to be found in the space allowed to other countries, exhibited not only as specimens of the handiwork of their makers, but as American devices, a fact cited as a means of recommendation. In spite, therefore, of the poverty of our individual exhibit, it will be seen that we are abundantly represented, not merely through advertising our own products to the world's notice, but by having them heralded for us by other nations through the sincerest flattery of imitation.

The Fourth of July in Vienna was the occasion of a colossal jollification by all the Americans in the city. Speeches were made by Messrs. Schultze and Adams, and Baron Senborn; also by Professor Thurston on "Agriculture and the Mechanic Arts;" by Mr. Hill of Massachusetts on "Manufactures in the Old and New Worlds," and on "Science" by Professor Horsford.

PROGRESS OF CABS.

The inhabitants of London and other European cities enjoy luxuries in the way of conveyances that the people of our American cities know but little about. We allude to hacks and cabs, of which some 10,000 are employed in London, and which convey two passengers anywhere within a distance of a couple of miles for 25 cents.

At the International Exhibition, London, a committee, of which the Duke of Beaufort was chairman, and Lord Somerset and other prominent persons members, recently made an official trial of the various improved cabs presented for the prize competition. The committee went through considerable exercise in jumping into and out of the various vehicles, and finally concluded that there were no very notable improvements in any of them.

One of the best was a novelty in the shape of a cab for four persons, set on very small wheels. The idea was that such vehicles may be started and stopped more easily than the large wheeled machines. The traction of the small wheels is a little more, but it was contended that the sum of the work upon the horse, in ordinary cab traffic, is less than the large wheeled vehicles.

Another improvement for two wheeled cabs was a shifting ballast box which the driver could readily move at pleasure, and thus counterbalance the weight of the vehicle in respect to its pressure upon the horse's back, to correspond with the number of passengers occupying the interior of the cab.

A GREAT UNRECOGNIZED INVENTOR.

Under this heading the *Wool Bulletin* devotes a half column to the consideration of the marvelous advantages that have been conferred upon this country and the world in general by the mechanical duplication of parts, in the manufacture of machinery; an idea which, it alleges, is of American origin. The *Bulletin* says:

"The American manufacture of implements and smaller machines owes its superiority not only to a larger use of machine tools, but to an idea more important in its results than any merely mechanical invention, and one which is unquestionably of American origin. This idea is the making each of the several parts of many different machines interchangeable. For instance, in making a lot of muskets, the manufacturer does not fabricate each musket separately, but he constructs each of the smallest pieces of ten thousand muskets, it may be, separately, and makes them so precisely alike that each will fit exactly any one of the ten thousand muskets. It is this system which makes it possible for a single factory of arms in this country to make more muskets in a day than can be made in all England in a month. It is this which enables us to supply all Europe with arms and to export sewing machines to all the European nations, notwithstanding the vastly higher cost of our labor. The name of the inventor of this, perhaps the greatest of all American inventions, but one which from its nature could not be secured by patent, is hardly known out of his own town; and the object of this note is to place it on record.

"We have received from Hon. C. C. Chaffee, of Springfield, formerly chairman of the Committee of Patents in the United States House of Representatives, the following note:

"Mr. Thomas Warner was master armorer at the time the musket, in all its parts, was made interchangeable. He is credited by his associates with the suggestions that led to the result. Out of this has grown all the enormous industry of the interchange of parts of sewing machines, watches, and indeed of all machinery composed of a large number of pieces; and, as you say, it was the 'greatest discovery of the age,' and like all great improvements it has been one of growth. Mr. Warner is now in his eightieth year, is hale and hearty, walks to the post office every pleasant day—three quarters of a mile—and is very justly proud of what he has done for mechanics."

We appreciate very highly the motive of our cotemporary in his desire to render honor to whom honor is due; but regret that his statements are not supported by the facts of mechanical history.

Perhaps Mr. Warner, as boss of the armory, was the first to suggest, in that concern, the making of the parts of the musket interchangeable; but he most assuredly was not the first inventor or suggestor of that method in respect to the manufacture of machinery in general. It was unquestionably *not* of American origin. It was a common mechanical expedient in use in the old country before Warner was born, or the Springfield Armory thought of.

How entirely at home the Yankee is in the art of self puffery! He takes to it like a young duck to the water. "It is this system," he modestly alleges, "which makes it possible for a single factory of arms in this country to make more muskets in a day than can be made in all England in a month. It is this which enables us to supply all Europe with arms and to export sewing machines to all European nations, notwithstanding the vastly higher cost of our labor." We are sorry that there is so little basis for so much of the spread eagle.

In respect to fire arms and sewing machines, while it is true that we export them, to some extent, the quantity sent abroad is but as a drop in the bucket compared to the aggregate continental production of these goods.

The practice of Europeans, when they find an American invention to be profitable, is to order goods here until they can fit up or import the machinery for the manufacture on the spot. It is in this way that a temporary exportation from this country, of certain novel kinds of mechanism, is from time to time produced. But it is only temporary, because Europeans have the same appliances that we possess, while they pay less for wages and living than the manufacturers of this country. It is therefore impossible at present greatly to extend the exportation of American machinery. But if the prices of coal and iron shall continue to rise in Europe, it will then be possible for the United States to do a great mechanical trade with England and the continent.

CONCRETE FOR BUILDING PURPOSES.

An esteemed correspondent writing from Indianaoplis says: "I would like to know something about the construction and durability of cement gravel houses, and I write you for the information. Are they durable? What is the cost of building as compared with a like quality of brick or frame? Is it better to make foundation of brick or stone instead of cement? We have an excellent gravel bed for foundation."

In reply to our correspondent, we would say that the durability of concrete walls depends upon the quality of the ingredients. If the sand and the cement are of good quality, the walls will be quite as durable as stone walls. The walls of some of the ancient buildings of Rome, such as the Coliseum and the Baths of Caracalla, were built partly with concrete and partly with stone, and the concrete remains as durable as the stone. Many buildings with concrete walls have been erected in the United States; and so far as they

have been constructed with care, they appear well. Some buildings erected with building blocks or large bricks made of lime and sand under pressure have proved worthless.

To erect walls of concrete, the essential thing is to secure good mortar in which to imbed the gravel and larger pieces of stone. The mortar should be made of cement and sand (the cement fresh from the kiln and tested as to its setting quality); and the sand should be sharp quartz perfectly clean and free from loam.

Clean sand will not soil the hand. Sand may be freed from loam by washing. Place the sand in a shallow box 4 or 6 feet square, or larger, and flood with water, stirring the sand with a hoe. The loam will discolor the water and flow off with it. Keep stirring and flooding until the water runs off colorless. The sand is then clean.

Combine the dry cement with the sand in the proportion of one measure of cement to two of sand, thoroughly mix them dry, and just before use add water enough to make a thin paste. To this paste add the gravel and small stones, and stir them about until the surfaces of the gravel and stones are all covered with the paste, taking care that no more of the stone filling is added than the paste will coat. The mass, thoroughly compounded, should be immediately carried and deposited within the boxes upon the wall, and the boxes allowed to remain until the concrete is set. The time for setting will depend upon the quality of the cement, but ought not to exceed from 6 to 12 hours. The proportions between the cement and sand should vary, in accordance with the quality of the sand, from two to five measures of sand to one of cement. There should be enough cement to coat the sand on all its surfaces.

Concrete is quite as good as stone for the foundations. The quantity of gravel used will depend upon its coarseness, usually about twice as much gravel as sand. It is better that the gravel be of various sizes. The resultant concrete will measure no more than the gravel measures; the cement and sand are lost in the interstices between the stones. The cost of concrete will depend upon the cost of the materials of which it is composed and the labor. These vary in different localities, but may be estimated from the above data.

MADDER, VEGETABLE AND CHEMICAL.

The ordinary red pigments used in dyeing and calico printing have heretofore been derived from the roots of the madder plant, cultivated in Turkey, France, and to some extent in the United States. By steeping and fermentation the roots are made to yield fine needle crystals of yellow color, termed alizarine. If this substance is administered to animals, certain peculiar results are alleged to follow. For example, the bones of pigs are made red; a red circle is produced around the iris of the eyes of pigeons; cows give reddish milk and the cream yields red tinted butter. It has been suggested that ladies who wish for red hair should swallow alizarine. But then it might also make their teeth red, and perhaps over-tinge their complexions.

The cultivation of madder is very extensive, thousands of acres of land being given up to the crops, while the preparation of the root forms an important branch of industry. But the onward march of chemical discovery is likely to effect a change, and there is every probability that the occupation of the madder root grubber will soon be gone.

Alizarine, one of the coloring principles of madder, is now extensively produced by chemical means from coal. When bituminous coal is distilled in the production of illuminating gas, coal tar comes over with the gas.

This tar, when again distilled, yields a variety of substances, which are separated by the application of different degrees of heat. For example, the light, brilliant-looking naphtha liquid known as benzole first comes over from the tar. If to this benzole nitric acid is added, the product is nitro-benzole, a peculiar red oil, having the odor of bitter almonds. Distil this with water, acetic acid and iron filings, and aniline is produced. The aniline is in turn refined, treated with preparations of arsenic and other substances, the results being the production of the magnificent series of colors known as aniline dyes. Among the last substances distilled over from coal tar is anthracene, consisting, when pure, of bluish-white crystals. A tun of coal yields about one pound of anthracene. The latter, when treated with manganese, sulphuric acid, bromine, potash and hydrochloric acid, yields alizarine, identical in nearly all of its properties with the alizarine of madder roots.

By the mixture of carbon and hydrogen in certain proportions, the chemists have artificially produced anthracene, from which, in turn, alizarine may be evolved. Thus are the productions of the vegetable world imitated in the laboratory.

The discovery of alizarine in coal tar is credited to Graebe and Liebermann, German chemists, in 1868, since which time the processes for its production, on a commercial scale, have been successfully and extensively introduced. In Germany there are at present some twelve large manufactories of alizarine from coal tar, and the product, which is rapidly increasing, is now 22,000 hundredweight per annum, valued at $2,000,000.

Germany also supplies the world with aniline colors.

THE STAR SHOWER OF AUGUST 10.

We hope that our readers will not forget to look for this well known star shower, which appears to radiate from the constellation *Perseus*. On the 10th of August, the earth annually passes for about six hours through the belt of meteors which originally formed a part of comet III, 1862, returning once in a hundred and twenty years.

It is estimated that four hundred million shooting stars daily traverse the atmosphere, adding, perhaps, a thousand pounds to the earth's mass. These bodies move in space as dust clouds or nebulæ. When they come within the sun's attraction, the nebula assumes the form of a comet, under the influence of gravitation, and the comet is gradually drawn out by the same force into a ring revolving round the sun in the same orbit and periodic time as the original comet.

The star showers bring us specimens from the remotest realms of space; sometimes meteoric irons, containing occluded hydrogen from the atmosphere in which the fragment was last heated; at other times, meteoric stones containing hydrocarbons and phosphorus.

Aerolites contain oxygen, nitrogen, phosphorus, sulphur, carbon, silicon, hydrogen, copper, iron, cobalt, nickel, manganese, magnesium, aluminum, etc., probably most if not all of the terrestrial elements. Their weight is generally inconsiderable, but varies up to fifteen tuns. The loud report which attends the fall of the larger masses is caused by the air rushing into the vacuum in rear of the projectile when it reaches our atmosphere.

PROPERTIES OF SATURATED STEAM.

We have recently received an inquiry, from one of our correspondents, as to the boiling point of water at different pressures; and we propose, in this article, to give the formula asked for, with several others. Nearly all the properties of saturated steam have been carefully investigated by M. Régnault, of France, and tables have been prepared from his researches. These tables, in very convenient form, adapted to English measures, may be found in Charles T. Porter's work on the steam engine indicator—a book which contains much useful information, in addition. The formulas by which these tables are computed are somewhat complex, but we will endeavor to render them as simple as possible, and we trust that our readers will find them both interesting and valuable.

In a previous article, we have spoken of the absolute zero, or theoretical temperature at which all heat motion ceases. This temperature is used in making calculations of the pressure of steam, because water forms vapor of appreciable tension at all temperatures except that of absolute zero. We will use the same notation in all the formulas, and will first explain the meaning of the terms: T = temperature of the steam as shown by the thermometer, on Fahrenheit's scale. t = absolute temperature of the steam = 461·2° + T, because the absolute zero is fixed by theory at 461·2° below 0° Fahrenheit. P = pressure of steam, in pounds, per square inch. p = pressure of steam in pounds per square foot = P × 144. L = units of latent heat per pound of steam at the pressure P. When water is converted into steam, a portion of the heat applied is used in the work done in producing a change of state. This heat is not indicated by the thermometer, and is called latent heat. A unit of heat is the number of degrees necessary to raise the temperature of a pound of water one degree. l = units of latent heat, in foot pounds of energy, per cubic foot of space occupied by the steam at the pressure P. The amount of heat that will raise the temperature of a pound of water one degree, if converted into work, will raise a pound weight through a distance of 772 feet; conversely, to find the units of heat that will be produced by the conversion of 1 foot pounds of energy, this quantity must be divided by 772. W = weight of cubic foot of steam at pressure P. V = number of cubic feet occupied by a pound of steam at pressure P.

We will now give the formulas, working out an example for each case.

1. To find the boiling point of water at a given pressure,

$$t = 1 \div \left(\sqrt{\frac{8{\cdot}2591 - \log.p}{396944} + \frac{(2731{\cdot}62)^2}{4 \times (396944)^2}} - \frac{2731{\cdot}62}{2 \times 396944} \right)$$

Or, to find the absolute temperature of the boiling point at any pressure, subtract the logarithm of the pressure per square foot from 8·2591, divide the difference by 396944, add the quotient of the square of 2731·62 divided by four times the square of 396944, take the square root of the sum, subtract the quotient of 2731·62 divided by twice 396944, and divide unity by the quantity so obtained.

EXAMPLE.—P = 30, p = 30 × 144 = 4320,

$$t = 1 \div \left(\sqrt{\frac{8{\cdot}2591 - \log.4320}{396944} + \frac{(2731{\cdot}62)^2}{4 \times (396944)^2}} - \frac{2731{\cdot}62}{2 \times 396944} \right)$$

= 711°.6.

Then the temperature of the boiling point, on Fahrenheit's scale, is 711·6° − 461·2° = 250·4°.

2. To find the pressure of steam, knowing the boiling point,

$$\log.p = 8{\cdot}2591 - \frac{2731{\cdot}62}{t} - \frac{396944}{t^2}.$$

Or, the logarithm of the pressure per square foot for the boiling point whose absolute temperature is t, is found by subtracting from 8·2591 the quotient of 2731·62 divided by the absolute temperature of the boiling point, and the quotient of 396944 divided by the square of the absolute temperature.

EXAMPLE.—Temperature of the steam by thermometer = 265·8°. Absolute temperature = 265·8° + 461·2° = 727°.

$$\log.\ p = 8{\cdot}2591 - \frac{2731{\cdot}62}{727} - \frac{396944}{(727)^2} = 3{\cdot}75077.$$

From a logarithmic table, we determine p = 5633·4, and the pressure per square inch = 5633·4 ÷ 144 = 39·12 pounds.

3. To find the latent heat of evaporation:

L = 1091·7 − 0·695 (T − 32°) − 0·000000103 (T − 39·1°.)

Translating this expression, we have, the number of units of latent heat in steam at the temperature T is found by subtracting from 1091·7, 0·695 times the difference between the temperature and 32°, and 0·000000103 times the difference between the temperature and 39·1°.

EXAMPLE.—T = 321°, L = 1091·7 − 0·695 (321° − 32°) − 0·000000103 (321° − 39·1°) = 890·8.

4. To find the latent heat of evaporation in foot pounds of energy, per cubic foot of space:

$$l = p\left(\frac{2731{\cdot}62}{t} + \frac{2 \times 396944}{t^2}\right) \times 2{\cdot}3026,$$

which may be thus expressed: To find the latent heat of evaporation in foot pounds of energy, per cubic foot of space, add the quotient of 2731·62 divided by the absolute temperature, to the quotient of twice 396944 divided by the square of the absolute temperature, and multiply the same by the product of the pressure per square foot multiplied by 2·3026.

EXAMPLE.—P = 79·03, p = 79·03 × 144 = 11380. The temperature corresponding to this pressure is T = 311°, t = 311° + 461·2° = 772·2°, l = 11380 × $\left(\frac{2731{\cdot}62}{772{\cdot}2} + \frac{2 \times 396944}{(772{\cdot}2)^2}\right)$ × 2·3026 = 127500.

5. To find the weight of a cubic foot at the pressure P.

Were steam a perfect gas, the pressure would vary inversely as the volume, and the weight of a cubic foot could be readily ascertained. Experimental researches in the density of steam have not been sufficiently extended to enable a relation to be established between the pressure and volume. Approximately, the pressure varies inversely as the tenth power of the ninth root of the volume. More exactly, the weight of a cubic foot of steam can be obtained, indirectly, from the latent heat, and we will give the formula for its computation in this way: l ÷ 772 = latent heat, in heat units, of a cubic foot of steam at pressure P.

$\frac{1}{772 \times W}$ = units of latent heat in a pound of steam at pressure P. But according to our notation, this is equal to L. Hence, $\frac{1}{772 \times W} = L$. Solving this equation for W we obtain, $W = \frac{1}{772 \times L}$.

EXAMPLE.—L = 916·6, l = 88740, $W = \frac{88740}{772 \times 916{\cdot}6} = {\cdot}1579$ pounds.

6. To find the space in cubic feet occupied by a pound of steam at any pressure.

$V = \frac{1}{W}$. Or, to find the volume of a pound of steam at the pressure P, divide one by the weight of a cubic foot.

EXAMPLE.—W = ·08285, $V = \frac{1}{{\cdot}08285} = 12{\cdot}07$ cubic feet. It will be observed that these formulas are progressive, the results obtained from one being needed for substitution in the next.

7. To find the hight of a column of mercury at a temperature of 32° Fahrenheit, corresponding to a given pressure per square inch.

RULE: Multiply the pressure by 2·037.

EXAMPLE.—For 30 pounds pressure, the hight of the mercury must be 30 × 2·037 = 61·11 inches.

Mercury expands 0·0010085 of its volume for every degree of increased temperature. Hence, for any temperature other than 32°, a correction must be applied.

EXAMPLE.—Suppose that, in the preceding example, the temperature of the mercury had been 80°. Then the expansion would be 61·11 × 0·0010085 × (80—32) = 2·95 inches, and the hight of the column of mercury corresponding to 30 pounds pressure would be 61·11 + 2·95 = 64·06 inches.

The results obtained in the preceding formulæ are for the case in which water boils in the open air at 212° Fahrenheit, the barometer standing at 29·913 inches.

SCIENTIFIC AND PRACTICAL INFORMATION.

COATING FABRICS WITH TIN.

According to Richard Jacobsen, linen and cotton goods may be covered with a thick and flexible film of tin, which gives to them a very silvery appearance. The method to be adopted is as follows: Ordinary commercial zinc dust is rubbed up with a solution of egg albumen to a thin paste, and applied to the goods with a brush or roller. When dry, this coating is fixed by coagulating the albumen with steam, and the fabric is then placed in a solution of bichloride of tin. The tin is precipitated upon the zinc in a very finely divided state. The stuff is then washed with water, and, after drying, put through the finishing machine, when the tin comes out with a brilliant luster. A very beautiful effect may be produced by printing different designs in this way, or applying the material with stencil plates, and its use may be extended to decorations. It is even possible that this strong, elegant, and waterproof material may yet replace tin foil for packing certain articles.

PHOSPHO-TUNGSTIC ACID.

This acid was first discovered by Scheibler. Its crystalline form depends upon the manner of its preparation, being either beautiful, regular octahedra, with strong refractive power for light and the sparkle of a diamond, very soluble in water and efflorescent in air; or it occurs in cubical crystals. Both forms of acid have a property, which is possessed also by the phospho-molybdic acid, of precipitating the natural organic bases from acid solutions, no matter how dilute. A clearly perceptible precipitate is formed in a solution of 1 part strychnia in 200,000 of water, while 1 part quinine is precipitated in 100,000 of solution. The precipitate when first formed is very bulky, but, if left a short time in the acid solution, it becomes thicker and may be filtered out and washed.

Phospho-tungstic acid is very important in toxicology and in judicial chemistry for detecting the alkaloids, since it can be safely trusted for separating them from large quantities of the liquid, and thus preparing them for further tests. It can also be used with advantage for the preparation of separate alkaloids.

A NEW APPLICATION OF SPECTRUM ANALYSIS.

We published some months since a brief notice of a lecture by President Morton on "Fluorescence," in which allusion was made to some very curious discoveries which owe their origin to an application of the spectroscope in connection with that peculiar action of light. This subject, however, possesses so much general interest that we have thought well to prepare, from various papers published by Dr. Morton, an abstract of the most important points. Assuming that, from the lecture above mentioned, our readers have been enlightened as to the meaning of fluorescence, we pass at once to the special application in hand.

As early as 1852, Professor Stokes, the real discoverer of fluorescence, had observed that, when the light emitted by certain fluorescing salts of uranium was examined with a prism, it gave a spectrum consisting of equidistant, brightly colored, shaded bands. He also observed that, in the case of two salts, the nitrate and the acetate, these bands occupied different positions. The spectroscope had not, however, at that time been invented, and no attempt at accurate measurement of these bands was made.

In 1859, the famous French physicist Edmond Becquérel, in the course of his elaborate investigation of phosphorescence, examined in a casual manner, with a spectroscope of simple form, a few of the uranium salts, together with other materials, and he gives two spectra as representing the appearances presented by these, one standing for nitrate of uranium and canary glass, the other for potassio-uranic fluoride, uranic chloride and the mineral uranite. He also figured the fluorescent spectrum of what he describes as "a hydrocarbon of the color of the uranium salts, obtained from Fritsche," who was the first to study anthracene and some of its kindred products.

So matters stood when, more than a year since, President Morton, while engaged in a general study of fluorescent phenomena, received from Professor E. N. Horsford a specimen of the last run of the still in certain petroleum refineries, which was remarkable for its strong fluorescence. A study of this material led to the elimination from it of a crystalline solid body, of a rich yellow color, and possessing the property of fluorescence in a degree quite unparalleled, and showing with the spectroscope a very characteristic spectrum. To this body President Morton has given the name "thallene," in allusion to its brilliant green fluorescence. Observing a striking resemblance between the thallene in a certain stage of its preparation and commercial anthracene, he was led to a similar special study of that body, which resulted in proving, among other things, that the hydrocarbon described by Becquérel must have been anthracene, but that the spectrum represented by him, and found with all ordinary specimens of anthracene, was due to the presence of a trace of another substance, in all probability identical with that described by Fritsche as chrysogen.

Fig. 1. FLUORESCENCE.—[From a Painting by James Hamilton.]

These and other results were mentioned in a paper read before the American Institute, March 29, 1872, and published in their transactions, 1871-2, page 910. After searching in various directions for a further supply of the thallene material, Dr. Morton detected it in some petroleum product brought by Dr. G. F. Barker, from the works of Mr. John Truax, in Pittsburgh; and from the last named gentleman, a large amount was obtained, with which a thorough study of its physical properties has been carried on.

For full details of these we must refer our readers to the *American Chemist* and other purely technical journals.

The wonderfully intense character of fluorescent action in this substance led Dr. Morton to apply it in a very striking manner during a lecture delivered by him in the Academy of Music, of Philadelphia; and, on this occasion, it so impressed Mr. James Hamilton, the eminent artist, that he made it the subject of a large oil painting, from which our artist has developed the accompanying engraving (Fig. 1). Here we see the stage set to represent a cavern with its visitas, columns of rock, and pendent stalactites, and, in the foreground, the lecturer with his electric lantern, from which issues a jet of faint blue light, whose rays fall upon a group of figures bearing banners, whose devices are painted with the new fluorescent bodies, and which, invisible in the ordinary light, blaze out as with colored fires when thus illuminated.

Having seen this substance ourselves, we were not surprised to hear that Professor Tyndall, when he for the first time witnessed its effect (during one of his own lectures, with a specimen which Dr. Morton had sent him), expressed his surprise and delight in a manner as emphatic as it was unpremeditated.

While work on the abovementioned substances was in progress, Dr. Morton naturally turned to account the same methods of examination with other bodies, and among them to the uranium salts; and in this work he was so fortunate as to secure the co-operation of Dr. H. C. Bolton, an able chemist, who had distinguished himself, among other things, by his investigations upon certain of these very uranium salts. Working together in this research, Dr. Morton conducting the physical and Dr. Bolton the chemical part of the labor, these gentlemen have attained results which promise to be of no little value, both in practical analysis and in the elucidation of obscure theoretical points.

It should be mentioned that, after this work of Drs. Morton and Bolton had made considerable progress, a new research by Becquérel, in the same direction, was published in the *Annales de Chemie et de Physique*. This, however, is so very brief and imperfect, as compared with the work of the abovementioned gentlemen, that, while of course depriving them of any claim to priority in the field, it in no respect detracts from the substantial value and importance of what they have done, which is in only a few points anticipated by anything in Becquérel's memoir.

The methods of observation, employed by Dr. Morton in all these observations, do not differ in any essential particular from those before used by Stokes, Becquérel, and others, but only in perfection of detail, and the accuracy thereby secured; and they may be briefly described as follows: The *porte lumiere*, A, Fig. 2, being attached to the shutter of a window facing toward the south, a beam of sunlight was thrown by it horizontally into the room, and concentrated by a lens of twelve inch focus placed at B. At C was placed an apparatus (Fig. 3) consisting of a circular horizontal table, adjustable up and down on a vertical rod, and turning with a click. Around the circumference of this table were eight little stalls, capable of holding test tubes or specimen bottles. By this means eight different specimens could be rapidly compared, each in succession, by the action of the click being brought into an identical position with reference to the exciting light and the spectroscope. This whole apparatus was so placed that an image of the sun was formed on the tube or bottle nearest to the lens, B. A glass tank, filled with a strong solution of ammonio cupric sulphate was placed between B and C, and to this was sometimes added a plate of violet glass. The fluorescent light emittted by the substance in C was examined by the spectroscope D.

For examining absorption bands everything else remained the same, except that the spectroscope was turned round into the position indicated at E in Fig. 4, and the stand for specimens was replaced by a plane table, D, on which the substance to be studied was supported, either in a cell of glass or in bottles. To study the optical behaviour of these substances under the influence of heat, a little oven, such as is represented in Fig. 5, was employed. In this, the substance to be examined was either placed in a small bottle, at E, surrounding the bulb of a thermometer, or between flat strips of glass. The openings through the oven were covered by a piece of thin mica kept in place by the rings, G G.

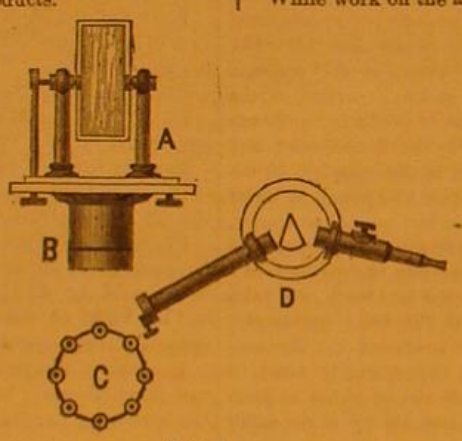


Fig. 2.

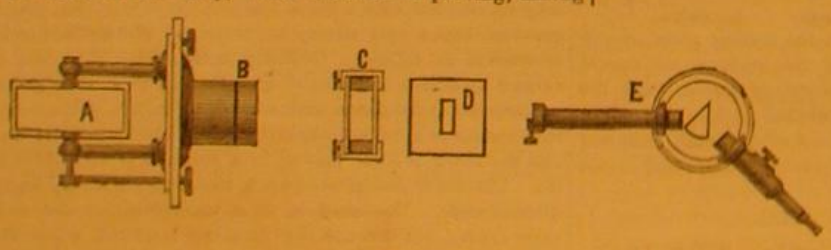


Fig. 4.

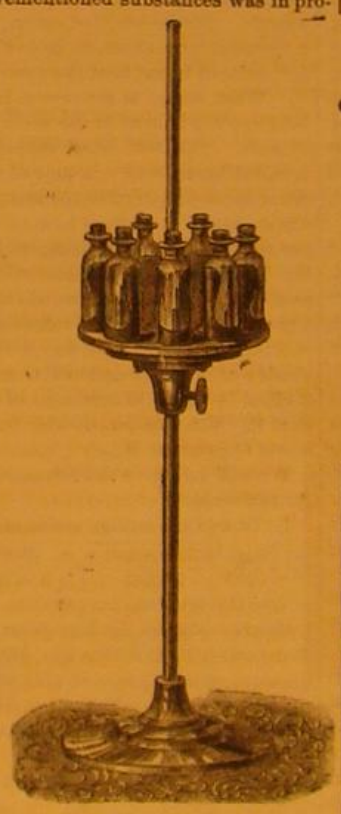


Fig. 3.

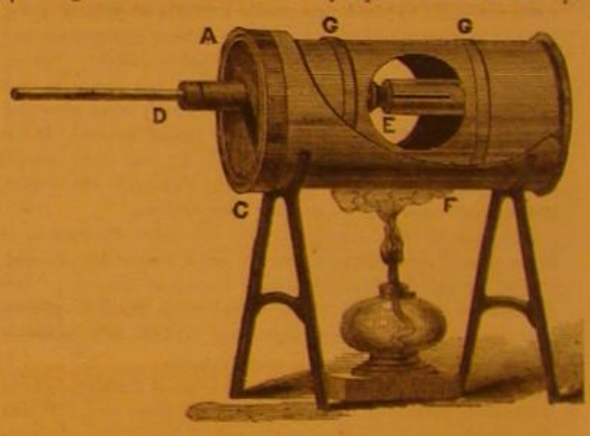


Fig. 5.

Many hundreds of specimens of uranium salts, in different states and in solution, have been examined, and numberless experiments on the effects of heat have been made, with the development already of many curious results and the promise of others for the future.

Thus, in the first place, it appeared that while there were certain points of likeness, running through the spectra of many classes of salts, which are useful as a means of recognizing their relation, yet that, either by some obvious peculiarity of character or position, many may be at once recognized and identified, while others, by their various behavior on drying or heating, may be as certainly distinguished. It thus happens that the presence of impurities in some of the commercial uranium salts were recognized and identified without so much as opening the bottles which contained them.

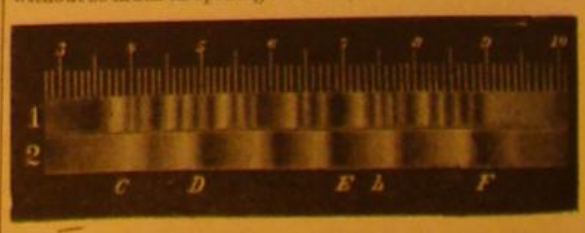


Fig. 6.

Thus Fig. 6 represents, in 1, the spectrum of the potassio-uranic oxychloride, and, in 2, that of the uranic oxychloride.

In Fig. 7, 1 represents the spectrum of the normal uranic acetate, 2 that of the same salt deprived of its constitutional water, and 3 that of the sodio-uranic acetate.

But what is far more interesting in a scientific point of view, is the fact that a change in composition or the formation of a new compound may thus be optically recognized, and the actual progress or development watched, step by step. This can be best illustrated by a relation of the instance in which this method was first applied.

Having heated for a short time some of the ammonio-sulphate of uranium, Dr. Morton noticed that, in place of its

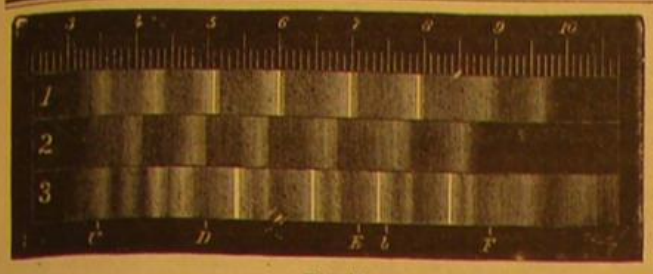


Fig. 7.

usual spectrum, shown at 1 of Fig. 5, it showed, as in 2 of Fig. 8, one in which, to the former bands, were added as many more, each located a little further down in the spectrum than its companion in the original spectrum. Now it was evident that water was being driven off from the salt in the process of heating, and therefore natural to suppose that these new lines belonged to a spectrum of the anhydrous salt which was being formed and mixing with the other. By continuing the heat until no more vapor escaped, the body was found to yield the spectrum shown in 3 of Fig. 6, which was thus probably the spectrum of the anhydrous salt; and, in fact, the salt in this state, being submitted to Dr. Bolton for analysis, proved to be the anhydrous ammonio-sulphate of uranium. But this was not all. On further heating to a

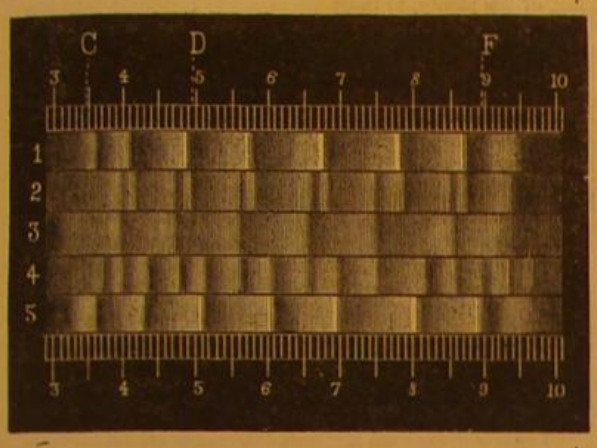


Fig. 8.

temperature approaching redness, the spectrum changed to the appearance shown at 4 of Fig. 6; fumes, evidently consisting of ammonium sulphate, being given off; and on continuing the heat until these fumes were no longer evolved, the spectrum assumed the character shown in 5 of Fig. 6. This material, again being submitted to Dr. Bolton, and analyzed by him, proved to be an ammonio-di-uranic sulphate, a salt not before known to chemistry.

Treatment, more or less parallel to the above, has developed a number of similar facts, and has shown that some of the spectra observed by Becquérel are not those of he salts named, but of mixtures of various hydrates, or even, in some cases, of different salts.

Thus, for example, the annexed engraving (Fig. 9) represents four distinct spectra, shown by perfectly pure sodio-

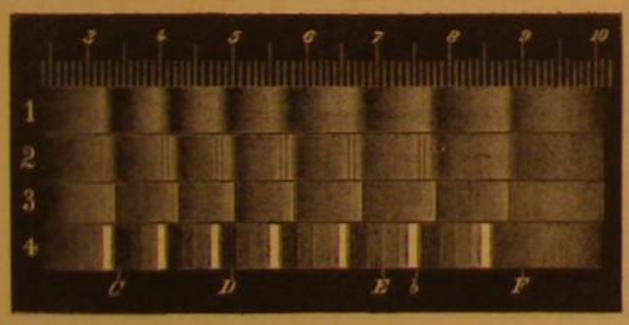


Fig. 9.

uranic sulphate. No. 1 is the spectrum of the normal salt, holding, in combination, five equivalents of water; 2 represents a mixture which was one of the first observed, and caused no little perplexity; it is now known, however, to owe its complex character to the overlapping spectra of several different hydrates. No. 3 is the spectrum of the mono-hydrated salt, or that containing only one equivalent of water; 4 is the spectrum of the anhydrous salt, or that from which all the water has been expelled.

Again, in Fig. 10, we have, in 1, the spectrum of the nor-

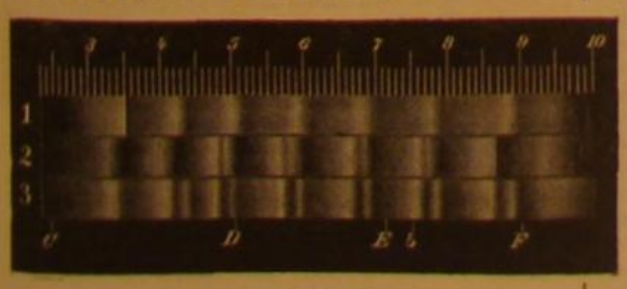


Fig. 10.

mal uranic sulphate which contains three equivalents of water; in 2, that of the mono-hydrate, while 3 is that of a mixture of the mono- and bi-hydrate into which the normal salt is apt to pass if suddenly heated, placed in a vacuum, or treated in several other ways.

Yet, again in Fig. 11, we have, in 1, the spectrum of the normal potassio-uranic sulphate, and, in 2, that of the same salt in its anhydrous condition.

One of the most remarkable developments, however, is that which has been obtained by a comparison of the absorption bands seen in various salts and their solutions; thus seventeen double acetates have been examined, and a different arrangement of these bands has been discovered in each case; but when they are dissolved in water, all are exactly alike, and are likewise identical with the solution of the simple acetate, thus seeming to prove that no double acetate exists as such in solution, but that all are reduced to the simple salt.

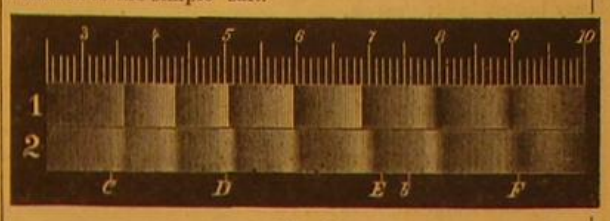


Fig. 11.

In Fig. 12, 1 represents the bands of the solid normal acetate; 2, those of the same salt when anhydrous, and 3,

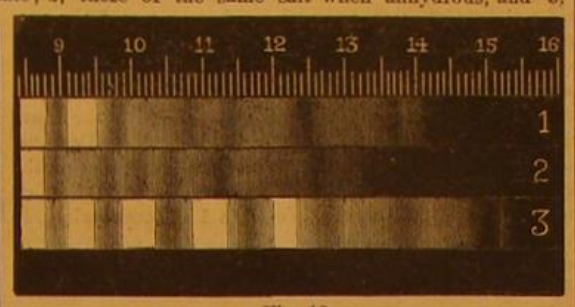


Fig. 12.

those given by a solution of the simple acetate or any of its double salts.

Another very interesting result was obtained in observing the effect of a rise in temperature upon the position of the fluorescent and absorption bands. It was found in a vast number of cases that a rise of temperature lowered the position of the bands both of absorption and fluorescence. When we remember that the heating of a tuning fork lowers its note, and that, wherever bodies change their color by heat without involving some chemical action, the tint is depressed in the spectrum, we see how this observation fits in with general theory.

There were no cases in which the displacement was opposite in direction; the exceptions were simply instances in which no displacement could be detected, and the observations were made as well with solutions as with the solid salts.

Another application of this method was to the determination of the moment at which combination in the case of double salts actually took place; and it was found that in all cases the spectrum of the simple salt changed into that of the double one only in the act of crystalization.

The effects of change of state by freezing solutions, of great pressure, and of solution in various solvents have been extensively studied; and indeed more has been done than we can well afford space to enumerate, and with results which, as we have shown, are already important and promise to be more so.

THE SHOE AND LEATHER CHRONICLE.—The already long list of contemporary journals devoted to special interests has, this week, been increased by the appearance of a well arranged and neatly printed sheet under the above title. The extent and importance of the shoe-making industry is a guaranty for its extended circulation. Mr. W. A. Van Benthuysen, of 6 Ferry street, New York city, is the editor and proprietor, who will please accept our good wishes for its success.

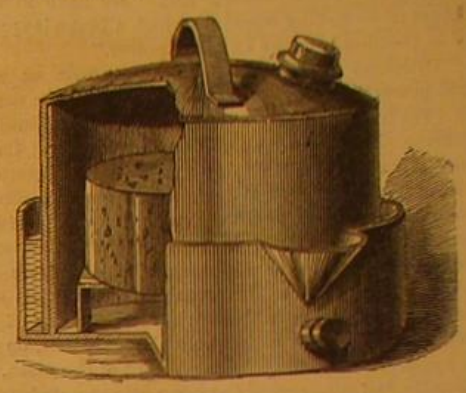
PARAFFIN GAS.—Paraffin oils are now produced at a very low price in Austria and Saxony, from peat. These oils may be used for the manufacture of illuminating gas instead of coal. The gas gives a light three times brighter than coal gas, and the apparatus for making gas from paraffin is simpler and less costly than the coal gas apparatus.

HOW TO MEASURE THE HIGHT OF TREES.—When a tree stands so that the length of its shadow can be measured, its hight may be readily ascertained as follows: Set a stick upright (let it be perpendicular by the plumb line). Measure the length of the shadow of the stick. As the length of its shadow is to the hight of the stick, so is the length of the shadow of the tree to its hight. For instance: if the stick is four feet above the ground, and its shadow is six feet in length, and the shadow of the tree is ninety feet, the hight of the tree will be sixty feet (6:4::90:60). In other words, multiply the length of the shadow of the tree by the hight of the stick, and divide by the shadow of the stick.

IN the digging of a well at Newark, N. J., the other day, the workmen struck "ile." About two barrels of good oil were pumped the first day. The owner proposes to bore deeper with proper apparatus, in the hope of finding a more abundant supply of the valuable liquid.

CHEESE SKIPPER EXTERMINATOR.

Many and varied are the devices which human ingenuity has provided for the extermination of the "creeping things of the earth." We have set forth at length the lyric effort of the inventor whose muse gushed into poesy on the inspiring theme of mechanical cockroach traps; we have alluded to the "deadly bug buster," by which the offending insects are persuaded into a hopper, placed under the influence of an anæsthetic and stabbed in the back with a pitch-



fork, or else are dosed with large quantities of laughing gas so that they meet a hilarious death in violent hysterics. Brief mention has been made of the tumbler fly trap, in which the hapless fly meets his doom in an alkaline bath; and recently, in glancing over an ancient volume of the English *Mechanics' Magazine*, we discovered a valuable recipe for poisoning bugs by a material "which they will never fail to eat while they can get it, and will as surely die; it causes them to froth at the mouth and to split in the back occasionally."

Another inventor has now joined the great army which is ceaselessly waging war upon the noxious insect tribe, and the offspring of his genius is represented in the accompanying engraving. Its object is the slaughter or, more strictly speaking, the asphyxiation of cheese skippers. The cheese is placed upon a raised grating within a circular box, the bottom of which extends beyond the sides, and is provided with a rim. The intermediate annular space is filled with water. A tightly fitting cover inclosed the entire box, its edge reaching to the bottom of the projecting flange, and is rendered airtight by the water packing. Suitable vents are arranged for obvious purposes. The unhappy mites, thus deprived of fresh air and cut off from the light of day, in the words of the patent, "all leave the cheese and drop down dead." Why they should pursue such a course, or as to the nature of the malady with which they are seized, and which invites the approach of the fell destroyer, our original researches, into the physiological constitution of the cheese skipper, are as yet not sufficiently extended to enable us accurately to determine. Suffice it that, after a period of twenty-four hours, their bodies, once so athletic and active, are senseless clay upon the bottom of the box. Mr. Caleb Green, of Osseo, Mich., patented this useful device on February 4, 1873.

IMPROVED MILK REFRIGERATOR.

This is an English invention, made by Lawrence & Co., London, who say that, by the aid of these refrigerators, the milk intended for transit, or for the making of butter or cheese, may be cooled as soon as it leaves the cow, and before any injurious change can possibly have taken place. It has long been a well known fact that milk is preserved in proportion to the rapidity with which it is cooled. Why this is so has never been satisfactorily explained, but recent scientific investigations have proved beyond a doubt that, when milk is

suddenly cooled, the infusoriæ or vital organisms, the cause of rapid decomposition, are destroyed, and the milk is consequently preserved, whereas if cooled by slow degrees, living infusoriæ will still be found in it.

By passing warm water through the refrigerator, instead of cold, the temperature of the milk may be readily raised to any degree required, which, in cold weather, is an advantage in cheese making.

The warm milk is poured into the receiver, A, whence it passes through the refrigerating box, A, in which is a coil of pipes through which cold water enters at D, discharging at E, while the cooled milk is drawn off at C.

Correspondence.

Diurnal Movement of the Earth--Is it Retarded at all?

To the Editor of the Scientific American:

In your issue of June 28, "Orthodox" claims that the two great tide waves act on the earth's surface as do brakes when applied to a revolving wheel. And he (admitting my statement that the earth is constantly revolving between two great never failing waves) asserts that "we have here an exact picture of a rotating wheel, to which a brake is applied and held in position by some external power."

Will "Orthodox" be kind enough to inform us what "external power" is pressing the tides down on the earth's surface? We have some little idea that there is an internal power forcing them up or apart from each other; for we conceive that each wave is highly charged with electricity, and is therefore repellent of the other. I would like to learn the name and origin of the "external power." If it be extra pressure on account of the extra waters, that extra pressure is destroyed by the repulsion of battery from battery or wave from wave. But even if it did exist, such pressure would not act as a brake; for the oceans of the earth, where the tides are and where they are not, do not move in opposition to the rotary movement of the earth, but are constantly and continuously moving, where not obstructed, eastwardly upon the earth's surface, the same as do the higher strata of air, far above the earth's surface. "Orthodox" talks as if the two tides were solid, frozen sheets, standing still, in a sense, and bearing and grinding hard upon the earth's surface, as she moves round between them. But this is not the case, for although the earth passes under the tides, the waters composing them constantly run before the earth, as it were; and therefore, friction, through such a cause, is impossible, absolutely impossible.

"Orthodox" supposes that "it is well known that the slow retardation of the earth's diurnal motion is an established fact in astronomy." Perhaps O. will be astonished, when I tell him that astronomy does not know, at this moment, whether the earth is retarding or the moon advancing. The latter is by far the most likely. And even if the former were the truth, still the problem has to be solved whether such retardation is the result of meteoric accumulation, of the withdrawal of matter from the bowels of the earth and piling it upon its surface, of the so called friction of the tides, of their butting against the eastern coasts of Africa and America, or of some hitherto unknown and unadvanced cause. We are perfectly willing to admit that friction, applied anywhere upon the earth's surface, will tend to stop in time the earth's diurnal motion; but we must know first about the friction, and then where and how it is applied.

Friend "Orthodox" concludes by saying: "If J. H. will station himself at the opposite celestial pole," etc. I have been there often in imagination; and among the last times I was there, I saw that upon earth there was a fierce contest going on between Old Orthodox and Young Orthodox; and I was glad to see that Young Orthodox was fast gaining the mastery. Old Orthodox had been, for thousands of years, "braking" the world, and hindering the progress of science and society by the pressure upon the world of its two mighty tide waves, ignorance and superstition; and, by this means, he (Old Orthodox) had retarded the world's progressive revolution so much that, under such pressure, the arrival of society at meridian splendor was impossible. Young Orthodox, seeing this state of things, walked boldly forward, with true scientific sledge hammer in hand; and as I see him now, he is dealing such blows upon Old Orthodox's head as will soon knock out his brains; and he is every moment lessening the pressure, relaxing the hold, and giving the world more room to revolve and rotate onward and upward to the shining day.

It was once considered "orthodox" in astronomy to tell and teach man that the sun, moon and stars—the whole universe—revolve around the earth westwardly every twenty-four hours; that God created the heaven and the earth, the sun, moon and all the stars, in six days of twenty-four hours each; that Joshua commanded the sun to stand still and it did so; that the earth was flat, and poised upon the head of a huge coiled snake; and hundreds of other things which are now proven to be entirely erroneous. And to come down to the present time: It was, a short time since, taught that the sun is moving in his orbit in "direct" movement; whereas it is now proven, beyond doubt or question, that the sun's orbital motion is retrogressive. And so it may yet be proven that the earth is not "braked" by the tides; that her diurnal motion is not hindered at all by any power; but that the moon has advanced a little in her orbit, which at least is as like truth as the other, although we cannot as yet point out how and why. But admitting that the earth is retarding: Is not such result as likely to come from a cooling and contraction of the earth (admitting that the earth is but little more than the bones and sinews of some old comet, or the extinguishing embers of an old worn out sun) as from tidal friction, meteoric gatherings, material extractions and heapings, or any other hypothetical cause hitherto offered or assigned?

If the earth be retarding, this last is the most likely to be the cause. But we conclude that there is evidence enough elsewhere to prove satisfactorily that the moon has advanced, and will advance; and so settle the question.

Gloucester, N. J. JOHN HEPBURN.

The Patent Right Question.

To the Editor of the Scientific American:

In expressing my views in regard to the first inquiry of the Secretary of State, I would consider the question of expediency, and the justice of the expedient. This question was agitated in England forty-three years ago, when it was proposed to abolish the system of patent rights; and, instead of being abolished, the patent laws were made more liberal. I hope that a similar effect may follow the investigations by the coming International Patent Congress, to be held in Vienna.

The evidence before the Select Committee of the House of Commons, in 1830, proves that many of the most useful inventions would never have been prosecuted to public advantage if they had not originally been worked under a monopoly; and it may be safely asserted that if inventors had never been encouraged in their labors by the prospect of a reward, proportionate to their success, we should be a century behind in civilization.

It is stated, in the course of the testimony, that Watt's invention and the perfection he gave to it during the operation of this act of Parliament has proved of more value to the nation than can be calculated; probably as much as the inventions of Lord Dudley for smelting iron by pit coal, in 1619, or as those of Hargrave, Arkwright, and Crompton, for spinning machinery, about the same date as Mr. Watt's. Dudley and Hargrave were not encouraged, but were persecuted, and their works destroyed by mobs; after Dudley's death, his process lay dormant during a century, probably for want of support to him. These great inventions have had a close connection, and each one has promoted the progress of the other very greatly.

The steam engine is an invention from which the nation has derived immense wealth during the last century, and increasing means of wealth for the future. After the enunciation of the principle of action had been made by De Caus, in 1615, and by Papin, in 1690, the real inventors of the engine have been: Savary in 1698, Newcomen in 1713, Watt in 1769, Trevethick in 1802, Woolf in 1804, and Fulton, in America, in 1807. Of these Watt is the only one among us who has derived any adequate advantage or recompense for his labors. Woolf's failure of a recompense was entirely owing to the want of protection by an extension of his term, for his engines came into general use in Cornwall soon after the expiration of his patent, in place of Watt's engines, and with such great advantage in economizing fuel that Mr. Woolf would have been amply recompensed if his term had been made as long as Mr. Watt's was.

I think that the quotations above referred to are more than sufficient to settle the question of expediency in the adoption of a liberal policy toward inventors. If the principles of justice only were taken into consideration, those who devote their time and energies to the study of new improvements would be entitled to a compensation for their labors and expenses even in case of failure, and in case of success they would be entitled to a recompense proportionate only to the labor, ingenuity and expense they have bestowed upon their invention. But as the rights of individuals are subordinate to the interests of the community, it becomes expedient to encourage men to study improvements by the prospect of a future reward, adequate, not to their labors or expenses, but to the usefulness, to the value, of their inventions. The grant of a patent, in certain cases, may not repay the actual outlay of the inventor; in other cases it may prove an extravagant reward when its value is compared with the origin of the invention. I can cite an instance of a patent, originated in a dream, being sold afterward for thirty-six thousand pounds sterling. The inventor in this case received a reward to which he had no claim on the grounds of justice, while Hargrave, Arkwright, Crompton, Woolf and many others derived no profit from their inventions, although they obtained patents from their government.

A monopoly, whether held by the State or by private individuals, being, in any case, an infringement of equal rights, is contrary to justice; therefore the grant of exclusive property, even for a limited period, of a new improvement to the inventor cannot be considered as an equitable means of recompense. LAURENS E. DE WARU.

Baltimore, Md.

To the Editor of the Scientific American:

I cannot drop this question where your reply to my former letter leaves it; for I am even more assured that inventors have a right which you do not recognize. It is a personal, individual title, which is superior to any claims of society, and one of the many for the protection of which society is organized: the same inherent, sacred and inviolable right which a parent has to the possession of his children. The government which does not recognize this is of a necessity weak and unstable, because it has not the full support of the individual. The same law of justice which applies to the one has equal force for the other; hence, it is as much the duty of the State to support the individual in the maintenance of those rights as *vice versa*. And I have yet to learn that the State can take from me either my property or liberty without, in the one case, rendering an equivalent, and, in the other, except as an act of self preservation. If my land is wanted, damages and benefits are assessed, and I am recompensed; if my liberty, because the protection of public and individual rights demand it; if my life, because I have forfeited that which I, as one member of society, was bound to maintain; but the condition which elicits forfeiture, according to your theory, is that in which every member of society exists, thus assuring him of no security except as the whim of society may direct. This is nothing more nor less than despotism, and is contrary to the spirit and principle of a government which is preëminently "from the people, by the people, and for the people."

It is of course expedient for the State to offer premiums for inventions, discoveries, improvements, etc.; but I certainly do not understand that it can, by any "law of justice or natural right," appropriate to its own use an invention until certain conditions are fulfilled. If it could, civil government would be a failure, and progress would be retrograde. Now, although an invention is, in one sense, an offspring, it assumes the character of transferable property, which makes it marketable, and its price is the exclusive ownership and consequent enjoyment of its benefits for a term of years. Hence my reason for regarding a patent simply as an official statement to the world that the inventor is the sole owner, and that it is, or should be, subject to the laws which govern other property until the term of years has expired, when it then belongs to the State by virtue of the compact entered into between the State and inventor, at the time when the patent was issued. In the end, it amounts to the same thing as if it originally belonged to the State, and its monopoly by the inventor was tolerated for a season, eventually to be seized by the State, as you say; but it is degrading the office of the inventor if we say "it belongs to us; you found it, but it is not yours." For if the Giver of all has given to him light which He has not to others, it is manifestly his by an inalienable right until such time as he shall make mankind the recipient of what it is in no wise the claimant; thus following out the law that every man must, by the exercise of his own abilities, first provide for himself, and after that comes the privilege and duty of giving, of his plenty, to those who are less fortunate than himself. J. E. WILSON.

Bridgeport, Conn.

To the Editor of the Scientific American:

It seems to me that it would be a lamentable thing for inventors to accept what you state in reply to the questions asked by the State Department, on pages 7 and 8 of your current volume. A patent is a private monopoly just as any other species of property is, and it is surely a disguised form of communism to speak of it as a tyranny and an infringement of equal rights. Inventors are comparatively few and poor, and it is easy to be blinded to the truth in regard to their rights; but if they were a large and wealthy class, such as the manufacturers and other classes of wealth-creators among us, the very assertion that their products are by natural right the property of their fellow men, without compensation, would refute itself.

Of course every man is "bound to contribute his best powers of mind and body to promote the common welfare;" but that does not abrogate his individual right to the property he may acquire while doing so. It is, in fact, the strongest guarantee that he shall be protected in its enjoyment. Society is the offspring of individual compromise; and, in consideration of its protection to us, we give over to it the control of ourselves and our property, so much as may be necessary for the mutual benefit of all.

You say that "patents are granted upon the ground of expediency, not of justice;" but I am sure that the official patent is only the authorized public evidence of an invention, and that the right to the invention existed before the public issue, which is only the guaranty. Therefore it seems to me that the converse is true, that patents should be granted upon the ground of justice, and that governments after a time (with the consent of the patentee, given in the fact of application) do not resume but, upon the ground of expediency or necessity, seize upon the invention for the free use of all. The supposed discoverer of bread should, therefore, not have had a monopoly of it to the detriment of all. His right existed, but necessity compelled the State to take possession, that is, to refuse to protect. So it is with patents; when the invention is made, it, by right, belongs to the inventor, and it can only be taken away by the sovereign power of the State, exercised for the protection of its citizens. If it would benefit the nation to exercise this power, let it be done, and let the patent laws be repealed, so that all may comprehend the matter; but in the name of human progress, do not put our noble army of inventors in the position of suppliants for favor at the expense of justice and the rights of their fellow men.

The view advocated by you is held by many; but it is surely wrong, and I hope soon to see the day when the SCIENTIFIC AMERICAN will take its place, as the mouthpiece of American inventors, upon the side to which natural justice, material prosperity and private interest inevitably lead. I have written this article because I sincerely feel that this heresy, as I believe it to be, must be met, or it will fasten itself upon legislation to the blight of the spirit of invention at home, and to its repression, where it is less able to speak for itself, abroad. J. W. HEYSINGER.

Philadelphia, Pa.

Hatching from Cold Eggs.

To the Editor of the Scientific American:

Having taken interest in the articles published in your paper on "The Egg," particularly in a communication signed I. H. P. in your number of June 14, in which the writer supposes that the eggs, which were cold for four hours, would hatch, I cannot refrain from relating an incident, which occurred under my immediate notice, which I think is much more remarkable than the one before mentioned.

A hen having left her nest for two days and a night, after setting within two or three days of the time of hatching, and the eggs being perfectly cold, out of curiosity I determined to try an experiment. I removed them to a garret room, which was very hot, the thermometer in the coolest part of the house being at the time 95° Fah. On the third day from the time the eggs were left by the hen, they hatched by themselves, and the chickens are now running about the yard quite strong and hearty. I would like to know if any one ever met with such an incident. H. E. H.

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

NUMBER 4.

VIENNA WELT-AUSSTELLUNG, JUNE, 1873.

On arriving in Vienna, after passing the *douane*, the stranger finds himself confronted by a most important problem, namely, to determine where he shall find accommodation during his stay. Experience teaches that a week's notice may be insufficient to secure rooms at an hotel; and, although we had taken this precaution when in London, we were compelled to drive from one hotel to another until we finally found refuge in a queerly arranged old building, whose lofty and once finely decorated rooms had probably been the scene of many interesting events in earlier days. The oddly caparisoned bedstead in our sleeping room, the great and ancient porcelain stove towering up in one corner, the antique furniture, and the absence of all modern improvements, indicated that the wealth of the family which had erected this pile of buildings had long since taken to itself wings. Neither the place nor the price suited us, and we moved into one of the modern hotels (of which a dozen or more have been recently erected in Vienna) at the earliest possible moment. After becoming fairly settled in our new quarters, and recovering somewhat from the fatigue of the journey, a visit was made to

THE WELT-AUSTELLUNG.

As we rode up the central avenue of the Prater, as the Viennese call the noble park in which the exhibition is located, we caught sight of the industrial palace, and, above it, the great dome of the rotunda. The first sentiment was one of disappointment, for its unusual size is, to some extent, concealed by the lack of surroundings with which to compare it, and its somewhat ungraceful shape and peculiar proportions do not aid the mind in the effort to realize that this is the largest dome in the world. Like all very large objects, it requires time and repeated visits to enable the spectator fully to realize its magnitude, and to appreciate it as a triumph of architectural construction.

The first visit to this wonderful exhibition of the products of all nations is bewildering and fatiguing in the highest degree. The visitor comes away confused and dissatisfied. He can hardly remember whether the splendid silks and satins he has seen are the product of the looms of France or China; whether the dazzling collections of gold and silver ornaments and of precious stones are exhibited by oriental or occidental nations; and even which continent excels in the exhibition of the products of the metal industries remains undetermined. Our first impression in regard to the display made by the United States was decidedly confirmed, however, by more systematic and leisurely subsequent examination. In quantity, we are far behind every civilized nation, and, even in some important departments, we are excelled by some uncivilized countries. Many of our most important and characteristic industries are entirely without representation, and those which are represented at all appear only partially and in disjointed divisions.

Other countries exhibit very complete and thoroughly well arranged

MINERAL AND METALLURGICAL COLLECTIONS,

illustrating their natural resources. In the United States show, excepting Professor Cox's excellent collection of Indiana minerals and productions, and two or three other similar local exhibits, there is little to indicate that we possess more extensive, more valuable, and more accessible mineral resources than any country on the globe, and that we are earnestly and intelligently working at developing them as rapidly as we can earn or borrow the capital requisite. Rock drills and mining tools are not exhibited in our section. Had they been placed here in competition with their European rivals, they would have readily carried off the premiums, and would have readily entered the foreign markets. The Burleigh drill is exhibited by Germany, and seems to be well and favorably known. Of

TEXTILE PRODUCTS

we exhibit but few samples; and, although those are excellent in quality, the stranger who may compare our department in this group with those of other nations would be led to believe that the United States is far behind other, and far less important, countries in the extent and variety of textile manufactures. We exhibit a good collection of leather, and a few manufactured leather goods. Our great India rubber industry is practically without representation, although it is one of our peculiarly American, and markedly successful, manufactures. Our manufacturing jewellers do not exhibit, and, of manufactured iron and steel products, many single firms, of nearly every other country, present far more extensive and far more interesting collections than appear in the whole of the space apportioned to the United States.

Similar remarks will apply to every other group in the official catalogue, except, perhaps, Group XIII, which includes machinery; and, even here, our exhibition is by no means what it should be. Our collection of

SEWING MACHINES

is exceedingly extensive; and the elegance in design, the beautiful finish and the fine work done by our best makers excite universal admiration.

The exhibition of mowing and reaping and similar agricultural implements from the United States also stands unrivalled in extent and in quality, but Great Britain is far ahead of all nations in the heavier classes of portable engines, steam plows, and road locomotives. We have sent none of these. Our wood and metal working tools are, at least, well represented, and Whitney's pail making machinery and the small collection of shoe manufacturing machines, from New England, with several single machines, represent, in an interesting manner, the peculiar talent possessed by our mechanics in designing machines for special purposes.

We have in our section no representative of our standard drop cut-off engines, with regulation by the adjustment by the governor of the point of cut-off; although the fact that nearly every other manufacturing country exhibits engines of the Corliss pattern may enable us to claim the credit which is due to our inventors in this field. Of the smaller and less complex classes of engines, we exhibit several superior examples. We find but one or two exhibits of cotton or woolen machinery in our section, although here, and in woodworking machinery, our mechanics are represented by creditable copies from almost every other country.

Not a locomotive appears from the United States, but close imitations of the standard American types appear elsewhere. Copies of our sleeping cars and other railroad stock are shown by several European builders.

Indeed, American mechanics are universally copied, and their genius finds its illustration in every section of the machinery hall. They are more fully represented, in many departments, by the exhibits of foreign countries than in that of their own. So patent is this latter fact that it is a subject of general remark among those visitors, of whatever nationality, who are familiar with our position as a nation of mechanics. Every product of American inventive genius, from the sewing machine to the steam engine, is imitated, and the copy appears here, while the original frequently, indeed generally, remains at home. Some of these imitations and copies are exceedingly creditable, and, in some cases in the British section, they even excel the original in some respects. In many cases, the imitation is declared in the circulars of the foreign manufacturer, and they are usually perfectly willing to acknowledge their indebtedness to us. They seem to look upon the fact as one of the strongest recommendations of their work. Jury work will soon bring these instances more fully under observation, and in succeeding communications they will be noted as they appear.

Excursions are proposed into the neighboring country, which promise to be enjoyable, as well as instructive. One of these excursions was made a few days ago to

KOLIN,

in Bohemia, where the party spent the day with the venerable Ritter von Horsky von Horskysfeld, who has had the boldness and the enterprise necessary to break down the conservatism which impedes progress in this country so seriously; and who, by the introduction of agricultural machinery, some of it imported and some of it his own invention, has increased threefold the income from his great estate, 6,000 acres in extent. A special train left Vienna, late on Friday evening, carrying the party, among whom a half dozen of us were "*aus Amerika.*" After riding all night, we breakfasted at Kolin, at 8.30 next morning. Our meal, which consisted of a glass of *bier* and the beautiful bread for which this country is justly celebrated, was quickly despatched; we re-entered the train, and were soon at Karolinenhof, entering the place through a beautiful deer park, evidently greatly to the consternation of the beautiful animals whose home it was. They had never before seen a railroad train, for the rails were laid expressly for our accommodation; and we caught occasional glimpses of the does scampering off as rapidly as the less fleet motion of their pretty fawns would allow. The masculine members of their family, being unimpeded, were all out of sight long before our train could bring us near their resting places.

The party were received and entertained with characteristic hospitality by the host, and, after an inspection of the farm buildings, which were remarkably well built and well arranged, and after examining his singularly heterogeneous collection of old and new, rude and creditable, farming tools, the cattle were presented for criticism. Many were of Hungarian stock, long horned, large framed and muscular, excellent for draft but of little value for other purposes. The remainder were of Swiss and other breeds, smaller and better filled out, sleek and well kept.

A *gabel frühstück* followed: a more pretentious meal than the preceding, but at which the absence of meats and of plain bread was not compensated by the abundance of native wines and of beer, excellent although they were, nor by the variety of cake presented. Before breakfast was over, the carriages, which had been collected from neighboring domains for miles around, had been brought up, and the party was soon comfortably seated in ninety-six of them, and those remaining unoccupied were sent home again.

THE FIELDS,

through which the long procession passed, were in fine condition. The principal crops seemed to be wheat, rye, and beets. The latter were the sugar beet, and a large proportion of the cultivated land was devoted to its production.

We were given an opportunity to witness the operation of all the agricultural implements used by our host, and also of the Fowler steam plow. Some of the latter are in use in our own country, and the time cannot be far distant when the steam plow will supersede the ordinary apparatus on all the large farms of our Western prairie districts. The manufacturers of the Fowler apparatus in England are building up a splendid business. At one point, we were shown the

ROPE TRAMWAY

in operation, transporting clay a long distance across the farm to the compost heaps, where it was used to correct the sandy character of the soil under cultivation. The wire rope was about five eighths of an inch in diameter, running over pulleys of thirty inches diameter and a hundred feet apart, at the rate of about four miles per hour. In such situations, this method of transportation affords many advantages over any other, from its cheapness of construction, its adaptation to every variation in the character of the country over which it is led, and its low cost of operation. Roebling & Sons, of Trenton, N. J., have been the pioneers in the introduction of wire rope transmission in the United States.

An inspection of a well arranged

SUGAR MANUFACTORY,

where the sugar beets raised on the farm are worked up, a visit to the American elevator, as it was called, where the grain is all cleaned, dried, and winnowed, and finally an excellent dinner, with speeches and congratulations in all languages, were the closing events of this most interesting excursion.

R. H. T.

The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections in the month of May, 1873:

During the month, 1,237 visits of inspection were made, and 2,386 boilers examined, 2,017 externally and 754 internally; 168 were tested by hydraulic pressure. The defects in all discovered were 1,062, of which 218 were regarded as dangerous. These defects were in detail as follows:

Furnaces out of shape 29—8 dangerous; fractures, 59—23 dangerous; burned plates, 34—18 dangerous; blistered plates, 133—32 dangerous; deposit of sediment, 173—25 dangerous; incrustation and scale, 197—16 dangerous; external corrosion, 62—10 dangerous; internal corrosion, 18—9 dangerous; internal grooving, 12—4 dangerous; water gages defective, 58—7 dangerous; blow-out defective, 17—1 dangerous; safety valves overloaded, 14—2 dangerous; pressure gages defective, 180—24 dangerous; without gages, 135—8 dangerous; deficiency of water, 9—3 dangerous; braces and stays broken, 29—12 cases placed the boilers in dangerous condition; boilers condemned as unsafe to run, 8. The defects enumerated in the above report are sufficient to show the importance of good care in the use of boilers. The tendency is to run boilers too long, and inspectors are often asked if they cannot "fix things up for another year, six months, or even one month." We are sorry to say that, in some instances, those who have used boilers for years do not (or will not) understand that an overworked, worn out boiler is unsafe, even when the evidences of weakness and insecurity are most shockingly visible. There is a disposition to "patch up and run along" a little longer, and so the matter often goes until accident and disaster put an end to such recklessness. If any persons pursuing such a course read this article, we desire to say to them that the kind of economy they practice is not infrequently attended with great loss of life and property.

A Preventive against Hot Journals

We have received a sample of a new elastic waste, which, from its appearance and the statements made as to its merits, seems superior to cotton or wool for the packing of journal boxes. It is composed of cow hair, sponge, and asbestos, and is quite elastic, a quality, we are informed, which effectually prevents its caking in the receptacle. The agents, Messrs. W. E. Allen & Co., of No. 4 Great Jones street, in this city, submit many testimonials as to the value of the compound from railroad officials by whom the article has been in use.

The advantages claimed are that the material is composed of incombustible and lubricating substances, wears longer than cotton or woolen waste, does not grind into mud, requires less oil, saves several brasses per annum in each journal, reduces friction and hence economizes traction power, and, lastly, effectually prevents the heating of journals. The invention, which has recently been patented, is known as Devlan's Patent Elastic Waste.

Meteoric Iron from California.

The analysis made by Mr. F. A. Cairns, assistant in the School of Mines, Columbia College, of this city, is as follows:

Iron	81·480	Calcium	0·163
Nickel	17·173	Carbon	0·071
Cobalt	0·604	Silicon	0·032
Aluminum	0·088	Phosphorus	0·308
Chromium	0·020	Sulphur	0·012
Magnesium	0·010	Potassium	0·026
	Total	99·987	

Of the twelve elements quantitatively determined by this analysis, aluminum, calcium, and potassium have been rarely observed in meteoric iron—meteors free from silicates—while the absence of copper, tin, manganese and sodium will be noticed.—*American Journal.*

PNEUMATIC SCREW VENTILATOR FOR CARS.

It is no very difficult matter to promote currents of air in railroad cars by means of the ordinary tubes and funnels, properly arranged; but to prevent the entrance of smoke, cinders, and disagreeable fumes with the incoming draft is a difficulty to obviate, requiring more efficient apparatus than the common devices above alluded to.

The improved ventilator, which forms the subject of our illustrations, aims to remedy most existing evils in quite a novel and ingenious manner. To a common spindle a wind wheel, A, of four or more paddles and a screw are attached, B. The screw, driven by the wind wheel, revolves in a cylinder, C, set upon the roof of a car, or connected with it sideways by an elbow pipe, D. A perforated cylinder is set on cylinder, C, and supports a plate which protects the opening, and forms a support for the portion around which the turret or hood revolves. The wind wheel and the sides of the perforated cylinder exposed to the current of air are protected by the turret, which forms a shield around the open part, and moves independently of the motion of the wheel and screw, following that of the vane, E. In the direction of the vane the upper half of the turret is perforated on the right or left, as the case may be, the openings being slightly larger than the paddles. This arrangement is of importance, because the returning paddles meet with little resistance, being shielded by the other closed half of the turret; the wind wheel consequently revolves at a high velocity and with it the screw. The latter is of peculiar construction; it is a double half spiral, winding from right to left and left to right around the spindle. It is made of thin sheet metal, and its diameter corresponds nearly with that of cylinder, C, leaving only room enough for play. This form of the screw is claimed to secure an excellent ventilation with a lower velocity than is required for fans.

It is evident that, with every revolution, the air before the spirals is pressed out of the way, upward if moved to the right, downward if to the left.

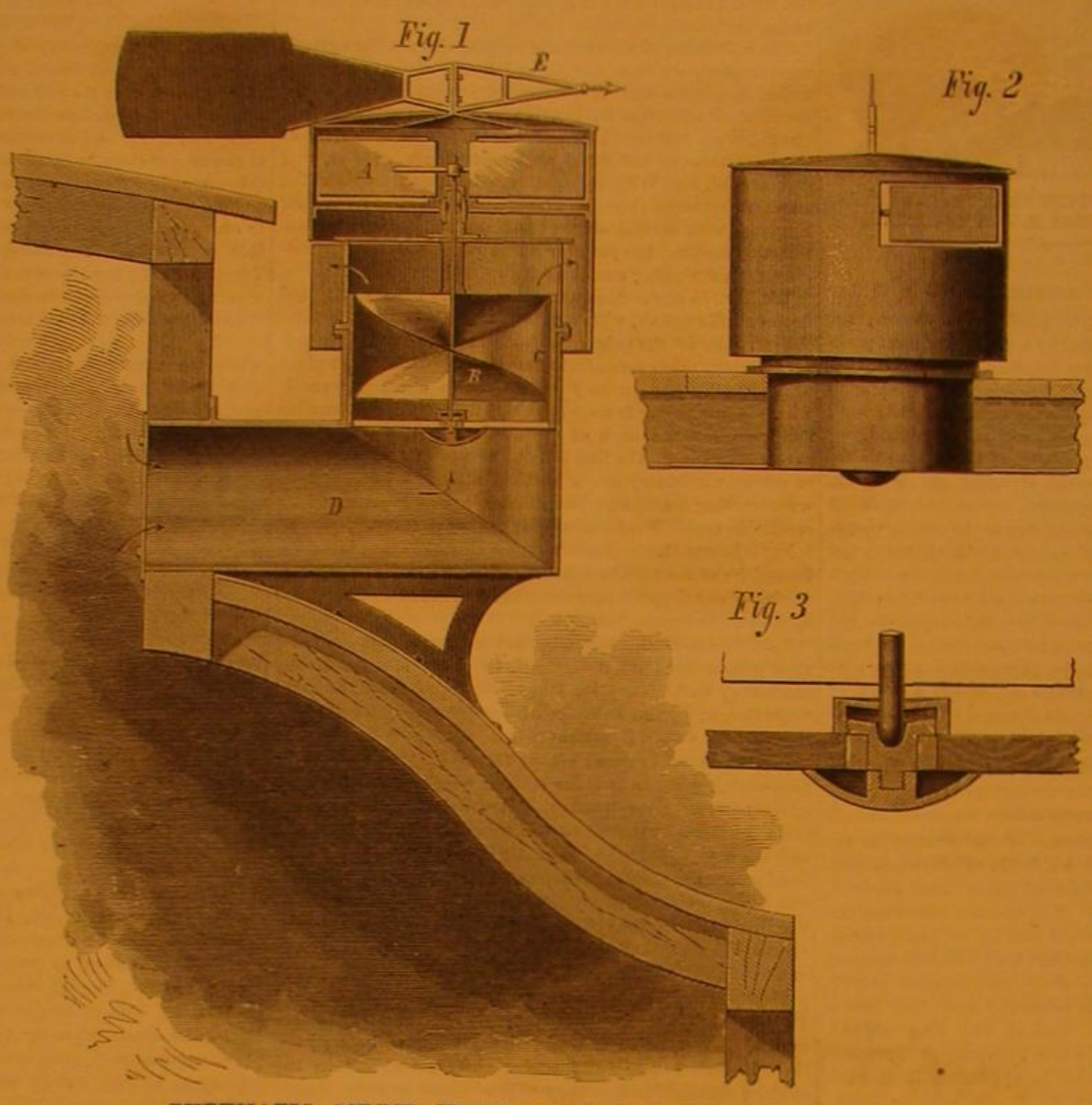
The inventor states that actual trials on a running train have proved that the screw will make at least from 500 to 600 revolutions in a minute; and consequently three ventilators, of 8 inches diameter of screw and 5 inches high, will remove the volume of air in a passenger car in about 15 minutes when running at the above speed. No drafts are produced, and the air changes constantly, the effect being not at all disagreeable to the passengers. Smoke and gases and fine dust also disappear rapidly.

The principal operation of the invention is suction, to bring away the foul and vitiated air, openings for introduction of fresh air being easily provided; or when a still more vigorous ventilation is required, the apparatus, with a slight alteration of the turret, can be set to forcing air into the car.

Fig. 1, in section, shows how the device can be attached to the skylight in the raised roof of a car. Fig. 2 shows the mode of attaching the ventilator to the flat roof, and also how the opening, in which the screw revolves, is protected against wind, dust and rain, the aperture for the exit of air from the car being on the opposite side. Fig. 3 is a section of the socket for the spindle, lubricator and hanging cup. If the lubricator be filled, re-oiling will not be needed for months, friction, it is claimed, being reduced to a minimum. The hanging cup serves to catch any oil that leaks out. A circular register may also be attached to the bottom of the cylinder to open or shut, for graduating the ventilation at pleasure. In Fig. 1, doors like those now in use will answer the purpose.

This entering draft, it is suggested, may be conducted around the stove so as to warm the interior during cold weather.

Patented December 31, 1872, by Philip I. Schopp, C. E., who may be addressed for particulars at No. 445 W. Jefferson street, Louisville, Ky.



PNEUMATIC SCREW VENTILATOR FOR PASSENGER CARS.

Safety Valve Levers.

An esteemed correspondent, J. M., of Cal., says: "I notice that some of your correspondents are puzzled how to compute the effective pressure that a taper safety valve lever adds to the load on the valve. Take the weight of the lever and make a mark on the side of the lever on line with the place where the lever rests on the center of the valve spindle, or at exactly one distance from the fulcrum. Make a loop of wire, slip it on the lever to the mark, hook a spring balance on to the wire, and raise this balance till the lever floats clear of the valve spindle; the number of pounds indicated on the face of the spring balance will be the weight that the lever adds to the load on the valve." This seems to be a simple and easily accessible device.

ABBE'S PATENT BOLT FORGING MACHINE.

It has long been a conceded fact, that, in forging bolts the four or six sides of the head should be acted upon by the forging dies without moving the bolt blank from the position in which it is first held, and that the forging dies should be wider than the bolt head, so as to leave no fins on the corners of the head. The object of the inventor of the herewith illustrated machine has been to produce a tool which should combine these advantages with all the requirements of every class of bolt forging. Four dies are used, and the bolt is held firmly and securely in one position until finished, always, it is claimed, producing a bolt, under the head, just the size of the rod, with the sides of the head in parallel lines with the body. All classes of bolts and shapes of head desired are made, especially the fish joint or T headed bolts, which, we are informed, cannot be made on machines where the bolt is turned to receive the action of the forging dies. The production of the apparatus varies, with the size of the bolt to be forged, from eight to sixteen perfect bolts per minute; and changing from one size of bolt to another, or from one shape of head to another, it is stated, requires hardly a moment's time, especially adapting the device to the use of railroad shops.

Among the points of advantage claimed are, first, simplicity; every bolt and joint being dispensed with except those which produce the result of working the four dies, while there are neither gears, cams, nor springs about the machine, thus saving to the user both the expense and the time occupied in making necessary repairs. The slides are all gibbed so that any trifling wear can be readily taken up without removing the slides to put on a thin strip of iron. The sliding surfaces are always running in oil, as they are placed above the water and cinders. The machine is provided with a cupboard for its tools, a new feature in this class of devices.

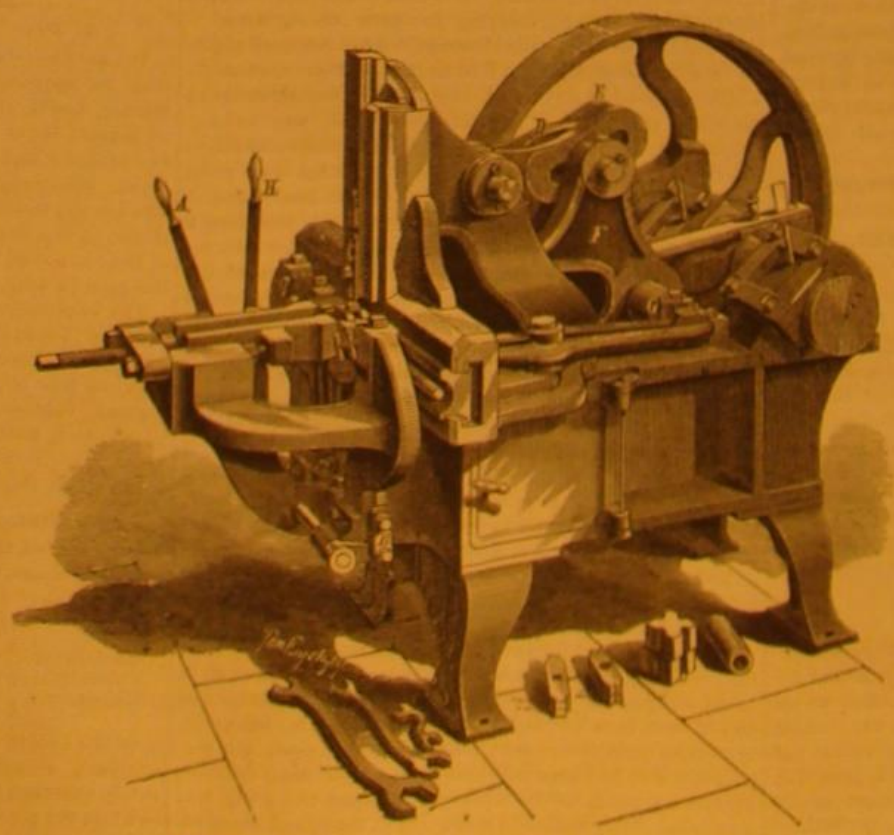
The holding vise is operated by a handle, A, attached to the cross shaft. On each end of the latter are the arms, having links, B, attached to work the sliding frame, which open the radial arms that carry the holding dies. These holders are backed up by a filling-in piece, adjusted forward by means of the screws. The length of the bolt is gaged from one inch upward by adjusting the end screw. The driving wheel is in operation all the time: the machine only when it is forging the bolt. The long slide carries the bottom die on its lower end. The top slide die, C, works on the face of the long slide, which is actuated by two levers, D, E, having curved slots, the top die slide having one lever with reverse curve, all working on the same pin. The pin in the upset carrier, F, passes through the curved slots, and as it acts back and forth moves them in opposite directions. The side dies have their motion by means of links, G, attached to the upset carrier.

When the bolt blank is placed in the holders and clamped tightly by means of the handle, A, the handle, H, clutches in the driving wheel with the shaft, the upset carrier advances by means of the connections to upset the iron, the forging dies being all open. As the upset carrier recedes to half stroke, the side dies compress the sides of the head, and at extreme end of stroke the top and bottom dies act upon the other two sides of the head, and so continue to do until the bolt is finished, which is done in four revolutions of the driving wheel.

Two sizes of these machines are now being manufactured, one for both large and small bolts, and the other more particularly for the smaller sizes.

Two patents have been granted for this header, bearing date of May 1, 1870, and June 6, 1871, respectively, while a third is now pending.

For further particulars address the inventor, John R. Abbe, or the manufacturers, S. C. Forsaith & Co., Manchester, N. H., at whose works the machines can always be seen in practical operation.



ABBE'S PATENT BOLT FORGING MACHINE

NEW PLASTIC COMPOSITION.—A new plastic composition, said to be capable of very pretty effects, consists in mixing finely divided mica with liquid shellac. A paste or putty is made of these substances, and then pressed by means of dies into any desired ornamental form.

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

THE CECROPIA SILKWORM.

Attacus [*Platysamia*] *Cecropia*, Lin.—(*Lepidoptera, Bombycidæ.*)

The Cecropia silkworm is common, and its great size and beauty attract general attention. It is also more easily obtained, for the cabinet, than most of our other large moths, because its cocoon is always fastened to a twig where it remains all winter, a conspicuous object. The ground color of the wings is a grizzled dusky brown with the hinder margins clay yellow; near the middle of each of the wings there is an opaque kidney shaped white spot, shaded more or less on the outside with dull red, and edged with black; a wavy dull red band, edged inside with white, crosses each of the wings, and the front wings next to the shoulders are dull red with a curved white and black band, and have near their tips an eye like a black spot with a bluish white crescent: the upper side of the body and legs are dull red; the forepart of the thorax and the hinder edges of the rings of the abdomen are white, and the venter is checkered with red and white. There is considerable variation in the ground color of individuals, some being quite dark and others quite light, but the female differs from the male in nothing but her larger abdomen and much smaller antennæ or feelers.

FIG. 1.—THE CECROPIA MOTH, MALE.

The genus *attacus*—meaning elegant—was founded by Linnæus, and our moth received its specific name from the same author.

During the winter time, the large cocoons of this insect (Fig. 2) may be found attached to the twigs of a variety of trees. I have found them upon the apple, cherry, currant, barberry, hazel, plum, hickory, blackberry, elderberry, elder, elm, lilac, red root, maple, willow, and honey-locust. It has also been found on the pear. This cocoon tapers both ways, and is invariably fastened longitudinally to the twig; it is formed of two distinct layers, the outer one, which is loose, wrinkled, and resembles strong brown paper, covering an inner oval cocoon composed of the same kind of silk, but closely woven like that of the mulberry silkworm.

FIG. 2.—Cocoon of the Cecropia.

Inside of this cocoon will be found a large brown chrysalis.

In the month of May, in the latitude of St. Louis, and earlier or later the further north or south we go, our Cecropia moth issues from its cocoon, and there can be no more beautiful sight imagined than one of these gigantic fresh born moths with all its parts soft and resplendent. The uninitiated would marvel how such an immense creature had escaped from the small cocoon which remains at its side, retaining the same form which it always had, and showing no hole through which the moth could escape. The operation—so interesting and instructive—can be witnessed by any one who will take the trouble to collect a few of the cocoons and place them in some receptacle which has sufficiently rough sides to admit of the moth's crawling up, to hang its heavy body and wings while they dry and expand. The caterpillar has the wonderful foresight to spin the upper or anterior end of its cocoon very loosely; and when the moth is about to issue, it is still further aided in its efforts by a fluid secreted during the last few days of the chrysalis state, and which is a dissolvent of the gum which so firmly unites the fibers of the cocoon. This fluid is secreted from two glands, which open into the mouth, and as soon as the chrysalis skin is split open on the back, by the restless movements of the moth within, the fluid flows from the mouth and wets the end of the cocoon, dissolving the gum and softening the silk to such an extent that, by repeated contractions and extensions of the body, the moth is at last enabled to separate the fibers, and to thrust out its head and unbend its front legs; after which it rapidly draws out the rest of its body, the mouth of the cocoon afterwards closing by the natural elasticity of the silk. At this moment the body of the moth is much swollen and elongated, the wings are small, folded, and pad-like, and the whole insect is soft and moist; but, attaching itself to the first object at hand where it can hang its heavy body and clumsy wings, the latter become expanded in about twenty minutes, and the superabundant fluids of the body sufficiently evaporate in a few hours to enable the insect to take wing.

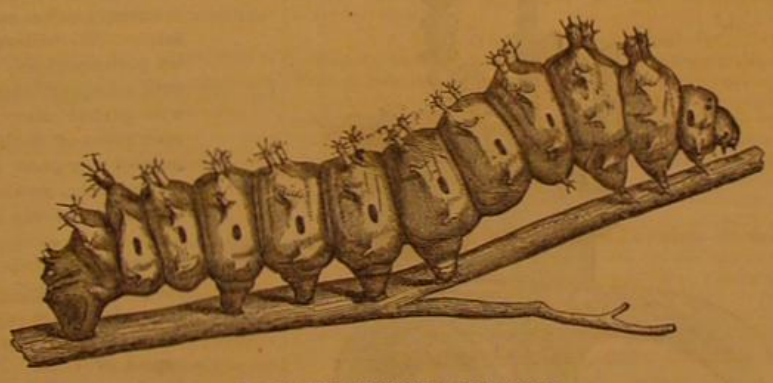


FIG. 3.—THE CECROPIA SILKWORM.

The eggs of the Cecropia moth are 0·09 inch long, sub-oval, flattened, and of a pale cream color, shaded with light brown; and they are deposited in small patches on the plants which are to form the food of the future larvæ. They are deposited in June, and hatch in from six to ten days thereafter.

When first hatched they are entirely black, with the tubercles placed in the same position; but are larger at the base and with a narrower stem than in the more mature individuals, the upper and smaller end being crowned with a whorl of conspicuous stiff black bristles. After the first molt, the body is of a deep orange color, with the tubercles and head black, and with longitudinal rows of black dots running between them. After the second molt, a still greater change takes place; the body acquires a beautiful yellowish green tint, the tubercles on the back are blue on joints 1, 12, and 13, coral red on 2 and 3, and yellow with black spines, with a black spot on the inside and outside of the stem, on 4—11; those at the sides are blue, and the head is of the same color as the body. After the third molt, the black spots, except a row below the stigmatal row of tubercles, disappear; the tubercles themselves lose all black except the spines, and the head and body become delicate bluish green rather than yellowish green, as formerly. After the fourth and last molt, the red tubercles near the head frequently become yellow, and when full grown, the worm measures over four inches, and presents the appearance shown in our engraving (Fig. 3), the tubercles being respectively of the most delicate yellow and blue.

Two weeks after the worm first begins to spin, it changes to a chrysalis, and, as already stated, passes the winter in this form, there being but one brood each year.

The cocoon of this insect is often found to contain a kernel of corn, a grain of wheat, or even an acorn; and the first time I found a corn kernel in one of them, I was sorely puzzled to comprehend how it came there, and imagined that it must have been accidentally dropped, by some bird, into the meshes of the cocoon while the latter was being formed. But the kernels are found in the cocoons altogether too frequently to admit of any such chance coincidence, which must necessarily be of very rare occurrence. There is every reason to believe, therefore, that these foreign materials are placed there, for safe keeping, by some bird; the loose end of the cocoon admitting of their being forced in, even after it is completed. Dr. LeBaron thinks that this bird is very likely the blue jay, which is known to have the habit, in common with other *coreidæ*, of pilfering and hiding in holes and crevices any small object that attracts its attention. One of my correspondents from Geneva, Ill., who has found no less than five of these cocoons containing kernels of corn, thinks the chickadee (*parus atricapillus*, L.) uses them as a storehouse, as well as the blue jay, and, indeed, inclines to believe that the former is the sole proprietor. He has seen it, with corn in bill, searching about apple trees for such a storehouse, and has witnessed it deposit a kernel in the crack of a board fence.

The Cecropia worm, as may be inferred from its size, is an immense feeder, and a small number will soon defoliate a young apple tree. It has, on a few occasions, been found numerous enough to do injury in this way; but as a rule, natural enemies keep it so thoroughly in check that it can hardly be classed as an injurious insect. The same may be said of the other large and native worms which I include with the silkworms, and which on account of their silk-producing qualities may with propriety be treated of rather as beneficial insects, though their products have not yet been utilized. Their great size and conspicuity not only renders them a ready prey to their natural enemies, but enable us to easily destroy them by hand picking whenever they happen to become unduly multiplied on any of our fruit trees.

PARASITES OF THE CECROPIA SILKWORM.

THE LONG-TAILED OPHION.—(*Ophion macrurum*, Linn.)—This large yellowish brown ichneumon fly (Fig. 4) is often bred from the cocoons in place of the moth which one expects. It is one of the most common parasites of this large insect, and the females appear to be altogether more common than the males. The female, according to Mr. Trouvelot, deposits from eight to ten eggs upon the skin of her victim, and the young larvæ soon hatch from them and commence to prey upon the fatty parts of the worm. But as only one of the parasitic larvæ can find food sufficient to mature, the rest all die from hunger, or else are devoured by the strongest one which survives them.

After the Cecropia worm has formed its cocoon, the parasitic larva, which had hitherto fed on the fatty portions of its victim, now attacks the vital parts, and, when nothing but the empty skin of the worm is left, spins its own cocoon, which is oblong oval, dark brown, inclining to bronze, and spun so closely and compactly that the inner layers, when separated have the appearance of goldbeater's skin. If we cut open one of these cocoons soon after it is completed, we shall find inside a large fat legless grub (Fig. 5), which sometimes undergoes its transformations and issues as a fly in the fall, but more generally waits till the following spring.

FIG. 4.—Ophion.

FIG. 5.—Grub of the Ophion.

THE CECROPIA TACHINA FLY.—(*Exorista leucaniæ*, Kirk. var. *cecropiæ*, Riley.)—The ichneumon fly last mentioned usually causes a dwarfed appearance of the worm which it infests, and parasitized cocoons can generally be distinguished from healthy ones by their smaller size. The larvæ of this tachina fly, which is also parasitic on the Cecropia worm, seem to produce an exactly opposite effect, namely, an undue and unnatural growth of their victim. This fly differs only from the army worm tachina fly (*exorista militaris*, Walsh) in lacking the red tail entirely, or in having but the faintest trace of it, and I consider it but a variety of that species.

THE MARY CHALCIS FLY—(*Chalcis mariæ*, Riley).—I received from Mr. V. T. Chambers, of Covington, Ky., numerous specimens of the beautiful large chalcis fly figured herewith (Fig. 6), which he had taken from the cocoon of the Polyphemus moth, which is quite common, and issues as early as the middle of February in that locality. He says, "I was satisfied that the cocoon did not contain a living Poly-

FIG. 6.—Mary Chalcis Fly.

phemus, and therefore opened it. It contained so little besides these insects and their exuviæ as to suggest strongly the old idea that the caterpillar had been metamorphosed into them (as in a sense it had). There were forty-seven of them, of which twenty-three were females. As all the males and some of the females were dead when I opened the cocoon, I think it likely that the former never do emerge, and perhaps few of the latter, otherwise Polyphemus would soon be exterminated."

I can very well imagine that most of these chalcis flies would die in their efforts to escape from the tough cocoon of the Polyphemus, but it so happens that these same parasites have been found by Mrs. Mary Treat, of Vineland, N. J., to prey upon the Cecropia worm, from the cocoon of which they can more easily escape.

This fly is of a yellow color, marked, as in the engraving, with black.

THE CECROPIA CRYPTUS—(*Cryptus extramatis*, Cresson).—Another ichneumon fly (Fig. 7) often infests the Cecropia worm, the larvæ filling its cocoon so full of their own thin

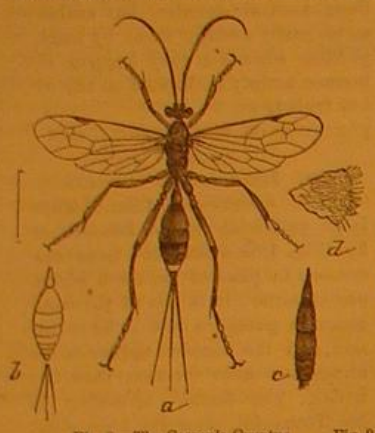


Fig. 8.—The Cecropia Cryptus.

Fig. 9.—Cocoons of the Cryptus.

parchment-like cocoons, that a traverse section (shown in Fig. 8) bears considerable resemblance to a honeycomb. The flies issue in June. The wings have a smoky appearance, caused, as may be seen when viewed under a microscope, by innumerable littleh ooks regularly arranged over their surface.

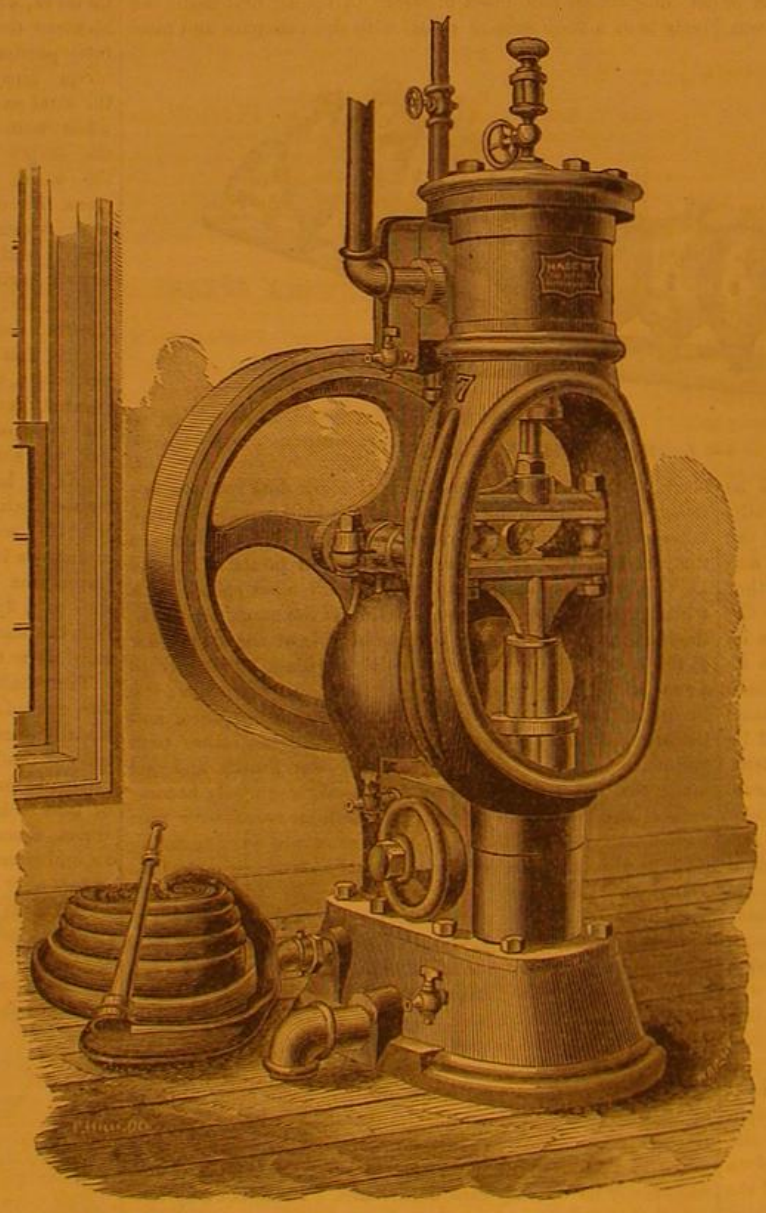
DOUBLE-ACTING BUCKET PLUNGER STEAM PUMP.

The fire pump illustrated in our engraving is of a form and manufacture doubtless already familiar to many of the readers of our journal. It is therefore not a new invention, but rather one which, during the three years that it has been before the public, has been made, from time to time, the subject of useful improvements; so that, in presenting it now, it is desired not merely to call attention to the advantages claimed for its peculiar mode, but also to the success which it has encountered from the period of its introduction.

The points to be noted consist in the arrangement of the bucket plunger and its method of operation. About the steam cylinder and valve there is nothing peculiar, unless it is the entire absence of complicated valve gear. The bucket plunger is composed of two cast iron cylinders, the larger one being below and packed with composition packing rings. The water cylinder in which it operates is made twice the area, in comparison to the steam cylinders, of the ordinary forms of double-acting steam pumps, the object being, it is stated, to dispense with half the number of water valves, as the quantity discharged on the upward stroke is, as will be explained hereafter, thrown out through an opening in the top of the pump cylinder, and does not pass through the valve opening. Water is drawn in, on the up stroke, through a suction valve near the bottom of the cylinder, filling the latter. The downward stroke forces the contents out through the discharge valve, one half the quantity passing into the air chamber, and the other half flowing up into a passage and thence into the upper part of the cylinder encasing the small part of the plunger. The reason that one half of the water is forced out is that the small part of the plunger takes up that proportion of the interior space of the cylinder. On the next upward stroke, the water around the plunger is forced out through a passage and into the air chamber, thus filling up the pump, the same stroke replenishing the cylinder as before. Thus, it is stated that, after the pump has made a few strokes, a steady stream is kept up, as the quantity of water taken into the cylinder through the suction valve on the up stroke is just double that forced out through the passage from the upper end of the cylinder on the same stroke. It will be observed that there is another reason for constructing water cylinders in the proportions above noted, from the fact that, while a large portion of power is required to discharge water, but little is needed to draw it through the suction valves.

The fly wheel is operated by a crank, sliding block and cross head; to the latter, the steam piston and bucket plunger are attached by their piston rods. The pump barrel and steam cylinders are in line with each other.

The working advantages are claimed to be ready taking of water, facility of running with greatest rapidity without jarring or thumping, and strength and durability in material and construction. Pumps of this description have been exhibited at the recent Fairs of the American Institute in this city, one of them receiving a medal and being rated first in order of merit at the exhibition of 1870. Numerous testimonials as to the successful operation of the device, from many leading firms, are also submitted by the makers. Patented by Mr. William Wright, of New York, March 8, 1870. For further particulars, address the manufacturers, the Valley Machine Company, Easthampton, Mass.



WRIGHT'S DOUBLE-ACTING BUCKET PLUNGER STEAM PUMP.

Lake Okeechobee.

This is the Indian name of a large lake in the southern part of the peninsula of Florida, distant 45 miles inland from Jupiter Inlet on the Atlantic coast, and 200 miles south of St. Augustine. The lake is 65 miles long and 30 miles wide, surrounded by extensive marshes which render it difficult of approach, and hence but little is known of its precise character. It contains several large islands, which we believe have never been carefully explored. A recent number of the New York *Herald* contains an account of a visit to this great lake by G. K. Allen, of San Marie, Florida, and four companions. It was with extreme difficulty that they made their way through the swamps and over quicksands, but they finally gained the edge of a bayou which floated them to the lake; and once upon its bosom, no further obstacles to progress were encountered.

From the first two or three miles out from the shore, they were terribly annoyed by mosquitoes and flies of various kinds, from which they could only in part protect themselves by thick veils over faces and hands. But at eight miles distance, the insects were no longer troublesome. Three miles from the shore they found shallow water—five feet—and sundry low islands inhabited by immense alligators. At a distance of eighteen miles from the shore, the water became clear and bottom was found at 170 feet. Here they discovered a group of three islands; the largest about six miles long, and four miles wide. The northern portion of this island was a barren, rocky waste, which extended back from the shore nearly a mile and a half, to the base of a line of rocky cliffs, about one hundred and fifty feet high, which extended across the whole width of the island. To the south of these cliffs is a magnificent forest, composed chiefly of large mahogany, palmetto and laurel magnolia. Many of the latter trees, being in full bloom, presented an enchanting scene. This forest extends over the whole of the southern portion of the island, except to within a few hundred yards of the shore, which at every point is sandy and covered with rocks.

The island next in size is about one fourth of a mile west of this large island; it is about four miles long and a mile and a half wide, and is covered by a forest like that on the large island. The third is quite small, being only about one mile long and from a half to three quarters of a mile wide. Very few animals of any kind, and none of a savage nature, were found upon these islands.

In the forests spiders of a gigantic species were found. One was seen which was fully two feet long. It had long and very strong looking limbs, and would have weighed three or four pounds. In its head, which was jet black, were several eyes, each surrounded by a bright yellow and scarlet circle. The body was encircled by bands of scarlet, yellow and black. Altogether the spider presented a very brilliant appearance

Upon the largest island, north of the cliffs, the explorers were surprised to find heaps of stones, lying in such a position as to resemble ruins of some kind of structures. None of the ruins were extensive, and the structures must, therefore, have been of small dimensions. Similar ruins, if such they were, were found in great numbers upon the small island, north of this one. Upon the summit of a cliff which stands upon the eastern shore of the large island, the party found a large heap of stones lying in a semicircular form, and facing to the east.

The length of these ruins was nearly two hundred feet. In front of this semicircle, and about fifty feet from it, was a large heap of stones, nearly twenty feet square. The ruins found on the plain below, and upon the small island, were much smaller than those found upon the cliff, being only from five to ten feet square.

One Hundred Miles an Hour.

The highest railway speeds in the world are attained in England, and the highest railway speed in England is attained on the Great Western Railway, and this speed may be taken roundly as fifty miles an hour. There is a tradition in existence that Brunel once traveled from Swindon to London at eighty miles an hour; but we have never been able to obtain a shadow of proof that this speed has been reached under any circumstances or at any time whatever on a railway. Mr. Stirling has run with one of his great outside cylinder express engines and a train of sixteen carriages at seventy miles an hour on the Great Northern, on a level or with a slightly falling gradient; and we know that the Yarmouth express on the Great Eastern sometimes has reached a speed of sixty-four miles an hour down the Brentwood bank. On two occasions, some years ago in Ireland, we ran 14 miles in sixteen minutes with a powerful engine and a train of but two carriages. Much of the run was done at over 65 miles per hour. On the Boston and Albany road, United States, the 54 miles between Springfield and Worcester were run by an engine with 16 inches cylinder, 22 inches stroke, and 6½ feet driving wheel, in fifty-eight minutes.

Much of the run was done at nearly seventy miles an hour. On a first class line there can be no question, therefore, but that a speed of sixty-five to seventy miles an hour may be available with safety. We believe that it would be possible to lay permanent way so well, and to maintain it in such excellent order, that trains might travel on it with perfect safety at 100 miles an hour. Miles upon miles of such track are to be found now on most of our great main lines, but it is not to be disputed that nowhere can 100 consecutive miles of permanent way in perfection be found; and as a chain is no stronger than its weakest link, so a few hundred yards of bad track would spoil for the purpose of traveling at 100 miles an hour a whole line. It would not be impossible, however, to maintain a line of such rails from London to Liverpool or York. The really important question is, given the line and the carriages fit for it, what shall the engine be like, and is it possible to construct an engine at all which, with a moderately heavy train, will attain and maintain a velocity of 100 miles an hour, on a line with no grade heavier than, say, 1 in 300. The first points to be settled are, how much power can a locomotive of a given size develope, and how much power shall we require to haul a train which will suffice to satisfy the demand of that portion of the public wishing to travel at 100 miles an hour. At 60 miles an hour on an ordinary line, and making due allowance for contingencies, the resistance to be overcome cannot, according to experiments carefully carried out both in France and in this country, be much under 40 lbs. per tun. At 30 miles an hour the resistance is about 20 lbs. per tun; at 47 miles an hour the resistance reaches 32·5 lbs. If the resistance goes on increasing in this proportion, then the resistance at 100 miles an hour cannot be less than 75 lbs. per tun; but it may be very much more, and it would not, we think, be safe to take it at less than 120 lbs. per tun. Now a speed of 100 miles an hour is 146·5, or in round numbers, 146 feet per second, or 8,800 per minute. This, multiplied by 120 and divided by 33,000, gives, say, 32 horse power. Therefore each tun moved at 100 miles an hour will represent 32 horse power. The "Great Britain" broad gage Great Western engine, with its tender, in running order represents a weight of about 64 tuns, and a heating surface of 2,100 square feet. This engine has indicated over 800 horse power. To run such a machine and a train weighing 35 tuns, or a gross load of 99, or, say, in round numbers 100 tuns, at 100 miles an hour would require 100 × 32, or 3,200 horse power, or just four times more power than the most powerful high speed locomotive that has ever been built could exert. To run the engine, weighing 38 tuns, alone would require a power of 1,216 horses, assuming that the engine resistance was identi-

cal with that of a carriage. These figures suffice to prove that it is absolutely impossible to obtain a speed of 100 miles an hour on a railway if the resistance is anything like 120 lbs. per tun.

It is little more than waste of time to discuss any other question connected with the matter, such as safety and working expenses, until it has be settled whether it is or is not possible so far to reduce resistance that it will become possible to construct an engine of sufficient power to fulfil the intended purpose.

If it can be shown that the resistance could be brought much below 120 lbs. per tun, then it may be possible to attain a velocity of 100 miles per hour.—*The Engineer.*

THE *Daily Graphic* says that the individual who styled himself Professor La Mountain, and who was lately killed in Michigan by a fall from a balloon, was an imposter who traded on the name of the real La Mountain. The latter died six years ago, and was one of the most distinguished aeronauts.

J. H. P. says: My brother and myself are in mechanical pursuits, and we owe half our success to your journal.

DECISIONS OF THE COURTS.

United States Circuit Court--Southern District of Ohio.

PATENT ROTARY BLOWER.

P. H. AND F. M. ROOTS *vs.* WILLIAM G. HYNDMAN.

EMMONS, *Judge:*

In an action for injunction to restrain infringement of reissued letters patent, granted P. H. & F. M. Roots, for cases for rotary blowers, dated July 27, 1869, wherein the inventors were complainants and William G. Hyndman respondent, in the United States Circuit Court for the Southern District of Ohio, before Justice Swayne and Judges Emmons and Swing, the following opinion, upon final hearing, was delivered June 11, 1873:

The four claims of the patent which were in controversy are as follows:

"1. A rotary blower case, the interior of which is rendered true and accurate by means of plaster of Paris, or its described equivalent, applied substantially as described.

2. A rotary blower case, the ends or heads of which are rendered true and accurate by means of plaster of Paris, or its described equivalent, applied substantially as described.

3. A rotary blower case, the concaves or arcs of circles of which are rendered true and accurate by the use of plaster of Paris, or its described equivalent, applied substantially as described.

4. A rotary blower case having concave arcs B B, in combination with end plates I I, arranged so as to admit of the abutments being introduced or removed without requiring the case to be taken apart, substantially as set forth."

The Court appears to have held the following:—

A patent for a rotary blower case, of which the interior and certain specified parts are rendered true by means of plaster of Paris, "or its described equivalent," and which describes as an equivalent a material capable of being made plastic when applied, and becoming hard in a suitable time, is infringed by the use of litharge and glycerin for the same purpose.

The novelty of the device is not impeached because a pump was before known lined with molten metal.

Nor because others have, by means somewhat similar, made the abutments in such a machine true, those not being specified in the claims.

A claim for "a rotary blowing case having concave arcs, in combination with end plates arranged so as to admit of the abutments being introduced or removed without requiring the case to be taken apart," held to mean so much of the case as incloses the operative parts, and that it was infringed by a case cast in two parts, of which one included only the legs and such portions as performed none of the functions of the machine, and on removing it the abutments could be introduced or removed.

James Moore, for complainant.
Wood & Boyd, for respondent.

United States Circuit Court--Southern District of Ohio.

THE UNION PAPER BAG COMPANY *vs.* NIXON & CO.

In this case, Judge Emmons, in his opinion given April 16, 1873, held as follows:

A specification is not fatally defective because it does not mention such modifications as practical use would readily suggest in order to render the machine efficient, such as employing a weight or a spring, or changing the dimensions of the parts.

Nor because it does not mention a cam on the main shaft, and the arms and connecting rod, which are all necessary to give the proper reciprocating movement to the pasting rollers on a paper bag machine, they being devices which any mechanic would introduce of his own accord.

Nor because the office of giving motion to the pasting rollers is attributed to another cam on the shaft, which is incapable of performing it, since any mechanic would know that another cam is necessary for the purpose, as well as its form, and where it should be placed.

Drawings of the bags indicated in the patent of a paper bag machine by which they are produced may be annexed to a reissue of the patent, although they were not to the original.

Because other United States Courts have decided that certain words constitute, under the circumstances, a claim to a principle, they are not necessarily to be so construed in all cases.

Claims which can be construed to embrace meritorious combinations and devices will not be construed to embrace a principle, and to be therefore void, though they are capable of being so interpreted.

Where the bar on which the tube is supported in a paper bag machine has the lower side extended beyond the upper, so that the lower side of the tube will be cut off with a lap to form the bottom of the bag, a claim for a combination of several of the devices employed, which enumerates among the rest "machinery for cutting the tube slantwise, as specified, while it is on the former or holder, and machinery for pasting or cementing the said tube near its front end, and bending or lapping the end of the tube on the cemented part so as to form the bottom of the bag," was held to embrace the extension of the lower side of the bar.

Such a claim is infringed by the use of such a supporting bar, although turned upside down, and made with its rear end smaller than the rest, and without the cutting edges or the rollers that carry forward and paste the paper.

A claim for "arranging the pitch line of the feeding gear in, or about in, the prolongation of the axis of the shaft of its crank, whereby we obtain intermittent and variable motions of the paper, as described," held to be a combination claim, and to include the roller which works in the supporting bar and the devices for carrying forward the paper, and giving it tension while it is severed, though they are not specified.

A patent for making the frame of a paper bag machine adjustable upon its bed by means of a slot and screw, is infringed by making the frame so heavy as to be held in place by its weight.

A claim for creasing rollers in a paper bag machine, in combination with other devices, is infringed by rounded bars or hooks working in a similar combination with the same effect.

An alternate claim to only one or the other of two things, but to neither positively, is void; but a claim to each of two things, whichever is used, is valid.

James Moore, respondent's counsel.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From July 4 to July 10, 1873, inclusive.

BOOK SEWING MACHINE.—A. M. Loryea, Portland, Oregon.
CARTRIDGE BOX.—S. McKeever, Mobile, Ala.
CUTTING GEMS.—C. M. Field, Boston, Mass.
DYEING MACHINERY, ETC.—C. G. Sargent, Graniteville, Mass.
FLUID METER.—J. O. Johnson, New York city.
MOTIVE POWER.—P. Protheroe, Baltimore, Md.
PREPARING HIDES.—J. Davis *et al.*, Pittston, Pa.
PRESERVING FABRICS.—S. W. Torrey, New York city.
PRINTING YARN.—J. H. Lorimer, Amsterdam, N. Y.
ROTARY ENGINE.—W. H. Eayrs *et al.*, Boston, Mass.
SAIL AND DRAG.—T. M. Fleetwood, Savannah, Ga.
SEMI-STEEL, ETC.—C. J. Cammon, New York city.
SEWING MACHINE.—T. Hall, Northampton, Mass.
SHOE FASTENER, ETC.—J. Wulf (of New York city), London, England.
WINDOW GRATINGS.—T. Hyatt, New York city.
WOOD PULP, ETC.—T. B. Armitage, New York city.

Recent American and Foreign Patents.

Improved Street Railway Switch.

John E. Pattison, New Orleans, La.—This invention is an improvement in the class of switches which are operated by the weight of the draft animal applied to a tilting or oscillating platform. By the arrangement of a reciprocating piston rod in connection with two narrow platforms, the switch can be adjusted from the main track to the side track, and *vice versa*, as required, whether one or two animals are used for the car. The animal whose weight is not required passes over the space between the platforms.

Improved Beer Strainer.

Charles M. Powers, Ridgewood, N. J.—A vessel similar in form to an ordinary beer tankard is divided into two compartments by a vertical sliding partition. This partition slides in grooves on the sides of the vessel, and extends from near the cover to near the bottom. A horizontal stationary strainer is in one compartment, and another strainer in the other compartment is hinged to the partition so that it can be withdrawn with the partition for cleaning, when necessary. The beer to be strained is introduced into the one part through the opening and passes through the strainer and finds its way into the other compartment. It then ascends and passes through the horizontal strainer and through the perforated side of the vessel, and is discharged from the spout, clear and free from froth.

Improved Middlings Purifier.

Joseph W. Wilson, Pawtucket, R. I., assignor of one half his right to John W. Vose, of same place.—This invention consists in using a fan blower and exhaust fan, in connection with a sieve so fine as to allow the passage of no middlings therethrough while being cleaned. By suitable construction, as the middlings are fed into the machine intermittently, each portion is subjected to the blast from the fan blower, which causes the fine woody fiber, dust, and all other impurities, to rise into the upper part of a chamber, where they are subjected to suction from, and are drawn off through, the exhaust fan. The other parts of the middlings pass down to the coarse cloth where they are separated.

Improved Cotton Cultivator.

Charles Zocher, Augusta, Ga.—This invention has for its object to furnish an improved sweep for cultivating cotton and other crops. The upper arm of the foot or shoe is secured to the standard of the stock, and its lower arm is designed to rest upon the ground, and thus give steadiness to the sweep when at work. The wings of the sweep are made solid in one piece, and the middle part fits upon and is bolted to the foot. The wings project and slightly curve rearward and outward, and the lower parts of their forward sides are made with offsets, which break up their edges, and thus cause them to readily discharge the grass or weeds that may collect upon said edges. Each offset is formed by cutting away the edge of the sweep both upward and backward, while the portion of the edge between the offsets slopes or is inclined to the line of draft so that the soil or other substance with which it may come in contact will readily escape or be turned off. It is thus an improvement on the plow share of L. M. Reed, patented in 1869, No. 85,533.

Improved Turn Table.

William H. Burch, Port Gibson, Miss.—This invention has for its object to furnish an improved turn table for railroads. The center or step plate rests upon a bed of brickwork, and carries a cast steel socket to receive the center balancing screw. At the end of the track are secured the bearings of two wheels in such positions that they may be directly beneath the end of the track of the turn table when in position for the engine to pass to or from said table, The wheels are designed to take the weight off the circular track, upon which the table revolves, when an engine is passing to or from said table. The stringers to which the rails are attached are bolted to each other. Each is made in two equal parts, which are strengthened at the joints and bolted at the centers to the center cross beam. To the stringers at the inner sides of the end cross beams are bolted the truck frames. To the under side of the center cross beam is bolted a cast iron plate, which plate is made sufficiently long to receive the bolts that secure the splice bars to said central beam. Through the center passes the pivoting screw, the bearing for which is lengthened by a boss formed upon the lower side of said plate. The said screw can be securely locked in place, and may be turned one or more revolutions, so that the table may be accurately adjusted. The table is locked, with the rails in line with the rails of the track, by the V shaped locking bar, attached to the shaft which works in bearings attached to a suitable support, which is worked by a lever. The free end of the V-shaped locking bar enters a groove in the catch block, one of which blocks is attached to each end of the track of the turn table. Suitable stays prevent vibration and hold the table securely and firmly under counter strains.

Improved Cultivator.

Philip F. Wells, Milford, Mich., assignor to himself and D. Webster Wells, of same place.—The invention consists in the improvement of cultivators. The longitudinal bars of the framework are connected with the tongue by an angle plate, to which they are securely bolted. The latter is made with a vertical and a horizontal flange, to strengthen it against the strain in the different directions in which it is exposed to strain. The plow standards carry the cultivator teeth or plows, and the draft strain is sustained by the draft bars, the forward ends of which are attached to longitudinal bars, and the rear ends to the said standards. The rear ends of the draft bar are connected with the standards by means of wooden pins, so that, should the plows strike an obstruction, the pins may break and allow the standards to swing back without being broken. The upper ends of the standards are connected with the bars by bolts, so that the said standards may swing back upon them, wedge-shaped washers being interposed, when required, so that the standards may be parallel with the draft line while being attached to inclined bars.

Improved Muff Lining.

Charles F. Butterworth, Troy, N. Y.—The lining of this muff is composed partly of fur and partly of elastic leather. The outer pieces are fur, and are blocked or crimped so that the lining part and the end part are at about right angles to each other. The former part extends into the muff so as to inclose the wrists after the hands are admitted, which the natural elasticity of the fur permits. The middle part is of material which readily expands and gives the required room.

Improved Butt Hinge.

Somers Van Gilder, Knoxville, Tenn.—This invention relates to the construction of hinges for hanging doors and for other purposes; and it consists in a divided leaf and in a pintle pin fast in the other part of the hinge. The pintle is stationary, and each part of the divided leaf bears its own portion of strain whichever end of the butt may be up; and the butt may be reversed as may be found convenient, so that making the butts in pairs or rights and lefts is not necessary.

Improved Clothes Washer.

George J. Terrell, North Blanford, Mass.—This apparatus is placed in the ordinary wash boiler, and is designed to fit the inside thereof, with its outer rim resting on the bottom, and form a false bottom itself. A tapering tube is attached to the center, which extends to near the top of the boiler, having upon its end a removable T-shaped exhaust pipe. The outer edge of a lining rests at its ends upon the bottom of the boiler, but its sides are raised up so that the water readily passes beneath it to the bottom of the boiler. The lining is arranged a short distance below the false bottom, leaving an open space between the two, and is held in position by means of a short tube. Holes are made through the false bottom. When water is placed in the boiler, it at once finds its way to the bottom. Heat being applied, steam is generated, and the water, or steam and water combined, is forced upward by the pressure through the tube through the agency of the conical imperforate lining which prevents the flow or escape of the same laterally. The clothes to be washed are placed in the boiler, resting on the false bottom, and the water thus raised is discharged through the T pipe on top of the clothes, and percolates by its own gravity down through the clothes; passes next through the holes, and thus enters the space between the false bottom and lining, whence it flows downward to the bottom boiler. A circulation of water is thus kept up through the clothes, the rapidity of which is according to the quantity of steam generated.

Improved Wash Boiler.

William J. Thomas, Frederick City, Md.—In the end parts of the boiler are formed tubular chambers, in which are formed transverse slots, through which the steam and water are discharged upon the clothes. The bases of the tubes project inward a little above the bottom of the boiler. In a false bottom are formed two rows of holes, one row upon each side of the central line and about half way between said central line and the side edges of said bottom. The holes are covered upon the upper side of the bottom by strips, which prevent the clothes from being forced into the holes by the pressure of the water. In using the boiler, the pressure of the steam when generated presses hinged plates up against the lower side of the bottom, closing the openings in said bottom until the said plates are again forced down by the pressure of the water, thus establishing a current.

Improved Fireproof Roof.

John B. Cornell, 129 Center street, New York city.—This invention consists of light iron beams or rafters, covered with sheet iron, corrugated with dovetail grooves, which is secured to the rafters or beams by metal brackets riveted to it, and hooked under the rafters. A top covering of fire and waterproof cement, and a mortar coat on the inside, are applied and plastered on the sheet metal, and secured by the dovetail grooves and ribs; the whole constituting a light, durable, fireproof roof, which is not subject to the dampness on the inside common to the metal-lined fireproof by the condensation of moisture on the iron.

Improved Apparatus for Pitching Barrels.

George Sichler, New York city.—This invention has for its object to furnish an improved apparatus for rolling beer kegs after they have been pitched to keep the pitch spread over the inner surface of the kegs until they have become so cool that it will not flow. The kegs are placed upon the forward or upper end of an upper skid, down which they roll and pass upon another skid which is pivoted and balanced by a weight. The kegs overbalance the latter and tilt the skid until the forward ends of its side bars come in contact with the upper side of the rear end of the lower skid along which the kegs roll to the forward end of the machine, where they are raised and again placed upon the upper skid. In this way a number of kegs may be kept in motion at the same time, the only labor required being to raise the kegs and place them upon the upper skid.

Improved Electrical Thermostat.

John H. Guest, Brooklyn, N. Y., assignor to Augusta Guest, of same place.—The object of this invention is to construct a reliable instrument for closing the circuit of an electric fire alarm as soon as the temperature of the surrounding air has reached a certain degree of heat. It consists of a bulb with an expansion tube surrounded by an outer vessel, which is closed hermetically by a suitable liquid, cork, and sealing wax. The end of the wire passes through this outer vessel and the bulb into the mercury, being in continuous contact with it, the action of the instrument being thus not disturbed by the changes of temperature and consequent access of air. Whenever the temperature will rise to the degree to which the thermometer is adjusted the mercury will rise in the expansion tube, and, coming in contact with the wire therein, establish the circuit and produce the alarm.

Improved Gyroscopic Toy.

Archibald C. Würtele, New York city.—This invention is an improved toy, which is so constructed that, by giving a rapid motion to a wheel suspended in it, it may be made to revolve in various positions and directions.

Improved Paint Compound.

Horatio Nelson, New York city.—This compound is claimed to possess antiseptic properties, which render it more desirable than other paints where such properties are not found. It is composed of plumbago, clay, silicate of potash or soda, and oil.

Improved Sofa Bedstead.

Charles F. Grundin, Boston, Mass.—The object of this invention is to construct an improved sofa or armchair bed, which can be thrown open in such a manner that the seat or back of the sofa is not used at all for the bed and consequently less worn, retaining its form and appearance. Any spring bottom can therefore be used for the bed part, and the whole be placed on casters, to be easily moved as sofa or bed. The invention consists of four parts, two for the back and two for the seat, hinged together to be swung open by disconnecting the arm top pieces from the arm braces, which form the legs of the front part of the bed. The sofa back and seat form the outer side, a spring bottom the inner and bed part of the sofa bed.

Improved Medicine Spoon.

James L. Colby and Le Roy B. Thomson, Saxonville, Mass.—The object of this invention is to supply a spoon for the nursery by the use of which the administering of medicine to children is greatly facilitated, without spilling the medicine. It may also be manufactured in larger sizes, and be placed on suitable supports on the bed table, so that the medicine may be filled into it before the actual time of taking has arrived. To the body of the spoon is attached, at the connecting point between bowl and handle, by means of hinges, a convex cover of the same size as the bowl, and resting edgewise upon it. A crescent shaped opening at the foremost part of cover serves, when the same is thrown open, as a rest for the vial, to steady the hand for counting the drops of the medicine; when closed, for the purpose of allowing the contents of the bowl to flow freely into the mouth of the patient. To the lower side of the bowl are connected supports for sustaining the spoon in such a position that the medicine is level in the bowl and does not spill.

Improved Mode of Constructing Wells.

Asahel Curtis, Bastrop, La.—This invention relates to a new and useful method of forming wells with less brick for the curbing than has heretofore been used. The ordinary wooden earth box, sharpened at the lower end and having bands at top and bottom, is intended to receive the bricks that are usually superposed thereon, while the wall and the box gradually sink lower and lower as the wall is built. A cylinder placed about the box is gradually raised as the work progresses, and is removed at its termination. This not only enables wells to be constructed with great evenness of the wall bricks, and with perfect perpendicularity, but also enables one to economize the number and expense of the bricks themselves, especially in country places, to which they are hauled from a long distance.

Improved Cotton Press.

William W. Patrick, Midway, S. C.—The object of this invention is to construct, for the use of cotton growers and others, a powerful press for packing the cotton in bales, which, on account of its plain construction, can be furnished at very moderate price. The invention consists of a frame of strong timbers, carrying the packing box and a windlass. Two levers are pivoted to the upright posts of the frame, the lower one with semi-circular head carrying the pendent follower block, the upper or king lever pressing on the lower and packing thereby the cotton in the box. By pulleys and ropes at the end of the levers, in connection with the windlass, the power is obtained.

Improved End Gates for Wagons.

Stephen F. Robertson, Rockford, Ill.—This invention has for its object to improve the construction of wagon boxes. To the inner surface of the side boards, at their ends, is attached a plate of malleable iron, which is cast with two flanges upon its outer side to form a groove to receive the end of the end board. Upon the lower end of the plate is cast a bolt which passes down through the bottom board, and through the cross bar placed beneath said bottom boards, and has a hand or lever nut screwed upon it. Upon the outer flange of the plate, near its upper end, is an eye to receive the hook cast upon the malleable iron cleat attached to the end board. A bolt attached to the end board passes down through the bottom board and the cross bar, and has a hand or lever nut screwed upon its lower end. By this construction, the parts of the wagon box will be much more firmly held together than when the ordinary wooden cleats and cross rod are used.

Improved Seed Planter.

William Call, Jr., Haverstraw, N. Y.—This invention has for its object to furnish an improved machine for planting seeds. A clutch which slides upon the axle is pressed out against the wheel by a spring, and is held by a pin to the axle. Upon the axle are secured star cams by which the dropping slides are operated. The main frame consists of two long bars, connected by three cross bars, while the auxiliary frame consists of two long bars connected by short bars, having sockets that enable the frame to slide upon the bars of the main frame. On the front bar is pivoted the seed-dropping slides of the hoppers. By suitable construction the hoppers and furrow openers may always be adjusted to rows of different distances apart.

Improved Chair.

William T. Doremus, New York city.—This invention has for its object to furnish an improved chair, so constructed as to yield, as a person sits down in it and as he leans in either direction, thus avoiding the rigid resistance experienced in sitting in an ordinary chair, and which at the same time adjusts itself to the weight of the person, and thus operates equally well with a light and with a heavy person. By suitable construction, when a person sits down in the chair, his weight compresses rubber blocks more or less, so that the said blocks will always adjust themselves to the weight they may have to support.

Improved Hinge.

James W. Wood, Conshohocken, Pa.—The object of this invention is to furnish an adjustable hinge, by means of which the doors can be easily set to any position desired on the shrinking or swelling of the door frame and door, or adjusted up and down to prevent dragging or catching at the sill or top frame. The invention consists of a flange cast to one wing or leaf of a common butt hinge, to slide and be adjusted by set screws in a metallic socket mortised into the jamb and secured firmly therein by wood screws.

Improved Dog for Circular Saw Mill.

James Taber, Rockford, Mich.—This invention has for its object to furnish an improved dog for securing the log or other timber upon the carriage in circular saw mills. By suitable construction the engaging ends of the dogs are thrown forward and inward, to enter the log, by moving the free end of a lever downward, and are thrown back and outward by moving the free end of said lever upward. The lever when moved upward moves along a spring to keep it from dropping down when released. By raising the free end of another lever a block will be drawn forward, causing the engaging ends of the dogs to project, to enable them to take hold of a rough, knotty or crooked log. By lowering the free end of the lever the dogs are drawn back to their former position. The sliding plate and its attachments may be raised, to adapt it to dog a larger log, and again lowered at will.

Improved Medical Compound.

Aaron Fuqua, Woodville, Ky.—The object of this invention is to furnish a remedy for diarrhœa and similar diseases of the bowels; and it consists in a compound composed of red oak bark, sweet gum bark, blackberry root, cloves, pimento, cinnamon bark, extract of logwood and refined sugar.

Improved Thrashing Machine.

Frederick R. Sutton and William O. Sutton, Wellington, Ill.—The crushing rollers are arranged directly in front of the upper edge of the concave so as to deliver the flax and grain to it. There is an endless roller or apron arranged on a feed table in front of the rollers for delivering to them. The lower roller is mounted in stationary bearings, but the upper one is arranged in movable bearings to slide up and down in a yoke; and springs of elastic rubber are arranged in yokes above them, so as to allow the upper roller to rise, as required by the flax or grain passing under it, and to keep the press down thereon, no matter how much or little it may be. The apron works over rollers, the latter bearing at the outer end of the table, and provided with adjusting screws, by which the requisite tension may be maintained on the apron. The beater blades of the thrashing cylinder are arranged upon projections of the arms of the cylinder beyond the head, and they are screwed by hook-shaped angle bars, which engage the bars of the cylinder at one edge, and are clamped by the clips, which engage the other edge, and are held by hook bolts.

Improved Till Alarm.

John F. Baldwin, Nashua, N. H.—The object of this invention is to furnish improved means for detecting fraudulent attempts to gain access to money drawers or "tills." The case consists of front and side plates attached to the bottom and end of the till. Keys are pivoted to the front plate, and act as levers, the back motion being produced by spiral springs. There are several bolts which work through a swing bar. The lower portion of each bolt extends down from the foot piece through a flange, and has the spiral spring around it, which spring rests upon the flange and presses the bolt upward with a constant pressure. The lower edge of the swing bar is forced forward in contact with the keys by a spring. On the inside of the swing bar is a small lug for each bolt, and each bolt is made with a shoulder which catches under this lug and holds the bolt down when it is not in use for locking. The openings in the top of the swing bar, through which the bolts work, are broad enough to allow the bolts to be forced one side, or into an inclined position, and when so forced one side and pushed down the shoulder catches under the lug of the swing bar. When the bolts are not required for locking they are not disposed of in this manner. The locking bolt or bolts may be changed, and one or more brought into requisition, as may be desired. When the bolts are thus pushed down and held the toe of the key (when the finger piece is pulled) slides down on the face of the bolt and thereby pushes back the swing bar and gives the alarm. When the bolt is up (as when used for locking) the toe of the key passes by the side of the bolt, and the angle of the key strikes the foot piece and draws down the bolt. When the drawer is closed a catch plate will be raised by the end of locking bolt; but when the bolt has passed behind, it drops down and secures the drawer. A small spring presses the plate down with a constant pressure. A spring rod keeps the drawer in position when it is closed. The alarm is given whenever the swing bar is pushed back, and this is done whenever a key is made to operate upon a silent bolt, or a bolt not employed in locking.

Improved Railway Frog.

John Woodville, Washington, Ind.—This invention consists of a turn out for mining railways, constructed with particular reference to the cars used in mines, in which it is necessary to have the wheels revolve on the axles, on account of the short curves necessary on such roads, and which said wheels, in consequence of so working, have considerable lateral play. The invention comprises improvements in the form or construction of points of switch rails. The peculiarities of these points are: The pointed end of one switch point terminates at such a point in the line of the outside rail of the branch track that the gage is increased on a radial line about one and a quarter inches; and the pointed end of the other point is so arranged that the gage on another radial line is increased about an inch and a half, so that notwithstanding the lateral play of wheels on the axles they will be switched off on the curve with certainty in case the car is pulled by the team to the left. In some cases, where the turn out is not very short, so that the team will not naturally turn out enough to pull the car over into the switch, it is desirable to employ a movable tongue, which is pivoted at the concave end of one switch point by a pin extending down through the wing plate, and having an arm fixed on it, and extending outside of the rail a suitable distance, and connected with levers and weights for holding the tongue open or closed, as may be desired, the weight being put on one arm to hold it open, and the other to hold it closed. It is proposed to have a cord or rod extending along the track each way, so that when it is desired to have the car take the course which the tongue would, under the influence of the weight, prevent it from taking, the driver can shift the tongue while riding on the car by reaching out and pulling the cord.

Improved Harvester.

John Werner, Jr., Prairie du Sac, Wis.—This invention has for its object to improve the construction of that class of harvester platforms that convey the grain longitudinally along the platform, and raise it into a receptacle to be conveniently taken by the binders and bound. The invention consists in the improvement of platform conveyers. When the cut grain falls upon a harvester platform it usually falls with its heads inclined toward the elevator, and is carried forward in that position to the elevator, when an ordinary conveyer is used. With this improved conveyer the heads of the cut grain fall upon the platform, and its butts upon the belt or belts, so that the said heads will lie still, and the butts will be carried forward until the grain lies straight across the platform when it will be carried forward by the slats to the elevator.

Improved Coffin Plate.

George Brabrook, Taunton, Mass.—This invention relates to coffin or other plates intended to receive an inscription; and consists in providing a tapered body with a circumjacent flange at the bottom, and a detachable beveled border.

Improved Meat Chopper.

Hoge P. Rankin, Allegheny, Pa.—This invention consists in a novel mode of combining a rotary table and a series of chopping knives; also, in a peculiar mode of constructing the knives, so that, when the edge of a knife loses its exact horizontal line by sharpening, it may be still adjusted on the stock so as to strike horizontally; and, finally, in a novel mode of preventing the mechanism from being broken by the contact of the knives with bones or other hard substance.

Improved Clay Molding Machine.

Charles A. Fisher, Baltimore, Md.—This invention relates to molds for making earthenware plates, engraved or otherwise, for stoves, flooring, or other purposes; the same being made in two parts, hinged together at one end.

Improved Curtain Fixture.

Lloyd J. Earll, Union City, Pa.—This invention consists in suspending a curtain from the cornice so that it can be adjusted with respect thereto and at different distances therefrom. It also consists in a suspended wire frame, provided with bearings, in which rotate the curtain roller. It also consists in providing a novel detachable journal for the roller, whereby if a journal is injured or impaired it can be easily replaced.

Improved Toy.

Albert R. Batchelder, Newburyport, Mass.—This invention is an improvement upon the toy for which letters patent were granted to E. L. Morris, June 25, 1872, No. 128,399. The improvement consists mainly in suspending balls from the handle by flexible cords or strings. The object is to increase the difficulty of operating the toy, and to enable a series of beautiful parallel curves to be described about the handle in various planes.

Improved Button Hole Cutter.

Casper Van Hoosen, New York city.—This invention consists in arranging a cloth gage within a circular slot of one scissor blade, which is shouldered, and a stop screw on the other slotted blade, which acts against the shoulder. When adjusted, a stop will prevent the blades from closing beyond the required point, so that all the button holes will be of exactly the same length. The part of the scissors upon which the stop slides is provided with a scale of division marks for convenience in adjusting said stop.

Improved Shutter Worker.

Hervey S. Phillips, Wilmington, Del., assignor to himself and Robert Blair, of same place.—The object of this invention is to provide improved means for opening and closing window blinds and shutters. A bar of irregular form, or zigzag in shape, having offsets therein, is attached to the inside of the shutter at its ends. A lever is attached by a pivot screw to the window sill, so that it may be made to swing horizontally. The opposite end of this lever is curved, and has lugs projecting upward, between which the bar is placed. When the lever is moved outward the bar slides between the lugs, but there is sufficient play to allow the offset to pass without binding, and when the lever is held at rest without the lug in the angle of one of the offsets, the shutter is held immovable, while, by a movement of the lever one lug slips from the angle, and another lug pushes the bar outward. The blind or shutter may be securely held by the lever when either open or closed, or in three, more or less, intermediate positions. The lever is operated by means of a curved or circular bar, which is moved horizontally through the casing above the window sill from the inside.

Improved Ant Trap.

Leander Rubarth, Davilla, Texas.—This trap is for catching burrowing insects, but is especially adapted for exterminating a species of large ant which infests portions of the Gulf States, and is very destructive to vegetation. The trap is in the form of a hollow truncated cone, and has downwardly projecting annular flanges or "overhangs" applied to the inner and outer tubes, and made detachable to enable the ants to be discharged from the trap when necessary. The ants reach the inner chamber by crawling up the inclined outer sides of the trap or up the vertical inner tube. Thence their escape is prevented by the aforesaid "overhangs" or flanges.

Improved Fruit Jar.

Mrs. Ella G. Haller, Carlisle, Pa.—This invention consists in forming a groove for the packing on the outside of body, while the cover is constructed with a lip or flange that overlaps the groove and packing, allowing each to be blown in a single piece; whereby the liability to fracture, which exists where the neck is blown separately and applied in a plastic state, is entirely obviated; and whereby a jar of much greater simplicity and efficiency is produced.

Improved Egg Beater.

John W. Condon, Logansport, Ind.—This invention consists in providing a suitable vessel with beaters and scrapers rotating in opposite directions, so that the material adhering to bottom and side of vessel will be thrown out by scrapers and into the path of the beaters. It also consists in the means for operating the beaters and scrapers.

Improved Churn Power.

Elijah Barrett and Geo. W. Fenimore, Franklin, Tenn.—This invention consists in an arrangement of a supplementary driving shaft, so arranged as to be brought into and out of gear with the main shaft for the purpose of changing the rapidity of reciprocation of the dasher. It also consists in an attachment whereby a brush is caused to move over the top of the churn to keep away flies, etc.

ANSWERS FROM CORRESPONDENTS

C. H. S.'s query as to blue paper is a business question. For waterproof paper, read articles on pp. 129 and 177, vol. 28.—T. is informed that the four world's fairs were held in London, 1851, Paris, 1855, London, 1862, Paris, 1867, the 1851 show being the first that ever took place.—A. B. S. can blacken his iron bands or other articles by following the directions on p. 203, vol. 28.

F. E. T. asks: 1. How can I distil water so that I can get it in large quantities quickly, and at little expense? 2. Can powdered silica be found in market, and where? It is used in white for the complexion, and is composed of white sand and anhydrous soda. 3. Where can I get the white sand? 4. Is Herr Artus' recipe, on p. 73, vol. XXVI, for paste or liquid blacking? Answers: 1. You may make it in large quantities and quickly, by the use of a large still; but unless you are using heat for some other purpose, it will not be very cheap. 2. You can prepare very finely divided silica by precipitating a solution of water glass with muriatic acid, and igniting. Electro-silicon is infusorial silica. 3. Fine white sand can be obtained from the beach. 4. Liquid.

N. W. questions our reply to F. B. who asked as to the efficacy of the forked stick in discovering hidden springs of water, and refers him and us to the Patent Office report for 1851, part 2, "Agriculture," for evidence as to the error of our views given on p. 282 of our volume XXVIII. Answer: The statement in the report is merely an assertion in a letter to the Commissioner of Patents, and is unsupported by independent testimony.

F. P. C. asks: How can I remove the oil from white lead? How can I know that the oil has been properly removed? I have tried commercial (188 per cent) alcohol, and find that pure white lead and zinc, treated in this way, give a gray precipitate. I have also placed some of the lead and zinc in a porcelain dish and placed it on charcoal; I find a dark brown residue after treating with dilute nitric (C. P.) acid. In a mixture of lead, zinc, and baryta, I find (after burning) that the precipitate is very dark, almost black, having all the appearance of baryta except the color. Can I precipitate the zinc, after precipitating the lead with sulphuric acid? Answer: You can free white lead from oil by agitating it with successive portions of common ether in a closed bottle. The lead is free from oil when it appears dry and its particles do not stick together. You can separate barytes (sulphate of baryta) from a mixture of white lead, zinc and barytes after the oil is removed by treating with dilute nitric acid. This will dissolve the lead and zinc, while the barytes will remain undissolved. Sulphuric acid added to the solution of nitrate of lead and zinc formed will throw down the insoluble sulphate of lead. By adding carbonate of soda, to the solution of sulphate of zinc remaining, until effervescence ceases, zinc oxide will be precipitated. A careful ultimate analysis, however, to determine the quantity of lead, zinc, and barytes in a given mixture, will cost $10.

I. W. asks: Is a lead vein, with its wall rocks well defined, (for instance, limestone on one side and sandstone on the other) a sure indication of a valuable lead mine; and if *so*, is a large sized vein or medium sized one the most profitable? Answer: We should judge from your description of the occurrence of the galena that it was a veritable lode. Galena often occurs in limestone, as in the counties of Northumberland, Derby and Durham, England, in veins which traverse compact limestone. In Kentucky, at Millersburg, in Virginia, Wythe county, and in Maryland, near Baltimore, it occurs in limestone. In Pennsylvania, on Perkiomen creek, 23 miles from Philadelphia, galena has been mined. Here there is a shaft 170 feet deep, with a horizontal drift of 300 feet entering the shaft 80 feet below the surface. The ore found here is in the old red sandstone formation. The value of a mine can only be approximately estimated before working. Of course the larger the vein and the nearer the surface, the more valuable the mine.

S. W. asks: How can I remove inkstains from linen? Answer: Dissolve a teaspoonful of oxalic acid in a gill of water. By means of a sponge or cloth dipped in the solution, soak the stain thoroughly, and afterwards rinse or wash with water. Throw away, or keep in a bottle labeled "poison," the oxalic acid solution.

J. S. C. says: In an engine running from 150 to 200 revolutions per minute, can an expansion of one quarter of the length of the cylinder be used to advantage? A mechanic of good ability and long experience says the engine will pound itself to pieces. Will expansion make any difference in the pounding of an engine? Answer: The best point of cut-off depends upon initial pressure, clearance, etc. But you can cut off the steam at the point mentioned, with perfect safety, and all shock can be prevented by giving a proper amount of exhaust cushion.

M. R. S. asks: 1. What effect does a hot blast have on wrought iron when used in a common blacksmith forge? Does it injure the iron or not? If not, does it save fuel enough to pay for itself? 2. Is there any known cheap compound that will make an intense heat for 30 or 40 minutes without replenishing? Answers: 1. The hot blast will cause the iron to be heated more quickly, and will not injure it. Under ordinary circumstances it would hardly pay to introduce the hot blast in a common forge, if much trouble or expense were involved. 2. We do not know of anything except a heavy fire and strong blast.

W. F.—White gunpowder is granulated in the ordinary way.

W. W. O. asks: What acids and in what proportions are used for brightening German silver or brass, and how are the articles cleaned after dipping in the acid? Answer: Brass is cleaned with oxalic acid. The acid must be washed off with water, and the brass rubbed with whiting and soft leather. A mixture of muriatic acid and alum dissolved in water imparts a golden color to brass articles that are steeped for a few seconds in it. Vinegar and common salt may be used instead of the acid. For cleaning silver and Britannia ware, we have seen zinc white (first quality) recommended.

J. D. asks: What can be used effectually to coat the inside of cider cisterns, to prevent them from leaking? I have made 12 cisterns of Norway pine, and the cider seems to ooze right through the wood. Answer: Paraffin is not acted upon by alcohol or acids. Soluble water glass will also answer your purpose, if not too expensive. Pitch and bitumen are the cheapest substances you can use.

J. B. says, in reply to T. W. S., who asked what would keep flour paste from fermenting: I have an excellent paste composed of 3 parts of gum tragacanth, 1 part of gum Arabic, and a small portion of mercuric bichloride; will alcohol or carbolic acid prevent it from souring? Answer: If a sufficient quantity of mercuric bichloride (corrosive sublimate) is added, that alone ought to prevent decomposition. That is the only object in putting in this poisonous substance. If that does not do, carbolic acid will. Alum is also sometimes used to prevent paste souring.

J. A. M. asks: What other (if any) ingredient is used with starch, and how is it applied, to produce the fine polish on linen as it comes from the laundry? Answer: A small piece of pure paraffin, added to the starch when hot, and well incorporated, will give a brilliant gloss to starched linen. Add a piece as large as a hickory nut to an ordinary bowlful of starch.

W. F. M. & Co. say: We have several hundred gallons of neat's foot oil; its lubricating qualities are good; but when hot in the journal or in boring, it emits an odor very offensive to the workmen. Is there any process by which we can refine it so that it will lose its offensiveness without destroying the lubricating property? Answer: Filter the oil through freshly burnt charcoal, or boil it for 15 minutes with a little water and calcined magnesia.

W. F. asks: Can you inform me of any simple process for softening the water in a well? The bottom of the well is rock. Answer: You can soften the water by adding a solution of carbonate of soda, known as washing soda, as long as the water turns milky. After settling, draw off the clear portion. If the hardness of your water depends on the presence of limestone dissolved in it, simply boiling it and allowing the mineral matter to subside will soften it.

A. B. W. says: We make the gas to light our building in iron retorts, from what is known in the trade as "residuum." It is the black tar-like oil from refined petroleum; it makes good gas, but is quite expensive on account of the high heat required, and the amount of fuel (coke) it requires to get up the heat. Is there anything we could use that would not require so great a heat and that would be equally as free from danger in using? The high heat soon burns out the retorts and new ones are quite expensive. Answer: Try the ordinary gas coal or cannel coal, which, as you mention coke, ought to be within reach. You can then make your own coke.

M. G. S. says: A Leffel 56 inch water wheel was set for a 6 feet head, going at 60 revolutions, giving with an open gate 36¼ horse power. Under this head we only used a ⅜ open gate, showing, we think, that it requires ⅝ of 36 or 24 horse power to run our machinery at the required speed. During low water, our main shaft decreased in revolutions from 175 to less than 140 with an open gate. Our hydraulic engineer says that by changing the set of the wheel from a 6 feet to a 4 feet head, we could obtain the required speed with a ⅝ open gate. He is now setting it for a 4 feet head (49 revolutions) and enlarging the main driving pulley to counterbalance the decreased speed of the wheel. We claim that, instead of running at 49 revolutions, the wheel will decrease its speed, that the surface of the enlarged pulley will have the same velocity as before, that the main shaft will still run less than 140 revolutions, and further that, by no possible means under the circumstances stated, can the required speed be obtained. Answer: By decreasing the head, the power of the wheel will of course be decreased. And your assertion, that "by no possible means under the circumstances can the required speed be obtained," is correct. It can only be done by a sacrifice of power.

A. B. asks: 1. Where should an engine 8 x 24 inches take steam to give the most power when run at full stroke, when the crank is on the center, or a little before it reaches the center? 2. Is there anything that will prevent lime collecting in my boiler? 3. Are you printing a paper called the *Patent Report* or some similar title? Answers: 1. Set the valves to admit steam when the engine is on the center; and if you need cushion, obtain it from the exhaust. 2. Try tannate of soda. 3. The paper you refer to is published at the Patent Office, Washington, D. C., and is called the *Patent Office Official Gazette*.

W. W. A. asks for an explanation of a literary allusion to the dust of Cæsar stopping a beer barrel. Answer: Read Hamlet's meditations on the skull of Yorick: "Imperial Cæsar, dead and turned to clay, may stop a hole to keep the wind away," etc.

J. J. B. asks how to get rid of red ants. Answer: Try common salt.

C. W. B. says: I have a thresher which I wish to level at each setting with an ordinary spirit level. The sills to be leveled are 4 feet long; the distance between the wheels is 4 feet 10 inches. Can you give me a rule by which I can determine just how much to raise or lower one side to compensate for any given deviation of the level? Answer; Place the level on the sill in the direction of its length, and measure how much the level itself requires to be raised or lowered at one end; and then raise or lower the corresponding end of the sill a distance equal to this amount multiplied by the length of the sill, and divided by the length of the level. Suppose, for instance, that the level is 2, and the sill 4, feet long: and that when the level is placed on the sill, one end requires to be raised one sixteenth of an inch, to bring the bubble to the center. Then applying the rule, multiply one sixteenth by 4 and divide it by 2 and thus obtain ⅛ of an inch as the distance the corresponding end of the sill must be raised to render it level.

W. B. F. asks how to obtain the sulphate of soda resulting from the action of sulphuric acid on carbonate of soda in the manufacture of carbonic acid gas for soda water. "I use about 25 lbs. soda per week, Will it pay to try and save it?" Answer: The reduction of sulphate of soda to the carbonate is a difficult operation, and cannot be carried out on a small scale. Leblanc's process for making soda ash accomplishes this by mixing the sulphate of soda with chalk and fine coal, and fusing the mixture in a reverberatory furnace. Can you not employ muriatic acid instead of sulphuric, and thus produce common salt? Sulphate of soda is, however, used in the arts, and you should try to sell it to a glass house, if there be one in your neighborhood.

M. asks for a material that is both flexible and transparent, which may be folded up without destroying its transparency. Answer: Try tracing paper or tracing cloth.

C. O. S. says: We have a steam cylinder for drying purposes, placed about 100 feet from the boiler, and fed through an inch pipe direct from the boiler. Does it make any difference, in the drying capacity of the cylinder, whether the steam goes through fast or is confined so that just enough passes out of the exhaust pipe to keep it clear from water? In other words, does steam lose its heat by passing through pipes as long as it remains steam? Our fireman insists on a strong current of steam passing through, which we would like to save, if possible without loss of heat, for drying. Answer: You will probably obtain satisfactory results by the method you propose. Suppose that you try it one day by your plan, and the next by the engineer's, and compare the results. We would be glad to hear from you, in case you make the experiment.

D. B. T. asks in what ratio with the pressure the friction of water increases in its passage through an iron pipe of a given size and length, that is, what is the difference in friction between one and ten atmospheres pressure? Answer: The resistance due to friction will be about 10 times as great in the second as in the first case, increasing nearly as the pressure, or as the square of the velocity. See article on "Friction in Pipes," on page 48 of this volume.

D. C. asks how to make nickel solution for plating iron or other metals by galvanic process. Answer: The nickel solution may consist of ¼ lb. of the double sulphate of nickel and ammonia dissolved in a gallon of water, or of ¼ lb. of the double chloride of nickel and ammonia in a gallon of water. The main condition of nickel plating lies in these points: (1) to have the solution always kept neutral, it is necessary to test the liquid frequently by means of litmus paper; and if it be acid, to add sufficient caustic ammonia to make the liquor perfectly neutral; (2) to have the materials to be plated always perfectly clean, which, if the goods are of iron, can be done by dipping them in a mixture of muriatic acid and water. The surface of the nickel anode should in no case be less than the surface to be coated, and may be much greater. See also page 197 of our volume XXVIII.

A. D. C. says: In pumps of the same size of barrel and length of piston rod, does the length of the column of water under the piston valve (whether 15 or 20 feet) make the pump work easier or harder? The pump is under 33 feet long. Answer: The shorter the length of the water column, the easier the pump will work. The weight lifted is proportionate to the length of the column.

A. B. asks: What is the customary rule for measuring charcoal? How many inches are a bushel, or how many cubic feet are a hundred bushels? Answer: Charcoal is measured and sold in New York by the barrel, the size being that of a flour barrel, which holds 3 bushels or 5¾ cubic feet. A barrel of charcoal is sold here for $1.

F. W. asks: Will some one give me the different degrees at which water boils, under different pressures? Answer: See editorial pages of this issue.

H. P. asks: 1. Would it be practicable to raise water by means of a beam similar to a beam engine, a float being attached to one end and a vessel for raising the water at the other, and the float operated by the tide? 2. How high does the tide rise at New York? 3. A friend says that, by placing rubber inside of a wheel hub around the axle, the shock to the wheel will be much less when striking against obstructions than when nothing is used, the momentum being the same in each case. What is your opinion? 4. Can attraction be accounted for otherwise than supposing some sort of a vacuum? 5. Will a magnet have any attraction, being detached entirely from any connection with the earth? Answers: 1. Yes. 2. From 8½ to 35½ feet. 3. We think the rubber would help to prevent injury to the wheel. 4. Yes. 5. Yes.

C. B. says: I have built a small slide valve horizontal steam engine, cylinder 1½x2 inches. What power would such an engine have? Answer: About two tenths of a horse power.

J. S. T. asks: Why is it that a screw can be driven more easily and farther into wood with a long driver than a short one, the handle and everything else being equal? Answer: Because the screw driver is held at an angle, and the long driver affords greater leverage than the short one. If both were secured so as to be at right angles to the face of the screw, there would be no difference in their action.

S. W. says: In SCIENTIFIC AMERICAN of July 26, page 59, you speak of oil of rhodium as if it were a name without a reality. I have bought an essential oil so named. Dunglison's "Medical Dictionary," under "rhodium," says that "rhodium is the wood or root of a tree supposed to be the *genista canariensis* of Linnæus, of the family *leguminosæ*. The essential oil is a perfume (of a rose-like odor, we may add) and possesses cordial and tonic virtues. Its smell is attractive to fish, rats, etc." The *Encyclopedia Americana* says of rosewood that the tree (*amyris balsamifera*) yields an odoriferous balsam.

S. G. Jr. says: Suppose I take 20 gallons of hydrogen gas, and compress it to 10 gallons, would the 20 gallons of gas while under pressure lift twice as much as the 10 gallons of free gas? Answer: 10 gallons of free, uncompressed hydrogen gas will lift about 1½ ozs. By compressing 20 gallons of hydrogen into 10 gallons, you double the density, and consequently double the weight of the compressed gas. Therefore 10 gallons of free, uncompressed hydrogen will lift twice as much as 20 gallons of hydrogen compressed into 10.

D. asks: Is there any way to restore meat that is musty or tainted? We packed some of it away in wheat bran and rye after it was smoked, and the wet spring caused the rye to sprout, thus giving the meat a musty flavor. Answer: Pack the meat in freshly burnt powdered charcoal for a few days.

F. D. B. asks for a good recipe for making birdlime? "The only recipe for it that I can find contains white holly bark, and this is not procurable in this country." Answer: If you cannot obtain holly, use mistletoe or other parasite with a gummy or glutinous resin in it which does not dry.

Y. E. says: 1. I am running a 12 horse power vertical engine; it is not as large as we want and we cannot sell it to any advantage. How would it do to connect another engine of the same size to the other end of the shaft? Twenty-four horse power is all we want. 2. Our boiler is ¼ inch shell, 16 feet long and 42 inches in diameter, with two 14 inch flues. Could we make it drive two 12 horse power engines? 3. How much steam pressure would it bear with safety to the square inch? It is nearly new. 4. What is the "Science Record" worth, and where can I get a copy of it? Answers: 1. The plan you propose would give you 24 horse power, but probably the shaft is not strong enough to stand the increased strain. 2. We do not think the boiler would be large enough to drive both engines. 3. About 50 pounds per square inch. 4. Two volumes of the "Science Record" are published, either of which will be mailed to you from our office on receipt of two dollars.

J. G. asks: In raising weights, if the upper pulley has two grooves with notches where the links fit in, and there are 20 notches in one groove and 21 in the other, the lower pulley being much smaller, with but one smooth groove, and the chain being continuous: if both grooves in the upper pulley had an equal number of notches, would it hoist faster, supposing the chain on both constructions was pulled at the same rate? Answer: The amount the weight rises in one revolution of the upper pulley is equal to the difference of their diameters, and if both were of the same size, the weight would be stationary.

H. F. B. says: I want from 6 to 8 horse power, and have a plain slide valve engine, 10 inches cylinder and 12 inches stroke; I have thought of getting an 8 horse power boiler for it. Would the arrangement be as economical as regards fuel as an 8 horse engine of the same class with the same boiler, and if not, about what difference would there be in favor of the smaller engine? Answer: If the engine you have is in good order, it would hardly pay to get a new one, as, by arranging it to work with high steam and short cut-off, it could probably be run very economically.

T. J. J. asks: Which will produce the greatest amount of heat, a cord of green wood, or one of wood dried or seasoned in the open field for, say, four or six months before using? Which contains the largest amount of carbon, and what is the relative amount of heat of the different kinds of wood? Answer: Green wood contains about the same amount of carbon as dry, and the chief difference is in the amount of water in the green wood. From careful experiments on the total heat of combustion of different kinds of fuel, it is found that a pound of dry wood, containing 50 per cent of carbon, will give out about 7,000 units of heat in its combustion, while a pound of the same wood, containing 20 per cent of moisture, will give out something less than 6,000 units of heat. Taken bulk for bulk, the amount of heat given out by the combustion of each quality would probably be the same. In ordinary practice, dry wood is the best, because it can be most easily consumed; though, where combustion is very rapid, there might not be much difference.

S. C. H. asks: 1. Which is the best way to feed the boiler of a feed steamer? 2. Can it be done with a small force pump? 3. Should the water be hot before entering the boiler; and if heated by passing through the furnace flues, what should be the position of the valves? In feeding from an elevated barrel, the pressure of steam must be as great in the barrel as in the boiler, making it slow and unsafe. Answers: 1. Continuously, near the bottom. If but a little feed is required, it could be managed with a vessel arranged on the principle of an equilibrium oil cup. 2. Yes. 3. Yes. If a pump is used, draw cold water through the pump, and force it through the heater, into the boiler, placing the check valve between the boiler and heater.

J. A. says: You tell G. van H. to place his pump 20 feet from the level at which he is sure to always have water. Will this answer for wells of all depths, say from 24 feet to 200 feet or more? Why should he place his pump within 20 feet if the water will rise 32 feet after a vacuum is produced in the pump barrel? Why not place it 32 feet from the water and save lifting the additional column of 12 feet of water? Answer: It is difficult to give a universal rule for the best position of a pump, but in general it should not be placed further than 20 feet from the surface of the water. If it is placed further than this, it is somewhat difficult to keep the pump in good working order. But the more important reason is that it is necessary to have a surplus of vacuum, in order to give the necessary velocity to the water If nearly all the vacuum is used up in lifting the water there will be very little to give a head to the entering water. The water will therefore enter slowly, and if the pump makes many strokes, it will run away from the water. In practice, it is found that it is cheaper to force water to an elevation, than to lift it by a vacuum.

J. H. B. says: 1. Would a glass water gage for a high pressure boiler be strong enough if it had twice the present inside diameter (I think it is now ⅝ inch) and were made of the same thickness and strength of glass as at present? 2. Are there any now in use that are larger? 3. Is the present size made with reference to the size of the two pipes supplying it, or only to the necessary strength? Answers: 1. Probably not. 2. Yes, up to one inch outside diameter. 3. Generally with reference to the size of the pipes. Glass tubes, if well annealed, could stand much more strain than is ordinarily put upon them. They are usually broken by sudden changes of temperature.

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

J. W.—The specimen is not corundum, but felspar. You had better advertise your mica, asbestos, plumbago, etc., in our columns.

COMMUNICATIONS RECEIVED.

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

On Explosive Projectiles. By J. T. F.
On Medical Practice in Early Times. By P. H.
On Sailing Faster than the Wind. By H. B.
On Retrogression of the Sun. By J. A. B. and by J. S. P.
On Constructing Large Lenses. By F. H. R.
On the Patent Right Question. By J. S. P.
On Deep Sea Soundings. By T. H.
On the Zodiacal Light. By H. B.
On Testing Steam Boilers. By W. S. K.

Also enquiries from the following:

A. B.—T. F. M.

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 8, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Window weather strip, G. P. Potter	140,640

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

25,726.—BLIND WIRING MACHINE.—B. C. Davis. Sep. 24.
25,767.—CUTTING & PANNING CAKES.—J. H. Shrote. Sep. 24.
25,814.—SLEEPING CAR.—J. Danner. October 1.
25,843.—CULTIVATOR.—T. McQuiston. October 1.
25,867.—COVERING SADDLE TREE.—J. Maclure. October 1.

EXTENSIONS GRANTED.

15,661.—NUT MAKING MACHINE.—W. E. Ward.
24,734.—PAPER MAKING MACHINE.—W. Goodale.
24,748.—PAINT CAN.—J. W. Masury.
24,755.—OPERATING WINDLASS.—P. Philip.
24,772.—POWDER KEG.—J. Wilson *et al.*
24,773.—HOLLOW AUGER.—A. Wyckoff.

DESIGNS PATENTED.

6,746.—ADVERTISING FRAME.—M. M. Burnham *et al.*, Syracuse, N. Y.
6,747 to 6,752.—CARPETS.—R. R. Campbell, Lowell, Mass.
6,753 to 6,756.—CARPETS.—J. M. Christie, Lowell, Mass.
6,757.—TABLE CUTLERY.—J. D. Frary, New Britain, Conn.
6,758.—CARPET.—H. F. Goetze, Boston, Mass.
6,759.—CHAIN CHARM.—W. B. Hamm, Philadelphia, Pa.
6,760.—RAILWAY STATION.—J. W. Hoyt, Springfield, Mass.
6,761.—PRINTING TYPE.—A. Little, New York city.
6,762.—CEMETERY FENCE.—T. Pitbladdo, Brooklyn, N. Y.
6,763.—SWORD HILT, ETC.—V. Price, Woodside, N. Y.
6,764.—BOLT THREADING MACHINES.—S. W. Putnam, Jr., Fitchburg, Mass.
6,765.—CEMETERY FENCE, ETC.—J. Sharkey, Brooklyn, N. Y.
6,766 to 6,768.—SHELF PAPERS.—S. Simon, New York city.
6,769.—PRINTING TYPE.—R. Smith, Philadelphia, Pa.
6,770.—PHAETON BODY.—G. Delker *et al.*, Henderson, Ky.

TRADE MARKS REGISTERED.

1,852.—CRANBERRY PACKAGE.—N. H. Bishop, Manahawken N. J.
1,853.—GREASE.—A. Gunnison & Co., Cincinnati, O.
1,854.—CURED MEATS, ETC.—G. Phipps & Co., Cincinnati, O.
1,855.—FRUITS, ETC.—Sleeper & Co., Burlington, N. J.
1,856.—PERFUMERY.—T. F. Jenkins, Louisville, Ky.
1,857.—OIL CANS, ETC.—Meissner & Co., New York city.
1,858.—SHIRTINGS.—J. L. Moss, Jr., Westerly, R. I., *et al.*
1,859.—WATER GAGES.—Tomey & Sons, Perth, Scotland.
1,860.—BATH TOWELS.—Stark Mills, Manchester, N. H.

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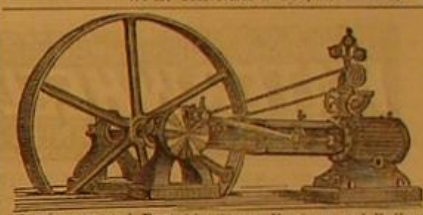

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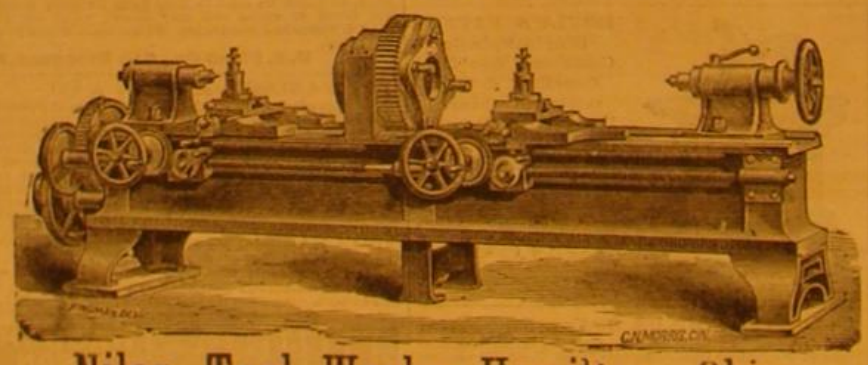

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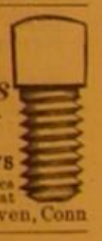

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