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The Manufacture of Zinc and Zinc White.

That beautiful snow white substance, the oxide of zinc, which, during the past fifteen years, has come into extensive use in the arts as a substitute for white lead in paints, is produced in enormous quantities in this country. One of the most extensive manufactories of zinc and zinc white is at Bethlehem, Pa., and is described as follows by an able correspondent of the *New York Times*:

At the works of the Lehigh Zinc Company, two processes are carried on the manufacture of oxide of zinc and the manufacture of metallic zinc for rolling into sheet zinc, etc. Either process is very interesting.

The making of metallic zinc—or spelter, as it is termed in the markets—is one of those wonders of the chemical world which are so astounding and so fascinating to witness. The three kinds of zinc ore—sulphuret, carbonate, and silicate of zinc—are found in the company's mines. From the two first the sulphur and carbonic acid can be expelled by roasting the ore; the siliceous, however, cannot be got rid of. When the ore is ready for the furnaces, the zinc in it is composed of oxide of zinc and oxide of zinc combined with siliceous. The ore is then mixed with 33 per cent of crushed coal and placed in dry clay retorts, each holding 27 lbs. of the mixed coal and ore. These retorts are placed in layers, fifty-six in a furnace, the face of which is sealed up with fire clay, the orifices of the retorts being cemented in conical shaped tubes of baked fire clay, which project 18 inches from the furnace, and act as condensers.

The firing up is then carried on till the heat of the furnace is 2,160° Fah, the vaporizing point of zinc.

The reduction of the zinc in the ore into metallic zinc vapor is done by means of the carbon and carbonic oxide gas depriving the oxide of zinc of its oxygen, and liberating metallic zinc as a vapor. This vapor is carried forward by the gases (which are formed by the reduction of the oxide of zinc) into the conical tube condensers, which project outside the furnace, the temperature of which is far below the vaporizing point of zinc attained in the retorts inside, and sufficiently low to condense the vapor into liquid metal. When this condensing process is going on, men go round the different furnaces and, with iron hooks, draw out the melted zinc into large ladles, from which the zinc is poured into iron molds and cast into slabs of 30 lbs. weight. The gaseous flames which issue in great force from the orifices of the condensers are intensely brilliant and of all the colors of the rainbow—the brightest yellows, reds, violets, and greens. As there are sixteen stacks of furnaces, each having fifty-six retorts, the beauty of the colors at night may be easily imagined. The furnaces are charged twice in the twenty-four hours, each charging taking 1,500 pounds of ore and coal. This process is known as the Belgian process.

While still hot, the slabs of metallic zinc are taken from the molds and rolled into rough thick plates, which are cut into two pieces. From nine to twelve of these pieces are placed in iron boxes in muffle heating furnaces, and are heated up to 300°, hot enough to make water dance upon them in spherical globules before it evaporates. As soon as this heat has been attained, the pack of plates is taken out and they are all rolled out together. In twenty-five minutes the plates, two of which formerly made a slab of 10 by 18 inches, are rolled out into sheets which, when trimmed, are 7 feet by 3 feet. Of the importance of these works it is unnecessary

to say more than that their capacity is nearly equal to producing one half the metallic sheet and oxide of zinc consumed in this country. The company makes annually 3,600 tons of metallic zinc, 3,000 casks of sheet zinc, and 3,000 tons of oxide of zinc.

To make oxide of zinc, the carbonate and silicate of zinc, beyond being crushed and mixed with thirty-three per cent of coal, is put into large fire brick furnaces just as it comes from the mines. Air is blown into the furnaces, and the oxygen in it oxidizes the metallic zinc vapor, for which it has a great affinity, as soon as it is liberated. The oxide of zinc is thus formed, and is propelled by air forced into the furnaces into a high tower in white flocculent particles, with which are associated coal ashes and particles of other foreign substances. It is driven by powerful blowers through a series of chambers connected by pipes; the majority of the oxide associated with impurities deposits in the tower, and the less impure in the chambers and cooling house, the most flocculent and purest passing through pipes, to which muslin bags are attached and in which it is collected. The best is like white wheat flour, though very much heavier, an almost impalpable powder. There are fifty-two of these brick furnaces in the works. They are charged every four hours, from 750 to 1,000 pounds making a charge. The pressure of air forced in is twenty-four pounds to every square foot of furnace.

How to Search for Metals.

A correspondent, C. G., Virginia city, Nev., having read an article on this subject on page 133 of our current volume, states that, in his experience, all the gold and silver west of the Mississippi is found on the Sierra Nevada and not on the Rocky mountains. He also states that gold has been found in limestone, some of the richest ore he has ever seen being rock of that description; and that it is often found in the beds of rivers, those of the Yuba and Feather having continued to yield it from the year 1849 to this day. Leads of gold ore do not become poorer as the search is prosecuted to a greater depth, and silver ore becomes more plentiful under similar circumstances. C. G. has seen both gold and silver in limestone, black spar, white spar, granite, slate, porphyry, and conglomerate in which everything seemed to be melted together.

Peat Ashes as a Fertilizer.

M. Lebeuf, a large cultivator of asparagus and strawberries, of Argenteuil, France, has recently obtained some advantageous results from peat ashes used as a fertilizer. He filled three pots with the substance without any other admixture and planted in one oats, in another wheat, and in

the third strawberry plants; leaving them through the winter without attention, germination took place, the wheat and oats sprouted and bore large and heavy grains, the stalks attaining for the wheat a height of 4.5 feet and for the oats 3.6 feet. The strawberries were unusually vigorous. M. Lebeuf has repeated the experiments several times with uniform success.

Railway Management.

The *London Railway News* gives some interesting comparisons between English and American railway returns. In regard to rolling stock and train earnings, it is surprised to find that our roads are more economically run than their own. Taking four roads in each country, aggregating about 4,000 miles, it is found that the American road has only .33 of a locomotive and 6.72 freight cars per mile, while the English has .93 of a locomotive and 28.83 cars. The New York Central, with a heavier traffic than the London and Northwest-

ern, has not half the locomotives per mile. The English refuse to believe that the superior size and strength of American locomotives account fully for this difference. The earnings for instance of an American locomotive are 70 per cent more than those of an English, and the entire rolling stock, which, in England, barely pays for itself in a year, in this country pays for itself and 65 per cent more.

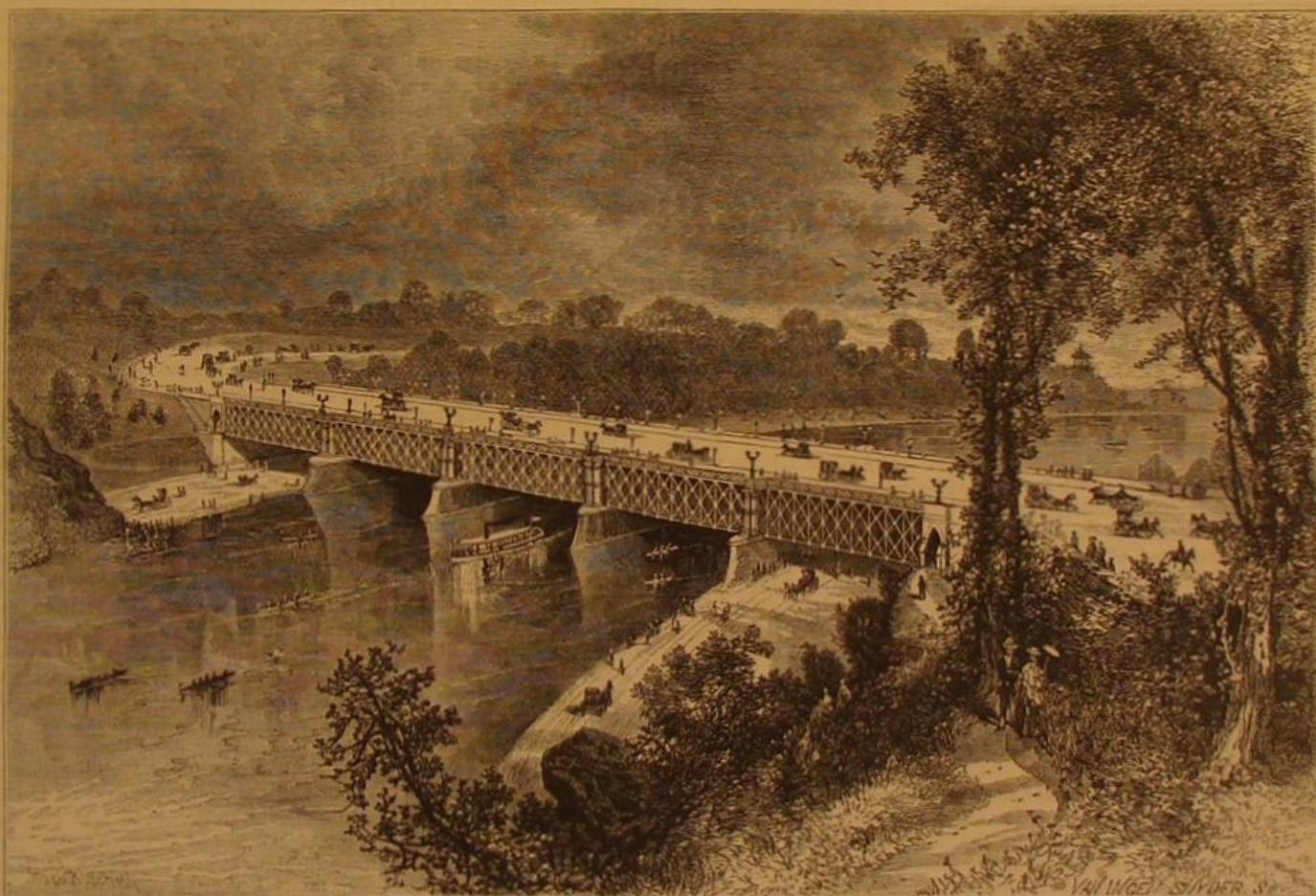
The *News* also discovers that, while passenger fares are 30 per cent lower than in England, the earnings per train here are 40 per cent more, and on freight trains 15 per cent more. It concludes that it is time for English managers to study our system.—*Railway Review*.

Hints to Inventors.

A correspondent, J. W. K., says: If manufacturers of rubber goods would get up a style of rubber picture frames that would permit the picture to be easily removed, they might sell many of them. The frames should be made so as to exclude dust and rain from the picture, and would then be useful for outdoor advertisements or bulletins.

Cannot some one manufacture an apparatus to obviate the necessity of turning the leaves, in short hand or long hand reporting? A tablet with a roller at the upper and lower ends, the upper rollers to work with a spring so as to move the paper the proper distance each time the spring was touched with one of the fingers of the left hand, and thus present a fresh surface of paper to the writer, would be very useful. It might be arranged so that the reporter could have his eyes at liberty to watch the speaker during most of the time and yet write legibly and in straight lines. Such an apparatus would be convenient for the blind, for persons with weak eyes, and for writing where the light was insufficient. The paper should be made in sheets long enough for one or two hours' writing in phonography.

DURING the visit of the late Mr. Seward to China, while in Peking, he visited the residence of a wealthy native who was withal a mandarin and an intelligent man, somewhat scientific in his tastes and well acquainted with the modern appliances for household purposes. Among other objects contained in this Chinaman's residence was a Yankee cast iron pump. To Mr. Seward's enquiry as to the use he made of the pump, Yang Fang replied: "It is set up to extinguish accidental fire, and I put the women under it when they quarrel." He had five wives.



GIRARD AVENUE BRIDGE, PHILADELPHIA.

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MEDICAL PRACTICE IN EARLY TIMES.

History teaches us that, at the dawn of civilization, the two vocations of medical practice and spiritual authority were usually combined. This was the case over all the world. Even when Greece, that most advanced nation of antiquity, had reached quite a high standard in art and literature, the priests were also physicians, and the famous temples of Æsculapius were the special resort of patients suffering from severe ailments, who implored the assistance of the gods by the intervention of the priests. It is not known if the latter had a regular tariff of charges; but the gratitude of the patients was often manifested by gifts, and tablets were erected in the temples, giving a full account of the symptoms of the disease and the means of cure. These tablets, of course, soon became very valuable to all who studied the medical art, and in this way these temples became medical colleges, as well as dispensaries, and the incorporation of the ecclesiastical and medical professions was more and more complete.

There was, however, a prevalent notion, which for a long time paralyzed all attempts at the relief of society from epidemics, etc., by sanitary regulations; it was the belief that every ailment was due to the revenge of offended divinity. These ideas prevailed among the best informed of men, and religious acts, such as sacrifices, invocations, pilgrimages, penances, etc., formed the chief part of all medical treatment. We regret to say that, even in our own times, such notions prevail among certain classes, especially among the ignorant, who indulge in prayers and useless penances, but neglect personal, domestic, and municipal cleanliness, and appear to be totally unable to realize the beneficial effects of fresh air and sunlight on all highly organized beings.

It was reserved for the great and good Hippocrates to entirely upset the theological treatment of diseases, and to replace it by a practical and material theory, founded on the most careful and admirable observations concerning the causes, symptoms and general courses of different ailments. This glorious revolution was indeed one of the greatest triumphs of human genius; but it was not accomplished without a struggle, which ended in the complete separation, among civilized nations, of the business of the priest from that of the physician, and it is for this, especially, that the memory of Hippocrates should be honored as a successful reformer and intellectual revolutionist. His works abound with the proofs of his profound study of the medical art; and his descriptions of symptoms have never been surpassed. For instance, his sketch of the physiognomy of the dying is still copied in our works on the practice of medicine, and the characteristic appearance of the patient in that last stage is so infimitely described by the great master that it is still called "the Hippocratic countenance."

While rejecting all the imaginary notions about supernatural influence, in vogue in his time, he attempted to impute all symptoms to their true physical causes, and to substitute the action of Nature for the action of the gods. He did not give himself any concern about the opposition of the priests, to whose interests it was to refer every disease to the anger of some divinity, and who taught that health could only be restored by a reconciliation with the same, by gifts to his temple, sacrifices, etc. Hippocrates was the first to teach that every disease will run its natural course; and his greatness consists chiefly in his masterly conception of pathology, which caused him never to attempt to check or prevent this physical process, but to watch the critical period, and to modify and bring relief at the right moment by assisting in the elimination of what he called the peccant humors, which he considered to be, by poisoning the blood, the cause of almost all ailments. By his fearless war against superstition, he created a beautiful example to all who have succeeded him in his important profession, teaching them not to hesitate to resist ignorance and

prejudice, and courageously to encounter the opposition and disapproval of their contemporaries, being sure that the appreciation of a not very remote future will offer a glorious reward for those who are in the advanced guard of progress.

THE HORSE POWER AND THE POWER OF THE HORSE.

Some of our readers are finding great difficulty in reconciling the definition of horse power, as given by writers on engineering subjects, with their own knowledge of the power of the horse. There are three terms which we must define with precision, before attempting to place the subject before our readers in such a manner as shall give them an accurate notion of the meaning of the term first referred to.

Force is defined to be anything which produces or tends to produce motion, or change of motion, in bodies. The force of gravitation, of electrical and magnetic attraction, of heat repulsion, of steam pressure, and of a compressed spring, are illustrations. It is measured by the weight which will counterpoise it.

Work is force acting through space, and is measured by multiplying the measure of the force by the measure of the space. A force which overcomes a resistance of 5 pounds through a space of 7 feet, does 35 "foot pounds" of "work." A weight of 2 tons is raised 5 feet, or 60 inches, by the expenditure of 10 "foot tons," or its equivalent, 120 "inch tons."

Power, as the term is only properly used by engineers, is the amount of work done in any given example, in some known time. Its unit is called the "horse power." Thus, a machine doing 33,000 foot pounds of work in a minute develops one horse power. The same machine, working in the same manner, would do 550 foot pounds of work in each second, or 190,000 foot pounds during each hour that it might be continuously worked. The horse power, therefore, is a rate of work.

A horse cannot usually exert a great power; but the term was first introduced by James Watt, and since its actual value is a matter of no consequence so long as it is well understood what that value is, engineers have not thought it advisable to change it. The actual power of horses varies immensely, being sometimes more than a horse power, and often much less. The average power of a good draft horse is about three quarters of a horse power, but it can only be sustained about eight hours a day. The same horse drawing in a gin or a mill would exert a power which would average for eight hours work a trifle more than a half horse power. An ox is said to have about two thirds the power of a horse, or to be capable of exerting about a half horse power. The ox can pull as heavy a load as the horse, but moves more slowly, and hence does less work in a given time, and rates less horse power.

The mule pulls about one half the load of a strong draft horse, at about the same speed. He may therefore be rated at $\frac{1}{2}$ of $\frac{3}{4}$ = $\frac{3}{8}$ of a horse power. The ass rates at about $\frac{1}{2}$ of the power of the horse, or $\frac{1}{2}$ of $\frac{3}{4}$ = $\frac{3}{8}$ horse power.

On a direct pull, the average lift which a horse can exert in steady work over a single pulley is about 120 pounds. The maximum is probably double this figure. Professor R. H. Thurston, in the paper on "Traction Engines" of which we gave an abstract some months ago, says: "Experiments made by Captain Robert Merry, at the Jackson Iron Mine, Negaunee, Mich., and the observations and experiments of the writer, indicate the maximum direct traction force of a good horse to be about 250 pounds." This weight, raised at the rate of 250 feet per minute or about three miles per hour, would give $250 \times 250 \div 33,000 = 1.9$, nearly two horse power for the power of such an exceptionally strong animal; but we should not expect any horse to keep up such exertion for more than a very short space of time. The estimates before given were for average work, kept up eight hours a day for days and weeks together.

British engine builders use a term, in giving the size of steam engines, which is known as "nominal horse power," and is much smaller than the actual power of the engine, which is usually known as the "indicated horse power," or the "dynamometrical horse power," according as it is determined by the indicator or the dynamometer. Thus the engines of the British iron clads, *Devastation* and *Thunderer*, if driven at the slow speed and with the low steam used in the time of James Watt, would be of about 800 horse power. They still are said to be of 800 nominal horse power, but the *Thunderer*, in her recent trial, developed 5,700 indicated horse power. In this country, this unfortunate and confusing application of the term "nominal" horse power is almost unknown, and we indicate the size of an engine by specifying its diameter of cylinder and length of stroke. The engines of the *Thunderer*, for example, have two cylinders for each of her twin screws, which are 88 inches diameter and 39 inches stroke.

CHEMICAL HEAT INDICATORS.

A method of exhibiting the temperature of solutions in vessels without the use of the thermometer is suggested by the *British Journal of Photography*. It consists in painting the exterior of the vessel with the double iodide of mercury and copper. Two drachms of iodide of potassium are dissolved in an ounce of water, to which is added a small quantity, drop by drop, of a saturated solution of bichloride of mercury (corrosive sublimate) until the red precipitate ceases to dissolve. A minute quantity of the iodide will then clear the solution. $1\frac{1}{2}$ drams of sulphate of copper dissolved in the least quantity of water are now added, when the desired compound is precipitated. The clear liquid is then poured off and the precipitate dried for use. The double iodide of mercury and copper thus prepared is a rich red

crystalline powder, distinct in color from the simple scarlet iodide of mercury.

When paper or other substances are stained with the double salt mentioned, the red color changes to black when heated to 130° F., and the intermediate variations of temperature are indicated by modifications from red to black. The red color returns when the temperature sufficiently falls.

Professor Mayer, of the Stevens Institute, suggested some time ago the use of the iodides of mercury and copper as a paint for car wheel boxes, to indicate the heating of the journals. He also used the salts for illustrating the spread of heat in conducting bodies, and also for the demonstration of the unequal heat-conducting powers of different sections of crystals. It seems quite possible that chemical investigators may be able to discover other salts still more sensitive to heat than those mentioned, and that this method of heat indication may become practically useful for many purposes.

LEAPING BY MACHINERY.

Among the sensational amusements now going on in this city, the performances of a young feminine gymnast, Lulu by name, at Niblo's Garden, are noticeable. The deliberate attempts at neck-breaking which she nightly undertakes attract immense audiences of ladies and gentlemen, who enjoy the sensation amazingly, and recommend it to their friends as a worthy and thrilling sight.

The astounding feat consists in what appears to be a direct leap, thirty feet high from the stage floor, and the grasping of a pair of bars at that elevation, directly over the heads of the audience. We need hardly say that the flight is assisted by mechanism.

The performer, costumed in stage tights, totally unembarrassed by petticoats, exhibiting all the charms of her well proportioned physique, stands upon a small iron step, which forms the extremity of a lever that projects up through the stage floor. Below the stage and connected with the lever is a weight of 4,000 pounds and a trigger arrangement. At the appointed moment, the gymnast places herself upon the step, assumes the required position, an attendant taps the floor as a signal, the trigger below is moved, and the gymnast shoots up like an arrow through the air to the bars above. It is a dreadful trick, for the least variation in the force of the mechanism, or the most trifling deviation in her course through the air, would drive the gymnast away from the friendly bars and send her headlong upon the iron chairs below. We sometimes marvel at the strange taste of the Spaniards who still find enjoyment in the gory spectacle of the bull fight. But what shall we say of the sensibilities of Americans, whose popular evening entertainments depend for their chief zest upon the antics of a company of half nude ballet dancers coupled with the fearful risking of human life by methods such as we have described?

LOSS OF THE POLARIS.

Telegraphic despatches bring the news of the probable loss of the United States exploring steamer *Polaris* and the end and failure of the Arctic exploring expedition. On the 15th of October, 1872, in lat. 77° 35', a party of the crew, altogether some nineteen souls, left the ship to place some provisions on an ice floe. A severe storm came on, causing the *Polaris* to part her moorings. The few remaining aboard got her under steam, but were unable to render any assistance to their comrades on the ice, who, to their dismay, saw their vessel disappear among the surrounding fields and bergs. The tide and wind, it seems, fortunately drove the great floe, bearing the survivors, down through Baffin's Bay and Davis' straits until, on the 30th of April last, they were rescued after one hundred and ninety-six days on the ice, by the British steamer *Tigress*, in lat. 53° 30' near the coast of Labrador.

Captain Hall died of apoplexy on the 8th of October, 1872, after returning from an expedition on sledges, in which he reached within 7° 44' of the North Pole. The *Polaris*, the survivors state, was without boats and leaking badly at the time of her breaking adrift, so that there is but little chance of her present safety. The sufferings of the rescued party are described as terrible, but all were taken off their perilous raft uninjured and in comparatively good health.

IMPORTANT DECISION IN RESPECT TO ASSIGNMENTS.

We publish, in another column, the text of a recent decision of the United States Circuit Court, District of California, by Judge Sawyer, in which he holds, substantially, that the purchaser of a patented article, obtained from a bona fide owner of a territorial patent right, may use and sell such article outside of the territory owned by the seller. Thus, in the case of the Egg-case patent, the Judge held that the purchaser, who bought the patented goods of parties owning the patent for Illinois, had the right to send the goods to California, use and sell them there, notwithstanding the protest of the party who held the patent for California.

If this doctrine is sound, then the selling of patent rights in specified territorial divisions is a farce, and new restrictions become necessary in the assignment, as Judge Sawyer suggests.

THE DEATH OF LIEBIG.

It was in 1826 that Justus Von Liebig, then only 23 years old, and already Professor of Chemistry of the University of Giessen, Germany, opened there the first chemical laboratory for the use of students in practical chemical operations, and thus soon attracted pupils from nearly all parts of the civilized world. By this, the little university at Giessen soon rose to great eminence as a scientific school, and was, ere long, in advance of all others. The influence which such instruction had on the industrial progress of Germany and of all Europe cannot be over-estimated, and is one of the most

* *Vide Science Record*, 1873, p. 222.

lasting merits of the great man who so long maintained the lead in this branch of science.

The early education of Liebig was imparted in his native place, Darmstadt, and was of a very ordinary kind. After leaving school, his predilection for chemistry caused his father to place him with a druggist, but soon after he entered (at the age of 16) the university of Bonn, and afterwards went to Erlangen, where he graduated before he was of proper age. Here one of the good acts (too seldom) done by princes was of great benefit to him. The Grand Duke of Hesse paid his expenses for a residence of two years in Paris, where he enjoyed the instruction of such men as Gay-Lussac, Dumas, Pérou, and Mitscherlich. By an able report on the fulminates, he obtained Humboldt's friendship, and an introduction to his many scientific friends, which at last resulted in his being offered the professorship at Giessen.

Eleven years later, when his name had become known over all the scientific world, he visited the meeting of the British Association in Liverpool, where he read some valuable papers; and he afterwards dedicated his celebrated "Organic Chemistry applied to Agriculture and Physiology" to this same body. This work shed so much light on the processes of nutrition, respiration, waste of system by motion, the theories of disease and of reproduction, etc., that it was at once published in German, French and English, in the three countries respectively.

In 1843, he published his theory of "Motion of the Liquids in the Animal Body;" in 1849, "Researches in the Chemistry of Food;" then his well known "Familiar Letters on Chemistry in relation to Industry, Agriculture, and Physiology," and several other works and reports, to the number of nearly three hundred.

Although at the present day some of his views have been upset by additional information resulting from the always accumulating store of discovered facts, it must be acknowledged that he deserves the credit of having first attempted to bring system into organic chemistry, and above all that he has very greatly simplified the processes employed for organic analysis, which before his time were so complex as to be, in a great many cases, impracticable. He was so universally esteemed that he was invited to fill many chairs of chemistry, which he declined. Among them was that of Heidelberg, which had been filled by Gmelin, then just deceased. In 1845 the Grand Duke of Hesse created him a baron; and the British Royal Society, the French Academy, and nearly all the leading academies of the world elected him to membership, and he earned the Copley Medal, for original investigations. He finally accepted a professorship in the University of Munich, and then became President of the extensive laboratory there. A fund of \$5,000 was raised by subscription in Europe in order to give him a testimonial, as a proof of the value set upon his researches; and with it was bought five pieces of plate, one for each of his children.

He died in Munich last April, at the age of 70, after a short illness; and as he to the last filled his useful position, it will be acknowledged that, notwithstanding his advanced age, his death took place too early for science, which cannot afford to be deprived of such glorious apostles, as long as they are able to add to the progress and diffusion of the most useful of all human pursuits.

THE FALLING OF THE DIXON BRIDGE.

A terrible casualty, resulting in the killing of forty-five persons and the wounding of a large number additional, recently happened through the falling of a bridge over Rock River, at Dixon, Illinois. Baptismal ceremonies were being performed in the stream a short distance below the structure, which, from the view it commanded of the scene, became thronged with some one hundred and fifty people, all of whom were gathered upon one side, outside the truss. Suddenly, with a quick crash, the main western stringer of the north span of the bridge snapped, and the fabric, falling, dislodged the stays from the abutments. The shock ran along the whole length like lightning, and span after span was drawn from the piers and sunk sagging to the water's surface till the whole five literally folded up, crushing and heaping upon the mass of human beings precipitated into the rushing flood beneath. Help was speedily at hand, and the reports of the disaster detail heroic efforts, made in extracting the wounded held in the fearful wreck. Many were killed outright by the falling iron, and others were drowned in the river, which at the point is some thirty feet deep. The number of wounded is not definitely stated, and it is believed that twenty-five more bodies are still entangled in the debris.

Turning from the heart-rending details of this latest horror, it is of importance that the public should understand the construction and plan of the fabric, to the inefficiency of which the lives of so many have been sacrificed. It was a wagon and foot bridge with five spans of 132 feet each, making it 660 feet long. Its width at the center was thirty feet, and it stood fifty feet above the water. The roadway was twenty feet wide and the foot paths were enclosed with a heavy flagstone work of iron. The structure was a double truss, and was erected by L. E. Truesdell & Co., of Chicago, in 1868, and cost \$80,000. Both shore spans are broken to pieces, while the three middle ones, resting entirely upon heavy stone piers, remain hanging by the wrought iron members of the main chords from six to eight feet below their proper places. Between the roadway and foot path were 12 foot high partitions of lattice truss work, directly under which was the main chord. This is broken in every case about twelve feet from its bearing on each pier, or where the first truss bolts to it. The truss bars, of wrought iron, were only half inch by one and one eighth inches iron, filling in between the upper and lower chords perhaps every five feet.

The metal work throughout the whole fabric was exceptionally frail. The accident is explained by the fact that the northern span was thickly crowded and bore a weight of twenty tons or more on the extreme westerly side. The weight strained the trusses, and, at the point where the first of the truss lattice bars passed over the 12 foot cast iron pillar and bolted to the lower main chord (some twelve or fourteen feet out on the pier), the cast iron part of the north shore span first broke. In quick succession, and at about the same point in each span and in both the main chords, this snapping of cast iron chords took place. The breaking is described to have sounded like a volley of musketry.

From the information gleaned regarding the superstructure, there is little question but that its theory of construction was wrong and the material poor and clearly inadequate. The principle of the Truesdell patent, upon which it was based, is to lock joint all supports. Each bar has a crook in the center and all are locked together, the joint being covered with a cast iron shoe. It has been the opinion of many engineers that the idea is a total failure. Too much light and cast iron is employed, and the lock joint arrangement so weakens the metal that its full strength cannot be gained.

If this casualty were the first that had happened from the use of this bridge, it might be considered inevitable and unforeseen. But when the facts are on record, not only of the falling of a structure (its counterpart) but of the pronounced opinions of experts that this very fabric was unsafe, the fault must be plainly attributed to neglect. The first Truesdell bridge fell in Elgin, Illinois, in December, 1868, and was repaired and said to be strengthened by the inventor. Subsequently, on a strolling menagerie passing that way, an elephant, with curious sagacity, tested the fabric and refused to venture his weight upon it. On the 4th of July, 1869, some two or three hundred spectators gathered upon it to witness a race in the river, when a span, some sixty-eight feet in length, fell, carrying down over a hundred people, though fortunately killing but few. It is said that this disaster destroyed, as well it might, all confidence in the bridge, and that Truesdell could get no more contracts, and eventually died bankrupt. Later experience has proved that not a structure of the kind has been built which has not sagged or required extra trussing within a year.

What with the frequent marine disasters, boiler explosions and kindred horrors that have crowded upon us of late, it seems an almost useless task to repeat in the present instance the denunciations of criminal negligence which so often have found place in our columns. Here was a structure which any competent engineer should have been able to perceive at a glance was improperly built and unsafe, even were he not aware of the experience of others with its defects. Yet we are told that a city council examined it and were suspicious of its strength, and still it was allowed to remain. Naturally, the people are indignant, and in the midst of their sorrow call loudly for the exposure and punishment of the guilty parties; but private grief will, doubtless, soon overcome the complaints of those bereaved by the catastrophe, while the general public, shocked by the sensation for a day or two, will relapse into its usual apathy until again awakened by some new calamity, adding further evidence of the cheapness and insecurity of human life.

Death of John Stuart Mill.

We regret to announce the death of John Stuart Mill, a writer and thinker of great celebrity, whose works are known to the civilized world. He was the son of James Mill, the author of a "History of India" and a speculative philosopher of great reputation. It is as a logician of the highest order, whose reasonings led him to sympathize with the cause of freedom in all countries, that John Stuart Mill will be remembered. He died at his country house at Avignon, France, in the 67th year of his age, on the 9th of May.

SCIENTIFIC AND PRACTICAL INFORMATION.

CURARIC POISONS.

M. Rabuteau has discovered that the iodide of methyl-ammonium and the iodide of tetramyl-ammonium act upon animals in exactly the same manner as curare poison, paralyzing muscular movement without blunting the sensibilities, and with the same subtlety and energy. A fraction of a grain of these substances will kill a dog in a very few minutes.

FIRST ASCENT OF COTOPAXI.

Professor James Orton, of Vassar College, N. Y., has published an interesting account of the ascent of the great South American volcano of Cotopaxi, made in 1872 by Dr. Reiss, a German naturalist. The height of the volcano was found to be 19,660 feet, and the depth of the crater, 1,500 feet. The inner surface of the crater is very steep, and is lined with innumerable fumaroles, which send forth dense masses of hot gas, and also emit deposits of sulphur, gypsum, and chloride of lime.

NEW METHOD OF EXHIBITING THE CARBON POLES.

Mr. S. H. Landy, of Columbia College, New York city, has succeeded in effecting a decided improvement in projecting the carbon poles upon the screen. The old manner of showing them is to place them behind the condenser in the interior of the lantern, and then throw them upon the screen, giving but a faint and confused image. Mr. Landy's method is to place them in front of the condenser (a sufficient distance to avoid injuring the glass, about an inch); and then, by using an ordinary objective, they are thrown upon the screen greatly magnified and clearly defined. The electric current is then established, the carbon poles are drawn apart

and we have a magnified arch of about eight inches, making visible to an audience the transfer of the incandescent carbon from the positive to the negative pole. By placing caustic potash upon the positive carbon, the arch is greatly extended; by the use of thallium, silver, or copper, the characteristic color of each element is gorgeously depicted upon the screen, making altogether a most beautiful and instructive experiment.

NEW METHOD OF PREPARING ALUMINUM.

The oxide of aluminum is first prepared by any of the processes now in use, either from kaolin or clay. It is then mixed with wood charcoal in the proportions of 40 parts charcoal to 100 of alumina, and heated to a red heat. While still hot, the mass is placed in retorts heated to dark redness, and chlorine gas is passed over it from a gasometer. The volatile chloride is condensed in the receiver, and afterwards decomposed by the battery; the chlorine which is set free is returned to the gasometer to be used over repeatedly. The electric current, employed by Garneri, was produced by a magneto-electric apparatus.

PREVENTING MOLD ON SOLUTIONS OF GUM.

A new preventive of mold on solutions of gum Arabic, more efficient than sulphate of quinine, is simple sulphuric acid. According to Hirschberg, a few drops of strong sulphuric acid are added to the gum solution, and the precipitated sulphate of lime allowed to settle. Solutions prepared in this way a year and a half ago have neither become moldy nor lost their adhesive power.

AN AIR BATTERY.

Drs. J. H. Gladstone, F. R. S., and Alfred Tribe recently read before the Royal Society a paper on a new air galvanic battery, constructed on the principle that if pieces of copper and silver in contact are immersed in a solution of nitrate of copper in the presence of oxygen, a decomposition of the salt ensues, with the formation of cuprous oxide on the silver and a corresponding solution of the copper, while a galvanic current passes through the liquid from copper to silver. To employ the oxygen of the atmosphere and facilitate its contact with the silver and dissolved salt, the silver plate is placed in a horizontal position just under the surface of the liquid, with the copper plate beneath it, connection being established by a wire as usual. Holes are made in the silver tray to shorten the communication between the air surface and the copper plate, and to facilitate the movements of the salt in solution.

The conclusions determined are briefly as follows: The current gradually diminishes on account of the using up of the dissolved oxygen in the neighborhood of the silver, but is augmented by merely moving the liquid so as to bring fresh parts of the solution against that metal. A similar result is gained by stirring the silver crystals so as to expose new surfaces. If the wire be disconnected for a time, so as to allow the oxygen to diffuse itself from other parts of the solution, and if the connection be again made, the current is found as strong, or nearly so, as before. Oxygen is taken up with the greatest avidity, the solution absorbing even minute quantities from the surrounding gas. Six per cent was found to be the best strength of the copper nitrate solution. As regards the best proportion between the areas of the metallic surfaces, the increase of the copper has little effect, while that of silver, the negative metal, causes an almost proportionate increase in the chemical action. Heat increases the action of the cell greatly, the augmentation being more rapid in the higher than in the lower ranges of temperature, from 68° to 122° F. The internal resistance of the battery is small. As to the electrolytic power of the current, six cells were sufficient to decompose dilute sulphuric acid slowly, and dilute hydrochloric acid pretty quickly, copper electrodes being employed.

The theoretical interest of this battery lies mainly in the fact that it differs essentially from every other galvanic arrangement, inasmuch as the binary compound in solution is incapable of being decomposed either by the positive metal alone or by the two metals in conjunction; it cannot serve, in fact, as the liquid element of the circuit without the presence of another body ready to combine with one of its constituents when set free. The practical interest centers in the fact that the device is an approximation to a constant air battery. By employing chloride of zinc, power may be obtained at a minimum of expense. Such a battery would appear to be specially adapted to cases where the galvanic current has to be frequently broken, as in telegraphy; for at each period of rest, it renews its strength by the absorption or diffusion of more oxygen from the air.

PROGRESS OF THE HOOSAC TUNNEL IN APRIL, 1873.—Heading from east advanced westward, 163 feet; heading from west, advanced eastward, 136 feet; total penetration during April, 299 feet. Length opened from east end westward, 13,798 feet; length opened from west end eastward, 9,294 feet. Total length opened to May 1st, 23,092 feet. Length of the tunnel, 23,031 feet. Leaving rock to be perforated, 1,939 feet, being 179 feet more than $\frac{1}{2}$ mile.

I. H. P. says: "The chief defect of mowing scythes is that they are too light at the heel. More than half the scythes I have used have, after a few weeks or months, broken in two at the junction of the blade with the heel. This part of the scythe should be made wider and stronger, as nearly the whole strain comes at this particular point."

THE smallest known race is that of the bushman of Southern Africa, the largest that of the Patagonian of South America. The mean height of the bushman is four feet three and a half inches, and that of the Patagonian five feet eight inches.

JUDSON'S PATENT LATHE CHUCK.

This invention is an improved lathe chuck, which is so arranged that the pressure of the screw toward the center also presses the jaw firmly against the face of the chuck, thus holding the work with great security, while the minimum force is expended in turning the screw. It is claimed to be sensitive, strong, durable, to economize power, and never to require re-adjustment in order to take up lost motion.

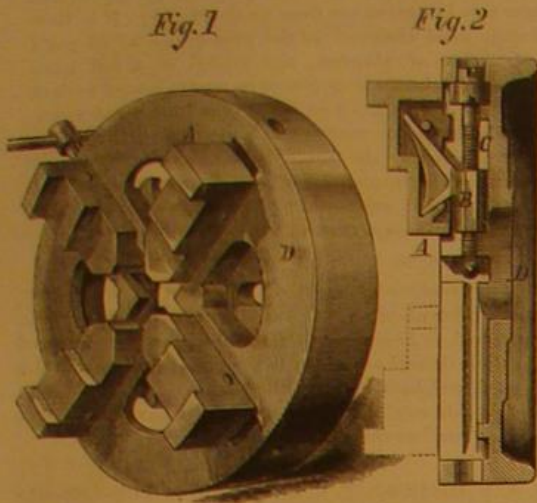
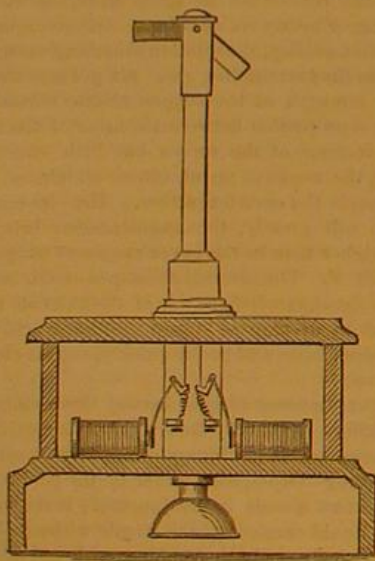


Fig. 1 is a perspective view, and Fig. 2 a vertical section of the device. A is the jaw, B the nut, C the screw, and D the bed of the chuck. The jaw, A, is formed with an angle bearing, against which the nut, B, with a similar bearing, is brought in contact. The nut slides in grooves planed in the bed, D, which allow of its travel in the direction of the length of the screw, C, but guide it in all other directions. The lever for revolving the screw is shown in Fig. 1. This chuck is manufactured and sold by Dwight Roberts, Wythe avenue, between Hewes and Penn streets, Brooklyn (E. D.), N. Y., from whom further particulars may be obtained.

ELECTRIC RAILWAY SIGNAL.

We find in *Iron* the accompanying illustration and a description of a new electric semaphore block-signalling instrument, the invention of F. Russell. The apparatus consists in a case within which the armature of an electro-magnet is connected with one end of a rocking crank lever, the other end of the lever being connected with a wire. When the electro-magnet is excited, the armature approaches it, depressing one end of the rocking lever and elevating the end in connection with the wire. The latter rises in a hollow



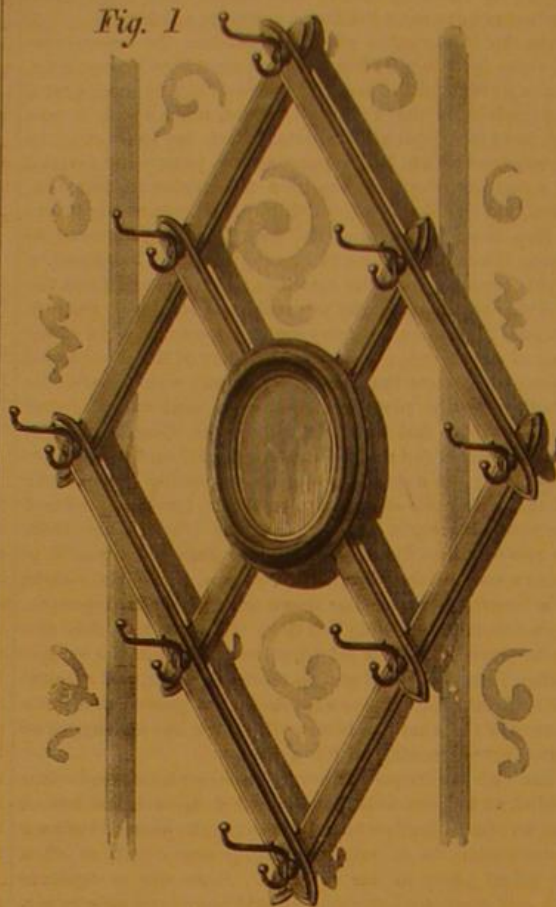
column some 18 inches high, and moves a semaphore arm at its upper extremity. Two of these arms—red and white—and two electro-magnets are employed, as represented in the engraving. On top of the case, a switch lever is arranged which serves to throw the battery current into the line wire. In front of the instrument is a tapper or ringing key for sounding the bell at the other station. The bell is shown at the lower part of the case.

The device is adapted for use on lines upon which two trains or engines are not allowed to run on the same section of road at the same time. The same signals are used to denote "line blocked" and "line clear" as are actually exhibited to the engineer of the train. In its normal position the instrument denotes "line blocked," that is, with the arms up. So long only as a current is caused to flow from the battery to the line will the arm fall to "line clear," because the moment the current is cut off from any cause, the arm flies up to danger, the whole apparatus being in equilibrium. As the red arm can only be lowered from the station towards which the train is approaching, the signal must be under the sole control of the signalman of that station. The white arm is worked electrically by the switch of its own instrument, and shows the signalman the position in which he has placed the electric signal at the other station. In this arrangement three wires are employed for bell, signals, and arms, for a pair of roads.

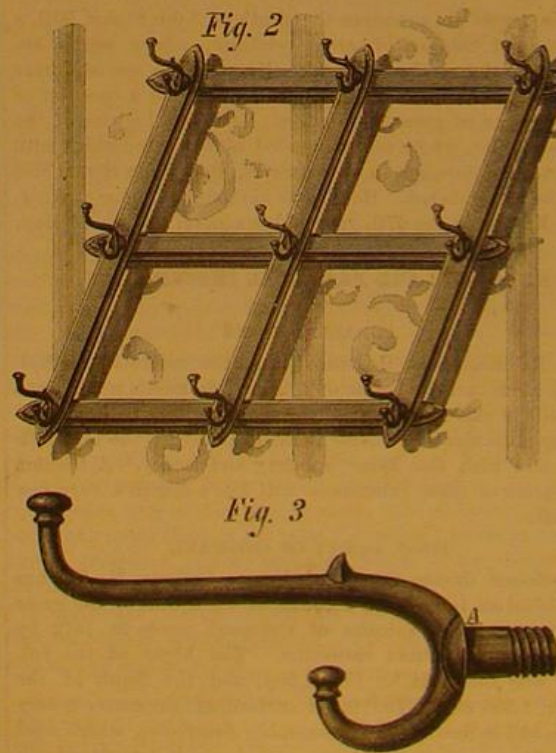
THE use of bronze in the manufacture of field guns has been abandoned both in England and Germany.

HAT AND COAT HOOK.

This is a convenient invention, designed to replace the ordinary wooden pin commonly used in expansible and swinging hat and coat racks, and consists principally in the metal hook shown in Fig. 3. A portion of the shank of the device, it will be noted, is threaded, while that part nearest the curve is made plain. The object of this arrangement is to enable the hooks to be secured to the slats or bars forming a hat or coat rack, and at the same time to unite the two sets of slats together without the aid of any other fastening.



Of the bars which constitute the rack, the inner set, Fig. 2, next to the wall, remain always horizontal and parallel to each other; the outer slats, though also relatively parallel, can be swung to the right or left, so as to give the frame a diamond or rhomboidal form. As the hooks have upon them the securing device, the putting together of the rack is a very easy matter. Holes are bored through the slats where they cross each other, those through the outer bars being somewhat the larger. The shank of the hook is passed through the hole in the outer slat, and screwed into the hole of the inner one until the shoulder, A, brings up against the wood. The outer slat, therefore, swings freely on the plain portion of the shank, while the inner bar is held by the screw part.

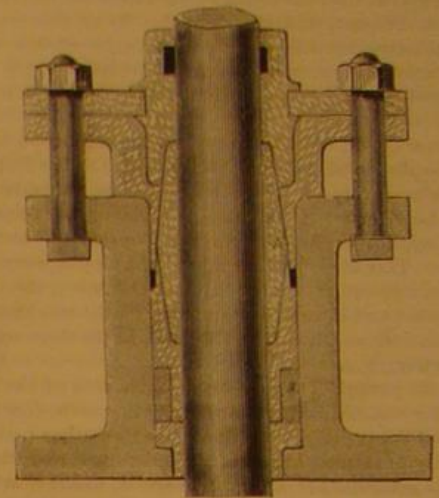


The frame thus united can be hung, as in Fig. 2, thus allowing the use of all its hooks; or it may be provided with a mirror attached to its center and suspended from an angle, as represented in Fig. 1. The hooks necessarily have double the holding capacity of single wooden pegs, are more ornamental, and are claimed to be much stronger and cheaper. The rack can be folded into compact form for shipping, making, the inventor states, a package, without the glass, less than three inches thick and two feet long. It can be readily taken apart when desired.

Patented March 18, 1873. For particulars regarding the purchase of this article complete, separate hooks, territory, etc., address the inventor, Mr. John Danner, Canton, Ohio.

IMPROVED METALLIC STUFFING BOX.

The accompanying illustration represents an improved metallic stuffing box recently patented by Mr. Watteau, of Middlesborough, England. This invention has been applied in France to nearly one thousand locomotive engines, and stationary engines of every description are daily being fitted up on this system. So says the *English Mechanic*. In large hammers, which soon burn their packing, the invention has been applied with great advantage. The metallic packing, A, composed of an anti-friction metal, has a double conical shape; by means of the coiled spring, B, in the bottom of



the box, it will always be forced against the piston rod, as it is made in halves. In locomotive engines the metallic packing has been found to last a year without being renewed, while the cost of maintenance is insignificant. After that time the metal can be remelted. It is stated that there is much less friction than with any other packing. After it has been at work for some time, both piston rod and packing acquire a smooth and glassy appearance; and in no case has the metallic packing been found to damage the rods in any way.

A New Siphon.

Jos. Sedlacek says, in *Poggendorff's Annalen*: It is, in many cases, desirable to withdraw liquid from a vessel by means of the siphon, and a form of the instrument used for certain liquids is that in which the longer arm is furnished with a suction tube, in order that no portion of the liquid may enter the mouth (though this object is not always attained). With harmless liquids, a simple bent glass tube may suffice as siphon; but suction with the mouth at the end of the longer arm is somewhat inconvenient.

The following arrangement is simple, and presents certain advantages:—A glass tube *g*, 8 inch wide, and 12 or 16 inches long, contracted at the lower end, has, at its upper end, a cork stopper, in which the mouthpiece, *M*, and the siphon, *h h'*, are fixed airtight. The shorter arm, *h*, of the siphon reaches nearly to the bottom of the tube, and limits the play of the glass ball, *k*, which acts as a valve. The diameter of the ball is about 4 inch, that of the siphon 2 inch.

The instrument thus arranged, being dipped into the vessel to be discharged, the tubes *g* and *h* become filled with liquid to the surface, *N N*. Instead now of sucking, as with the common siphon, one blows into the mouthpiece *M*; and in consequence of the compression of air, the lower opening is shut by the ball *k*, while the liquid rises in *h*, and begins to flow through *h'* in the usual way.

If the vessel to be emptied is not full, or the column of liquid is a small one, it is then necessary, before blowing into the mouthpiece, to suck it slightly, in order to obtain a larger volume of the liquid in *g*; as one condition for the right action of the instrument is that *h h'* should be filled before the column of liquid in *g* sinks to the mouth of the siphon at *k*, when one blows through *M*.

A Large Casting.

At the South Brooklyn Steam Engine Works, in Brooklyn, the second immense anchor plate for the East River bridge was recently cast. Four weeks were occupied in forming the mold alone. A circular excavation was first made, twenty-five feet in diameter and three feet deep, at the bottom of which was placed an iron plate. Upon this a course of brick, eight inches thick, was laid in a mortar of fine sand and fire clay; the upper surface was then leveled off and baked with charcoal. This surface served as the base of the mold, which was of loam, secured by brickwork and iron girders built in sections.

The anchor plate is of oval shape, seventeen feet six inches by sixteen feet in dimensions, with a thickness at the ribs of three feet. It weighs 47,000 pounds when cleaned, and its cost is \$3,200. About 60,000 pounds of iron were melted, transferred to a huge tank, and thence allowed to flow into the mold. The casting took place without accident and was allowed one week to cool.

TELEGRAPH SERVICE OF THE UNITED STATES.—For the 1st of January, 1873, the telegraphic system of the United States may be thus approximately estimated: Aggregate nominal capital, \$60,000,000; length of lines, 80,000 miles; length of wire, 180,000 miles; number of stations, 6,300.

THE WONDERS OF THE EGG.—III. (LECTURE BY PROFESSOR AGASSIZ.)

Having seen something of the great diversity among the eggs, characterizing different classes of the animal kingdom, we may now consider the functions of the egg itself—that is, the part which eggs take in the history of generation. I cannot dwell too emphatically upon the fact that eggs are produced and grow without any agency of the male animal. They are a production of the female organism. So true is this that the ovarian egg may be found in animals before they have reached maturity, before they have completed their physical growth—nay, ovarian eggs have even been observed in the embryo before birth. Neither do successive generations begin with the birth of new individuals, but with the formation of the egg from which these individuals proceed. We must look, then, upon the egg as the starting point of the complicated structure of the adult being. It is, as it were, a sieve through which the qualities transmitted by parents to their offspring are sifted. Whatever peculiarity there may be in the new being has its foundation in the egg. Within those narrow limits are circumscribed all the conditions of change; and therefore it is of paramount importance to know what the egg receives and what it transmits. We cannot investigate this part of the subject too closely. It is of vital importance to the question. And yet I have not seen it discussed in connection with the various explanations of the origin and diversity of life recently attempted. The egg arises in the maternal organism, without the co-operation of the other sex, and it can transmit only what it receives directly from the maternal organism, or from the paternal organism through contact with the maternal, or from ancestors through one or both. There has never yet been recorded an instance in which an egg has grown to be anything but a being similar to its parents, and yet the possibilities of modification are so numerous under these conditions, and the range of variation so great, as to make us wonder the more at the constancy of types.

MODIFICATIONS DUE TO ANCESTRY AND SEX.

Suppose, for instance, that a male and female (I deal here with the subject in the most general way without reference to any particular species or type of animal) produce three new individuals. The three may be all males or all females, or two may be females and the third a male, or *vice versa*. The three may all resemble the mother, have her features, her stature, her physical tendencies generally; or they may all resemble the father; or one or two of the three may resemble the mother, the third may resemble the father; or only one may resemble the mother, the other two being like the father; or they may all combine the physical features of both parents; or one may present such a combination, and the others follow distinctly one or the other parent. Any one case, be the offspring more or less numerous, will show us what a variety of modifications arises merely from the contact of two beings to produce one or more new individuals. But the matter is still further complicated. These new individuals have had a grandfather and grandmother on the paternal side. You are all familiar with the singular fact, well known to us in the human family and often observed throughout the whole animal kingdom, that children may not resemble their parents at all, but be strikingly like their grandparents. Thus in the new individuals, the same combinations which might arise from their immediate progenitors may also pass to them from a previous generation, from their grandparents, or even from their great grandparents, or further back still. This reproduction of the features of nearer or more remote ancestors in their descendants is so well known and recurs so frequently that it is looked upon by naturalists as a law, and is called the law of atavism. There are historically recorded instances of the reappearance of characteristic family features after a lapse of several generations.

All these intricacies of inheritance, so frequently interrupted and seemingly so capriciously reproduced, must be connected with the egg through which influences pass to the new being. Suppose, for instance, that any features or traits, physical, moral, or intellectual, are handed down from a male grandparent through the paternal side. In such an instance the egg, which produces the new individual, does not receive the direct transmission of inherited qualities, for, as I have said, that egg arises in the maternal organism, and has a life and growth of its own before the act of fecundation takes place. Through that act of fecundation must be made the impression by which these inherited qualities are received and transmitted to the new individual. Where the new individual reproduces the maternal features only, or features characteristic of the maternal line of descent, the case may seem at first sight more simple; but when we analyze it in all its bearings, we shall see that there is matter enough for wonder, and that we as yet know almost nothing about the mysterious problem of life. What can there be of a material nature transmitted through these bodies called eggs, themselves composed of the simplest material elements and arising in the female organism without co-operation of the male, what influence can there be, I repeat, by which all peculiarities of ancestry belonging to either sex are brought down from generation to generation?

The egg, as we have seen, is, in its incipient condition, only an organic granule arising between the structural cells of the ovary. It grows there and acquires a remarkable complication before it has completed its successive phases as an egg. Not until it has reached the state which I have described as that of the perfect egg does it receive the contact of the spermatic cells from which dates the formation of a new being, either male or female. This in itself is a strange thing—that a mother produces, not necessarily a being like herself, but quite as often beings so unlike herself in struc-

ture as to be endowed with all the peculiarities of the male sex. In the origination of a new species, this double series of influences must be included and combined in the proportions necessary to produce a being differing from all foregoing species, and capable of maintaining its pattern generation after generation.

There is one feature in the growth of the egg of which I have as yet said nothing. The yolk, that homogenous substance, which fills the vitelline membrane, in which swim the germinative vesicle and germinative dot, must undergo a very remarkable change before it can give rise to the new individual. It is self-kneading, broken by the process of its own growth into a smaller or larger number of distinct fragments.

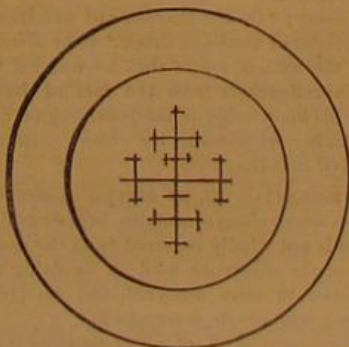
This breaking up of the whole substance which simulates disintegration ends in a recombination; these fragments reunite to form the mass out of which the new germ is to be developed. This process is known as segmentation, and has been observed in the eggs of all animals. The process of segmentation has been studied in the mammalia, in birds, in reptiles, in fishes, among articulates, among mollusks and radiates. This process may or may not be initiated by fecundation. There are some animals in which the first appearance of segmentation may precede fecundation; others in which it is always subsequent to fecundation; in no animal is the process known to be completed without fecundation. Neither does it take place in all animals in the same manner.



EGG OF MAMMAL DURING SEGMENTATION INTO TWO PARTS.

Within the vitelline membrane, occasionally it would seem that the whole yolk is not taken in; there are sometimes little fragments left out from the larger masses. Whether these separate balls of yolk have envelopes of their own is a question difficult to decide. The most skillful naturalists differ about it. The original yolk being thus divided into 2, the same process goes on till the 4 are divided into 8, the 16 into 32, the 32 into 64.

Beyond this it is almost impossible to track them individually; it is difficult to bring the whole yolk under the microscope, so that each fragment can be counted; and if it is pressed, however slightly, the whole mass then runs together, so that no division whatever can be traced. Occasionally, however, the self-division has been followed even beyond sixty-four. By this time, the yolk is transformed into a body which has much the appearance of a mulberry, and this condition of the yolk has been called the mulberry stage. When it has become so far subdivided that every separate particle, owing to its diminutive size, is difficult of microscopic observation, even under very high power, each such particle seems like a cell, and may indeed be considered as a cell. This self-division of the yolk mass ends in an accumulation of cells which differ from those of the initiative yolk, and are the basis for the formation of the new being, the material in fact out of which the new being is to be built.

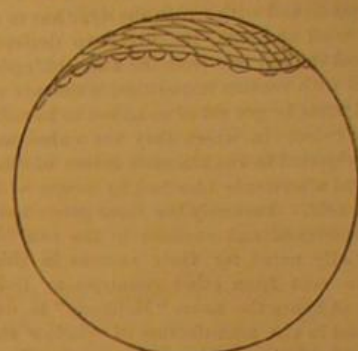


EGG OF TURTLE DURING SEGMENTATION.

If we now compare the egg of a reptile, that of our common snapping turtle for instance, with the mammalian egg, we find that the process of segmentation differs somewhat, and does not penetrate the whole substance in the same manner. A portion of the surface of the yolk becomes plowed, as it were, by furrows at right angles with each other. These furrows do not extend over the whole surface but encroach upon it only for a certain circumscribed area, the remainder of the yolk remaining in its original condition of yolk cells, while the furrowed area rests upon it as a skin or layer. There is now a difference between above and below, marked by the distinct character of the upper and lower portions of the yolk. We shall presently perceive a difference between right and left, between front and back also.

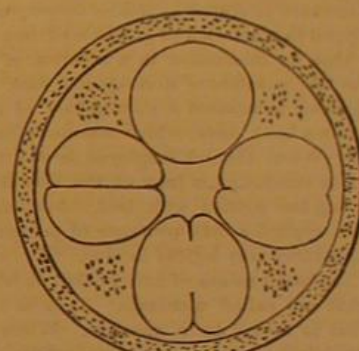
Take, for instance, the highly magnified yolk of a mammalian egg, with the germinative dots already formed on the side. The vitelline membrane surrounding such a yolk is rather thicker than in a bird's egg, and forms a sort of

transparent zone outside of the yolk. When the process of segmentation begins, the yolk shrinks slightly upon itself and no longer fills the vitelline membrane completely. Presently a slight indentation becomes visible on one side of the yolk, and another corresponding to it on the opposite side. This indentation grows deeper and deeper until it cuts the yolk through, and ends its total division in two halves,



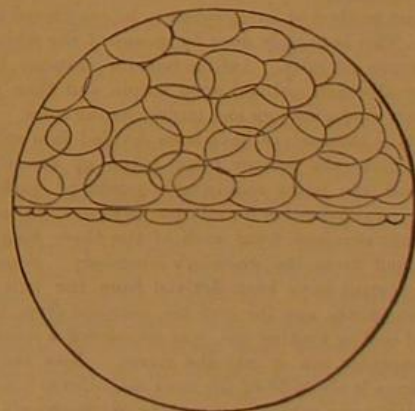
EGG OF TURTLE IN MORE ADVANCED STAGE OF DEVELOPMENT.

the two halves remaining, however, in close contact. While this process goes on, the germinative vesicle vanishes, if indeed it has not disappeared before. In some animals this vesicle is dissolved before the segmentation begins; in others, during the process. This division of the yolk in halves being completed, the same change begins now in the two halves. Indentations are seen on either side of each half, and these indentations deepen till they meet and sever the two masses of yolk; and now, where we had one yolk mass, we have four distinct lumps side by side; they become rounded in form, and look like four soft balls.



EGG OF MAMMAL UNDERGOING SEGMENTATION INTO EIGHT PARTS.

In the eggs of the frogs and toads, there is still another mode of segmentation. The yolk divides, as in the mammalian egg, into halves. But only one of these halves proceeds with the self-division and multiplies itself into an indefinite number of cell-like particles. The other half of the yolk remains unchanged.



EGG OF BATRACHIAN.

You will easily understand how difficult it has been for embryologists to put together in their true sequence these phases of development. Not only must the exceeding difficulty of the microscopic observation be considered, but also the fact that, in order to find every single link in the chain, to obtain, for instance, a slight of the mammalian egg just at the process of self-division or at any one point of it, the mother must be killed at a given moment of the segmentation. Suppose a naturalist to be investigating the process in some of the higher mammalia, for instance, such as produce but one young only at a time; it is evident that he must meet extraordinary, almost insuperable, difficulties at every step. No one has ever seen the segmentation of the egg in a mare or a cow, or even in a sow. These are too expensive to be sacrificed for the study of embryology. Professor Vischoff made his investigations upon the rabbit, and that one investigation cost him ten years of his life. Science must be conquered; and these conquests bespeak the high intellectual culture of those who make them. It is easy to fling theories into the world broadcast, based upon a few imperfect and shallow observations, and palm them upon those more ignorant than their originators; but it is one thing to theorize about what nature may do, another to know, by virtue of patient and intense study, what she does.

C. E. says: "I have taken your paper during the past two months; but if I could not get another, I would not take \$10 for the balance of the year's subscription."

STEVENS INSTITUTE LECTURES.—DYEING AND CALICO PRINTING.

BY PROFESSOR CHARLES F. CHANDLER.

The fourth lecture of the spring course before the Stevens Institute of Technology was by Professor Charles F. Chandler, of Columbia College, New York city, on "Dyeing and Calico Printing." He said: The materials of which our clothing is made, and with which the dyer has to do, are cotton, linen, wool and silk, the first two derived from the vegetable and the last two from the animal kingdom. They occur mixed with various impurities, which are more or less colored and must be got rid of so as not to impair the clearness of the colors in which they are subsequently dyed. They are subjected to the alternate action of dilute alkalies and acids and afterwards bleached by means of chlorine or sulphurous acid. Formerly the linen goods were bleached by being moistened and exposed to the sun. The Dutch were especially noted for their success in this industry. Goods were sent from other countries to Holland to be bleached, and hence the name "Hollands" to designate the material used in the manufacture of window shades. The application of chlorine to bleaching put an end to this trade.

Dyes are fastened upon fabrics in various ways. Some are insoluble in water but soluble in other substances. If cotton is dipped in a solution of chromate of zinc in ammonia and dried, the ammonia evaporates and the chromate of zinc, being insoluble in water, remains imprisoned in the fibers.

In some cases the color is developed by exposing the impregnated fabric to the action of the oxygen of the air. This is called "ageing." When indigo, for example, is mixed with sulphate of iron, lime and water, it dissolves to a nearly colorless liquid, which has the property of absorbing oxygen from the air and turning blue. When cloth is steeped in this liquid and then aged, the change to blue takes place in the fiber.

Some colors are produced by double decomposition. When cloth is dipped in a solution of sulphate of iron and dried, it will turn blue on immersion in a solution of prussiate of potash, the two substances decomposing each other. Professor Chandler mentioned a curious case of restoring the signatures on a bank note, which somebody had taken out with acid. When the ink employed is the ordinary nut-galls and iron compound, a trace of the iron is usually left after treating the writing with acid. Availing himself of this fact, he applied a little prussiate of potash and brought out the signatures very legibly in blue.

A very important means of fixing colors on fabrics is by the use of what are called mordants. Alum is a good example of what is meant by a mordant. When an alkali is added to a solution of alum, a white, gelatinous substance contained in it is thrown down. This is alumina, which has so strong an affinity for coloring matters that it will take them out of solution and precipitate them. When a fabric is impregnated with it and then steeped in the dye, the precipitation will take place in the substance of the stuff. Another mordant is the chloride of tin, which, in addition to fixing the colors, heightens them. Compounds of iron change the tints and enable us to obtain a long series of colors from a single dyestuff.

The last method of fixing colors to be considered is "gumming." This is usually done by means of the white of egg or the curds of milk. Aniline red, for instance, is mixed with the albumen, printed upon cotton and then steamed. The steam cooks the egg and imprisons the color.

The dyes themselves have been divided into substantive and adjective; the former being taken up directly by the fabric, and the latter requiring a mordant. Safflower, for example, is substantive for silk but adjective for cotton.

Dyes are obtained from each of the three kingdoms of nature and from the chemist's laboratory. Some of the most important have been derived from the latter source. Not many years ago the coal tar, obtained from the distillation of coal in making gas, was considered a nuisance and gas companies ran it into the rivers. Now the chemist makes from it about 56 of the most magnificent colors. The Philadelphia gas company is making arrangements for mining it from the bottom of the river, into which they had thrown about \$150,000 worth.

The most ancient dye, known as the Tyrian purple, was obtained from two species of shell fish, each of which contained about a drop of it. It was not purple but red, and was considered so precious that a pound of wool dyed with it sold for what is equivalent to about \$150 in gold. Cochineal is the dried body of an insect found on a species of cactus cultivated for that purpose in Central America. Its coloring principle is carmine. It is used for dyeing wool scarlet, the mordants being chloride of tin and cream of tartar. With alum, it gives a crimson. The dried precipitate with alum is called crimson lake, a "lake" being a compound of a coloring matter with alumina.

In the vegetable kingdom, the dyes are obtained from the roots, the wood, the bark, the fruit, and in fact from every portion of plants. Among the roots, the most valuable is the madder, largely cultivated in France and other countries. It is estimated that about ten millions of dollars are invested in its cultivation. Before long, however, all this capital must find another employment; for the chemist has succeeded in preparing artificially the alizarin or coloring principle of madder. By the use of different mordants we obtain from madder a great variety of shades, from Turkey red to chocolate. Besides the color, madder contains sugar in such quantity that most of the alcohol in France is manufactured from it. When, therefore, madder ceases to be cultivated, Frenchmen will have to get their whisky from a different source. Alkanet and turmeric are other examples of roots, the latter furnishing us with test paper for alkalies

and for boracic acid. Among the woods, logwood, Brazil wood and fustic are the most important. Their coloring principles are extracted by boiling, in a vacuum pan or closed vessel to which an air pump is attached. The air being exhausted, the water boils far below its ordinary boiling point by reason of the diminished pressure. By this method there is no danger of destroying the colors from too high a heat. The same principle is applied to sugar boiling, evaporating down our jellies, etc. A good example of a bark is quercitron, which gives a brilliant yellow. Safflower is the fruit of a species of thistle. This substance, the professor remarked, has stood more in the way of human progress than perhaps any other, being the color with which red tape is dyed. It is almost the only dye which is "substantive" to cotton. Tannic acid, contained in nut galls (the excrescences produced on a species of oak by the sting of an insect), in sumach, etc., gives a black color with salts of iron. Ink is also made from it. Most blacks, however, are made with logwood and acetate of iron or bichromate of potash with the addition of some fustic, because logwood alone gives a blue black. Indigo, which has already been mentioned, is obtained by fermenting the leaves of several species of the *indigofera* genus in water. A yellow liquid is produced, which absorbs oxygen and turns blue. The indigo precipitates, and is sold in cakes. Woad is another similar vegetable blue, chiefly interesting from the fact that the ancient Britons used it as a war paint to smear their bodies with.

Among the mineral dyes, we have a fine yellow made by dipping the cloth first in acetate of lead and then in chromate of potash. To make this orange, it is boiled in lime water. A blue color is made by using, first acetate of iron and then prussiate of potash. Ultramarine, which is now prepared artificially by the chemist, is fastened on to the fabric by means of white of egg. Chrome green, made by heating chromate of potash with borax and treating with water, is used in the same manner.

On distilling coal tar, the first, or light, portion contains benzole, which by means of nitric acid is converted into nitrobenzole or artificial oil of bitter almonds. When this is acted on by acetic acid and iron filings, aniline is the result. By the oxidation of aniline with chloride of tin, arsenic acid, etc., aniline red, fuchsin, or magenta is obtained, and all possible shades between this, through purple and violet to blue, are made by heating it with more aniline and stopping when the desired shade is obtained. Besides these shades, green, black and yellow dyes are made by processes which we must omit for want of space. In the heavier portions of the coal tar distillates is found a substance called anthracene, from which a long series of splendid colors are prepared; among them artificial alizarin, which rivals that from madder in beauty.

The above lecture was copiously illustrated by means of specimens, and a practical dyer produced some beautiful results in silk dyeing before the audience. The portion of the lecture relating to dyeing occupied so much time that the professor was obliged to omit the subject of calico printing.

SANITARY NOTES.—FLAVORING SUBSTANCES FOR FOOD AND DRINK.

The State Board of Health of Massachusetts publish in their fourth annual report a number of very exhaustive and valuable papers on important sanitary questions of the day. These essays are from the pens of well known physicians and scientists, and contain the newest and most reliable information on the subjects of which they treat. As the approaching warm weather renders all matters relating to the public health of timely importance, we shall present, under the heading of "Sanitary Notes," in the present and subsequent articles, condensations of these treatises, in which the various points of interest and conclusions drawn will be carefully retained.

The first essay: "On the character of substances used for flavoring articles of food and drink," is by Henry K. Oliver, M.D., and the author states that he was led to make the necessary investigations from the fact of having a case brought to his knowledge of the poisoning of five individuals by partaking of pistache ice cream. Inquiry into the matter proved that the

ESSENTIAL OIL OF BITTER ALMONDS

used for flavoring always contains prussic acid, which it is safe to infer is not wholly removed from the commercial oil. Specimens of the substance used in flavoring the ice cream above referred to were analyzed, and the presence of the deadly poison was clearly determined.

Very little essential oil of bitter almonds is made in this country, but it is largely imported. It is always employed when an almond or peach flavor is desired, one or two drops sufficing to impart the taste to large quantities of material. Some idea of the poisonous nature of the ordinary essential oil may be gathered from the fact that experience has proved that two teaspoonsful have destroyed life in ten minutes. According to Dr. Taylor, one hundred parts of the oil contain nearly thirteen parts of anhydrous prussic acid. One drop is sufficient to kill a cat. It has a yellowish color, a bitter, acid, burning taste and the odor of the almond kernels in a high degree. Virey says that accidents occasionally happen among children in Paris from their eating freely of macaroons, which are sometimes too strongly flavored with the substance. In 1871 one hundred and forty-nine pints of the oil were imported to Boston. Of this quantity, the author estimates that forty-nine pints were employed for flavoring—equal to 2,750 fatal doses. It may not be out of place, he adds, to state what became of the other hundred pints, 5,500 doses; it all went to a manufacturer of patent medicine.

NITRO-BENZOLE, OR OIL OF MIRBANE

is the result of the action of nitric acid on benzole, which is one of the lighter products of the distillation of coal tar. It closely resembles the above described substance, and hence is called artificial oil of bitter almonds. It is principally used in the manufacture of aniline colors and for scenting soap and perfumery, and, on account of its cheapness, it is employed to some extent by confectioners. It is a very active poison, eight or nine drops being sufficient to cause death, and its vapor is also dangerous.

ARTIFICIAL FRUIT ESSENCES.

The compound ethers have been found to possess the odor and flavor of certain fruits, and hence are largely substituted for the genuine sirups and extracts. Butyric ether is prepared by mixing butyric acid with sulphuric acid and alcohol. The former acid is obtained by mixing decaying cheese with grape sugar and chalk, and allowing fermentation to take place. The ether dissolved in another portion of alcohol forms pineapple essence. Pelargonic ether is prepared by digesting pelargonic acid with alcohol at a gentle heat. Pelargonic acid is the result of the action of nitric acid on oil of rue. This ether with alcohol forms quince essence. Acetate of amylic ether, a distilled mixture of fusel oil, acetate of potash, and sulphuric acid, forms the essence of Jargonelle pears. Valerianate of amylic ether, made by the action of sulphuric and valerianic acids on fusel oil, forms apple essence. A mixture of acetate of amylic ether with butyric ether gives banana essence. Other mixtures of ethers, modified by the addition of various agents, as nitrous ether, acetic acid, camphor, tincture of orris, vanilla, the volatile oils, result in imitations of the strawberry, raspberry, apricot, currant, and other flavors. Taken into the stomach in an undiluted form, these compounds would be highly dangerous; but as in confectionery they are largely mixed with other substances, their noxious effects are much lessened. Children are more susceptible to their influence than adults, and have been known, after eating candies with liquids within, to become seized with alarming sedative symptoms requiring prompt medical treatment. These artificial essences, though employed to a great extent for flavoring soda water, are rarely used by reputable druggists, though the latter all agree in substituting citric or tartaric acid for lemon juice, on account of the difficulty of keeping sirup made from that fruit. Both of these acids are derived from fruit and hence are not deleterious in an occasional summer beverage. Sarsaparilla sirup, sold by street pedlars of soda water, is generally innocent of the root, being nothing more than molasses and water flavored with oil of anise. Cochineal is generally added to give sirups an attractive color.

SPURIOUS ALCOHOLIC LIQUORS.

The most important part of Dr. Oliver's report is under the above heading, and it exposes the abominable compounds which are sold to the poorer classes in the reeking taverns and gin mills in the obscure portions of great cities. An individual named Eichler (we give him the gratuitous advertisement) publishes a circular giving recipes for the composition of these liquid poisons, which he says will save hundreds of dollars to those in the business. We select a few of these recipes at random, from a long array: *New York Whisky*.—Concentrated essence Bourbon, four ounces; compound tincture of green tea, one pint; tincture of capsicum, one pint; tincture of grains of paradise, one pint; corn whisky, twenty gallons; water, twenty gallons. *Port wine*.—For forty gallons. Port wine ether, four ounces; aromatic tincture, eight ounces; tincture of rhatany, eight ounces; tincture of orris, twelve ounces; simple sirup, three gallons; rectified spirits, three gallons; wine coloring, two gallons; plain or raisin wine or fermented cider, thirty-two gallons. The former recipe, it will be noted, contains less than half poor whisky, and the latter not a drop of the wine it is intended to represent. "An imitation champagne is made of a delectable compound of sugar, water, white argols, cider, and yeast," mixed with a little rectified spirits and orris; and even so innocent a beverage as sweet cider is counterfeited by water with a little cider flavoring, brown sugar, and yeast. The manufacturer, with an impudence which borders closely upon the sublime, remarks that these doses "improve very much by age."

TARTARIC ACID AS A SUBSTITUTE FOR FRUIT

is put up in boxes and sold as "fruitina." "One package," says the maker's circular, "makes twenty-five pies or sixteen pounds of jelly. Twenty-five pies for thirty-five cents." As might be imagined, it is endorsed by forty female names, the owners of which are principally boarding house keepers. Some of the prescriptions for its use are refreshing; for instance: "To make lemon pie: Pare and boil a turnip, add a teaspoonful of fruitina and a cup of sugar; season and bake." A quantity of common starch, fruitina, flavoring matter and sugar makes "a delicious jelly," and a wonderful mixture of the acid, molasses, milk, eggs, crackers, and spice undergoes some incomprehensible change in the oven which transforms it into a "pumpkin pie." Tartaric and citric acids, even in considerable quantities, may be swallowed without fatal results, and, dissolved in water, form a refreshing drink in fevers; but it is a cheat to use either of them as a substitute for fruit in domestic economy, and it is not unlikely that they may do harm if partaken of too freely.

As regards the opinion that strychnin is used to impart a bitter flavor to ales and beers, the writer considers it erroneous. English imported ales are absolutely pure, a fact determined by careful analysis of samples from different breweries throughout the kingdom.

A PLANT has been discovered in Angola, Africa, so sensitive that it closes its leaves at the mere sound of a footfall.

Correspondence.

The Atlantic Disaster.

To the Editor of the Scientific American:

The late lamentable disaster and sacrifice of life off the coast of Nova Scotia must render it painfully evident to the public, and particularly to those acquainted with the sea, that the present system of saving life from shipwrecks by means of the boats usually carried for that purpose is almost useless; and I quite coincide with the views expressed in a recent article in your valuable paper as to the desirability of the scientific world discovering some effectual and reliable life preserver at sea, which shall be capable of rapid manipulation and render sea voyages less fraught with such fearful danger and anxiety to ship passengers as the late examples of the Northfleet and Atlantic are justly calculated to inspire. I have been a passenger on the ocean several times during my life, and can readily understand the awful difficulties that have to be contended with in rescuing human beings from shipboard in the face of fire, rock or tempest. In such cases, which generally occur at night, all is darkness and confusion; and, with the exception of a few whose minds, accustomed by training to the sea, comprehend the situation at once and do their duty nobly, all lose their presence of mind and, in their frantic efforts to escape, only hasten their destruction. In such cases, also, time is so short that the attempts made to lower the boats carried by the ship are generally futile. Some of the boats are perhaps found to be leaky and stove in by previous storms, others never reach the sea owing to derangement of their lowering tackle, while the remainder are generally swamped by heavy seas after leaving the wreck. I beg, therefore, to offer to your notice a plan for dealing with this subject, which may or may not be the desideratum sought. If the idea should meet with the approval of the nautical world, who are alone capable of judging as to its character, I shall be happy to furnish full particulars of my proposed plan; if condemned, I shall still have the satisfaction of having endeavored to aid in the cause of humanity.

My plan is as follows: I propose to place on the uppermost after deck of a ship a false deck, in the form of a raft, say 100 feet long from the stern by 45 feet wide, according to the length and beam of the ship, and of suitable thickness, constructed with alternate layers of planking and cork thoroughly secured together, and capable of supporting from 500 to 600 persons without inconvenience. This false deck or raft is to have sides or bulwarks of thin plate iron, in the form of air tight tubes (which might be used for the stowage of provisions and for other purposes); the ends are to be closed with lattice girders or strong wire rope netting. Other suitable gear is also to be provided thereon for the safety of passengers. When not required for use, the raft would simply rest on and form a raised portion of the ship's deck; but in case of accident, I propose to launch it, by simple, powerful, rapid and efficient gearing, from the stern of the ship into the sea.

The following are some of the most important features of my proposed raft:

1. From the nature of the materials used in its construction, as well as from its form and size, the raft would be unsinkable, and could be made of any floating power.
2. In case of fire, the raft could be instantly launched from the stern of the ship and the passengers and crew betake themselves to it.
3. In the case of the ship foundering, the raft would of itself float free from the wreck with its living freight.

It is not my intention, in this short letter, to describe how I propose to secure the raft (when not in use) to the deck on which it is to be placed, or the manner of launching the same, or to meet the many objections which may be justly raised to its adoption, such as the disposition of the wheel-house, mizen mast, skylights, and other impeding gear; these objections, serious as they may appear at first sight, are mere matters of detail which can be easily overcome, and which I am prepared to meet. In case of its adoption, alterations would necessarily have to be made in the disposition of the steam gear of a ship; but the importance of the subject is such that no expense should be spared; and these alterations once made, my proposed raft would form the safest, simplest and most efficient life preserver at sea ever invented.

I beg to inclose my card and to solicit the interest and support of the scientific world in developing my invention.

Toronto, C. W.

EDWARD W. FURRELL, C. E.

Girdled Trees.

To the Editor of the Scientific American:

In your issue of April 19, I find an article headed "A Cure for Girdled Trees," in which a system is shown by which to unite the bark below and above the wound by the use of scions of last year's growth of wood. In my home, the ravages of field mice and rabbits in winter make it a very common matter to have the young trees in our fields and orchards girdled, and the system shown has been tried, but without the best of success, the winds causing the tree to be so shaken as to loosen the scions and prevent the connection from forming between the old bark of the trees. "Necessity, the mother of all inventions," caused me to adopt a plan by which all the evils in your system are overcome, and almost perfect success attained; and as the matter may be of interest to many of your readers, I will describe my system. When a tree is entirely girdled, I cut out, on either side of the stock fixed upon, a space large enough to admit in a limb from $\frac{1}{4}$ inch to 2 inches in diameter, according to the size of the tree, fitting in the parts of the limb to meet the bark both above and below the wound; then with nails suf-

ficiently large, I nail the limb into the tree stock, fastening it securely, using two or more nails, placing three or four of these limb jointers upon each other, according to its size. When this is done, I bank up with soil sufficient to cover the connections, which will be all-sufficient.

In case the wound is should be too high for banking, a mixture of clay and cow dung can be used, being held in place by a canvas covering securely nailed in the tree. This system can be used up to the middle of July.

Tuckerton, Pa.

ADAM DEYSHER.

The Proposed Great Telescope.

To the Editor of the Scientific American:

The limits of size, with our present machinery, are nearly reached by Lord Rosse's six foot, the Melbourne four foot reflectors, and the large silvered glass mirrors of Foucault and Draper; but reflectors are inaccurate and unwieldy.

The world's great lenses comprise at present, to the best of my recollection, a twenty-nine inch, twenty-eight feet focus, by Merz, of Munich, Bavaria, not tested by experts; a twenty-four inch by the same maker; a twenty-five inch by the late Mr. Cooke, of York, England; the new Washington twenty-six inch, by Alvan Clark, of Cambridgeport, Mass.; and the Chicago eighteen inch, by the same maker. The two latter are, perhaps, the best object glasses in existence. The life time of an artist optician would hardly suffice for the slow and toilsome process of correcting, for chromatic and spherical aberration, a single pair of huge lenses, say, six feet in diameter, even if we could obtain the glass. We must, therefore, to make any decided advance in space-penetrating power, divide up our "telescope of the future" into small fragments, much as the Fresnel light-house lenses are built, each portion presenting no great difficulty of construction.

As the subject has been a hobby with me for several years, I will describe a method of constructing a composite telescope of any required power, which presents no difficulty except the cost.

The unit of construction is a stationary, hexagonal fragment of the great telescope lens into which a movable heliostat mirror reflects the object observed. Each part of the lens is of the size and cost of an ordinary ten or twelve inch object glass, and is to be corrected mechanically by a local polisher. The necessary calculations may be made and verified by completing and using Mr. Babbage's analytical engine, which applies the principle of the Jacquard loom to any possible computation.

Supposing ourselves to be in possession of unlimited skilled labor and machinery, with sufficient funds, we select, in the far northwest, an elevation where the sky is generally clear. On its southern slope, we dig and build a tunnel pointing to the pole, 80 feet in diameter at base, and narrowing upwards for nearly a thousand feet. At the upper end of this tunnel is placed the observatory, containing the binocular and microscopic eye pieces of the great telescope, a frame to hold the eye piece in use, and a meridian circle, for time. Outside are buried clocks in air-tight vacuum cases, and electric batteries and wires for adjusting any one of the five thousand prismoidal lenses below, and for moving their mirrors. At the lower end of the tunnel is mounted the great compound lens, and outside of this, the mirror frame. Each mirror is driven westward, against the earth's daily movement, by a spring governor clock, keeping time with its fellows. All are controlled to follow the planets or moon, by a mercurial pendulum clock of absolute perfection. Its wearing parts are faced with boron or iridium, with black diamond bearings. This main driving clock is moved by many water batteries and its electro-magnets, in an exhausted glass case containing rarefied hydrogen and the wires, through which, every second, the clock sends its electric beats. The flat glass heliostat mirrors are coated on their front surfaces with platinum-iridium from the Oregon iron sands, polished to reflect nine tenths of the incident light.

To find a star with our telescope, one has only to move a pointer forward on a telegraphic dial, for the difference between the star's right ascension and the local sidereal time. Each mirror turns on its polar axis, moved by an endless screw, as is the type wheel of the stock printing telegraph, by its ratchet wheel and electro-magnets. At another touch of an index on a second dial, indicating declination above or below the celestial equator, the star flashes into the field with overpowering brilliancy. Touch an index on a third dial, and the mirrors are all clamped and will follow the object round and round the world, and have it yet in view at its third rising.

Such a telescope could be built in fifteen years for inside of fifty millions of dollars. If every part could be kept at a uniform temperature, or compensated, it would enable us to contemplate the moon as from a distance of two miles.

According to the nebular theory, as the outer planets are the oldest, their inhabitants, if such there be, must have developed a civilization far superior to ours. The chief value of such a telescope would be to assist in opening communication with them by means of the ordinary Morse night signal flashes, so that we may learn from their experience instead of slowly evolving the arts and sciences for ourselves.

New York city.

S. H. MEAD, JR.

To the Editor of the Scientific American:

I am greatly pleased to see that there are so many would-be stockholders in the telescope stock company, but the company is not started yet, and so no one knows where he can send his ten dollars. Being the one who started the project, I claim the right to propose some rules, and also to nominate some officers, providing that they meet with the approbation of those who are also interested; and I propose Mr. O. D.

Munn as our president, and Mr. Peter Cooper as our treasurer, both gentlemen being known to be friends of the working man, and to be very popular among the working classes. I hope that they will accept, and also that the nomination will be approved of; for if these gentlemen accept the offices, I will be the first one to buy stock.

I see nothing in our way to prevent us from going ahead with our mammoth undertaking, so let us build ourselves a lasting monument that will be useful as well as ornamental. A million dollars appears to be a large sum, but it will be nothing more than Peter's pence among so many.

I propose that no stockholder shall hold more than twenty shares, so that we small fishes may not be swallowed up by whales; and I hope that all those who are in favor of these nominations will signify their acquiescence in the SCIENTIFIC AMERICAN.

Let us hurry up matters, as there is not much time between now and 1876.

AN OLD MECHANIC.

Hudson, N. Y.

To the Editor of the Scientific American:

I would like to add my mite towards the million dollar telescope. I think the joint stock plan the most practical, and will take at least three shares, and perhaps more, provided they are ten dollars each. Do all you can to make the thing a success, and count on me as an humble supporter.

Hockanum, Conn.

F. C. VIBERT.

To the Editor of the Scientific American:

I go in for the million dollar telescope. At \$10 per share there will be only 100,000 shares; and as everybody wants the telescope, it will doubtless be easy to dispose of all the shares. The idea of a correspondent of allowing each subscriber to use the instrument in proportion to the amount subscribed is capital. But probably not more than two hours out of the twenty-four are suitable for star gazing; and as one half of this time would be consumed in focusing the instrument for different eyes and in looking through the finder, the time allotted to the owner of a single share would be about thirteen seconds a year; and if he did not see much during that time, still he could congratulate himself that he had looked through the big telescope.

Having had in my college days the care of a large telescope, I can say from experience to your correspondents that a telescope in the hands of the unscientific is only a big plaything, with but little play in it. The pleasure derived from manipulating the instrument, with the aid of the *Nautical Almanac*, clock and micrometer, was far greater to me than that of simply gazing at the stars or nebulae. And further: No one who is not perfectly familiar with the management of a telescope should ever be allowed to meddle with one, or hardly to look through it. A big telescope should be approached by the uninitiated with silence, uncovered heads and light steps, but—Hands off!

J. H. P.

A Mysterious Noise.

W. A. M. reports that he recently heard a succession of strange crackling noises out of doors at night; and had great difficulty in finding the cause. The sounds came from some fallen walnut tree leaves, and he naturally expected to find that some species of insect caused the leaves to rustle. "At the next spot where I examined, I closely watched the *modus operandi* and saw the dry, brown leaves gradually curling open, moving like little automata; one, opening, would touch another, and that in turn rolled open, with the peculiar rustling sound that had at first attracted my attention. But there was no worm there. What then was the power that carried on this general movement? Upon meditating a little, the truth flashed upon me; it was simply that the day had been remarkably warm for an April day, and the heat of the sun had warped the leaves, curling them up like a voluta; but as the sun set, the northeast wind had blown the clouds and moisture from the Atlantic, and, coming in contact with the dry leaves, had caused them to uncurl. Thinking that some motion would accelerate their movement, I stamped upon the ground, and immediately the whole garden seemed alive with motion. The occurrence seems of small account, but it illustrates in a perfectly natural way the force and effects of variations in temperature."

Utilization of Slag.

Mr. Woodward, of Darlington, has patented, says *The Builder*, a plan for manufacturing bricks from scoræ, and the system is now at work at the Eston works of Mr. Thomas Vaughan. The slag is taken as it comes from the blast furnace. It runs into a series of molds, placed at regular intervals on a revolving table. After being removed from the molds, the bricks are thrown into a kiln or furnace close at hand, where they are annealed; and afterwards they are used in any ordinary structure for which clay bricks are suitable. The fracture is said to be close and firm, and they are capable of resisting an intense heat. So far as strength is concerned, they will withstand a crushing force of 3 to 4 tons per cubic inch, or four or five times more than that of common bricks. The scoræ brick remains unaffected by exposure to the atmosphere, it is said, but this does not accord with what has been said of slag (used for roads) which is said to contain sulphur, and to be liable to disintegration. This should be disproved, if possible, of the bricks. There is a considerable loss by breakage, but once solidified they are as hard as granite. It is calculated they can be made for 8s. per 1,000, or even less, whereas ordinary bricks cost 20s. and upwards per 1,000. A new company has been formed, on the limited liability principle, to work Mr. Woodward's patent, and they have acquired the right to the slag of all the blast furnaces on the Tees, including those above and below Middlesborough.

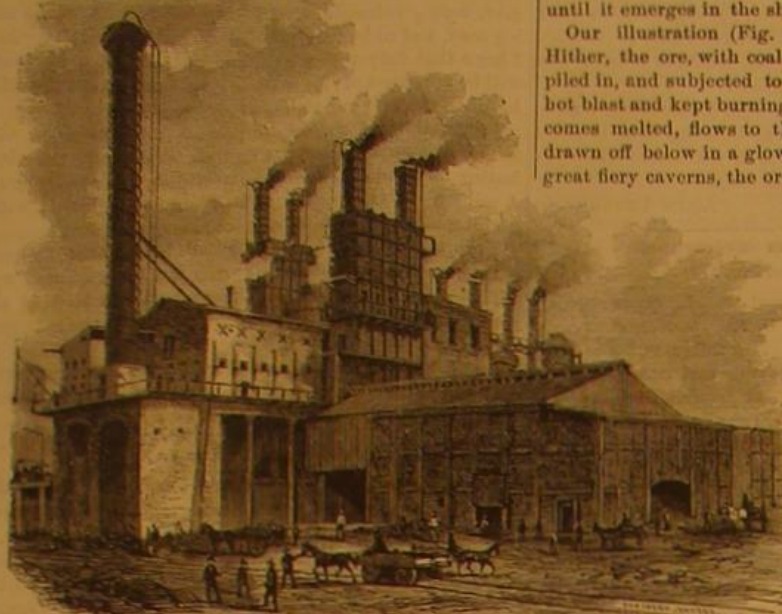


FIG. 1.—THE PHOENIXVILLE BLAST FURNACES.

IRON BRIDGE CONSTRUCTION.

The various processes by which iron is prepared to be used in bridge building are many of them as new as is the employment of this material for the purpose. The subject is



FIG. 6.—BOILING FURNACE.

one of considerable public interest, and hence we extract from an album of designs, recently published by Messrs.

the mine, can be followed through all its transformations until it emerges in the shape of a finished bridge.

Our illustration (Fig. 1) represents the blast furnaces. Hither, the ore, with coal and a flux of limestone, is carried, piled in, and subjected to the heat of the fires, driven by a hot blast and kept burning night and day. The iron, as it becomes melted, flows to the bottom of the furnaces, and is drawn off below in a glowing stream. Into the tops of these great fiery caverns, the ore and coal is dumped, being raised by elevators (Fig. 2) operated by a blast of air, and then thrown in by the men, as shown in Fig. 3. The blast for the furnace is driven by two three-hundred horse power engines, and is heated by the consumption of the gases evolved by the material itself.

The engine room, with its giant machines, forms the subject of our fourth engraving. Twice every day the furnace is tapped, and the stream of liquid iron flows out into molds formed in the sand, making the iron into pigs (Fig. 5). Next follows the boiling process, the furnace being an oven heated to an intense heat by a fire urged with a blast (Fig. 6). The cast iron sides of the furnace are double, and a constant circulation of water is kept passing through the

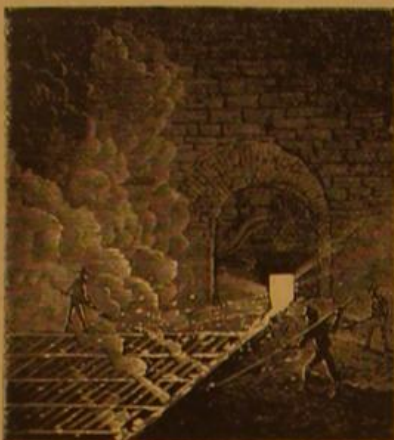


FIG. 5.—RUNNING METAL INTO PIGS.

chamber thus made, in order to preserve the structure from fusion by the heat. The inside is lined with fire

rolling. The rolls (Fig. 9) are heavy cylinders of cast iron placed almost in contact, and revolved rapidly by steam power. The bloom is caught between these rollers and passed backward and forward until it is pressed into a flat bar, averaging from four to six inches in width, and about an inch and a half thick. These bars are then cut into short lengths, piled, heated again in a furnace, and re-rolled. Af-



FIG. 2.—ELEVATOR.

ter going through this process they form the bar iron of commerce. From the iron reduced into this form the various parts used in the construction of iron bridges are made, by being rolled into shape, the rolls through which the various parts pass having grooves of the form it is desired to give to the pieces. These rolls, when they are driven by steam, obtain this generally from a boiler placed over the heating or puddling furnace, and heated by the waste gases from the furnace. This arrangement was first made by John Griffie, the superintendent of the Phoenix iron works, under whose direction the first rolled iron beams over nine



FIG. 8.—ROTARY SQUEEZER.

inches deep that were ever made were produced, at these works. The process of rolling toughens the iron, seeming



FIG. 3.—DUMPING ORE AND COAL INTO BLAST FURNACES.

Clarke, Reeves & Co., the well known iron bridge builders, the accompanying engravings and description, deferring, to a subsequent article, illustration and notice of some of the most remarkable structures constructed at the extensive establishment of the above firm.

The Phoenix Iron and Bridge Works are located in Phoenixville, in the Schuylkill Valley, Pa., and were founded in 1790. At the present time over fifteen hundred hands are constantly employed, and the establishment is probably the only one in the world where the crude iron ore, fresh from

brick, covered with metallic ore and slag over the bottom and sides, and then, the oven being charged with the pigs of iron, the heat is let on. The pigs melt, and the oven is filled with molten iron. The puddler constantly stirs this mass with a bar let through a hole in the door, until the iron boils up or "ferments," as it is called. This fermentation is caused by the combustion of a portion of the carbon in the iron; and as soon as the excess of this is consumed, the cinders and slag sink to the bottom of the oven, leaving the semi-fluid mass on the top. Stirring this about, the puddler forms it into balls of such a size as he can conveniently handle, which are taken out and carried on little cars, Fig. 7, made to receive them, to the squeezers. In the latter (Fig. 8) the ball is placed and forced with a rotary motion through a spiral passage, the diameter of which is constantly diminishing. The effect of this operation is to squeeze all the slag and cinder out of the ball, and force the iron to assume the shape of a short thick cylinder, called a bloom. This process was formerly performed by striking the ball of iron repeatedly with a tilt hammer.

The bloom is now reheated and subjected to the process of



FIG. 7.—CARRYING THE IRON BALLS.

to draw out its fibers; and iron which has been twice rolled is considered fit for ordinary uses. For the various parts of a bridge, however, where great toughness and tensile strength

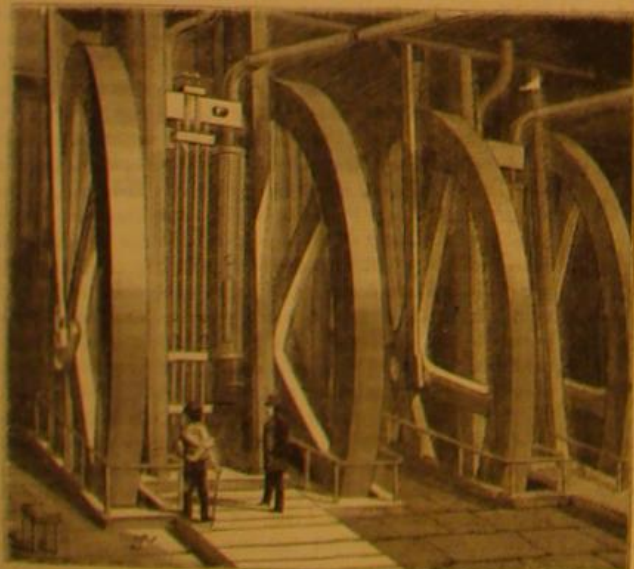


FIG. 4.—THE ENGINE ROOM.

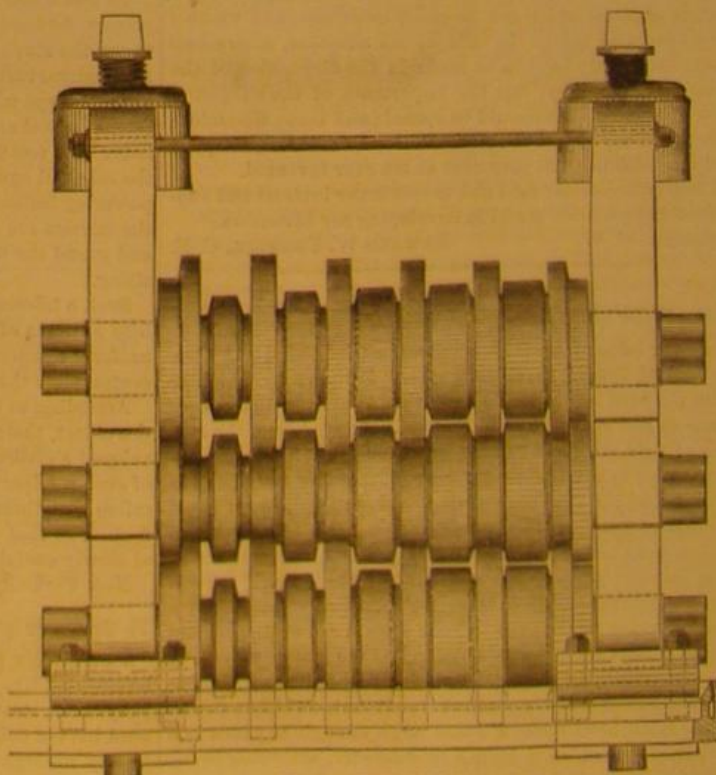


FIG. 9.—THE ROLLS.

as well as uniformity of texture, are necessary, the iron is rolled a third time. The bars are therefore cut again into pieces, piled, re-heated, and rolled again. A bar of iron which has been rolled twice is formed from a pile of fourteen separate pieces of iron that have been rolled only once, or "muck bar," as it is called; while the thrice rolled bar is made from a pile of eight separate pieces of double rolled iron. If, therefore, one of the original pieces of iron has any flaw or defect, it will form only a hundred and twelfth part of the thrice rolled bar. The uniformity of texture and the toughness of the bars which have been thrice rolled

not exceed a certain maximum, usually fixed at ten thousand pounds to the square inch. As the weight of the iron is known, and its tensile strength is estimated at sixty thousand pounds per square inch, this estimate, which is technically called a factor of safety of six, is a very safe one. In other words, the bridge is so planned and constructed that, in supporting its own weight, together with any load of locomotives or cars which can be placed upon it, it shall not be subjected to a strain of over one sixth of its estimated strength.

ways caused by an ill-fitting shoe. So long as a level shoe rests evenly upon the proper bearing surface of the foot, no corn can occur, but when the surface of either foot or shoe is irregular, then the most prominent point of contact is pressed upon unevenly and bruised. A corn is a bruise and nothing more, save that usage has confined the term to bruises of one part of the foot—the angle of sole between the wall and bar. This part of the foot is most liable to injury by uneven pressure, because it is in relation to the termination of the shoe. If the end of the shoe does not reach the extremity of the heel, it forms a point upon which the yield-

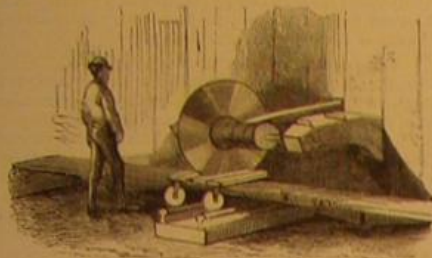


FIG. 10.—COLD SAW.

are so great that they may be twisted, cold, into a knot without showing any signs of fracture. The bars of iron, whether hot or cold, are sawn to the various required lengths by the hot or cold saws, shown in the illustrations, Figs. 9 and 10, which revolve with great rapidity.

For the columns intended to sustain the compressive thrust of heavy weights, a form of the firm's own design is used in this establishment, to which the name of the Phoenix column has been given. They are tubes made from four or from eight sections, rolled in the usual way and riveted together at their flanges (Fig. 12). When necessary such columns are joined together by cast iron joint blocks, with circular tenons which fit into the hollows of each tube.

To join two bars to resist a strain of tension, links or eye bars are used, from three to six inches wide, and as long as may be needed. At each end is an enlargement with a hole to receive a pin. In this way any number of bars can be



FIG. 11.—HOT SAW

After the plan is made, working drawings are prepared and the process of manufacture commences. The eye bars, when made, are tested in a testing machine at double the strain to which, by any possibility, they can be put in the bridge itself. The elasticity of the iron is such that, after being submitted to a tension of about thirty thousand pounds to the square inch, it will return to its original dimensions; while it is so tough that the bars, as large as two inches in diameter, can be bent double, when cold, without showing any signs of fracture. Having stood these tests, the parts of the bridge are considered fit to be used.

When completed, the parts are put together or assembled, as the technical phrase is, to see that they are right in length, etc. (Fig. 15).

ing horn is pressed at every step. Short shoes then are most objectionable, and, we find, a frequent cause of corns. They are often purposely employed on hunters, and on horses with capped elbows, seldom really necessary, but if so, should be very carefully fitted. By way of avoiding corns, it is the common practice of many farriers to "ease the heel of the shoe," that is, to so fit it that the last inch of the shoe takes no bearing on the foot. A space is thus left between the shoe and foot in which one might place a penny piece. This is one of the greatest evils of shoeing, for not only is an



FIG. 12.—RIVETING A COLUMN.



FIG. 13.—FURNACE AND HYDRAULIC DIE.

joined together, and the result of numerous experiments made at this establishment has shown that, under sufficient strain, they will part as often in the body of the bar as at the joint. The heads upon these bars are made by a process known as die forging. The bar is heated to a white heat; and under a die worked by a hydraulic pressure (Fig. 13), the head is shaped and the hole struck at one operation. This method of joining by pins is much more reliable than welding. The pins are made of cold rolled shafting, and fit to a nicety.

The general view of the machine shop (Fig. 14), which covers more than an acre of ground, shows the various machines and tools by which iron is planed, turned, drilled, and handled as though it were one of the softest of materials. By means of this application of machines, great accuracy of work is obtained, and each part of an iron bridge can be exactly duplicated if necessary. This method of construction is entirely American, the English still building their iron bridges mostly with hand labor. In consequence also of this method of working, American iron bridges, despite the higher price of our iron, can successfully compete in Canada with bridges of English or Belgian construction. The American iron bridges are lighter than those of other nations, but their absolute strength is as great, since the weight which is saved is all dead weight, and not necessary to the solidity of the structure.

Before any practical work upon the construction of a bridge is begun, the data and specifications are given, and a plan of the structure is drawn, whether it is for a railroad or for ordinary travel, whether for a double or a single track, whether the train is to pass on top or below, and so on. The calculations and plans are then made for the use of such dimensions of iron that the strain upon any part of the structure shall

Then they are marked with letters or numbers, according to the working plan, and shipped to the spot where the bridge is to be permanently erected.

As an example of the architectural beauty as well as the engineering skill displayed in the manufacture of these fabrics, we give on our front page an engraving of the Girard avenue bridge, in Philadelphia, Pa. Its width is one hundred feet, equal to six railroad tracks. It has three spans of one hundred and ninety-seven feet and two of one hundred and thirty-seven feet, with seven trusses.

Corns in Horses.

There is a wide-spread fallacy that corns usually depend upon some peculiar form of foot, and that with such feet they are, like coughs and colds, almost unavoidable even with the best management. The truth is, that corns are al-

inch of the best bearing surface of the foot unused, but increased pressure is thrown upon the spot where shoe and foot are in contact. Instead of preventing corns, it is a common cause, and why it should be so will be understood when we say that the seat of the corn is about an inch in front of the extremity of the foot, in fact, just at the spot upon which this "eased heel" throws most weight. Corns may be due to an uneven surface of foot, not of shoe, as when the wall at the heels is lower than the bar, in which case a level shoe is almost certain to act as an exciting cause.

Lameness from corn usually shows itself about a week after the horse is shod, depending of course upon the degree of pressure existing. In some cases, however, a corn is the cause of lameness after a shoe has been on for a month or more. This may be due to the shoe having shifted on the foot, or to the growth of horn carrying the shoe forwards and within the wall.

The inside heels of the fore feet are most commonly affected, because the shoes for them are always fitted closer on the inside than the out, and hind feet are hardly ever affected, because the shoes for them are always fitted long and wide.

Let us repeat, a corn is simply a bruise, similar in every way to a bruise of our nails. There is injury to the sensitive parts, followed by discoloration of horn. When a horse is lame, if on removing the shoe and gently trying the foot all round with the pinners, tenderness is shown at the heel, we suspect a bruise or corn. The farrier would at once cut away the horn at the part until he saw it discolored, and then would say he "had found a corn." Imagining this discolored horn to be the offending substance, he would proceed to remove it, layer after layer, until he reached the sensitive and now bleeding tissues. We need hardly point out the absurdity of this practice. The stained horn is simply a sign of injury to the sensitive foot, and the removal of this horn, while it does no good

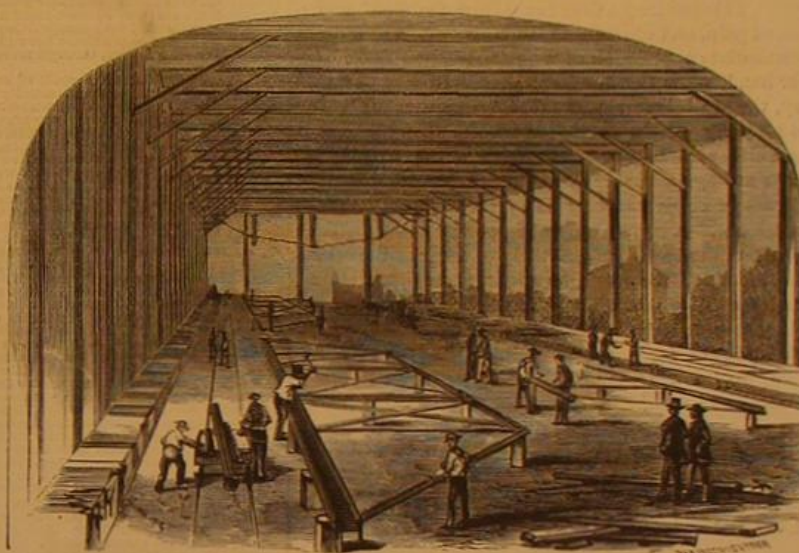


FIG. 15.—ASSEMBLING BRIDGE UNDER SHED

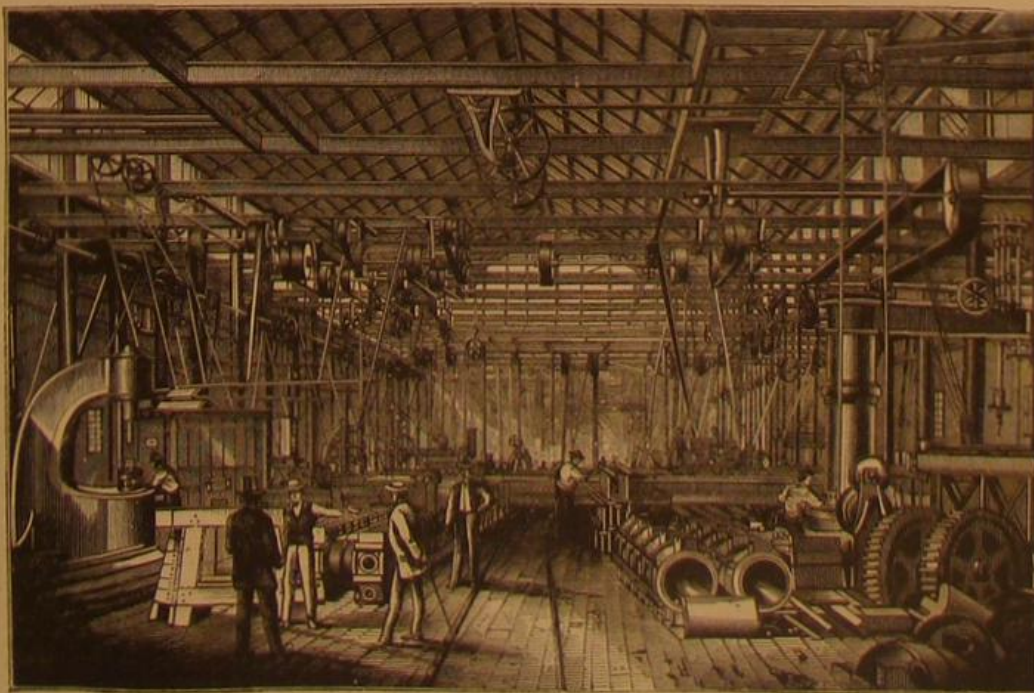


FIG. 14.—VIEW OF MACHINE SHOP

Theodore E. Button, Waterford, N. Y., assignor to himself and L. Button of same place.—The invention consists in the improvement of pipe or hose couplings. The joint where the two pipes are connected may be either ground or packed. A nut, made in two parts, has each part hinged to swivel working on one pipe. The other pipe screws into this sectional nut which draws the pipes together. The two parts of the nut are held together by a ring which is made to fit the conical surface of the outside of the nut. The taper of this surface must be sufficient to allow the ring to be easily pulled off. The ring is provided with lugs to which are attached chains which are made fast to some fixture. Now, by a slight movement of either the coupling or the fixture, the ring is pulled off and the coupling disconnected. Each pipe is provided with a pressure valve. When the pipes are connected these valves are open; but when the pipes are separated, the close automatically or by the pressure.

Improved Railroad Rail Joint.

Thomas V. Allis, New York city.—This invention consists in making, in a rail or other joint in which the rails or bars are subject to expansion and contraction, the holes for the joint bolts of the same size in the crosswise direction of the rails or bars as the threaded portion of the bolts; and said bolts are made as much smaller in the parts which are in said holes as the depth of the grooves of the thread, or thereabout.

Improved Nut.

William Van Anden, Poughkeepsie, N. Y.—Nuts for screw bolts that are made by punching or cutting them from bars of rolled metal have the fiber or grain of the iron disposed diametrically to them in some parts, so that a splitting or bursting strain on the nut acts on the metal in the direction of the least cohesion—that is, transversely to the grain—so that they split open easily. In this invention, before cutting up the rods into the short pieces required for the nuts, they are twisted to cause the grain of the metal to extend in its lengthwise direction from a half to two thirds of a coil around the nut, so as to cross the lines of the bursting strains, or the directions in which these strains act, and thus oppose them in the direction in which the adhesion of the metal is most powerful.

Improved Hydraulic Cane Crusher.

Charles H. Dickinson, Rosedale, La.—The invention consists in the improvement of cane crushers. The cane being dumped from the cart into crushing cylinders, pistons are forced down upon it by hydraulic presses with great force, crushing the cane far more effectually than it can be by the common roller presses, and expelling the juice into the pan below. The pistons are then partially withdrawn; the bagasse is saturated with steam introduced through a pipe for the purpose of dissolving the crystallized particles so that they can be expelled; then the pistons are brought down to act a second time upon the bagasse and expel the remaining portion of the juice or the greater part of it. Water may be used with good results instead of the steam for saturating the partially crushed bagasse, but steam is much more effective.

Improved Window Mirror.

Alfred Olander, Glen Gardner, N. J., and Albert Olander, New York city.—It is quite common in cities to place mirrors outside the windows, so adjusted as to enable persons within to see pedestrians on the sidewalk reflected in the mirror. The above inventors propose an arrangement of a double mirror mounted on vertical pivots at the center, to turn about a quarter of a revolution, so that either side can be used by changing it slightly. For changing it a pull piece is carried inside of the room, connected to the mirror by a bell crank and rods for turning it in one direction, and a spring in the space between the two mirrors acts on one or both of the pivots for turning it in the other direction; and for holding it against the action of the springs, the pull piece has ratchet notches and engages with a catch.

Improved Lady's Work Box.

Wm. Brace, Washingtonville, O.—The invention relates to ladies' work-boxes, in which are kept their spools of different numbers of threads or silks, needles and other matters. It consists in making them portable and easy to be handled, by the construction and arrangement of their parts.

Improved Butcher's Implement.

John Baggs, Easton, Md.—This invention has for its object to furnish an implement, adapted especially for butchers' use, which embodies a knife, jaw, and spring balance, so that meat can be sawn, cut and weighed, at one and the same operation, without removing the hand from the handle.

Improved Dovetailing Machine.

Thomas Colles, Blackstone, Mass.—The invention consists in the improvement of dovetailing machines. The saws are triangular in cross section, with teeth formed on each side, and on the corners. They are fitted in holes through studs, and fastened by binding screws to turn on their longitudinal axes, to adjust them to the work properly. The crank shaft, by which the saws are worked, is arranged at the center, around which the saw gate oscillates in adjusting the saws for working obliquely, and provided with a driving pulley behind the face plate. A scale is arranged on part of the face plate, and an index finger is arranged on the saw gate to sweep it and indicate the degree of the inclination of the saws. Adjustable stops arrest the saw gate at the right points in shifting it forward and back in sawing tenons, the said stops being set by the scale and index at the top, so that the changes, which in this kind of work are of necessity frequent, can be made without reference to the scale. The adjusting screw holds the gate in position after it is adjusted. The studs by which the saws are held are swiveled, to allow them to turn as is necessary for the shifting of the saw gate, and shifted more or less distant from each other according to the distances the notches are to be apart, which vary considerably in the different kinds of work. The saws are only used in the vertical position, and the board is fed to and from the saws obliquely, to form the side, but for cutting the bottom sides it is fed at right angles by the screw. For the direct feed for cutting the bevel edges of the tenons, and the cross or transverse feed for cutting the bottom of the notches, merely two ordinary sets of ways, at right angles to each other, with corresponding feed screws and carriages, are needed; but for the oblique feed for the sides of dovetail notches, the ways can be shifted around obliquely to the plane gang of saws. Mechanism is provided to prevent the table from turning with the carriage and to cause it to keep the work square to the saws. The shifting of the carriage for the bevel sides of the notches is effected by a shaft, turned by hand to screw the feed table forward until it is arrested by a stop coming against a lug; then the feed screw will be turned to slide the work to the left by the carriage to cut the bottoms of the notches, and during this time the shaft will be thrown around to the right to shift the ways around to correspond with the sides of said notches, ready to feed the work back from the saws and from said sides as soon as the limit of the transverse movement for cutting the bottom is reached, and the movement stopped by one of the stop middle pins and a stop; then the board is taken out and the other end presented to the saws, and the work continued by feeding it up.

Improved Plow.

Stephen L. Stockstill, Medway, O., and Henry D. Kutz, Harrisburg, Pa.—This invention is an improvement in the class of plows provided with one wheel, or connected to and supporting one end of an axle having a wheel on the other end; and the improvement consists in the adjustable connection between the axle and plow beam for the purpose of allowing vertical adjustment of the axle.

Improved Cotton Stalk Knocker.

Marcell M. Carruth, Helena, Ark.—This invention is an improvement upon the machine for which letters patent were granted to George Gorman, September 20, 1853; the objects aimed at being to isolate the gearing from danger of contact with the cotton stalks, to secure free space for the operation of the revolving knocker, and also to secure rapid rotation of the latter from a slow forward movement of the machine over the surface of the ground. By suitable construction, as the machine is drawn slowly forward, a shaft is revolved rapidly, and its bars strike, knock down, and break into small pieces the cotton stalks, enabling the plowman to readily cover them with his plow, so that they will fertilize the soil.

Improved Coffee Roaster.

James Hart, Kekoskee, Wis.—The object of this invention is to furnish a simple utensil, by the use of which coffee beans may be quickly roasted, preserving all the fragrant volatile oils, and producing thereby a more aromatic coffee. The invention consists of a lens-shaped metallic vessel provided with a handle and adjustable slide covering the aperture for the admission of the beans, which is slowly turned over the fire till the beans are properly roasted.

Improved Machine for Cutting and Perforating Cigars.

Jacques Levy, Theodore Levy and Armand Levy, New York city.—The object of this invention is to furnish to cigar manufacturers a machine which, by mechanical means, pierces the heads of form cigars, and cuts at the same time the tufts of the same, improving thereby the smoking quality of the cigars and economizing the time consumed in piercing by hand. It consists, mainly, of a working table, to which upright guide bolts or standards are applied, which carry the needle bar, held by strong springs and acting by a treadle connection. The cigar bunches are placed under the needle bar in the form blocks, adjusted thereon, and pierced by the descending needles. A sharp blade at the edge of the table serves to cut the tufts of the bunches when passing the form blocks to the needle bar.

Improved Composition Paint Oil.

James McCafferty, New York city.—This invention has for its object to furnish an improved paint oil, simple in composition, causing the paints to flow freely and dry without scumming or cracking, which may take the place of linseed oil for most purposes, and will be much less expensive. The invention consists of the paint oil formed of resin boiled with oxide of manganese. Boiled linseed oil is then poured in, and the mixture is then taken out and poured into a tank containing refined petroleum oil and dissolved India rubber. The mixture is then thoroughly stirred and allowed to stand for twenty-four hours to settle.

Improved Cutter for Tonguing and Grooving Lumber.

Daniel Perrin, McGregor, Iowa.—This invention has for its object to furnish improved cutters, spurs, or trimmers for matching tongued and grooved lumber, which will enable more and better work to be done with less expense and less wear and strain upon the machine than when the ordinary cutters are used. The invention consists in the cutters for trimming off the sides of the groove and tongue, made of equal breadth with and of half the thickness of the other cutters to adapt them to be used in pairs.

Improved Oil Cloth Printing Machine.

Charles Rommel, Elizabeth, N. J., assignor to himself and Wiener H. Townsend, New York city.—This invention relates to machines which permit the successive printing of oil cloth or other fabrics in different colors, and has for its object the substitution of the hand coloring of the printing blocks, and the adjustment of the fabrics by such means that the whole apparatus may be driven by steam power, and the manufacture of oil cloth and other fabrics be accelerated. The invention consists in the arrangement of suitable coloring rollers with boxes on a spider frame in such a manner that the requisite number of printing blocks are successively colored and the cloth carried forward as soon as the printing of the blocks is completed. The shaft of the printing roller is connected by pawl and ratchet arrangements with the printing bed and movable frame, which regulate the forward motion of the cloth and the return of the supporting frame at the time required.

Improved Animal Cage Trap.

Sylvester W. Rice, Roseburg, Oregon.—This invention relates to a new self-setting animal trap; and has for its object to effect the continuous operation of the trap, and to cause each animal, as it is entrapped, to reset the trap for its successor. The invention consists in providing the trap with a treadle having perforated end plates or gates, which, according to the manner in which the treadle is inclined, close or open the trap at the ends.

Improved Wagon Brake.

William B. Stanley, Groveton, N. H.—The invention consists in the improvement of wagon brakes. By means of short chains, a brake beam is connected with two levers which are pivoted to the reach behind the beam. The connection of the beam with the levers is made with the short ends of the latter; their long ends or arms are by rods connected with a lever which is pivoted to the front of the wagon body. When the lever is swung back by the driver of the wagon, the long arms of the levers will be swung forward and their short arms thereby carried back, so that they will draw the beam back in equal degree on each side of the reach, and thereby firmly apply the brake shoes against the wheels. The rods have parts formed of chains, so that the same can be extended or contracted at will, in conformity with the contraction or extension of the wagon reach, if it should be found necessary to vary the length of the same.

Improved Dentist's Flask.

Clemon Bailey, Kingston, N. C., assignor to himself and H. C. Bailey, of same place.—This invention relates to an improved construction of vulcanizing flask, used by dentists for preparing artificial gums, etc., and has for its object to keep the two parts of the flask properly together, and to obviate the necessity of tightening the connection while the flask is in the vulcanizer, and also to improve the shape and style of the flask. The invention consists in an improvement upon devices which are now in use to contract the parts of a dentist's flask when in the vulcanizer. A semi-elliptic spring, placed on top of the flask and connecting its ends with bars that project from the bottom of the flask, the said bars being secured to the flange under the flask, pulls the two parts of the flask firmly together, even if the other fastenings should, by unequal expansion in heat, fail so to hold the parts together.

Improved Musical Instruments.

Justin Whitney and Horace W. Whitney, Boston, Mass.—This invention relates to musical instruments in which hooks are made to vibrate to produce musical tones. Holes of any shape are bored in a bar or frame, into which the shanks of the hooks are inserted. These shanks are flattened horizontally, so that the bearings will be at right angles to the line of vibration, by which the tendency to produce harmonic tones is lessened. The hooks are of wire, which produces a quality of tone more agreeable than other forms of metal. When double hooks are used, a middle leg is soldered to them in the bow, by which to attach them to the bar, and a support is applied to this shank about midway between the bow of the hook and the bar, the said support being placed on the sounding board, to assist in sustaining the hook and to communicate the vibrations to the sounding board. A load of metal or other substance is also fixed to the bow of the double hook, to destroy the harmonic tone; and the base end of the sounding board is given freedom to vibrate.

Improved Wheel for Vehicles.

Orlando D. Spalding, Mankato, Minn.—This invention consists in the mode of forming an anti-friction bearing for axles. A tube passes through the hub and is fast therein, and at each end of the latter is a casing in which the rollers are placed. A cap screws on the end and confines the rollers. The casings are screwed into the tube, such screw portions of the shells being tubes through which the axle passes. This enables the shell to be screwed tight up to the ends of the hub. The rollers are simple solid cylinders of steel, the diameter of which is just sufficient to fill the angular space in the shell around the axle. The entire bearing at each end of the hub is on the two sets of these rollers. The rollers revolve around the axle as the wheel revolves.

Improved Harvester.

Charles H. McCandlish and John C. Nagley, West Rushville, O.—This invention has for its object to furnish an improved device for supporting the tongue of front cut harvesters to relieve the horses' necks from the weight. The invention consists in the particular means by which the wheel is attached to the tongue. To the upper part of a bar are pivoted the upper ends of other bars, which pass down upon the opposite sides of the wheel, and their lower ends are connected by a bolt which passes through the hub of the said wheel, and serves as its journal. To the lower end of the arm first mentioned is pivoted the end of a short bar which has a number of holes formed in it. The latter passes between the bars, where it is adjustably secured in place by a pin or bolt, which passes through a hole in the bars and through one of the holes in the bar, so that by shifting the said pin or bolt from one to the other of the holes the tongue may be adjusted higher or lower, according to the height of the horses.

Improved Steam Washer.

Charles A. Bradley, Monticello, Fla.—This invention has for its object to improve the construction of steam washers in such a way that the steam and water can only escape through the discharge tube, and cannot escape through the return or ingress openings. The invention consists in the combination of downwardly projecting tubes, made Y-shaped in their cross section, with the ingress openings in the plate of a steam washer. The tubes have holes in their lower ends, and extend to the lower edge of a flange so as to be always submerged, and thus prevent the possibility of the steam or water being forced out through said ingress openings, and insuring its passage through the discharge tube.

Improved Grapple.

John Burkhart, Brookville, Ind.—This invention relates to a new instrument for grappling and supporting heavy stones and other bodies during the building of houses, bridges, walls, embankments, or other structures; and consists in the combination, within a suitable cleft, of a pin or bar of adjustable grappling hooks, so arranged that they can be conveniently shortened or elongated to suit the sizes of the bodies to which they are applied.

Improved Sewing Machine.

John O'Neil, New York city, assignor to himself and E. A. Schenckman, of same place.—This invention consists in a simple and efficient arrangement of gear for working the rock shaft which carries the hook and works the feed. The machine is designed more particularly for securing the wire in the brim of a lady's hat frame. The stand is therefore constructed to allow of presenting the hat frame so as to be properly acted upon. The needle arm has an extension placed below the journals and connected at its lower end with the wrist pin of a drive shaft. This extension is also connected by a rod with a bell crank, which is attached to a block having a pin that enters a slot of the arm in a rock shaft which carries the parts for catching the upper thread, and also the feed operating cams, so that the reciprocation of the block turns the arm and shaft.

Obtaining Sulphur and its Compounds from Gas Lime.

Julius Kireher, New York city.—This invention is intended to provide a simple and efficient means of extracting sulphur, sulphuric acid, and sulphurets of sodium and potassium from gas lime. The lime is heated to 300° Fah. in a closed retort, and steam at 60° Fah. passed over it, evolving sulphuretted hydrogen, which passes to a leaden chamber, and is there ignited with atmospheric air to produce sulphurous acid; it is then mixed with nitric acid vapors, when the reaction produces sulphuric acid. The gas lime is mixed with clay, loam, or sand, and subjected to heat, when the silica or alumina unites with the lime and with oxygen, forming silicate of lime, etc., and liberating the sulphur. To produce the sulphuret of sodium or potassium, the gas lime, etc., is mixed with caustic soda or potassa, and allowed to stand until the reaction takes place.

Improved Manufacture of Gas.

Robert H. Patterson, Hammersmith, England.—This invention relates to the purification of coal gas, used for illumination, by the use of purifying vessels containing alkaline sulphides or sulphur finely divided and mixed with a substance which will permit the gas to pass freely; especially is the presence of this sulphide or sulphurous mixture necessary in the first of the purifiers, called the "decarbonating vessel," the other vessels containing the alkali to be converted into sulphide. The decarbonating vessel is recharged when the mixture therein is saturated with carbonic acid gas, which is indicated by the presence of that gas in the illuminating gas leaving the vessel; and when the gas issuing from the vessels containing the alkali to be sulphuretted shows the presence of sulphuretted hydrogen, the production of the sulphides is complete.

Improved Stop for Water Main Attachments.

William Young, Easton, Pa.—As a cheaper stop for keeping the water back while attaching service pipes to water mains until a connection is made, a pipe connection attached to the main is proposed, consisting of two sections coupled together by a union, with a disk of glass or any substance that will break readily by a crushing force, and packing washers between the two sections, which will stop the water until the connection is made; and then let it flow by screwing up one section against the other, hard enough to break the glass.

Improved Corrugated Metallic Rolling Shutter.

Alexander Clark, London, England.—The object of this invention is to lessen or prevent noise in raising and lowering corrugated metal revolving shutters. The invention consists in applying a soft or pliant material—such as leather, webbing, sheet India rubber, or India rubber tubing—to the shutters and the grooves in which they move. When applied at one or more intermediate points in the width of the shutter, a strip or length of the material is used, fastened at one end to the top and the other end to the bottom of the shutter, and also at any intermediate points, as required, so as to coil up therewith, and form a cushion between the several coils of the metal shutter, and thus prevent the noise produced by the corrugations catching and slipping over one another when the shutter is being coiled or uncoiled. In addition to the said strips the edges of the shutters which move in the grooves are bound with India rubber or leather as well as the grooves themselves. The inventor is a very extensive manufacturer of iron shutters, metallic cornices, etc. The invention just patented is considered a very important improvement.

Improvement in the Manufacture of Acid Phosphates.

Henri Storck and Farnham Maxwell Lyte, Asnières, near Paris, France.—It has hitherto been found difficult to extract, from the phosphoric acid or superphosphate as usually produced, the sulphuric acid employed in the attack. The object of the present improved process is the extraction of this sulphuric acid. The inventors take mineral phosphates, bone earth, or any other form of phosphate of calcium, more or less impure, and treat them with the quantity of sulphuric acid requisite to convert them into phosphoric acid, or a soluble acid phosphate of calcium; the former, remaining in solution, is drawn off. This liquid is now treated with a hydrate of barium, carbonate of barium, sulphide of barium, or any convenient compound of barium, by means of which the sulphuric acid may be withdrawn from the solution of phosphoric acid. Another method consists in forming an acid phosphate of barium, lead, or strontium, and adding this, in sufficient quantity, to the crude phosphoric acid or superphosphate. By either of these means the sulphuric acid contained in the crude phosphoric acid is precipitated, and the purified phosphoric acid or superphosphate may be drawn off by decantation or filtration.

Improved Press.

Warren E. Warner, Syracuse, N. Y.—The top of the press is a broad and strong metal cross head cast in one piece, with holes for the rods, lugs, and sockets for the upper ends of the toggle jointed bars, and with the strong projection from the under side downward from the center for guiding a screw and the ratchet nut. The follower starts level in the beginning of the operation, and does not require the powerful guiding follower stem (commonly used in this kind of press) with the double cross head, between which it works to keep it level at starting, as when pressing cider, hay, and the like. The cavities in the nuts for the round heads of the bars are made so that the heads of the two bars will meet at the bottoms of the sockets which run into each other and roll together, so as to transmit the force directly from one bar to the other, and relieve the nuts of the strain, besides changing the friction from sliding to rolling, and thus economize power and wear.

Improved Station Indicator.

James K. Magle, Canton, Ill.—In this invention an endless belt carries the names of the stations, and works over rollers, one of which is turned by a shaft and wheel connected by suitable gearing with a pin wheel, all to operate by a step piece arranged on the track at the stations, against which one of the pins of the wheel comes, as these contrivances are usually arranged. Mechanism is provided in order to have the pin wheel turn further than it naturally will by the influence of the step against which it comes, so as to have the next pin in advance high enough to clear the blocks in all contingencies when not set to be acted upon by them, and yet come down to a vertical line to be ready for the next step.

Improved Clock Escapement.

Charles Fasoldt, Albany, N. Y.—This invention has for its object to so impart the impulse to the pendulum of an astronomical or other clock that the said pendulum will not receive it directly from the escape wheel, but indirectly by a gravity arm or lever whose oscillations are created by the escapement. In this manner a surplus power may be imparted to the clock without increasing the oscillation of the pendulum, and a complete regulation is obtained. The present invention is based upon the United States letters patent which were granted to the same inventor February 1, 1859, and March 7, 1863, more especially upon the latter.

Improved Dried Fruit Loosener.

Cornelius Hagan, Waterloo, Iowa.—This invention has for its object to furnish an improved device for loosening dried apples, dried peaches, and other dried fruit packed in barrels or boxes. The invention consists of a square steel rod, having its lower part flattened, rolled spirally and pointed and provided with a handle.

Improved Fruit Dryer.

John Stevenson, Sparta, Ill.—This invention consists in a fruit dryer having two separate but communicating chambers, which are provided, one with a series of superposed open frame supports for trays, and with steam pipes arranged beneath the open frames, and the other with a steam cell, which serves to heat the air preparatory to its passage to the drying chamber.

Business and Personal.

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

Wanted—The address of parties who can make first class small iron castings and do galvanizing. Address C. L. T., P. O. Box 773, New York.

Wanted—A new or second hand Pratt & Whitney Shaping Machine, 8 in. stroke. Henry Diestel & Sons, Philadelphia, Pa.

How to draw Gear Teeth, 50 cts. E. Lyman, C. E., New Haven, Conn.

Wanted—A full set of Pail Machinery. Address, with price, V. W. Kelly, Genoa, Ottawa Co., Ohio.

Address Gear, Boston, Mass., for Machinery Catalogue.

The discomfort caused by Rupture can be instantly relieved and soon permanently cured by wearing the newly invented Elastic Truss, which holds the rupture securely tight and day, even during the most violent exercise. Worn with great comfort. It should not be removed till a cure is effected. Sold cheap. Very durable. It is sent by mail by The Elastic Truss Co., No. 60 Broadway, N. Y. City, who send Circulars free on application. —New York Independent, April 24, 1873.

Send orders for the newly discovered Oil Stone of precisely Turkey quality, and for best Mineral Paint, to J. M. Scribner, Middleburgh, N. Y.

C. R. Vincent, 812 Broadway, desires to procure instructions for decorating zinc with colors and configurations. A process is required that shall be durable and permit the bending of the zinc after having been decorated. A satisfactory bonus will be paid for such recipe.

Boiler for Sale—Six horse, upright tubular, 30 in. diameter, 6 ft. high, 32 two in. flues, with gauges and cocks complete. All in perfect order. New, February, 1872. Trump Bros., Port Chester, N. Y.

Ira Bucklin, Lebanon, N. H., wants to know what to put on bait to attract fish.

Buy Gear—New Emery Grinding Machine for Stone purposes, Boston, Mass.

Portable Steam Engines for Plantation—Mining, Mill work, &c. Circular Saw Mills complete for business. First class work. Simple, Strong, Guaranteed. Best Terms. Address the Old Reliable John Cooper Engine Mfg. Co., Mt. Vernon, O.

Abbe's Bolt Heading Machines, latest and best. For cuts, prices and terms, address S. C. Forsyth & Co., Manchester, N. H.

The Ellis Vapor Engines, with late improvements, manufactured by Perkins Machine Company, Fitchburg, Mass.

For the best and cheapest small portable Engine in market, address Peter Walrath, Chittenango, N. Y.

For Circular Saw Mills, with friction feed works, and Stationary Engines, address Wm. P. Duncan, Bellefonte, Pa.

Shortt's Patent Couplings, Pulleys, Hangers and Shafting a Specialty. Orders promptly filled. Circulars free. Address Shortt Mfg. Co., C. R. Hage, N. Y.

New England Band Saw Machines, cheapest and best, only \$457. For descriptive cuts, address S. C. Forsyth & Co., Manchester, N. H.

Grain, Paint, Ink, Spice and Drug Mills, Ross Bros., 35 First Street, Williamsburgh, N. Y.

Drawings, Models, Machines—All kinds made to order. Towle & Unger Mfg. Co., 30 Cortlandt St., N. Y.

Dickinson's Patent Shaped Diamond Carbon Points and Adjustable Holder for dressing emery wheels, grindstones, etc. See Scientific American, July 24 and Nov. 20, 1869. 44 Nassau St., New York.

A Rare Opportunity is offered to Manufacturers of Agricultural Implements, to purchase the Patent and a complete Set of Patterns, including Power and Jack for a Small Threshing Machine, with Eighteen Machines completed and ready for work. For particulars, address Mansfield Machine Works, Mansfield, Ohio.

Key Seat Cutting Machine, T. R. Bailey & Vail. Cheap Wood-Working Machinery. Address M. R. Cochran & Co., Pittsburgh, Pa.

Wood workers—Ask your Bookseller for Richards' Operator's Hand Book of Wood Machinery. 65 cts. Only \$1.20.

Agents' names wanted. Wendell & Francis, 436 Walnut Street, Philadelphia, Pa.

Shaw's Planer Bar—For Shop, County, and State Rights, apply to T. Shaw, 913 Ridge Av., Phila., Pa.

Peck's Patent Drop Press. For circulars, address Milo, Peck & Co., New Haven, Conn.

Royalty—Manufacturers and Inventors, have your Machinery, &c., made in the west for western use. Extra inducements offered by Doty Manufacturing Company, Janesville, Wis.

Iron Ore Crusher Jaws and Plates, Quartz Stamps, &c., cast to order by Pittsburgh Steel Casting Company. All work warranted.

Stave & Shingle Machinery, T. R. Bailey & Vail.

Monitor Leather Belting you can always rely on. Send for Circular. C. W. Army, 308 Cherry St., Phila.

3 Winn's Pat. Improved Portable Steam Brick Machines. Averages 40 m per day. Fully guaranteed. For sale cheap. John Cooper Engine Manufacturing Company, Mount Vernon, Ohio.

Buy First & Prybil's Bandsaw machines, which are more used than any other in the country. Also, Shafting and Pulleys a specialty. 467 W. 4th St., New York City.

Hand Fire Engines, Price \$300 to \$2,000. Also, over 800 different Style Pumps for Tanners, Paper Mills, and Fire Purposes. Address Ramsey & Co., Seneca Falls, N. Y., U. S. A.

The Best Smutter and Separator Combined in America. Address M. Deal & Co., Bucyrus, Ohio.

Steam Boiler and Pipe Covering—Economy, Safety, and Durability. Saves from ten to twenty per cent. Chalmers Spence Company, foot East 9th St., New York—122 N. 3d St., St. Louis, Mo.

Damper Regulators and Gage Cocks—For the best, address Merrill & Keiser, Baltimore, Md.

The Berryman Heater and Regulator for Steam Boilers—No one using Steam Boilers can afford to be without them. I. B. Davis & Co.

Circular Saw Mills, with Lane's Patent Sets; more than 120 in operation. Send for descriptive pamphlet and price list. Lane, Pitkin & Brock, Montpelier, Vermont.

Tree Pruners and Saw Mill Tools, improvements. Send for circulars. G. A. Prescott, Sandy Hill, N. Y.

Brown's Condyard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable. W. D. Andrews & Bro., 41 Water St., N. Y.

Steam Fire Engines, R. J. Gould, Newark, N. J.

Cabinet Makers' Machinery, T. R. Bailey & Vail.

Boring Machine for Pulleys—no limit to capacity. T. R. Bailey & Vail, Lockport, N. Y.

For Sale Cheap—Six Horse Power Portable Engine, mounted on truck, good as new; been used only two months. Address N. Abbott, Mansfield, Ohio.

Five different sizes of Gatling Guns are now manufactured at Colt's Armory, Hartford, Conn. The larger sizes have a range of over two miles. These arms are indispensable in modern warfare.

40 different Bandsaw machines, 60 turning and improved oval lathes, shaping, carving and moulding machinery, for sale by First & Prybil, 461 W. 4th St., New York City.

For best Presses, Dies and Fruit Can Tools, Ellis & Williams, cor. of Plymouth & Jay, Brooklyn, N. Y. Gauge Lathes for Cabinet and all kinds of handles. Shaping Machine for Woodworking. T. R. Bailey & Vail.

Tool Chests, with best tools only. Send for circular. J. T. Pratt & Co., 33 Fulton St., New York.

To Let—For Manufacturing purposes—a brick building 12x20, with Water power 25 H. P. day and night on Morris Canal and Midland R. R., and but a short distance from the D. L. & W. and Erie R. R. Address Box 524, New York Post Office.

Shafting and Pulleys a specialty. Small orders filled on as good terms as large. D. Frisbie & Co., New Haven, Conn.

All Fruit-can Tools, Ferracute, Bridgeton, N. J.

The Berryman Manuf. Co. make a specialty of the economy and safety in working Steam Boilers. I. B. Davis & Co., Hartford, Conn.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrew's Patent, inside page.

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 49 Grand Street, New York.

Machinists—Price List of small Tools free: Gear Wheels for Models, Price List free; Chucks and Drills, Price List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Gauges, for Locomotives, Steam, Vacuum, Air, and Testing purposes—Time and Automatic Recording Gauges—Engine Counters, Rate Gauges, and Test Pumps. All kinds fine brass work done by The Recording Steam Gauge Company, 91 Liberty Street, New York.

The Berryman Manuf. Co. trap excels all others. The best is always the cheapest. Address I. B. Davis & Co., Hartford, Conn.

Absolutely the best protection against Fire—Babcock Extinguisher. F. W. Farwell, Secretary, 407 Broadway, New York.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

A Superior Printing Telegraph Instrument (the Selden Patent), for private and short lines—awarded the First Premium (a Silver Medal) at Cincinnati Exposition, 1872, for "Best Telegraph Instrument for private use"—is offered for sale by the Merchants' Mfg. and Construction Co., 20 Broad St., New York. P. O. Box 6963.

Williamson's Road Steamer and Steam Plow, with rubber tires. Address D. D. Williamson, 23 Broadway, N. Y., or Box 189.

Parties desiring Steam Machinery for quarrying stone, address Steam Stone Cutter Co., Batavia, N. Y.

Notes & Queries.

A. P. asks: Is there an invention for extracting watery matter from meat for the purpose of preserving the meat?

S. A. says: We have serious difficulty in drying glue in making petroleum barrels during hot southerly winds in summer. Can you tell us of any preparation that will facilitate the drying of glue and not injure the oil?

A. E. S. says: I tried to make ink by following the recipe given in a recent number of your paper; but as soon as I put in the bichromate of potash, the water and coloring separated, and no amount of gum would make them unite again. Why did I fail?

U. E. asks: What are the cause of and remedy for the cracking of taps, etc., when in process of hardening in water? Oil will not always make them hard enough. The same trouble occurs with cutters, which crack and split off from the outside circle. It is usually accompanied with a report, especially in the cutters.

C. E. asks: Can you give me a reliable approximation of the horse power required to drive the different kinds of cotton machinery, namely, opening and lapping machines, cards, drawing, coarse, intermediate, and fine spinners, ring spinning, mule spinning, spooling, warping, slashing, weaving, etc.?

D. T. asks: What is the best process for imitating Russia leather?

R. C. K. desires to know the difference of strength, for farm purposes, in ashes made from white wood and from oak, maple, and birch.

J. H. P. asks for a formula for determining with accuracy the contents of a barrel or cask when only partly full.

S. A. T. asks for a recipe for a dead black for making a "black board" on white pine.

S. A. T. says: I should like a recipe for making hard soap for toilet use, say about 25 lbs. quantity, colored and perfumed.

W. H. R. asks: Can magnesium be obtained in a finely comminuted state? If so, where and at what price, and how are its characteristic qualities affected?

W. F. H. asks for the best method of cleaning empty cider barrels so that they will be sweet when wanted for use in the next fall.

J. H. W. asks: 1. If 100 gallons of proof spirit are mixed with 100 gallons of water, what will be the degree below proof and what the gravity? 2. How many gallons of water are required to reduce 100 gallons of spirit of 60 above proof to a spirit 20 below proof? 3. Is there a rule for reducing a high proof liquor with one of lower proof?

B. L. B. asks: Is the temper of steel knives impaired by cutting apples or other fruit? If so, why?

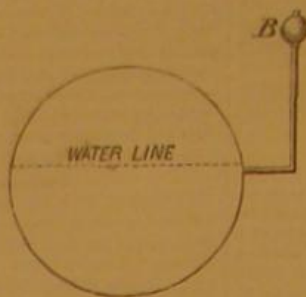
B. L. B. says: I have noticed that my varnish (gum shellac and alcohol), after standing a while in tin cups, becomes of a dark muddy color. Does the tin affect it?

J. W. K. asks: Would there be any advantage in using dry sponge as a filling for waterproof life preservers, rafts, etc.? Could sponge itself be made waterproof, so as to retain the buoyant properties of dry sponge?

Answers to Correspondents.

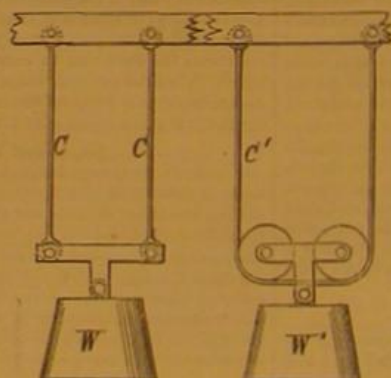
J. B. asks how to prevent food, put in a cupboard newly painted inside and grained outside, from tasting of paint. Answer: Wait till the smell has passed away, which will be when the paint, varnish, etc., are thoroughly dry.

E. J. M. says: Near here was a high pressure steam boiler, with a low water indicator attached, as represented below. During a cold snap, the little globe marked B was found filled with ice, and a piece was broken out. It puzzles us to know how the globe could have been filled with water, when there was nothing to prevent its flowing back to the boiler as fast as condensed. One says the pipe, being only 1/4 inch diameter, filled up and froze first. There's the rub, as how did any more pass, so as to fill the globe? A friend says that he took the indicator down, and that there was nothing in the pipe at all, neither ice nor anything else. Answer: With a small pipe, the water would not be able to circulate within and to allow of the entrance of steam or air to displace it. The pipe should be made at least 1/2, and straight from B down to the lower end.



J. B. D. says: 1. I heard some gentlemen have an argument about the rainbow. P. K. D. says the bow is in the clouds because God put it there, that all the nations of the earth might know that it would not be destroyed by water again. I contend that it is the sun shining on the rain, reflecting on the clouds, because the bow always shows in the opposite direction from the sun. The bow shows more plainly on the sky than on the clouds. I have never seen a bow in the south or north. I once saw a very tall tree fall into a river. The water splashed up about 40 feet high, and came down in a fine sprinkle; there was as fine a rainbow shown as ever I saw. 2. I have heard it said that the machinery of a water mill ran 25 per cent faster in the night than in the day time. The water appeared to be the same. What was the cause of it? 3. I want to know the cause of the knocking in an engine. One engineer says it is in the cross head, another says it was an up and down or side knock in the wrist. Answer: 1. The cause of the rainbow is that supposed by our correspondent. The rays of light from the sun, reflected and refracted by the transparent rain drops, are brought to the eye in such a manner as to cause the beautiful colors that characterize the rainbow. The center of the curve, the sun, and the eye, are always in one line. Hence a rainbow cannot be seen at midday. The moon sometimes causes a rainbow to appear. The physical conditions necessary to produce the rainbow may have first occurred as stated in the Scriptures. Scriptural truths and the truths of nature never conflict, although our interpretation of the former often creates an apparent contradiction. 2. We do not know what is the cause of the phenomenon noted. 3. We cannot guess, but a good engineer should be able to determine by examination.

G. C. H. says: W W' represent two weights of equal height and size; one is suspended by two wire ropes, C, C, the other by one continuous rope C', passing under pulleys with smooth flat faces. Some assume that these methods of suspension are equally strong; others assert that the continuous rope will break quicker at A, than the two ropes, C, C, for reason that the continuous rope is straining apart between the two pulleys.



Which is the strongest, if there be any difference? Answer: There would be no difference in the amount of strain on the rope, and one would be just as likely to part as the other, if the ropes are equally strong. The tension on C' must be equal throughout, at A as well as elsewhere, and equal to that on each part of C.

J. B. P. says: A circular sawing machine, run by one or two men with cranks, has two light balance wheels, 22 inches in diameter. Would there be gain, or loss, by placing a large balance wheel beneath the floor, connected by a belt with the machine? If such a change is advisable, what size and weight of wheel would be necessary? We use an 8 inch saw. Answer: We should not anticipate a gain, and the friction of the added apparatus would cause loss of power.

R. & S. say: We are running an engine 7 inches x 12, cutting off steam at half stroke, and running 175 revolutions per minute; we use a 20 horse power boiler, and carry 70 lbs. of steam. Please state how many lbs. of steam we should carry to give one half of the power as described above, and also how we should run the engine to produce its full power. Answer: Answered in part on page 257 of our current volume. Probably 40 lbs. steam would give about half power. It can only be determined with certainty by the indicator or dynamometer.

E. says: One of our workmen from England gave us the following recipe for removing scale from boilers. Is there anything injurious to the iron or objectionable otherwise? 3 lbs. gum catechu, 3 lbs. black lead, 5 lbs. crystals soda. Answer: The mixture would do no harm, probably, unless when used in excess; the decomposition of the gum should produce vegetable acids. Let us know, if it succeeds, what kind of water you have, and the nature of the scale.

F. O. C. says: 1. I claim that in order to get perfect combustion, you must not admit any more air under or through the fire than it will consume, for if you do, it will tend to deaden the fire, and to lose the heat that you would get if only the right quantity were admitted. A friend claims that it does not matter how much air you admit to the fire, and that all the difference is, that the fire roars under my arrangement and not under the other; but still, he says, the fire is burning just as well as at first. 2. My friend says the classics are the foundation of everything in the matter of learning. I say they are not; and that, if a great part of the time spent on them were devoted to mathematics, mechanical drafting, drawing, natural philosophy and some other practical studies, there would be many less drones in the battle of life, and that we should have many more young men ready and willing to work. Many a father and mother will work to stuff their children with Latin, French and German; and when the parents drop by the way, dead, the children find their stay is gone. 3. My friend says the Christian Sabbath was not changed from the seventh to the first day of the week till a number of centuries after Christ, and that by the Pope. I claim that Christ changed it when He arose from the dead, and that that day was in reality our Sabbath, and that it has been so regarded by historians ever since that time; and that nowhere in the New Testament, after the death of Christ, can you find it mentioned as any other than the first day of the week. 4. On page 251 of your current volume, the directions for making sealing wax do not say what the proportion of shellac should be. 5. A book on astronomy says that light moves 299,000 miles per second; I claim that it is from 188,000 to 192,000. Which is right? Answer: 1. Were it possible to reduce the temperature of escaping gases to that at which they entered the furnace, your friend would be correct. Actually, however, he is wrong. It is, however, found usually necessary to supply about twice the quantity of air required to combine with the fuel, in order that complete combustion may take place. The excess causes some loss, but it is not so serious as would be the loss from incomplete combustion, were a less quantity supplied. About 12 pounds of air per pound of fuel would be sufficient, could time be given it to find and unite with every atom of fuel. It is, however, necessary to supply usually 24 pounds, although in some cases of forced draft the quantity has been brought as low as 15 pounds. 2. To a man of fortune, or to the man who proposes to devote his life to study, we should say that his education would be incomplete did it not include a knowledge of the classics. To the man of business, to the working man, or to any one who must depend upon his own intelligence, energy and education for support and for success in life, we should commend a thoroughly practical, technical course of study. Were we desirous of fitting a son for a high position as a workman, and to take a valuable position as superintendent of a manufactory, we should send him to some such school as the Industrial School at Worcester, Mass. If he aspired to excellence as a professional mechanical engineer, we might give him a higher course of study in such a school of engineering as that of the Stevens Institute of Technology, at Hoboken, that of the Massachusetts Institute of Technology, in Boston, or that of the Sheffield School, at New Haven. To make him a good civil engineer, we should go to a special school of engineering like that at Troy, N. Y. The necessity of such schools has long been seen by us, and in answer to the rising demand they are springing up all over our country. Their success is one of the most encouraging signs of the times. 3. Your friend is about right. The change, however, was a gradual one, beginning with the time of Constantine the Great, in the fourth century. 4. Six ounces. 5. You are right.

E. W. G. says: 1. I have two engines running a circular saw mill. They have cylinders 8x22, set about 5 feet apart and connected by a crank on each end of shaft. The boiler is an upright tubular. The steam pipe is 2 inches, about 30 feet from boiler to near the cylinders; then it branches to each steam chest with 1 1/2 inch pipe. The question is: Is this 2 inch pipe large enough for the main pipe, and the 1 1/2 inch for the branches? 2. The regulator valve is about half way along the main pipe; would it be better nearer the engines or the boiler? 3. My steam gage shows 10 lbs. when at rest, and we usually run the engines at 60 lbs. by it. Do we really have 60 lbs., or only 50 lbs.? Is there any way of adjusting the gage? Answer: 1. We should make the main pipe about 2 1/2 inches diameter, and perhaps 3 inches, if the engine were running at high speed, and the branches 2 inches. 2. The regulator should always be as near the cylinder as possible. 3. Probably 50 lbs. Have the gage tested if you would be safe.

L. P. C. says: I would like to know how large a round chimney would be required for a boiler with 38 three inch tubes. In other words, ought the chimney to contain the same number of inches in its area as the sum of the areas of the tubes? Answer: The chimney is usually made of somewhat less cross area than the collective cross section of the tubes. A common proportion, when natural draft is employed, gives the area over bridge wall one eighth the area of grate, one ninth through the tubes, and one tenth in the chimney.

H. B. B. says: I have a saw mill with 54 inch saw; the engine is of 11 inches bore x 4 feet stroke. There is a drum of wood 12 feet in diameter, connecting with counter shaft, on which is a small drum, 22 inches in diameter, and a large drum about 3 feet in diameter. I use two cylinder boilers, no flues, 34 inches in diameter and 21 feet long, and have considerable trouble in keeping up steam, with wood sometimes partly wet. The smoke stack is of iron, 28 inches diameter and 33 feet long. What kind of grate surface should I have to burn saw dust and wet wood? Would a blast of air or steam help it? Which is best of the two, and at what point and in what way should it be applied? How many revolutions per minute should the saw make cutting soft cypress timber, and how much feed should there be to each revolution? Answer: Run the saw about 60 revolutions per minute. There are many devices for burning wet saw dust and spent tan bark, few of them satisfactory, however. A blast must be used to burn them on ordinary grates, but it is better to make special furnaces for them, with large area of grate, and with provision for drying them before burning, and allowing considerable air to enter above the grate.

S. B. E. asks: What injury, if any, would there be in oiling locomotives and other machinery with hot oil, say at boiling point? Which lens would be best for a miniature bull's eye lantern with very small flame, plano-convex or double convex? Answer: 1. There should be no injury to the machinery from the high temperature, unless where the parts are case hardened. But hot oil has less body than cold, and would be less valuable as a lubricant. Using hot oil would compel running journal brasses quite slack, to prevent binding and overheating in consequence of expansion with the heat. 2. Plano-convex, with plane side toward the source of light.

A. V. K. asks: How can the horse power of a boiler of given dimensions be ascertained? Answer: Already answered in earlier numbers. About one horse power for each twelve feet of total heating surface is a common proportion in the boilers of good builders.

F. M. M. asks: 1. What diameter of cylinder and what length stroke must I give the engine for a horizontal boiler 12 x 30, of 1/2 inch iron, with no flues? The engine is to run 100 to 150 per minute. 2. What pressure can 1/2 inch iron stand, and what horse power would such an engine be? Answer: 1. About a 1 1/4 or 1 1/2 inch cylinder by 3 or 4 inch stroke. 2. It would be safe, if the heads were well secured and work well done, at 175 lbs. 3. Perhaps 1/2 horse power.

H. C. J. asks: 1. Will a boiler, under which there may be the usual amount of fire, make or lose steam if the blow off or safety valve is suddenly opened wide, or the engine started in the same way? 2. Have you ever published a report of a trial in regard to loss of weight and heat in coal from being stored in the open air? If so, please tell me where I can find it. Answer: 1. The rapidity of generation of steam would be temporarily increased by opening the safety valve or increasing the speed of engine. The pressure would not be increased, although the mass of steam in motion may carry a quantity of water with it sufficient to strike a dangerous blow upon any surface against which it may be thrown. 2. We cannot call to mind any such trial.

J. T. says: I cannot understand the answer to the crank question: 1. What do you mean by a line perpendicular to both the lines of the shaft and of the crank? 2. Have I found the proper thickness of cylinders in the two following cases, according to Van Buren's formula, $t = \sqrt[3]{\frac{P \cdot D^2}{1000}}$? A 10 inch cylinder with 90 lbs. pressure, I found to be 0.9 inches, and a 22 inch cylinder with 25 lbs. pressure, 1.27. 3. Please give me a plain, simple rule for obtaining the right size of a wrought iron connecting rod for any pressure of steam, and (4) also the right diameter and length of a parallel wrought bar to resist any pressure without deflection. 5. Please let me know where you get the 806,000 when calculating the collapse of flues. 6. How does Van Buren arrive at his formula? In your answer draw all your reasoning right from the foundation or the strength of the material, so that I may know where and how every number is found. Answer: 1. Put on another crank at right angles to the first, and it will be at right angles both to that crank and to the line of shaft. 2. We make $\frac{P \cdot D^2}{1000} = 0.9$ and $\frac{P \cdot D^2}{1000} = 1.27$ for the two examples. 3. We know of no simpler rule than that given by Professor Thurston, in an approximate formula: $d = \sqrt[3]{\frac{P \cdot D^2}{1000}}$. Rule: Multi-

tiply together the square of the diameter of cylinder in inches, the maximum steam pressure, and the square of the length of the rod in feet, between centers; divide the product by 30,000 and extract the fourth root of the quotient. Add $\frac{1}{4}$ inch, and the result is the diameter of the rod in inches at its middle. 4. No rod can be made to bear any pressure with absolutely no deflection. 5. 806,000 is a coefficient derived by Mr. Fairbairn from experiment. 6. Van Buren's formulas are based upon the results of experiments made by trustworthy authorities, and by comparison with the experience of practical application.

J. G. H. says: I am using 3 plain cylinder boilers for grinding purposes, with a plain slide valve engine which works very well. The objection is that we use too much wood. Two of the boilers are side by side; the third is separated by a brick wall, and so constructed that we can shut off the feed water and steam connections, and use 2 boilers only; but we cannot keep up steam unless we have the best wood. What I wish to know is: Would it be safe to leave, and should I gain power by leaving, the steam pipe open from the boiler, with the feed pipe shut off and no fire under it? Would it answer for a steam dome, it being level with the boiler, or would it be dangerous and disadvantageous? What is the cause of the smoke stack getting red hot? It is 3 inches in diameter, of 1/4 inch iron, 25 feet long horizontally, then 4 feet high. Answer: The trouble is, first, that a plain slide valve is not an economical arrangement, although eminently satisfactory on the score of expense for repairs. If it has lap enough to cut off at about two thirds stroke, and both piston and valves are tight, nothing can be done to improve it, probably. If the steam pipe and cylinder are lagged, to prevent radiation of heat from them, the exterior is probably all right. The boilers have too little heating surface in proportion to the amount of wood burned, and therefore cannot absorb the heat generated, which consequently escapes through the smoke stack, heating it as described. More heating surface is wanted. The arrangement proposed to increase steam space would, probably, simply result in filling that boiler with water from condensed steam and priming. It would be better to keep both steam and feed pipes open, but even then we should not expect, on the whole, an advantage.

H. T. L. asks: How can I estimate centrifugal force? For instance, what will be the centrifugal force of a one pound weight, revolving at 100 revolutions per minute in a 4 foot circle around a perpendicular shaft, and what is the rule by which I can get at the force of any weight at any speed in any circle? Please give me an arithmetical answer, as I do not understand algebra. Answer: Multiply the square of the number of revolutions per minute by the radius of the circle in which the body swings, and by its weight in pounds, and divide the product by 100,000. Thirty-three times the resulting figure will be the centrifugal force in pounds. This rule, expressed algebraically is: $F = \frac{W \cdot R \cdot N^2}{100000}$. In this case, $F = \frac{1 \cdot 4 \cdot 100^2}{100000} = 0.4$ lbs. If our correspondent were to take the time and do some hard work in learning the principles of algebra, he would never regret such use of his time. A little patience and earnest effort would accomplish a great deal even without teachers.

W. W. says: 1. My employers and I appeal to you to decide a question about the horse power of a first class horizontal steam engine, cutting off steam at a point that will give it the most power. The size of cylinder is 10x18, pressure of steam 60 lbs. at boiler; the engine runs at 80 revolutions per minute, or 240 feet speed of piston; there is a 2 inch steam pipe 8 feet long. We are about ordering a new engine of a good firm, whence this dispute has arisen. I maintain it will give us nearly 20 horse power, if properly constructed. They say I am greatly in error in overestimating it. I also maintain that, if we speed it up to 100 revolutions, it will give us 21 horse power. 2. I would also like to know your opinion as to the most economical coal to use under a 25 horse power boiler (tubular) with a good draft. We are using large Lehigh. It is thought that a cheaper coal would be better. Answer: 1. We think our correspondent right on the question of power. 2. It is generally economy to use the best coal. The difference in price is amply sufficient to compensate for the difference in heating power, and for the annoyances attending the use of poor coal.

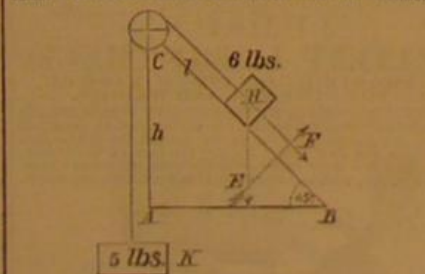
C. S. C. says: I have a small English toy locomotive, and I cannot make it go. It is eighteen inches in length, and runs on eight wheels; two of them are the drivers. The cylinders are about two inches, and oscillate from the end. The trouble is, as follows: When I get up steam sufficiently to run it, I turn on steam, but the engine will not go; if I lift it up so that it will not touch the track, the wheels go around with lightning speed; but as soon as I let it down on the track, they stop. I always keep on sufficient quantity of steam. Can you suggest a remedy? Answer: Probably the valve may be set with too much lead.

D. K. asks for an explanation of the phenomena of polar attraction and magnetic variation. In this latitude, 40° N., variation west has increased 1' in fourteen years. Why is it that the annual precession is not the same everywhere? As you are supposed to know everything, I think that you can give a more satisfactory explanation than can be found in ordinary treatises on surveying. Answer: The directions of the magnetic and the geographical or true meridian do not coincide because the geographical and magnetic poles are many miles apart. The variation is westerly in the eastern states, and easterly in the western states. The line of no variation is nearly straight, passing in a north northwest direction from the extreme eastern point of South America, through Cape Hatteras, Cleveland, O., and Erie, Pa. The changes of variation are secular, annual, diurnal, and irregular. The latter may be comparatively great, are liable to occur at any time, and are subject to no known law. The diurnal change, though small in amount—a quarter of a degree at most—is quite enough to produce annoying differences in surveys of the same line taken at different times of the day. This change of a quarter degree amounts to about 25 feet in a mile. Annual changes of this diurnal variation are noticeable, this change being twice as great in summer as in winter. The secular variation extends over a period of centuries, and the amount of this change is, in Paris, where it has been longest observed, over 34 degrees. These changes correspond to and accompany the solar movements. The irregular are frequently—although not invariably—produced by solar phenomena. The diurnal accompany the rotation of the earth, which thus presents its sides successively to the sun's rays; the annual follow the motion of the earth in her orbit, and the secular probably have a close correspondence in period with secular changes in the relation of the sun and the earth. These variations have different magnitudes at different points on the earth's surface, in consequence of the fact, already stated, that the geographical and magnetic poles and meridians do not coincide; and hence, while the needle at Cape Hatteras may point north, at the north pole it would point south. The north magnetic pole is in 70° N. lat. in the Earl of Ross Strait. If our correspondent will trace meridian from it on a globe, he will readily solve all the problems which occur to him.

J. R. L. says: We have a gin connected with our mill. Is it possible to extinguish fire in a lint room with steam? If so, how should it be applied, with stationary pipe entering at bottom or top of room, or with hose? We only use forty pounds steam when ginning. 2. In cleaning out the furnace, I notice drops of water standing at one seam of boiler; is that a sign of rust or burning? It is clean and smooth inside. No water runs after the fire is started. Answer: 1. Steam will extinguish fire in a lint room, or in any other apartment where it can be sufficiently well confined to thoroughly pervade the enclosed space. It would be best applied by leading pipes into the room and making them fixtures. In an emergency a hose pipe could be thrust through a small hole cut in the door or a partition, and steam carried by hose, of gum or well greased leather. The nozzle should, of course, be covered with canvas or other covering to enable it to be handled. Forty pounds pressure, or even four, would be ample for the purpose. 2. No.

H. S. M. wishes to know where an indicator can be purchased, what it will probably cost, how it should be applied, and what the result will be. Answer: A treatise upon the construction, method of application, and the interpretation of the diagrams obtained by the steam engine indicator, would occupy far too much space for our columns. We have prepared a brief sketch for the general reader, but for such full accounts as every engineer should make himself familiar with, our correspondent must consult some such work as that of Chas. T. Porter on the Richards indicator, to be obtained through any bookseller. The instrument can be purchased of Elliott, of London, or of the dealers in engineers' supplies in New York or Boston. A pair of good instruments cost about a hundred dollars.

C. B. N. sends the following solution of the problem proposed by E. C. M., who said: "A body weighing 5 lbs. descends vertically and draws a weight of 6 lbs. up a plane whose inclination is 45°, and wishes to know how far the first body will descend in ten seconds." Let ABC, in the figure, represent the inclined



plane, and H and K the weights, joined by a cord which works over a pulley at C. Let l = length of the plane, h = height of the plane. From H draw a line HE, perpendicular to AB and let H represent the pressure of the weight at H. Then resolve H E into components, H F and F E, parallel and perpendicular to B C. The component F E will be counteracted by the reaction of the plane and only the component H F will produce tension on the cord. To find the value of H F, we have, H E : H F :: 1 : h; or 6 : H F :: $\frac{1}{\sqrt{2}}$: $\frac{1}{\sqrt{2}}$; or H F = 6. To find the acceleration of the descending weight at K, we have the general principle that the mass multiplied by the acceleration is equal to the moving force; or, representing the acceleration by a , $M \cdot a = f$, or $a = \frac{f}{M}$. (1.)

In this case, f , the moving force, is the difference between the weight at K and H F, or $f = 6 - 6 = 0$. (2.) The whole mass moved is equal to the sum of the weights K and H F divided by g ; or, since $g = 32$ feet at New York, $M = \frac{6 + 6}{32} = \frac{12}{32} = \frac{3}{8}$. (3.) Substituting the values of f and M (equations 2 and 3) in equation 1, we have $a = \frac{0}{\frac{3}{8}} = 0$. (4.) Again we have from the

laws of falling bodies that the space through which the body falls is equal to the acceleration multiplied by the square of the time and divided by two, or $s = \frac{1}{2} a t^2$. Substituting in this the value given for t ($t = 10$ seconds) and the value of a from equation 4, we have: The distance = $\frac{1}{2} \times 0 \times 100 = 0 = 181.5$ feet. The principles involved in this problem are substantially the same as those upon which the action of the well known Atwood's machine is explained.

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

H. W.—Both are crystalline hornblende, of no value.
T. F. A.—Iron pyrites, of no value.

COMMUNICATIONS RECEIVED.

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

On Fast Side Wheel Steamers. By M. N. L.
On the Million Dollar Telescope. By O. M. and by F. C. V.
On a Vacuum Balloon. By F.
On Deep Sea Soundings. By H. N. C.
On Increasing the Crops. By A. W.
On Diving Bells. By Q.
On the Wheel Question. By H. S.
On the Aurora Borealis. By A. C. C.
On Air and Gas Engines. By F. G. W.
On Sugar Boiling Apparatus. By A. W. J. M.
On Plows. By L. L. B.
On the Sea Urchin. By P. S.
On Tannate of Soda. By N. S. T.
On a Boiler Explosion. By W. J. S.
On Deep Sea Soundings. By A. R.
On Science and Revelation. By J. W.

Also enquiries from the following:
E. J. M.—S. W. J.—E. W.—G. W. T.—H. N. J.—A. R.—D. J. R.—L. P. A.—C. F. S.—G. F. M.—C. M. B.—M. K.—C. K. C.—B. H. 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

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EXTENSIONS GRANTED.

23,730.—ANIMAL TRAP.—A. S. Blake.
23,731.—CUTTERS, ETC.—W. E. Lockwood. Three patents.
23,732.—GAS PIPE CUTTER.—J. E. Starwood.
23,735.—PUMP BOX.—F. & J. Stock.

DESIGNS PATENTED.

6,591.—CARPET.—J. Fisher, Enfield, Conn.
6,592.—COFFIN HANDLER.—N. Hayden, Essex, Conn.
6,593.—COFFIN.—H. Horan, Newark, N. J.
6,594.—BED OIL CAN.—J. R. Lomas, New Haven, Ct.
6,595.—CARPET.—L. G. Malkin, New York city.
6,596.—CARPET.—E. J. Ney, New York city.
6,597.—CARPET.—H. Nordmann, New York city.
6,598.—FRAME.—R. H. Slusser, L. Pearson, South Bend, Ind.
6,599.—CARPET.—J. H. Smith, Enfield, Conn.

TRADE MARKS REGISTERED.

1,218.—SOAP.—H. W. Bell & Co., Buffalo, N. Y.
1,219 to 1,222.—WHISKIES.—Du Vivier & Co., N. Y. city.
1,223.—HAIR DRESSING.—E. A. E. Meyer, Watertown, N. Y.
1,224.—COSMETIC.—Miller Brothers, New York city.
1,225.—YEAST POWDER.—Preston & Merrill, Boston, Mass.
1,226.—STARCH.—Proctor & Gamble, Cincinnati, Ohio.
1,227.—CIGARS.—Seidenberg & Co., New York city.
1,228.—MINERAL WATER.—A. L. Kane, Milwaukee, Wis.
1,229.—FLOUR.—Jones, Williams & Faxon, Boston, Mass.
1,230.—GRINDING MILLS.—Straub Mill Co., Cincinnati, O.
1,231.—OPERA GLASSES, ETC.—Sussfeld & Co., N. Y. city.

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VALUE OF PATENTS

And How to Obtain Them.

Practical Hints to Inventors

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Large inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years they have acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents better and cheaper than any other reliable agency.

HOW TO OBTAIN PATENTS

This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A positive answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them; they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct: Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of \$5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

Reissues.

A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

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Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1851 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension except by special agreement. The Government fee for an extension is \$100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row, New York.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is \$10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

Design Patents.

Foreign designers and manufacturers, who send goods to this country, may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

A patent for a design may be granted to any person, whether citizen or alien, for any new and original design for a manufacture, bust, statue, alto relievo, or bas relief, any new and original design for the printing of woollen, silk, cotton, or other fabrics, any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

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On the first of September, 1872, the new patent law of Canada went into force, and patents are now granted to citizens of the United States on the same favorable terms as to citizens of the Dominion.

In order to apply for a patent in Canada, the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

The patent may be taken out either for five years (government fee \$20), or for ten years (government fee \$40) or for fifteen years (government fee \$60). The five and ten year patents may be extended to the term of fifteen years. The formalities for extension are simple and not expensive.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

All persons who desire to take out patents in Canada are requested to communicate with MUNN & Co., 37 Park Row, New York, who will give prompt attention to the business and furnish full instruction.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

Foreign Patents.

The population of Great Britain is 51,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, when business is dull at home, to take advantage of

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Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

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MUNN & Co. will be happy to see inventors in person, at their office, or to advise them by letter. In all cases, they may expect an honest opinion. For such consultations, opinions, and advice, no charge is made. Write plain; do not use pencil or pale ink; be brief.

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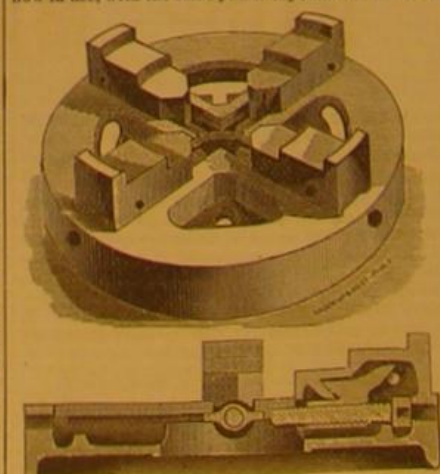
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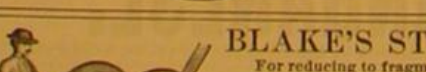
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SCIENTIFIC AMERICAN

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(NEW SERIES.)

NEW YORK, MAY 31, 1873.

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IN ADVANCE.

GRAIN BINDER ATTACHMENT TO HARVESTERS.

We present, in the accompanying illustrations, a new attachment for binding grain on the harvester, immediately after it has been cut, which, it is claimed, operates without any more attention than is necessary to throw the twisting and binding mechanism into or out of gear. The sheaf is held in jaws until a band is twisted from a portion of its straw, then it is turned, rotated, and the band wound around it, secured, and finally the finished bundle is released from the machine.

Fig. 1 is a perspective view, showing more particularly the devices for holding and manipulating the sheaf. Fig. 2 represents the band gatherer and twister, and Fig. 3 a section of the bundle with the straw rope partially around it. The rake is arranged on the endless chain, A, operated by means of the gearing at H, Fig. 2, in the platform of the harvester. The latter rests on drawing wheels and has suitable cutter and finger bars, with mechanism for operating and adjusting the same. The sickle is placed at B, Fig. 2.

In describing the essential portions of this invention, we shall first refer to the twister, depicted in our second figure. On the ends of the rake platform is supported a longitudinal, horizontal frame, C, for the purpose of holding and guiding a sliding carriage, D. A horizontal shaft, E, is hung lengthwise in this frame and connected by the gearing, F, with the driving mechanism. G is a bevel pinion, which, while fitted upon the shaft, E, so as to slide freely thereon, is connected so as to revolve with it by means of a groove and feather. Between the pendent arms of the carriage, which are fitted over the shaft, E, there is arranged upon the latter, besides the pinion, G, above referred to, a frame, I, and between the parts of this frame another pinion, J, which, with regard to the shaft, E, is connected in the same manner as the first mentioned pinion. The pinion, G, meshes into the teeth of a bevel gear wheel, K, mounted upon a vertical shaft that hangs in the carriage. Loose upon this shaft is a pinion, L, which engages with the teeth of the horizontal rack shown, as constituting a part of the frame, C. Whenever, by means of the clutch, M, the pinion, L, is thrown into gear it will, by its connection with the shaft, E, be revolved and roll on the rack, imparting longitudinal motion to the carriage. In place of this arrangement of rack and pinion, the inventor states that an endless chain may be substituted, thus accomplishing the same object with less working parts. The pinion, J, by the intermediate gearing represented, actuates a horizontal shaft, N, hung in the frame, I, the rear end of which, O, carries a series of hooks or other projections for twisting the straw. The frame, I, is either suspended directly from and hangs with the shaft, N, beneath the shaft, E, or it may be swung to one side by a suitably arranged lever fitting against a rail in the frame, C. By means of a clutch, at P, Fig. 1, which connects with the system of gearing, F, the above described apparatus may be readily thrown into or out of use.

To the rear end of the rear platform, Fig. 1, and about in line with the frame, C, is pivoted a horizontal plate, Q, which is the bed for the sheaf holder. This plate, for purposes to be described, can be swung in a longitudinal direction, as in Fig. 2, or laterally, as in Fig. 1. Above the pivot, and affixed to the plate, is a vertical ring, R, above which again is the turrel, S, surrounding an upright shaft, T, Fig. 2, which is in

line with the pivot, and which supports two horizontal bevel wheels, as shown. The lower bevel wheel engages with a similar wheel which is on a horizontal shaft, U, which has its bearings in the plate, Q. The upper bevel wheel meshes into another mounted on a horizontal shaft, V, Fig. 1, hanging in the frame of the harvester proper. By means of the clutch, at W, the wheel on the shaft, U, is thrown into or out of gear. X is another shaft connected with the shaft, U, by the vertical gearing shown, which is in line with the center of the ring, R, and holds a pair of jaws, Y Y, which ex-

same into a band, as represented in Fig. 2. When the carriage has traveled far enough to form a rope of requisite length, the clutch, M, strikes a suitable stop, and is thrown out of gear to release the pinion, L, and arrest the longitudinal motion of the carriage. The wheels, C', are now thrown into gear with the wheel, B', so as to turn the turrel and with it the plate, Q, and entire cradle at right angles to the frame, C, as in Fig. 1. The pendent frame, I, is then, by suitable mechanism, swung outward into position, and so supported, by a lever before mentioned, that the shaft, N, holding the

band, is thereby thrown higher and in proper line with the middle of the sheaf. The clutch, W, is next moved to throw the shafts, U and X, into gear and have them revolved. Thereby the sheaf is rotated in the direction of the arrow, Fig. 3, winding the band around it and pulling at the same time the carriage, D, back. The end of the band is then tucked under by the tucker, D', Fig. 1, which consists in a slotted plate connected with a lever and arranged in the position shown. When the lever is swung, the end of the tucker, forming a claw for embracing the band, is carried down and ahead, and thus operated. The slide, A', is next moved to open the jaws and discharge the sheaf, the cradle is swung round into line with the frame, C, to receive grain for another sheaf, and the lever holding the shaft, N, outwards, is tripped so as to allow the pendent frame, I, to come in line with the center of the cradle for forming another band.

Patented through the Scientific American Patent Agency, May 30, 1871. For further particulars address the inventor, Mr. Charles G. Dickinson, Poughkeepsie, N. Y.

GRAIN BINDER ATTACHMENT FOR HARVESTERS.

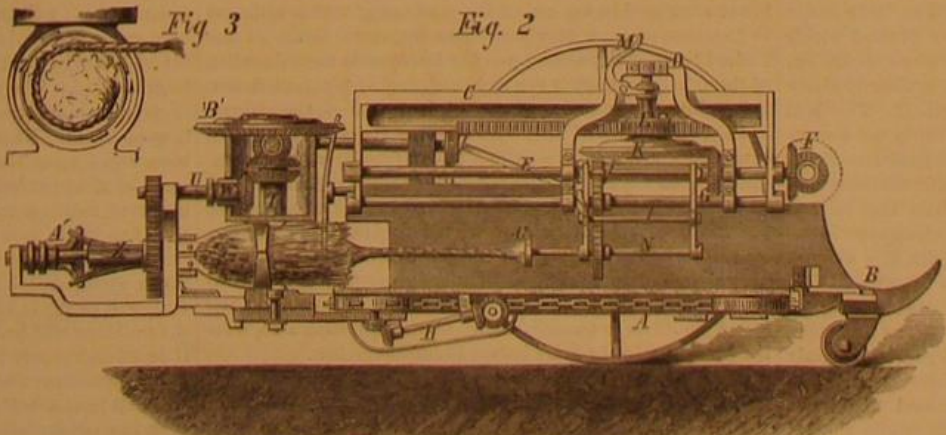
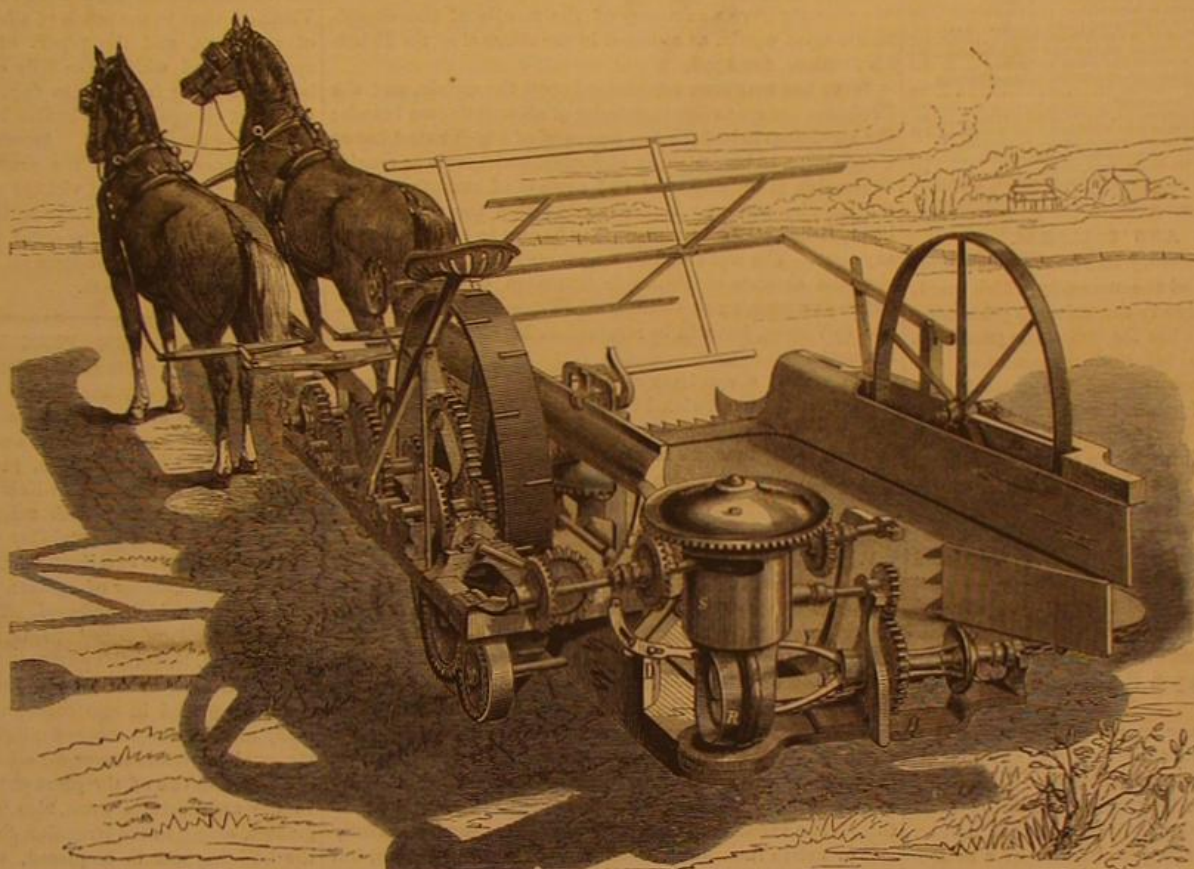
tend within the ring, holding curved clasps, Z, Fig. 3, within the same. On the shanks of these jaws is fitted a slide, A', Fig. 2, by means of which they can be opened or closed at will. On the upper part of the turrel is shown a large bevel wheel, B', with which the wheels, C', on the shaft, V, engage whenever the turrel, and with it the plate, Q, is to be turned. When the wheels, C', are not in gear, but the shaft, V, is rotated by suitable connection with the main driving gear of the harvester, and the lower bevel wheels on the upright shaft within the turrel is in action, the motion of the shaft, V, is transmitted to the shaft, X, and jaws, Y.

Agency, May 30, 1871. For further particulars address the inventor, Mr. Charles G. Dickinson, Poughkeepsie, N. Y.

New Watering Cart.

A new watering cart, or van, has lately been put in operation in London. It consists of an iron tank, 7 feet 3 inches long, 4 feet 6 inches wide, and 2 feet 6 inches deep, which holds 450 gallons of water. The tank is mounted on springs and carried on four wheels with light hinged shafts, and the whole of it is painted in bright colors. The distributor and branch pipe are on the improved principle, which admits of the outflow of water being regulated to meet the varying conditions of streets and weather. An interesting competitive trial has taken place in Regent street between this machine and the old watering cart. The pair were filled, and started from a stand post by Hanover church, and the object was to ascertain the area of ground the water from each would cover. The two vehicles proceeded on their way towards the Regent circus till they reached Newman's yard, where the cart, having made all the running it was capable of, "compounded," while the van, "still going well within itself," proceeded as far as the circus, and returned up Regent street to Air street, where it finally gave out. The width of spread of the water from the van was twenty-three feet, that of the water from the cart being sixteen feet. By measurement of the plans at the Vestry Hall after the trial, it was ascertained that the van had traveled 2,640 feet, and had spread its water over an area of 60,720 square feet, while the cart had traveled only 1,440 feet, and had covered only 23,040 square feet. The older machine has thus been signally defeated by its youthful rival.

According to Dr. Wallace, of Glasgow, the mortar used in the construction of the great pyramids of Egypt was composed chiefly of plaster of Paris—hydrated sulphate of lime



The above details being understood, the operation of the machine is readily followed. Grain enough for one sheaf is, by the rake on the chain, A, swept into the cradle while the same is in line with the frame, C, so that the straw will be held in the jaws, Fig. 2. Then the carriage, D, is thrown into action by the clutch, at P, so that it will move forward on the rack; but before so moving the pendent frame, I, hanging straight down, has the hooked end of its shaft, N, inserted in the butt end of the sheaf and revolved. As the carriage is moved ahead, the twisters continue to revolve and draw straw from the center of the sheaf, twisting the

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MINING SCHOOLS AND COLLEGES.

In view of the vast and apparently inexhaustible mineral wealth of the United States, and the necessity which manifestly exists for wider knowledge in the sciences pertaining to its exploitation, the question has for some time past been under discussion whether the future development of our mines would be materially promoted and the great industries which are based thereon furthered by the establishment of a national school, under government auspices, which should form a nucleus for all information relating to mining pursuits, and thus afford to the student an education which, for practical value and extent, could not be gained in smaller and less favored institutions. The project is one which has met with much approval from a large class who, convinced that the inculcation of sound principles relating to the profession of the mining engineer could be best thus effected and that the present tendency toward wasteful and reckless systems of mining could be thus in a measure averted, have strenuously urged the matter upon the consideration of the general government.

While admitting that such a scheme, based on so broad a foundation, is by no means destitute of material advantages, it nevertheless appears to us more probable that the benefits sought can be attained with greater surety through the establishment, in preference, of local schools of a similar nature. It cannot be doubted that the proper situation of a national institution would form a matter of discussion, and perhaps remain always a mooted point: one, indeed, which would inevitably give rise to sectional dissension between the advocates of the coal pits and the gold mines, the Atlantic and the Pacific slopes.

This, however, aside, it is questionable whether a single institution, necessarily widely separated from the majority of its points of advice, would be able to receive, ordinate and apply information gathered over so large and diverse an area with that efficiency which could be secured in smaller colleges located directly upon the field. Clearly, we think, the latter would in this particular have as decided an advantage as the present numerous local weather stations would possess over a single central bureau for the study of meteorology. The nature and situation of our mines, their mode of exploitation, and the treatment of their several yields widely differ. In varying localities, even where ores are extracted for the same metal, it is more advantageous to study the work in the place where it is to be practised. The best method for obtaining silver from a Nevada ore is not always the most efficacious for one of Colorado; the graduate of one of our eastern mining schools, bristling with theories and crammed with book knowledge, too often finds that he has much to unlearn when he begins his actual experience in the West, and, to him at least, the fact is sufficiently evident that many hours of fruitless toil might have been saved had he acquired the theory of his profession while studying its practical workings. The Royal Schools of Mines at Berlin, at Freiberg in Saxony, and at Clausthal in Prussia, certainly produce men of high culture, but only the latter two graduate really practical miners, metallurgists and engineers. Practice alone degenerates into empiricism, while theory, pure and simple, singly is helpless; hence it is in the combination of the two that the most useful knowledge is to be gained. This learning, through territorial schools, maintained not by national but by state funds, should, we believe, be first acquired. Each institution could then pursue untrammelled that course of study best adapted to its geographical and geological position, transmitting the results of its observations to a central national bureau, for statistical reference and comparison with those of others; while the student desiring to follow any particular branch of mining could select the seminary best situated for the imparting of the instruction required.

These and other considerations have been suggested to us

by learning of the foundation of a school of mines at about a mile from Golden City, at the base of the Rocky Mountains (latitude 39°40'), in Colorado Territory. Professor E. J. Mallett, of this institution, whose experience we may here remark leads him to the adoption of views substantially the same as those above advanced, informs us that its site presents every facility for the practical training of the mining engineer. The university, of which this school is an integral portion, comprises three fine buildings; two of which are devoted to theology and the classics and the third is exclusively set apart as an academy of the physical sciences. Being less than a mile from the terminus of the high grade railway, the principal mines and metallurgical works of the territory are within easy communication of the students, thus affording especial advantages for study in the field.

We trust that this institution will be the precursor of many others of its class in every mining district, as we believe that the establishment of such colleges cannot but tend, through the acquirement and dissemination of valuable knowledge, largely to increase the wealth and material prosperity of the nation.

EXPERIMENTS ON THE STRENGTH OF MATERIALS.

Valuable results are anticipated from a series of experiments undertaken by Professor Thurston, at the Stevens Institute of Technology, upon the strength of materials. We recently gave a summary of the results of the experiments upon woods, as reported in the *Journal of the Franklin Institute*, for April.

Work has now been commenced upon the metals, and the Professor desires to obtain samples of all well known brands; the specimens to be 3½ inches long, and of 1 inch round bar or ½ and ¾ square bar, with, in each case, statements as concise as possible of the ores used and method of manufacture of the sample, with the understanding that the results may be published. The specimens may be sent to the Institute at any time. The work will be interrupted May 24th, and during the absence of Professor Thurston to attend to his duties as a member of the United States scientific commission to Vienna, but will be resumed on his return in September next.

We noticed a specimen of Ulster iron taken from open market, which had twisted to the limit of the machine, over 200°, without breaking off. The specimens are turned down in the middle, the neck being 1 inch long and ½ inch diameter, by Whitworth gages.

RIGHTS OF PURCHASERS OF PATENTED ARTICLES.

We published last week the decision lately rendered by Judge Sawyer, of California, in the case of McKay vs. Wooster. Those who are in possession of an exclusive state, county or other territorial right to make, sell and use a patented machine or patented article, of any description whatsoever, will be interested in learning that it is now settled by the decision of more than one United States circuit judge that the purchaser of such a machine or article within the territory of one exclusive licensee may sell or use it within the territory of any other exclusive licensee without liability to an action for infringement. It amounts in a nutshell to this: The exclusive licensee for one county cannot lawfully sell or use in the county of another exclusive licensee, but the purchaser without condition of the machine or article from such licensee can lawfully use or sell it in the territory of the other licensee.

With the present construction of the statute, exclusive licensees may take undue advantage of each other. It would be wise, therefore, in many cases to seek, through the grantors of territorial rights, the placing of restrictions on those working adjoining territory, so that neither licensee would sell to parties whose only intention at time of purchase was to resell or use in the territory of the other.

The decisions so far made on the point proceed on the ground that, the machine or article having passed to the hands of the purchaser without condition, it is no longer within the limits of the monopoly, and hence such purchaser is not restricted in the use of the machine or article either as to duration of time or place. The Supreme Court of the United States has passed upon the lawfulness as to duration of time, in determining the rights of users of patented machines for any extension of the original term of the patent, but not as to place of use. No case has there been decided involving the question whether the purchaser without condition, from a licensee restricted as to place in making, using, and selling, may lawfully use or sell the patented articles so purchased outside of such restricted territory. It is, however, foreshadowed, by those cases which involved the right of purchasers to continue lawfully to use through any extended term of a patent, that the decision of the court of last resort would be in the affirmative on this question also, were the precise point to come before them for review.

THE NEW PHILADELPHIA STEAMSHIPS.

Under the heading of the "Loss of the Steamer Atlantic," we recently printed a *resumé* of the views of several correspondents regarding the construction of sea going vessels, and among others the opinion of one writer signed "A River," in reference to alleged serious faults in the building of the ships of the new American line lately established between Philadelphia and Liverpool. Since the date of the issue containing the above, we have received a communication from Mr. B. H. Bartol, an officer of the company owning these steamers, in which the strictures of our correspondent are explicitly contradicted. We are informed that the vessels have been superintended from the keel upward by an experienced engineer from the Clyde, that \$2,500,000 is invested in the enterprise, and that the confidence of the proprietors in

the construction of their ships is such that the usual precaution of insurance is deemed unnecessary.

We take pleasure in making this correction, as the statements of our correspondent, doubtless honestly based on a misapprehension of facts, were such as to engender a feeling of public regret that so laudable an endeavor toward the re-establishment of our commercial prosperity should have its inception under such unfavorable auspices. The pioneer vessel of the line, the *Pennsylvania*, we notice, has recently accomplished quite an extended trial trip, satisfactorily proving her capability and efficiency for transatlantic service.

THE VIENNA EXPOSITION—APPOINTMENT OF A NEW COMMISSIONER.

Jackson S. Schultz, Esq., of New York, an energetic, talented and distinguished merchant, has been appointed United States Commissioner at Vienna, in place of Van Buren, removed. Commissioner Schultz is a gentleman of real ability, and under his auspices the American department will doubtless assume as creditable an appearance as is possible under the circumstances. He is authorized to restore those of the suspended commissioners who were not connected with the disgraceful schemes of corruption.

The *New York Sun* says that, if reports are to be credited, the Vienna exhibition has not so far proved successful. The Viennese were in too much of a hurry to empty the pockets of strangers, and the report of their exorbitant charges spread far and wide. The bills of fare at the hotels have been increasing from day to day, a dollar and a half being the latest charge for a tolerable breakfast, and twenty cents for getting boots blacked. Americans will be interested in the announcement that the proprietor of a hotel built expressly for transatlantic visitors openly avows his intention to get all his money back during the season of the exhibition. Extortion seems to be the order of the day in Vienna, and after all it may not have been all native corruption that infected our commissioners.

THE NEW YORK POST OFFICE.

In the number of its substantial and costly business structures, New York city has always been conspicuous, but the new post office and court house building, now being constructed in the southern portion of what has for years been known as the City Hall Park, promises to overshadow all buildings hitherto erected in New York, if not in the country, when considered with reference to its architectural beauty, its complete adaptability to the purposes for which it is designed, the excellent workmanship put on all its details, and the number of modern improvements which have been and are to be introduced. The Drexel building, at the corner of Wall and Broad streets, which has been just opened for business, is, for the purposes for which it was designed, one of the most beautiful structures in the country, but it could be placed in one corner of the new post office, and many of the arrangements for lighting, heating, ventilation, etc., which would answer for a building of such size, would be useless in one of the great extent of the larger building. In the architectural work, also, the difficulties were much greater, owing to the irregular shape of the land on which the building was to be placed, which is almost a triangle; the frontage on Broadway being 340 feet, looking down Broadway 130 feet, on Park Row 320 feet, and looking toward the City Hall 200 feet. The entire area covered is about one and one quarter acres, and this space, for the cellar, basement, and entrance floors, is unbroken by any interior walls, the supports for the upper stories consisting of 122 cast iron pillars for each (cellar, basement and entrance) floor. These pillars are 18 inches in diameter each, the iron being 2½ inches thick. There will be four stories from the ground up, beside the high Mansard roof; the cornice will be 120 feet above the sidewalk at the lowest parts, and the front elevations will be considerably higher, according to the elevations of the design on the corners and in the middle of each façade, beside the domes on the northern and southern fronts, which will tower high above the main building.

In every detail of the building, all the latest contrivances for making the work substantial and of the best quality have been studied. The roof will be of copper, with two corrugations in each sheet to allow for expansion and contraction by heat and cold. Numerous substitutes, less expensive, have been urged upon the superintendent, but this was decided upon as most perfect and durable. Each window will have fireproof shutters made of a composition somewhat lighter than fire brick, and which has been tested up to a white heat without showing any change. These shutters will be taken up by cast iron boxes, built in the wall, into which they will be made to slide, and, considering that the rest of the building will be entirely of granite, iron, brick and glass it is tolerably safe to conclude that, isolated as it is from other structures and with granite walls of great thickness, we shall have a building which would be practically fireproof, even in a conflagration similar to those which so recently devastated Chicago and Boston.

In the thorough ventilation of so large a building, where so many are to be employed, and where a large proportion of the work is to be done by gas light, the difficulties presented are of no ordinary nature, and have never yet been entirely overcome in any of our large public edifices. It is believed, however, that the plan for effecting this object in the new post office will be the most perfect of any that has yet been contrived. It is on the principle of that first applied on a large scale in the north wing of the Treasury Department at Washington, under the direction of Supervising Architect A. B. Mullett, who is the architect of the new post office and general superintendent of all new public buildings. For

the three lower floors, in which all the post office business will be transacted, there are four ventilating shafts, with an inside area of fifty feet each on the bottom. These shafts run from the cellar to a little above the roof, and in the center of each will be a smoke pipe from the furnaces, thus heating the air so as to make a constant upward current. At the bottom, these shafts are connected with what are called foul air chambers, into which run flues from all the rooms on the ground floor and below. These flues are made to run from openings at the bottom in the hollow cast iron pillars which support the whole interior of the building, so that, by the upward current which is created by the heat in the ventilating shaft, the foul air is drawn down from the bottom of each room to the foul air chambers and thence into the ventilating shafts. In addition to openings into the ventilating shafts, the rooms in the upper stories are provided with flues which terminate in ridge openings at the angle of the pitch of the Mansard roof and the center of the water shed. These openings have what are called pitch top covers, to make a draft, no matter in which direction the wind may be.

In cold weather, the rooms are to be heated by steam coils supplied from the exhaust steam furnished by the boilers which will supply power for the engines to run the elevators. Grave doubts are entertained whether sufficient preparation has thus far been made for properly heating the interior of this vast edifice, but this will be a want which can be easily supplied by additional boiler capacity in the cellar. The steam coils will be placed opposite each window, under which, in the panels, are openings, so that the air will be drawn fresh from the outside. The pipes, however, are protected by a kind of apron from the current of cold air, which is made to pass down and then rise through the heated coil into the room.

The floors, throughout the building, are all made with iron and brick arches. These arches have been built according to a method of Mr. W. G. Steinmetz, the superintending engineer, by the use of center hangers, which has lately become quite popular with builders. It does away with the necessity of building platforms, as formerly, is very simple, and the men can thus readily work on as many floors as desirable at the same time. In many of the arches in the building, where a flat ceiling is wanted, a large sized hollow brick is used, which is molded to make a perfect arch on the top and be level on the bottom. The same end can be attained by filling out under the arches, in the old way, but the work is not so durable. The cost is about the same in one way as in the other, but the hollow brick are lighter, so that the weight on the iron is not so great, and the ceiling is more certain to be dry.

There are to be four large elevators which will afford communication between the basement and top floors, and ten small elevators, of the telescopic style, worked by hydraulic pressure, from the basement to the entrance floor. The latter are to be simply platforms without carriages, for the convenience of the post office business, as the basement will be used for sorting letters and making up mails, the entire north end being devoted to printed matter. On the first floor will be the post office, receiving and money order departments, registering office, stamp and envelope bureaus, and the postmaster's, secretary's, cashier's and book-keepers' rooms. The second, third and fourth floors will be devoted to United States court rooms, examination rooms, etc.

It is difficult, without a personal visit, to obtain an adequate idea of the great amount of work and material which this building, when completed, will represent. The additional story which is now being added, before the Mansard roof is put on, involves no material change in the plan for the whole, although a portion of the cornice which had been placed will have to be taken down until the fourth story is completed. The granite used all comes from Maine, where six hundred men have been employed for many months in cutting and dressing it, so that no work of this kind is done on the ground. There have, thus far, been used 300,000 cubic feet of granite, 10,000 yards of concrete, 27,000 barrels of cement, 9,000,000 brick, and 5,500,000 pounds of iron; and the excavation previous to laying the foundation amounted to 100,000 cubic yards. It is impossible at present to say when the work will be completed, but as Congress at its last session appropriated \$2,500,000 to carry on the building, it is now being energetically pushed forward, with a probability that the roof will be on during the present year. New York has waited long for a post office suited to its needs; but with the completion of this building, it will have such an one as befits the importance of the leading city on the continent.

MODERN PRINTING MACHINERY AND APPLIANCES.— HOW A DAILY NEWSPAPER IS MADE.

The use of types and the introduction of the power printing press marked the commencement of a series of improvements in the printing business, no one of which have, subsequently, created a distinctive era in the trade, but the combined results, as seen in the offices of one of our "great dailies," afford one of the most interesting, though not the least complicated, subjects for careful examination. The machines for casting type have worked a great saving to the type founder, and to make, by the old hand process, the great amount of type now used, would require almost as many hands in a type foundry as it takes to run a cotton mill; but, as in the case of the sewing machine, the demand seems to have been thus enlarged only with the increased facilities of production. Of type-setting machines, there have been a great many brought before the public, one or two of which have certainly possessed great merit, but, from one cause or

another, they have not been generally adopted, and are not used at all in daily newspaper work. For some kinds of book work they have, however, proved a moderate success, and there is fair reason to suppose that a successful type setting machine, which will accomplish all the labor of the compositor, may, at no distant day, be perfected. It is a field which has long taxed the ingenuity of some of our most skillful artisans, and is one in which success will be sure to bring a rich reward, as by far the greater part of the expense in the mechanical part of the daily newspaper, as in fact of nearly every printed book and paper, is in the type-setting.

The press room, however, is by far the most attractive part of a modern newspaper, and here the improvements made have been constantly in the direction of more rapid, economical, and perfect printing. The Hoe ten cylinder rotary press, which has been and still is used in most of the large newspaper offices, was long thought to be the most perfect machine possible for doing a large amount of work, and doing it well. It is capable of printing twenty thousand impressions per hour, but to do this work, ten feeders are required, beside a pressman, and two or three assistants to take away the printed sheets, and only one side of the paper can be printed at a time. To make a press which will save the work of this number of men, which will print both sides, or a perfected sheet, at the same time, and which will also do the work as rapidly, has long been a problem which inventors have endeavored to solve, and both here and in England have their efforts been crowned with success.

THE WALTER, BULLOCK AND HOE PRESSES.

The Walter press, so named from its inventor, the proprietor of the *London Times*, and the Bullock press, which has been used here for the past four or five years, are each self feeding, and deliver a perfect printed sheet, or one printed on both sides. There are some points of similarity in their construction, both feeding from endless rolls of paper, with a knife to cut off the sheets at the proper time before they are passed to the "fly" where they are delivered. The Walter press is considerably smaller and more compact than the Hoe ten cylinder press, but the Bullock press is still smaller, occupying a space only ten by six feet and six feet high. The Walter press, it is claimed, will print eleven thousand and perfected sheets per hour, which is somewhat faster than the Hoe ten cylinder, when it is remembered that the maximum work of the latter is only twenty thousand copies of one side, or half printed papers, per hour, while the average work of the Hoe press will only equal about fifteen thousand impressions per hour. The Bullock press prints ten thousand copies per hour, both sides.

In all of these fast presses, the more rapidly the work is done, the less perfectly are the sheets printed, but the Walter press is especially designed to do better work than any other fast press, and with this idea, the proprietors of the *New York Times*, who are this year expending one hundred thousand dollars in refitting and adding to the facilities of their already admirably arranged office, are about putting up one of the Walter machines in their press room. The press will cost, as put up and ready for work, about \$45,000, or about the same as a Hoe ten cylinder press. The paper is taken from a reel and passed through rollers, one of which revolves in a trough, where it is partially immersed in water, thus wetting or damping the sheets, which adds much to the facility of obtaining a clear impression of the types. In the Bullock press the paper is dampened by a separate machine, the rolls of paper being already wet when placed in the press. From the rolls which dampen it, the paper is passed on between cylinders, on one of which are the stereotyped forms, and the other constitutes the impression cylinder, the latter revolving against covered rollers to remove any ink which may have been taken from the printed sheet. To do this perfectly, constant attention is required, and the covers, when soiled, have to be changed. The inking apparatus is quite similar to the fountains used in the Hoe presses, and there is nothing essentially different in the principle of the fly for delivering the sheets. Two men, however, are required at the box where the sheets are delivered, to keep them straight, which, with the pressman and one assistant, make at least four men required to attend one of these machines. The Bullock press does not require more than one man, but it is claimed that the Walter press will do much better work than the Bullock.

NEWSPAPER STEREOTYPING.

Perhaps the greatest improvement for facilitating the rapid production of newspapers, since the introduction of the power press, is that by which newspaper forms are quickly and cheaply stereotyped. In fact, it would hardly be possible to use either the Bullock or the Walter press to print from type, as the cylinder which the stereotype form is made to fit is so small that the type could not well be held in place. Even with the Hoe presses, however, if it were not for the process of stereotyping, great difficulty would be experienced, and was felt in former years, in printing an edition of anything more than twenty or thirty thousand copies with sufficient rapidity to meet the demands of a daily newspaper. To obtain and make ready all the news, and have the types set up and put in the form, requires the full force of editors, reporters and compositors up to 2 and 3 o'clock in the morning. Then stereotype plates are made of each page, for as many presses as desired, according to the number of copies to be printed. If three of the ten cylinder presses are to be used, by making three sets of plates, fifty or sixty thousand copies can be printed per hour instead of only twenty thousand per hour, which was the maximum before the introduction of stereotyping.

Newspaper stereotyping was first made successful about

ten years ago. It must not be supposed that this was the first successful stereotyping for any kind of printing, as printing has been done from plates almost as long as types have been used; but by the ordinary method of making stereotype plates from plaster of Paris molds, the time consumed was so great as to render this method totally unavailable for newspaper work. After many experiments, however, what is called the

PAPER PROCESS

of making the stereotype mold was successfully introduced. This consists in beating into the face of the type, with a heavy brush, a prepared sheet, with a body almost like paper pulp, and somewhat thicker than heavy railroad card. The type form, with this wet blanket kind of mold beaten into it, is then placed on a steam bed to drive out the moisture and harden the mold, which, in a few minutes, can be taken off almost as hard as a sheet of card board, but holding a perfect impression of the type. To make and trim a plate, with type metal, is now very simple, and the same mold can be used for as many plates as desired. The shortest time occupied in getting a plate ready, from the time in which the form is ready for the stereotypers, is about twenty minutes, the greater portion of this being taken up in drying and baking the mold, and the difficulty in doing it more rapidly lies in the fact that the type form, when ready for the stereotypers, is very wet, and all must, of course, be made perfectly dry. These stereotype plates are made of type metal, which consists of lead, zinc and antimony, and they may be used to print any number of copies required. The cost of making the plates cannot be said to add anything to the expenses of a large newspaper, as enough is saved in the wear of type to cover the expense of making the plates. The mechanical work of a daily morning newspaper is nearly all done at night, as the copy of the paper which the city subscriber reads at his breakfast table represents the work of printers and editors up to 3 o'clock in the morning, and the pressmen thereafter.

EDITING A DAILY NEWSPAPER.

All through the twenty-four hours, however, the reporters, correspondents and agents of a daily newspaper are busily engaged in collecting, writing and telegraphing information on every possible subject for its columns. In Washington and San Francisco, in London and Vienna, in China and Japan, and in almost every known quarter of the globe, the agents of the press may be found, whether they act as the direct employees of some particular paper, or send accounts of matters supposed to be interesting, to be paid for only when used. Some idea of the number and activity of these agents may be formed from the fact that, notwithstanding the great amount of matter which a daily newspaper contains, it often occurs that two or three times as much is prepared and paid for as is printed in the paper. This matter is constantly coming in from the telegraph office, from the mails, and from reporters, and the editor and his assistants receive and prepare it for the printer, or consign it to the waste paper basket, writing their comments thereon, witty or wise or commonplace as they may be; but in all cases the news and editorials are intended to represent a day's picture of the world's life, with the reflections which we all, according to our light, gather from reading and past experience, for future guidance.

SETTING UP THE TYPE.

The compositors commence type setting at 6 or 7 o'clock, all letters, editorials, articles of any kind, or advertisements, going to a common desk, where the fifty or more compositors, in regular order, are handed their "takes," or pieces of copy, which are longer or shorter according to the work, and when one "take" is finished another is ready, so that a compositor may first set up thirty lines of one of Tyndall's lectures, then a theater advertisement or a notice of an auction, then a portion of a letter from Vienna, or perhaps an account of a riot in New Orleans; but the work is all so arranged that the labor of these fifty or more compositors represents the steady and orderly preparation of all the articles and advertisements which appear in the paper. The foreman and his assistants receive the editorials, the telegraph, and all the reading matter, from the editor and his assistants, and the advertisements from the counting room, and the work is so divided up as to keep all hands at work until it is time to go to press, or until all the copy is set up. There is a limit to the time, however. The paper must go to press in time for the mails, and so that copies can be sent out by the morning trains. This makes it necessary to have all the type set up and ready for stereotyping by half past 2 or 3 o'clock, and here not a minute is lost. In case, however, of important news coming in after this hour, the men are kept at work and a later edition is printed for the city and near-by circulation.

In the publication of newspapers, as in all other branches of business, there is, of course, an active competition; every reader has his preferences, and each paper has particular qualities or advantages which commend it to its patrons, but all are anxious to get the first and fullest details of all matters of public interest which transpire in any part of the world.

THE Stillwell & Bierce Manufacturing Company, of Dayton, Ohio, add the following postscript to a business letter received from them on May 12: "It may be of interest to you to know that we have received inquiries about the Eclipse water wheel from New Zealand, and about Stillwell's heater and lime extractor from Belgium, as well as a great many about each from nearly all the States in the Union, each, of the parties writing, starting by saying: 'I saw your advertisement in the SCIENTIFIC AMERICAN.'"

ABOUT TEA.

Mr. Chan Lai Sun, Chinese Imperial Commissioner of Education, recently delivered a lecture in Springfield, Mass., on the subject of tea and its culture. He began by stating that tea grows in every province in China except three or four upon the northernmost Siberian border, but the quality and quantity depends largely upon the locality. The leaves resemble those of the willow, and are gathered during the spring and early summer. They are first exposed in a cool dry place for a day or two, then rolled into a ball on a table of bamboo slats, and dried in the sun. The rolling is to extract a portion of the juice of the leaves. After they have been dried in the sun, they are put into an egg-shaped iron pan over a charcoal fire, and incessantly stirred until a certain point of dryness is reached. The operator stirs with his hands, thrusting them in all portions of the pan, and practice enables him to dry the leaves almost exactly alike. The raiser superintends this process, and then brings his tea in bamboo baskets to the tea merchant, who adjudges its quality, and buys it at prices ranging from \$15 to \$20 per picul, equal to 133½ pounds. The merchant mixes his purchases together in a large reservoir, and at his convenience weighs out a number of pounds of tea leaves, and women and children spread them upon a large stage, and separate the leaves into grades according to quality. The tea stalks are the lowest grade, and the sorters are paid by the number of ounces of stalks they bring in. Children earn from 4 to 5 cents a day; the very best workers rarely earn as much as 10 cents a day. Americans could hardly live upon such wages, and until other nations can raise tea for 12 cents a pound they cannot compete with China in its production.

After the sorting each grade is packed by itself in chests or bamboo baskets, the first for exportation and the latter for home consumption. It is ordered by importers abroad through a tea taster, who receives a salary of some \$3,000 a year and operates as follows: He has a long, narrow table, on which 60 or 70 cups are set; a boy weighs exactly one ounce from a small box into one of these cups, and if he has samples enough, all the cups are used. Hot water is then poured into each cup, and after five minutes the boy calls the master, who sips from every cup, holds the liquid in his mouth a moment, then ejects it and notes in his book the quality of the tea. The purchaser orders upon his taster's estimate, and when his packages arrive at the warehouse, about one in twenty is opened for comparison with the sample. If it proves of inferior grade, a material reduction is at once made in the price, so that without connivance with the tea taster the adulteration of tea is next to impossible in China.

The tea is always examined to determine its age, as it is choicer when young. It is a vexed question whether black and green tea belong to the same species; it is probable, however, that they are branches of the same variety, and the color depends upon the locality. If a seed of black tea be planted in the green tea region, a few generations will make them both alike. When black tea is high, green can readily be turned into black, but black cannot be made to appear green. The latter obtains its bluish color artificially, Prussian blue being used in the coloring, but in such small quantities as to be harmless. The annual average yield of a tea plant is about twenty ounces, and too much rain affects the quality as well as the amount. The plants live from 20 to 30 years, and, when old, are frequently cut down, and a young shrub grafted into the old stock. Quicker returns are thus obtained, but the plant does not last so long.

Tea is drunk pure in China, but there are very different ways

of preparing it. The Chinese tea connoisseur purchases an article costing variously from \$16 to \$20 per pound. If he uses this choicest kind, which is only grown on the tops



FIG. 1.—BRIDGE AT ALBANY.



FIG. 2.—BRIDGE AT AUGUSTA, MAINE.



FIG. 3.—LA SALLE BRIDGE.

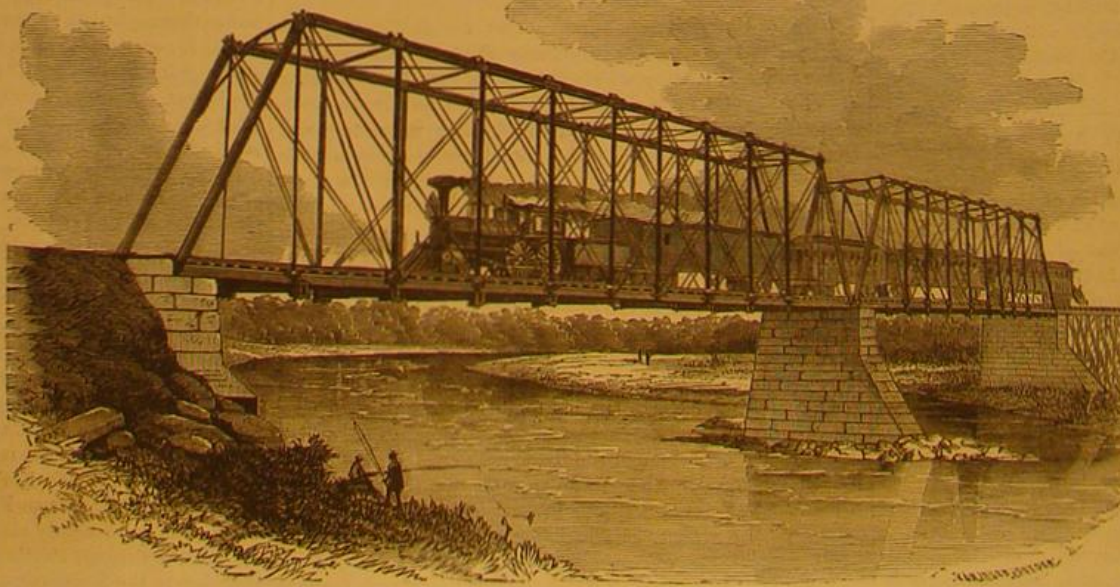


FIG. 4.—SACO BRIDGE.

hours after the tea has evaporated. The more common way of tea drinking is to have a teapot six feet high and three feet in diameter, kept warm, ready for any one to drink who chooses.

The speaker considered that, as long as the tea is of good quality, it matters little how it is prepared. The best way is to warm the pot with boiling water, then put in the tea and pour the water upon it. It should never be boiled.

The seeds of the plant are about the size of a small cherry; and from those not wanted for planting, oil is expressed, used for cooking purposes. The tea in this country is generally much injured by long conveyance by sea, and has a moldy taste to one who has drunk it in its freshness. The individual consumption of tea is much greater in China than here.

IRON BRIDGE CONSTRUCTION.

In our preceding article, we traced the manufacture of iron bridges from the state of crude ore to the finished fabric, ready for shipment to the locality where it is permanently to remain. We will now give our readers views and particulars of some of the most important bridges erected by Clarke, Reeves, & Co. The view of the Albany bridge (Fig. 1) will show the style which is technically called a through bridge, having the track at the level of the lower chords. This view of the bridge is taken from the west side of the Hudson, near the Delavan House, in Albany. The curved portion crosses the basin or outlet of the Erie canal, and consists of seven spans

of seventy-three feet each, one of sixty-three, and one of one hundred and ten. That part of the bridge which crosses the river consists of four spans of one hundred and eighty-five feet each, and a draw two hundred and seventy-four feet wide. The iron work in this bridge cost about \$320,000.

The bridge over the Kennebec river (Fig. 2), on the line of the Maine Central Railroad, at Augusta, Maine, is another instance of a through bridge. It cost \$75,000, has five spans of one hundred and eighty-five feet each, and was built to replace a wooden deck bridge which was carried away by a freshet.

The bridge over the Illinois river, at La Salle, on the Illinois Central Railroad, shows the style of bridge technically called a deck bridge, in which the train is on the top. This bridge consists of eighteen spans of one hundred and sixty feet each, and cost \$180,000.

The bridge on the Portland and Ogdensburg Railroad, which crosses the Saco river, is a very general type of a through railway bridge. It consists of two spans of one hundred and eighty-five feet each, and cost \$20,000.

The Lyman Viaduct (Fig. 5), on the Connecticut Air Line Railway, at East Hampton, Conn., is one hundred and thirty-five feet high and eleven hundred feet long.

The New River bridge, in West Virginia (Fig. 6), consists of two spans of two hundred and fifty feet each, and two others of seventy-five feet each. Its cost was about \$75,000.

Before the erection can be begun, however, a staging or scaffolding of wood, strong enough to support the iron structure until it is finished, has to be raised on the spot. When the bridge is a large one, this staging is of necessity an important and costly piece of work. In Fig. 6 is shown the staging erected for the support of the above mentioned New river bridge, which is on the line of the Chesapeake and Ohio Railway, near a romantic spot known as Hawksnest. About two hundred yards below this bridge is a waterfall, and while the staging was still in use for its construction, the

river, which is very treacherous, suddenly rose about twenty feet in a few hours, and became a roaring torrent.

The method of making all the parts of a bridge to fit exactly, and securing the ties by pins, is peculiarly American. The plan still followed in Europe is that of using rivets, which makes the erection of a bridge take much more time, and costs, consequently, much more. A riveted lattice bridge, one hundred and sixty feet in span, would require ten or twelve days for its erection, while one of the Phoenixville bridges of this size has been erected in eight and a half hours.

These specimens will show the general character of the iron bridges erected in this country. When iron was first used in constructions of this kind, cast iron was employed, but its brittleness and unreliability have led to its rejection for the main portions of bridges. Experience has also led the best iron bridge builders of America to quite generally employ girders with parallel top and bottom members, vertical posts (except at the ends, where they are made inclined toward the center of the span), and tie rods inclined at nearly forty-five degrees. This form takes the least material for the required strength.

The safety of a bridge depends quite as much upon the design and proportions of its details and connections as upon its general shape. The strain which will compress or extend the ties, chords, and other parts can be calculated with mathematical exactness. But the strains coming upon the connections are very often indeterminate, and no mathematical formula has yet been found for them. They are like the strains which come upon the wheels, axles, and moving parts of carriages, cars, and machinery. Yet experience and judgment have led the best builders to a singular uniformity in the treatment of these parts. Each bridge has been an experiment, the lessons of which have been studied and turned to the best effect.

There is no doubt that iron bridges can be made perfectly safe. Their margin is greater than that of the boiler, the axles, or the rail. To make them safe, European governments depend upon rigid rules, and careful inspection to see that they are carried out. In this country government inspection is not relied on with such certainty, and the spirit of our institutions leads us to depend more upon the action of self-interest and the inherent trustworthiness of mankind when indulged with freedom of action. And so we find that the best security for the safety of iron bridges is to be found in the self-interest of the railway corporations and others, who certainly do not desire to waste their money or to render themselves liable to damages from the breaking of their bridges, and who consequently will employ for such constructions those whose reputation has been fairly earned, and whose character is such that reliance can be placed in the honesty of their work.

The fall of the Dixon bridge, with its three score of victims, and similar disasters which have, from time to time, shocked the community, go far toward proving the truth of this proposition. Experience, we trust, has fully demonstrated the futility of intrusting the construction of fabrics, to which the lives of hundreds may be confided, to parties whose sole claim to consideration is a plausible appearing invention on paper or in the model, but whose ideas have never withstood any prolonged or severe ordeal of practical use.

We close our description in presenting a general view of the Phoenix Works (Fig. 7). From this a good idea of the large extent of the establishment may be gained.

The extent of this important center of industry fully justifies us in giving the pub-



FIG. 5.—THE LYMAN VIADUCT.

lic this ample and detailed description of one of the most interesting of American manufactures. For the engravings we are indebted to the publishers of *Lippincott's Magazine*.

Recent Life Boat Experiments.

Experiments recently made at Liverpool with an iron life boat, constructed from the designs of Mr. Hamilton, of the

test also satisfactorily. The boat was then filled to the outside level with water, and with twenty-one men on board she had still a freeboard of 16½ inches. She was again rocked heavily, when it was seen that the water acted as ballast and promoted steadiness, the motion of the water being checked and confined to the center of the boat (in conformity with the requirements of the Ships' Life Boats Com-

mittee) by the perpendicular shape of the inner sides of the side and end cases or compartments. As another test of buoyancy, the boat was filled to the outside level with water, but with no one on board, when the freeboard showed 20½ inches. The boat was then filled with water to the thwarts, in order to show her manageability in the event of being filled by a heavy sea. Two plugs in the bottom of the boat were then drawn, and the boat gradually relieved herself of the water until it had subsided to the level of the water in which she floated. The last test of buoyancy was to fill the boat with water to the outside level, and then to direct twelve men to stand on the gunwale. The water of the dock thereupon just touched the edge of the gunwale, showing that the water ballast gave her really greater buoyancy and stability. Lastly, to test the enormous strength of iron boats constructed on this principle, a dingy of a size suitable for coasting vessels—12 feet long by 5 feet beam, and 2 feet 4 inches in depth inside—was dropped from the crane bodily into the dock—a height of upwards of 21 feet. It fell perfectly flat, with a tremendous force of impact and a noise as of thunder. On examination it was found that the bottom of the dingy, on the starboard side, was slightly flattened, but that not a single joint or rivet had been started, and that the buoyancy of the boat had in no wise been affected.

The *London Times* says that the impression made by these crucial trials was that Messrs. Hamilton & Co. have, in their patent life boat, in the words of Captain Ward, Inspector of Life Boats to the National Life Boat Institution, provided a "bond fide" life boat for passenger ships and merchant vessels, and that if the Northfleet and Atlantic had been supplied with these boats and a proper boat lowering apparatus, hundreds of lives might have been saved. The extra buoyancy of these boats, which secures their manageability after being filled by a heavy sea, is obtained by means of inclosed air. The lateral stability and steadiness in a heavy sea are secured by distributing this air buoyancy along the sides of the boat, while an ample amount of end buoyancy gives longitudinal stability and prevents the water being shipped in a heavy sea from rushing to either end of the boat. This side and end buoyancy is obtained by means of a series of portable water-tight cases or boxes, conforming

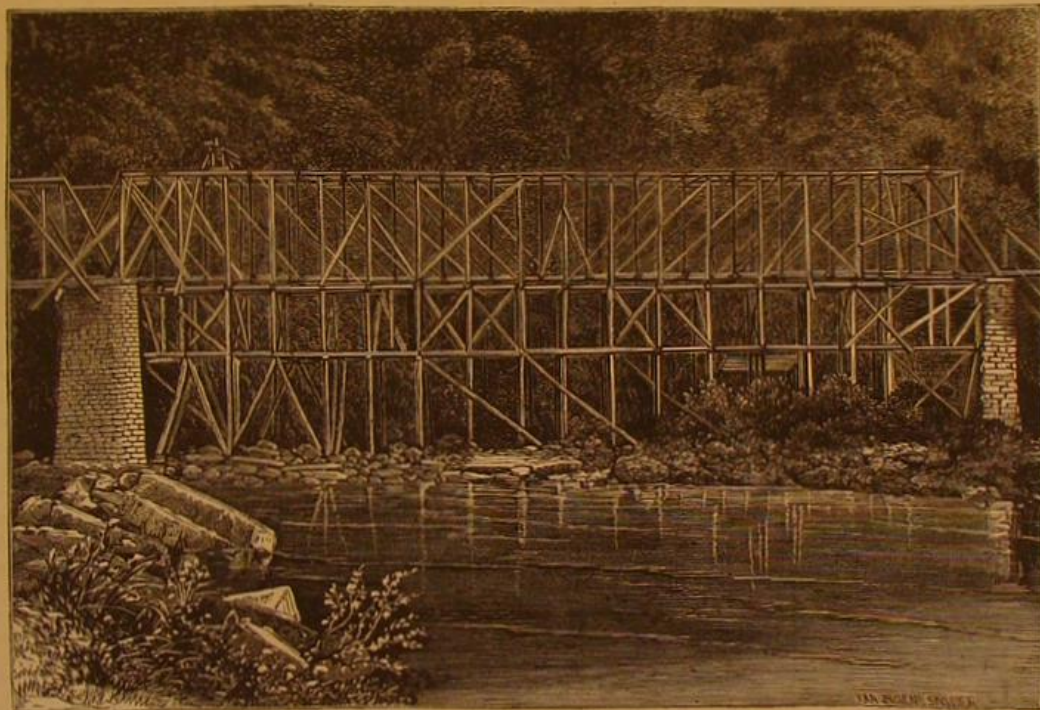


FIG. 6.—NEW RIVER BRIDGE ON ITS STAGING.

Windsor Iron Works, have given some very satisfactory results as far as its strength and stability are concerned. The boat is 25 feet long, with 7 feet beam, and 3 feet 3 inches inside depth. She is double bowed, with side and end air chambers. The boat, when empty, had 2 feet 8 inches free board amidships. Eleven men were made to stand upon the edge of the gunwale until the water just touched the edge of the gunwale on the loaded side. The boat was kept in this

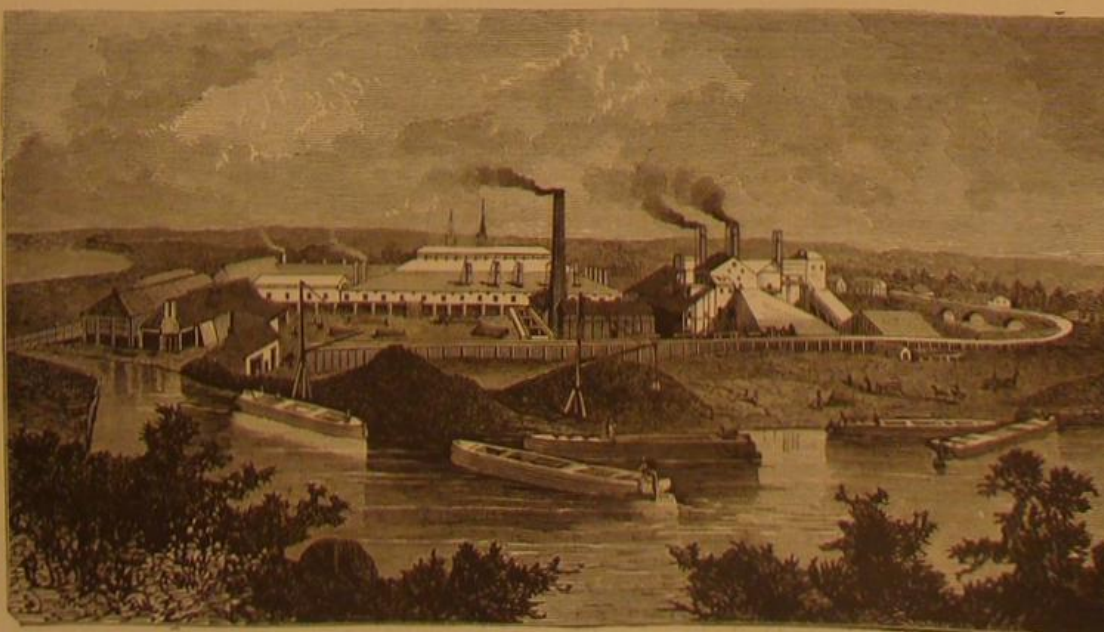


FIG. 7.—THE PHOENIX WORKS.

to the boat's sides, and fitting close to them. When in harbor, and the boat is required to carry cargo, these watertight portable cases can be removed, and easily and quickly replaced on a vessel going to sea.

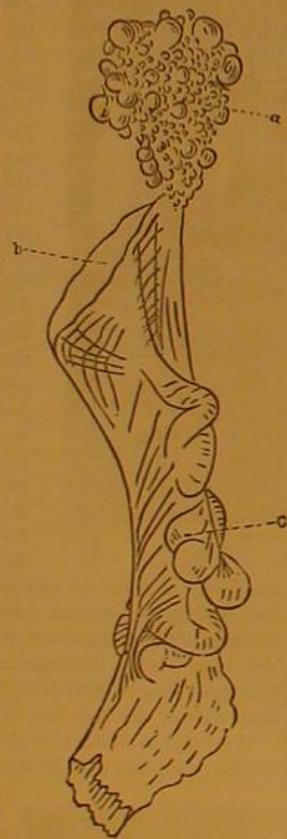
THE WONDERS OF THE EGG.—IV.

[LECTURE BY PROFESSOR AGASSIZ.]

We continue the publication of Professor Agassiz' interesting lectures on embryology, for the reports of which we are indebted to the *New York Tribune*:

You may open dozens of eggs brought for sale from the country, and find that not one is in a perfectly natural condition, because the careless transportation has changed the relation of parts. I have told you, on a former occasion, that the white speck marking the spot where the germ begins its development (what naturalists call the blastoderm) would always be found floating on the top of the yolk, being kept in that position by the strings of albumen by which the yolk is suspended, as it were, in the egg. I opened a number this morning without finding what I wished to show you, all the eggs I had for examination having been jerked in market carts and exhibiting torn chalazae (the strings of albumen by which the yolk is held in position), and I only succeeded by borrowing eggs from a neighbor who keeps hens. I now pass you one in which you see the little speck floating on the surface of the yolk, the beginning of the germ. Here is another egg prepared in the same way and showing the same thing, though in this specimen one of the strings is broken. It is not so easy to prepare an egg for investigation as you may suppose. [Here Professor Agassiz showed how to open an egg from the side so as to cut the shell longitudinally. Various specimens of open eggs were passed around.] In one of these two eggs, you can see the membrane which lines the shell and covers the white; in the other the membrane is removed, together with part of the white, in order that you may see how the white is deposited in layers. Here are two hard boiled eggs cut longitudinally, so as to show the position of the yolk, exactly in the center of one, while in the other it is on one side. The first has felt no influence from the hen; in the second the yolk has been drawn on one side by the warmth of the hen as she brooded upon it. You also see in these eggs the air chamber at the blunt end of the egg, and you will observe that these air chambers are lined by two membranes which are seen to be distinct at that end of the egg, but which unite to surround the white.

In order that you may have some idea of the growth of an egg before it reaches the stage in which we usually see it, I have brought the ovaries of two hens, taken from the animals this morning, and the oviducts—that is, the passage or channel into which the eggs are dropped from the ovaries after they have reached a certain phase of development. In the oviduct the egg receives its final envelopes, and in that organ is secreted whatever is needed to form the shell and the white. I was fortunate in my selection this morning, for the two ovaries showed successive phases of growth in great perfection. In one all the eggs are small, the largest hardly the size of a pea, others that of a pin's head, others hardly visible to the naked eye. The oviduct is empty and collapsed; its share in the work is not yet begun. In the other we have eggs of all dimensions, up to the full sized mature egg of the fowl; a yolk just ready to be dropped into the oviduct which gapes to receive it, and at the lower end of the oviduct a perfectly formed egg with a perfect shell, just about to be laid.



EARLY STAGE OF OVARIAN EGGS OF HEN (NATURAL SIZE.)

a. Immature ovarian eggs; b. Opening of oviduct; c. Empty oviduct.

In this second ovary, then, you have all the successive phases—eggs so small as to be hardly perceptible with the naked eye; others as large as a pin's head; others the size of a pea; others about the dimensions of a hazel nut; others as large as a walnut, and finally one complete, mature egg. The first of these hens had not yet begun laying, while the second was already sitting upon eggs. My finding of these ovaries in the right condition was a mere chance; and, indeed, when you consider how many fortunate circumstances are essential to a successful investigation in embryology, the wonder is that we know so much rather than that we know so little. Indeed, nothing better rectifies a tendency to over-hasty conclusions than an attempt to observe.

Let us now return to the subject where we left it in the last lecture, and consider especially the process of reproduction in vertebrates. I choose that type because vertebrates have no other mode of multiplying than by eggs, and I wish now especially to dwell upon the history of the egg, and its importance as such in the problem of reproduction. I told

you that all eggs were alike up to a certain point in their development. By this I mean that the essential characteristics of all eggs in their incipient condition are the same. But the yolks of different eggs produced by different animals may differ in color and size. The yolk may be light, almost white in some; dark yellow, orange or reddish, greenish or



OVARY AND OVIDUCT FROM A LAYING HEN. ($\frac{2}{3}$ NATURAL SIZE.)

a. Immature ovarian eggs. b. Mature ovarian eggs. c. Opening of oviduct which receives the egg when it drops from the ovary. d. Egg with shell, in lower part of oviduct.

brown in others. It may have the size of a hen's yolk just ready to drop into the oviduct, such as you have seen in the specimen just passing, or it may be so small as to escape the unaided vision; but the elements composing the yolk and the membrane surrounding it are the same in all—at least, no power of the microscope has ever yet revealed any difference in these parts. Yet no naturalist would confound the egg of a mammal with that of any other vertebrate. The vitelline membrane of the mammalian egg seems thicker in proportion to the size of the egg than the membrane surrounding the hen's yolk. In examination it is found to be a very complex apparatus. The mammalian egg has, indeed, a kind of membranous shell, called by naturalists the chorion or *zona pellucida*. It is made of special cells, and might at first be taken for a part of the yolk membrane, and thus lead to the impression that the vitelline membrane of mammalia is much thicker than that of birds. There is also a great difference in the tenacity or elasticity of the yolk. The yolk of a hen's egg is so plastic that I can press it with my finger and yet not break the membrane; others are hard to the touch, and others so soft they can barely be handled. Eggs differ greatly in transparency at different periods of their development. A hen's egg is at first so transparent that the whole interior may be seen under the microscope; later, when mature, the whole yolk is, as you all know, yellow and opaque. The different parts of an egg may differ with reference to one another. The germinative vesicle may be, for instance, nearer the center or nearer the side. It may even be drawn so near the vitelline membrane as to touch it. This is especially the case among turtles' eggs. Let it be understood, then, that when I speak of the identity of egg structure I allude to the correspondence of essential parts, overlooking those differences which are indeed of secondary importance and of no value with reference to the part played by the egg in the economy of reproduction.

THE FECUNDATION OF THE EGG.

In what now does fecundation consist, and what is the substance whose contact with the egg contributes to the formation of the new being? When entering upon this subject, let us not forget that some eggs undergo all the necessary phases of growth without any such influence from the male organism, and that this occurs even among animals whose structure is highly complicated, as with the bees, among whom unfecundated eggs produce males or drones, while fecundated eggs produce females or working bees. Among vertebrates no egg has ever with certainty been known to produce a new being without fecundation; but in numerous cases the eggs enter upon the processes which lead to the formation of the new being, as, for instance, segmentation, previous to fecundation. The spermaries are

organs of exactly the same structure as the ovaries. In the spermary, cells are formed which may be compared to those peculiar cells of the ovary which we have called eggs. These sperm cells do not produce yolk, but gave rise within themselves to peculiarly constructed particles usually called spermatid particles. Previous to the formation of these particles a kind of segmentation of the substance filling the cell takes place, which may be compared to the segmentation of the yolk in an ovarian egg. This kneading process ends in forming bundles of little bodies (the so-called spermatid particles) which, on closer examination, resembles tadpoles, and have indeed been compared to them, not inaptly. They are long in comparison to their width, almost thread-like, and have a blunt end with a tail-like appendage. When highly magnified, the edge of this tail-like appendage seems very thin and resembles a fin. When the cell breaks, which occurs under somewhat different circumstances in different animals, these particles move with astounding rapidity, producing a commotion in the liquid in which they are held, and having every appearance of animated beings. Indeed, when these phenomena were first observed by microscopists of the 17th century, the spermatid particles were supposed to be little animals. What they are, and the part they play in the process of fecundation, has been learned only within a few years, if indeed we know even now what their function truly is. That they exist throughout the animal kingdom is an ascertained fact, and they can be observed under the microscope without a very high power. A magnifier of a few hundred diameters will bring most of them, though not all, into view, and will show their rapid motions. These motions cannot be better compared than with those of the tadpole, the chief movement being a wriggling, rapid vibration of the tail-like portion. A great many theories have at different times been current respecting these particles, but it is useless to recall them, since they have been found to be wholly incorrect. At one time physiologists did not doubt that these particles were actually the beginning of the new germ; they went so far as to assume that they constituted the portion of the body known as the axis, the backbone or nervous center. We are sure now that all these theories were unsound. But it cannot be doubted that these particles play an important part in the economy of reproduction, since, under investigation of the most minute and difficult character, they have been seen to reach the egg and penetrate into its interior. This is an accepted fact, though not all embryologists who admit it as such have had the good fortune to see it themselves.

Controlling Sex in Butterflies.

A suggestive article as to the possibility of controlling sexes in butterflies has been communicated to *The American Naturalist* by Mrs. Mary Treat, and from the results of numerous experiments she finds occasion to believe that the larvæ to which the freshest and most tempting food was supplied in unlimited quantity nearly always developed into female butterflies, while those for which the supply of food was limited almost as uniformly proved to be males. Dr. Packard is, however, inclined to think that the sex of this insect, as well as that of all animals from eggs, is determined at or about the time of conception, or at least, early in the embryonic condition. In the honey bee, especially, it has been proved that the sex is decided at the time the egg leaves the oviduct. The sex in man, according to Koeliker, becomes fixed toward the end of the second month of fetal life.

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 March, 1873:

During the month, 1,056 visits of inspection were made, and 2,254 boilers examined, of which 720 were examined internally, and 214 were tested by hydraulic pressure. Defects in all discovered, 1,207, of which 314 were of a dangerous character. These defects were mainly as follows:

Furnaces out of shape, from overheating and other careless management, 86—16 dangerous; fractures of plates, 106—52 dangerous. (These fractures, in many cases, come from carelessness in blowing out boilers when hot and immediately filling them again with cold water. It is safe to say that one half the boilers with fractured plates have become so from this practice. It will be readily seen that boilers set in brick must retain their heat for a long time after the fires are drawn and water and steam blown out; hence the introduction of cold water before the boiler is cool is very hazardous. The strength of the iron is not only impaired, but serious fractures and bad strains are the results.) Burned plates, 89—47 very bad; blistered plates, 162—34 of which were reduced to a dangerous thinness. The outer leaves were burned and contained no strength, and the inner one was of insufficient thickness to sustain safely the pressure carried. Deposit of sediment, 176—20 very bad, with great danger of burning the fire sheets so that they would become contorted and dangerously fractured. Incrustation and scale, 232—24 dangerous; external corrosion, 72—12 dangerous. This trouble usually comes from defective boiler fittings. Internal corrosion, 33—7 dangerous; internal grooving, 12—5 dangerous; water gages defective, 42—4 dangerous; blow-out defective, 31—9 dangerous; safety valves overloaded and out of order, 23—3 dangerous; pressure gages incorrect and defective, 106—of which 19 were so unreliable as to be very dangerous indicators; boilers without gages, 103—1 was running at very high pressure and was regarded as in dangerous condition; cases of deficiency of water, 15—10 dangerous; braces and stays broken and loose, 47—24 dangerous; boilers condemned as unsafe to use, 16.

A Gigantic Newspaper Establishment.

The proprietors of the New York *Tribune* are about to erect a new building for the better accommodation of the wants of the establishment, and in announcing the fact the editor says:

The *Tribune* has outgrown its cradle, and requires a home more in harmony with its wider plans and greater influence. The building from which Horace Greeley for a quarter of a century led the free thought of the country will be long remembered. The room in which he labored has been kept sacred since his death. No lesser presence has ever broken the spell his memory left there. And now that we are about to erect on the old site the largest and most imposing newspaper office in the world, the controlling thought of the proprietors of the *Tribune* is that here is his true monument. The great journal which he founded, animated by his spirit and faithful to his teachings, will, we trust, keep his memory green in every region upon earth, and the massive pile, reared upon the scene of his labors and his glory, will speak continually of him and his work to the millions of citizens and strangers who shall traverse for centuries to come the broad avenues of Manhattan Island, and the noble rivers that wash it on either hand. The space we have formerly occupied being much too narrow for our uses, we have acquired property on every side of us, until our front extends upon Printing House Square over 60 feet, upon Spruce street 100 feet, thence north to Frankfort street 165 feet, with a frontage upon that street of nearly 29 feet. This liberal space is to be covered with a building nine stories high, surmounted by a lofty tower, which in beauty and elegance as well as in bulk will be the most considerable business edifice in the southern part of the island. Some of the most eminent architects of the day have competed in furnishing designs for the building, and the result is one upon which all who take pride in the architectural adornment of the great metropolis may justly congratulate themselves. It will be not only a superb and artistic monument; it will also be as perfect a business house as the skill and experience of the most competent builders can devise. It will be absolutely fireproof in every part, and built to last for ever.

The New Water Tunnel at Chicago.

Our readers will remember that the city of Chicago is supplied with fresh water by means of a tunnel, built under the bottom of Lake Michigan and extending out under the lake, two miles from the shore to a crib where the water is let in and flows to the shore, being then pumped and distributed through the city. Its capacity is only 54,000,000 gallons a day, a quantity insufficient for the rapidly growing demands of Chicago. Contracts for another tunnel have been accordingly made, and this new work is now in process of construction. The new tunnel will be seven feet in diameter and six miles long, of which two miles will be under the lake and four miles under the city. A correspondent of the New York *Times* says that "the laborers on the shore end have progressed some 2,000 feet out under the lake, while from the crib end another body of men are working steadily forward to meet them. The limited diameter of the bore renders it impossible for many to work at once, but they are at it night and day, averaging at each end a progress of perhaps twelve feet in twenty-four hours. The masons keep as close behind the diggers as possible. The soil penetrated is a hard blue clay, and such a thing as a caving in has not happened so far. A tin tube, eight inches in diameter, is constantly advanced with the workmen, thus furnishing a circulation which prevents the accumulation of foul air. It is hung in the top of the tunnel, and, when necessary, is worked with a fan at the outer end. This new tunnel runs parallel with the old one, distant from it about fifty feet. It enters the same crib, and strikes the shore at the same water works, but will deliver its supply at the new works, at the corner of Ashland and Blue Island avenues, three and five-sixths miles from the old ones; and to reach it the new tunnel is to be extended under the city, river, large business houses and all. It is estimated that the cost will be somewhere in the neighborhood of \$1,000,000.

From the tunnel there are to be nine or more shafts reaching to the surface of the ground for fire purposes. The water, of course, will rise in them to the level of the lake, and, should the pumping works give out, will be easily accessible to the engines. This land tunnel, as well as its lake connection, is to have a vertical diameter in the clear of seven feet and two inches, and a horizontal diameter of seven feet. Its capacity will be over 100,000,000 gallons per day. It will be lined with heavy masonry, a foot thick, and of the best materials. January 1, 1875, is specified as the date of its completion.

New Electrical Instrument.

Among the recent patents granted here is one to F. H. Varley, of London, England, for a novel portable electrical machine. It consists of a glass or rubber rod, having upon it an exciting band or girdle of suitable cloth. A small Leyden jar is attached to the girdle. The rod is held in one hand and the girdle moved with the other. The friction of the girdle upon the rod excites electricity which passes to the jar, and thus a considerable quantity of electricity may be collected. It is a simple and apparently an effective instrument.

ALL new subscriptions to the *SCIENTIFIC AMERICAN* will be commenced with the number issued in the week the names are received at this office, unless back numbers are ordered. All the numbers back to January 1st may be had and subscriptions entered from that date if desired.

Correspondence.**Deep Sea Sounding.**

To the Editor of the *Scientific American*:

Allow me to suggest a further improvement in the deep sea sounding apparatus suggested by Dr. George Robinson, and commented upon by Mr. C. F. Lewis, on page 277 of your current volume.

The gage suggested by Mr. Lewis may have a weight attached to its lower part by a pair or more of clutches, reverse of those used in pile drivers, to release the hammer at the requisite height, and an air chamber, or, still better, a cork float, at the upper part. The weight must be sufficiently heavy to rapidly sink the whole apparatus, while the cork float or air chamber must have sufficient buoyancy to sustain the gage on the surface of the water when the weight is detached; thus, instead of letting down and hauling up the gage with a rope (an operation always troublesome in deep waters and difficult in any but calm weather), it could simply be thrown overboard; the weight (a stone or a couple of bricks would answer just as well) would carry it to the bottom, upon contact with which the hooks would let go the hold on the weight, and the gage, thus released, would speed to the surface, carried by its float and bearing on its register the pressure of the water on the very bottom of the sea.

Mr. Lewis is certainly correct in saying that, should the gage be carried a certain distance away from the vertical line of its descent or ascent, it would not materially alter the pressure on the same; but my opinion is that, for great depths, a correction for the compressibility of the water, however small, would have to be made. An objection seems to suggest itself. A gage, as described, would sometimes be carried, by the under currents of the sea, out of sight and thus be lost. This could probably be remedied in the following manner: Let the weight be considerably large relatively to the surface which the body of the gage presents to the current, and let its shape be that of two cones joined by their bases, or of pyramids, or of some similar form. Thus by facilitating the descent of the gage by augmenting its velocity, the deviation from a vertical line will partly be remedied. Besides, to the upper part of the gage a small flag can be attached, or still better, a phosphide of calcium tube, such as was described several weeks ago in the *SCIENTIFIC AMERICAN*. Such tube, bursting into flame upon contact with air when the gage has returned to the surface, would, at night, show its whereabouts at a considerable distance; or the phosphide of calcium tube may be so constructed as to emit a thick, black smoke, easily perceptible at a distance in day time, while its flame would be visible at night.

New Orleans, La.

A. R.

To the Editor of the *Scientific American*:

The object of an article by Dr. Robinson on "Deep Sea Soundings without a Rope," on page 244 of your current volume, seems to me to be to invite discussion rather than to suggest a means of accomplishing the object. In the first place, it would be impossible to time it, on account of currents and counter currents. Secondly, no vessel could be made strong enough to withstand the pressure of water at 2,000 fathoms; and should the gases condense, a vacuum would consequently be produced within the vessel; and if the vessel were made strong enough, it would be too heavy to rise. The powder and fulminate would be liable to ignition from the immense pressure before reaching the bottom. It would be liable to stick in a soft bottom, and, if charged too heavily, it would produce rupture, or too lightly, it would force out the piston.

The great and insurmountable obstacle, in my opinion, is the low temperature of the sea at great depths, which has been found, by actual tests, to be as low as 34°; consequently the gases must condense, if not liquefy, under the pressure; and either a collapse of the instrument, or loss by displacement, would prevent its rising. All the other obstacles can be overcome. If any way could be devised to keep up the temperature of the gases and consequently the expansion, so as to balance the pressure of the water, it would be feasible. The suggestion of a pressure gage by Charles H. Lewis, of Albion, N. Y., is perfectly practical and reliable, so far as a line could be made to reach.

Grand Rapids, Mich.

HAWLEY N. CARROLL.

Remarkable Astronomical Phenomenon.

To the Editor of the *Scientific American*:

On May 6, at 8 P. M., the 1st and 2d satellites of Jupiter were observed so close together (having only about the distance of the radius of the planet between them) that, if the direction of their motion was favorable, contact seemed likely. Upon further observation, both were found to be receding from the planet, but the one near to it, being the 1st, had the more rapid motion, and at 9:30 had approached so near to the other that they seemed to be separated only by the space of a satellite's diameter.

At 9:45, the contact was almost nearly perfect. At no time did they present the appearance of a single spherical body, but that of an elongated disk, with a faint shadow where one satellite overlapped the other, appearing to cover one half its surface. The instrument used was a Dollond glass of four inches aperture.

An instance of two satellites having come in contact, so that one completely covered the other, is recorded in the memoirs of the Royal Astronomical Society, but is of rare occurrence. The observation was made by the Rev. R. Main, at Radcliffe Observatory, Oxford. He writes: "I observed that the 1st and 2d satellites were approaching each other, and it appeared to me that they would pass very nearly, if

not exactly, over each other. I therefore continued to watch them until conjunction took place, and was not disappointed, as they came in actual contact and covered each other so completely that only one single body, with perfect sphericity, was visible."

Vassar College.

JUNIOR.

The Million Dollar Telescope.

To the Editor of the *Scientific American*:

Before we make the telescope, let us have some ideas of what may be expected to be discovered by its use. Judging from the remarks of some of your correspondents, they probably calculate to see, on the distant planets, mountains and valleys, rivers and lakes, cities and towns, and even the sort of inhabitants who occupy them. Now if we admit that all these things are there, and that we have a telescope powerful enough to see objects at that distance which are no larger than a man, is there not still a difficulty to be overcome, which has escaped attention? This difficulty is readily understood when we consider the immense velocity of the earth in its daily revolution, and also that of the planet under view. It is easy enough to see the planet whirling in space, but we may probably require something more than the powers of an instantaneous photographic machine to form any proper idea of the particular objects on its surface; though with our moon, which mostly has but one side towards us, it may be somewhat easier. If any one doubts, let him place himself on the periphery of a wheel which is turning round at the rate of five thousand revolutions per second, and then try to discover the beauties of a flea which is revolving on another wheel at the rate of ten thousand revolutions in a second, in a contrary direction. After this experiment, let us hear what he has to say on the subject.

New York city.

D.

A Voice from the South.

Messrs. Munn & Co.:—GENTLEMEN:—

Please accept my thanks for the prompt attention which you have paid to my application for a patent, and the persevering energy which secured it.

I think that the *SCIENTIFIC AMERICAN* is the great patron of inventors, and is worthy of its name and reputation. I will endeavor to obtain subscribers.

Rosedale, La.

CHAS. H. DICKINSON.

Manufacture of Whiting and Paris White.

At the Plymouth works of Reynolds & Co., Bergen, N. J., four huge grinding mills are constantly running, breaking up the chalk and mixing it with water, which is constantly flowing in as the chalk mixture flows on. On leaving the mills, the mixture passes along a series of wooden troughs, where the sand, which has a greater specific gravity than the chalk, is deposited, the chalk passing on into the settling pits, of which there are twenty-four. On being taken from the pits, the whiting is partially dried on a flooring, under which hot flues run. It is then cut up into large rough lumps and placed in racks on cars which run round on tramways into an immense oven. The heat from the flues in this oven is greatly increased by an airblast, which also carries off the moist exhalations from the drying whiting. Twelve hours on the heated floor, and twelve hours in the oven, thoroughly dries the whiting, and it is ready for packing or the putty factory. The old process of drying, first for twenty-four hours on chalk stones, and then for thirty-six hours on open racks, was not only more tedious, but, from the variations of the temperature, was bad for the whiting for some purposes. These Plymouth works turn out about twelve tons of whiting a day—between 3,000 and 4,000 tons a year.

Paris white, of a fine quality, is used for finishing parlor walls, adulterating paints, making paper heavier and whiter, etc. For this purpose, what is called cliff stone, a better and harder quality of chalk, is used. Paris white is made much on the same principle as whiting, only being more carefully washed and more slowly dried. Many thousands of tons of cliff stone and chalk, imported from England, are worked up every year.

Patent Medicines.

Dr. Pierce, proprietor of Dr. Sage's "Catarrh Remedy" and Dr. Pierce's "Golden Medical Discovery," takes exception to our publication of the analyses of his medicines, as translated from the Berlin *Industrie Blätter* in this journal of April 26. He admits that the description of the ingredients of the "Catarrh Remedy" is correct as far as it goes, but states that some of the most important are omitted, and that the proportions are not correctly stated. In respect to his "Golden Medical Discovery," he asserts that it "contains not one single drug, medicinal agent, nor poisonous ingredient mentioned in the said analyses."

THE contract for the supply of the letter carriers' summer uniforms, for the New York post office, has been awarded to Messrs. Freeman & Burr, of Fulton street, New York city. The dress is a gray flannel blouse braided with black, with vest and pants of the same material. The contractors' system of making clothes to order by mail is described on our advertising pages.

S. A. T. says: "I am an amateur mechanic, chemist, and a little of everything, or what is termed a 'jack of all trades'; and I must say that I owe the *SCIENTIFIC AMERICAN* for nearly all my knowledge. I would not be without it, as I constantly receive from its columns ideas and information which are of benefit to me in my large manufacturing business."

SIMPLE HAND STAMP.

Our illustration represents a new hand printing stamp which seems excellently adapted for use in printing cards, envelope advertisements, ticket marks, and similar purposes. It consists of a stand, one end of which is made circular and is filled with ordinary printer's roller composition, the other contains a pliable material upon which to place the paper to be imprinted. At the middle of the stand are upright projections, to which is pivoted the inner end of the stamp lever. To the outer extremity of the latter is pivoted the stamp holder, which thus, when held by the wooden handle shown, always retains its horizontal position. On the lower end of this appliance is detachably secured a small electrotype or other reproduction of the desired inscription. Directly under the lever are springs which serve to raise it a little after the end is brought down, and also a receptacle for holding the small roller shown in the foreground. Ordinary printing ink is used, a small quantity of which is supplied in the circular box represented, which is furnished with the apparatus.

To operate the device a portion of the ink is distributed over the bed of roller composition by means of the small roller. A metal cap, in which is made an opening of suitable size, is then placed over the inked surface, as represented in the engraving. The end of the lever is next turned in the direction indicated by the dotted lines, and the stamp pressed down upon the ink, when the lever is then carried over, ready to make an impression. As this motion takes place by means of the rod, A, connected with the end of the lever and actuating suitable mechanism, the ink slab is rotated so as to present a fresh surface of ink for the next impression.

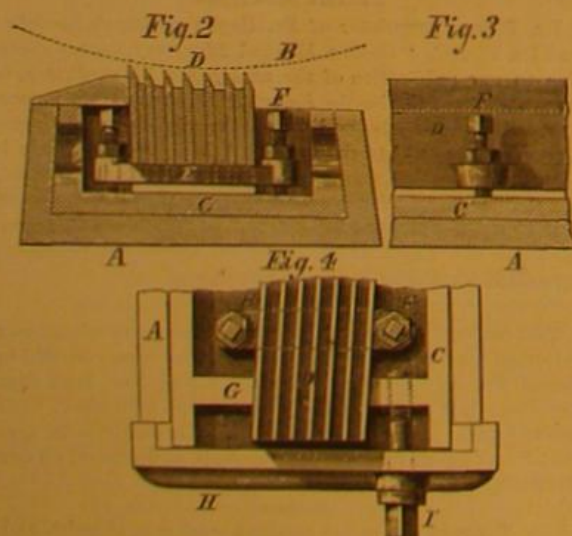
Any colored ink may be employed, and the pad and type easily cleaned by a little oil of turpentine. The inking surface, it is stated, will last for years, and may be renewed for a few cents. The device is of convenient size and strongly constructed, and will doubtless form a convenient article for employment in counting houses, ticket offices, and similar localities. Patented March 4, 1873. For further particulars address the inventor, Mr. Geo. H. Rountree, Milwaukee, Wis.

RAG CUTTING ENGINE.

The invention herewith illustrated is an apparatus for holding the bed cutters of a rag-cutting engine, and adjusting them up to the cylinder. It is claimed to obviate the use of wedges, and to admit of applying a set of cutters and removing them in the most ready manner, thus forming an important improvement over the rude devices in common use.

Fig. 1 is a perspective view of the invention, and Figs. 2, 3, and 4, sectional, plan, and detail drawings. A is a metal box fitted in the bed frame of the machine immediately under the cylinder, indicated by the dotted line, B, Fig. 2. This box serves to hold the case, C, in which the cutters, D, are confined. Its sides are made slightly wider apart at one end and bottom than at the other end and top, so that the case, C, which is correspondingly fitted, will wedge in tight when shoved therein. The cutters, D, are fitted to bars or saddles, E, Figs. 2 and 3, placed in the bottom of case, C, transversely. The bars have temper screws, F, passing down through them to the bottom of the case, by means of which they may be raised or lowered. In Fig. 2 a transverse view, and in Fig. 3 an end view, of one of the saddles and its screws is clearly represented.

The cutters are also secured between the crossbars, G, Figs. 1 and 4, which hold them to the work while being ad-

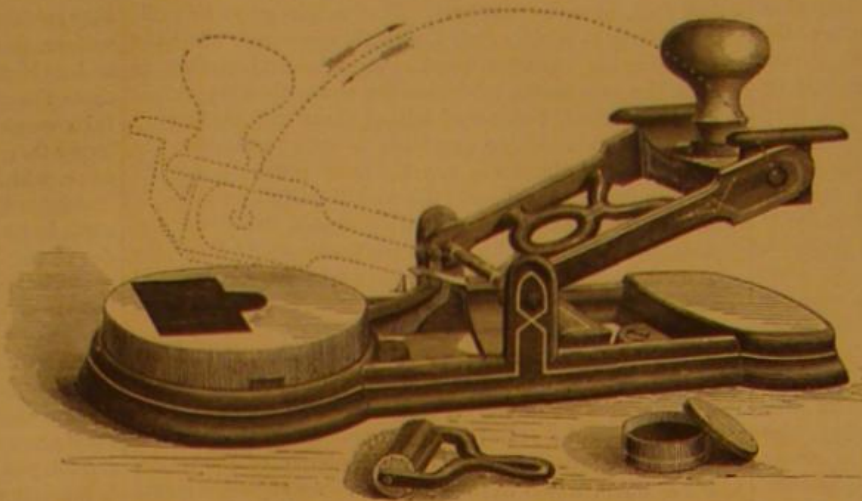


justed up and down. Two or more cases, C, with sets of knives, may be employed, so that when one gets dull it may, through the above arrangement, be readily removed and another substituted. If the case, C, be difficult to start when wedged in, a bar, H, Figs. 1 and 4, and screw, I, may be employed for the purpose the screw passing through said bar,

which is placed against the end of box, A, and screwing into the case, C.

For the convenience of parties preferring to grind their cutters, the bars or saddles are inserted with a dovetail, so that the knives may be easily removed for that purpose and again adjusted. The bedplate is firm and does not vibrate.

It is further claimed for the invention that all steel knives may be used up much closer than by the old process, thereby effecting a saving in both time and material. It is stated that actual experience has shown that the blades, through



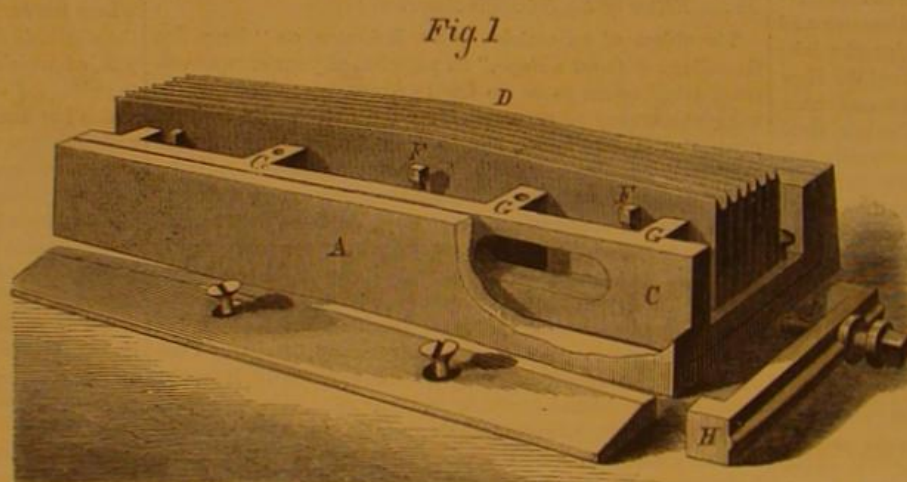
ROUNTREE'S HAND STAMP.

this mode of adjustment, will last at least twice as long, and that the device has been tested by three years' use in binders' and trunk board making, working up tarred rope and performing other heavy work.

Patented through the Scientific American Patent Agency by Edward Wilkinson, Sept. 5, 1871. For further particulars address W. O. Davey & Sons, 117 Wall street, New York city, or Cyrus Currier, 290 Market street, Newark, N. J.

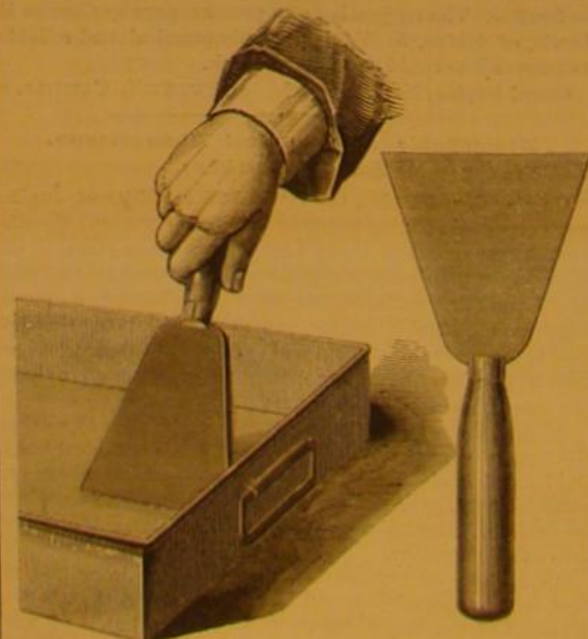
SCRAPER FOR HOUSEHOLD USES.

We presume that every housekeeper, of however short experience, has at some period discovered that dirt has an unexplainable and withal a marvelous affinity for inaccessible corners: that, with remarkable pertinacity, it seeks out odd angles of staircases, and mop boards, and doors, and corners of cooking utensils after grease has been in them, and cakes



WILKINSON'S RAG CUTTING ENGINE.

itself there, and declines to come out under the persuasions of the sharp end of the dust pan, or the point of a spoon, or frantic slashes with a broom; and it wears a woman's soul out, and then she gives it up, and her husband comes home and



immediately perceives it, and says she isn't half as neat as his mother was, and makes other and similar brutal remarks. Well, the object of the instrument represented in our engraving is to obviate all these difficulties. It is simply a

blade of thin plate steel, having a shank which is fixed in an ordinary wooden handle. The edge is made sufficiently sharp to scrape and loosen the dirt from griddles or bake pans, and the corners may be poked into angles and used to dig out the deposit. It was patented Feb. 11, 1873, and further information regarding it may be obtained by addressing the patentees, Messrs. V. N. Davis & Son, Stoneham, Mass.

THE SIGL MITRAILLEUSE.

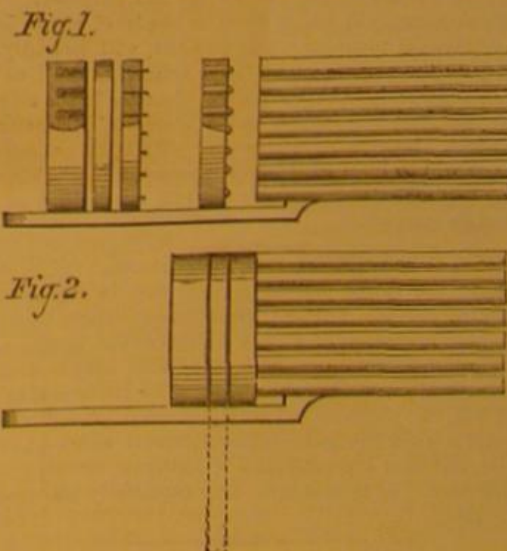
A new mitrailleuse, invented by M. Sigl, of Vienna, has recently been experimented upon at the camp of San Maurizio, Italy. The weapon, we learn, has already been adopted by Austria and that government has ordered 140 to be constructed for its use.

The *Revista Maritima* says that the barrels are 37 in number, of a caliber similar to that of the new Wernli breech-loading musket used in the Austrian army, that is .432 inch, with six grooves of rifling. The weight of the charge is 61.7 grains, and of the ball 312.1 grains. The essential portion of the device lies in the firing mechanism. A lever, placed in line with the axes of the barrels, serves to draw to the rear the breech arrangement containing needles, spindles and their springs. This portion moves upon two slides applied laterally to the posterior edge of the bundle of barrels. By placing the lever straight, the device is drawn away from the rear face; by pushing the lever down, the movable part is carried in close contact with that surface. While the parts are separated a charged chamber is dropped in two vertical grooves in the frame. The lever is then brought down, the mechanism is pushed forward, the cartridges enter the bores, while the movable breech, fitting firmly against the rear of the barrels, closes that portion and prevents all escape of gas.

The firing apparatus is contained in the fixed or rather sliding portion, between which and the barrels the magazine of cartridges is placed. First, and nearest the cartridge chamber, is a disk containing movable needles; next in rear is a simple plate, which may be freely moved in a vertical direction. This plate lies between the needles and the spring spindles, when the machine is being charged and before firing (Fig. 1). After the breech is loaded and closed, by pressing firmly on a charging lever, a cylinder of bronze, in which are 37 cavities, is pushed forward. In each cavity is a spindle with its spring. The plate interposed between the needles and spindles hinders the latter from moving, and consequently, the containing cylinder being pushed ahead by the lever, the spindles are forced back in the sockets, at the same time pulling upon and extending their springs.

To fire the piece, an articulated lever, placed in the direction of its axis, is lifted, the interposing plate is drawn down as shown in dotted lines, Fig. 2, when the spindles, set at liberty, are thrown forcibly, by their springs, against the needles. These carry on the motion to and explode the cartridges in the chamber. After the spindles are drawn back after the round has been fired, the simple weight of its lever causes the interposing plate to return to its former position. The cartridges are arranged with central priming, and the needle has sufficient play to be disengaged from the cylinder and thrown back by the action of the gases. Dispersion of the balls is effected by giving the bundle of barrels

both a lateral and a vertical movement on a suitable pivot. The firing lever is connected with graduated mechanism, by means of which motion may be imparted to the machine coincident with the discharge, so as to scatter the balls according to the distance they have to traverse. The weight of the whole machine, with appendages, is 3,275 lbs.



In the absence of special information, we presume the cartridges are forced back into the chamber by the explosion, and removed with it. A very slight recoil was noted. The most effective firing and dispersion of balls took place at 3,608 feet distance. The average rapidity of fire was 500 shots, or 15 filled chambers, per minute.

NEW STEAM ROLLER.

We illustrate a new steam roller, constructed by Messrs. Aveling and Porter, of Rochester, Eng., which has, for some weeks past, in company with another roller by the same makers, been doing excellent work at Vienna, rolling the roads in the Prater, and preparing the approaches to the Exhibition. The steering wheels are at the back of the fire box, and carry that end of the boiler without the intervention of any framing. The machine is, in fact, as nearly as possible a traction engine with very broad wheels, those at the leading end being placed close together, so that they roll the space which would otherwise be left between the tracks of the hind wheels.

The leading wheels are, as will be noticed, made some, what conical, and they are mounted on a dead axle of which the ends are deflected downwards, so that the wheels are brought together at their lower edges and spread at their upper ones. This arrangement enables a strong center pin, bolted to the leading axle, to be carried up between the wheels as shown, this center pin passing through brackets projecting from the smoke box. A collar on the pin takes a bearing against the lower bracket, and the holes in the latter are formed so that the center pin can not only rotate freely, but can rock to a limited extent, so as to allow the leading wheels to adjust themselves to the curve of the road surface. The outer ends of the leading axle are connected by a bow or frame, as shown, which serves to receive the steering chains, the engine being steered by the driver from the foot plate.

At the trailing end the arrangement of the machine is similar to that of the agricultural locomotives of the same firm, the crank shaft, etc., being supported by wrought iron brackets formed by extending upwards the side plates of the fire box casing. This mode of carrying the crank shaft bearings saves much dead weight, and substitutes simple riveted work for brackets bolted to the boiler.

This roller weighs $7\frac{1}{2}$ tons; but machines of the same type, of much larger sizes, are made by the same manufacturers. We are indebted to *Engineering* for our illustration.

STEVENS INSTITUTE LECTURES.—FLUORESCENCE.

BY PRESIDENT HENRY MORTON.

The spring course of lectures at the Stevens Institute of Technology, which we have reported in full, closed with a brilliant lecture on "Fluorescence," by President Henry Morton.

Like a traveler on the surface of the earth, so the pilgrim of science will pass through regions where he is familiar with every inch of ground, catching now and then a glimpse of inaccessible lights, which he can approach, by a steep ascent, sufficiently near to obtain a basis for conjecture as to their nature, but which he cannot reach with the means at present at his command. After having frequently acted as a guide to his audiences through well known regions, the lecturer requested his hearers this time to set out with him on a journey to one of those inaccessible uplands of science.

Before entering upon the study of fluorescence, we must

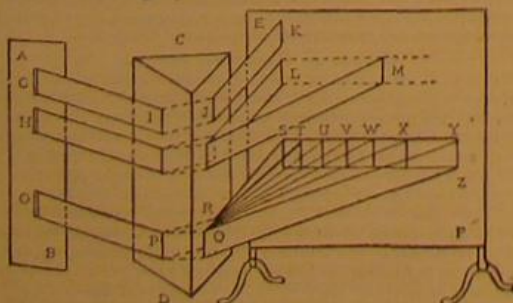
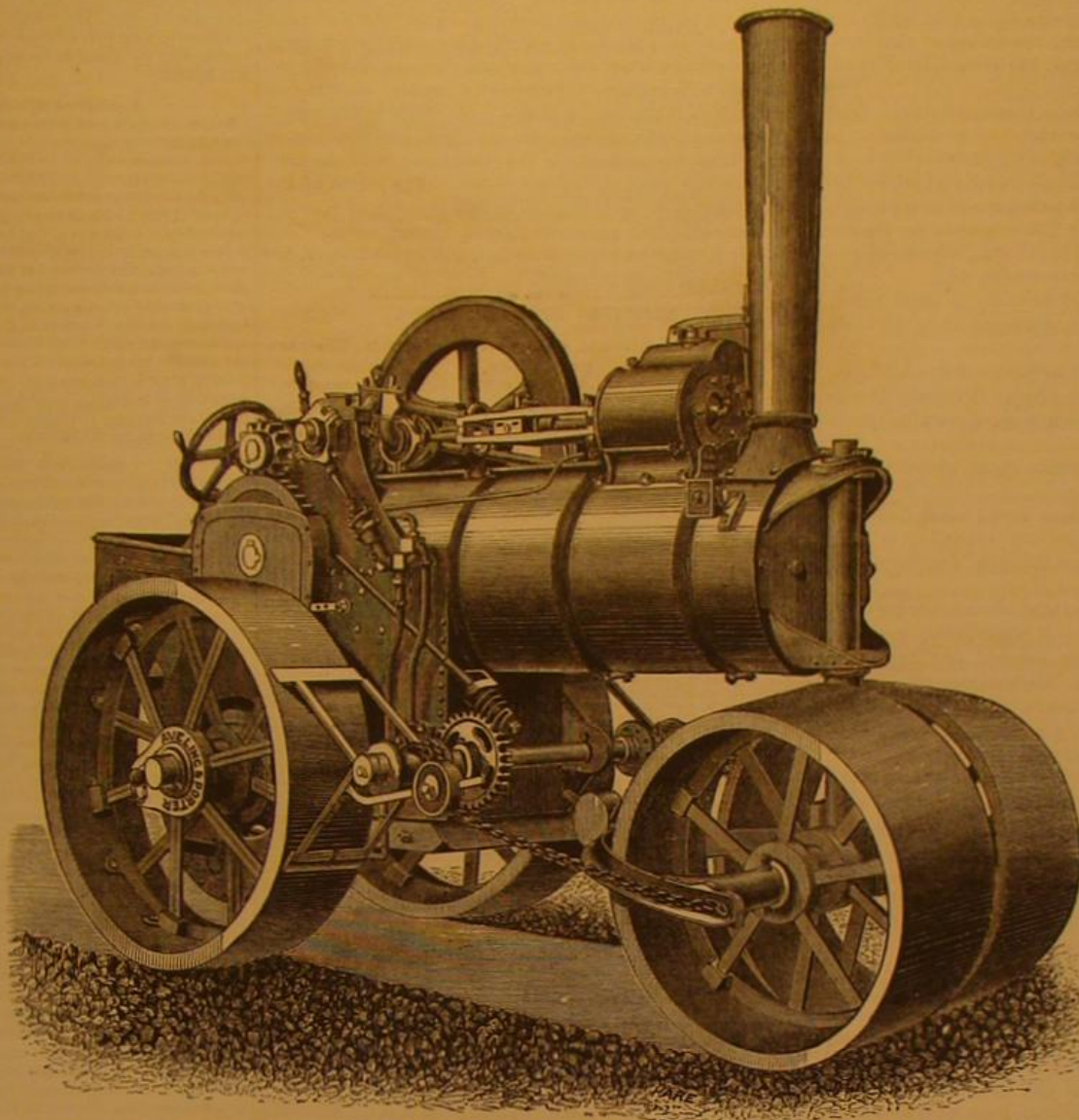


FIG. 1.

clearly bear in mind the nature of light and color. White light is a compound wave motion containing waves of various lengths or colors. Those of red light, for instance, might be compared to the billows of the ocean, while blue would correspond to a ripple upon the surface of a lake. When light waves strike obliquely upon a body differing in density from the one they are passing through, to reach it their direction is changed unequally, the little waves being affected more than the large ones. They were therefore sep-



NEW STEAM ROAD ROLLER.

arate, and such separation of waves or colors is called dispersion.

Through the slits G, H, and O in the screen, A B, are passing rays of different kinds which strike upon the prism, C D. Those coming through G are all of one wave length, and are consequently all bent equally by the prism and form one line of light on the screen, E F. This is called refraction. Those coming through H are composed of waves of two different kinds; they are bent differently and appear separated on the screen as two different colors at L and M. Finally

covered substances which, on being illuminated with one kind of light or color, exhibited another. To illustrate this phenomenon, the lecturer exhibited two pictures of a flower with leaves and buds. The colors of one appeared brilliant by ordinary light, while the other was of a yellowish hue, so pale as almost to escape notice. On illuminating both with a bright yellow light, the highly colored one faded and became as dull as its companion; but in substituting violet light, a remarkable change took place. The colored picture remained dull, but the pale one seemed

to glow with splendid red, blue, and green hues. Here, then, substances receive violet light; they neither absorb nor reflect it, but change it to red, blue, and green. What does this mean?

The lecturer then interrogated a large screen, which seemed perfectly white when illuminated by the electrical light, as to what property it possessed in reference to light. With green light and red light,

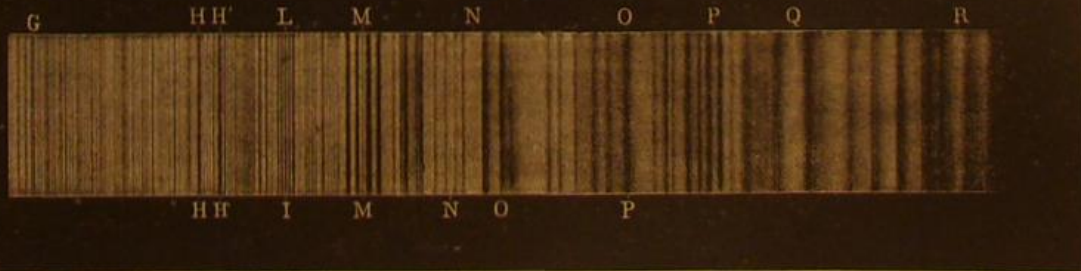


Fig. 2.

those coming through O are composed of many colors or waves of many different sizes; they are separated and appear so on the screen at S Y. Such a band of colors is called a spectrum. When a beam of pure white light is passed through a prism or is analyzed, as we call it, we get the well known series of colors: red, orange, yellow, green, blue, indigo, violet. Beyond the violet, however, there are invisible rays for a distance more than five times as great as the length of the visible spectrum. They are called actinic rays, and produce photographic and chemical effects. The lecturer exhibited a drawing of the invisible spectrum by casting on a screen the greatly magnified image of Fig. 2.

Although the difference between the colors seems but slight: only a difference in the length of the wave; yet each element of the most composite beam of light is so unalterable that the least change of tint never takes place. Red light, though it were passed through a hundred lenses or prisms, cannot become one atom more or less red, and still less can it be changed to another color.

the screen gave no answer; but with blue light, the word

FLUORESCENCE

flashed out in large luminous green letters.

In the experiment just performed, it was only violet light or a mixture of blue and violet that produced the effect. Thousands of experiments go to show that violet light alone develops fluorescence in all bodies capable of exhibiting this phenomenon, but any color may cause some body to fluoresce. In the picture of the flower, the blue color is only excited, so to speak, by violet light, the green by blue rays, and the center, which was red, was excited by the violet and also by the red rays, but not by the intermediate ones. From hundreds of such observations, Professor Stokes deduced the law that the exciting light is always of a less wave length than the fluorescent light which it develops.

To show that the invisible or actinic rays of the spectrum also excited fluorescence, the professor projected a spectrum from the electric light on a screen coated with some fluorescent substance, in such a way as to cause the extreme violet

What then is the cause of color in Nature? Is not white light changed to green when it falls upon a leaf, or to red when it strikes a brick wall? No; white light contains all colors; when it falls on a leaf, all rays of light except those producing green are absorbed by the leaf or converted into other forms of force, while only the green are reflected. On the other hand, red objects absorb all but the red rays. To prove this, a cluster of banners of various bright colors was illuminated successively by light of different tints. The banner having the same color as the light remained bright, while all the others appeared black. If colored objects changed the color of the light, a red banner, for example, would have remained red even in a green light.

Do not colored glasses and solutions modify the lengths of the waves or the colors of the rays which they transmit? No; they check the passage of some rays, while they permit others to pass through them. To demonstrate this, the lecturer produced a splendid spectrum on the screen by means of the electric light. On interposing a plate of red glass, the red of the spectrum was not made brighter, but all the other colors were extinguished. A green solution interposed extinguished all the colors of the spectrum but the green, and a blue solution all but the blue. A solution made by extracting boiled tea leaves with alcohol, absorbed entirely the violet and also certain shades of crimson, orange, and green. The colors which passed through formed a combination of olive green. A solution of permanganate of potash produced five dark bands in the green of the spectrum, nearly obliterated that color, and consequently the light it allowed to pass through was reddish purple.

Such being the universal laws of color, it must have been a matter of no little surprise to the first observers when they discovered substances which, on being illuminated with one kind of light or color, exhibited another. To illustrate this phenomenon, the lecturer exhibited two pictures of a flower with leaves and buds. The colors of one appeared brilliant by ordinary light, while the other was of a yellowish hue, so pale as almost to escape notice. On illuminating both with a bright yellow light, the highly colored one faded and became as dull as its companion; but in substituting violet light, a remarkable change took place. The colored picture remained dull, but the pale one seemed

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and ultra violet rays to strike it. Far beyond the visible violet rays, the substance fluoresced with green light. Here, then, we have a method of rendering that region of actinic rays visible and amenable to experiment.

In spectrum analysis, the metals are recognized by bright lines in different localities of the spectrum. Silver, for example, gives two bright lines in the green. Stokes discovered that it as well as other metals gave lines in the actinic spectrum also. The lecturer exhibited these lines on the screen by burning bits of different metals in the electric arc, when they came out beautifully in the fluorescent spectrum of the invisible rays. It seems to us that, by means of this extension of the spectrum, the utility of that wonderful instrument, the spectroscopic, has been extraordinarily increased.

It follows from these experiments that light rich in short waves, such as that produced by the electric discharge in rarefied nitrogen, is the most effective for showing the beauties of fluorescent substances. The lecturer had accordingly arranged a number of Geissler tubes, containing pure nitrogen highly rarefied, through which he passed the electric discharge of the enormous Ruhmkorff coil, represented in the SCIENTIFIC AMERICAN of December 28, 1872.

Sulphate of quinine solution, illuminated by these tubes, glowed with a milky blue light, although it is perfectly transparent.

Esculin, a substance contained in the decoction of horse chestnut bark, produces the same effect. By means of this property, the one twenty-millionth part of esculin can be detected in water.

An extract of the seeds of stramonium glows with a green light.

Morin, a substance extracted from Brazil wood, lights up with a brilliant green.

"Canary" glass, which contains uranium, fluoresces with a splendid green color.

Many other substances were exhibited with beautiful effect by Professor Morton; the most remarkable, however, were two recently discovered by himself, and which he named thallene and petrollucene. To these was due the striking beauty of the flower exhibited in the early part of the lecture. Messrs. Hawkins and Wale, instrument makers in the Stevens Institute building, have made a very neat portable arrangement for showing these substances. A small folding pocket of blue glass contains a design painted with fluorescing substances. This can be carried in one's pocket and exhibited by daylight.

In order to study the properties of fluorescent bodies, the lecturer had examined by means of a spectroscopic light emitted by a great number of fluorescent substances, which were illuminated by a beam of sunlight deprived of all but the blue and violet light by passing through a solution of ammonio-sulphate of copper. He found that esculin, quinine, morin, and many other bodies gave continuous spectra, while those of the salts of uranium, thallene, petrollucene, etc., were characterized by bands of great regularity but differing with different substances and resembling their absorption spectra. Curious connections have been found between the latter and the luminous bands of fluorescence in certain cases, as, for instance, with thallene and petrollucene, as had indeed been already observed in other substances by Stokes and Hagenbach?

What, then, is fluorescence?

In answer to this question, the lecturer projected on a screen the image of a little pith ball suspended by a thread so as just to touch a tuning fork. Then taking another similar tuning fork, he went off to some distance and sounded it. The vibrations from this fork traveled through the air, set the other one in motion, and this motion was communicated, though with far inferior rapidity, to the pith ball, whose swinging to and fro was plainly visible to the audience. In a similar manner the vibrations of light might be conveyed by the luminiferous ether to a fluorescent body, whose particles would set in motion, though with diminished velocity, the ether filling up the interstices between them, thus giving rise to a color of lower order.

Railroads and Bridges.

During a recent lecture at Cooper Union, in this city, by Professor Plimpton, of the Stevens Institute, he described the wonderful influence railroad power had upon commerce and all descriptions of industry in this country, and stated that the United States had more miles of railroad than Great Britain, France, Spain, Italy, Switzerland, United Germany, Austria, Turkey, and Russia combined. The London Engineer recently asserted that in the world there were 130,000 miles of railroad, and America had 60,000, but the fact was that this country had no less than 68,000 miles, and this year would have 76,000 miles of railroad. The lecturer described the formation and materials composing the four great descriptions of bridges—the arch, truss, suspension and tubular, their relations to each other, the amount of pressure they could bear, and what strain they should be expected to resist, by comparison with the work they would be required to perform.

The Hydra.

This is an instrument for obtaining samples of the ocean bottom, the invention of a blacksmith on board of the British ship Hydra. The Challenger, the English exploring ship now on a voyage of discovery round the world, is supplied with quite a number of these instruments. The machine consists of a hollow metal rod, fitted with valves, and on which are rove cast iron weights of 100 pounds each, one for every 1,000 fathoms of estimated depth. The whole is so adjusted that the weights detach themselves on striking the

bottom, and only the rod, with the soil within it, is recovered. When the Challenger started on her voyage three months ago, she had thirty of these weights, which will probably have to be replenished before she has completed her work.

A much better instrument for deep sea sounding is that invented by Sidney E. and G. L. Morse, brother and nephew of the late Professor S. F. B. Morse, patented here in 1866. This machine consists of a rod containing a series of hollow glass balls, by means whereof, the number of balls being increased or diminished, any desired degree of buoyancy may be imported to the instrument. Bags of sand or stones are attached by which the rod is carried down and the lower end made to scoop up a portion of the ocean bottom. The sand bags become detached when the rod strikes bottom, and the rod then rises with amazing velocity to the surface, shooting up into the air as if discharged from a gun. This instrument is also provided with glass pressure chambers, and mercury, so arranged that the pressure of the water will drive the mercury from one chamber to the other. The depth of the ocean bottom will be indicated by the quantity of mercury so exchanged. The register of depth is very exact. This sounding instrument requires no line, and is, we believe, the first of the kind ever invented.

DECISIONS OF THE COURTS.

United States Circuit Court—Nineteenth District, California.

TRADE MARK INFRINGEMENT.—HARDY AND MOORMAN vs. CUTTER et al.

This action is brought to perpetually enjoin the defendants from infringing the trademark of the plaintiffs, and for damages.

The substantial allegations of the bill are that one John H. Cutter, in his lifetime, was the manufacturer and vendor of an article of whisky known as "Cutter Whisky," that said article was a superior article, and acquired great reputation throughout the United States; that said Cutter adopted and used certain trademarks to designate said article, and which are set out in the complaint; that in July, 1860, said Cutter assigned and transferred to the plaintiffs his stock of whiskeys, and also the exclusive right to use his said name, trade mark and brands.

Exhibit "B" of the complaint is a copy of the wrapper used by plaintiffs on their bottles containing Bourbon whisky; the other, "C," is used on the bottles containing "Rye" whisky; and, save in this particular, the wrappers are precisely alike. I will therefore examine "B" only. This wrapper or label is of a light brown color, and about six by twelve inches in its dimensions. Near the top are printed in large black letters the words, "J. H. Cutter, Old Bourbon Whisky." Immediately under this lettering is the representation of a barrel, on the head of which are printed the words "J. H. Cutter, Old Bourbon." Under the word "Bourbon" is a representation of the British crown, and under that the words "A. F. Hotelling & Co., sole agents for the Pacific Coast." Underneath the barrel, in black shaded letters, are the words "C. F. Moorman & Co., distillers, Louisville, Kentucky." Beneath all this are eight additional lines of printed matter, in type of various sizes, and occupying a space of about three by five inches. The whole is surrounded by an elaborate border, also in black.

Copies of the labels or trademarks alleged to have been employed by defendants, and which it is claimed, are a simulation of the plaintiffs' trademarks, are also annexed to the complaint, marked Exhibits "D" and "E," and these Exhibits "D" and "E" are the only trademarks that the defendants are alleged to have used or employed in and about their business.

I will first examine "D." This label is about two inches shorter and one inch narrower than Exhibit "B." Indeed, the difference in the dimensions of the two labels is so great as to be detected at a glance. In color, instead of being a light brown, it is a bright yellow. Near the top are printed the words and letters "J. F. Cutter, Extra," and immediately under the word "Extra" is a yellow star within a shield. On the left of the shield is the word "Trade," and on the right the word "Mark;" and under the shield the words "Old Bourbon." This label contains no other device, letters, words, figures, or emblems. The whole is surrounded by a black border, much less elaborate than that surrounding Exhibit B, and only about half its width. This Exhibit D is used by defendants on their boxes, barrels, and casks.

Next in order is Exhibit "E." This is used by defendants on their bottles. In size it is about three by four inches. In color it is pure white, surrounded by a plain and very narrow border of black. The device and lettering are precisely like those contained in Exhibit D, except that the star within the shield is white upon a field of gray. Underneath, and within a separate border, are these words: "Notice.—This whisky has been distilled from selected grain, and is bottled expressly for medicinal and family use. None genuine without the fac-simile signature of the subscriber covering the cork." J. F. Cutter, son of the late J. H. Cutter, of Louisville. To say that either D or E is a simulation of B is, to my mind, the utterance of an absurdity that the senses of the most ordinary observer would at once rebuke. To say that a star within a shield is a simulation of the British crown is no more absurd than to contend that the American eagle is an imitation of the British lion, or that the crescent of the Turk is a simulation of the cross of the Christian. The only words used by the plaintiffs, and which have been adopted by defendants, are "Cutter" and "Old Bourbon." As shown above, defendants have an unquestioned right to the use of the words "Old Bourbon;" and this brings us to the second inquiry, namely: Has the defendant used his own name, J. F. Cutter, improperly? Several cases have been cited where a party has been restrained from the use of his own name in connection with his own goods, but in all these cases he was guilty of appropriating the whole or material portions of the plaintiff's trade mark in addition to the name.

In the case of *Croft vs. Day*, decided in the English Chancery, the defendant not only used the name, Day & Martin, under which plaintiff's business was conducted, but the colors of his labels were of the same nature as plaintiff's colors; his labels were of exactly the same size; the letters were arranged in precisely the same mode; and the very same name appeared on the face of the jars. In deciding the case the Master of the Rolls says: "The defendant has a right to the use of his own name; * * * but I must prevent him from using it in such a way as to deceive and defraud the public, and to obtain for himself, at the expense of the plaintiff, an undue and improper advantage." It is unnecessary to refer to the cases in detail, as the one cited above lays down the doctrine that has been uniformly followed.

J. F. CUTTER'S WHISKY. It may be true, and probably is, that the profits of the plaintiffs have been diminished by the defendants emulating in a similar business; and this remark will apply with equal force to thousands of other cases where competition has lessened the income of established houses; and yet the law does not forbid a remedy. J. F. Cutter has a right to manufacture and vend Bourbon whisky that the plaintiffs have, and so long as he refrains from simulating their trademark, and uses only his own proper name, together with the name of the article in which he deals, with an emblem or device in no way resembling plaintiff's, clearly he is acting strictly within the rights guaranteed to him by the law of the land. From these views it follows that the demurrer must be sustained, with leave to the plaintiffs to amend within ten days, if they shall be so advised.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From April 18 to May 1, 1873, inclusive.

BRUSH MAKING MACHINE.—H. C. Covert, New York city.
CAR COUPLING.—E. H. Janney, Alexandria, Va.
CLEANING WARE.—S. S. Lewis et al. (of New York city), London, England.
DYEING INDIGO.—J. Marble, Worcester, Mass.
ECONOMIZING FUEL, ETC.—E. F. Griffin, Chicago, Ill.
FRUIT CAN, ETC.—W. H. I. Howe, New York city.
GAS PURIFIER.—E. Duffee, Haverhill, Mass.
MAKING METAL TURNING.—S. R. Wilmot, Bridgeport, Conn.
ORDNANCE, ETC.—J. P. Taylor, Elizabethton, Tenn.
PILED FABRIC.—A. Warth, Stapleton, N. Y.
RAILWAY CARRIAGE.—W. B. Rogerson, Paterson, N. Y.
REED ORGAN.—G. Woods, Cambridgeport, Mass.
SHAPING STONE, ETC.—C. W. Lewis, New York city.
TELEGRAPH.—T. A. Edison, Newark, N. J.
TELEGRAPH.—W. F. Coffin, New York city.

Recent American and Foreign Patents.

Improved Heating Stove.

William R. Akers and James E. Johnson, Malcolm, Iowa.—This invention consists in the arrangement of an air chamber at the base of an air heating stove, to receive the foul air from the room and discharge it into the smoke chamber to be carried off with the smoke, so as to maintain a purer atmosphere in the room and regulate the draft, the construction of the whole being simple and cheap, and calculated to be very efficient and serviceable.

Improved Cradle.

David Souder, Houston, Ohio.—This invention consists, mainly, in a folding frame, to which is suspended by suitable means the bottom frame, with some strong fabric stretched over it, which frame rocks readily on the folding or supporting frame, and may be adjusted on it to any desired height. By disconnecting one side of the bottom frame, the supporting frame may be folded up to be "carried about or stored, without taking up unnecessary space.

Improved Grain Dryer.

Edwin S. Forgy, Dayton, Ohio.—This invention is an apparatus for drying grain and other similar substances which can be moved from place to place, and which will fully utilize the heat generated. A stove is arranged in the base of a casing of sheet metal with which is connected a pipe which passes through the casing and extends upward on the outside to conduct off the smoke and gaseous products of combustion. A zigzag, which consists of a frame in which is fastened a series of inclined plates, is so arranged that grain placed upon the upper plate will, when the zigzag is vibrated, descend from one plate to another, or from the top to the bottom of the zigzag, and be discharged near the bottom of the casing. The zigzag has room to play laterally within the case, and is vibrated by means of an eccentric rod which is supported on eccentric journals in boxes on the sides of the case, a rotating motion being given the eccentric rod by means of a crank, so that hand or other motive power may be applied. By this arrangement the grain is subjected to a gradually increasing temperature as it descends. The vibrations of the zigzag will evenly spread the grain over the plates and set it in motion.

Improved Cloth Measuring Register.

Samuel Crocker, Port Allen, Iowa.—This invention has for its object to furnish an improved device for attachment to a merchant's counter, which shall be so constructed as to count and register the number of yards measured, thus rendering a second and third measurement of the goods unnecessary. In using the machine, a bar is adjusted to the division marks of the scale of a plate that indicates the number of yards to be measured off, where it is held by a spring catch. The end of the edge of the cloth to be measured is then brought by the right hand of the operator to the button on the upper end of a stop. The left hand is then slipped along the edge of the cloth to the last fret of the scale. The stop is then pressed downward by the thumb of the right hand, and a spring revolves a wheel half a tooth. As the pressure upon the stop is removed, the said stop is forced upward by another spring, and the wheel is revolved another half tooth, bringing a pointer to the division mark marked 1 on the scale of the plate, and so on, the pointer always registering the number of yards measured off. As the pointer in its movement reaches the bar first mentioned, the further operation of the machine is stopped, and the operator knows that he has measured off the required quantity.

Improved Boiler Tube Scraper.

John B. Christoffel, Williamsburgh, N. Y.—This invention has for its object to improve the construction of the boiler tube scraper for which letters patent No. 62,816 were granted to the same inventor on March 12, 1867. Upon a rod are placed two movable collars. On these are formed as many radial pins as there are designed to be blades in the scraper. The blades are made of light spring steel, are arranged spirally, and have holes in their ends to receive the pins of the collars. To the rod at the inner sides of the collars are secured stops, to prevent said collars from moving toward each other while allowing them to move outward freely. Upon the rod at the outer sides of the collars are placed washers, against which rest the inner ends of the springs which are coiled around said rod. This construction enables the scraper to adjust itself to the size of the tube to be operated upon, and adapts it to be used either end forward, as may be desired.

Improved Invalid Bedstead.

Oscar G. Cosby, Richmond, Va.—This invention consists of a bed with canvas above the mattress on rollers extending from head to foot, one on each side, arranged as to stretch the canvas tight and hold the patient on it; while the mattress and its frame, which are suitably arranged and provided with devices for lowering it, are lowered to allow a vessel to be presented under the mattress. The rollers are joined near the head, and provided with devices for raising and lowering that portion to support the patient in a sitting or reclining position. Gears and cranks are employed to raise and lower the mattress and its frame, also the head portion of the canvas and the rollers on which it is stretched, and ratchets and holding pawls are used to hold them in position.

Improved Trimmings.

Wellwood Murray, New York city.—The above inventor has patented two inventions. The first consists of a bias box plaited trimming of plain lace alone, or the same with the edges trimmed with figured lace, or figured lace or other goods trimmed with figured lace or other suitable trimming on the edges, folded longitudinally a little one side of the middle, so that one edge trimming comes a little higher than the other, showing two rows of edging or trimming. The bias box plaits of one part cross those of the other diagonally. This trimming it is proposed to use for making collarettes for ladies' neck wear, also cuffs and other light articles, and also trimmings for various purposes. The second invention, called collarette trimming, is composed of a combination of plaited ruffling of net, with narrow plaited and pointed muslin, the net being placed on one side only, or on the front and back of the muslin, and sewed along the middle of the front piece and upper edge of the back piece when a back piece is used, to the plain edge of the muslin. There may be one or two strips of the latter, one placed above the other when two are used, and made narrower than the bottom piece so that the points of the latter will not be covered. The back piece of net will be wider than the widest strip of muslin so as to project below the points, thus making the said trimming of one or two rows of points, and with or without a margin of net projecting below the points.

Improved Carving Machine.

Henry Grubenbecher, New York city.—The invention consists in the improvement of carving machines. The supporting table furnishes bearings for the spindle of the cutting tool and for the gage pin, and also a support for the sliding carriage, to which the jointed block and pattern holding frame are attached. The spindle is revolved with a suitable driving shaft. The tool can be applied to and removed from the spindle, so that it may be replaced when desired. The gage pin is fastened in the support, which is laterally adjustable on the table and can be set at any suitable distance from the tool, according to the dimensions of the articles to be cut. It can also be longitudinally adjusted in the support, so that its point can be set and held exactly in line with the point of the tool. The slide can move back and forth, but not sidewise, or up and down. To its front end is secured a cross arm. The block to be carved, and the pattern to be imitated, are fastened to the face of a plate which has ears at its ends, which are pivoted to the ends of a bar. The plate can be swung to hold the block and pattern at any suitable angle to the tool and gage pin, and can be locked at any desired angle to the bar. The whole frame can moreover be vibrated so that the block and pattern can be swung on two different curves. A spring connects with the slide and tends to draw it back, away from the tool and pin. Another spring serves to balance the frame and to hold it nearly horizontal. The operator, after the block and pattern have been properly secured to the plate, and the tool and pin being adjusted, has only to vibrate the plate up and down, and draw it back and forth, and swing it sidewise so as to bring every part of the pattern in contact with the pin, which will cause the tool to reach corresponding depths and parts of the block, and to reproduce the pattern. When work is to be cut on more than one side, namely, when it becomes necessary to turn the pattern, in order to bring all parts of its surface in contact with the pin, a holder is used in which laterally adjustable brackets are fastened to the face of the plate. The block to be cut is centered between the brackets, and the pattern between the brackets. When the pattern is turned, the block will also be turned in the same manner and degree by virtue of a swivel connection.

Improved Furniture Spring.

William T. Doremus, New York city.—This invention has for its object to furnish an improved spring for chairs, bed bottoms, and other articles of furniture. The invention consists of an improved spring formed by the combination, with each other, of the case, made in two parts oscillating upon each other. To one part are attached rigid blocks, and in the face of the other part is formed a recess to receive them. In the inner part of the latter plate is also formed a transverse groove to receive a cross bar, between which and the blocks rubber springs are interposed. Open metallic bands pass around the rubber blocks and the projections to prevent the former from spreading when under pressure, and also to prevent the wear of said rubber blocks by friction. By this construction, as the one part of the case is oscillated or turned back and forth upon its pivoting point, the rubber blocks will be alternately compressed by the bar.

Improved Boiler Fire Extinguisher.

John D. Breenhan, Montgomery, Ala.—The object of this invention is to supply steam boilers with an instrument by the use of which the fire may be expeditiously reduced or extinguished, curtailing thereby expenses and diminishing accidents. The invention consists of a hollow tube extending through both sheets of a steam boiler, with lateral perforations. The aperture of the tube toward the fire may be opened or closed by a movable bolt acting as a valve, which either allows the admission of the water from the boiler or shuts off the same, giving thereby perfect and quick control over the fire in the fire box.

Improved Lock Hinge.

Mortimer C. Lee, New York City.—The invention relates to an improved hinge for locking window blinds and shutters, the lower or plate portion having two shoulders or footholds, with which a pawl, pivoted to the upper portion of the hinge, engages when the blind is swung open. It is adapted for use upon either side of a window. The patentee would like to correspond with manufacturers of hinges in regard to introducing his invention. Address 253 East 63d street, New York City.

Improved Paper File.

Robert Henning, Ottawa, Ill., assignor to himself and J. D. Caton, same place.—The invention consists in the improvement of paper files having guards to prevent the loss of the filed bills or other papers. A rectangular plate of brass, bronze, or other suitable material is applied by screws or otherwise to the walls or other convenient place within reach of the operator. A flattened conical shoulder is cast to the plate, and has screws into its lower end the file hook of strong metal wire, which bends upward and terminates in a sharp point so that the papers may be placed over the same. At the upper end of the shoulder the guard lever is pivoted with its arms to a quadrantal projection, and rests, when closed, on the projecting shoulder. The lever, by its weight, drops down on the hook as soon as the message files are placed thereon and the pressure for holding up the lever is relinquished. The guard lever thereby effectually closes the file, and prevents the loss of messages.

Improved Machine for Dressing Stone.

George H. Ray, Bridgeport, Conn.—This invention relates to improve ments in stone dressing machines, in which steel or other cutters or chisels are mounted in a rotary cutter head, which is mounted on a support on the ends of radial arms, by which it is adjusted vertically to the work which is automatically fed along under the cutters. The said cutter head is caused to traverse laterally on its support by a feed screw, and the radial frame is adjusted vertically by screws geared with a worm shaft for turning said screw; and the worm shaft is mounted on bearings so pivoted as to allow the screws to oscillate while working in nuts pivoted to the radial frame, to admit of the vibration of the screws necessary for the working of the radial frame.

Improved Snow Shovel.

Henry C. Cole, Wallingford, Vt.—The invention consists in the improvement of snow shovels. A thin blade of wood is arranged at right angles to the handle and parallel with the edge, so that the handle, which is attached to the front or upper face, extends across the grain, which is the best way of connecting them and arranging the grain for the prevention of splitting. The cutting edge of the blade is beveled and shod with a thin plate of metal on the bevel face, the edge, and a narrow margin of the upper side, to make a strong edge, capable of cutting hard snow, and protecting the wood from splitting. U-shaped thin metal bars strengthen the ends of the blade. This arrangement is designed to avoid having the upper surface of the blade incumbered by the edge of the protecting strip, which is liable to spring up and be pushed off by objects catching against the edge.

Improved Fireproof Floor and Chimney Connection.

William Neracher, Cleveland, Ohio.—For the connection of floors with chimneys, so as to insure the protection of the wood work from fire when the chimneys are overheated, the inventor proposes to shoe the joists at the ends and some distance therefrom with cast iron socket pieces, thereby wholly inclosing the ends of the joists which enter the brickwork of the chimney, and the sides exposed to the heat outside thereof for a suitable distance. The sockets are to be much wider than the joists, with holes through the upper sides through which the spaces not filled by the joists are packed with cement or similar material, the said spaces being on the sides exposed to heat. In case of chimneys having fire places, metal bars extend from one socket piece to another in front of the brickwork, and rest on a rib in each socket piece a little below the surface of the floor, so as to support a hearth of cement or other non-combustible material as far from the brickwork as the hearth need extend for safety.

Improved Wash Boiler.

Philip Krumscheld, Boston, Mass.—This invention has for its object to improve the construction of wash boilers. Two plates are secured to the sides of the boiler, near its ends, so as to form tubular spaces between said plates and the ends of the boiler. The upper ends of the plate are bent outward and are secured to the ends of the boiler so as to wholly close the upper ends of said tubular spaces. In the plates, just below the flanges, are formed a number of small holes for the water to escape through. The lower ends of the plate, a little above the bottom of the boiler, are bent inward. Other plates have their outer edges secured to the sides of the boiler in a horizontal position, and are bent downward and outward till they reach or nearly reach the sides of the boiler, so that the water can readily pass into the space between the plate and the boiler. Another plate is arranged the side parts of which rest upon the last mentioned plate, and the end parts of which slip in beneath the flanges, so that it can be readily removed and inserted when desired. In the middle part is formed a hole, which is covered upon the under side by a cap plate, the ends of which are bent upward and are secured to the under side. With this construction the clothes are kept from getting into the hole in the plate and thus impeding the operation of the boiler by the cap plate, and the water is kept from boiling up through the hole in the plate, while it can flow down freely to be heated and forced through the tubes and again discharged upon the clothes. By this construction the boiling water cannot be forced up around the false bottom, but must always be forced up through the tubes.

Improved Bolt Mechanism for Prison Doors.

Thomas H. Pollis and John Pollis, St. Louis, Mo.—The object of this invention is to provide a mechanism by which the doors of prison cells may be locked simultaneously, allowing at the same time the opening and closing of each door separately. The invention consists of a horizontal bar, placed above or below the doors of a series of cells on one side of the passage, provided with pivoted arms and horizontal friction rollers, locked to the bar by a padlock, the whole bar traveling horizontally in suitable guide supports by means of a screw end and female screw applied in proper manner to the wall, or partition, or frame at the end of the passage. By taking out the padlock, the arm with friction roller may be swung outward from the horizontal bar, and each cell door opened and closed by itself.

Improved Car Coupling.

John P. Whipple, Whitewater, Wis.—The invention is an improvement in the class of couplings wherein pivoted spring hooks are employed. The forward ends or the bumper heads are slotted vertically, a bar being left at the lower part of their ends to receive a hook and sustain the draft. The rear end of the hook is pivoted in the inner end of the slot in the bumper head by a pin, which passes horizontally through a hole in the bumper head and in the said hook. The pins are locked in place by small pins, which pass down vertically through a staple and through a hole in the forward end of the pin. The staple keeps the pin from turning, and thus prevents the possibility of the small pin dropping out. The forward end of the hook is inclined, and is extended upward so that, as the cars are run together, the inclined end of the hook may strike against the small pin, rise, pass over, and catch upon the bar, even should the cars differ materially in height. When the train is made up, the connection between the cars is further secured by two links, one end of each of which is secured to the opposite sides of the opposite bumpers, so that their other ends may be passed over staples attached to the other bumpers, when they are secured in place. Pins are passed transversely through holes in the forward part of the bumper, above the free end of the hook, to prevent the said hook from becoming accidentally detached. The butt ends of all the pins have eyes formed upon them for heads, so that they may be readily withdrawn by a hooked rod, which is made of such a length that it may be used from the top of a car for uncoupling.

Improved Car Coupling.

Demey C. Morris, New Sharon, Iowa.—This invention has for its object to furnish an improved car coupling, which shall be so constructed that the cars shall couple themselves as they are run together, and which cannot become accidentally uncoupled, and thus break up the train when running. In coupling cars with this improved coupling, the link is turned up against the end of the car. Then as the bumpers strike each other, as the cars are run together, the concussion will throw down the link, which will drop into the notch of the bumper of the other car, and thus complete the coupling. After the train has been made up, the attendant can pass along the train and turn the bumpers into a groove, thus holding the link in place with perfect safety. When not required for use, the link may be allowed to hang down beneath the bumper head, so that it cannot be injured or broken should two cars be run together.

Improved Saw Machine.

Charles H. Smith, Fairbault, Minn.—The invention consists in the improvement of wood sawing machines. The platform is mounted on car wheels and has a hand crank, which gears with one of the axles for moving the machine up to the pile of wood from time to time. A couple of circular saws are mounted on an arbor, near one corner of the platform, and raised in suitable supports above the platform. One saw is on the end of the arbor and directly above the edge of the platform. The other is as far inward of the platform as the length to which the wood is to be cut, and beyond this the mandrel projects sufficiently for the application of the driving belt, which works on a pulley, from a large pulley on the driving shaft, to which the engine which is to be mounted on the platform will be connected. The inside collars, for clamping the saws on the arbor, are slightly convex, and the outside collars are correspondingly concave to concave the saws on the side fronting each other, so that the middle pieces of wood will not bind at the ends with the saws, particularly along the middle. The collars are screwed up against the saws on threads pitched, so that in case the saws get bound or cramped in the wood too hard, they will unscrew and release the saws. A wood rack projects forward from the space between the saws and inclines upward, on which the wood is placed as it is taken from the pile to be presented to the saws. At the bottom of this rack is an endless carrier, which takes the long pieces of wood laid on the rack one by one and carries them up to the saws, and carries the middle pieces to a point where it discharges them to the elevator. The end pieces fall down chutes to the same elevator, and all are carried and delivered to piers. A platform or stand projects from the side of the platform under the saws for the sawyer to stand on for overlooking the saws and adjusting the wood. The roller of the carrier is driven by the belt and countershaft, and the elevator is driven by the belt, which works from the crank shaft on to a pulley on the upper roller. The guard over the saws to protect the attendants from them consists of a light frame of two bars and cross bars extending from one to the other over the saws. A cord hangs down where it is convenient to be reached by the sawyer to swing the frame up away from the saws when they are to be filed. The presser bars, for holding the wood on the carrier and controlling it, consist of a number of right angled bars pivoted at one end to the under side of the guard frame, near the front of the saws, and extending rearward at the other ends along the space between the saws, about to the rear of them. They are so numerous and of such different lengths that they are adapted to pieces of wood of all sizes within the common range. The pieces of wood are carried against the knives of these bars before they are entirely cut off, and swing them back until they pass under them, and the bars then rest on the pieces until they pass beyond the saws.

Improved Button.

Frank Washbourne, Brooklyn, N. Y.—This invention has for its object to furnish an improvement in the construction of buttons, making the buttons much more serviceable without increasing the cost of manufacture. In order to insert the button into the bosom or sleeve of a shirt, the back or inner plate should be first turned as far back as possible upon the shank, and then it can be put through the button hole from the outside without difficulty. After insertion the base or inner plate of the button is turned into a position at right angles with the shank by pressure of it against the person of the wearer or otherwise, and thus the button is prevented from becoming casually detached.

Improved Watchman's Time Check.

Theodore Hahn, Stuttgart, Germany.—The object of this invention is to simplify the construction of watchmen's time detectors and to lessen the expense of the same so that they may come within reach of all who heretofore avoided the use of time detectors on account of their great expense and complexity. The invention consists in using in connection with a rotary paper dial a piercing tool, which is acted upon by several different sized keys, and which is pivoted below the dial support, so that it can be swung nearer to or further away from the center of the dial, and which is jointed so that it can be swung up by the keys to pierce the dial. This tool or piercer is provided or connected with two springs, one of which serves to keep it down and to hold the piercing points away from the paper, while the other swings it outward to its greatest distance from the center of the dial. Above the dial support is, furthermore, employed a stationary pointer or hand to show the time on the movable dial, said pointer being, by preference, slotted to admit the piercing pins through it from below.

Improved Paper File.

Charles D. Lindsey, Cincinnati, O.—This invention relates to apparatus for securing or holding papers of various kinds, as letters, bills, or other papers. The frame is made of metal consisting of a bed plate and an upright back of any desired size. The center of the back is raised and slotted. The clip plate has on its back edge an upright lug, and is connected with the back so as to be allowed to rise and fall. Both the clips of each plate may be put through the sheets, but at such point that the sheets will be held securely. The clips stand vertically, and are pointed and pass through holes in the clip plate as the latter is pressed down on the paper to be filed. A bow spring of steel is confined at its center to the spring piece which is attached to the lug of the clip plate. The ends of the spring are confined to the back by hooks. The clip plate is raised for the filing of a letter or paper by drawing the finger piece upward while bearing upon a thumb piece.

Improved Coal Stove.

Heinrich Meldinger, Carlsruhe, Germany, assignor to himself and Frederick Gutzkow, San Francisco, Cal.—The invention consists in providing the lower part of fuel chamber with a crescent shaped throat plate; also, in connecting with said plate a bottom piece having a mouthpiece, and in connecting the door and said mouth piece by a hinge so that the former can slide. To work this stove, an inner fuel chamber is filled to within some inches below the fire hole with coke or coal. A wood fire is lit on the top, the heating cylinder is closed, and a sliding door opened. The combustion takes place from top to bottom, and is regulated by the sliding hinged door, or by a ventilator—that is, by admittance of air either into the stove or into the chimney. The burned fuel is replaced by fresh, filled into the heating cylinder when required, and the ashes are removed once or twice during twenty-four hours, after shoving a small fork shaped grate, provided with a handle, into the ash pit. This grate rests and moves on slides that may be left in the mouth piece of the bottom piece. The grate serves merely to prevent the burning fuel from settling while the ashes are being removed, and is afterward withdrawn. Owing to the absence of grate bars and the circumstance that the burning coal rests on a heap of hot ashes, the heat is kept better collected and the fire regulated with such minuteness as to keep it going when its effect is barely felt and the stove appears quite cold to the touch of the hand. The fire may be maintained for months without relighting, and may be brought to the highest blaze or a mere glimmering within a few minutes.

Improved Refrigerator Water Cooler.

Thomas Smith, Brooklyn, N. Y.—The object of this invention is to construct a cooler for water and other liquids, to be arranged in the common refrigerator in use, by which the liquids are cooled and drawn off at pleasure, avoiding thereby the admixture of ice water and its impurities with the liquids used for drinking purposes. The invention consists in a rectangular hollow casing around the ice chamber of the refrigerator, into which the liquid to be cooled is admitted by a funnel shaped opening and drawn off by a faucet, the bottom part of the cooler being inclined so that the cooled liquid may be drawn off completely at the lowest point, and the cleaning of the cooler be fully accomplished.

Improved Buttons.

Mary P. Carpenter, New York City.—This invention has for its object to furnish an improved button, so constructed that the eye may be detached from the head, passed through the cloth or leather, and again secured to the head, rendering sewing unnecessary. The invention consists in a button eye made of a piece of wire bent into proper form, and having its ends flattened and pointed, and a screw thread cut upon them above the taper.

Improved Water Wheel Gate.

John M. Burghardt, Great Barrington, Mass.—This invention relates to a mode of discharging water on turbine and other water wheels. The gate is adapted for the turbine wheel, with the head of water resting on the curb and gate. The wheel revolves in close proximity to the face of the curb, to which stationary chutes are attached. The gate is confined by the center of the curb, rests upon it and receives a rotating motion thereon by means of a rack and pinion applied to its projecting flange. The flange is a segment which passes beneath the flange of the curb. The power for operating the gate is applied to this segment flange. The movable chute or tongue projects from the plate of the gate and passes through the water apertures in the curb. The movement of the gate is limited by the water apertures. When the gate is turned in one direction, the chutes come in contact with the stationary chute which cuts off the water. By an opposite movement the water apertures may be made of any desired size. By this arrangement of the chutes, the water is directed to the wheel in unbroken columns, and is brought in direct contact with the buckets. The water apertures are made variable, and the gate may be adjusted to discharge more or less according to the quantity of water or the power required, while the shape of the aperture is not varied.

Improved Loom for Weaving Wire.

Samuel Holdsworth, Maspeth, assignor to himself and James Black, Brooklyn, N. Y.—The series of blades, for beating up the weft, consists of small triangular pieces of metal, and are pivoted at the apex side by side on a rod behind the front beam of the loom, with their bases fronting the shuttle race, and lower corners resting on a cam roller so that the upper corners can be thrown up between the warp wires by the spirally arranged ribs of the cam roller. There are two of these ribs to correspond with the two throws of the shuttle during each revolution of the drive shaft, and they are spiral to cause the blades to act successively. The shuttle has a T shaped projection on one side fitted in the notches of vertical plates, forming a horizontal way, and it rests on the top of the roller placed in front of the plates a little below the notches, and having the radial pins arranged in a spiral row and working in an oblique slot, in the bottom of the shuttle to force it upward and back, the roller being turned to the right for moving the shuttle across in one direction, and to the left for moving it in the other direction. This motion is imparted to the roller by a reciprocating piece arm, and wheels, the said sliding piece being worked to and fro in ways on the loom side by a crank on the shaft of the roller, and having a slot through which the arm projects at the free end. In practice the shuttle will have a circular cavity or socket in the upper surface for a flat circular spool or bobbin, and it will have a hole through the front side at or about the center for the weft to run out. The harness frames are connected at the bottom to the arms of a rock shaft. At one end of the rock shaft, and outside of the loom frame, is a weighted arm extending upward and passing through a horizontal sliding piece arranged in ways on the side of the loom frame, and worked by a crank on the end of the shaft of the roller. The slot in this sliding piece, through which the weighted arm passes, is long enough to allow the arm to complete the changing of the harness by falling after it has been raised to and carried a little past the vertical line by the slide, and the weight of the arm is sufficient to continue the motion without the aid of the slide; also to hold the harness in position after the shifting. To effect the shifting the weighted arm has only to be raised to the vertical line or slightly beyond by the slide, in which it is greatly aided by the tension of the warps, so that, its weight being only little more than the force of the tension, the slide has little actual work to do, and this is accomplished without much friction; also, in holding the harness there is no loss by friction. For letting off the warp and taking up the fabric, a small roll is placed a little in advance of the warp roll, around which the warps are carried one turn; another roll is arranged at the front of the loom, over which the fabric passes, and another one alongside of the cloth roll, under which the fabric passes before going on the cloth roll, which is so mounted in slotted bearings as to constantly bear against the said roller, no matter what is the size of the roll of fabric on it, and so receive a uniform motion from it.

Improved Cultivator.

Jack Helm, Hochheim, Texas, assignor to himself and Charles Timm, of same place.—The invention consists in an improved mode of connecting eveners with a pair of gang plows or cultivators. Two gangs of two cultivator plows are attached to an evener in the same ring, and connected together at the rear by a cross piece attached to vertical standards rising from the top of the beams, which separate the plows from each other the required distance. The outer beam is connected to the outer end of the evener by a chain, which also assists in keeping the plows separate at the rear by its tendency to pull the outer one away from the other laterally. The two gangs are connected by a straight bar when the corn or other plant being cultivated is not very high; but when more advanced, a yoke is substituted at the front for the straight bar. The screw threaded standards attached to and rising vertically from the eveners are used for attaching either of these devices. The plow beams are provided with vertical standards for being connected by the short cross pieces, also, by the long jointed cross piece when the corn is not too high to admit of it, or by the Y bars and short cross pieces when the corn is too high for the use of the jointed cross bar. They are also connected by the yoke, which is bolted to the top of the short cross pieces. The standards and pieces keep the plows from swaying laterally too much, as well as separate from each other the distance required. The two gangs of plows are allowed to work forward and back relatively to each other, as necessary, on account of the uneven action of the team, which will, like the cultivator, work on both sides of the row.

Improved Churn.

William H. Holdam, Crab Orchard, Ky.—The invention consists in the improvement of churns. The churn body is made cylindrical in form, and to the bottom is pivoted the lower end of the dasher shaft. To the sides of the dasher shaft are attached a number of radial arms, which are made wide and are inclined laterally. A curb or short tube is made of such a size as to surround the dasher and allow said dasher to revolve freely within it. The tube fits into a similar tube or curb, which has radial flanges or blocks formed upon or attached to it, the outer edges of which rest against the inner surface of the churn body so as to keep the curbs securely in place and accurately centered. The milk has a free passage beneath the lower edge of the said curb. In using the churn the curb is adjusted so that the upper edge may be a little above the surface of the milk to be churned. Then, as the dasher is revolved, the blades raise the milk through the curb and project it outward over the edge against the sides of the churn body, its place being immediately supplied by milk flowing in beneath the lower edge, thus producing a continuous circulation and a violent agitation of the milk, bringing the butter in a very short time.

Improved Music Notation.

Ebenezer P. Stewart, Cotton Plant, Miss.—The object of this invention is to simplify the method of writing and to facilitate the reading of music. The invention consists in writing music in figures which indicate the length of tone, and in writing canceled notes or figures for pauses, or, rather, rests so that each canceled note will indicate the position and length of rest to be produced.

Improved Lamp.

George Brownlee, Princeton, Ind.—The object of this invention is to construct a burner for coal oil lamps by the use of which explosions may be prevented, a quick extinguishment of the flame be obtained, and clearer and brighter light be produced. The invention consists in a weighted valve on the end of a lever connected with a tubular wick slide, which extinguish the flame, either by the pressure of the oil gases or at will by jerking the lamp or inclining the same. If the lamp is inclined in any direction to an angle of more than 45° from the perpendicular, or is let fall a few inches, or receives a violent jar; or if there is a pressure of gas inside it equal to what a person might produce with his breath, the light is extinguished. This is all done by one and the same device, consisting of three parts: a wire spring, a slide on wick tube and an L shaped weighted lever.

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Notes & Queries

J. V. D. asks for the process of staining wood to imitate rosewood.

E. H. C. asks for directions for building a small wherry to carry one person. What material is the best for that purpose?

A. L. asks how to lay out a division plate for a shaping machine. What is the most advantageous number of holes to use?

W. H. Y. asks: How can I take rust off any polished article and replace the polish? I have a lot of carpenters' steel squares encrusted with salt water rust.

G. W. asks for a recipe for making a size mixed with clay, such as is used in the making of paper. "I have made size of starch and clay, but find that, if it stands a while after being boiled, the starch and clay sink to the bottom, leaving nothing but water."

P. asks if there is a process for hardening gold, copper, brass, etc., other than hammering or drawing; and, if so, what is it? In what manner are the peculiar colors given to jewelry? Their hues are frequently removed by heat while under repair. Can it be replaced? If so, how?

J. H. S. asks for the most approved mode of manufacturing the Western stirring or cross plowshare. "I have not been successful in welding wing to land-side, and will feel thankful for the information. I would also like to know if there is any satisfactory way of welding cast iron."

P. J. E. says: We have a mine locomotive with chilled tires on drivers. They have worn down about 1/4 of an inch, leaving a ridge on the outside of the tread which makes it bad to run over castings. The cost of new tires is expensive, besides the disadvantage of the loss in time in sending off to have it done. I would like to know whether there is any way in which we could turn or grind off the tires.

E. P. asks if any lasting evil effects are experienced from the taking of quinine, such as weakness or stiffness of the joints or limbs. If a person takes too much at once or too often, it will produce ringing in the ears, etc., and if continued, other and more serious effects will be produced. But if taken in moderate doses, will any of the effects first mentioned be experienced?

H. W. M. says: As the correct setting of the slide valve of common steam engines is one of the most important duties of the engineer, and as I have found no simple and correct scientific method in any of the books and papers, I would ask engineers to give their methods through your paper. I am sure they would be very interesting to a large number of your readers.

J. S. asks if wire bells, so much used for clocks, have ever been tried, and with what success, for churches. If coiled like clock bells, in form of a vertical plane, such a bell would take up too much space; but the space would be very much reduced if wound in a spherical form, and it is of interest to the public to know how the sound would compare with that of other church bells, as the cost would probably be less.

J. E. G. wishes to put in steam to help in a mill during busy times, but objects to the danger from fire from the smoke stack. Does any one know of a system by which the smoke and sparks from the stack can be made harmless? It is proposed to lead the stack into the tall race of the mill; would the outflowing water give draft enough, supposing the end of the stack to be entirely under water? Or would a fan blower, which could be run at any time by water power to get up steam, be necessary? "I should like to hear from some one who has had experience in such matters."

H. B. says, in reference to the question of sailing faster than the stream: During an experience of many years in the navigation of the Allegheny and Ohio rivers, it has been asserted that a raft of boards will run faster than a log or piece of drift wood, and that an oil or coal boat will run faster than a raft of boards. It has been further observed that rafts and boats do run faster than the water in which they float. Moreover, a boat will outrun the rise of the stream so as to have to wait for it. Oil barges in Pennsylvania were run out of Oil Creek by what are called pond freshes. There was, at or near Titusville, a very large mill pond, the dam of which had a "breast" that was raised four or five feet by a temporary "bracket." The oil barges, when light, were towed up the creek with horses; when loaded, the oil shippers would club together and "buy a fresh," that is, they would hire the mill owner to "cut the bracket" of his dam and let the water run out of his mill pond. When the creek was fairly full of water, the oil shippers would start their barges on plenty of water; but they would often have to stop twice, before reaching the river, to let the water overtake them, the average distance run not being more than twelve miles to the river. I would like to know the reason of it.



J. C. R. can coat his iron articles with a black Japan by following the directions on p. 233, vol. 28.—E. F. L. should write to the author; we published his address.—S. H. & Co., will find full directions for tempering steel for all purposes in the recent numbers of our journal.—X. Y. Z. will find full directions for tinning iron on pp. 212 and 213 of our vol. 26.—C. H. F. will find his question as to loss of power by use of a crank answered by our reply to G. W. L. on p. 235, current vol.

C. H. F. asks if an iron or brass wire electroplated with copper will convey electricity as well as a copper wire of the same size. Answer: No. The copper wire would be a much better conductor. Electricity travels not merely on the surface, as formerly supposed, but in and throughout the wire.

T. D. & Co. ask: How long would it take one man, working 10 hours per day, to do the same work that could be done with an engine using 1 ton of coal? Answer: An engine of small power may use ten pounds or more of coal per horse power per hour. A large engine may run on two pounds. A man power is equal to about one-tenth the "horse power" of engines, as an average.

L. W. E. asks what carbolate of lime is. Answer: A compound of carbolic acid and lime, which is an excellent disinfectant, although to some the odor is unpleasant. It can be made by putting 3 ozs. carbolic acid in 12 quarts lime water. Whitewash your hennery with this preparation.

J. T. D. asks: At what distance should the crank of an engine be from the "straight" when the steam first enters the port? Answer: In a slowly running engine, the steam valve should open just as the crank reaches its center. In a quick moving engine, as that of a locomotive, it is given considerable lead, and should be open to the extent of perhaps five sixteenths of an inch when the piston commences its stroke. Some well known engineers dissent from the general opinion as expressed above, and believe that lead is, under no circumstances, beneficial.

G. T. asks: By what rule is the horse power (nominal and actual) of a marine engine of the compound and surface condensing system determined? Answer: Precisely as in any other case. By determining the mean pressure in each cylinder, multiplying by piston area and speed, and dividing by 33,000.

J. L. asks: 1. Which will propel a boat the faster, the paddle wheel or the screw wheel? I believe the screw wheel propels a boat the faster, and if so, why is it not used on river boats? 2. How many feet do river boats draw on the average? How many do ocean steamers? Answer: 1. The screw in vessels of deep draft; the paddle wheel in vessels of light draft. 2. Three to 6 feet; 15 to 20 feet.

E. A. V. asks why some water backs in ranges rust the water after standing a few minutes, and others do not. Is it owing to the iron or to the water? Answer: Such cases are usually due to some exceptional cause, which has rusted the water back badly, and the

difficulty generally disappears after a time. Some kinds of water will, however, be more likely to produce rust than others. Water from rapidly running streams which absorb considerable free oxygen is more likely to cause rust than water from wells, or from rivers having a sluggish current.

A STUDENT IN CHEMISTRY asks: 1. Will the oxyhydrogen blow pipe burn a hole in a thick piece of iron? 2. Will gunpowder burst any thickness of iron if confined in the center, or could there be strength enough to prevent it from exploding? Answer: 1. Yes. Experiments with ordnance have developed a pressure by firing gunpowder as high as 27 1/4 to 40 tons per square inch. The latter pressure would burst an iron vessel of any thickness, but might be confined by steel of higher tenacity than 40 tons per square inch, as good tool steel, or Bessemer metal of very high quality and containing more than 1/2 per cent carbon. No thickness whatever can be made to withstand pressures per square inch exceeding the tenacity, per square inch, of the metal adopted.

S. & D. say: 1. We have rented 30 horse power, to be received by means of 60 feet shafting connecting with 40 feet of 3 1/4 inch cold rolled shafting. Is 3 1/4 inch cold rolled strong enough? The shaft is to revolve 110 in a minute; how shall we determine the amount of power we are getting? 2. How many horse power do we require for two 4 1/2 inches run of flouring burrs, and a 30 inches middlings, run with ordinary bolting, elevating, cleaning, etc? Answer: 1. Two and a half inches cold rolled shafting will probably carry the specified amount of power, but we should prefer 3 inches. 2. Thirty horse power should do the work if everything is in good order and lubrication well done.

W. F. says: For some time past I have noticed that iron castings molded in our shop have a different color after being cleaned; some of them have a blue color on the surface, and others are of a clear gray color. What is the cause? Those having the gray color are molded in sand mixed with pure Sydney coal for facing. I do not know what the blue ones have mixed with the sand, unless it is a small portion of Cumberland coal. A short time ago I saw a short editorial of yours on molding sand, and I hoped to have seen more on that subject. I would like to know how to mix the facings, blackening and other finish for molds. No workman seems to know; or if he does know, he does not care to tell a boy, who wishes to learn all the details of the trade. Answer: We are glad to hear from an intelligent and ambitious apprentice, and will try to help him. We presume that the Sydney coal blackening gave color to the metal by its ash, if it produced any change at all. The blue on other castings may be due to bituminous matter from the Cumberland coal. For black wash, mix charcoal, plumbago and size with water enough to give the consistency desired. For small fine work, do not use blackening at all. Select fine, clean, sharp sand. For larger work blacking is necessary; black lead is least affected by heat, anthracite and charcoal next, and bituminous coal most. Blackening of anthracite or charcoal weakens the sand, and, if too fine, clogs its pores. Bituminous blackening opens the sand and weakens it, but if it is properly used, by an experienced molder, smooth castings are always obtained.

N. M. says: We have in our establishment the following machinery: Two rip and 2 cross cut saws, 1 planer and matcher, 1 tenoner, 1 scroll saw, 1 sticker, 1 shaper and 1 boring machine. For power, we have an engine, 10 inch bore, 8 inch crank, making 70 turns per minute. We have to carry 60 lbs. of steam, and even at that it is very hard work for the engine to drive the machinery; in fact, I cannot run the matcher and siding saw (which I run on a large saw table) together. Our boiler is 12 feet long x 40 inches diameter of shell, with 41 three inch tubes, firing underneath and returning through the tubes. 1. Do you think the boiler would make steam enough to run the engine up to, say, 120 turns per minute? Should a boiler of those dimensions make steam enough to run an engine of that size at that speed? 2. How is the heating surface of a boiler calculated, what is termed the grate surface, and what is the fire surface? I have twenty-four volumes of your paper bound, and money would be no temptation to part with it. Answer: 1. We should speed up the engine and also carry higher steam if convenient and safe to do so. Some benefit should be expected from both changes. 2. Measure the area of all surfaces of the boiler in contact with the furnace gases on the one side and water on the other. Thus a tube 4 inches diameter would be one foot in circumference, very closely, and would have a foot of heating surface for each foot of its length. The grate surface is simply the area of fire grate, and is measured by multiplying its length by its breadth. We are pleased to hear from our old friends and readers of such long standing.

J. H. says: I wish to construct a small steam engine and boiler, for the purpose of running a family sewing machine, for my wife, and wish to ask: 1. Will a plain cylindrical boiler, 6 inches diameter and 20 inches length, with cast iron heads 1/2 inch thick, having flange outwards for riveting to the boiler, constructed of sheet copper 1/4 inch thick riveted, give power enough to an engine of 1 1/4 by 3 inches cylinder? The motive power is to be a gas flame from an ordinary burner. 2. What pressure would such a boiler sustain before rupture? 3. What pressure would be required to run the sewing machine? 4. Where must the water line be? 5. What must be the size and stroke of the pump supplying the boiler, said pump being constantly in use? 6. What must be the size of opening for safety valve in boiler? 7. Will such a boiler and engine be safe? 8. Where must the opening in boiler be for the pump? Answer: 1. Yes, but the heating surface is too small for economy. We doubt if a single burner would give sufficient heat. 2. Without joint, it should sustain 1,500 pounds on the square inch. Actually, the riveted joint and possible weak spots in the metal would probably reduce its strength to about 750 lbs. We should set the safety valve on such a boiler at anywhere from 100 to 150 lbs. 3. We can only guess—20 lbs. The resistance would be quite as much, or more, in the engine itself as in the sewing machine. 4. A little above the middle line. 5. Three sixteenths, if of same stroke and number of revolutions per minute as the engine. 6. One quarter inch diameter. 7. Yes, as safe as any ordinary steam engine and boiler. 8. Near the back end.

G. E. B. asks how carbons for Bunsen batteries are made. Answer: In the manufacture of illuminating gas, the retorts become coated with amorphous carbon; from this retort carbon, or coke, the battery carbons are made. There are several processes; one is to cut it into shape, another is to press the pulverized coke into a mold, having first laid a strip of platinum in the mold, so that the carbon will cast on it, the aim being to hold the material together with the least amount of cementing substance, as is the case in the manufacture of solid emery wheels.

D. C. M. asks for an explanation of the term "a horse power." Answer: See editorial pages of this issue.

W. A. C. asks: 1. How many gages of water should be carried in stationary tubular boilers, where the water used is clear and the force pump works well? Does it require any more fuel to drive the same machinery by carrying the water in boilers at first, second or third gages; and if so, what proportion does each gage take more respectively? 2. Forty lbs. pressure will give our machinery the required motion; how many lbs. would be advisable to carry to be economical? 3. Where it is necessary to transmit steam through pipe some distance, what is the best way to cover and pack the pipe, and what with? 4. What would be the loss in fuel in transmitting steam from boiler to engine situated 200 feet apart more than if close by? Answers: 1. The lower the water is carried, the drier the steam; the higher it is habitually kept, the safer against accidents from low water. In ordinary boilers we should carry six inches of water over the crown sheet. The gages should be so placed that the middle one should be at about that line. The lower should be above the level of the crown sheet. The higher the pressure and the drier the steam, the greater the economy, where boiler and steam pipe are well felted and lagged. 2. The amount of economy varies in every instance. Try it, if safety permits carrying higher steam. There is a pressure, giving maximum economy, which can only be determined by experiment. 3. Hair felt, for low temperatures, as of steam at 60 or 80 lbs., and for higher pressures, ashes, plaster, and the patent cements sold for the purpose, are effective as covering. 4. Properly covered, the loss from the steam pipe would be of little amount in the case mentioned.

A. L. K. asks: Is there any kind of an instrument by which a person can see an object in the dark, distinctly or nearly so? Answer: None except the lantern.

A. E. L. says: Will you give us a description of the steam engine indicator and the manner of using it? Answer: Consult Hamilton's "Useful Information for Railway Men," pp. 314-319, or see our reply to H. S. M.

G. H. M. asks: If rails and drive wheels of engine locomotives were toothed so that they could not slip, and two engines were built, similar in every respect with the exception that one locomotive had a 6 feet driver and the other a 3 feet, which locomotive will haul the biggest load? Answer: All other things being equal, the smallest drivers will pull the heaviest load.

J. W. S. asks: Will some one please inform me how I can get a thin coating of rubber on a solid object like a block of wood? Answer: Dissolve rubber in bisulphide of carbon and apply as a varnish.

H. E. N. asks: How is bird lime made, especially that which is very tenacious? Answer: Bird lime is made by boiling the middle bark of the European holly (*Ilex aquifolium*), or the young shoots of elder, plants like mistletoe, and other parasites, separating the gummy matter from the liquid and leaving it for a fortnight in a moist, cool place, to become viscid. It is next pounded into a tough paste, and washed and put aside for some days to ferment. Some oil or thin grease is to be incorporated with it, when it is ready for use.

B. O. asks whether there is any known process of coating glass with gold from solution, similar to the process of silvering the same by precipitating metallic silver. Answer: Three solutions are required for depositing gold on glass: 1. 1½ drams caustic soda, 3½ ozs. water. 2. 1½ dram grape sugar (glucose), 3 ozs. distilled water, 2½ ozs. alcohol of 80 per cent, 2½ ozs. aldehyde of sp. gr. 0.75. 3. Neutral solution of chloride of gold, 1½ dram gold to 37 ozs. water. Take 4 volumes of No. 1, and 1 volume No. 2, mix and add ½ of a volume of No. 3. Pour quickly into the hollow glass globe to be plated. Five minutes or more is required. Do not warm above 140° Fahr. Clean the glass with soda and alcohol, not with acids.

H. B. asks: How can I ascertain for myself whether a substance is lime or magnesite, or whether it is a mixture of both? If the latter, how can I get them apart? Answer: Lime, when in solution, gives with oxalate of ammonia a white precipitate. If lime and magnesite are to be separated, add to the solution some sal ammoniac, and afterwards oxalate of ammonia as long as a precipitate is formed. After filtering, add phosphate of soda, which will precipitate the magnesite if any be present.

C. R. asks: How are the eggs of the so-called Pharaoh's serpents made? Answer: Pharaoh's serpents' eggs are made by precipitating a solution of sublimate of mercury with sulphocyanide of ammonium. Filter the precipitate; wash and dry and mix with every pound of the precipitate one ounce gum tragacanth, soaked in hot water. Make a somewhat dry pill mass, and roll in pellets of the desired size, and dry again. The fumes are dangerous and must not be inhaled.

J. B. S. says: I am building an aquarium, and want to know whether, in the use of the cement mentioned on page 292, of your current volume, it is intended that the glass shall be let into the wood, or can the cement come only to the glass, forming the joint of itself? 2. What is the best polish for black walnut, and how is it applied? Answers: 1. Use an angular beading of wood, outside the glass, and cement the edges of the glass into the angle. 2. See page 72 of our volume XXVI.

J. S. J. asks: Is there any friction gained by placing the hub of a wagon brake below the horizontal center on the front side of the wheel, or above the center on the rear part, instead of on any other part of the wheel? Answer: Not unless the pressure is, by that arrangement, increased.

C. H. wants to know what sized boiler is wanted to run two cylinders of 2 inches stroke x 1½ inch bore, to make 300 revolutions per minute. How thick must the iron be for a small locomotive boiler, what diameter should the drive wheels have, and how many should there be on a side? Answer: Measure the sizes of the first locomotive that you can conveniently obtain access to; make all parts in proportion except the boiler, which should have a considerable excess of heating surface.

B. A. R. asks: How large pulleys should I use to run a 1½ inch band saw over, of 16 gage? Answer: The larger the better; 30 inches is a good size.

J. F. W. asks: Will wood answer as a float in a steam boiler, in its natural state, or will any preparation better it for that purpose? I want it to operate a valve, and for certain reasons the common copper one will not answer. Answer: Wood in its natural state would answer for a time as a float. But we should not wish to trust it as a permanent float. We do not call to mind any preparation that would keep it waterproof under the heat and pressure of a steam boiler.

A. W. C. asks: Do galvanized sheet iron kettles impart, to food cooked therein, any poisonous or unwholesome properties? Answer: Zinc, with which the so-called galvanized iron is covered, is poisonous. Galvanized iron should not be used for culinary purposes.

J. & J. T. say: We have in view the building of a flouring mill, and we propose to drive the main spindles by friction. A rough sketch of the proposed plan is enclosed, and we wish to have your opinion about it. The dotted lines at each pair of pulleys show the edges of the pulley frame, which works in suitable slides, the pulleys being brought into gear by a short rope or chain fastened to an upright rod something like a hand brake on a railroad car. The bottom of the rod is to work in a slot so that both pulleys will have the same pressure, and a spring or weight will be arranged to take them out of gear. The pair on the right hand are in gear and the pair on the left are out. One great advantage will be that the driving pulley or engine need not be stopped to throw them in or out of gear. We propose making the small friction pulleys of disks or rings of thick paste or card board; we have used one now for more than a year to drive our saw mill carriage and it is quite true, smooth, and hard yet, and as good as when made. It surpasses anything we ever tried in our twelve years experience, and that alone has saved us far more than \$3, the price of your paper, from which we got the idea of paper friction pulleys. Previous to that time we used iron, wood, rawhide, leather, rubber and rubber belt, but we find nothing like paper.

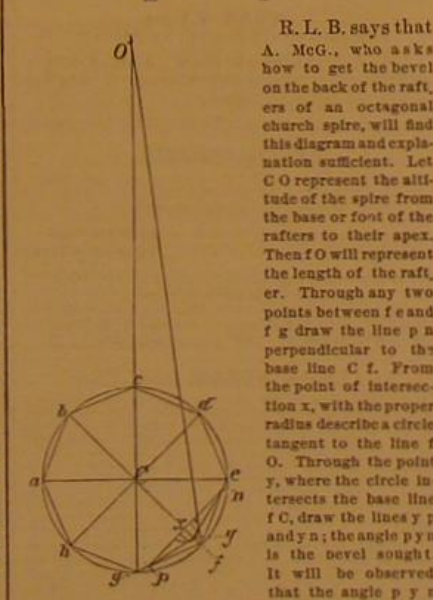


A, C, cast iron pulleys on burr spindles, each 3 feet diameter x 6 inches face. B, cast iron driving pulley, 4½ feet diameter x 6 inches face. D, E, F, G, paper friction pulleys, each 18 inches diameter x 6 inches face. Answer: The proposed arrangement promises well.

A. F. Jr. says: I have two Daniell's batteries, and I use diluted blue vitriol and pure water in the porous cups, and insert the zinc. I have never succeeded in getting but a slight current, and find that, after a few hours standing, the lower part of the porous cups are all coated with copper. What is the cause? Answer: If you use a saturated solution of sulphate of copper outside, to act on the copper, and nine parts of water to one part of sulphuric acid, inside the porous cup, to act on the amalgamated zinc, it will be at least a month before you are troubled with the copper deposit.

T. A. N. asks for information concerning the discovery of the ancient tablets pertaining to Scriptural history, and the name of the student who translated them into English. Answer: The translator is George Smith, of the British Museum. A full account may be found in the *Eclectic Magazine* for February, 1873, p. 201.

J. E. H. says: In accordance with your request that some reader would furnish solutions to the questions of E. C. M. and E. W. H., published in your issue of April 19, 1873, I submit the following solution to the question of E. C. M.: Let $w=5$ lbs. and $w'=6$ lbs; and let $\sin. \phi = \frac{1}{2}$; then we shall have for the accelerative force, $f = \frac{(w-w' \sin. \phi) + (w+w')}{g} \times \frac{(5-6 \times \frac{1}{2}) + (5+6)}{32} = 2.21476$. Hence, the distance the first body will descend in 10 seconds will be $\frac{1}{2} \times (2.21476 + 2) \times 100 = 221.476 + 2 = 110.738$ feet, answer. The solution to the question of E. W. H. is: Let r = the distance of the point of application of the force, P , from the center of inertia of the body, k its principal radius of gyration, m its mass, v its progressive velocity, and ω its angular rotary velocity. Then we shall have: $v = \frac{P}{m} (1)$, and $\omega = \frac{rv}{k^2} (2)$.



R. L. B. says that A. McG., who asks how to get the bevel on the back of the rafters of an octagonal church spire, will find this diagram and explanation sufficient. Let C O represent the altitude of the spire from the base or foot of the rafters to their apex. Then C O will represent the length of the rafter, er. Through any two points between f and g draw the line p n perpendicular to the base line C f. From the point of intersection x, with the proper radius describe a circle tangent to the line f O. Through the point y, where the circle intersects the base line f C, draw the lines y p and y n; the angle p y n is the bevel sought. It will be observed that the angle p y n depends upon the length of C O and C f, or, in other words, the bevel depends upon the rake of the rafter.

H. M. W. says, in answer to W. W. C., who asked for a cement to fasten leather upon iron: 1. Use glue and gum ammoniacum; melt together, then add nitric acid. 2. Coat the clean iron with a hot solution of glue, and soak the leather in a warm infusion of nutgalls. Put both together and subject to pressure. 3. Put pulverized rosin to the flesh side of the leather and apply to the heated iron.

R. F. replies to J. G. K., who asked if acorns were edible; I would say that in the southern mining district of California, there are plenty of oaks that yield a very pleasantly tasted acorn. I presume they may be found on this side of the Rocky Mountains, but I never found them in the New England States. They are very pleasant eating, either raw or boiled, and seem to be very nutritious. Whether they could be used as food in a regular way is doubtful, because of the fact that they are of a stringy nature; and I believe that, when eaten raw, they are an excellent preventive of and cure for diarrhoea.

W. W. replies to T. E. B., who asked how to remove clinkers from stoves: Take an iron rod about half an inch in diameter, sharpened at one end to a point, and with a hammer, drive it through the clinker, at such distance from the side of the stove as not to injure the firebrick; having made one hole in this manner, repeat the operation at the distance of an inch from the first, and if the stove be a cylinder, make a circle of holes, when with a smart blow the center of the clinker can be broken away, and the other part will easily detach from the firebrick, the vibration caused by the hammering causing it to loosen.

H. M. W. says, in reference to artificial butter: The following two recipes will perhaps be of interest to your readers: 1. The London Lancet, 1859, p. 460, says: Sixty lbs. colza oil are put into a well tinned brass boiler (of about twice the capacity); add 2 lbs. potato starch and stir with a wooden spatula until the mixture begins to boil. Let the boiling continue for several hours until the oil has lost all disagreeable taste or smell. Decant and let cool. Add half its weight of clean suet. 2. The *Pharmaceutische Centralhalle*, vol. 5, p. 157, contains the following: 1 lb. mutton suet is melted with 9 ozs. of milk and strained; there is then added thereto 1½ lbs poppyseed oil. Heat with 2 ozs. of bread crust, ½ oz. mugwort and 2 sliced onions. Strain.

S. W. H. says, in answer to E. W. H., who asked what motion would be imparted to a body by a given force applied at one end, at right angles to its axis: My opinion would be that it would move in a direct line for ever, its axis remaining at right angles to the line of motion. Having no weight, it could have no inertia; and there being no resistance of air or anything else, if it were once in motion, it would always be in motion. The absence of inertia and all resistance would prevent the upper end from getting the start of the lower end. I know little of higher mathematics, and am perhaps entirely wrong, but give my ideas for what they are worth. Since impossible conditions are allowable in problems, I would like to ask E. W. H. what the result would be, should an irresistible moving body come in direct contact with an immovable body.

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

O. M.—The mineral you send contains silver.
A. O.—The composition consists of prussiate of potash, chlorate of potash and bichromate of potash.

COMMUNICATIONS RECEIVED.

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

On the Patent Office Surplus. By F. D. J.
On the Retardation of the Earth's Motion by the Tides. By J. H.
On Girdled Trees. By A. D.
On the SCIENTIFIC AMERICAN. By C. H. D.
On Solar and Sidereal Time. By J. E. H.
On Saw Teeth. By C. H. B.
On the Million Dollar Telescope. By A. D.
On Iron Shipbuilding in Philadelphia. By B. H. B.
On Light. By C. E. T.
On a Remarkable Astronomical Phenomenon. By J.
On Concentration of the Sun's Heat. By J. C. F.
On Boiler Explosions. By J. C.
On the Ransom Condenser. By W. C. D.
On Patents. By J. B. C.
On Deep Sea Soundings. By C. E. A.
On Marine Carriages. By C. A. B.

Also enquiries from the following:

A. de W.—H. E. N.—J. McC.—J. E. H.—P. E.—L. L. B.—J. W. C.—J. 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

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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:

- 24,915.—CASTING COPPER CYLINDERS.—F. Adams, July 16.
 24,925.—ELEVATOR.—G. A. Betteley, July 16.
 24,933.—MEAT CUTTER.—J. G. Perry, July 16.
 25,061.—ELEVATOR.—O. Tufts, July 23.
 25,148.—WEIGHING SCALES.—F. M. Strong, T. Ross, July 30.

EXTENSIONS GRANTED.

- 23,820.—MANUFACTURE OF WATCH CASES.—J. Boss.
 23,815.—LAMP SHADE.—C. & A. C. Wilhelm.
 23,826.—SKATE FASTENING.—J. C. & W. B. Sniffin.
 23,822.—ROOFING CEMENT.—N. A. Dyar.

DISCLAIMER.

- 3,333.—SKATE FASTENING.—J. C. & W. B. Sniffin.

DESIGNS PATENTED.

- 6,613.—GLASS WARE.—T. B. Atterbury, Pittsburgh, Pa.
 6,614.—KNOWS, ETC.—E. B. Braggan, Philadelphia, Pa.
 6,615.—STAIR BODS.—W. T. Mercereau, Orange, N. J.
 6,616.—LAMP STAND.—M. H. Mosman, Chicopee, Mass.
 6,617.—HAMES TOP.—H. Besig, Jr., Philadelphia, Pa.
 6,618.—COOK STOVE.—M. M. Coppuck, Philadelphia, Pa.
 6,619.—TOY SAVINGS BANK.—R. F. Friebe, Cromwell, Conn.
 6,620.—HOT AIR REGISTERS.—E. A. Tuttle, Morris-town, N. J.
 6,623.—DOOR KNOBS.—G. W. White, New York city.
 6,624.—DOOR BOLT PLATE.—G. W. White, New York city.

TRADE MARKS REGISTERED.

- 1,222.—NEEDLES.—Bridgeport Cold Swaged Needle Co. Ct.
 1,231.—FRILLINGS.—Browett & Co., Coventry, England.
 1,234.—BRANDY BOTTLE.—Cazade et al., New York city.
 1,235.—SEALING WAX.—R. B. Duvell's Son, N. Y. city.
 1,236.—BURNISHING INK.—Fletcher et al., Lynn, Mass.
 1,237.—MEDICAL OIL.—M. S. Goodrich & Co., Flint, Mich.
 1,238.—PREPARED FLOUR.—Hopkins & Co., N. Y. city.
 1,239.—OINTMENT.—F. H. Kimberley, Springfield, Mass.
 1,240.—RAKE HANDLES, ETC.—Smith et al., Gallen, Mich.
 1,241.—HARVESTER.—D. M. Osborne & Co., Auburn, N. Y.
 1,242.—BLUING.—H. Sawyer, Chelsea, Mass.
 1,243.—GAS BURNERS.—Mrs. A. H. Wood, Boston, Mass.

SCHEDULE OF PATENT FEES:

On each Caveat.....	\$10
On each Trade-Mark.....	\$25
On filing each application for a Patent (17 years).....	\$15
On issuing each original Patent.....	\$20
On appeal to Examiners-in-Chief.....	\$10
On appeal to Commissioner of Patents.....	\$20
On application for Reissue.....	\$30
On application for Extension of Patent.....	\$50
On granting the Extension.....	\$50
On filing a Disclaimer.....	\$10
On an application for Design (5 years).....	\$10
On an application for Design (7 years).....	\$15
On an application for Design (14 years).....	\$30

VALUE OF PATENTS

And How to Obtain Them.

Practical Hints to Inventors

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Large inventions are found to pay correspondingly well. The names of Blanchard, Morse, Higlowl, Colt, Ericson, Howe, McCormick, Hoe and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years they have acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office, men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office; enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN Patents. This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A positive answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them; they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

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To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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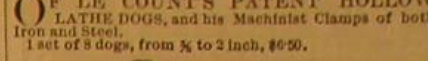
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(NEW SERIES.)

NEW YORK, JUNE 7, 1873

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CHAIN MAKING MACHINE.

Chain cable for anchors is generally made by hand, each link being separately welded by the hammer of the blacksmith. When it is considered that on the perfection of each weld the safety of a ship, with all her cargo and the lives of passengers and crew, depends the necessity of a reliable chain is evident.

The cable produced by the machine represented in our engraving is of one and a quarter inch iron, of superior excellence in appearance as well as in quality. The links are perfect in form, the weld is invisible, and the strength of the chain has, as is stated, been proved by actual test to be much greater than that of the best handmade. The standard test for cable formed from one and a quarter inch iron is twenty-eight tons; but chain of this size, made by the machine, withstood a strain gradually increased to forty-six and a half tons before breaking. Even then the fracture occurred not in the weld but in the opposite end of the link, thus proving the welding to be equal in strength with the iron used.

The illustration shows the position of the chain in the machine while being manufactured. The anvil block is a cubical mass of iron having a square recess from top to bottom, in which fits a vise or die carrier. This is pivoted at the bottom, and is operated by toggle jointed levers. This joint is connected to the vise at the top and to a cross-head or horizontal beam at the other end, and is elevated and depressed by the piston of a small steam cylinder standing upright directly under the union of the levers. Inserted in the face of the vise is a die, cut to receive the half of one link in a vertical and the half of another in a horizontal position. A corresponding fixed half in the anvil completes the die. When closed the latter presents on its face two holes, as far apart as the width of the link, and of a size to receive the iron to be welded. There is a channel passing between these holes for the reception of the last welded link. A trough or leader, inclined and leading from the back of the machine, through a slot in the center of the die, serves to convey the studs or bridges, and by a simple automatic movement, a single one is fed to the die simultaneously with the closing of the vise.

The small cylinder, with its piston rod attached to the upper side of the toggle joint, is filled with water, and serves only to steady the movement of opening and closing the vise.

Rising from the back of the anvil block is a heavy frame, supporting above a steam cylinder of thirteen inches diameter with a square piston rod, which serves as a hammer or press, the end of which is formed to correspond with the channel in the top of the die, and recessed to receive the link to be welded.

There is another attachment, not shown in the engraving, a description of which is unnecessary, as it is merely an automatic appendage designed to turn and move the chain along as it is completed; when attached it is operated by the segmental gear shown on the side of the anvil block.

The links are prepared by another machine, which cuts and bends them to the form of an elongated U.

The operation of the machine is as follows: Convenient to the machine is a furnace, provided with more or less openings to receive the ends of the links, which, when properly heated, are inserted into the apertures of the closed die. Steam is then admitted, and the hammer is brought down, thus forcing, with a single blow, the link into the die and bringing the ends together, forming a butt weld. The vise

is then opened by the small cylinder below, and the perfectly formed link extracted. The vise is now closed, and the last made link placed in the channel between the apertures of the closed die, when the next link is similarly proceeded with.

Links for connecting railroad cars, and those for bridges and many other purposes, can be made with this machine, with a slight alteration. One of the merits of the apparatus is the perfection of its weld, it being instantaneous and affecting the whole surface of the uniting parts at once.

The inventor claims that this is the first successful attempt to weld chain cables by mechanism, and the importance of the product is such as to give to his invention the interest and value due to a much needed industrial improve-

ment on the earth's surface; in the upper strata this again becomes liquid, and returning to the earth does a large amount of mechanical work. The machine is only 6.1 horse power, needs little alteration, and is quite safe, the tension of the steam being low. If heated by gas, it consumes 25 cubic meters per hour. The cylinder-shaped boiler is expanded conically at the upper part. It stands at an angle of 45°, and turns on supports, while a beveled wheel arbor changes the motion into a horizontal or a vertical. It will be seen in action at the Vienna Exhibition. The above description is as clear as mud.

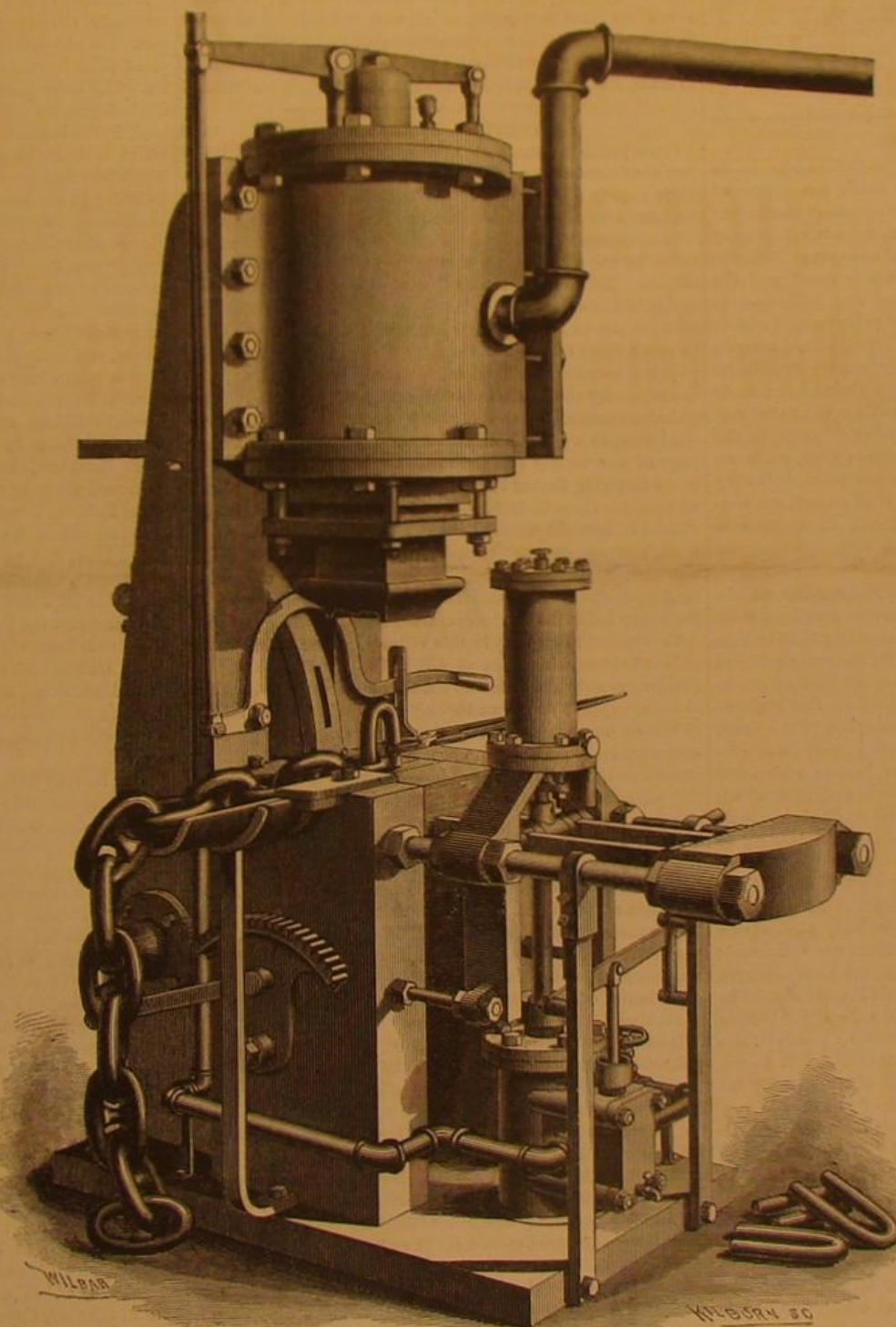
Tumbling Pigeons.

Professor Darwin, in a recent communication in *Nature* upon the origin of certain instincts, referring to tumbling pigeons, says:

The behavior of the ground tumbler or lotan, of India, renders it highly probable that in this sub-breed the tumbling is due to some affection of the brain, which has been transmitted from before the year 1600 to the present day. It is necessary gently to shake these birds or, in the case of the Kalmi lotan, to touch them on the neck with a wand, in order to make them begin rolling over backwards on the ground. This they continue to do with extraordinary rapidity, until they are utterly exhausted, or even, as some say, until they die, unless they are taken up, held in the hands, and soothed, and then they recover. It is well known that certain lesions of the brain, or internal parasites, cause animals to turn incessantly round, either to the right or left, sometimes accompanied by a backward movement; and I have just read, through the kindness of Dr. Brunton, the account given by Mr. W. J. Moore (*Indian Medical Gazette*, January and February, 1873) of the somewhat analogous result which followed from pricking the base of the brain of a pigeon with a needle. Birds thus treated roll over backwards in convulsions, in exactly the same manner as do the ground tumblers; and the same effect is produced by giving them hydrocyanic acid with strychnin. One pigeon which had its brain thus pricked recovered perfectly, but continued ever afterwards to perform summersaults like a tumbler, though not belonging to any tumbling breed. The movement appears to be of the nature of a recurrent spasm or convulsion, which throws the bird backwards, as in tetanus; it then recovers its balance, and is again thrown backwards. Whether this tendency originated from some accidental injury, or, as seems more probable, from some morbid affection of the brain, cannot be told; but at the present time the affection can hardly be called morbid in the case of common tumblers, as these birds are perfectly healthy and seem to enjoy performing their feats, or, as an old writer expresses it, "showing like footballs in the air." The habit, apparently, can be controlled to a certain extent by the will. But what more particularly concerns us is that it is strictly inherited. Young birds reared in an aviary which have never seen a pigeon tumble, take to it when first let free. The

habit also varies much in degree in different individuals and in different sub-breeds; and it can be greatly augmented by continued selection, as is seen in the house tumblers, which can hardly rise more than a foot or two above the ground without going head over heels in the air.

HORSE CHESTNUT STARCH.—Starch is now manufactured in the south of France and the neighborhood of Paris from the horse chestnut. This nut yields about 16 or 17 per cent of pure starch. If it is to be used as food, it must be treated with water containing carbonate of soda, to remove all the bitterness, and then the starch must be washed repeatedly with pure water.



MACHINE FOR MAKING CHAIN CABLES.

ment. Patented by William Dennison. For further information address H. B. Dennison, East Cambridge, Mass., where the machine can be seen in operation.

An Expensive Motor.

The *English Mechanic* says that a small motor, suitable for sewing machines, has been invented by Friedrich Siemens, in Dresden. It is described as a steam engine which has neither cylinder, nor piston, nor guide bars, nor crank, nor valves, but only a boiler, which is at the same time the moving part. The machine works always with one and the same quantity of water. The steam passes through a cycle something like what is seen in nature; the sun evaporates water

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LEATHER BELTING.

Good bands, well put on pulleys of sufficient size to do easily the work required, constitute no small proportion of the expense of getting into operation any considerable amount of machinery; but when this part of the work is well done at the outset, an almost endless amount of annoyance from the breaking down of machinery is subsequently saved, and the good belting, if properly cared for (and very little care is needed), will so long outwear the low priced article as to make it cost really far less in the end. There is, however, considerable misapprehension, not only among machinists but even among belting manufacturers themselves, as to what constitutes the best leather for making the most serviceable bands, and, with the large number of firms in the business, there is such an active competition that, while an apparently good belt can be bought at a low price, it is very difficult, and almost impossible, even for an expert, not considering where the belt was manufactured, to distinguish between the best belts and those which in wear will be found decidedly inferior.

The first point to look at in a belt is the quality of the leather, and here we have at once diverse opinions even among belting manufacturers, some contending that leather cannot be made too heavy and too hard for the best quality of belts. This is the general impression among foreign manufacturers, and the same idea is advanced in the business here, but it must be evident, on an examination of the facts, that such an opinion is erroneous. There is very little difference in the texture and appearance of leather which will wear best for the soles of boots and shoes and that which will serve best for band leather, and most of the heavy harness leather, if well stretched and finished with less oil or stuffing, would make good belt leather. But it should be noted that, in the best belt leather, the original fiber of the hide must be as little disturbed as possible. An examination with a microscope of the edge of an ordinary piece of sole or belting leather will show how these fibers are interlaced; and, when not disturbed, this constitutes the great strength of a raw hide. The object in tanning belt leather should be to unite the tannin and the gelatin in the cells of the hide so as to preserve, while disturbing as little as possible, this tissue of fibrin, while for sole leather the object is to put into the hide the largest possible amount of tannin. By the first method the original tensile strength of the hide is preserved and added to; and by the second, where tensile strength is not so much the object, the leather is made harder and tougher to stand the wear in the way of attrition to which it is to be subjected.

Notwithstanding, however, the necessary distinction here made, it is very difficult to mark the point between the best belt and the best sole leather, taking only a small piece of each; but another point, of far greater importance, is the proper selection of the part of the hide of which the belt is made. For the making of the best belts, only a comparatively small portion of a hide can be used, and this is taken off the butt or thickest part. Where a cheaper belt is required, a larger portion of the hide is used, covering a portion where wrinkles exist, or an unevenness of service. These defects may be in a great measure covered up by rolling and stretching, but the natural shape of the hide will soon make itself manifest, so that the belts will not hug the pulleys closely and will run unevenly. It is understood that the largest and best hides are always selected for belt leather, and that they must be free from cuts or brands; but where this is not the case, the purchaser can readily see that he is buying a low-cost article.

It is a great desideratum to have the belt hug the pulley as closely as possible, and this is best attained by running what is called the grain or hair side next the pulley, with the flesh side out, and for this purpose all good belt leather

is most thoroughly dried and rolled very hard, to change as little as possible in use and present a smooth, even surface to the pulley. Where a thick belt is used, there is an advantage also in having the flesh side out, from the fact that it gives and stretches more readily, as it has not the firm even surface of the grain side. It is now coming to be understood, however, that pulleys covered with leather, will add greatly to the efficiency of a belt, and that a much larger amount of work can in this way be done without the slipping of the belt. If the band hugs the pulley the more closely, as it does with the latter covered with leather, it will not need to be strained so tightly, and will, therefore, wear proportionately longer, although this is of small account compared with the large saving of power which would thus be effected. There is good reason to believe that, in many establishments where the power is not sufficient, this simple improvement alone, which costs very little, would supply just the deficiency.

To keep belts soft and pliable, but little care is generally needed, but a little attention on this point would be well worth the while of many mill owners. When a belt is dry and husky, but still pliable, a little blood-warm tallow dried in by the fire or the heat of the sun is all that is needed. Belts which have become hard and dry should have an application of neat's foot oil mixed with a small quantity of resin.

One not acquainted with the business cannot fail to be surprised at its extent. A convention of belting manufacturers was held in New York city a few months since, for the purpose of agreeing upon a general tariff of prices, at which seventeen firms were represented, and at least one of these firms has a capital of over a million dollars in the business, running seven large tanneries in Pennsylvania and Maryland to make leather, principally used in their belting business.

SCIENTIFIC EXECUTIONS.

Since juries in this State have become impressed with the fact that murder is a crime punishable by death, and not a mere vagary of an "emotional" or other form of insanity, we have remarked some comment relative to the question why the present barbarous mode of execution is not superseded by one of the ready methods of taking life known to science. Hanging by the neck is supposed to cause a dislocation of the vertebrae, but its object is rarely effected. The distance a man should be dropped or jerked upward in order to break his neck depends upon his size, weight, and other physical peculiarities, so that it can only be guessed at; and consequently the estimate is frequently incorrect and strangulation ensues. It is asserted by many that death from the latter, as well as from any other cause involving a stoppage of the supply of air to the lungs, is painless; and, as when respiring foul or noxious gases insensibility supervenes without previous ill feeling, so the criminal, the moment his weight is brought upon the rope, becomes unconscious, although strong muscular movement may continue. This, however, is a disputed question, and the majority of opinion inclines to the belief that strangulation is attended with all the agony indicated by the contorted features of the sufferer.

Two recent executions in this vicinity, at one of which the pulse of the criminal beat at 108 after five minutes of suspension, clearly show that no matter how great care be taken to ensure speedy death, an absence of suffering due to failure of the preparations at the last moment cannot be guarded against. Hence it is well to consider why a death absolutely certain and painless could not be substituted for the gallows. The advocates of hanging point to its horrible nature, and the degradation of being strung up like a dog in the presence of witnesses, as a moral preventive of crime; but it is doubtful whether a person disposed to murder ever gives a thought to the nature of the penalty, or, even after imprisonment, shudders at aught other than the unknown pangs of death. Of the many mechanical means of execution proposed and practised, probably the surest and most bloodless is the Spanish garrote, but in this, as in hanging, there is a savor of barbarity of which a civilized community can well afford to rid itself.

It seems to us that, for the purpose, no better agent than a powerful electrical discharge could be employed. Professor Tyndall has investigated the effect of lightning strokes upon the human frame, and has arrived at the conclusion that animation and consciousness are instantly suspended; in other words, life is blotted out the moment the current passes through the body. The Professor involuntarily made himself the subject of an experiment of this kind, though fortunately without harmful results. He states that, while delivering a lecture before a large audience, he accidentally came in contact with a wire, from which he received the discharge of a powerful battery of Leyden jars. For a time, he says, his existence was suspended; he was utterly unconscious, although he did not fall nor alter his position. Then as the effects passed away, he describes the sensation to be as if he had been blown in pieces, each limb feeling separate and one member after another regaining sensitiveness until he had entirely recovered. The recognition of his surroundings, suggesting where he was, and also the thought of not alarming his audience were his first efforts of mental consciousness.

While these experiences of Professor Tyndall go to show the instantaneous and deadly effect of large quantities of electricity upon the human frame, other investigations that have been made upon the lower animals have given different and varying results. Professor Pepper, in one of his lectures in this city, stated that at one time experiments were made in London in order to determine whether cattle could not be slaughtered by this means. It was found that sheep, after receiving a discharge, underwent powerful muscular contrac-

tions which engendered a strong doubt as to whether sensation were absent. Pigeons were very difficult to kill, and, indeed, the only bird which appeared instantly affected by the shock was the common turkey. These facts may be explained by the non-conducting qualities of the wool of the sheep and the feathers of the birds, and in addition the inference may be fairly drawn that such experiments made upon animals afford no data which may with certainty be considered as applicable to man.

The objection that electrical executions would be free from the horrible impressiveness of hangings might be easily obviated. The criminal, for instance, could be exposed upon a platform, in full view of the assembled witnesses, and manacled to a chair, his irons being connected with a battery and Ruhmkorff coil capable of giving, say, an 18 inch spark. The mode of closing the circuit might be a simple button to be pressed by the finger of the sheriff. Then when the usual formalities conclude, the latter official establishes the current, the convict instantly expires, and all is over. There would be no slipping nor breaking of ropes, no black cap, no suspension of a writhing form for twenty minutes or half an hour, none of the grim watching for death by the medical attendants nor any of those hideous surroundings which now only serve as food for sensation mongers, and prove that a relic of barbarism can still be retained in the laws of a civilized country.

THE LATEST ARCTIC EXPLORATIONS.—THE REMARKABLE ESCAPE OF THE POLARIS PARTY.

A strange, eventful history, more like the fiction of the romancer than the recital of plain unvarnished fact, is the narrative gleaned from the lips of the men who have survived their fearful mid-winter voyage on a raft of floating ice. The story is one of hope and bitter disappointment; of the indomitable perseverance of an intrepid leader toward a goal, in the attainment of which he was prevented by a death which is shrouded in mystery, and not untouched with dark suspicion; and of strife and dissension among the crew, culminating in the heartless abandonment of a score of souls to an almost inevitable fate. Then follows the record of the long sunless winter spent on the ice floe, the horrors of an ever present death from the fury of the waves, or the slower tortures of starvation, staring the despairing band hourly in the face. Lastly, when the perilous craft has, after being swept over fifteen hundred miles of ocean, reached warmer waters, and is beginning to melt gradually away, when the destruction so long averted seems imminent, the finger of a merciful Providence is interposed, and by wondrous fatality a vessel colliding with their floe rescues the wanderers and bears them home in safety, snatching them from a doom which doubtless, ere this, has overtaken their comrades in the frozen waste of the far North.

The *Polaris*, it will be remembered, was fitted out for Arctic service in the New York navy yard, during the summer of 1871, and under the immediate supervision of her commander, Captain Charles F. Hall. Leaving the port she touched at St. John's, Newfoundland, and in the early part of August met the United States steamer Congress, at Disco, Greenland, from which vessel she received her final supplies. On the 24th of the month, after purchasing Esquimaux dogs, skins, and other necessities, Captain Hall wrote his adieu to civilization from Tessinsack; and from that date to the present time, no tidings of the expedition have been received.

After leaving Greenland, the ship, according to the statement of the rescued survivors, proceeded to the north through Smith's Sound, which is described as identical with the Polar Sea of Kane, discovered in 1853-5, and reached Robeson's channel, in which the highest latitude was attained, 82° 16'. The strait, it was found, extended north for about 45 miles, from 81° 44' to 82° 20'. Beyond this was a lead of water, and then another ocean or bay, having on its western side land stretching as far as the eye could reach, and on the east another shore but dimly discernible. This expanse was free from ice, and is conjectured to be either the North Polar Ocean, or a sound leading directly thereto. Many important circumstances indicated with great clearness that beyond this channel lay an open sea, for mild weather, fogs and mists, could come from no other source. There was no impediment to immediate advancement, and every probability existed of a clear path directly to the long sought pole. Buddington, the sailing master, became anxious, and strongly opposed proceeding further, grossly, it is stated, misrepresenting the difficulties and dangers of such a course. He being the navigator and the official judge of this expediency, Hall, contrary to his own inclinations and those of others of his crew, yielded, and returned to winter at Polaris Bay, lat. 81° 38', long. 61° 44', where the ship was soon frozen in. On the 10th of October, Captain Hall determined to make an individual effort to reach the polar sea, and accordingly organized a party consisting of himself, two Esquimaux and Chester, the mate, the means of transportation being dogsledges. After an absence of two weeks, on the 24th of October the expedition returned, but as to what it accomplished no authentic information can be gathered. Hall on his arrival was in good health, but soon complained of the heat of the vessel. A cup of coffee was given him, after which he became quite ill. From the statements of Joe, the Esquimaux, it seems that he believed that he was poisoned; and he said so, pointing out to his attendant the name of a drug, which the latter cannot remember, in a medical work. Added to this, there is a strange reticence on the subject among the white men saved, although it is hoped that later they may impart fuller particulars. After fifteen days the captain died, as it is stated, of apoplexy, though it is very difficult to reconcile the quick stroke of that disease with the symptoms of

vomiting, paralysis, etc., described. He was buried during the dark winter's day by the light of a solitary lantern, in a grave hewn in the ice—sleeping in the midst of the solitude, the secrets of which he had given his life in seeking to reveal.

Afterwards the weather became somewhat warmer, ranging from zero to 15° below. The wind was at times very strong, often blowing at the rate of 60 miles an hour, and the fog and mists continued. During June, Mr. Tyson set out with two boats, but was soon obliged to return. The vessel now became very leaky, and finally Buddington abandoned the expedition and started homeward. On the 15th of October, in lat. 80° 03', the ship encountered severe gales and became jammed among the bergs, the ice lifting her out of water and crushing her badly. Anticipating her breaking away, orders were given to shift the provisions ashore, but after the greater part were deposited, together with a number of rifles with ammunition, a heavy storm arose, which caused the ship to part her moorings. The crew on the ice signaled and shouted for assistance, but although the vessel was under control and could have returned to their succor, no effort was made to do so, and the abandoned men saw with despair their apparently only hope of safety disappear in the darkness. The next day Mr. Tyson, who was among the number, attempted to reach land in the boats, but was unable to do so. Soon after the *Polaris* hove in sight under canvas and steam, making her way along the shore. The men tried every means to attract attention, but, although the ship was but eight or nine miles away and her crew must have seen the signals, she kept on her course and dropped anchor in a bay on Northumberland Island. Again the boats were launched, and again a struggle was made to escape from the floe, but the water was thick with ice and the drift and snow too powerful to overcome. Then the ice raft commenced the voyage, which lasted until the 30th of April last, or 197 days. Up to the 1st of November the narrative tells of repeated attempts to reach the shore, and of as many failures; then land disappeared and the weather became stormy, the men relinquished their endeavors, and built snow houses on the pack to protect themselves. Three were dwelling houses and one was for stores. The party now consisted of Captain Tyson, Joe, Hannah (his wife) and one child, Hans Christian, wife and four children, and Mr. Myers and eight men. On the 1st of December the Arctic winter set in and the sun rose no longer. Day could not be distinguished from night except by a faint streak on the horizon. The capture of seals, the flesh and fat of which formed the principal sustenance, became almost an impossibility, and the absence of blubber prevented the making of fires.

This fearful condition of affairs lasted until the 19th of January when the sun once more shone forth for a short time. On the last of February the provisions were nearly all gone, and one of the boats had been cut up for fuel to melt ice for drinking water. Providentially a lot of Esquimaux dogs drifted on the floe, and these, killed and eaten, furnished food for a month longer. During the latter part of March a heavy gale drove the ice out to sea, and finally broke up the floe on which the houses were built, reducing it from a field of five miles in circumference to one of twenty yards. On the 1st of April the danger became so great that it was decided to abandon a large stock of meat, clothing and other articles and regain the main pack. This was done, but another tremendous storm arose, smashing the ice into smaller fragments. Starvation seemed now imminent, for it was impossible to hunt around for seals. Luckily a polar bear ventured on a marauding expedition into the camp, where he met an untimely fate from the rifles of the men. His flesh supported the party until their rescue. More bad weather took place until they drifted further south and encountered smoother sea. On the 29th of April two steamers were sighted, but the signals made were not seen. The disappointment was, however, atoned for on the morrow, for the British sealing steamer *Tigress* accidentally, in a dense fog, ran against the very floe of ice which bore the survivors. Their rescue was speedily accomplished, all hands being not only alive but even healthy and well. The *Tigress* carried them into St. John's, where steps were immediately taken to restore them to vigorous health. It will be understood that their perilous adventure and strange rescue made them objects of both curiosity and commiseration to the people of Newfoundland.

The scientific results of the *Polaris* expedition are of course nothing. Captain Tyson, to whose courage and firmness the safety of the rescued party is due, states that near Robeson channel he found many marine fossils, which indicate that the locality was once the bed of the sea. No traces of any permanent habitation of Esquimaux were discovered. History furnishes no parallel to this wonderful voyage. The escape of the crew of the *Hansa*, of the German north polar expedition, by the same means, is thrown far in the shade. The *Hansa* was crushed in the ice off Greenland in October, 1869, in lat. 70° 49', long. 10° 51'. The men, fourteen in number, took to the ice and built a snug house out of patent fuel. They drifted 1,100 miles and, on June 14, 1870, arrived at Frederikshavn, on the other side of Cape Farewell. Their cruise was longer than that of the *Polaris* party, but they only drifted 10° of latitude, while the latter sailed over 24° 35' and besides lived in constant peril.

A vessel, it is stated, will soon be dispatched in search of the *Polaris*; and if there is a clear way through Robeson channel, it is probable that the expedition will press on toward the pole. At least we shall have some information as to the fate of the ship and her remaining crew, which will, perhaps, clear up the mystery surrounding the statements of the rescued men.

AMERICAN EXHIBITS AT THE VIENNA EXPOSITION.

A facetious correspondent of one of the daily journals in this city recently, in a lofty flight of humor at the expense of the United States exhibit at the Vienna show, asserted that our sole products there to be found consisted of some bottles of Mississippi water, a dentist's chair, a case of Colt's revolvers, one stuffed eagle and a few other etceteras which we do not just now recall. The paragraph, we notice, has been extensively copied, and in many instances we find it accepted by country exchanges as sober truth, and published in connection with editorial comments. It might be supposed that so ridiculous a statement would need no explanation, but for the benefit of our journalistic brethren who have innocently put their faith therein, as well as for general public information, we condense from the columns of *Engineering* the following description, showing the true state of our representation in Vienna.

The space allotted to the United States is altogether 70,000 square feet, which is rapidly filled as quickly as the disorganized state of affairs incident to the charging of the commission and the slowness of the workmen will permit. On the opening day, the condition of the transept was screened from view by two large barricades formed of packing cases which, stretching across the space, were covered with cloth. Upon them were placed a heterogeneous mass of exhibits which, however, made a good show and hid the chaos beyond. This, it will be observed, does not accord with the *Herald* reporter's description: that our department looked like "an abandoned railway town on the plains." *Engineering's* correspondent adds that within three weeks (about the present time) all should be in good order and all the machinery in motion.

Our section of the machinery hall will be remarkable on account of an absence of steam engines. True, there are four engines, but these can scarcely be regarded as exhibits; they are rather necessary appliances for the machinery in motion. Of these engines two small ones stand, one in each side aisle of the hall, one in the northern side of the main body of the hall, to drive the machine tools, whilst the fourth, a large horizontal engine, is on the southern side, and will work the wood-working machinery.

It had been hoped that some large engines of the Corliss type would have been exhibited, but this was found impossible. The horizontal engine, before mentioned, is but a small one, with a cylinder 12 inches in diameter and 24 inch stroke, and is only remarkable for the rapidity with which it was constructed. It was built at the Norwalk Iron Works in less than three weeks, the iron of which it was made having been lying in pigs at the works 20 days before the vessel, placed by the Government at the disposal of the exhibitors, quitted Brooklyn navy yard. The steam for working the four engines in this section is obtained from an ordinary horizontal tubular boiler, made by Messrs. Pitkin Brothers, of Hartford, Conn., and was sent over by them, not in any sense as an exhibit, but simply to help towards maintaining the credit of the section.

It will be seen, from what we have said above, that the mechanical exhibits in the hall may be divided broadly into four groups, light machinery being in the north and south aisles, and, in the center of the hall, machine tools on the one hand and wood-working machinery on the other. Close by, at the extreme end of the hall, there is a great exhibit of Fairbanks' weighing machines, the largest having a capacity of 30 tons, whilst others (there are about thirty in all) range from 4 or 5 tons down to the smallest sizes made.

The United States section is exceptional in having erected shafting in the side aisles. This shafting, as well as that for the wood-working machines, has been supplied by Messrs. Jones and Laughlins, of Pittsburgh, the shafting supplied in the exhibition not being suitable for the light tools and the wood-working machines. Specimens of this shafting, as well as examples of pulleys, hangers, special castings for agricultural implements, etc., are shown by these manufacturers, close beside the stand of the Ramapo Wheel Works, of New York. This is in the north aisle, where are also the Woodbury Brush Machine, a circular loom and other textile machines, some pumps, and several smaller exhibits. In the south aisle the most interesting exhibit will be a series of machines for making shoes; these machines, of which there will be about twenty, are sent, like most of the exhibits in this section, from New England. Some printing and stereotyping machines will, with others of minor interest, fill the remainder of the available space in this aisle.

Conspicuous in the main part of the hall are the exhibits of Messrs. Sellers and Co., Philadelphia. Amongst them we may mention in this general notice a mechanical puddling plant, rolling mill housings, a slotting machine, a lathe, a planing machine, and a 650 lb. steam hammer. Messrs. Pratt and Whitney, of Hartford, Conn., show fine sets of special tools, sixteen in all, and designed, some for sewing machine manufacture and others for the production of guns, etc.

Messrs. Stiles and Parker, of Middletown, Conn., exhibit presses of different kinds for cutting and stamping metals, embossing, etc. Close by are several milling and screwing machines, exhibited by the Brown and Sharpe Manufacturing Company of Providence, R. I. Messrs. Darling, Brown, and Sharpe, the standard makers of measuring instruments, will show a fine collection of their specialty. This, with perhaps one or two unimportant exceptions, completes the number of machine tools. The wood-working machines, which are also in the center of the hall but on the southern side, are quite numerous and important. Messrs. Richards, London, and Kelley, of Philadelphia, exhibit only one tool, a hand saw of excellent design. Messrs. Rogers and Co. have a good selection of wood-working tools, including plan-

ing and matching, tenoning and mortising machines. Messrs. Whitney, of Winchendon, Mass., exhibit five wood-working tools, similar to those shown by them in the Paris Exhibition; but they have besides an interesting series of nail making machines. Messrs. A. J. Fay and Co. also contribute five wood-working machines; as does Mr. Ball, of Cincinnati. A Root blower, a woolen loom from New England, and a few more of which the traces are hardly yet visible, fill the space allotted in the machinery hall.

In the covered garden court, which by the way is an elegant structure, will be exhibited a large number of small labor-saving machines. Amongst these, sewing machines preponderate. The leading makers, indeed, wish apparently to turn this hall into a depot for their wares; thus for the Wilson sewing machine, 2,000 square feet are allotted, for the Singer, 1,000 square feet, and for the Howe, 600 square feet. The other makers follow at a respectful distance, some of them being contented with only 6 square feet. In this same hall Nathan and Dreyfus, of New York, exhibit specimens of lubricators, and pumps of all classes will occupy most of the space which the sewing machines have not absorbed. We may also mention an interesting exhibit contributed by Mr. Pickering, consisting of blocks of sandstone quarried from a great depth, and impressed with the imprint of some primitive monster.

In the agricultural hall entirely devoted to the United States, there are established some finely finished specimens of American reapers and other similar implements. It remains now only to mention the smaller independent halls, in which will be shown, principally, street cars. It was hoped, and in fact arrangements were completed, for the exhibition of some Pullman palace cars, fitted with the Westinghouse air brake. Circumstances, however, prevented the arrangement from being carried out.

SCIENTIFIC AND PRACTICAL INFORMATION.

PRESERVATION OF ORGANIC SUBSTANCES.

M. Lanjorais communicates to the French Academy the following method for preserving organic substances. It consists in adding to the material to be preserved a minute quantity of fuchsin, barely one hundredth part. A vessel filled with gelatin in solution, to which fuchsin had been added eleven months before, was exhibited by the inventor, and although the receptacle had remained open to the atmosphere, its contents were unchanged. Pieces of beef enveloped in blotting paper soaked with gelatin and fuchsin, were found to keep unaltered, the fibers of the meat only becoming somewhat tough and presenting the appearance of gutta serena. By maceration in water for twenty-four hours, the beef became perfectly fresh and furnished a soup in which no disagreeable flavor could be detected. Coffee and other substances were experimented upon with similar good results.

BURNING THE DEAD.

Professor Polli is agitating the subject of cremation of the dead in England. He not only repeats all the well known arguments in support of this disposition of bodies, but demonstrates that, at the present day, when the science of hygiene has made such progress, and especially in a country like Great Britain, where every inch of ground has its value and where the population is out of proportion to the area of the soil, it should be understood that the organic principles emanating from decaying corpses both poison the water and engender endemic maladies.

WEEDS AND THE FERTILITY OF THE SOIL.

Professor Volske, says *Les Mondes*, has found by analysis that, of the *carduus acutis* and *utricar repens*, two useless weeds which infest fields in France, the first grows principally in soils rich in potash, and the other in soils largely containing silica as well as phosphate and sulphate of lime. It would be a good idea for agricultural chemists to avail themselves of the hint, and, by determining the nature of the ground in which our most common weeds are principally found, thus afford to farmers a ready way of approximately determining the quality of their land.

PREPARING SLIPS FOR PLANTING.

The *Gazette des Campagnes* recommends to dip the extremities of the slip in collodion, containing twice as much cotton as the ordinary material used in photography. Let the first coat dry and then dip again. After planting the slip, the development of the roots will take place very promptly. This method is said to be particularly efficacious in woody slips, and to succeed well in scions of the geranium, fuchsia, and similar plants.

COMBUSTIBILITY OF THE DIAMOND.

An experiment recently made by Mr. Spencer of Manchester seems to prove that under certain conditions the diamond is combustible at quite a low temperature. A South African diamond, strongly colored and of about the size of a pea, was enveloped in refractory clay with a mixture of soda and hydrate of lime, placed in a crucible and then heated on the hearth of a muffle furnace for three days and nights. Although during this period the temperature was not elevated above a cherry red, it was found on opening the mass that the diamond had completely disappeared.

CHANGING THE COLORS OF FLOWERS.

The *Gazette des Campagnes* says that M. Hughe has succeeded in changing the common cowslip from its natural yellow to an intense purple by merely transplanting it into richer earth. The color of plants can be readily varied by mixing certain substances with the soil. Wood charcoal will darken the hue of dahlias, petunias, and hyacinths. Carbonate of soda turns the last mentioned flowers red, and phosphate of soda alters greatly the shades of many plants.

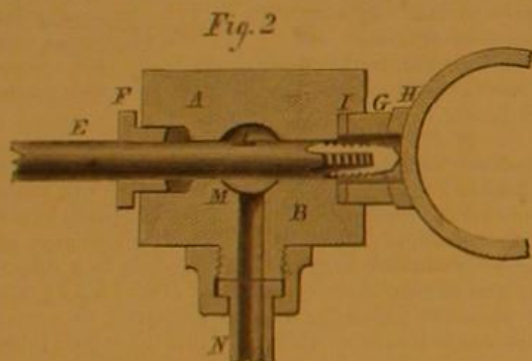
WATER MAIN TAPPING MACHINE.

Our engravings illustrate a new and convenient machine for tapping water mains previous to attaching conduit pipes thereto. The operation is one of some difficulty; and as this device is constructed so as to perform its work with rapidity while necessitating but very little waste flow, it will doubtless meet with ready appreciation from plumbers and others requiring its use.

Fig. 1 is a perspective view, and Fig. 2 a sectional view. The two parts of the drill case, A and B, are clamped together by bolts, C, and have a hole formed half in each for the drill, E. At one end is a stuffing box, F, and at the other a detachable washer, G, in a socket, having a concave face to be clamped against the packing gasket, H, on the side of the main to make a water-tight joint. Another gasket, I, is placed at the bottom of the socket. These gaskets and the washer are made in two parts, so as to be removed when the pipe is inserted, as the stop cock on the latter, if they were in single pieces, would prevent their being slipped off over the end. J is the cock traversing the drill hole to close it when the drill is drawn out. It has a handle, K, on the outside for turning it, and has a deep notch, L, cut in it, coinciding with the drill hole, to let the drill pass into the pipe for making the aperture when it is adjusted to the position represented in Fig. 2.

After the hole is drilled and the point of the drill is drawn back beyond the cock, the latter is turned so that the part, M, comes up and stops the orifice. The instrument is then removed, and the pipe to be screwed in is inserted. The cock being turned back again, the pipe is pushed forward and connected with the main, after which the apparatus is detached.

The passage, N, for blowing out chips by the water may either have a pipe connection fastened to it for conducting the washings away by a flexible pipe, as shown, or it may be entirely closed by a screw cap, to be taken off when the drill case is to be washed out. The apparatus is clamped to the main by the ordinary clamps clearly represented. O is the feed screw for the drill, the latter being operated by the ratchet pawl and lever, P.



The inventor has recently patented an ingenious improvement on this device which will shortly be published.

Patented through the Scientific American Patent Agency, March 18, 1873, by Mr. William Young, of 67 Northampton street, Easton, Pa., by addressing whom further particulars may be obtained.

IMPROVED CUTTING NIPPERS.

Mr. Frederick A. Adams, of Shelburne, Mass., has recently patented the improved tool represented herewith. To the jaws are fastened two cutters which are alike, one of which is attached to the jaw, A, by the screw, B, and by a dovetail having its angle at C. On the jaw is a projection or flange, D, and on the cutter is a corresponding depression or socket. The arrangement and direction of the screw, B, indicated by the dotted lines, is such that, by turning the same, it tightens the cutter and jaw on both surfaces of the dovetail. The flange, D, serves to receive the strain, so that cutting with one end of the cutting edge does not force the other end of the dovetail, and also holds the parts firmly together, preventing looseness.



Government Experiments on Boilers.

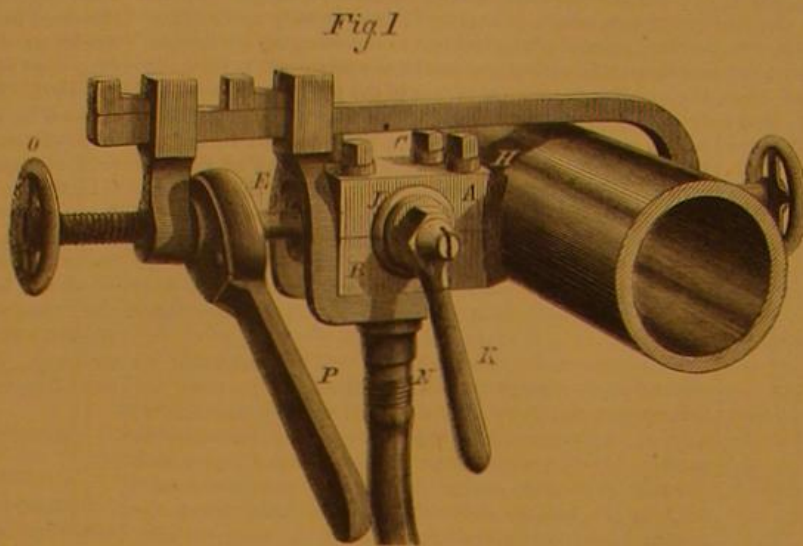
General D. D. Smith, Supervising Inspector General of Steam Vessels in the United States, lately informed the Master Mechanics Association, as a matter of importance to them, that Congress had appropriated \$100,000 for the purpose of

experimenting to discover the cause of boiler explosions. The experiments would be made during the months of September, October, and November next, at Pittsburgh or Cincinnati, and Sandy Hook, N. J. An effort would be made to find the cause of explosions, and in this master mechanics who navigate the land were as much interested as those who navigate the sea.

Persons who have suggestions to make in reference to the experiments should address General Smith, Treasury Department, room No. 28, Washington, D. C.

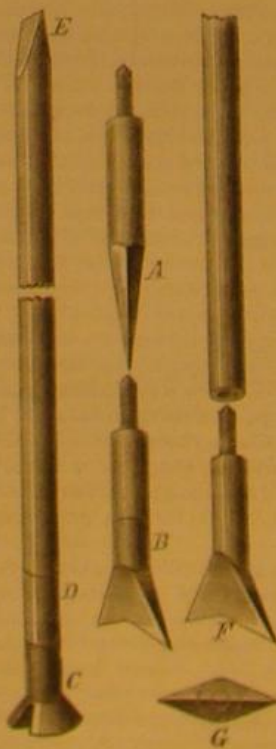
MINER'S DRILL BAR AND BITS.

Few are aware of the dangers, incurred by the miner in pursuing his perilous avocation far under the surface of the earth, from the premature explosion of blasts; nor does the



YOUNG'S WATER MAIN TAPPING MACHINE

public generally realize the large number of men annually killed and maimed by such disasters. During the year 1871, in the anthracite coal fields of Pennsylvania, 44 miners were thus slaughtered, and it is stated that the number of wounded, the majority of which were rendered totally blind, reached almost incredible figures. These casualties are due in great measure to carelessness in the use of powder, but more frequently to the ignition of the charge while tamping or while withdrawing the cartridge from a miss-fired shot, through sparks made by the striking of the iron or steel bar against the rock. That so easily prevented a danger should not, ere this, have been permanently averted by suitable devices is a subject of wonderment; though perhaps the circumstance is accounted for by the fact that inventors seem to have overlooked the miner, and allowed him, so far as implements and safeguards are concerned, to fall behind workers in other industries. The invention which we herewith illustrate is, however, a long step toward the amelioration of present difficulties, especially by the substitution of copper for iron. It consists in a bar for miners' use, to which tools or points may be adjusted as required. By this means it is claimed that a single instrument is substituted for the ordinary number (three to seven) of drills employed, which average in weight from 18 to 22 lbs. each. The necessary of carrying such a heavy weight of metal in and out of a mine or to and from a quarry, in order to have the bits dressed, is thus avoided, as the latter weigh but three or four pounds each, and can be detached from the bar at the pleasure of the workman. The bar is of the usual description and is provided with a screw-threaded socket at its end for the connection of the several tools, which are fitted with a corresponding screw-threaded projection above a shoulder. One of the ordinary bars now employed can be readily altered for the purpose by any blacksmith, at a small cost, so that the miner will only have to purchase the necessary bits. A is the diamond or pick pointed tool of steel, and is calculated for working off masses of coal or rock that have been loosened by blasts in places where it may be dangerous to use a short-handed pick or inconvenient



to employ an ordinary bar. B is the copper reaming drill for reaming out holes in which the charges have failed to explode. C is a tamper (of copper, so as not to strike fire while tamping the charge, thus avoiding the danger of premature explosion) which is attached to the bar by a shank, D, so that less copper will be wasted when the tamper head is worn out. The crowbar-shaped end of the bar, E, is of

steel. F is the steel pointed drill bit for ordinary use, and G an end view of the same.

An especial advantage of this bar is that it can be used for deep or shallow holes by simply adding to the length of the tool. In brief, in this single invention the miner or quarryman is at once provided with a pick pointed bar, crow bar, copper drill, copper tamping bar, and any number of steel bits, the whole adding but little weight, over a single drill of the kind ordinarily employed, to his kit of tools.

Patented through the Scientific American Patent Agency, April 22, 1873. The inventor, Mr. R. B. Platt, is a practical miner of some 30 years experience. He may be addressed, for further particulars, at Hazleton, Pa.

Hudson on Liability to Disease.

Dr. Alfred Hudson, in a recent lecture reported in the *London Medical Record*, pointed out various causes that predispose the body to disease, rendering it liable to suffer from contagion; and after referring to the various theories with regard to contagion, he stated that he believed typhus fever had its origin principally from overcrowding, and was not so much the result of contagion.

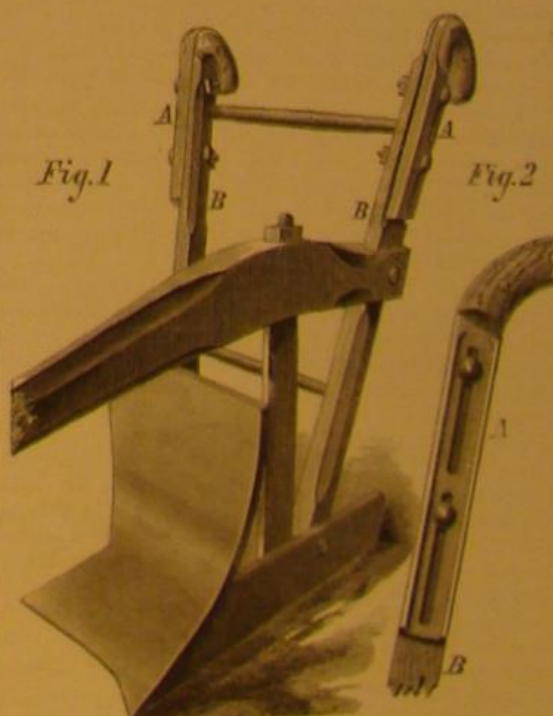
The importance of the study of predisposing causes in a sanitary point of view rested in a great degree upon three considerations: first, that liability to zymotic disease exists in different persons in different degrees; secondly, that its amount varies in the same person at various times and under various conditions; and, thirdly, that many of these conditions are preventable. He remarked that fatigue was one of the most frequent of the causes that predispose to disease, and that this was shown in the case of soldiers who suffered so much after long marches, often exposed to the worst influences of the weather. Dr. Hudson concluded an able and exhaustive lecture, by stating that the

following were some of the conclusions to be arrived at from the facts that had been adduced: 1. That liability to zymotic disease may be considered inherent in our constitution—a law of our nature. 2. That this varies in degree in different individuals at different times and under different circumstances. 3. That these circumstances are partly external, or extrinsic, and partly intrinsic conditions. 4. That both are partly preventable and partly non-preventable. 5. That, *ceteris paribus*, liability is least in those in whom healthy blood, healthy tissues, and healthy excretion coexist, constituting perfect nutrition. 6. That it is greatest in those whose blood contains the greatest amount of the products of waste of the tissues and of matters in a state of decomposition introduced into the circulation from without.

IMPROVED FLOW HANDLE.

The invention herewith illustrated consists in arranging the handles of a plow so that they may be raised or lowered to suit the stature of the plowman, and may be readily attached or detached from the implement.

The portion grasped by the hands is secured to curved metal bars, A A, which are slotted as shown more clearly in Fig. 2. Through the apertures and through holes made in the fixed arms, B B, of the plow, headed bolts are passed which are secured by nuts on their inner ends. It is evident that, by loosening the latter, the handles can be elevated or depressed the length of the slots, or, by removing the bolts,



can be detached from the plow altogether. The inventor claims that this apparatus is strong and durable, can be used in connection with any plow, and attached thereto by any person, thus saving the expense of the work of a skilled mechanic. For further information regarding interest, rights, etc., address the inventor, Mr. J. T. Raftery, El Dara, Pike county, Ill. Patented April 29, 1873.

A COLLAPSIBLE LIFE BOAT.

The Rev. E. L. Berthon, of Romsey, England, has devised a very novel form of life boat which can be caused to collapse, or rather be folded into an extremely small space. The invention is one which at the present time will excite a widespread interest, as it seems based on correct principles and to be an efficient and valuable device. It need not be pointed out that by its use passenger steamers can not only readily carry a number of boatsamply sufficient to save every soul on board in case of wreck, but even several extra ones in the hold, which may be employed to bear provisions, or may serve good stead in event of the davit boats being disabled by the careening of the ship, as in the Atlantic disaster.

In our illustrations, for which we are indebted to the *English Mechanic*, Fig. 1 is a side view of the invention; Fig. 2 a section of a part of a ship's side with a boat attached, both shut and open, and Fig. 3 a gunwale plan. The length of the boat is 36 feet. The frame work consists of fore and aft timbers, generally four on each side of the keel, jointed together at each end on the top of the stem and stern pieces. These timbers are made broad and flat. Their position, when collapsed, is vertical and parallel, like the leaves of a closed book when on its edge. When open, they stand out at various angles on planes radiating from a line drawn from the top of the stem to the top of the stern.

There are two skins, of an enormously strong but flexible material, one of which is attached to the outer edges of all the timbers and the other to their inner edges. The falling open of the boat extends these skins, and the whole body of the boat is thus divided into eight separate compartments, which inhale their proper bulk of air in the act of opening. As dingies for small yachts, for which they are admirably adapted, they are made in a more simple manner, with only three timbers on each side of the keel.

A life boat 12 feet wide is stowed within the space bounded by the black line, *a a*, Fig. 2, which is a covering of very strong canvas; it is protected below by a kind of channel, *b*, the davits, *d*, being topped up, that is, in a vertical position. The boat is secured in place by strong girdles, which bind her fast to the bulwarks. When these are cast off, the davits drop, into the position represented by the dotted lines, with the boat, which immediately opens by its own weight; *c c* is then its midship section, the shaded parts representing the air cells.

The Mother Lodes of the United States.

Since its discovery in 1859, the Comstock has produced nearly \$150,000,000, and has been worked with more energy than any other vein upon the continent. A depth of 1,800 feet and over has been reached upon the vein, and as yet no deterioration found in the quality or quantity of the ore. The limit of advantageous mining from the surface has, however, been nearly reached, and were it not for the provision of the Suto Tunnel, which will cut and drain the lode at a depth of 2,000 feet, the Comstock would soon have to be abandoned as unprofitable.

The Raymond and Ely mine is of very recent location, but is producing at present a larger amount of bullion than any one silver mine, under one management, in the world. Over \$4,000,000 was yielded in 1872, and an idea can be had of its value from the fact that the local tax upon its bullion produce for the first quarter of 1873 was \$18,000.

The Moss lode of Arizona has, as yet, received no extensive developments, and only claims a place among the list of mother lodes on account of its great length. It is silver-bearing, and may

probably become one of the great veins of the future, when the Apache is no more, and the Southern Pacific railroad is an accomplished fact.

Last, and greatest of all, in extent, production and size, is the great California gold vein, or the mother lode of the Sierra Nevadas. This fissure has been distinctly traced with occasional interruptions for nearly 80 miles. A line drawn



FIG. 1.

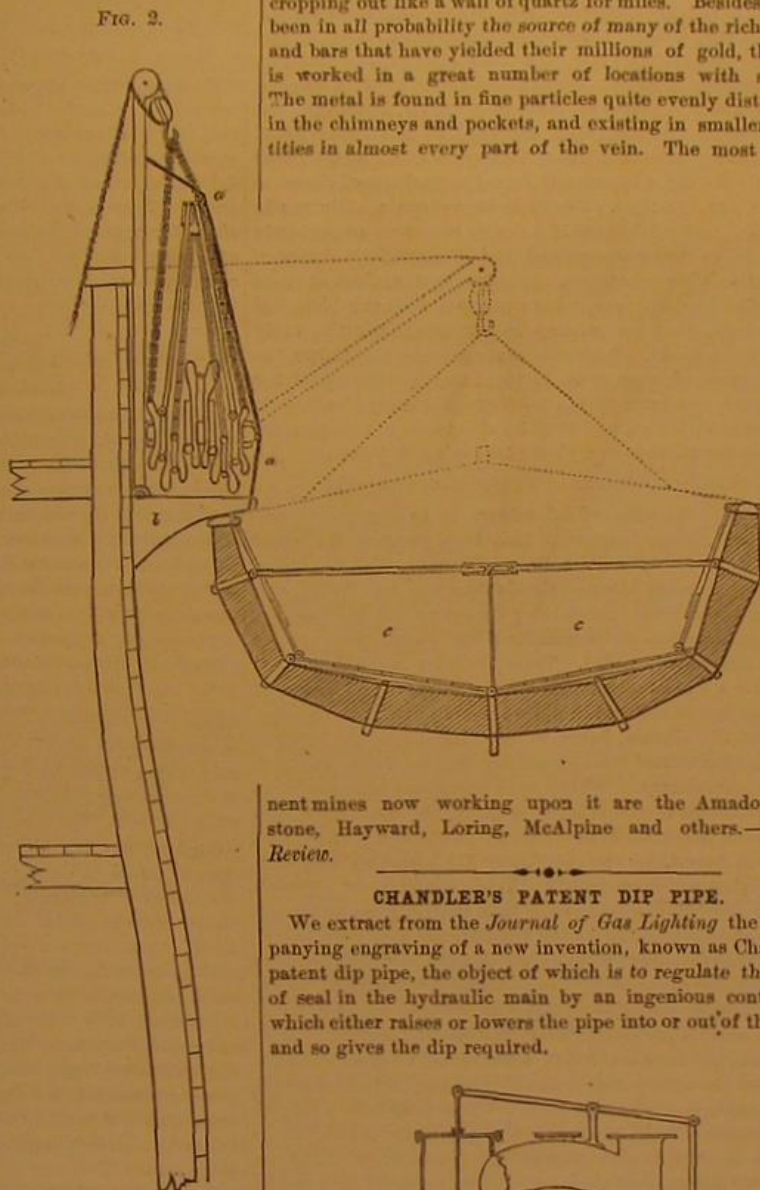


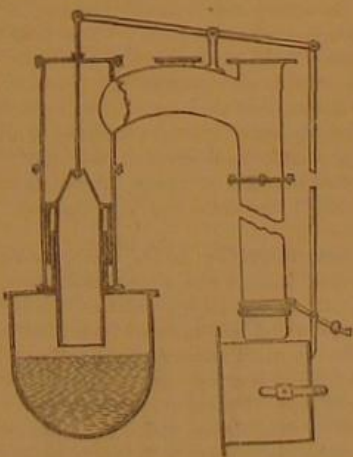
FIG. 2.

on the map from Mariposa to Amador would not depart from the course of the lode more than two or three miles at any place. At the crossing of the main rivers it is lost almost always, but again found on the bluffs beyond, in places cropping out like a wall of quartz for miles. Besides having been in all probability the source of many of the rich placers and bars that have yielded their millions of gold, the lode is worked in a great number of locations with success. The metal is found in fine particles quite evenly distributed in the chimneys and pockets, and existing in smaller quantities in almost every part of the vein. The most promi-

nent mines now working upon it are the Amador, Keystone, Hayward, Loring, McAlpine and others.—*Mining Review*.

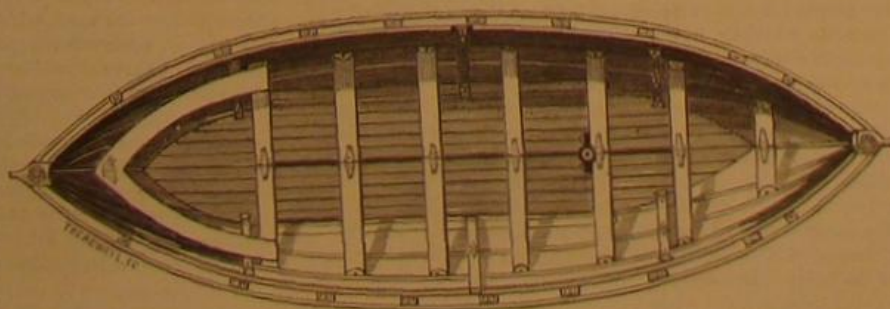
CHANDLER'S PATENT DIP PIPE.

We extract from the *Journal of Gas Lighting* the accompanying engraving of a new invention, known as Chandler's patent dip pipe, the object of which is to regulate the depth of seal in the hydraulic main by an ingenious contrivance which either raises or lowers the pipe into or out of the same, and so gives the dip required.



The seal cup is charged with tar, which permits the movable dip pipe to be lifted into or out of the main. It will be seen that the lid cannot be removed from the mouthpiece until the handle is raised, which removes the lock and seals

FIG. 3.



The advantages claimed are an unobstructed passage for the gas, no deposit of carbon on the retorts, increase in the quantity of gas made, saving in fuel, economy in wear and tear of retorts and in labor, and the saving of the time occupied in scurrying, as necessitated by the old systems.

A NEW DEEP SEA THERMOMETER.

Among the recent scientific instruments, the invention of which is probably due to the impetus which deep sea investigations have recently received, notably by the voyages of the Hassler and school ship Mercury and the present expedition of the Challenger, is a new thermometer for measuring the temperature at great ocean depths. The device is that of M. Dietrichsen, a Norwegian, and possesses the advantages of indicating the degree of temperature of the water at several different distances from the surface or bottom at one sinking. We reproduce our illustrations from the pages of the *English Mechanic*.

The principle is briefly as follows: A small thermometer, protected against water pressure, is sent down to the desired depth. By suitable arrangements the thermometer tube is abruptly broken off, and from the column of mercury remaining in the separated part the temperature is inferred. A thermometer is thus, of course, lost each time, but the kind used are very cheap. The mercury is not lost.

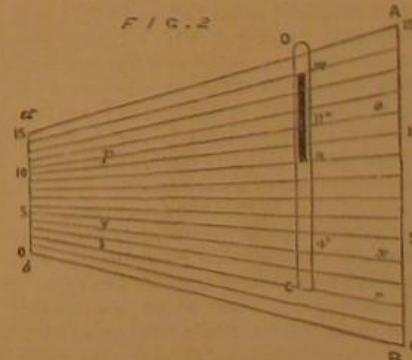
The arrangement is as follows: A E (Fig. 1) is a brass tube, the upper part of which, A B, is screwed on at B. The piece E C is of lead. C D is a thick brass wire, about which the lower end of the lead tube, E C, is soldered, and which is continued up into the tube as a thin but pretty stiff lamina, resting against the inner side of the tube when the lead pipe is bent; this lamina is pressed towards the opposite side. The entire tube can be screwed into the brass case, F G H. At G there is an arm, L G K, bent at right angles, and turning about G. At A and G are attached two spiral brass wires.

The thermometer, T, having a length of 4 inches, is stuck in a piece of cork. A mark is made with a file on the thermometer tube near the cork, which is so fixed in the mouth of B C that the mark is on the same side as the lamina, *x y*. The apparatus is made fast to the line by the spiral wires.

When it has been sunk to the required depth, it is allowed to remain five or ten minutes, that the thermometer may take the temperature of the surrounding water. A ring-shaped weight is then allowed to fall, and this, gliding over the tube, presses on the arm, L G K, whereby the lead tube is bent, and the thermometer is broken off by the lamina, *x y*, at the file mark, *x*. If there are several apparatuses

on the same line, the ring breaks off the several thermometers in succession. In its descent it also liberates a stone which is used to sink the apparatus.

The graduation and subsequent reading of the thermometer are effected in the following way: When the thermometer has been filled and closed by heating, two points are taken on the scale, say at 4° and 20°, the tube beyond the cork having previously been marked throughout its length with a stripe of white oil paint; and this is then scraped off above and below the points mentioned. The degree numbers can be marked at the extremities. When the thermometer has been broken, the reading can most simply be effected by means of the scale represented in Fig. 2. The parallel lines, A B and *a b*, differing in length, are each divided into a corresponding number of equal parts, say 15. Straight lines join the corresponding points. Suppose the severed piece of the tube to inclose 7° of mercury, 4° to 11°. The



piece, C D, is laid on the scale parallel with the line, A B, so so that the mark 4° is on the line, *x y*, and the mark 11° on the line *a b*. The broken end, C, will then, for example, fall on the line 2, *r s*. The column of quicksilver, *m n*, reaches thus, from the line 9 to the line 14. The required temperature is therefore = 2 + (14 - 9) = 7°.

THE WONDERS OF THE EGG.—IV.

(LECTURE BY PROFESSOR AGASSIZ.—CONCLUSION.)

When you bring an egg (the spawn of fish is perhaps the easiest subject for the investigation) into contact with the contents of the sperm cells, that is, with spermatic particles, you will see these particles crowding with their quick sudden movements around the egg and covering its surface. At particular seasons of the year in some of the hermaphrodite mollusks, these particles may be seen in numbers around the eggs. It would seem that at such times nothing could be easier than to trace their functions. The great mobility of the particles, however, and the difficulty of keeping any one of them in the focus of the microscope, makes the operation an exceedingly delicate one. The crowding of the particles about the eggs of a variety of animals is indeed easily seen; in fishes, in the mollusks mentioned above, and also in sea urchins and star fishes, and even in jelly fishes. It is more difficult to observe in the higher animals and among insects and crustacea.

Although the introduction of the spermatic particle into the yolk is so difficult of observation, there are investigators who have seen this phenomenon repeatedly. Siebold, a master among masters and an observer who never exaggerates his facts, has seen the spermatic particles within the yolk membrane of the bee's egg more than 20 times, and has been able to show this to others. I have spent months in trying to find it in the eggs of turtles, and have never succeeded. But my own failure does not in the least diminish my confidence in Siebold's results. His capacity for observation is so admirable, his results are so free from exaggeration or personal bias, that his statements may be accepted without a question. To his demonstration we owe our first absolute knowledge of this phenomenon; and in some animals the spermatic particles penetrate into the yolk more easily than in others, owing to the openings in the envelopes of the yolk—the so-called "micropyle"—through which the introduction takes place. But under any circumstances these "micropyles" are difficult to watch. So experienced an observer as Bischoff, at the time he published his magnificent embryological monographs on mammalia, had never had the good fortune to see a spermatic particle penetrate into a mammal egg, or to detect one within the egg. He indeed, doubted and controverted the fact until it was demonstrated past all question. The nature of the special influence exercised by the spermatic particles in the growth of the egg is not yet ascertained; but this much, at least, we know with certainty, namely, that the spermatic particles penetrate into the yolk, and that the material combination thus taking place between the substance of the spermatic cells and the substance of the ovarian cells influences in some way the production of a new being. And yet we have seen that this combination is a necessity, not an invariable law, since eggs undergo the whole process of reproduction and give rise to new beings without any such contact. Of this I shall have more to say when we come to the consideration of those animals in which the new being is produced without fecundation.

TRANSMISSION OF HEREDITARY CHARACTERISTICS.

The question of inheritance, transmission of qualities from individuals or one generation to those of another, or of many succeeding generations, is very perplexing, considered with reference to the above facts. I have shown you that the egg is entirely the product of the female organism; that it grows to its perfect condition as an egg without any other stimulus than that furnished by the mother. When fecundation takes place it acts upon the ripe egg alone; it has no power to produce an egg, and exerts an influence only upon eggs which have already reached a certain degree of maturity. And yet notwithstanding this independent production of eggs by the female, the male influences the progeny quite as powerfully. We have only to look among our domesticated animals, or indeed among ourselves, to know that features are handed down from the maternal and paternal side equally, and reappear in direct succession among the children, and that this occurs, as I have reminded you in a former lecture, in all possible combinations. Still more curious is the fact that certain things acquired by an individual during his lifetime, and therefore essentially his own and not inherited in any way, may be transmitted to his progeny, and may even reappear in subsequent generations. I do not here allude to the so-called law of "atavism," but to a seemingly capricious reappearance and disappearance of all sorts of individual, mental and physical qualities. They may all be transmitted or may all be dropped as a new generation appears. And yet, with all their plasticity and power to assimilate or to reject new features, we do not find that species change. The law of inheritance seems so ordained as to retain what is essential to the type, and to allow of variation only in what is not characteristic of the typical organization. At all events, as far as we can trace the animals with which we are familiar now—and we can follow many of them beyond the primitive ages of mankind into the geological epochs immediately preceding and connected with our own—we find no indication whatever that any animal has ever swerved from his own type. Slight variations occur, such as occur about us every day, but they are individual differences, coming and going with new generations, sometimes preserved through generations, and even when maintained by intelligent care becoming permanent in what are called breeds, but never affecting typical structure. We must, as it seems to me, look upon the law of inheritance as intended to preserve, not to diversify, types; active only so far as to introduce freshness, a constant renewal of individuality, as it were, but never impairing original patterns or norms.

PERSISTENT TYPES.—THE LACUSTRINE EPOCH.

I shall show the persistence of type in more detail when we examine the successive introduction of organized beings in geological times. I allude to it now only with reference to what are known as prehistoric times, and especially to the prehistoric times to which humanity itself belongs. In the lacustrine dwellings of Switzerland there lived a race of people, all record of whose existence had faded before the Romans made their incursions into Gaul and Germany. Caesar's armies in their invasion of Gaul passed over regions of country once occupied by these lake dwellers. Roman roads still exist along the shores of the Lake of Neuchâtel, built upon their remains, and yet the great Roman general and historian knew nothing of them. Their ruins lie under the water, the dwellings having been built out upon piles into the lake, no doubt for greater security. The windows of my father's parsonage at Concise looked down on such a buried settlement, though we did not then know of its existence. As a boy I played in its immediate vicinity; in later years, on my last visit to Switzerland, when the cutting of a railroad along the lake shore had revealed the story so long hidden, I gathered implements, worn bones, etc., on the spot myself. In these ancient dwellings, remains are found of our domesticated animals and of our cultivated plants. Bones of pigs, dogs, cattle, deer, etc., and wheat, oats, cherries, nuts, and the like have been found within the precincts of these lacustrine dwellings. These relics do not differ in any way from the products of the same kind in our own time. The facts here given sustain me in the belief that inheritance is a device of nature to maintain type, and to preserve essential and characteristic features, generation after generation. It is true that, ancient as these lacustrine dwellings are, when compared with any historical chronology, they are modern as compared with the early geological periods. But those early periods, far before the introduction of man upon earth, furnish evidence of the same kind, and form part of a coherent history leading to the same conclusion, as I shall be able to show you when we examine the animals and plants belonging to them.

INHERITED TRACES OF SURGICAL OPERATIONS.

But while the office of inheritance is to preserve typical features, its power to transmit individual peculiarities is also wonderful. My friend Dr. Brown-Séquard, who has made more experiments among animals than any man living, continuing them upon successive generations and ascertaining what diseases may be transmitted, has stated facts to me which almost defy belief. These facts are unpublished. I will give a few of them. He has found that the disease of epilepsy can be induced in guinea pigs by certain operations, and that this disease, being so introduced into the system, may be transmitted from generation to generation, and thus become hereditary. Where such operations have produced malformations of the skin, as is often the case, these also have been transmitted; or where the paws have been affected by such operations the peculiarity has been also transmitted. Malformation produced by these experiments as a disease during the life of a parent has been passed down to the offspring, and even habits arising from disease have been inherited in the same way. In one such case the peculiarity existed in the female; in another it was produced in the male. In the latter instance the male transmitted its own diseased condition to another generation through a healthy female. More than this, the female through whom these diseased descendants had been produced eventually became herself diseased in the same manner as the male. These facts have a fearful significance. With reference to the process, the subtle influence by which such results are produced, we must be silent for the present, since we cannot explain or understand it. All that we know is that a material combination takes place which enables us to say that these individual peculiarities are sifted through the egg of the female and the spermatic particles of the male, and may reappear in their progeny.

A still more surprising fact is that of a man who had a diseased tooth, marked with a little black speck. This slight mark was transmitted to his children. Is such an inheritance brought about by a material transmission? It will be long before we shall answer this question; but all these facts have a direct bearing upon the question of maintenance or change of type. Therefore, I return again and again to this subject of inheritance, and try to illustrate it from all sides. In direct connection with this question of inheritance is that of hybridity. I have shown you that the progeny of closely allied animals may resemble indifferently the male or female from which they spring. All the descendants may be like the one or the other parent, or may share the characteristics of both. But whenever animals of different species cross with each other, as for instance the horse and donkey, the progeny is always a medium between the two—neither a horse nor a donkey, but a mule. In other words the offspring is always a half breed, always intermediate between what are called species. Among men it occurs between what are called races. The children of whites and negroes are neither blacks nor whites—they are mulattoes. The children of negroes and Indians are neither the one nor the other, but are half breeds, having characteristics of both. The same is true of the white and Australian, the white and Chinese. This is one of the facts brought forward in favor of the independent origin of the races of men. It has been on this account inferred that they must be distinct from each other in the same way as species of animals are distinct from each other. I will not dwell upon this point, but only ask what bearing these facts have upon the preservation or alteration of type. What is the next step? Suppose that in

the next generation the cross takes place between the half breed, we will say a mulatto and a white, or between the mulatto and a black, and this continues for two or three generations? The mixture is then completely gone, and we revert to the pure type. The same is true of animals; we may produce hybrids or half breeds; but put them for a generation or two with their own kind, they have no power to transmit the bias they have received, but their progeny revert to their own original norm. It seems to me that this is very strong evidence that all these laws of inheritance and transmission tend to the maintenance rather than to the diversification of type.

SANITARY NOTES.—DRAINAGE FOR HEALTH.

The chief object of this paper, contributed by Hon. H. F. French, to the fourth annual report of the State Board of Health of Massachusetts, is to show, to people living in the country, how practically to render their homes more healthful, by draining off the natural surplus water from their building sites and surroundings, and by carrying away and rendering harmless and even useful the outflows of sinks and other receptacles of filth.

DRAINAGE OF BUILDING SITES.

To drain a tract large or small, one acre or ten-thousand acres, find an outlet low enough to give the necessary fall. One foot in a hundred is sufficient and the author has drains working well that have but a quarter that fall. Common drain tiles are recommended, as they are cheaper and more durable than stone. They can be purchased at a cost of about 2 cents each for two inch, 4 cents each for three inch, and 6 cents each for four inch; these are the only sizes necessary. They are usually about 12 inches long. If the four inch are not large enough, two or more lines of them abreast may be laid. If tiles cannot be procured, stones, bricks, or wood may answer the purpose.

LAYING OUT THE WORK

should be done before breaking ground; generally a day's service of a good engineer, to fix grades, etc., will be worth far more than it costs. Usually a single main drain should run through the lowest part of the tract, and it is not important that the main should be straight. Lay side drains into it, having always in view two principles: first, to run each drain up and down the slope of the land rather than across; and second, to have them parallel to each other. The depth should be four feet or more and the distance apart with this depth may be from 30 to 50 feet. In any soil, except a close clay, 50 feet apart will be safe. In

OPENING THE DRAINS,

begin at the outlet, so that the water may run off as the work proceeds; with a common spade, and a pick if necessary, cut a trench by a line eighteen inches wide at the surface, narrowing to four inches or the width of a laborer's boot, at the bottom. The laborers will insist that they cannot work in so narrow a trench, and probably convince their employer, who of course has a right to follow their advice and waste his money if he pleases. To finish the bottom, a spade four inches wide is needed, and may be made by getting a blacksmith to cut down a common long handled spade to that width, no wider at the heel than the point. This is the only peculiar implement necessary, all the assortment of "draining tools" being only valuable to sell. Having opened all the drains, keeping the main low enough to let off the water, we begin to lay the tiles at the upper end. If there is much fall and there is danger that the main or the lower end of it may cave in, it may be only partially excavated at first, just enough so that the water may run off from above.

Lay the first tile, usually of two inch size, with a brick or flat stone over the upper end to close it entirely, and the next end to end with it, and so on to the main, keeping always an inclination, however slight; for if any depression is made, the silt will lodge in it and obstruct the work. No water is to be admitted except by percolation through the soil, and it enters chiefly at the joints which are as close as two rough bricks laid end to end would be.

Having laid two or three tiles on the bare earth, if hard, and on laths or other thin wood, if soft, cover each joint half or more round the tiles with a piece of tarred paper as large as a common letter envelope; and holding the whole firmly, place soil or gravel over it and on both sides of the tiles, pressing it enough to keep them in place. However tempted to do so, put no stones, nor straw, nor shavings into the drain. Cover and fill up with anything at hand except soft clay or fine sand, which should not be placed in contact with the tiles. Sole tiles, having flat bottoms and egg shaped orifices, the small end downward, are much used, but round tiles have the advantage that they may be turned so as to get a better joint. They require however more care in laying unless collars are used, which add 50 per cent to the cost. When we approach the junction of the minor drain with the main, a curve should be made, so as not to bring the side streams at right angles. Branch tiles may be obtained for this purpose.

Having thus connected the drains in one system with only one outlet, this should be so secured by a wire grating that no frog or other creeping thing can explore it. It should be built up solid with stone so as to be permanent, and should have a clear fall of a few inches upon a flat stone that it may not be obstructed by back water and mud.

HOW TO DRAIN CELLARS.

The common method of draining a cellar of a New England country house is to construct a small stone culvert running from the lowest corner of the cellar to some low place a few rods distant and digging small trenches across the cellar

bottom leading to this outlet. Such a drain is very imperfect, as it readily clogs and admits small animals. The writer considers that the best mode of cellar drainage is exemplified in the method adopted by himself in a house where, at certain periods of the year, the water in the cellar stood sometimes two feet deep. Having taken levels, it appeared that a low tract some distance off gave sufficient fall, when a trench was opened from that point to the nearest corner of the cellar. This was made about 4 feet deep except near the house, where a depth of 9 feet was reached, tunneling under roots of trees, walls, etc. In the cellar, the drain was continued to the farthest corner, one foot below the surface. Common two inch drain tiles were used inside, then three inch for some distance, and lastly, four inch to the outlet. The joints were covered with tarred paper and the soil returned and levelled. The outlet was secured by a little wall of stone and a copper netting, placed over the last tile completing the work. The whole cost of this arrangement did not exceed \$25, and not a drop of water has since been in the cellar even in the wettest seasons. In cases of buildings on a slope or hillside, having a subsoil not readily permeable by water, the cellars often become reservoirs. It is best to catch the water before it enters the cellar and so avoid all dampness by running drains, on one or more sides of the buildings, outside the walls. Cementing a cellar to exclude water is not advisable, for the pressure of the fluid heaped up behind the wall to the surface is often sufficient to lift up the whole body of cement from the bottom and break it in pieces. Water it is true can be thus, if a heavy wall is used, excluded, but the process is expensive and the adjacent soil is left saturated.

WHAT MAKES THE WATER BAD?

The answer is, too frequently, "because sink drains and vaults empty into the source of supply." A well often operates as a very deep drain, and whatever fluid penetrates the soil tends to flow into it. The subsoil has generally an inclination or dip, and the water tends down the slope. Careful observation will teach the direction of this underground flow, and it is always safest to dig a well on the up stream side of buildings so that the tendency of the natural drainage will be away from the well. A shallow well in sandy soil is far better laid with brick in cement than with stone. All water will thus be compelled to filter through the soil, to the depth of the bottom of the well. Well water is usually worst when lowest, and bad water may be expected, due to fluids from the soil rushing in to supply the place of the liquid pumped out, particularly after a drought. Common privy vaults should be laid with brick and cement, water-tight, say of 40 to 80 cubic feet capacity for a common country house. Fill one third full of dry soil of any kind except sand, and add more from time to time, clearing it out two or three times a year for use in the garden or field. If no water is poured or drained in, the contents will be dry and inoffensive when removed. A bed of muck or soil hollowed in the middle, upon which through a spout the chamber slops can be poured, if occasionally changed, will absorb their odor and add value to the compost heap.

SINK DRAINS.

There is no fluid so hard to carry away as sink water. The soap and grease are deposited on the sides of the pipe, which in course of time becomes choked. For this reason, the drainage of clear water should be kept distinct from that of cesspools and sinks. Clear water will flow in half inch pipe while four to six inches is not too large for sinks and cesspools. The joints for the latter must, also be tight, while common drain tiles are open. The following method for constructing sink drains, the author says, is cheap, efficient and durable. At the sink is a common bell trap. A lead pipe of 1½ to 2 inches bore runs down and out through the cellar or ground into a reservoir, which may be a strong oil cask of 50 to 100 gallons, or of well cemented hard brick. It should be a foot below the surface, so that, properly covered in winter, it will not freeze. The lead pipe should discharge under water and thus form a second trap that prevents any air passing up the bore. The outlet pipe, starting about one third up from the bottom, may be of lead, ½ to 2 inches bore, and should run upward and out of the reservoir at about a third from the top and into a large pipe of stone or iron. Thus the water enters the lead pipe about midway from top to bottom, leaving the greasy particles floating on top and the heavy particles at the bottom, so that what runs off is comparatively clear. It still carries off a great deal of soap, and will deposit it for a long distance.

The large pipes fit into each other, and are made tight with cement. They should be carefully laid, keeping always a slope, and a swab should be used to rub down the cement inside as each joint is laid. Three or four times a year the cover of the reservoir should be removed and everything cleared out.

The final deposit or cesspool into which sinks and water-closets are discharged should be placed, if possible, below the level of the water in the wells at their lowest, and always on the down stream side of the well, as the water is supposed to flow in the ground. A large vault, cemented or not as seems necessary, may be supplied with a quantity of dry soil or peat, and the moisture may be thus absorbed, or a trap may be there arranged which shall separate the fluid, which may be pumped out and applied to the soil; or the moisture may be absorbed by the earth, if the conditions are such as to render it safe.

THE agent in this country for the Aveling & Porter steam roller, illustrated in our last issue, is Mr. Wm. C. Oastler, 43 Exchange Place, New York city. See advertisement on back page.

Correspondence.

Transmission of Light.

To the Editor of the Scientific American:

The following thoughts having occurred to me, I would like to learn, through the columns of your indispensable journal, whether they are correct deductions from the facts already known to science.

If light is a wave motion, there must be a medium pervading the space between us and the sun, by which this motion is conveyed. Call it ether. There must also be friction between the earth's atmosphere and the ether, created by the earth's diurnal revolutions. This friction would create electrical currents in an equatorial direction. The earth would then represent a huge electro-magnet, the circulating currents inducing polar magnetism in our globe, as similar currents (through the insulated wire,) induce magnetism in the soft iron core of the telegraphic magnet. The magnetic needle points in a parallel line to the great magnet by its side.

Having taken all the numbers of your paper since 1851, and carefully preserved them, I have come to have a confidence in your decision of scientific questions which is almost limitless.

Washington, D. C.

REMARKS BY THE EDITOR.—We will enumerate a few of the objections to which our correspondent's theory is open.

The friction produced by diurnal rotation, if it existed, would be equal at all points of equal latitude; there would consequently be no tendency to produce equatorial currents but only those from the equator to the poles, which would make compass needles point east and west. The air is a sure conductor, and if electricity were developed in the upper regions of the atmosphere it would be visible in its passage as lightning or auroral flashes. There are occasional, not constant, phenomena. Any such friction would have long ago shown its effect in changing the rate of the earth's motion.

The Million Dollar Telescope.

To the Editor of the Scientific American:

I have noticed with much interest the various correspondence and plans proposed for the \$1,000,000 telescope, and should regret exceedingly to see any lottery scheme gotten up for the purpose of accomplishing so noble an object. If some distinguished scientific professor of astronomy would accept an invitation to preside over a meeting at Cooper Institute, New York city, after giving the object of the meeting abundant publicity, and then and there a society be organized of men of character to give it public confidence, the money would be forthcoming. For such an object, a society, I think, would be preferable to a company. Let there be grades of membership in proportion to subscription, with table of memorials, and the thing is done.

Beaver Falls, Pa.

Professor Haeckel on the Origin of Man.

To the Editor of the Scientific American:

In an article on page 231 of your issue of April 12, 1873, certain theories of Professor Haeckel, of Jena, are set forth; these, to say the least, are very curious and apparently opposed to every principle of common sense.

In substance, the Professor says that man at the outset is an egg, a little cell the one hundredth of an inch in diameter. The egg becomes an embryo, brought about by the original cellule being divided into two, these two into four, etc., continually increasing in number until a quorum is formed, when they lay their heads together, so to speak, nominate committees to attend to particular duties, and finally, all agreeing, like good citizens, to abide by the laws (made by themselves?), set to work to form a perfect man or woman precisely like those who for thousands of years have been striving to obtain a living from the bosom of their mother earth. But stay, I am too hasty. We are to suppose that in case our present circumstances are ever so altered as to render it necessary that man should become a monkey or a winged individual like the angels our forefathers believed in, then these tiny cellules will go to work accordingly and clothe us with hair or feathers, as the case may be.

What a beautiful theory! What wisdom these little cells display in thus cutting themselves up indiscriminately to build up the perfect man with his noble nature, his glorious ambition, his high attainments!

Can it be possible that any reasonable person would entertain such a theory as the above? Must we be led to believe that particles of matter (themselves composed of elements well known to us) are capable of acting in concert on their own responsibility, as it were, like ourselves, and so creating man to suit the circumstances, as we would construct a government or a machine for certain ends or purposes? Granting even this to be so, then we must go back to the elements of which the embryo itself is formed. By what power are these brought into the form of an egg or cellule? Since the same elements combine to form man and monkey, trees and plants, surely we must look for the original reasoning power in them, if we discard the idea of a Supreme Creator, and not in any particles or cellules formed by them. Thus we have oxygen, hydrogen, nitrogen and carbon transformed into reasoning beings, who either created themselves or have existed through eternity, and have the power of creating at pleasure man, beast or plant from their own substance.

Here we see that certain of mankind, in their frantic endeavors to overthrow the claims of theology and the distasteful idea of a Supreme Being, with power to reward or punish, unconsciously set up a god formed of the elements, who

has, at least, the power to create and destroy at will; for we must not lose sight of the fact that to plan and accomplish a given purpose requires an effort of will, be it natural or supernatural, and that there is a vast difference between the controlling influence of mind and the passive obedience of matter to established laws: the existence of which laws itself implies the prior existence of a law-making power.

I would suggest that the learned Professor turn his attention to the moral of an old and well known fable, for his great mountain of words, with monstrous labor, brings forth an exceedingly microscopical mouse of proof for Mr. Darwin, who will surely exclaim "save me from my friends."

Washington, D. C.

JOHN LEPPER.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations, which are only approximate, in the following notes, and for most of the information, I am indebted to students.

M. M.

Positions of Planets for June, 1873.

Mercury.

Mercury rises on the 1st at 4 A. M., and sets at 6h. 37m. P. M. It is at its least distance from the sun on the 8th. On the 30th it rises at 6h. 15m. A. M., and sets at 8h. 57m. P. M. It is then approaching its greatest elongation east from the sun, and should be looked for in the evening twilight.

Venus.

On the 1st Venus rises at 2h. 56m. A. M., and sets at 4h. 28m. P. M.

It is at its greatest brilliancy on the 10th, and should be looked for about a quarter after nine in the morning, at an altitude of 61°.

On the 30th Venus rises at 1h. 58m. A. M., and sets at 3h. 52m. P. M.

Mars.

Mars is at too low altitude for the best observations, but is a conspicuous object in the evening sky, coming to the meridian on the 1st at 9 P. M., having risen a little before 4 in the afternoon, and setting at 2h. 19m. the next morning.

On the 30th Mars rises at 2h. 6m., comes to meridian 7h. 19m., and sets at 12h. 30m. the next morning.

A small telescope is sufficient to show the markings on the surface of Mars, and the white regions, supposed to be icy, around the poles.

Jupiter.

Jupiter is still among the stars of *Leo*, and still a beautiful object in the evening sky; it rises in the forenoon on the 1st, and sets at 11h. 58m. P. M.

On the 30th it rises at 8h. 43m. A. M., and sets at 10h. 16m. P. M.

The phenomena of eclipses and occultations of satellites are now less often seen; only nineteen of them can be seen during June.

Saturn.

Saturn rises south of east on the 1st at 10h. 50m. P. M., and sets at 8h. 19m. the next morning. It souths at 3h. 35m. in the morning at an altitude of only about 28°. It is near the star π *Capricorn*.

On the 30th Saturn rises at 8h. 52m. P. M., and sets at 4h. 22m. A. M. It is then on the meridian at 1h. 35m. in the morning.

Uranus.

Uranus is still among the stars of *Gemini*, and passes the meridian now too early for observation, at 3h. 40m. on the 1st of June, setting at 10h. 56m. P. M.

On the 30th it sets at 9h. 6m. P. M., so that no good observations may be made upon it.

Neptune.

For a sight of Neptune a good telescope is always necessary, and in June it rises in the morning and sets early in the afternoon; on the 1st at 3h. 37m., and on the 30th at 1h. 46m., so that it is above the horizon, for the most of its diurnal course, in the day time.

Spots on the Sun.

At this time (May 18th) the sun is unusually free from spots, more so than for many months; with a glass of low power not a spot can be found.

Meteors.

Meteors were reported on the evenings of April 3, 24, 25, 27, 28, and 30; they were more frequent on the 30th than on any other evening.

Eclipses and Occultations.

On the 5th of May the moon occulted or seemed to pass over a small star, ι *Leonis*.

On the 12th, in the morning, the moon was eclipsed, but it had set in our longitude before the dark shadow came over its face. The dimming of the surface of the moon just before its setting showed that it had passed into the faint shadow known as the penumbra.

Auroras.

Several students report that auroral streamers were observed on the evening of May 15th from 8h. 30m. to 9h. 30m. P. M., and at 8h. 45m. an auroral belt was formed, passing through the zenith, its northern edge being 15° south of α *Lyra* and its southern edge 8° north of Jupiter. This belt was seen for only a few minutes.

Thermometer.

Up to this date (May 18) the thermometer has only once been recorded as high as 70 at 2 P. M. This was on the 5th of May.

A SEMI-MONTHLY scientific periodical in Turkish is about to be brought out in Constantinople. It is called the *Dolab*, which is, in English, the *Repository*.

IMPROVED ROTARY STEAM ENGINE.

The principal feature of the invention herewith illustrated consists in a rock shaft which is driven by a cam on the face of the rotating part of the engine, so as to operate a cut-off on both steam induction pipes, in combination with internal cut-offs and slides. By this means it is claimed that the steam has a more direct application to the rotating center or cylinder, and that the mechanism is actuated with regularity and reduced friction.

Our engravings present a perspective view, Fig. 1; a front elevation, with parts broken away to show interior arrangements, Fig. 2; and a vertical cross section, Fig. 3.

In the external rim, A, of the engine, is made a recess, B, for convenience in attaching the steam pipes, C C; also flanges at the sides of the recess with cam grooves, D D, for imparting reciprocating motion to slides, E E. In the inner angles of the rim, A, are formed rabbets to receive face plates, F G, on either side of the machine. In these plates are arranged packing rings, H, Fig. 3, secured by springs and set screws, the latter passing through the plates and adjusted from the outside. Between the plates, F and G, and fastened thereto by bolts, is a disk, I; the rotating parts, F G and I, being thus held together in connection with the rim, A, in position to receive steam. On the back of the engine are reciprocating slides, E E, which operate in suitable guides, J, the latter being fastened to the plate, F. To prevent these slides from springing to one side when passing the cams in grooves, D, braces, K, are attached to the guides, J, and extend outwardly against the roller supports, L, thus preventing any springing of the parts so as to cause a jar. The arrangement of the roller supports is more clearly shown in Figs. 1 and 3. It consists of a box, L, secured to the slide, E, by a screw and also by a dovetail-shaped projection fitting into a slot at the extremity of the arm. To this support and revolving on a pivot secured therein by the set screws, M, is a friction roller, Fig. 3, which rotates within the groove, D. The opposite ends of the slides, E, are fastened to internal cut-offs, N, by screws, so that the latter are thereby operated. To allow of their motion, openings, O O, are made through the shaft cylinder, I, the shape of which is shown in Fig. 2. It will be noticed that for the first half inch, about, into the disk, they fit around the cut-off, but afterwards are constructed larger to accommodate the packing and packing plate, P. For a like purpose, notches are made on the inner sides of the face plates, F and G.

On the inner periphery of the rim, A, are formed cut-offs, Q, provided with suitable packing, R, which presses against the shaft cylinder, I, and against the plates, F and G, lapping under the rings, H, in the latter, as indicated by the dotted lines, Fig. 3, so that the steam cannot pass through it. It is halved and lapped so as to spread apart, has a plate under the joint, and is thrown out by springs or steam, thus forming a steam-tight connection, behind which the steam cannot penetrate. The cut-offs, N, extend outwardly from the cylinder, I, to the internal periphery of the rim, A, and form a steam-tight joint against it. The rings, H, in the face plates are cut out a little where the cut-offs would strike them, so that the latter fit closely against the rim without wearing against the packing. To prevent these rings, H, from turning, holes are made in them which slip over pins in the face plates.

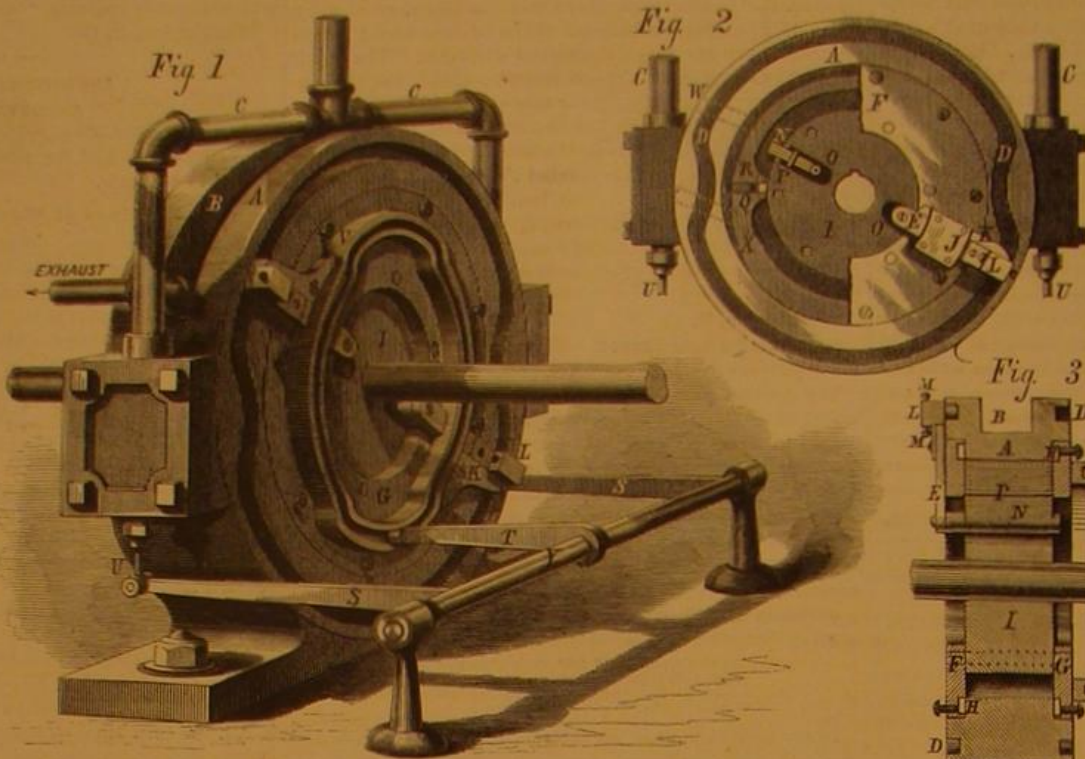
Y, Fig. 1, is a rock shaft hung in bearings in the standards, as shown, and supporting arms, S S and T. The former operate the cut-offs, U; the latter, on the end of which is a friction roller, is moved by a cam groove, V, in such a manner as to give the proper motion to the arms, S S, in order to open and close said cut-offs, U, at the time the cut-offs, N, are passing the projecting packing, R. By this means no steam is used while the cut-offs, N, are passing from the exhaust, W, to the induction ports, X, shown in dotted lines in Fig. 2.

The operation of the machine may be briefly described as follows: Steam is admitted at the pipe, C, through ports, X, and escapes through ports, W; striking the cut-offs, N, just as they come up tight against the external rim, it carries them around to the cut-offs, Q, at which points the former are drawn in by the slides, E, and cam grooves, D, while at the same time the rock shaft is set in motion, as above explained, by the cam groove, V. The exhaust is operated so as not to have a vacuum ahead of the slides, N, after they pass the exhaust port. The rim is cut out so as to let the steam ahead of the internal cut-offs, N, while exhausting

and while the latter are passing the cut-offs, Q, on the inner periphery of the rim.

The advantages claimed are that the machine works by the expansion of the steam, which can be cut off at any point; it is evenly balanced, steam being let in at both sides at the same time; and it has a regular motion, and can be driven at a high rate of speed. The mechanism, though apparently somewhat complex, is simple, and not liable to get out of repair.

Patented February 25, 1873. For further particulars re-

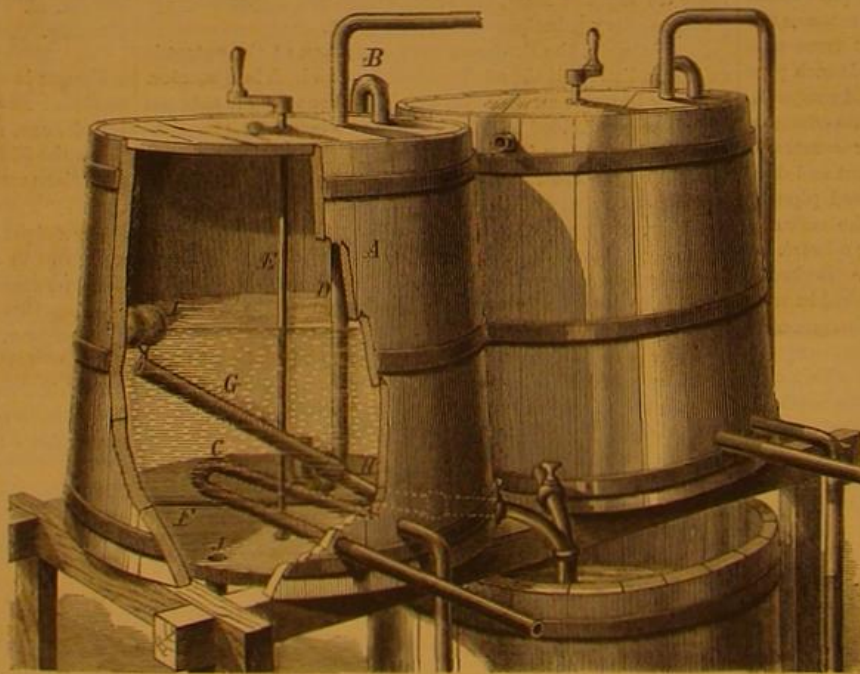


INMAN'S ROTARY STEAM ENGINE.

garding sale of rights, etc., address the inventor, Mr. Charles Inman, Hope, Midland county, Mich.

FEED AND FILTER FOR STEAM BOILERS.

The invention represented in the accompanying engraving is an apparatus for supplying steam boilers with purified feed water, thereby preventing the formation of sediment and incrustation. The device consists of the tanks, A, part of which is broken away to exhibit the internal arrangements, into which water is conducted by the pipe, B. At the bottom is a bent pipe, C, extending from the engine and serving to heat the contents. For a similar purpose another pipe, D, leads directly from the boiler to the lower part of the tank to admit steam into the same. E is a vertical shaft, actuated by a crank handle shown above, and carrying at its



FEED AND FILTER FOR STEAM BOILERS.

lower end a horizontal rod, F. G is a pipe extending from the tank, or from both reservoirs where two are employed, as represented in the engraving, into an intermediate vessel. That part of the tube, G, which is within the tank, A, is provided at H with a section of India rubber or other material, so as to be flexible. At I, floats are attached to the extremity of the pipe, holding the same elevated in the feed water, a short distance below its surface, at whatever height the water may stand in the tank.

After the feed water has been received in the reservoir, it is boiled by the steam from the boiler, so as to cause the settlement of its suspended impurities. A supply from the pure upper portion, through the always elevated end of the pipe, G, is then drawn off and either carried directly to the boiler or else into the lower receiving tank, as represented, so that any impure matter which may still remain may be deposited. Chemicals of suitable kind may be added to the

water in the tank, A, to cause the precipitation of foreign substances, if the boiling alone should not produce the desired effect. By means of the shaft, E, and stirring device, F, by revolving the former the deposited sediment may be agitated previous to discharging it, so cleaning out the tank through the opening, J.

This plan contemplates tanks the capacity of which is more than sufficient for, say, twenty-four hours consumption of water, thereby giving the impurities in the upper receptacle time to settle before the water is discharged into the lower vessel, from which the boiler is supplied. Patented through the Scientific American Patent Agency, April 1, 1873. For further information address the inventor, Mr. John G. Fulton, Toledo, Ohio.

Trade Marks.

"Every person or firm doing business, no matter of what kind or nature, so long as it is honorable, should have a trade mark. It serves as an advertisement, and the first mere nominal cost is a trifle. Yet in a year's business the same amount of circular advertising would cost hundreds of dollars. The trade mark is a distinction which cannot be imitated, as the law protects it. Americans, who excel in the manufacture of certain classes of goods, and place their goods in European markets, soon discover that they are not only in competition with the best makers of the same line of goods, but find that their trade mark protects them from imitation and counterfeit. Ingenuity can be called into exercise by the use of trade marks. Some use an almost indescribable monogram, and others eccentric

or unique ones, but the most appropriate is the concentration of aptitude for the especial business in which parties are engaged. If a pyrotechnist, he would not use for a trade mark a fire engine engaged in putting out the flames of a building. There should be an eternal fitness of things. There are many people engaged in the same business, yet it would not be at all difficult to have an especial originality in their designs. Let manufacturers put a trade mark on all their productions, and let dealers do the same to all the wares they send out. It is a protection to the former, and of vast business benefit to the other."

[The editor of the *Advertiser's Gazette*, from which the above is taken, should have added that it is important that trade marks be registered at Washington. The Government fee is \$25. Full particulars may be had by addressing the publishers of this paper.—Eds.]

The Wonders of the Deep.

During the recent passage of the British exploring ship *Challenger* from England to the West Indies, the sounding line and dredge were kept constantly going. The former showed that a pretty level bottom runs off from the African coast, deepening gradually to a depth of 3,125 fathoms at about one third of the way across to the West Indies. If the Alps, Mont Blanc and all, were submerged at this spot, there would still be half a mile of water above them. Five hundred miles farther west there is a comparatively shallow part, a little less than two miles in depth. The water then deepens again to three miles, which continues close over to the West Indies. At the deepest spots both on the east and west side of the Atlantic, the dredge brought up a quantity of dark red clay, which contained just sufficient animal life to prove that life exists at all depths. No difficulty was experienced in obtaining these deep sea dredgings, and it was merely a question of patience, each haul occupying twelve hours. In depths over two miles little has been found, but that little was totally new. One

of the lions of the cruise is a new species of lobster perfectly transparent. Not content with obtaining animals with eyes so fully developed that the body may be said to be an appendage, a new crustacean has now been dredged up, in which the body has cut itself clear of the eyes altogether, and the animal is totally blind. It has no eyes, or even the trace of an eye. To make up for its deficiency Nature has supplied it with the most beautifully developed, delicate lady-like claws, if one may use the term, it is possible to conceive. Nearer the West Indies, in a depth of only half a mile, some similar creatures were brought up, and here the claws, longer than the body, are armed throughout with a multitude of spike-like teeth, looking more like a crocodile's jaw than anything else. At a short distance from Tenerife, in a depth of a mile and a half, a rich and extremely interesting haul of sponges and coral was obtained, but the latter was unfortunately dead.

COUNTRY COTTAGE AND STABLE.

We complete the series of designs which we recently published, extracted from *Downing's Cottage Residences*, published by John Wiley & Son, New York city, with the accompanying engravings of a very tasteful and elegant country dwelling (Figs. 126 and 127), and of a neat and commodious stable (Figs. 99 and 100), which might be erected in connection therewith. The material for the construction of the cottage is brick, and a very picturesque style of architecture has been followed, with which the interior fittings of the house are designed to harmonize.

There is a large front porch leading to the vestibule, which is separated from the hall by an ornamental screen of carved chestnut. The flooring is of encaustic tiles of ornamental pattern. The main hall is large and roomy, and communicates at the right with a library, which opens into a small conservatory or flower alcove. The parlor immediately in rear of this apartment is a spacious room, and fronts upon a broad veranda. The dining room is supplemented by a butler's pantry, and contains several closets and other conveniences. This story is ten feet high and finished in chestnut. The basement is similarly divided, the partitions being of brick to insure a strong support to the floor above. The kitchen is under the dining room and has three large windows.

The second story is finished in chestnut and pine, and comprises three square chambers and a small servants' room. The height from floor to ceiling is ten feet. There are open fire places in all the rooms, and provision is made for a portable furnace in the cellar.

In constructing the house, blue stone trimmings, neatly dressed, may be tastefully employed, and the bricks for the outside facings should be selected for uniformity of tint and sharpness of outline, and laid in dark colored mortar. The roofs are slated and surmounted by ornamental cresting of cast iron. The estimated cost is about \$8,000, but it is probable that, near cities or in localities where the ruling rates of building materials are high, this sum would be somewhat exceeded.

The stable is of quite ornamental form, and is designed to be built upon sloping ground. It has beneath it another story for farm horses, cows, cellar for roots, etc. (not shown in the elevation), making altogether a very complete building. It is constructed of sound timber, sheathed with matched pine plank, battened, and the whole filled in with brick. The walls of the cellar story are blue stone, laid in mortar. The plan shows a carriage room, double floored and

ceiled all around, with a harness room and separately inclosed stairway in the rear. On the left is a tool room, workshop, etc.; on the right a stable with stalls for four horses. Over the whole is a large loft for hay, with mouths in the floor to feed the racks below. The cost would average from \$2,500 to \$3,800, depending upon expense of labor and material.

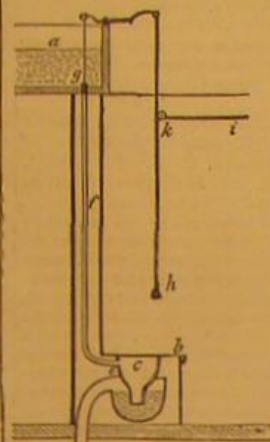


FIG. 46.

the basin, it is only necessary to pull the string, *h*, which, if the cistern be at a distance, may pass over several pulleys. In order to insure the descent of a quantity of water to the basin every time it has been used, a cord, *i*, may be joined to *h*, and passed over a pulley, *k*. The end is then fastened to the upper part of the door of the closet at such a distance as will suffice to lift up the valve, *g*. The door should have a spring to shut it, lest it be left open by neglect. The waste pipe from the water closet should leave the house by a properly fitted underground drain, and should either terminate in a covered drain or sewer at a considerable distance or in a well or cistern for liquid manure, the contents of which may be turned to valuable account.

THE POSITION OF A HOUSE.

Houses on streets running north and south are far preferable to those located on streets going east and west, in a sanitary estimate. In the first, here at the north of the equator, the sun shines brilliantly in the forenoon on the front,

and with nearly equal force in the afternoon on the rear. Thus dampness is expelled, and the whole edifice is dry and far purer for its solar exposure. If a house is on an east and west street, those fronting north are decidedly the best for a residence, because the sun's action on the yard, the kitchen, and usual regions of neglected accumulations, purifies and modifies the humid atmosphere that is sure to predominate in yards and the back part of houses whose rear is north of the street. Thus circumstanced, the back rooms are never so pleasant, cheerful or economically warmed in winter, as when on the south side. Opening on the street, the front of such gets both light and air by reason of the frequent swing of the front door.

Manufacture of Putty.

One of the largest manufactories of this substance is that of Reynolds & Co., at Bergen Point, N. J., and the process is thus described by a correspondent of the *New York Times*:

Only whiting and linseed oil are used; no barytes or other adulteration are introduced. The whiting and linseed oil are roughly mixed in wooden troughs—two gallons of oil to 100 pounds of whiting—and are then shoveled into the mills, 750 pounds forming a batch. The chaser, which is an enormous iron wheel revolving horizontally in a pan like a fountain basin, is at once set in motion. It gradually works the whiting and oil together, two scrapers turning the mass up into a ridge in the center, on the principle of a plow share. In twenty minutes the putty is thoroughly kneaded into a pliable and lubricated mass, and is ready for packing. The daily product of the two mills is about 12,000 pounds. The putty is packed in ox bladders, tubs and barrels; about 10 pounds to a bladder, 100 pounds to a tub, and 720 pounds to a barrel. It is amusing to watch the workmen stuffing the bladders. They seize a lump of putty and stuff it into the bladder with their thumbs with astonishing rapidity. A bladder is filled and tied in about ten seconds. It rather reminds one of sausage making, in our grandmothers' days. The following figures will give some idea of the extent of this business: Last year the firm packed 2,027,962 pounds of putty in tubs and barrels, and 696,683 pounds in bladders, the latter using up no less than 62,116 bladders.

ALL new subscriptions to the *SCIENTIFIC AMERICAN* will be commenced with the number issued in the week the names are received at this office, unless back numbers are ordered. All the numbers back to January 1st may be had, and subscriptions entered from that date if desired.

A PICTURESQUE BRICK COTTAGE.



Fig. 126.

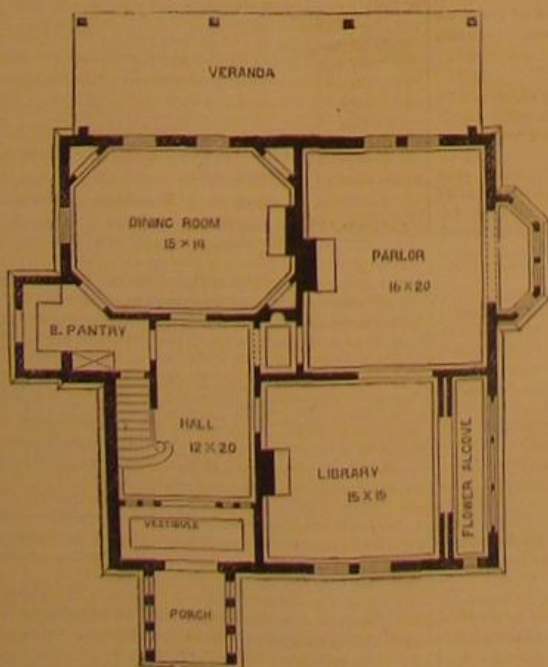


Fig. 127.

A CARRIAGE HOUSE AND STABLE IN THE RUSTIC POINTED STYLE.



Fig. 90.

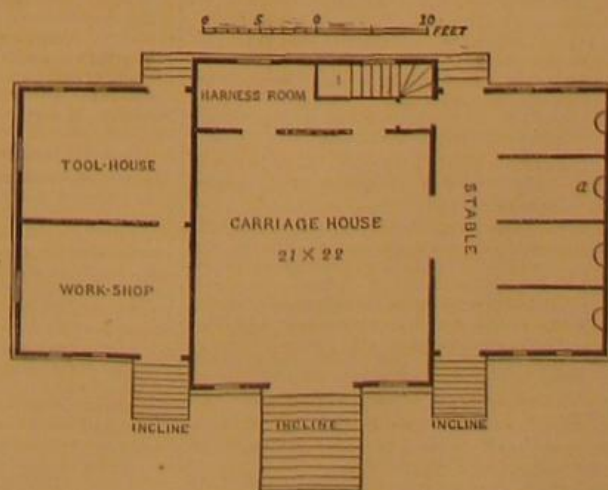


Fig. 100.

The Proportions of Ocean Steamers.

In publishing (on page 309 of our current volume) Mr. W. Cunningham's letter on the proportions of ocean steamers, an error in the engraving gave an incorrect impression as to the relative widths of the vessels. We therefore reprint the dimensions, with new illustrations accurately drawn to scale.

Baltimore, N. G. Lloyd's line—Length 185 ft., beam 29 ft.; length to breadth, 6.35.

Peruvian, Allan line—L. 270 ft., b. 38 ft.; length to breadth, 7.11.

Moravian, Allan line—L. 290 ft., b. 39 ft.; length to breadth, 7.44.

Lepid, N. G. Lloyd's line—L. 290 ft., b. 39 ft.; length to breadth, 7.44.

Minnesota, Williams & Gulon line—L. 332 ft., b. 43 ft.; length to breadth, 7.90.

Rhein, N. G. Lloyd's line—L. 332 ft., b. 40 ft.; length to breadth, 8.30.

Westphalia, Hamburg line—L. 340 ft., b. 40 ft.; length to breadth, 8.50.

Pennsylvania, American S. S. Co.—L. 343 ft., b. 43 ft.; length to breadth, 7.91.

Russia, Cunard line—L. 358 ft., b. 45 ft.; length to breadth, 8.83.

Queen, National line—L. 358 ft., b. 41 ft.; length to breadth, 8.73.

Ville du Havre, French line—L. 423 ft., b. 49 ft.; length to breadth, 8.63.

City of Montreal, Inman line—L. 433 ft., b. 44 ft.; length to breadth, 9.84.

Atlantic, White Star line—L. 435 ft., b. 41 ft.; length to breadth, 10.61.

A New Window Awning.

Mr. George W. Geran, of No. 359 Fulton street, Brooklyn, N. Y., has recently patented, through the Scientific American Patent Agency, an improved window awning, which is so arranged as to afford shade and at the same time to create a draft, thus ensuring the thorough ventilation of the apartment to which it may be adjusted. The invention consists in making the wings of the awning detachable, so that, by means of suitably contrived braces, either or both sides may be pushed outward and held open. When one wing is thus arranged, the other is stretched across the awning diagonally and fastened to the window frame, thus forming a clear passage for the air into the room. The device can be readily applied to old awnings and will doubtless prove a convenient and pleasant addition to our means of keeping cool during the coming hot weather.

NEW BOOKS AND PUBLICATIONS.

FIFTH ANNUAL REPORT ON THE NOXIOUS, BENEFICIAL, AND OTHER INSECTS OF THE STATE OF MISSOURI, made to the State Board of Agriculture. By Charles V. Riley, State Entomologist. Jefferson City, Mo.: Regan & Carter.

This is not the first time we have had occasion to commend the liberality of the State of Missouri in engaging the distinguished scientist, to whom we are indebted for this valuable report, to examine and describe the insect tribes of its rapidly advancing province. As a trustworthy and instructive volume on a most interesting branch of science, this report will be highly valued by all who will obtain and read it.

THE GERMAN PHARMACOPOEIA: Translated from the German and carefully compared with the Original Latin Text. By C. L. Lockman. Carlisle, Pa.: C. L. Lockman & Co.

We have received advance sheets of this work, which show at once the ability and accuracy with which it has been translated. The supremacy of German scientists in all branches of chemistry is everywhere acknowledged; and this text book will be found welcome to the libraries of our students and in our druggists' laboratories. Mr. Lockman has only recently contributed valuable technical information to our columns.

THE MINERAL SPRINGS OF NORTH AMERICA: How to reach and how to use them. By J. J. Moorman, M.D. Philadelphia: J. B. Lippincott & Co.

Dr. Moorman gives to the public in this timely volume, the result of a long experience in the investigation of the nature and medicinal applicability of mineral waters. He tells, in a clear and concise manner, to those desirous of regaining health through the healing fountains scattered over the country, just what places should be visited for the benefit of certain disorders, how the medicine should be used, its nature, and in fact about everything in which one going to a watering place for a purpose other than to follow the dictates of fashion would care to be posted. The work contains several illustrations of popular resorts with instructions how to get there, and also maps of the well known sulphur springs of Virginia.

THE BATH: Its History and Uses in Health and Disease. By R. T. Trall, M.D. 25 cents, paper; 50 cents, cloth. New York: S. R. Wells, 389 Broadway.

This is a neat little volume, in which the various forms and uses of baths are pleasantly described, especially with reference to hydropathy. The Turkish and Russian baths are, however, dismissed in one paragraph, and that is selected from the writings of a singularly prejudiced English physician. The text is liberally illustrated with engravings.

CONSUMPTION AND ITS TREATMENT IN ALL ITS FORMS. By Dr. Carl Both. Boston: Alexander Moore. Boston and New York: Lee & Shepard. London: Tribner & Co.

This book is a valuable contribution to medical literature, being the work of an able and learned writer. It contains much interesting physiological information which will be of value to the general reader as well as to the physician.

THE SCIENCE OF HEALTH: Devoted to Health on Hygienic Principles. \$2 a year. New York: S. R. Wells, 389 Broadway. Also, from the same publisher:

PHRENOLOGICAL JOURNAL AND LIFE ILLUSTRATED.

These two magazines are well known to our readers, and are mentioned here on account of their sustained and uniform excellence. They contain much varied matter, some of which is well selected from the current literature of both hemispheres.

FORMULAS AND TABLES FOR ARCHITECTS AND ENGINEERS in Calculating the Strains and Capacity of Structures in Iron and Wood. By F. Schumann, C. E. Illustrated. Pocket size in flexible covers. Washington: Warren, Choate & Co.

We need add no further words of recommendation of this convenient little volume than to say that it is a compendium of the formulas of the celebrated works of Weisbach, Rankine and other eminent authors, simplified and reduced to practical form. The book is designed for ready reference—a pocket guide, in fact—and hence space is economized throughout, though an incredible amount of information necessary in the daily routine of the engineer and architect is comprised within its covers. The contents include formulas for strength of material, strains, loads and all general calculations of similar character. The volume is illustrated with three hundred original diagrams, elucidating the text. The author, we think, in thus simplifying reliable formulas so that they may readily supplant the rough and empirical rules too often carelessly used, has done a good work which we do not doubt will meet with a well deserved appreciation from all members of the profession.

PATENT OFFICE DECISIONS.

PATENT FISHES.—THE AMERICAN SARDINE COMPANY.—APPEAL.

LEGGETT, Commissioner:

Applicants seek to have the words "American Sardines" registered as their trade mark, to be applied upon boxes containing a preparation of fish of the herring family, to which Mediterranean sardines belong, known as the "Menhaden," or "Moss Bunker." These fish, it is alleged, are of larger size than sardines, and have not heretofore been used as an article of food, owing to their numerous fine bones. Applicants set forth that they have been accustomed to treat them by a certain patented process, whereby their bones become softened, and they are converted into a valuable article of food. As thus prepared they have packed them in suitable boxes as sardines are packed, placed them upon the market, and adopted the name or label "American Sardines" for them, by which it is alleged they are known to the trade, and appropriately designated, as to source or origin, as the product or article prepared and sold by the American Sardine Company. This name, it is said, is neither the true denomination of the goods, nor of the fish themselves before their preparation, but is merely an arbitrary mark calculated to designate this manufacture as a product furnished the trade by this company, and is no further descriptive of the product than merely as such a designation of it. This is all of the substance of applicants' arguments.

It is acknowledged that the word "sardines" is not intended to truly indicate, and does not truly indicate, the contents of the boxes—the kind of fish they contain. That word, then, is obviously calculated to deceive when placed on a box of applicants' prepared fish as a label. But the word "American" employed with it is supposed to obviate this objection. This word, however, is, from the nature of the case, merely descriptive. It is in common use to distinguish all sorts of products made in this country from foreign products. It cannot be divested of that significance when placed upon an article displayed for sale. It does not diminish the deception which the false name applied to the boxes of fish is naturally calculated to convey. It rather aids that deception, for in fact there are no American sardines. The designation of the boxes of fish as "American Sardines," therefore, is but the adoption of a false name for them. If there were any American sardines known, or if any should be discovered in the waters of any of our coasts, American sardines would be their true name, and for that reason could not constitute a trade mark to designate them.

These words have not the virtue of a new name, a "coined" word, which, like the word "cocoaine," for instance, may be a legal trade mark. Especially is this true when they are applied as a label upon boxes of fish like ordinary sardine boxes. They are simply a misnomer in such a use, calculated to produce a false impression. It is immaterial that, on account of their large size, an examination of the fish will readily undeceive the purchaser. The effect of the mark itself is alone to be taken into consideration. If that is a false mark merely, and likely to be deceptive, it is not a legal trade mark and ought not to be registered. Such I regard it. The decision of the Examiner of Trade Marks is sustained.

Recent American and Foreign Patents.

Improved Work Stand.

Chauncey S. Caple, Frankfort, N. Y., assignor to himself and William Gates, of same place.—This invention consists in the improvement of work stands. The center piece is a casting of metal with four vertical holes arranged around the vertical center in which the pivot pin of the table top works. In these holes are introduced the upper ends of the legs. A ring or disk connects the legs at the middle, and has a recess in the under side, and as many radial holes extending from the periphery to it as there are legs, and the legs, being notched, are fitted in corresponding notches in the disk, and secured by bolts inserted in the said holes, and fastened by keys driven into the ends projecting into the recess, and having holes provided for said keys. A spool stand is fastened detachably to the top of the table center. For so fastening it, and having it at the same time so that it can be readily detached, a recess is arranged in the bottom of the disk of metal, and a hole near the periphery large enough to admit the head of a pin. From this hole the slot, as wide as the shaft of a pin, extends to the center. The pin is fitted into the vertical hole in the center of the table, and has a coiled spring fitted in the bearing against the table top so as to constantly press it down. A lever is connected at one end to the pin at its lower end, and extends towards the periphery of the table top as far as the opening, when the finger can be applied to push it down and raise the pin when the cover of the opening is removed. The pin head, being suitably shaped and held in it by the pressure of the spring, holds the stand in place so that it cannot be detached until the pin is raised by the lever. To detach the stand, the head of the pin is raised out of the countersunk recess, and the stand moved sideways till the hole comes to the pin, when it can be lifted off.

Improved Milk Cooler.

William Hodgdon, North Craftsbury, Vt.—This invention consists of a large water pan divided into compartments, with a separate water supply pipe for each and a discharge pipe connection of each with a main waste water pipe, arranged for filling and regulating the temperature in each independently. A separate milk pan is arranged for each compartment, each pan having a discharge pipe for milk, all in a convenient way for treating the milk of each milking independently, so that the treatment can be varied as to the temperature, as required during the time it has to be cooled. The arrangement is also designed to facilitate the removal of the milk pans readily for painting the bottoms, which has to be done frequently to protect them from corrosion; also for cleansing the large pan.

Improved Combined Stop Cock, Check Valve, and Blow Off.

Elbridge G. Cushing, Oswego, N. Y.—This invention consists in a combined stop cock, check valve, and blow off cock. The shell of an ordinary stop cock is used with the inlet pipe connection arranged near the bottom, and the outlet pipes near the top. The hollow plug cock has an opening into the lower part coinciding with the inlet pipe, and two others in the upper part coinciding with the outlet pipes. It also has a diaphragm between the said openings, dividing the hollow space into two chambers. A passage is formed through this diaphragm, and a valve seat arranged on the upper side of it, on which a check valve is fitted to close downward. This valve has a tubular extension upon the upper side, in which the smooth part of the stem fits in such manner as to form a guide for the valve. This stem screws out and in through the top of the plug, having a hand wheel on the top, and it has a shoulder on the lower end to be forced down on the top of the valve to fasten it closed. This shoulder will also limit the amount of the opening of the valve in case it be desirable to do so. One pipe connection is to be connected with the boiler, and the other to be used for the blow off. When the water is to be forced into the boiler, the plug will be adjusted, by which the passage is opened from the inlet pipe up through the valve and pipe into the boiler, and the escape is closed; but when the boiler is to be blown off, the position of the parts may be suitably altered.

Improved Adjustable Sewing Machine Chair.

Franklin Chester, Milwaukee, Wis.—This invention has for its object to furnish an improved chair for the use of sewing machine operators, which shall be so constructed that it may be readily adjusted as the convenience of the operator may be required, and the back of which will automatically adjust itself to the back of the operator. The pedestal is secured to the center of a cross bar, the ends of which have downwardly projecting arms formed upon them, to which are attached pivots. To the outer ends of the pivots are pivoted plates attached to the side edges of the chair seat. The upper middle part of the rear arms of the plates is cut away so that its lower edge may be about upon a level with the top of the cross bar, and in said edge are formed notches to receive the latch. The latch may be drawn out to enter the notches of the plate, and pushed in to release said plate. It is kept from lateral movement by guide logs, and is locked in either position by a projection formed upon said cross bar which enters notches on the under side. Springs are connected with the lower side of the forward part of the chair seat. By this construction the chair seat is held securely in place when adjusted by the latches, the springs simply making the adjustment more easy. The chair may be used as a rocking or oscillating chair. Springs are attached to the connecting bars, which pass up through slots between the plates and the edges of the chair seat, and their upper ends support the forward ends of the arms. Latches are pivoted to these bars which catch upon notches formed in the upper edges of the forward parts of the plates. The lower edge of the lower part of the chair back is hinged so that it may be adjusted in any desired position by adjusting the arms by means of the bars and latches, the springs making the adjustment more easy. The lower part of the back consists of a cross bar and two side bars. A coiled spring is so arranged as to tend to throw the lower end of the upper part of the back forward against the back of the person sitting in the chair.

Improved Carriage Axle Box.

Joseph Jones, James Dunkerley, and Joseph Dunkerley, Paterson, N. J.—This invention has for its object to furnish an improved axle arm and axle box so constructed as to prevent the entrance of mud and sand at the inner end of the hub, to hold the axle box securely in place upon the axle arm, and to enable the axle to be conveniently kept thoroughly lubricated. The axle box fits and revolves upon the axle, and its inner end is kept in place by a collar formed upon the axle arm. The outer side of the collar is recessed to receive the inner end of the box, which end is allowed to project a little beyond the inner end of the hub for this purpose, so that mud and sand may be wholly prevented from working in at the end of the hub. The inner end of the box is also reamed out and enlarged to form a shoulder to rest against a shoulder formed upon the axle to relieve the collar from having to support the whole inward pressure of the wheel. In the outer end of the axle is formed a screw hole into which is screwed a screw, the head of which is made of a little larger diameter than the axle, so as to rest against a shoulder. The screw projects beyond its head, and the projecting part is perforated longitudinally, and from the inner end of said perforation an inclined hole is formed, leading out at the inner side of the head of said screw. A screw cap screws into the recessed outer end of the box, and is flanged to overlap the outer end of the hub. The cap is made hollow to serve as an oil chamber, the inner wall of said cap being perforated to receive the perforated end of the screw, so that the oil from said chamber may pass through the perforations of the screw to the axle arm, which is grooved longitudinally to conduct the oil to the inner part of said axle, and thus lubricate its entire surface. The box has lugs formed upon its outer surface to prevent it from turning in the hub.

Improved Saw Set.

Cyrus E. Grandy, Stafford Springs, Conn., assignor to himself, Ziba B. Grandy, and William D. Heald, of same place.—This invention consists in the mode of combining certain instrumentalities to form a saw set for band saws. The stock to which the parts of the saw set are attached forms a handle and base of the instrument. The die bar is hinged to the end of the stock and carries the die. Power is applied by means of a cam lever, confined to the end of the die bar by means of an adjustable link. The back motion of the die bar is produced by a spring. The spring keeps the end of the die bar in close contact with the cam end of the lever, and the power is applied by simply raising the end or operating the lever. The purchase thus obtained is very great, and the power is applied gradually. A guide slides on the stock so that it can be adjusted to the width of the saw. This guide is used in setting band and gig saws. A loose adjustable pawl is attached to the stock, which in setting band saws engages with the teeth, and thereby governs the position of the teeth in relation to the dies. Allowing the teeth of the saw to be of uniform size a movement of the pawl to each alternate tooth will bring the proper tooth to be set in contact with the die.

Improved "Knock Down" Chair.

Charles R. Long, Louisville, Ky., assignor to Long & Brothers, of same place.—For making knock down chairs, for convenience of packing them in parts for shipment and storage and then setting them up readily, the inventor proposes to bevel the ends of the back rail of the seat frame, and form a half round notch in each end fitting the tenon of the side stretchers, and arrange them so that said tenons extend through and by said notches to enter the holes for them in the posts of the back of the chair, in which oblique notches are made for the ends of the back rail coinciding with the holes for the tenons of the side stretchers. When the seat frame is put together, and the seat bottom woven in it, the back rail and the side stretchers can be put together with the back posts by entering them in the notches and holes together from the front. The back rail and side stretchers are fitted together and glued, and the side and front stretchers connected to the front posts in the ordinary way. The seat bottom, when woven on, forms an L-shaped structure which nests together compactly for shipping. The back posts are connected together by the back cross pieces, and thus are in convenient shape for packing compactly.

Improved Weather Strip.

Jerome Bacon and Gilbert Bacon, Medina, Wis.—The object of this invention is to furnish a weather strip for doors. Triangular shaped pieces of wood are connected together by butt hinges and by a spring, a piece of sheet rubber covering them. This rubber extends a little above the upper piece and considerably below the lower piece. Metallic strips, by means of which the rubber is fastened, are placed even with the upper and the lower edges of the wood. The upper piece is screwed to the outside of the door. A lug is made in the door sill or in the jamb casing of the door, and a hook or projection is attached to the end of the other part of the door strip. When the door is closed the hook catches on the lug and draws the part down on the sill, thus making a tight joint under the door. When the door is opened the spring forces the lower part upward so that it will swing clear of all obstructions.

Improved Washing Machine.

Nelson O. Wilcox, Omaha, Neb.—The object of this invention is to provide convenient means for washing clothes, and it consists in an extension be for adapting it and fastening it to tubs of different diameter, and in a corrugated spring roller, which is placed directly over and nearly in contact with the bed rollers. It will be understood that when the clothes are made to pass between the two rollers the corrugated roller must be forced upward, but that motion will be resisted by the springs, and consequently the clothes will be squeezed by a force proportioned to the strength of the springs.

Improved Thrashing Machine.

Charles M. Powers, Ridgewood, N. J.—The object of this invention is to furnish a machine for thrashing and cleaning grain, which may be used either by hand or motive power, and which shall effectually beat out the grain without injuring the straw. The frame of the machine is of rectangular form and elevated to a convenient height. In the middle and on a line with the platform is the corrugated and perforated bed. The material to be thrashed is laid upon an endless apron, which carries it along over the bed, where the grain is beaten out. The straw is then carried along by another apron and discharged from the tail of the machine. While the grain is passing over the bed it is subjected to the action of the beater, which is composed of a series of bars. The thrashing is effected by a rapid up and down motion of the beater, the bars of which are brought in contact, or nearly in contact, with the bed at each stroke. The motion of the beater is produced by means of the pin wheel on the driving shaft. The grain and chaff fall upon sleeves as they pass through the bed. These sleeves are given a vibrating motion by means of the ordinary fanning mill device.

Improved Lifting Jack.

William M. Doty, New York city.—The object of this invention is to improve, simplify, and cheapen apparatus for raising carriages and wagons, and for all similar uses. The back edge of the lifting bar is provided with ratchet teeth with which the ratchet link is made to engage for lifting the link, it being loosely attached to the short end of the lever. The link works loosely on the bar, and drops by its own gravity when the long end of the lever is received. When the link engages with a tooth of the bar its outer end binds or grips the other edge of the bar, the link being a gripe as well as a ratchet pawl. By means of the link the bar can be raised eight or ten inches, more or less. The weight of the lifting bar is supported by means of an adjustable friction spring, which is made to bear against its side. This spring consists of a piece of rubber tubing on a wood screw. By turning the screw the rubber tube is expanded or contracted, and the friction on the bar is increased or diminished, as may be required. Lifters on the bar are arranged so as to be nearly over the center of gravity when either one of them is employed. This adapts the jack for all kinds of vehicles, the axles of which vary from one to two feet, or more, in height from the ground.

Improved Wood Finishing Compound or Oil.

Frederick Webster, Brooklyn, N. Y.—This invention has for its object to furnish an improved oil designed more especially for black walnut, real or imitation, but applicable to other woods, which, when applied to new work, brings out the natural colors, removes the roughness, and gives a smooth finish, and which, when applied to old work, restores its colors to their former brightness. The invention consists in an improved finishing oil, prepared of raw linseed oil, boiled linseed oil, spirits of turpentine, and liquid paint drier. Beeswax is put into the mixture which is then thoroughly stirred, poured all at once or a part at a time into some suitable vessel, and heated sufficiently to wholly melt the wax. The oil is now ready for use and may be applied with a brush. When applied to solid walnut it should be allowed to stand twenty minutes and then rubbed in with a woolen cloth in the ordinary way.

Improved Scroll Saw.

Hosekiah B. Smith, Smithville, N. J.—This invention has for its object to furnish an improved jig saw so constructed that the work and saw may be rotated by turning the table so as to keep the work from coming in contact with the framework of the machine, or with other obstructions, without the necessity of stopping the saw. Upon the driving shaft is formed a cam to receive a rod, the upper and lower ends of which are pivoted to the arms of elbow levers, which are pivoted at their angles to the frame. To the other arms of the elbow levers are attached straps which pass around guide rollers and are attached to the outer ends of the square sliding rods, with the inner or adjacent ends of which the ends of the saw are connected, so that the saw may be moved up and down by the revolution of the shaft. The upper guide roller is pivoted in a frame which slides up and down in ways and is connected with a lever pivoted to an arm attached to the frame, and held in place. This arrangement enables the tension of the saw to be regulated as desired. By suitable construction, by holding the work fast to the table and turning the said table in one or the other direction, the saw will be turned with it so that the work can be fed to the saw in its new direction without delay and without stopping the machine.

Improved Neck Tie.

Reginald B. Parker, Indianapolis, Ind.—The object of this invention is to improve, simplify, and cheapen neck ties; and it consists in the manner of folding the silk or goods of which the neck tie is made over the corners of the shield. The points are covered by folded down triangular pieces.

Improved Corn Sheller.

Franklin Hollen and Amos C. Holland, Marion, Ill.—This invention has for its object to furnish an improved hand corn sheller, enabling the corn to be shelled easily and rapidly. The invention consists in the shelling grate, which is formed by a number of bars fluted or concaved longitudinally upon their upper sides so that their side edges may be sharp to remove the corn from the cob. The upper end of the machine may be conveniently raised and lowered, as required. In using the sheller, the ear of corn is passed into a box and drawn across the bars of the rack, the sharp edges of which quickly remove the kernels from the cob, the box keeping the kernels from flying about, and guiding them into the bag or vessel placed to receive them.

Electric Battery.

Louis Bastet, New York city.—The invention consists in a compound of cupric salt, preferably the sulphate, and of the nitrate of soda or potash, in a solution of the same ingredients in sulphuric acid, to form a liquid compound, and in the employment of nitro-hypophosphate of sodium or potash—all for application to electric batteries.

Marine Post Office Safe and Life Preserver.

George F. Abraham, Baltimore, Md.—The invention consists in a combined post office safe and life preserver applied on board of vessels so that papers and other valuables as well as lives may be saved. It consists in providing the same with a rope and ladder, arranged so that the person in charge may always be able to reach his proper position thereon, no matter where he may be when the accident occurs. It also consists in making the preserver and safe in sections.

Improved Seed Planter.

Isaac T. Suggs, Greene Hill, Texas.—The invention consists in the improvement of seed planters. To and between the forward ends of the main frame of the machine is pivoted the rear end of a short beam, to the forward end of which the draft is applied. The beam is made thick so that two or more holes may be formed in its forward end to receive the draft clevis. By this means, by adjusting the draft clevis higher or lower, the harrow may be made to work deeper or shallower in the ground, as may be desired. To the under side of the beam is secured a small triangular or V shaped harrow, to remove clods, stalks, and other obstructions, and to loosen up the soil to better prepare it for the opener and cover.

Improved Convertible Freight Car.

Thomas Fogg, St. Mary's, Canada.—The object of this invention is to construct a railroad freight car so that it may be readily converted from an ordinary freight or box car to a car for transporting grain in bulk, provided with a spout or chute for discharging the grain. Bars are attached to the flaps, which are connected with the ends of the car by slotted plates, which allow the flaps to drop down on angular cleats on the sides of the car. When thus arranged, they present the grain for entering the end angles of the car and allow it to slide forward toward a center chute. When not in use for this purpose, they slide up in the slotted plates, where they are supported by hooks. The hinged section of the bottom is held up in a vertical position by the buttons attached to the car stanchion. The action of these buttons is limited by the angular shanks which enter the curved cavities in the side of the car. By this mode of construction it will be seen that the car may be used either for ordinary freight, as common box cars are used, or for grain in the bulk, the change from one to the other being readily and speedily made.

Improvement in Oiling Millstone Spindles.

John J. Chuob, Decatur, Ind., assignor to himself and Samuel C. Bollman, same place.—This invention has for its object to furnish an improved device for oiling spindles, by the use of which the spindle may be kept properly oiled, and which shall be convenient in use. The invention consists in the tube embedded in a channel in the leading furrow of the stationary stone, and extending from the heel or skirt to the bosom of said stone. Upon the outer part of the tube is formed a cup to receive the oil, and which is provided with a cap or cover. The outer end of the tube is provided with a cap, cork, or other stopper, to enable a wire to be inserted to clear out the tube.

Improved Mitten.

Farnam L. Oakley, New York city.—This invention consists in the manufacture of knitted mittens in flat web with the wrist and hand portion shaped exactly as demanded, and nicely formed and well fitting thumbs, conforming as nicely to the shape of the natural hand as these portions of the gloves which are made by cutting by patterns from skins or cloths, by widening the web on one or both edges as much beyond the width required for the wrist and hand as needed for the thumb, so that when the web is folded and sewn up, the thumb springs out from the side of the hand portion as it does in the natural hand and in the mittens and gloves cut out by patterns.

Combined Journal Box and Lubricator for Shafting, Axles, etc.
Joseph B. Morris, Houston, Texas.—The invention consists in combining, with a journal box of peculiar construction, an oil elevator and a device for saving, to be used over and over again, oil which would otherwise escape and be wasted.

Improved Mortising Machine.

Eugene Hammond, Cumberland, Md.—The invention consists in adjustable spring spacing gages applied in the recessed side of the carriage of a mortising machine, to regulate the distance between the mortises; also in hinged gages for end-beveled posts; also in combining with the carriage of a mortising machine, a gage dog, gage, and stop bar to regulate the length of the mortise.

Improved Gate Hinge.

Willard G. Franklin, Shelbyville, Mo.—This invention has for its object to furnish improved gate hinges, which shall be so constructed that the gate may be adjusted to swing level or to incline upward as it swings back, and which will allow the forward end of the gate to be raised when desired to allow hogs or other small animals to pass through. It consists in the post piece having a screw shank, a shoulder plate, and a three hole eye plate, and the gate piece having slots and semicircular notches formed in it.

Improved Machine for Paring Horses' Hoofs.

George W. Schafer, St. Charles, Mo.—This invention relates to apparatus for facilitating the paring of horses' hoofs preparatory to shoeing. A circular piece of metal two inches in width, forming something more than a semicircle, has a bar extending from one end to the other. This circular plate corresponds with the size of the hoof, and is placed on the hoof when used. In forming the circle, the plate is made dishing so as to fit the hoof with the bar passing across the heel on a plane parallel with the bottom of the hoof. A knife blade with a double edge is fastened to the under side of the bar by a pivot bolt. The point of this knife reaches over the edge of the circle. A lever is attached to the bar by the pivot bolt, and is connected with the knife by a stud bolt. The knife is moved back and forth as the lever is moved. The edge of the circle forms a guide for paring the hoof, the edge of the knife being placed a little above the edge of the circle, but is sprung down to the edge of the circle by means of the lever, so that the portion of the hoof which protrudes will be pared even with the edge of the circle. A handle on the circle, which is grasped by the operator, allows him to counteract the force of the lever on the horse's foot.

Improved Rotary Steam Engine.

John Lucas, Hastings, Minn.—This invention relates to the class of steam engines known as "rotary," where a crank is dispensed with. The piston wheel is attached to the central driving shaft, and the pistons slide in slots in the flange of the piston wheel as that wheel revolves, moving longitudinally in the wheel, being constructed with slots through which the shaft passes. Each piston is formed of two like-shaped and equal-sized parts, which are connected by two right and left hand screw nuts. By turning these nuts the two parts of the piston can be adjusted to take up the wear and insure their working steam tight within the cylinder. A valve, having the form of a slightly obtuse angle, is pivoted at its apex equidistant between the induction ports. The end of each of its arms is made slightly convex to allow it to fit snugly against the inner periphery of the cylinder, and the outer side slightly concave, corresponding or concentric with the cylinder. The valve being in proper position to receive the impact of steam admitted by the left hand port, the steam acting on the piston projecting through the wheel on that side, causes the latter to revolve from left to right. Shutting off steam at the left hand port and admitting it at the other will cause the valve to turn on its pivot and assume the opposite position, which will effect the reversal of the wheel.

Improved Pruning Shears.

William McCray, Black Oak, Mo.—This invention has for its object to furnish an improved pruning shears. The cutting edge of the stationary blade is made with a re-entrant angle to receive and detain the limb while being cut. The edge of the movable blade is made with a rounded or convex edge to shear off the limb while detained in the angle. To the upper end of one handle is attached the end of a bar having the stationary blade formed upon its forward edge, near its upper end. Another bar is provided, similar in form, except that it has, instead of a blade, a curved arm made in a separate piece. The upper ends of the parallel bars are bolted to each other, and are kept at the proper distance apart by a washer. The lower parts of the bars are bolted to each other and are kept at the proper distance apart by the end of a curved arm. The bars are bolted to each other at the base of the stationary blade, which bolt also secures the curved arm to the bars and pivots the movable blade to and between said bars. The latter blade is formed upon the end of the bar, which is curved, and to its lower end is attached the upper end of the handle, the curvature of the bar bringing the handles into such a relative position that they can be conveniently operated even when made long. The curved arm passes through a keeper attached to the side of the bar, and assists in giving firmness and steadiness to the shears when in operation. To the side of the curved bar is attached a stop, in such a position as to prevent the edges of the blades from coming in contact with and being dulled by the frame work of the shears.

Improved Coiled Wire Brush.

John B. Christoffel, Williamsburg, N. Y.—This invention has for its object to furnish an improved wire brush, the brush of which shall be formed of coiled wire, and which shall be flexible, so that it may be readily used in different sized tubes. The invention consists in an improved coiled wire brush, formed by the combination of one or more coiled wires with two or more twisted wires. This construction makes the brush very flexible, the coils of the coiled wires inclining freely in either direction, and their outer sides, pressing against the surface of the tube, clean it quickly and effectively.

Improved Binding for Sewing Machine Covers.

Evelyn F. French, New York city.—The object of this invention is to prevent the breaking or parting at the corners or other places of sewing machine covers, or similar boxes which are exposed to strain and liable to be broken unless strongly protected; and it consists in making the lower molding which embraces the sewing machine cover, or any one or more of the moldings embracing the same, of narrow veneers, which are glued together, and in forming the combined veneer molding thus made in one single length, and placing it around the cover or box, thus preventing the necessity of interposing additional fastenings or of specially jointing the pieces at the corners where such boxes are most apt to become injured.

Improved Spring Bed Bottom.

Elon G. Sherman, Forestville, N. Y.—This invention has for its object to improve the construction of the spring bed bottom for which letters patent No. 103,425 were issued to Daniel C. Brownson, May 21, 1870. To the under side of the end part of the upper or arched springs are attached sockets to receive the ends of the lower shorter springs. The middle parts of the side springs are secured to bars which are made so that their ends may rest upon cleats attached to the end rails of a bedstead. The bars are connected by cross bars, which not only hold the side springs in their proper relative positions, but also receive and support the ends of the upper springs, should they be subjected to a heavy weight. The middle parts of the intermediate lower springs are secured to longitudinal bars. Cross bars, the inner sides of which are beveled off, connect the intermediate sections of the bed bottom with the side sections, and hold them in their proper relative position, and at the same time strengthen the springs. Coiled wire springs are secured to the side springs, upon the upper ends of which rest the upper springs, pieces of cloth being interposed between the springs to deaden the sound.

Improved Corn Crib.

Joseph M. Hughes and Andrew J. Mapes, Independence, Mo.—The object of this invention is to provide means for allowing the corn in the crib to be self discharging into a trough or troughs for the feeding of stock. The corn crib has a floor which inclines from the ridge in opposite directions. This ridge runs lengthwise of the crib, and the inclination is sufficient to allow the ears of corn to slide down by their own gravity into the troughs. Troughs are placed on the sides of the crib so as to receive the ends of the bottom boards. Adjustable feed bars are arranged by means of which the quantity of corn discharged is regulated. These bars slide in angular grooves in the corner posts of the crib, and may be adjusted so that more or less corn will slide into the troughs.

Improved Lubricator for Steam Engine.

William H. Patterson, Chicago, Ill.—This invention consists of a sheet metal oil tank, capable of sustaining the pressure of the boiler applied to the steam pipe, and having a connection with it, above and below, with cocks to allow the steam to pass through it and shut it off at pleasure. There is a filling cock at the top, a feed cock at the bottom, and a glass gage and waste cocks for letting off the steam pressure and condensed steam, all arranged in such manner that, the steam being admitted to the oil in the tank and the feed cock opened at the bottom, the oil will flow into the steam pipe with the current of steam when the engine is running, and be conducted along with the steam into the engine, but will be prevented from escaping through the feed cock when the engine stops, because the pressure on the oil is then equal below to that above. The small passage in the feed cock through which the oil passes will be sufficiently obstructed thereby to prevent the oil from descending by gravitation.

Improved Scrubber.

Israel J. Emory, Jr., Webster, O.—This invention relates to a new scrubber in which plates of rubber cut into narrow strips are employed to furnish the requisite rubbing surfaces. These strips are fastened to the head block by means of metal plates, and furnish excellent rubbing surfaces that will yield to all inequalities of the floor or articles to be scrubbed, and can be used on carpets, oil cloths, etc., without injury thereto.

Improved Lumber Measure.

Frank S. Baldwin, St. Louis, Mo.—The invention consists in the improvement of lumber measures. A small circular sheet metal case is made with a reel inside of it on the axis, with a tape measure coiled on its face. A coiled spring is arranged upon one side for winding up the tape measure, and a disk on the other side for transmitting its motion to recording dials, when the tape is pulled out and stretched along the piece to be measured. This disk has ratchet teeth in the periphery, and is engaged by a spring pawl on the wheel, which runs back on the disk when the spring winds up the tape, and engages and turns it when the tape is pulled out. A cone of differential gears is attached to this disk for transmitting the motion to the recording dials, of which there are four sets. These differential wheels are graduated to actuate the recording train correctly for several different lengths of lumber—say the smallest one will be of the right size for turning the recording dials so as to indicate correctly the measure of lumber of ten feet in length, the next one similarly for twelve feet lumber, and so on. It is only necessary to turn a thumb piece, and shift it in a slot properly for engaging any particular slot with the pin for changing the connection of the train of recording disks, to set the machine for the length of the lumber to be measured. The transmitting gears may be changed from one recording train to another; and suitable mechanism is provided in order to prevent the trains from being disturbed or changed when this shifting takes place.

Improved Portable Stock Feeder.

Joseph M. Spencer, La Plata, Mo.—The object of this invention is to supply a combined corn crib, hay rack, trough, and hog pen, constructed in a cheap manner, capable of feeding stock economically and of being easily taken to places and removed from one farm or part of a farm to another. The invention consists of a roofed corn crib with the hog pen in the lower part. At convenient height is placed the feeding trough extending around the crib and admitting a large number of animals to feed at the same time. Above the trough, bolted to the crib and also extending around it, is the hay rack, of the same height as and corresponding in shape to that of the corn crib. The whole structure may be constructed either entirely of wood, or of wood and iron or other material, and may, by placing it on scantlings, be easily transported.

Improved Machine for Gumming Saws.

Karl Weinberger, Milwaukee, Wis.—This invention is an improvement in saw gummers of the class in which an emery wheel is mounted on an arbor having its bearings in a pivoted frame, oscillating in a vertical plane to carry said wheel alternately into and out of engagement with the teeth of the saw, which is arranged horizontally, and secured to its support by suitable means or devices. The improvement relates specifically to a curved stationary arm and sliding adjustable stops thereon for limiting the throw or movement of the vibrating frame.

Improved Automatic Fan.

Philip H. Reichhardt and Morris Schnapp, Brunswick, Mo.—The inventors employ a chronometer mechanism for driving one or more swinging fans for generating air currents, driving away insects and the like in warm weather, using a pendulum instead of the hair spring for regulating the motion, and attaching a swinging arm to the shaft, which works the pendulum for obtaining the vibratory motion for the fans.

Improved Dress Facing.

William H. Gallup, Troy, N. Y.—This invention consists of a new article of trimming for facing, stiffening, and protecting the bottoms of the skirts of ladies' dresses, which is composed of a strip of starched, gummed, or otherwise stiffened muslin of the character of wigan, say four inches, more or less, wide, of the same or any equivalent material further stiffened by futing sewed on one edge. It is made in twelve yard pieces, and put up for market in the ordinary way of putting up goods of this class.

Improved Medical Compound or Liniment.

Joseph Benda, Yattou, Iowa.—The object of this invention is to furnish an improved liniment for internal and external diseases, such as rheumatism, colic, diarrhoea, headache, etc., to be used either by rubbing the parts lightly with it or by mixing it with water. The liniment consists of oil of sassafras, oil of hemlock, spirit of turpentine, tincture of Cayenne pepper, tincture of catechu, gualac, tincture of opium, tincture of myrrh, oil of origanum, wintergreen, gum camphor, chloroform, and oil of cedar. This compound is dissolved in alcohol, forming a light reddish liquid.

Improved Medical Compound for Treating Rheumatism, etc.

Gideon Lucy, Mobile, Ala.—This invention consists in a compound to be used as a medicine for the cure of rheumatism, neuralgia, and similar nervous diseases, and for benefitting the human system generally. The medicine in one form is composed of a tincture or extract containing the root of the lint plant, combined with diluted alcohol. The root of this plant may be macerated or reduced to a pulp, or be concentrated by boiling, and combined with any other material to form a sirup or for making pills for medicinal purposes.

Improved Lubricator.

William Morris, Dayton, Ohio.—This invention consists of a hollow stop cock in the passage from the oil chamber to the steam chest, into which a quantity of oil is received when the cock is turned so as to shut the passage to the steam chest or pipe and open the passage from the oil chamber. The oil is discharged by steam pressure when the cock is turned to open the passage to the steam chest, and shut the passage to the oil chamber. The steam for expelling the oil from the cock is admitted to it by a small pipe connecting it with the steam pipe so that a current will pass through the cock and back into the steam pipe or into the steam chest, according to which the lubricator is attached, and carry the oil in the hollow plug along with it.

Improved Balanced Slide Valve.

Abraham O. Frick, Waynesboro, Pa.—This invention is an improvement in the class of hollow slide valves provided with flexible diaphragms or packing rings; and it consists in the arrangement of a flexible corrugated ring in connection with a valve formed of two parts, one sliding vertically within the other. This mode of packing the two cylinders affords an absolutely steam tight joint, with little or no friction, and is alike applicable to cylinders or square or other shaped forms which it may sometimes be desirable to substitute for them.

Improved Doublet Stone.

Simon Bruhl, New York city.—The object of this invention is to furnish a doublet stone which not only avoids some of the disadvantages of the former doublets, consisting in a lack of brilliancy and an easy injuring of the edges, but combines advantages which have hitherto not been produced and by which the application of "doublets" to jewelry can be greatly extended, the brilliancy and transparency of the stones increased, and such jewelry manufactured at cheaper rates. This object is accomplished by adding to the form of doublet stones now in use one or more steps or rows of facets to the upper part or "front" of the stones, and by making the uppermost part or step only of genuine stone, and the rest of paste.

Business and Personal.

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

Explosive Bullets. J. P. Moore's Sons, 204 Broadway, New York.

Improved Wood Handle Ratchets, 18 in., \$5. G. E. Parker Mfg. Co., 117 & 119 Mulberry St., Newark, N. J.

Lyman's Gear Chart, 50 cts. E. Lyman, C. E. New Haven, Conn.

Wanted—An Experienced Turbine Water Wheel Salesman. Address Herrman & Herchelrode Manufacturing Company, Dayton, Ohio.

Dickinson's Patent Shaped Diamond Carbon Points and adjustable holder for working stone dressing. Emery Wheels, Grindstones, &c., 64 Nassau St., N. Y.

For Solid Emery Wheels and Machinery. send to the Union Stone Co., Boston, Mass., for circular.

Wood Bending Machines Wanted—For making small round boxes, 3 inches diameter and upwards. Send Circular, prices, &c., to Burnett & Co., 614 Cottage Grove Avenue, Chicago, Ill.

Boiler and Engine, with improved Tile Machine attached for sale. Address W. M. Bell Smyrna, Del.

Wanted a Machine that will grind Bones by Steam. Send Circular to Box 107, Smyrna, Del.

Boilers, 2 to 50 H.P., upright, horizontal, tubular, fine, locomotive and cylinder, for sale at low prices by Henry M. Collum, Long Island City, L. I.

Buy Wood and Iron Working Machinery of Gear, Boston, Mass.

For Sale Low—A Sash and Blind Factory, with modern machinery all in good working order, on Railroad, west of Albany. The whole or a part interest at a great bargain to a suitable party with means. Write, with address and amount of capital, to R. McHarg, 77 Cedar Street, New York.

Wanted—Machinery for making Lead Pipe. Address Box 281, Pittsburgh, Pa.

H. Moore, Manufacturer of Broughton's celebrated Oilers, Lubricators, Faucets, &c., has removed to 45 Centre Street, New York.

Buy Engine Lathes and Bolt Cutters of Gear, Boston, Mass.

Keyway Gauge, Donaldson's patent. The best and latest invention of its kind. See advertisement on another page.

Machinist Wanted—A Practical, Ingenious, Industrious Man, to take charge of a light Manufacturing Machine Shop and Foundry near St. Louis. The right man could buy an interest in the business, if desired. Apply, stating ability, wages, &c., Box 36, Belleville, Ill.

State and County Rights for Duryea's patent Refrigerator, the best in the world; or will exchange for Real Estate. Apply at 698 Seventh Avenue.

Manufacturers of Wagon Machinery and Wagon Material, send circulars to Union Mfg. Co., Rock Falls, Whiteside Co., Illinois.

Sure cure for Slipping Belts—Sutton's patent Pulley Cover is warranted to do double the work before the belt will slip. Circulars free. John W. Sutton, 25 Liberty Street, Room 2, New York.

Patent for Sale at a great inducement. Apply, for particulars, to Patentee of "Advertising Lantern," S. Kah, Jefferson, Iowa.

Nat'l Mfg. Co., 11 Dey St., N. Y., manufacture & sell novelties & utilities. Ag'ts wanted. Catalogue free.

Jennings' Steam Clothes Washer. Rights for sale. Best out. Samples \$6. Nat'l Mfg. Co., 11 Dey St., N. Y.

Portable Steam Engines for Plantation—Mining, Mill work, &c. Circular Saw Mills complete for business. First class work. Simple, Strong, Guaranteed. Best Terms. Address the Old Reliable John Cooper Engine Mfg. Co., Mt. Vernon, O.

Patent Chemical Metallic Paint—All shades, ground in oil, and all mixed ready for use. Put up in cans, barrels and half barrels. Price 50c., \$1 and \$1.50 per gal. Send for card of colors. N. Y. City Oil Co., Sole Agents, 116 Maiden Lane, New York.

Patent Right for Sale, the whole or by States. The Anti-Lamella for cleaning Steam Boilers. J. J. Allen, Philadelphia, Pa.

Wanted—A thorough machinist, fully capable in every respect to act as Foreman in a Manufacturing Establishment, who is willing to invest some money in one of the best paying inventions of the times; the object being to have an interested person in charge. Address, with particulars and references, Manufacturer, Box 525, Middletown, Conn.

Cabinet Makers' Machinery. T. R. Bailey & Vail.

Abbe's Bolt Heading Machines, latest and best. For cuts, prices and terms, address S. C. Forsaith & Co., Manchester, N. H.

The Ellis Vapor Engines, with late improvements, manufactured by Haskins Machine Company, Fitchburg, Mass.

For the best and cheapest small portable Engine in market, address Peter Walrath, Chittenango, N. Y.

Steam Boiler and Pipe Covering—Economy, Safety, and Durability. Saves from ten to twenty per cent. Chalmers Spence Company, foot East 9th St., New York—122 N. 2d St., St. Louis, Mo.

For Circular Saw Mills, with friction feed works, and Stationary Engines, address Wm. P. Duncan, Bellefonte, Pa.

Shortt's Patent Couplings, Pulleys, Hangers and Shafting a Specialty. Orders promptly filled. Circulars free. Address Shortt Mfg. Co., Carthage, N. Y.

New England Band Saw Machines, cheapest and best, only \$157. For descriptive cuts, address S. C. Forsaith & Co., Manchester, N. H.

Grain, Paint, Ink, Spice and Drug Mills. Ross Bro's, 55 First Street, Williamsburgh, N. Y.

Drawings, Models, Machines—All kinds made to order. Towle & Unger Mfg. Co., 30 Cortlandt St., N. Y.

Key Seat Cutting Machine. T. R. Bailey & Vail.

Cheap Wood-Working Machinery. Address M. B. Cochran & Co., Pittsburgh, Pa.

Wood workmen—Ask your Bookseller for Richards' Operator's Hand Book of Wood Machinery. 65 cuts. Only \$1.50.

Plow Shares, Mold Boards, Cultivator Teeth, &c., cast to order, by Pittsburgh Steel Casting Co., Pittsburgh, Pa., of steel which can be worked same as wrought steel. All work warranted.

Peck's Patent Drop Press. For circulars, address Milo, Peck & Co., New Haven, Conn.

Royalty—Manufacturers and Inventors, have four Machinery, &c., made in the west for western use. Extra inducements offered by Doty Manufacturing Company, Janesville, Wis.

Steam Fire Engines, R. J. Gould, Newark, N. J.

Buy First & Prybil's Bandsaw machines, which are more used than any other in the country. Also, Shafting and Pulleys a specialty. 467 W. 40th St., New York City.

Stave & Shingle Machinery. T. R. Bailey & Vail.

Covering for Boilers and Pipes. The most economical and durable article in use. Took first prize at American Institute Fair. Van Tassel Manufacturing Company, 528 Water Street, New York.

The Best Smutter and Separator Combined in America. Address M. Deal & Co., Bucyrus, Ohio.

Damper Regulators and Gage Cocks—For the best, address Murrill & Kelsor, Baltimore, Md.

The Berryman Heater and Regulator for Steam Boilers—No one using Steam Boilers can afford to be without them. I. B. Davis & Co.

Tree Pruners and Saw Mill Tools, Improvements. Send for circulars. G. A. Prescott, Sandy Hill, N. Y.

Brown's Coal Yard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable, W. D. Andrews & Bro., 414 Water St., N. Y.

Gauges, for Locomotives, Steam, Vacuum, Air, and Testing purposes—Time and Automatic Recording Gauges—Engine Counters, Rate Gauges, and Test Pumps. All kinds fine brass work done by The Recording Steam Gauge Company, 91 Liberty Street, New York.

Tool Chests, with best tools only. Send for circular. J. T. Pratt & Co., 53 Fulton St., New York.

For Sale Cheap—Six Horse Power Portable Engine, mounted on truck, good as new; been used only two months. Address N. Abbott, Mansfield, Ohio.

Five different sizes of Gatling Guns are now manufactured at Colt's Armory, Hartford, Conn. The larger sizes have a range of over two miles. These arms are indispensable in modern warfare.

40 different Bandsaw machines, 60 turning and improved oval lathes, shaping, carving and moulding machinery, for sale by First & Prybil, 461 W. 40th St., New York City.

For best Presses, Dies and Fruit Can Tools, Bliss & Williams, cor. of Plymouth & Jay, Brooklyn, N. Y.

Gauge Lathe for Cabinet and all kinds of handles. Shaping Machine for Woodworking. T. R. Bailey & Vail, Lockport, N. Y.

Shafting and Pulleys a specialty. Small orders filled on as good terms as large. D. Frisbie & Co., New Haven, Conn.

All Fruit-can Tools, Ferracuts, Bridgeton, N. J.

The Berryman Manuf. Co. make a specialty of the economy and safety in working Steam Boilers. I. B. Davis & Co., Hartford, Conn.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrews' Patent, inside page.

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 429 Grand Street, New York.

Machinists—Price List of small Tools free; Gear Wheels for Models, Price List free; Chucks and Drills, Price List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

The Berryman Steam Trap excels all others. The best is always the cheapest. Address I. B. Davis & Co., Hartford, Conn.

Absolutely the best protection against Fire—Babcock Extinguisher. F. W. Farwell, Secretary, 407 Broadway, New York.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Williamson's Road Steamer and Steam Plow, with rubber tires. Address D. D. Williamson, 32 Broadway, N. Y., or Box 1899.

Parties desiring Steam Machinery for quarrying stone, address Steam Stone Cutter Co., Rutland, Vt.

Hand Fire Engines, Price \$300 to \$2,000. Also, over 800 different Style Pumps for Tanners, Paper Mills, and Fire Purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

Boring Machine for Pulleys—no limit to capacity. T. R. Bailey & Vail, Lockport, N. Y.

Notes & Queries

L. asks for directions for staining pine wood in imitation of mahogany.

D. B. asks for the best mode of making spiral springs 5 inches long, from No. 8 steel wire; also for the best mode of tempering them?

J. J. G. says: Seeing an answer in the *Scientific American* regarding a standing point in the circumference of a wagon wheel in motion, I would like to know (1) if the center of a shaft revolving is also a standing point; and (2) what part of the wagon wheel is the fulcrum, and if the spokes of a wagon wheel are levers?

W. F. R. says: I was surprised to read the following in your journal for May 17: "Newton's explanation of the movements of the solar system is probably correct in theory, but it is deficient in one important particular: it fails to account for the motive power. The attraction of gravitation we all understand; but what is the counteracting force? An original impulse will not answer, for a transient force cannot successfully contend with a constant force of anything like equal intensity." It seems to me that a theory which fails to account for the essential condition in a problem must be ruled out as a theory. Your correspondent suggests magnetic attraction as affording the best solution of the problem of the movements of the heavenly bodies. His theory, if I understand this writer, equally fails in satisfying an essential condition of the problem: "An equal current of magnetism," he writes, "sweeping round the sun from west to east in the plane of the ecliptic, with immense velocity, would account for the motion of the planets in their orbits, and of the sun on its axis." What gave the original impulse to such equatorial current? and how is its velocity maintained?

W. S. B. asks: What is the best *modus operandi* for recovering diamonds from the debris of a fire, the settings having been melted and run into nuggets? The plan I pursued was first to run the debris through suitable screens, first through a coarse one to get out the large stuff, and then through a fine one to get out the dust; I then use a large tub of water and wash the debris in a fine sieve about a foot in diameter. After shaking a little in the water, I sink the sieve and float off the burnt wood or any other matter that will float; leaving the balance, in the shape of gravel and pieces of plaster, perfectly clean. I have no trouble in finding the smallest pieces of gold, as that metal will lay solid in the bottom of the sieve when held at an angle and shaken in the water; the balance rolls to the lowest part of the sieve. I have found some garnets with half the setting burnt off and the stones unaffected at all. Some people say that diamonds turn black by being in fire, and Fowne's *Elementary Chemistry* says that the diamond is infusible and unalterable by a very intense heat, provided air be excluded. If they are unalterable, can they turn black?

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The copyright law of the United States offers a variety of privileges of considerable value for business purposes. The 8th section of the patent laws of 1970 provides that any citizen of the United States, or any person resident therein, who may be the author, inventor or designer, or proprietor of any book, map, chart, dramatic or musical composition, engraving, cut, print, photograph, or negative thereof, or of a painting, drawing, chromo, statue, statuette, or of models and designs intended to be perfected as works of the fine arts, may obtain copyrights, which shall secure the exclusive privilege of printing, reprinting, publishing, completing, copying, executing, finishing and vending the same.

The copyright is in fact a patent, although not applicable to machinery. A copyright lasts for 28 years, at the end of which time it may be renewed for 14 years longer, by the author, inventor or designer, or, if deceased, by his wife or children. In applying for a copyright, no sworn papers are required, and no signatures; in fact, no forms or ceremonies are involved, nor tedious official delays. Parties who do not wish to attend to the matter themselves may for five dollars have the copyright promptly procured for them by the undersigned.

There is no form of protection that is more easily obtained, or which gives better satisfaction so far as it extends than the copyright, and the simplicity and excellent practical working of the law ought to afford useful instruction to those who constantly aim to add complexity to our mechanical patent laws.

Under the copyright law, it is to be observed that designs for ornamental objects or configurations, prints, engravings, cuts, pictures, cards, and pamphlets of every kind may be secured. Almost every business concern finds it necessary to produce some peculiar work of this kind, large or small. Thus if a man makes a new drawing of his building, his machine shop, interior of office, view of the town showing his works, or any new and pictorial form for border, or design to be used upon goods, circulars, or other purposes, he may, by simply securing a copyright, prevent others from imitating the same. It is obvious that the uses of the copyright are very extensive.

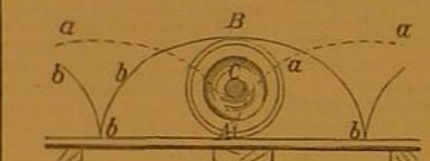
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H. C. T. will find the process of tinning cast iron described on pp. 212, vol. 26, and 123, vol. 28—R. B. P. will find the laying off of carriage wheels and axles discussed at length on p. 129, vol. 28.—E. McG. will find a rule for proportioning screw cutting gear wheels on p. 154, vol. 25.—H. C. L. should refer to p. 75 of our current volume for a recipe for paste that will adhere to bright tin.

P. says: In your issue of May 3, M. H. B. asks this question: Does the top of a drive wheel on a locomotive turn or run faster than the bottom when it is running on the rail? You answer: Yes. Will you be kind enough to explain why? Answer: Every point in the wheel describes a curve called the cycloid, roughly represented here, A, a, a, B, b, b. Each point in the



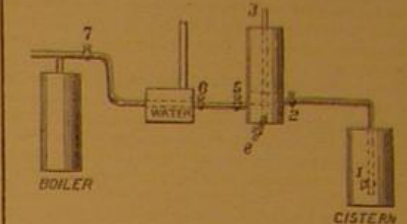
wheel, when in contact with the rail, as at A, must, unless the wheel slips, be at rest. Each point when farthest from the rail, as at B, moves with double the speed of the center C, which has the regular velocity of the locomotive.

C. B. O. asks how to dissolve mercury from gold coin, which had been put into mercury for experimental purposes. Answer: The mercury can be volatilized and expelled by heating the coin sufficiently.

E. S. says: I have three boilers in my charge, two Cornish and one return flue. The Cornish are 24 years old, and are to be taken out this summer and others put in their places. I would like to know what kind of boiler you would recommend, leaving the sectional boilers out of the question. I would prefer the Cornish to the return flue. How does the return tubular boiler compare with the Cornish on the points of steaming, safety, economy, attention, and expense? Can the Cornish be surpassed in any of these particulars? Answer: The choice of a boiler is determined by special circumstances, which vary in each individual case. With cheap fuel and cheap labor, the plain cylindrical boilers may be used. If the water is very bad, the cylinder or a flue boiler must be used, as it can be more readily cleaned than tubular boilers. The Cornish boiler is an excellent boiler where slow draft and moderate pressures are allowable. For high steam and quick draft it is not suitable. With clean water, high steam, a good draft, and with fuel at a high price, we should advise tubular boilers, as better than any of the other standard styles. We cannot say what style would suit the case here given but were we told something of the nature of fuel and attendance, we could readily say what we would do.

O. S. asks: Can you tell me why the air is warmer in a icehouse on top of ice than it is outside in the shade? I have a frame ice house, with two feet air chamber all around, and walls lined with saw dust 6 inches thick on each side. It is 30 feet high, with 6 foot loft; there are two 6x3 doors in loft, one in each end. The loft is tight, and I try to keep the house as near air tight as possible. I leave the loft doors open very often, so as to take off the heat that comes through the roof; the thermometer stands from 68° to 73° in the house on top of the ice. Is this warmer than it should be, and does the heat affect the ice beneath 12 or 18 inches of saw dust? Is it the best plan to keep the house closed, or let the air circulate over the ice? Answer: Cold air always remains as a lower stratum and warm air uppermost. Heat passes through the roof more readily than the cold is transmitted through the thick layer of saw dust, and the air is thus warmed above the latter as air is warmer in any garret or attic when the sun's rays fall on the roof. The cooler the air is kept, the less the loss of ice, but we presume that the sawdust is an effective protection.

R. L. L. asks: Can you explain the trouble with my pump? It is a combined lifting and supply pump; the plunger (No. 3) is solid 3 inch iron, which moves up and down in the pump stock, packed with hemp or cotton packing. I lift water 22 feet. Nos. 5, 6 and 7 are check valves to keep back the water in the boiler. My pump has failed to lift, although it has more than sufficient capacity; and I have frequently had to open the air cock (No. 8) to stop the action of the pump. Today my pump failed entirely, and when I took off the cap of valve (No. 2) I found the valve stem so tight that I had to use force to extricate it; and when I removed it, the air rushed in with a great noise. I put on a valve (No. 1) some time ago at bottom of pipe in cistern to hold up the column of water, thinking the lift was too great. Sometimes it throws for a few strokes, ceases



for a time and then commences again, and so on. I can find no leak between the pump and the cistern. Answer: Take out valve on suction side, turn off a sixteenth of an inch from its stem, or bore out its guide the same amount, or cut a spline either on stem or inside guide, to let air past it; repack plunger; see that check valves on the other side are all right. If trouble still occurs, the pump must be set lower. The lift is rather more than should be generally given. A plunger pump can force to any ordinary height or against any usual pressure, but no pump is likely to work well with such a lift after it gets a little worn.

E. P. asks: 1. What is hydrochloric acid of aniline? 2. What is bichloride of copper? 3. What mordants are used for aniline colors? 4. Are aniline and carbolic acid the same? Answers: 1. Hydrochloric acid of aniline is produced by the action of hydrochloric acid on aniline oil, and crystallizes in needles which may be sublimed without decomposition. 2. Bichloride of copper is prepared by dissolving the oxide of copper in hydrochloric acid, and forms green needle-shaped crystals. 3. Albumen is usually used for mordanting cotton; silk and wool require no mordants to take the aniline colors. 4. Aniline is entirely different from carbolic acid in composition, odor and properties, although dyes may be prepared from both. The former has the chemical composition represented by the formula C_6H_5N or $C_6H_5(NH_2)$, and hence is sometimes styled phenylamine. Carbolic acid has the composition C_6H_5O or $C_6H_5(OH)$, called also hydrate of phenyl.

R. H. A. says: A difference of opinion exists as to the location of the point delivering the average power from a lever or wheel, the pressure and the speed being the elements. Assume a hydrostatic or steam pressure against a surface represented by a lever: clearly the average would be in the center of space. Then if motion were given from the fulcrum, the speed necessarily increasing towards the free end, the same pressure, continuing, would seem to relocate the point of power. What do you say? Answer: At the middle point, if we see the point of the problem.

L. H. & Co., say: We are manufacturing car wheels and axles for coal mines in our vicinity. For the wheels, we select the closest iron, mostly scrap; in fact, we make them as hard as we can, and bore them. We bore the wheels to a gage and turn the axles to fit, so that there is no more play than is necessary for the wheel to work freely. Some of our customers think that the wheels and axles are not as durable as they should be, but that if the axles were forged and not turned, they would last much longer. One firm tried this and complain that, because a wheel working on such an axle lasts but one year (constant use night and day) that the wheels are made of poor iron for the business, and that the whole fault lies in the wheel; and they will not be convinced, that a turned axle would be better, without referring to you. Do you think that a chilled hole is preferable to a drilled one in such wheels? And is there any iron better for these wheels (unless it is Salisbury or other regular car wheel iron) than close hard scrap? Answer: The best wheels are made of selected iron. Scrap may make good, bad, or indifferent wheels, according to its original quality. Mixed scrap is likely to give a very close grained iron, and, if it chills well, will probably make a durable wheel. A wheel should run 4,000 or 50,000 miles before giving way. We should suppose that the wheel referred to was of excellent quality if it kept at work night and day for a year. The average life of a wheel under ordinary circumstances is three years. We presume that the actual running time is not a fifth, perhaps not an eighth, of this. We should not chill the hole, but should drill it.

I. B. asks: In vertical tubular boilers, what is the proper proportion of grate surface for square foot of heating surface; and what is the proper area of tube per square foot of heating surface and grate surface? What are similar figures for double return tubular, portable or fire box boilers? What difference is there between bituminous and anthracite coals? Answer: The greater the proportion of heating to grate surface, the more economical is the boiler, usually. The best proportion, all things considered, for a tubular boiler, is not far from 30 feet of heating surface to the square foot of grate. Make the cross area through tubes about one eighth the grate surface. Bituminous coal contains gaseous and bituminous constituents, while anthracite is nearly pure carbon and earthy matter. A rich bituminous coal contains 60 or 70 per cent carbon, 10 or 15 per cent gas, and the remainder is ash. Good anthracite contains 90 per cent carbon, and 10 per cent ash.

H. H. J. says: Will you please tell me how the water is elevated by the engine at the Ridgewood waterworks? Is it by a chain pump, water snail, or other means? What is the common method of elevating water? Will a pump of large dimensions work? All the pumps that I have seen were common well pumps having about 3 inches bore. Would a pump of 12 or 15 inches bore work just as well? Answer: Pumps are almost invariably used for raising water. In supplying towns they are invariably used. As a rule, the larger the pump, the more perfect its operation.

H. B. says: I have some gold and silver solutions, which have been mixed through mistake; how can I separate them? Answer: Take a solution of common salt and add it drop by drop as long as any white precipitate falls. Filter off this precipitate, which is chloride of silver, and the gold will remain in the solution. To get the silver out of the precipitate, dry it and fuse it with an equal weight of carbonate of soda mixed with one tenth its weight of saltpeter.

J. T. asks: What is the exact amount each of common burning gas and air requisite to make an explosion, when ignited, and what would be the force of such an explosion per cubic inch? Answer: Ten volumes of air and one of gas will explode when ignited, and exert a pressure of 210 lbs. to the square inch. Two volumes of pure oxygen and one of marsh gas will explode and produce a pressure of 305 lbs. to the square inch.

A. S. T. says: 1. Please tell me the composition of the clay of which sculptors make their models. If it is not clay, what is it? 2. Did the sewing machine companies get Congress to extend their patent? Answer: Sculptor's clay is composed of silicate of alumina chiefly. Almost any fine clay becomes plastic when moist, and the model must be kept wet until completed, when a plaster cast is made from it. Perhaps it is the plaster cast that A. S. T. refers to, for it is according to this model that the marble is cut, as the clay model cannot be preserved long. 2. The sewing machine patent has not been extended by Congress.

J. R. asks what is the best method of waterproofing canvas to be used in building a light boat? Should it be applied before or after stretching the cloth? Answer: For waterproofing canvas for tents H. Kehr passes the material through sulphate of alumina (1 part concentrated alum cake in 10 of water) then through resinous soap and water, afterwards drying and smoothing it. The soap bath is kept hot. See also SCIENTIFIC AMERICAN, pp. 122 and 170, vol. 25. For waterproofing a boat, linseed oil is boiled until viscous (for 4 or 5 hours) then burned 5 minutes, and either applied hot, or, if allowed to cool, is dissolved in benzine. This is, of course, applied after stretching.

W. R. K. asks how many cubic feet of pure hydrogen gas are required to raise 75 lbs. weight? How many cubic feet of common illuminating gas are required to raise the same weight? Answer: Since 100 cubic inches of hydrogen weigh 2.14 grains and air weighs 14.4 times as much, or 30.8 grains, 100 cubic inches of hydrogen will support or float about 28.5 grains. From these data, it will require, theoretically, about 1,000 cubic feet to sustain a weight of 75 lbs. Illuminating gas varies in specific gravity from 0.65 to 0.84; and hence, from 15,000 to near 30,000 feet are required to do the work of 1,000 cubic feet of hydrogen; nevertheless, street gas is generally considered to be the cheapest of the two.

B. says: I read in the SCIENTIFIC AMERICAN that India rubber varnish could be made by dissolving the rubber in bisulphide of carbon or sulphuric ether. I procured some sulphuric ether and put some rubber in it; it has been there several weeks, and looks just as it did when put in. Answer: Perhaps you did not employ crude unvulcanized caoutchouc, and hence its apparent insolubility.

A. says: In your paper of March 1, 1873, you notice two cases of spontaneous combustion in piles of coal. Is there any danger in piling 8 or 10 tons of coal in a cellar, in July or August, there to remain for the coming winter's use? The difference in the price of coal between summer and winter is an item worth saving; but if there is danger, we had better pay the winter price. Answer: No danger. Put in your coal. You need not fear spontaneous combustion in a coal heap if no organic substances or pyrites is present in the coal bin; there is more to fear from rags used in cleaning lamps and rubbing up your sewing machine.

S. asks for a recipe for making a solution to take the ink out of paper without injury to the paper. Answer: Employ dilute oxalic acid or some Labarraque's solution.

F. P. C. asks for the most approved and simplest way of testing adulterated mixtures of white lead, so as to tell the per cent of zinc and sulphate of baryta. Answer: White lead when pure is perfectly soluble in dilute nitric acid. If sulphate of barium is present, it remains undissolved in nitric acid, and may be filtered out, washed, ignited and weighed. Sulphate of lead and gypsum are also nearly insoluble in nitric acid. The lead can also be determined in the nitric acid solution by precipitating with dilute sulphuric acid, filtering, washing, drying and weighing; 1,000 parts of sulphate of lead correspond to 736 parts oxide of lead (PbO) or 881 parts of pure carbonate of lead. Or, we may say that 3,345 parts of PbO correspond to 3,575 parts of pure white lead, as represented by the formula $2(PbO, CO_2) + PbO, HO$.

H. M. L. J. says: To test gold, I use muriatic acid, but I am often fooled with heavily plated brass. Do you know of anything that will detect brass or any low metal under a heavy coat of gold? Answer: In buying gold rings, etc., which have no settings, the specific gravity will serve to distinguish brass, no matter how heavily plated, from gold. Suspend the ring by a horse hair from the end of your balance and weigh it; then arrange a glass of water in such a manner that the ring will hang in it without touching the sides or bottom and weigh again. Divide the weight in air by the loss of weight in water. Thus, if a piece of jewelry weigh 100 grains in air and 150 grains in water, 10 grains will be the loss of weight in water, and we have for its specific gravity $100 \div 10 = 10$, which is the specific gravity of pure gold. If, however, it were pure silver, we should have $100 \div 17.5 = 5.7$, and $100 \div 20 = 5$. For copper we have about 9, and for zinc only 7.

E. H. G. says: I have a small cylinder engine, 1 1/2 x 3 inch stroke. How large a boiler will it take? Had I better have it of copper or iron? How many pounds of steam ought it to take to run it? Answer: See reply to T. P. B. on page 283 of our current volume.

M. J. F. asks: How is sodium amalgam prepared? Answer: Rub together 30 parts, by weight, of dry metallic mercury and 1 part metallic sodium. The mercury is placed in a mortar and the sodium added in pieces not larger than a pea. The reaction is so violent that the hands and face should be protected by covering the mortar with a piece of pasteboard, through which the handle of the pestle projects.

J. L. P. says: I took some roll sulphur and placed it in a small glass retort, to make sulphurous gas. The small glass tubing, connecting the retort with the receiver, became choked up with thick sulphur in such quantity that the tubing could not be used. It appeared as if the vapors of the sulphur condensed in the tubes, thereby rendering them useless. After the operation, I could not remove the sulphur from the retort, as it adhered firmly to the sides and bottom to such an extent that I broke the retort in endeavoring to remove it. Can you give me a remedy? Answer: To make sulphurous acid gas, you should take copper turnings and sulphuric acid, and apply heat to the retort. You simply distilled the sulphur. You can remove such a deposit by heating.

S. A. B. asks: Will a horseshoe magnet, if perfectly magnetized, retain its power if the keeper does not touch it, but revolves very rapidly as closely to the magnet as possible without friction? Answer: We believe that an artificial steel or cast iron magnet under

these circumstances would gradually lose its power. Professor Tyndall, of the Cooper Institute, New York City, has had a large steel magnet induction machine for a long time; and no doubt will give you a positive answer to the question of diminution.

J. J. P. says: I have lately built a telegraph line along a distance of about 200 yards, the conductor of which is a large iron wire, well insulated with glass, and having copper wires soldered to the ends to insure good connections. The ground wires are treated in the same manner, with plates of clean copper soldered to their ends and buried in moist earth down in a cellar, at a depth of about two feet. The instruments used as sounders are of my own manufacture; the magnets only contain about twenty feet of wire, and consequently are not very sensitive to a small quantity of electricity. I find, on applying two cells of Daniell's battery and limiting the circuit to one instrument and the battery to short wires of three or four yards length, that they work with great neatness, but, on turning the same current to the long conductor and ground wires, that no visible force is produced. On adding two more cells (four in all) a slight ticking is produced on the sounders when the circuit is broken and closed. The wires are all of good size, and there seems to me to be no chance for any great amount of resistance. I have tried connecting all the lines, also connecting in the usual manner; but find the former to be the only way in which anything is effected. I wish to know the cause of the force being so greatly reduced in so short a distance. Answer: Your copper plates have not enough surface; make them larger and place them in the nearest pond or brook. A better way is to connect the ground wire, at both offices, with the gas or water pipe.

W. S. M. and others have asked us for an explanation of the wire gage used in describing the diameters of wires and the thickness of metal plates. The letters B. W. G. stand for "Birmingham wire gage," and the dimensions of the various marks are as follows, the sizes being in fractions of an inch:

Mark.	Size.	Mark.	Size.	Mark.	Size.
0000	.154	7	.180	17	.058
000	.163	8	.165	18	.049
00	.180	9	.148	19	.042
0	.240	10	.131	20	.035
1	.300	11	.125	21	.032
2	.364	12	.109	22	.028
3	.429	13	.095	23	.025
4	.494	14	.083	24	.022
5	.559	15	.072	25	.020
6	.625	16	.065	26	.018

L. L. asks: How can I restore the silvering to a mirror which has had the coating knocked off in a spot larger than a pea? Answer: Put on a square foot of tin foil about 3 drams of quicksilver, and rub in with a piece of buckskin until the foil becomes brilliant. Lay the glass on a flat table, face downwards; place the foil upon the damaged portion of the glass; lay a sheet of paper over the foil and place on it a piece of marble or other weight with a perfectly flat surface and sufficiently heavy to keep it down tight; let it remain in this position a few hours. The foil will adhere to the glass.

J. L. D. can charge wine with carbonic acid by placing it in strong metallic vessels, and forcing the carbonic acid made from chalk and hydrochloric acid into it under great pressure.

C. E. W. asks how percussion or fulminate powder is prepared. Answer: We give the following method, although we do not advise persons unfamiliar with chemical operations to meddle with the preparation of so dangerous a substance: One pint of mercury is dissolved in 12 pints of nitric acid of specific gravity 1.3; when cold, it is mixed with 11 pints of alcohol of 85 to 88 per cent, and the mixture heated in a water bath until it begins to show turbidity. Let it cool, pour off the liquid and collect the powder on a filter. It can be purified by dissolving in boiling water and recrystallizing it. It explodes at 356° Fahr., or when struck; and is highly dangerous to handle when dry.

F. P. B. asks: Why is the armature of an electro-magnet attracted by the ends of the cores and at no other place? Why is the magnetic force greatest at the ends of the cores? Answer: Magnetism of one kind attracts the opposite kind. A piece of soft iron becomes magnetic by induction. In the center of the bar, it is repelled as much by the magnetism in one half of the bar as it is attracted by that in the other, and hence seems to be unacted upon by the magnet. As we approach the end the sum of the attractive forces is greater than that of the repellant, and just at the end there is no repellant power to counteract the attractive force, so that, as Ganot says (page 538), the polarity at each end of a magnet is caused by the fact that the resultant action on a body is strongest at the end, and does not follow from an accumulation of the magnetic field at the ends. (See also Stillman's "Physics" p. 347.)

F. E. B. is making a tent of unbleached sheeting, and wants to know what will make it waterproof without rotting it. Answer: Coat it with India rubber varnish, or a solution of paraffin in benzine, or try a solution of gelatin mixed with a trifle of bichromate of potash. The latter will darken on exposure to the light, the gelatin becoming insoluble and impervious to water.

H. P. C. says, in reply to E. W. W.'s query as to the length of an arc where chord and versed sine are given: A simple rule is the following: From 5 times the chord of half the arc, subtract the chord of the whole arc, and one third of the remainder is the length of the arc. I do not think there is a simpler or shorter formula than this. Let A B C be the arc, A C the chord, B D, a perpendicular bisecting both the arc and the chord. Then, $SAB - AC = 3 \times BD$. [E. W. W. has answered this query to the same effect.]

J. S. R. replies to H. P. L., who asked what is the best material for laying up the arch for a steam boiler; Use fire brick and fire clay for the inside course; but in case they cannot be had or are considered too expensive, use the following for the course next the fire; a fair red brick, burnt neither too hard nor too soft, but of a light cherry red. For mortar, get a good yellow clay, 8 parts, wood ashes, unbleached, 6 parts, common coarse salt (any refuse salt will do), 6 parts. Mix well with a hoe and see that no lumps remain in the clay, adding water until the proper consistency is acquired.

J. E. H. says, in reference to E. C. M.'s problem: The result obtained by G. A. H. is not correct. He says $0.157 \times 32 = 5.024$. This is not true. It should be $0.157 \times 32 = 5.024$. His results would then agree with the answer I sent. His formula $\frac{1}{2}(P+Q) \sin a = (P+Q) \times g \sin^2 a$ is also incorrect. It should be: $\frac{1}{2}(P+Q) \sin a \times g \sin^2 a$.

F. H. C. says that, if F. H. R. and others who want to turn off solid emery wheels, will place a tin pan with some hot water just under the wheels, so as to keep the faces of them wet, they will find that it will be very easy for them to turn them off with a piece of 3 square steel. Let the wheels stand three or four hours after, to get dry.

L. A. G. says P. F. B., who asked how to restore old files: First remove all grease or oil by boiling for half an hour in a strong solution of rain water and saleratus, after which wash and dry well. Then take water, 1/2 gallon, sulphuric acid 5 oz.; mix in an earthen or glass jar. Coarse files require 10 or 12 hours to recut, while fine ones require but 5 or 6. Put in the coarse ones first, and the fine ones a few hours afterwards, that all may be taken out at once; sponge them off in boiling water, that they may dry quickly, and apply sweet oil to prevent rust. Files that have been used in the softer metals need not be kept in the cutting solution more than 3 or 4 hours, and may be recut two or even three times.

W. S. H. says, in reply to H. S.'s query on a leaky piston: It would not cause bumping, but would show in the exhaust. If the slide valve were loose, it would give visible evidence at once by stopping the engine. If only slightly deranged, it might not stop the engine, but would cause it to run very irregularly. In either case it would be seen that something was wrong.

L. N. L. says, in reply to W. W. C., who asked: "Is there anything that will make leather stick to iron?" In an old scrap book I find the following formula for making a cement that is said to adhere to the greatest tenacity to wood, stone, glass, porcelain, ivory, leather, paper, hair, etc. Melt together, in an iron vessel, 2 parts, by weight, of common pitch, with 1 part of gutta percha. It is said to form a homogeneous fluid, which is much more manageable for many useful purposes than gutta percha alone, and which, after being poured into cold water, may be easily wiped dry and kept for use.

S. A. T. replies to F. S., who asked how to make marking ink for marking boxes, etc.: Take 1 lb. extract logwood, dissolve in 1 gallon hot water; add 1 oz. bichromate potash. It is immediately ready for use.

S. A. T. says: I do not think the recipe of C. M. D. in reply to F. S. T., for making a black beard on the wall will do; in fact I know it will not for wood, as the varnish, as a matter of course, leaves a glazed surface caused by the evaporation of the spirits from the shellac, and chalk will not mark perfectly on that any more than on glass.

L. says that F., who asked if he could use three of Hooke's universal joints of 11" each to get an angle of 55°, can solve his difficulty by raising one of his shafts above the other, maintaining a parallel horizontal plane, and, with suitable grooved pulleys and a steel wire rope, transmit his power from one shaft to the other. Or, if the condition be such that the shafts cannot thus be accommodated, let him introduce a third shaft, either above or below the others, and on a plane precisely parallel with them, so adjusted in its bearings as to divide this vertical divergence, and then with grooved pulleys and steel wire rope transmit his power through the applied shaft. At the Industrial Exposition at Cincinnati, in October, 1871, 100 horse power was transmitted from one shaft to another, at a distance of some 150 feet apart, by means of a steel wire rope not exceeding one inch in diameter.

S. A. T. says, in reply to several correspondents who ask how to temper drills, chisels, taps, dies, etc.: The following process will make a drill bit sufficiently hard to rapidly drill through gray cast iron, porcelain, glass, etc.: Melt in an iron ladle, with a little rosin, 5 parts bismuth, 3 parts lead, 2 parts tin. Place the instrument to be hardened in an iron tube welded or capped at the lower end; pour in the above alloy, leaving sufficient room, between the surface of the same and a stopper or cap at the upper end, to allow for the dilatation of the contents; then bring the pipe to a bright red heat and plunge into cold water. Immediately take off the cap or stopper and reverse the tube in boiling water, when the contents will fall out and the operation is complete. When using the drill, keep it moist with turpentine and it will cut glass without losing its edge for a considerable length of time.

E. D. P. says, in answer to E. W. H.: The path described by the body A B, when acted upon by the force P, at or near the extremity would be represented by a straight line, perpendicular to the length of A B. In the earth's atmosphere, its path would be curved, as any one may find out by striking a falling stick at or near the extremity. Now the reasons of this curved path are as follows: First, the atmosphere acts upon the bottom of the stick by friction, and thus becomes a sort of fulcrum. Second, the force acting upon A B is not, as would appear, the simple force P, but the resultant of the forces P, and that of gravity. Both these causes removed, as they would be under the conditions of the problem, the body A B takes for path the line perpendicular to its length. If the body be acted upon by the force in its center, its path would evidently be the perpendicular to its length. E. W. H. does not state whether the force P, simply hits or pushes the body. If it hits it, the motion will be uniform; if it pushes it, the motion will be uniformly accelerated, traversing in the second second twice the distance traversed in the first.

A. sends us a correction of his statement of the boiler explosion at Sacramento, Cal., published on page 206 of our current volume: "I made further inquiries and found that the boiler was set the reverse way from what I stated. What led me into the error was the fact that, instead of putting the fuel in at the fire box end of the boiler, they had taken the grate bars out, built a brick wall on each side, and put a large cast plate at the back end of the boiler, with a door in it, through which the fuel was put. The fact that the firing was done at the east end led me to suppose, as a matter of course, that that was the fire box end of the boiler." [W. B. C. has written to us to the same effect.]

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

J. J. W.—The specimen contains the minute eggs and larva of *psococerus pictus*, a beetle usually infesting the currant and grape; but lately it has been discovered at the west on the apple tree, and has been very injurious to orchards in Wisconsin.

E. M. C.—The pebble is chalcedonic quartz, of no value in the arts, for, although it is hard enough to cut glass, it is too soft for a gem.

COMMUNICATIONS RECEIVED.

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

On the Effect of Electricity on Metals. By J. L. W.
On Death by Hanging. By E. H. R.
On Zinc in Ohio. By H. S. D.

On Rheumatism. By O.
On Tannate of Soda. By J. G. R.
On the Million Dollar Telescope. By L. V.
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On Boiler Explosions. By G. M.
On Magnetic Variation. By J. T. C.
On Life Saving Devices for Ships. By H. F. E.
On Creeping Rails. By S. P. McC.
On Arctic Mammoth Remains. By I. P.

Also enquiries from the following:

F. A. W.—W. C. McG.—H. B. G.—H. O'B.—J. E. 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.]

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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:

23,035.—GOVERNOR VALVE.—B. Fitts. July 23.
23,015.—WOOD SAW FRAME.—J. Haynes. July 23.
23,017.—STEAM BOILER.—R. Hooper. July 23.
23,030.—POST MARKING STAMP.—M. P. Norton. July 23.
23,071.—RAILROAD CAR ROOF.—A. P. Winslow. July 23.
23,167.—ELECTRIC GAS LIGHTING.—A. Wilson. July 30.

EXTENSIONS GRANTED.

23,886.—CULTIVATOR.—M. Alden.
23,921.—HARVESTING MACHINE.—M. G. Hubbard.
23,934.—MAIL BAG.—T. J. Lamden.
23,930.—CLOCK DIAL.—S. E. Root.
23,970.—STOVE.—J. G. Widmann.
23,937.—LATHES FOR IRREGULAR FORMS.—C. & A. Spring.
23,983.—COOKING STOVE.—H. G. Leonard.

DISCLAIMER.

23,291.—MAIL BAG.—T. J. Lamden.

DESIGNS PATENTED.

6,625.—CARPET.—O. Heinke, New York city.
6,626 & 6,627.—TYPE.—J. Herriot, New York city.
6,628.—CLOCK FRONT.—E. Ingraham, Bristol, Conn.
6,629 to 6,633.—CAPES.—M. Landenberger Jr., Phila., Pa.
6,634.—BREAD PLATE.—H. S. McKee, Pittsburgh, Pa.
6,637 & 6,638.—TRIMMINGS.—J. Phipps, Philadelphia, Pa.
6,639 & 6,640.—SOCKETS.—C. B. Rogers, Meriden, Conn.
6,641 to 6,643.—CAPES.—M. Landenberger Jr., Phila., Pa.
6,644.—FOUNTAIN BASIN.—J. Moore et al., Brooklyn, N.Y.
6,645 & 6,646.—HOT AIR REGISTERS.—E. A. Tuttle, Morris-town, N. J.

TRADE MARKS REGISTERED.

1,241.—BOTTLE CAPS.—Cazade & Crooks, New York city.
1,242.—CORDIALS, ETC.—Cazade et al., New York city.
1,243 & 1,247.—BOTTLES, ETC.—Cazade et al., New York city.
1,248.—CRACKERS.—J. Fox, Lansingburg, N. Y.
1,249.—WATCH OIL.—E. Kelley, New Bedford, Mass.
1,250.—CHEWING TOBACCO.—Walker & Co., Detroit, Mich.
1,251.—CANDLES.—G. Delano, New Bedford, Mass.
1,252.—MEDICINAL OIL.—E. F. Libby, Allegheny City, Pa.
1,253 to 1,256.—PLUG TOBACCOS.—Liggett et al., St. Louis, Mo.

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Chapter VI. NATURE OF STEEL.—Hardness; Fine cast-steel; shear-steel; spring-steel; German steel; effect of too high or too low heat. Refrigeration of steel; mediums; in mercury, in acidulated water, in solutions of salt, in oil and fat, in sand, cold metal, and in a manner in which it is performed. Tempering. Characteristics of steel; hardness and tenacity; color and lustre. Texture; Sound; Cohesion; Elasticity; Specific Gravity; Fusibility; Welding properties; Magnetic qualities. Appendix. Hardness of alloys; Tenacity, malleability and ductility of metals.

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