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THE CAMERON SPECIAL STEAM PUMP.

Two thousand steam pumps, known as the Special, have been manufactured in England, under the patents of Mr. A. S. Cameron, since the introduction of the invention into that country, some four years since, by Messrs. Tangye Brothers & Holman, of Soho, Birmingham. At first only small machines were made, but as their usefulness became developed, the manufacturers designed pumping engines on the same principle for use in collieries. At the close of 1870, 130 machines were at work in the Durham and Newcastle coal districts, where their performances proved so satisfactory as to justify the conclusion that the pump might be constructed to do still heavier work.

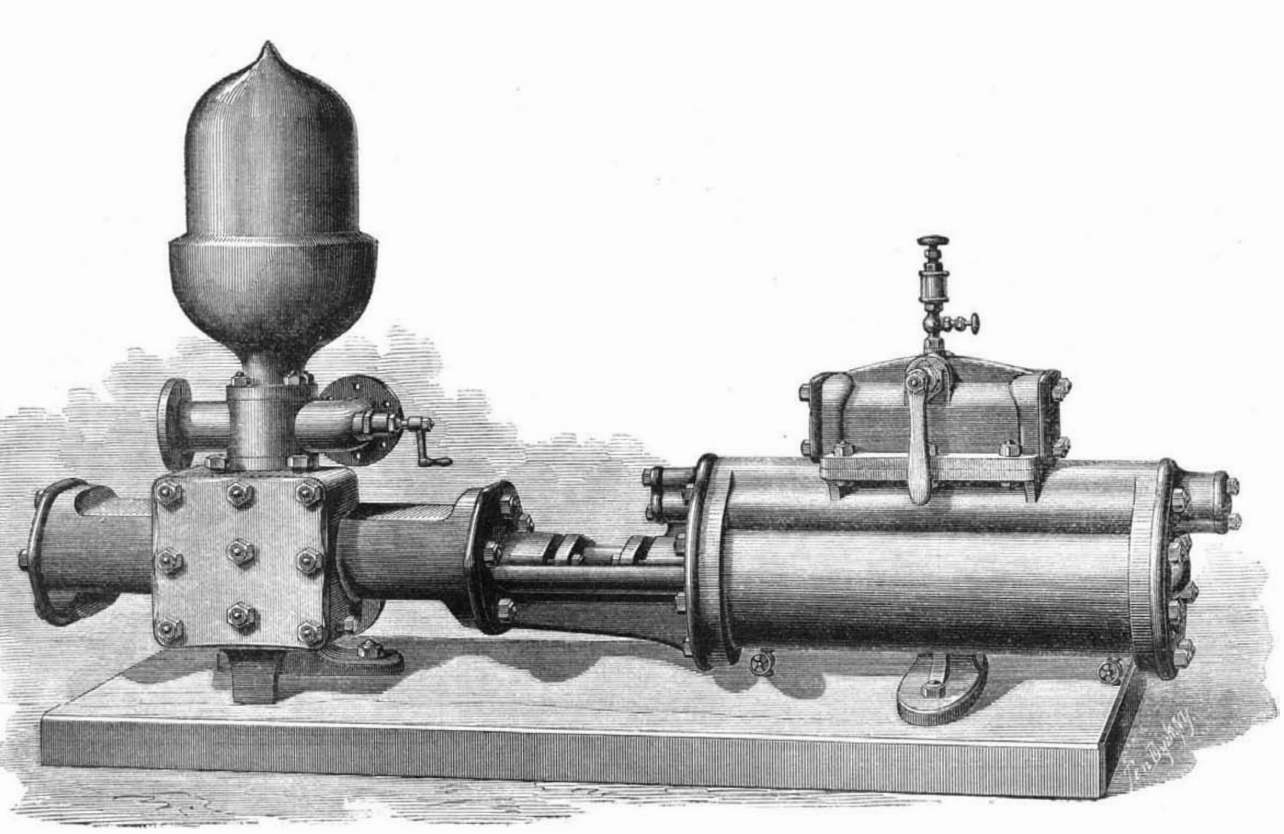
As a result, an engine was built by the firm above mentioned for the Adelaide collieries at Bishop's Auckland, in general style and form similar to that shown in our illustration, Fig. 1. Of this machine, the dimensions and points of construction are as follows:

The steam cylinder is 26 inches diameter, and the pump—which is double acting—is 6½ inches diameter, with a 6 foot stroke. The slide valve is steam-moved, and its alternate action is effected by means of two steel reversing valves, operated by the piston in the interior of the cylinder at either end. Hence there is no external mechanism except the piston rod, a few inches only of which is seen reciprocating between the stuffing boxes of the steam and pump cylinders. In the contract it was stipulated that the engine should raise 120 gallons per minute 1,040 feet high in a single lift, and this it more than accomplishes with apparently as much ease as if its load was delivered at only 100 feet high.

The pump barrel is lined with gun metal one half inch thick, and is itself 1¾ inches thick in the body. The valve boxes are 2 inches thick in the body, and 2½ inches thick in the center of covers, each being secured with sixteen 1⅜ inch bolts and nuts. The piston rod is of steel, 3½ inches diameter; the steam piston is 6 inches deep, and packed with a single broad packing ring, tongued and set out by six curved springs adjusted by set screws. The engine is bolted down to a massive bed plate, the holes at the back end of the cylinder being slotted to permit of expansion and contraction. The joints of the pump and valve boxes are made by means of gutta percha rings, let into grooves in one flange and compressed by projecting tongues on the other. The engine has an air vessel 30 feet high, 30 inches in diameter, and 2¾ inches thick. Intermediate valves have been provided to relieve the load on the pump as much as possible. Before leaving the works, the engine complete was tested up to a pressure of 700 lbs. per square inch.

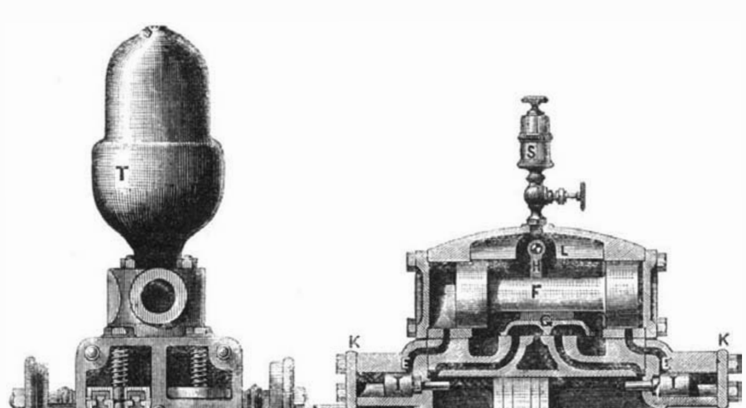
Figure 2 is a sectional view of the pump, from which a clear idea of the simplicity and fewness of parts of the device may be obtained. At A, the steam cylinder is shown in section. C is the steam piston rod, and D the piston rod. At L is represented the steam chest, F the plunger, G the slide valve, and at H a starting bar connected with a handle on the outside; I I are the reversing valves, and K K the bonnets covering them; N is the body piece connecting the steam and water cylinders; B is the water cylinder with the valve chest bonnet removed; M is a valve seat which, with the valve above it, is shown in section, and, lastly, T, is the discharge air vessel. To understand the operation, it is necessary to suppose the steam piston, C, moving from right to left; when it reaches the reversing valve, I, it opens it, and exhausts the space on the left hand end of the plunger, F, by the passage, E, which leads to the exhaust pipe; the greater pressure inside of the steam chest changes the position of the plunger, F, and slide valve, G, and the motion of the piston, C, is instantly reversed. The same operation, repeated at each stroke, makes the motion continuous. The reversing valves, I I, are closed by a pressure, on their larger ends, of steam conveyed by an unseen passage direct from the steam chest.

Having explained both construction and operation, we turn to our file of *Engineering* for a report of the performances of the pump. The engine room at the Adelaide collieries, we are informed, is situated at a depth of 1,040 feet below surface, and is an arched chamber about 100 feet long by 20 feet wide, and 10 feet high at the center. At the far end of this chamber is a double-flued boiler 27 feet long and 7 feet diameter. Placed between the boiler and the shaft is the pumping engine we have been describing. It was started on the 6th of June, 1871, and after working for six weeks its duty was measured, and 137 gallons per minute, at 10½ strokes, was found as the average of seven trials. Later experiments gave a duty of 12½ gallons per stroke, the engine running at the rate of 10 strokes per minute.



THE CAMERON SPECIAL STEAM PUMP.

A still larger Special steam pump, calculated to raise 22 500 gallons per hour 540 feet high, has also been made by Messrs. Tangye, and eight engines are about to be constructed for coal mines in Germany. They are employed on similar work to a much larger extent in the United States, where there are upwards of 4,000 of them in use, adapted to all kinds of work, from feeding boilers to supplying cities with water.



The works of Messrs. A. S. Cameron & Co., which are engaged exclusively in the manufacture of these engines, are situated at the foot of East 23d street, New York city; they cover 16 lots (just one acre of ground), and are conducted on the co-operative plan. The establishment has grown to its present proportions in the course of a few years; it is an example of what can be accomplished by ingenuity and enterprise under the beneficent influence of our patent laws.

Mr. Cameron's first patent was secured through the Scientific American Patent Agency, when he was but seventeen years of age.

A Wild Pigeon Roost.

For the past ten days the annual migration of wild pigeons, to the forest regions of the Alleghany mountains, has been going on, and, according to the *News*, of Cumberland, Md., the town of Oakland, in that State, and the farm of Mr. Wm. Schley, have become the temporary nocturnal roosting place of the birds.

The pigeons collect nightly on a tract of ground covered with alder bushes, occupying about six acres. The pigeons first appeared about ten days ago in countless flocks. The Cumberland *News* says: The inflocking pigeons gradually settle down upon the bushes, until they are bent to the ground by the weight of the birds. Still more pigeons come flying in from distant points, and continue to settle down upon the already living mass, until the whole five or six acres are completely covered. So great is the number of birds that they pile upon each other, in places from one to two feet in depth. The pigeons continue flocking in and settling upon and among each other from about 4 o'clock in the afternoon until nightfall, when at last they become still and prepared for their night's rest. With the early dawn of the morning, flock after flock arise and fly away in all directions until about 9 o'clock, when the place is deserted, and not a living bird is to be seen, during the remainder of the day, until toward evening, when they again begin flocking back to the same roosts, and the scenes of the evening before are witnessed.

It is estimated that all the flocks of pigeons, for perhaps fifty or sixty miles around, thus gather at the one spot each evening, preparatory to their flight to the Alleghany Mountains, in quest of the heavy mass of acorns abounding there. This is the only roost known this season in this or any of the bordering counties, and is, perhaps, the only one within a circle of several hundred miles. It is a well established fact that these birds have but one roosting place within a very large territory, and in their transit to warmer climates, and during their stoppages by the way, use one place only as a roost at night. At this wonderful roost, on Colonel Schley's place, thousands and thousands of pigeons have been nightly captured by men and boys, with guns, clubs, and bags. After nightfall a person can go among the birds and scoop them into the mouth of a bag. It is needless to add that thousands of them have been wantonly shot, and allowed to remain upon the ground where they died.

Crystallized Silica from Aqueous Solutions.

In a paper published some time ago, in which the author had attempted to obtain quartz crystals from aqueous solutions of silicic acid, at ordinary pressures and at both ordinary and elevated temperatures, only negative results could be reported. In this series of experiments, attempts were made to obtain crystals after Senarmont's method, in water heated to 200° or 300°, and therefore under pressure. Crystals, under these circumstances, were obtained, but small, and evidently consisting of hydrated silicic acid, and with these crystals were numerous granules of silicic acid, consisting of two distinct parts, a nucleus and a coating. Tridymite appeared to have formed, and over it a coating of minute crystals of hydrated silicic acid, which evidently had formed as the temperature had lowered.

His conclusion is that quartz cannot be formed under any circumstances, at ordinary or even at slightly elevated temperatures, or under ordinary pressure, in aqueous solutions.—*O. Maschke.*

[From the New York Ledger.]

JOSEPH PRIESTLEY.

BY JAMES PARTON.

Time brings its revenges. I read, in a recent number of the London *Athenæum*, a quiet advertisement informing the public that "it is proposed to honor the memory of Dr. Priestley, and to commemorate his discoveries and his services to the scientific world by the erection of a statue in Birmingham, where he lived so many years."

The advertisement goes on to say that, as no other public memorial of Dr. Priestley exists, it is believed that a large number of persons interested in science will be glad to contribute something to perpetuate the memory "of the father of pneumatic chemistry, the discoverer of oxygen, and one of the most illustrious men of science whom the last century produced." Then follows a list of sixty-six subscriptions, varying in amount from fifty pounds to ten shillings. Among the names we recognize those of Professor Huxley, Mr. Martineau, Dr. Russell, Sir Rowland Hill, and seven other members of the Royal Society.

A statue to Priestley in Birmingham! Does the reader happen to remember how Dr. Priestley left Birmingham seventy-nine years ago? July the 14th, 1791, some of the liberal people of that city proposed to celebrate by a public dinner the anniversary of the destruction of the Bastile, which had taken place only two years before. But two years in revolutionary times is equal to a century. When the Bastile was destroyed in 1789, the event was hailed with joy throughout the world; but during the two years following, the revolutionists of Paris committed excesses which repelled and disheartened all but the stanchest friends of liberty—all but such as Priestley, who was recognized in Birmingham as a chief and representative of the liberal party. Priestley had published a reply to the "Reflections" of Edmund Burke. He had been named a citizen of the French republic. He had defended the revolution in the local press.

The aristocratic faction of Birmingham, whose instinct was then, and is now, to advance their cause by violence, determined to prevent the celebration. It is easy to stir up a riot in times of popular excitement, but it is not so easy to limit or check its ravages. After breaking up the banquet, and destroying the tavern in which it was given, the mob rushed to the house of Priestley, who had not attended the dinner, broke it open, and compelled the family to seek safety in flight. The rioters took out his books in armfulls—those precious books, the solace of his life, which he had been fifty years in gathering, for he was a hoarder of books from his infancy. His library was scattered over the road for half a mile, and his torn manuscripts covered the floors of his house. His apparatus was broken to pieces; and when the destruction of the interior was complete, the house was set on fire. The fire, however, was extinguished before further harm was done.

This disaster, strange to relate, made the philosopher's fortune; for although the jury, after a trial lasting nine years, awarded him but twenty-five hundred pounds damages, of his claim of more thanfour thousand, the liberal portion of the public subscribed handsomely to make good his loss, His own brother-in-law, as Lord Brougham tells us, gave him ten thousand pounds, besides settling upon him an annuity of two hundred pounds for life. As he already had a pension of one hundred and fifty pounds a year from Lord Shelburne, whose librarian he had formerly been, he was now in very liberal circumstances for a philosopher. In Pennsylvania, where he spent the residue of his life, such an income, at that period, was even superabundant.

There is an error in the advertisement quoted above. It is not true that no "public memorial" of Dr. Priestley has been erected. Every soda fountain is his monument; and we all know how numerous and how splendid they are. Every fountain, too, whence flow the home made waters of Vichy and Kissingen, is a monument to Priestley, for it was he who discovered the essential portions of the process by which all such waters are made. The misfortune is, however, that, of the millions of human beings who quaff the cool and sparkling soda, not one in a thousand would know what name to pronounce, if he were called upon to drink to the memory of the inventor. And really his invention of soda water is a reason why Americans should join in the scheme to honor his memory. He not only did all he could to assist the birth of the nation, but he invented the national beverage.

Yet he always protested that he was very little of a chemist; and often said that his making chemical experiments at all was a kind of accident. A Yorkshire man by birth, the son of a cloth finisher, he was one of those boys who take to to learning as a duck takes to the water. He was an eager, precipitate student from his childhood up. Not content with the Latin and Greek of his school, he must needs learn Hebrew in the vacations, and push on into other ancient languages of the East, Chaldaic, Syriac, Arabic, not neglecting such trifles as French, Italian and German. This way of passing youth never fails to do lasting injury. He had an aversion to the sports of the playground, and to all the lighter literature. Need I say, then, that before he was eighteen years of age his health had completely broken down, and he was obliged to lay aside his books for months?

Beginning life as a Calvinist minister, he gradually adopted a milder theology—became, in fact, a Unitarian, and abandoned the pulpit for a time. Then he set up a school. He spent many years in teaching and writing school books, his first publication being an English grammar for children. At one school, where he taught for awhile, a course of lectures was given upon chemistry, a science of which he knew nothing not even its object or nature. Attending these lectures, his curiosity was awakened, and he began to experiment.

It was Dr. Franklin's influence, however, that weaned him from other subjects, and caused him to devote his main strength to science. In 1761, when Dr. Franklin was in London Priestley, who was in the habit of visiting the city once a year, sought the acquaintance of Franklin, and became intimate with him. Franklin related to him the history of those delightful six winters, during which he and his Philadelphia friends were experimenting in electricity. The young schoolmaster, who had already had some success in bookmaking, now offered to write a history of electricity, if Franklin would put him in the way of getting the material. Twelve months after, Franklin had the pleasure of receiving from his industrious friend a copy of the work, one of those square massive quartos in which the science of that age was usually given to the world. In this work was printed, for the first time, a narrative of Franklin's immortal experiment with the kite, which Priestley received from the experimentors own lips. It is a curious fact in the history of science that Dr. Franklin himself never took the trouble to write out an account of this experiment—the most daring, ingenious and celebrated which science records. The work was remarkably successful, passing through three editions in nine years. From this time onward, Priestly was almost wholly a man of science, and no year passed without his adding something to human knowledge. He very greatly increased our knowledge of the air we breathe and its constituent gases.

He would have been even more successful, if he had been more favored by fortune. Being compelled, through his poverty, to spend a large portion of his time and strength in earning his livelihood, he could not follow out his discoveries, nor pursue them with that watchful calm so necessary for avoiding error, and perfecting truth. His zeal, however, made up in some degree for his lack of means, and the list of his discoveries will always invest his name with distinction.

Later in life, he accepted an offer to enter the service of the Earl of Shelburne as librarian. He had better retained his poverty and independence. He groaned under servitude, and would have thrown up his employment sooner than he did, but for the advice of Dr. Franklin. Franklin told him to arrange all the reasons for keeping his situation in one column, and all the reasons for leaving it in another, then strike a balance, and so reach a wise conclusion. Priestley supported his servitude a while longer, but he was glad enough to retire, in 1778, upon a pension of one hundred and fifty pounds a year.

During the whole period of Franklin's residence in England, Priestley aided him by his pen and influence by opening the eyes of the public to the folly of the Ministry in estranging the American colonies. The last day of Franklin's stay in London, Priestley spent with him from morning to night, without interruption, looking over American newspapers just arrived. Franklin was completely overcome with the prospect of a civil war, and the dismemberment of the Empire.

"A great part of the day," says Dr. Priestley, "he was looking over some American newspapers, directing me what to extract from them for the English ones; and in reading them, he was frequently not able to proceed for the tears literally running down his cheeks."

The two friends never met again; for it was not until 1794, when Franklin had been dead four years, that the English philosopher landed in New York. He had a distinguished public reception in the city, and, proceeding to Philadelphia, he was invited to become Professor of Chemistry in the University of Pennsylvania. He declined on the ground that he did not know enough of the subject. He refused also an offer, most munificent for that day, of a thousand dollars, for a course of scientific lectures in Philadelphia. His labors in America were chiefly theological, and he resided usually on his son's farm in Northumberland county, Pennsylvania. He died in 1804, aged seventy-one. He was an immense personage in his day. The public were constantly reminded of his existence by some publication bearing his name. According to Allibone, he gave the public one hundred and forty-one separate works.

Physiological Effects of Electricity.

Animals electrified under certain conditions produce an increased quantity of urine and carbonic acid, indicating greater energy in the vital functions. Young animals subjected to electric currents grow larger and more rapidly than in ordinary circumstances.

MM. Robin and Legros, experimenting with noctilucæ, those little organisms which produce in great part the phosphorescence of the sea, found that on passing a current through some sea water in the dark, its course was marked by a luminous trace, the phosphorescence of the animals being excited by the electricity.

Induction currents retard or arrest the circulation, by contracting the blood vessels. Continuous currents, however, generally have an opposite effect. MM. Onimus and Legros have further established the law that a descending current dilates the vessels, while an ascending current contracts them. Part of the cranium of a healthy dog was removed, the positive pole of a strong pile connected with the brain, the negative pole with the neck. The superficial vessels of the encephalon were visible contracted, and the organ appeared to be weakened. On reversing the position of the poles, the opposite effect was observed. By means of an ophthalmoscope, the fine blood vessels on the retina of a living person's eye may be observed; and if the head be electrified, these will be visibly distended.

The effect of an electric current on bodies newly dead was studied by Aldini, who thus produced violent motions in the bodies of guillotined persons. Similarly, Ure experimented in Glasgow on the body of a man who had just been hanged. Using a battery of 270 couples, he connected one pole with the spinal marrow at the nape of the neck, and the other with the heel, whereupon the leg was moved so vigorously as to knock over one of the attendants. He succeeded also in producing motion in the chest, the abdomen, and the features of the face.

Recent research has defined the conditions of such influence on the muscles. Continuous currents applied directly cause contractions at the moments of opening and closing; but the shock on closing is much the stronger. While the current is passing, the muscle remains in a state of semi-contraction, the nature of which is not agreed upon by physiologists. Under excitation frequently repeated, and prolonged a certain time, the muscles get into a state of contraction resembling that in tetanus. While in this state, they are in constant minute vibration.

Induction currents cause more energetic contractions, but this energy does not last long, and, if the electrification is continued, gives place to cadaverous rigidity. In both the foregoing cases, there is a local elevation of temperature, proportional to the force and duration of the electric action. This reaches its maximum (sometimes 4°) in four or five minutes after the electric action has ceased. The muscular contraction disengages heat.

The action on the nerves is more complex. MM. Onimus and Legros state that, in the case of motor nerves, the direct or descending current from a battery acts more energetically than the other, the reverse being the case with the sensatory nerves. The sensation experienced in these cases (which refer to continuous currents) is insignificant; induction currents, on the other hand, produce a pain, which continues to be felt so long as the nerve retains its excitability. If a frog is kept some time in tepid water at 40°, it dies. If then taken out, and its spinal cord electrified by an ascending current, vigorous contraction ensues; a descending current produces no motion. On the other hand, if the latter be applied to a decapitated animal, in which reflex motions are being caused by excitation of the spinal cord, it tends to paralyse them.

In general, the battery current applied to the cord, if an ascending one, increases the excitability of this organ, and therefore its power of causing reflex action; the descending current acts in the opposite way.

When the brain is electrified, the animal does not give signs of pain, but of calm stupor and tendency to sleep. Some have proposed electrification as a means of developing the intellectual faculties; but there is no evidence that it will thus act. On the other hand, extreme care is necessary in electrifying the encephalic parts, as a strong current may produce rupture of the vessels and serious hemorrhage.

Electricity stimulates all the other organs of sense, producing luminous effects in the eye, sound in the ear, taste in the tongue, odor in the nose.

Applied to the nerves of the nutritive organs, it has the effect of suppressing spasmodic movements which are not subject to the will.

The German theories as to the electrotonic properties of the nerves when electrified were opposed by Matteucci, who urged the obvious phenomena of electrolysis, that is to say, the chemical decompositions caused by the currents. He thought the modifications in nervous excitability produced on the passage of electricity were due to acids and alkalies arising from the decomposition of salts in the animal tissues. To this class of phenomena may be added the electro-capillary currents recently discovered by M. Becquerel.

A COMPANY has been formed for the construction of a telegraphic cable from Rio de Janeiro to the River Plate. A recent report presented by the directors states that the sea distance from Rio de Janeiro to Lobos Island, off Maletonado, at the mouth of the River Plate, is 1260 miles, and a few more miles of cable will be required from the island to the main land. The shore once reached, a land line of 90 miles will establish communication with Monte Video. Monte Video is connected with Buenos Ayres by a cable, and from the Argentine capital a message can be sent quite across South America, the Andes included, to Valparaiso on the shores of the Pacific. The capital of the Rio de Janeiro and River Plate Telegraph Company has been fixed at $3,000,000, and the work is to be pressed forward with vigor.

M. Marion, of Paris, has devised a method of photographic printing which consists in impregnating paper with ferro-prussiate, by which it is rendered sensitive to light. The drawing, which is made on tracing paper, is laid upon the sensitive paper as a negative, and exposed to light, after which the sensitive paper is washed in water, when the copy is found produced thereon in white lines on a blue ground. By the use of a tannin solution, the ground can be changed from blue to black, the work remaining white.

ZINC GREENS.—M. Elsner uses five parts of zinc oxide, with one part cobaltic sulphate, and sufficient water to form a paste; on being well mixed and then heated to redness, this gives a fine dark green powder. A grass green may be prepared by using 10 parts of zinc oxide instead of 5, and by the use of 20 parts, a light grass green is produced. The latter is capable of being used as a safe substitute for the dangerous Schweinfurt green.

DESPATCHES from Dakota announce the arrival at Fort Rice of General Stanley's Yellowstone military expedition. The track laying on the Dakota division of the Northern Pacific railroad is progressing at the rate of three miles per day. The grading is nearly complete to the Missouri river, and trains now run to within forty miles of the crossing. The Yellowstone division, extending into Montana, is preparing for the contractor.

NEW TERTIARY AND POST TERTIARY BIRDS.

Some new species of birds were found by the Yale party during their explorations of last year in the lower tertiary strata of Wyoming. We give the following descriptions, and add an account of a few species of interest from the post-pliocene of the Atlantic coast.

The *Aletornis nobilis*, new both in species and genus, was a large wading bird, nearly equal to the flamingo in size. It is indicated in the collections by the distal end of a tarso-metatarsal bone and by a few other fragmentary remains. The *Aletornis pernix* is a smaller species of the same genus, represented by portions evidently belonging to one skeleton. It was about as large as a scarlet ibis. Another species of wading birds, apparently belonging to the genus *Aletornis*, is indicated by the distal part of a tibia in perfect preservation, showing the bird to have been of about the size of a curlew. The *Aletornis gracilis* was another small aquatic bird, not larger than a woodcock. It is represented in the Wyoming collections by the proximal end of a humerus in excellent preservation and by some less important remains. A diminutive species of about half the size of that just mentioned is the *Aletornis bellus*. The remains found somewhat resemble similar bones in the killdeer plover. A small bird belonging to the *Scansores* and evidently related to the woodpeckers is termed the *Uintornis lucaris* and is represented by the distal end of a tarso-metatarsal in perfect condition. The specimens indicate a bird about as large as the golden winged woodpecker—(*Colaptes auratus*, Su.) A new species of *Catarractes* termed the *Catarractes affinis* may be based upon a right humerus, which is entire and in an excellent state of preservation. The *Meleagris altus* is determined on portions of four skeletons and resembled most nearly, in size and general features, the common wild turkey of North America. It may readily be distinguished, however, by its more slender proportions, and especially by the more elongated posterior limbs. A much smaller species of the same genus is the *Meleagris celer*, represented by two tibiæ and the proximal half of a tarso-metatarsal, which were found together and probably belonged to the same individual. The remains indicate a bird of about one half the size of the *M. altus*. The *Grus proavus* is an extinct species of crane, somewhat smaller than the *Grus Canadensis*, Temm., and is indicated in the Yale museum by a nearly perfect sternum, a femur and a few other less important remains, which probably are parts of the same skeleton. The sternum apparently resembles most nearly that of the sand-hill crane, but differs from it in many particulars.

The Throw Stick.

Sir Walter Elliot has traced to East India a curved "throw stick" resembling, but differing from, the Australian bomerang, inasmuch as it does not return to the hand when thrown, The Indian "throw stick" is found among the rude races inhabiting the mountain and forest tracks of Central and Western India. In waste and jungle tracks, the people turn out in great numbers during the hot season, commencing on the first day of the Hindu new year in March, and continued on every succeeding Sunday till the monsoon begins. Hares, deer, hog, pea-fowls, partridges, etc., raised by this lowly race of beaters, each carrying a "throw stick," are knocked over by showers of these weapons, thrown with great force and precision.

From the form of such sticks, which are from 1½ to 2 feet long and 3 to 6 inches broad, thrown with the concave side foremost, the author deduced the form assumed by the iron weapons subsequently formed by the same races. Professor Huxley, in classifying the varieties of the human race exclusively for physical characters, had included under one head the people of New South Wales, of the Highlands of Central India, and of Ancient Egypt, all of whom he includes under the term Australoid. Now it is a remarkable coincidence that among these three far distant peoples the "throwstick" was the weapon of the chase, and that examples do not occur in the intermediate countries. The pictures in the tombs of the kings at Thebes represent hunting scenes in which the curved sticks found at this day in India are extensively represented. The bomerang of Australia is precisely of the same form, but, being thinner and lighter, is so fitted as to have a recoiling property.

The Fruit Garden.

A fruit tree never suffers from too much manure, if the roots are healthy. If a tree seems to suffer after a heavy manuring, it is only that it was in a bad way before this. Of course, if one were to empty a cesspool, a cart load of fresh lime, or some other inordinate mass of food under a tree, it would suffer; but our meaning is that no amount of manure that would be found of benefit to any regular garden will be otherwise than beneficial to a fruit tree, if the roots be healthy.

Many trees suffer from the scale insects, as well as from many other minute animal forms, some of which take up their winter quarters in some form or another in crevices of the bark, or in the crotches of the trees. There is nothing which "pays" better than to have these trees washed in the winter with a compound of sulphur and whitewash, colored with anything which may be desirable, so as to make a shade agreeable to the eye. Many of the small twigs in a badly infested tree may be cut away, so as the better to cover with the mixture the parts which are left.

In regard to pruning, many recommend to defer it till spring, in order to see what may be killed in the winter before cutting away much. Many trees are pruned which do not need any cutting; but where it is necessary, we should operate as soon as possible after the fall of the leaf. There is less danger of any part of the tree dying in the winter, when it is pruned in autumn or early winter. This is particularly the case with the grape vine, unless the plant has been mildewed during the growing season, in which case the wood does not mature. There is no better way to save from winter killing than vigorous fall pruning.—*Gardener's Monthly.*

Graphotyping.

The art of graphotyping had its origin in the accidental discovery, by Mr. De Witt Hitchcock, an American engraver, that it was possible to remove the white surface of an enameled visiting card by means of a brush, leaving the inked letters in relief. He was hence led to conceive the idea of drawing upon a surface which might be similarly treated, so that the lines of the artist should remain prominent and capable of being copied by stereotype or electrotype in a form that could be printed from in the usual way. For this purpose, a surface is prepared by placing a layer of finely powdered French chalk upon a zinc plate. A thick steel plate is then placed upon the powder, and the whole subjected to very strong pressure, equivalent to that of a weight from 80 to 100 tuns, in a hydraulic press. By this pressure, the powder is compacted into a slab of a perfectly smooth surface, and of moderately coherent texture. The slab is further strengthened by being moistened with size and dried in a hot chamber, and it is then fit for the draftsman, who draws upon it with a peculiar ink prepared for the purpose. The ink has two chief qualities. It remains fluid in the brush, so as to flow readily; but when deposited on the chalk, it dries very rapidly, and hardens the chalk in drying. Hence, when a sketch is completed, the chalk lying between the lines can be rubbed away by a dry brush, while the lines themselves resist the friction and remain prominent. As soon as the interspaces have been cleared out to a sufficient depth, the plate is saturated with a chemical solution which renders it as hard as marble, and is then ready to furnish the mold for an electrotype. For this, a flat dish of sufficient size is filled with a melted mixture of beeswax, stearine, and lampblack, and as soon as the composition is sufficiently set, it is dusted over with finely powdered plumbago, and the chalk plate is placed upon it face downwards, and hydraulic pressure is applied to force the composition into every line and point. The chalk plate is then lifted out, and the wax mold is placed in the cell of a galvanic battery, where copper is deposited upon it in the usual way. The copper is backed up with type metal, fitted to a wooden block, and the plate is then complete and ready to be used in an ordinary letterpress printing machine. In this way, plates for book illustration may be produced at small expense, and with the merit that they are absolute fac similes of the work of the artist. Every line placed by him upon the chalk will be reproduced in the print with unimpeachable fidelity, and with no possibility of being altered or distorted in any of the intermediate processes. Besides this, the art is applied also to the reproduction of photographs; or, more correctly, the action of light is employed to supersede the work of the draftsman upon the chalk. By this means, accurate copies that are either larger or smaller than the originals can be obtained. The electrotyping cells derive their force from a magneto-electric machine worked by a small steam engine; and the same machine feeds also an electric light in the photographing room, by which the operations are rendered independent of the solar beams or of the frequent murkiness of the atmosphere. Processes of color printing have been lately introduced, and for these the principle of exact reproduction seems likely to be of great value. Some very good colored cards and colored pictures for advertisements were exhibited lately by the Graphotyping Company at their works, but, perhaps, the most interesting work of this description has been in the way of designs for pottery supplied to Messrs. Minton, and transferred to tiles, dishes, and wares of various kinds. Patterns are also made for japanners of toilet hardware, and the possible applications of the graphotyping art seem to extend to almost every kind of decoration.—*British Trade Journal.*

Elastic Force of Witch Hazel Capsules.

At a recent meeting of the Academy of Natural Sciences of Philadelphia, Mr. Thomas Meehan stated that, while traveling through a wood, he had been struck in the face by some seeds of *Hamamelis virginica*, or common witch hazel. He gathered a quantity of the capsules of this plant in order to ascertain the cause of the projecting power and to measure its force. Laying the capsules on the floor, he found the seeds were thrown generally from four to six feet, and in one instance as much as twelve feet. The cause of this immense projecting power he found to be due simply to the contraction of the horny albumen which surrounds the embryo. The seeds are oval and are enclosed in a smooth bony envelope; and when the albumen has burst and expanded sufficiently to get just beyond the middle where the embryo narrows again, the contraction of the albumen causes the embryo to slip out with force, just as we should squeeze out a smooth tapering stone between the finger and thumb.

A Chinese Funeral in New Jersey.

At Belleville, New Jersey, Captain Harvey has a large Laundry which is worked almost exclusively by the "Heathen-Chinee," natives of the Celestial Empire, over two hundred in number. One of them, Li Chow Chin by name, recently died, and the unique ceremonies of a Chinese funeral were performed in his honor. The latter days of Li Chow Chin's life were spent in communion with an ugly wooden god, to which he remained desperately loyal, in spite of the efforts of a Christian minister to convert him. His funeral was attended by 220 Chinese, the total number of Captain Harvey's imported washermen. Dressed as usual in wooden shoes, flabby pantaloons, loose skirts and far-extending pigtails, they assembled in the spacious ironing room of the laundry, awaiting the removal of their departed brother. When all was ready, they moved gravely down to the burial place in the field below. They surrounded the grave and each threw a piece of lighted paper down upon the corpse. A volume of smoke arose from the grave, and the spirit of Li Chow Chin was believed by his brethren to have ascended with it to the clouds. As the clay was being heaped upon the corpse, little sticks and pieces of nickel currency were mingled with it, and money was distributed among the strangers who witnessed the ceremony. After the funeral, the Chinamen's supper bell rang, and they repaired uproariously to their chop sticks and unseasoned tea and rice.

Japan as a Naval Nation.

A report by the captain of the Russian corvette Boyarin published in the *Cronstadt Messenger*, gives some curious details on the present state of the naval armaments of Japan. On the 14th of July, 1871 (he says), five Japanese ships of war entered the harbor of Yokohama. One of these ships is a corvette of English construction, armed with six long cast iron guns and two bronze guns. The second ship is an iron clad ram, the Stonewall Jackson, formerly part of the American Confederate fleet. It is armed with a 300 pounder and two Armstrong rifled 70 pounders. The three other vessels are screw gunboats of English construction, each armed with three guns. The crews of these vessels are composed exclusively of Japanese, with a uniform exactly the same as that of English sailors. On the 28th of March a casemated Japanese corvette, the Reuzeokan, armed with eight guns, also entered the harbor. The Japanese army is equipped and armed in the French manner, and its rifles are according to the Albini system. In the Gulf of Yeddo there is an arsenal, situated on a terrace cut into the side of a mountain. This arsenal is provided with a large dock 407ft. long, 82ft. wide, and 21ft. deep. The largest ocean steamers can enter it for repairs. The water of the dock is exhausted in ten hours by three large steam pumps. Its construction occupied eighteen months, and cost the Japanese Government $240,000. Thirty vessels have already been refitted in this dock. Another dock of smaller dimensions is being constructed, by the side of the first, for ships of small tunnage. The Admiralty also has a rope manufactory, a foundery, a boiler manufactory, a mechanical forge, a steam sawing machine, and all the appliances necessary for repairing ships. Engines and boilers are now being constructed for river steamers. The buildings are all of wood; they are not supplied with much machinery, but what they have is sufficient for the wants of the harbor. This small establishment will evidently never become the naval arsenal of Japan, but it forms an excellent nucleus for the young Japanese fleet, and will afterward be of great use for the squadron which the Japanese Government is apparently about to keep up in the neighborhood of the capital. The arsenal was built by a French engineer, M. Verny, who has been retained as manager of the establishment. Thirty Frenchmen are attached to it in the capacity of foremen, assistants, and instructors. The maintenance of the works costs $300,000 a year; and since they were begun, five years ago, the expenses of the establishment have amounted to $1,500,000.

Samuel Wheeler the Ironsmith.

Samuel Wheeler was the most eminent ironsmith of his time in the United States, and probably equal to any in the world. During the Revolution, General Washington desired to put a chain across the Hudson River in order to stop the ships of the British. He happened to mention this one day in the presence of General Mifflin, saying, "I wish much that I could get a chain made; but that is impossible," "I think," said the other, "I know a man who can make such a chain." "Who is he?" "Sam Wheeler, a friend and townsman of mine," replied Mifflin. "I should like to see that man," said Washington earnestly. "He is here now in the army," said Mifflin; and sending a messenger to him, Mr. Wheeler soon presented himself. "I wish a chain made," said Washington, "to put across the river to stop the British ships. Can you make it?" "I can." "Then I wish you to do so." "I cannot do it here." "Then," said Washington, "I cheerfully give you dismission from the army. Badly as we want men we cannot afford to keep such a man as you."

Mr. Wheeler made the chain. It was hauled in links across New Jersey, was hung, and did good service. It was cut ultimately by building a fire about a link, and then using a chisel and sledge hammer.

THE Belgian industrial journals are jubilant over the astonishing demand, in their country, for coal which, in consequence in the great rise in the British prices, is now shipped in large quantities to England. They state that the prices given are so great that it is impossible to trace the course of the market. The proprietors of mines not only sell the coal as fast as it is extracted, but are actually obliged to refuse large numbers of foreign orders on account of being unable to fill them.

DR. PETERMANN, the distinguished German geographer, has received intelligence, bearing date August 24, of the successful progress of one of the Polar expeditions, commanded by Captain Altmann. This officer found the east coast of Spitzbergen to be remarkably free from ice, an encouraging circumstance on account of the many vessels now seeking to penetrate to high latitudes. He also rediscovered and landed upon King Carl's land, and reports that it consists of three large and many small islands, lying in the throat of the Polar stream that pours around Spitzbergen.

Putting up Stoves.

We have no doubt that a great many of our readers will find their own experience reflected in the following amusing account, by an unknown author, of a disagreeable task to be performed at this season of the year in many households:

The first step a person takes is to put on a very old and ragged coat, under the impression that, when he gets his mouth full of plaster, it will keep his shirt bosom clean. Next he gets his hand inside the place where the pipe ought to go, and blacks his fingers, and then he carefully makes a black mark down the side of his nose. It is impossible to make any headway in doing this work until this mark is made. Having got his face properly marked, the victim is ready to begin the ceremony. The head of the family—who is the big goose of the sacrifice—grasps one side of the bottom of the stove, and his wife and the hired girl take hold of the other side. In this way the load is started from the woodshed toward the parlor. Going through the door, the head of the family will carefully swing his side of the stove around, and jam his thumb nail against the doorpost. This part of the ceremony is never omitted. Having got the stove comfortably in place, the next thing is to find the legs. Two of them are left inside the stove since the spring before; the other two must be hunted after for twenty-five minutes. They are usually found under the coal. Then the head of the family holds up one side of the stove while his wife puts two of the legs in place, and next he holds up the other side while the other two are fixed, and one of the first two falls out. By the time the stove is on its legs, he gets reckless, and takes off his old coat, regardless of his linen. Then he goes off for the pipe, and gets a cinder in his eye. It don't make any difference how well the pipe was put up last year, it will be found a little too short or a little too long. The head of the family jams his hat over his eyes, and, taking a pipe under each arm, goes to the tinshop to have it fixed.

When he gets back, he steps upon one of the best parlor chairs to see if the pipe fits, and his wife makes him get down for fear he will scratch the varnish off the chair with the nails in his boot heel. In getting down, he will surely step on the cat, and may thank his stars if it is not the baby. Then he gets an old chair, and climbs up to the chimney again, to find that, in cutting the pipe off, the end has been left too big for the hole in the chimney. So he goes to the woodshed, and splits on one side of the end of the pipe with an old axe, and squeezes it in his hands to make it smaller. Finally he gets the pipe in shape, and finds that the stove does not stand true. Then himself and wife and the hired girl move the stove to the left, and the legs fall out again. The next move is to the right. More difficulty with the legs. Moved to the front a little. Elbow not even with the hole in the chimney, and he goes to the woodshed after some little blocks. While putting the blocks under the legs, the pipe comes out of the chimney. That remedied, the elbow keeps tipping over, to the great alarm of his wife. He then gets the dinner table out, puts the old chair on it, gets his wife to hold the chair, and balances himself on it to drive some nails into the ceiling. Drops the hammer on his wife's head. At last gets the nails driven, makes a wire swing to hold the pipe, hammers a little here, pulls a little there, takes a long breath, and announces the ceremony completed.

Job never put up any stoves. It would have ruined his reputation if he had.

Disinfectants.

In the Central Chemical Department of Public Health at Dresden, numerous researches have lately been made with various disinfecting materials for the purpose of disinfecting liquid manures; the chief results are appended below. The value of chloride of lime and sulphuric acid, which form the most effectual disinfecting material, is here expressed by 100, while the remaining numbers show the value of the other materials as compared with this standard;

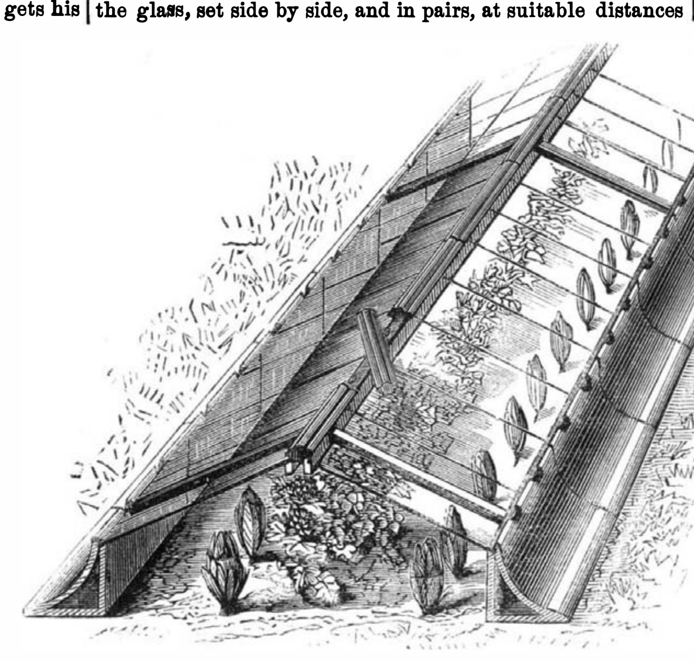
Chloride of lime with sulphuric acid	100·0
Chloride of lime with sulphate of iron	99·0
Luder and Liedloff's powder	92·0
Carbolic acid—disinfecting powder	85·6
Slaked lime	84·6
Alum	80·4
Sulphate of iron	76·7
Chloralum	74·0
Sulphate of magnesia	57·1
Permanganate of potash with sulphuric acid	51·3

A NEWLY erected four story building recently tumbled down at Louisville, Ky., at 7 P. M. Two adjoining buildings were crushed, in one of which a family of eight persons, five of whom were children, were seated at supper; all were killed except three of the children. The accident is reported to be due to bad mortar, which had the appearance of wet mud. The architect and contractor have been arrested for murder.

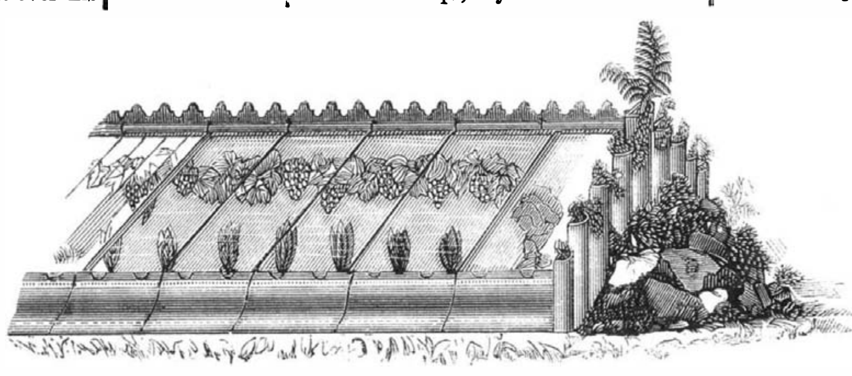
THE aeronauts Mr. Glaisher and his companion Mr. Coxwell reached an altitude of 37,000 feet or seven miles from the earth, where they found a temperature of 80° Fah. below freezing.

EARTHENWARE HOTBED FRAMES

This is a cheap and effective combination of glass and earthenware for horticultural purposes, wherein is obtained complete facility for perfect ventilation, without removal of the glass, or risk of fracture. The sides of the frame, Fig. 1, are formed of chairs or slabs of terra cotta or earthenware, somewhat of an L section, with a recess at the top to receive the glass, set side by side, and in pairs, at suitable distances apart. At intervals, angle pieces, doweled at the ends and securely fixed to the chair tiles, support a light double wooden ridge, the opening in which thus admits of ventilation, throughout the length of the frame; being also closely fitted with bevel-ended earthenware caps, any one or all of which are readily removed and replaced. Thus not only is there adequate provision for easy ventilation, but, on the removal of the cap, any one or more of the glass sheets can be removed to permit the plants to be watered. The ends of the frames are closed by means of half round hollow earthenware tubes, Fig. 2, of varying lengths, arranged so as to form a kind of gable end, to which an ornamental appearance can be given by filling the tubes with mold and planting ferns and other suitable plants therein. These frames, says the *Mechanics' Magazine*, are useful and ornamental as garden accessories, and are well adapted for every description of flowers, vegetables, or fruit, or as forcing pits and frames when placed on sunk brickwork or heated by a system of pipes with hot air or water.



EARTHENWARE HOTBED FRAMES.—FIG. 1.



EARTHENWARE HOTBED FRAMES.—FIG. 2.

FIG. 3.

The same principles, on a smaller scale, are applied in the cover, Fig. 3, made of red earthenware with sloping glass covers. The propagating box, Fig. 4, is made of the same material. These improvements are the designs of Benjamin Looker, and were lately exhibited at the Horticultural Exhibition, Birmingham, England.

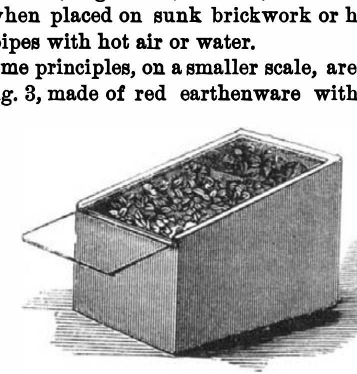


FIG. 4.

CEMENT FOR STEAM BOILERS AND GAS PIPES.—This cement offering a great impermeability and more strength than the cement generally used, is prepared by an intimate mixture of six parts of graphite finely ground, three parts of slacked lime, eight parts of sulphate of baryta, and seven parts of linseed oil varnish.

Black Varnish for Wood.

There are two kinds of black varnish: 1. The ordinary black varnish for different kinds of wood; 2. The black ebony varnish for certain woods which approach nearest to ebony in hardness and weight. The ordinary black wood varnish is obtained by boiling together blue Brazil wood, powdered gall apples, and alum, in rain or river water, until it becomes black. This liquid is then filtered through a fine organzine, and the objects painted with a new brush before the decoction has cooled, and this is repeated until the wood appears of a fine black color. It is then coated with the following varnish: a mixture of iron filings, vitriol and vinegar is heated (without boiling), and left a few days to settle. If the wood is black enough, yet for the sake of durability, it must be coated with a solution of alum and nitric acid, mixed with a little verdigris; then a decoction of gall apples and logwood dyes is used to give it a deep black. A decoction may be made of brown Brazil wood with alum in rain water, without gall apples; the wood is left standing in it for some days in a moderately warm place, and to it merely iron filings in strong vinegar are added, and both are boiled with the wood over a gentle fire. For this purpose soft pear wood is chosen, which is preferable to all others for black varnishing.

For the fine black ebony varnish, apple, pear, and hazlewood are recommended in preference for this; especially, when these kinds of wood have no projecting veins, they may be successfully coated with black varnish, and are then most complete imitations of the natural ebony. For this varnish: 14 oz. of gall apples, 3½ oz. of rasped logwood, 1¾ oz. of vitriol, and 1¾ oz. of distilled verdigris are boiled together with water in a well glazed pot, the decoction filtered while it is warm, and the wood coated with repeated hot layers of it.

For a second coating a mixture of 3½ oz. of pure iron filings, dissolved in ¾ of a liter of strong wine vinegar, is warmed, and when cool the wood already blackened is coated two or three times with it, allowing each coat to dry between.

For articles which are to be thoroughly saturated, a mixture of 1¾ oz. of sal ammoniac, with a sufficient quantity of steel filings, is to be placed in a suitable vessel, strong vinegar poured upon it, and left for fourteen days in a gently heated oven. A strong ley is now put into a good pot, to which is added coarsely bruised gall apples and blue Brazil shavings, and exposed for the same time as the former to the gentle heat of an oven, which will then yield a good varnish. The pear wood articles are now laid in the first named varnish, boiled for a few hours, and left in for three days longer; they are then placed in the second varnish and treated as in the first. If the articles are not then thoroughly saturated, they may be once more placed in the first bath and then in the second.

Metallic Printing.

Many attempts have been made to produce patterns upon cotton, worsted, and other tissues, by depositing reduced metals upon them. One of the most successful experimentalists in this direction was the late Mr. W. Robinson, of Clifton Vale Print Works, Brighouse, Yorkshire. He found that lead, tin, bismuth, copper, etc., could be deposited in given designs in a metallic state upon woven tissues, producing a variety of novel and striking effects. One serious drawback remains, however, to be overcome before this new style of printing can be adopted on the large scale. The metals capable of easy reduction and deposition have all, with the exception of gold, which is too costly for general use, a strong affinity for sulphur. When exposed in thin films to the action of the air, they are consequently easily tarnished and lose their beautiful metallic luster. Vial moistens tissues of cotton, silk, etc., with a solution of nitrate of silver, dries slightly, and then lays upon the cloth a metal plate with an engraved design in raised lines. Wherever this metal touches the cloth, the silver is reduced in fine black metallic powder, which adheres very tenaciously to the fiber and reproduces the design with great sharpness and delicacy. The process is most successful on fine, compact goods. A slight previous dressing or sizing is of use. The designs thus produced are permanent in air and light, and are not affected by washing in water, soap leys, or dilute acid and alkaline liquids. They are, however, of no value, as they are devoid of that metallic luster which alone is wanted. Black designs, perfectly permanent, can be produced to satiety with much cheaper materials than the nitrate of silver.

THE RISE IN TEMPERATURE OF DISCHARGED LEADEN SHOT.—The motion of the leaden bullet, if all converted into heat, would be three times the amount sufficient to melt the amount of lead found to be melted by actual experiment. J. Bollynski explains this as having been actually expended in denting the iron plates used. By using a hard stone target, he was able to melt all the lead by firing the bullets against it.

THE tooth of a mastodon is reported to have been found in Clay county, Ind., which weighs ninety-two pounds. With an ordinary row of teeth, the lower jaw of the animal must have weighed at least fifteen hundred pounds.

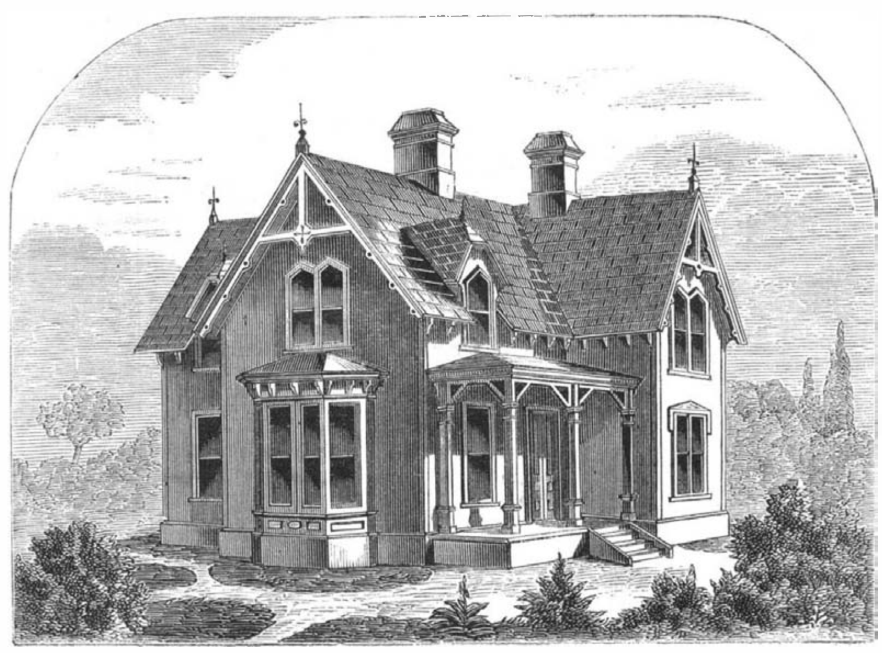
CHEAP COUNTRY HOMES.

There is an immense number of people, whose daily labor necessitates their residing in close proximity to our great cities, and who, owing to the high rents and advanced cost of living, are forced to dwell in the suburbs or in villages situated on the radiating lines of railroad. To meet the requirements of this class in New York, during the past few years, villages and, indeed, towns have sprung up as if by magic, from the hitherto vacant fields of New Jersey and Long Island. The streets of our city are placarded with flaming posters, setting forth, in glowing terms, the advantages of a country residence; enterprising auctioneers vie with each other in lavishing money on sensational announcements, offering grand collations, free rail road passes, and the easiest of terms of payment to allure purchasers; banks and capitalists in the vicinity of the land, with unaccountable liberality, advertise building loans, taking a mortgage on the prospective dwelling for the sums advanced toward its erection, and, in fine, every attraction that human ingenuity can suggest is presented to induce those in moderate circumstances to leave the city and become the owners of rural homes. While it is not our province to comment upon the desirability of the building sites, or on the value of the apparently overwhelming advantages so freely proffered, we perhaps may suggest to those contemplating such investments that it is a much better policy to invest their savings in a small but inexpensive house for which they can wholly pay, and thus be possessed of a clear title, than by the aid of borrowed capital to erect a more pretentious mansion, from which, in the hour of misfortune, they may be ejected by the process of a foreclosure suit.

With this view, we present, in the accompanying illustrations, the plans and elevation of a neat, cheap, and commodious cottage, for which we are indebted to the *Supplement to Bicknell's Village Builder*, and which, we are informed, may be erected in the vicinity of New York for three thousand dollars, or in some other sections of the country for five hundred dollars less. The dwelling is designed to be no hastily thrown-together structure, but a substantial and durable house.

The gothic roof, with which the dwelling is surmounted, is appropriate and tasteful, while it affords ample room in the apartments in the upper story. The plans explain themselves, and are so designed as to leave no space unutilized.

To those desiring to avail themselves of this design, we may add, that it is only necessary to decide upon the size of the dwelling, which, of course, will be based upon the size of the building lot, and to obtain the estimates and specifications which ordinary carpenters, plumbers, and masons can readily furnish, to carry out the construction without the aid of either architect or professional builder.



CHEAP COUNTRY HOUSE.

GROUND FLOOR.

UPPER STORY.

American Gas Wells.

Dr. J. S. Newberry, State Geologist of Ohio, gives the following particulars: The town of Fredonia, in Western New York, has for more than forty years been fully or partially lighted by gas which issues from springs at that place. In the borings made for oil in the various oil districts of the Western States, the gas which has been produced so abundantly has been regarded as a useless, frequently an inconvenient and dangerous, product. Within a year or two past, however, this gas has been utilized in numerous localities, and already a large number of wells have been bored for the express purpose of obtaining it. In some cases these gas wells have been highly productive, furnishing an abundance of material for heating and lighting in its most convenient and manageable form, so this deserves to be reckoned as one of the important elements in the mineral resources of our country. As this method of procuring carburetted hydrogen gas forms a new industry and one which will probably assume considerable importance, a few words in reference to its present condition and prospects may not be without interest to the public. I therefore extract from my notes a few facts in regard to some of the most interesting of our gas producing districts. On the Upper Cumberland, in Kentucky, gas accumulates in such quantities, beneath the sheets of Lower Silurian limestone, that many hundred tuns of rock and earth are sometimes blown out with great violence. These explosions have received the local name of "gas volcanoes." In Ohio, gas escapes from all the wells bored for oil in the oil-producing districts. Of these, two, bored by Peter Neff, Esq., near Kenyon College in Knox county, present some remarkable features. These wells were bored in 1866, at the same geological horizon as that which furnishes the oil on Oil Creek, Pa. At the depth of about 600 feet, in each well, a fissure was struck from which gas issued in such volume as to throw out the boring tools and form a jet of water more than 100 feet in hight. One of these wells has been tubed so as to exclude the water, and gas has continued for five years to escape from it in such quantity as to produce, as it rushes through a two and a half inch pipe, a sound that may be heard at a considerable distance. When ignited, the gas forms a jet of flame three feet in diameter and fifteen feet long. The other well, which has never been tubed, constantly ejects, at intervals of one minute, the water that fills it. It thus forms an intermittent fountain, one hundred and twenty feet in hight. The derrick set over this well has a hight of sixty feet. In winter it becomes encased in ice, and forms a huge translucent chimney, through which, at regular intervals of one minute, a mingled current of gas and water rushes to twice its hight. By cutting through this chimney at its base and igniting the gas in a paroxysm, it affords a magnificent spectacle—a fountain of water and fire which brilliantly illuminates the ice chimney. No accurate measure has been made of the gas escaping from these wells, but it is estimated to be sufficient to light a large city.

At West Bloomfield, N. Y., Erie, Pa., Conneant and Painesville, Ohio, quite a number of gas wells have been bored and yield large supplies of gas which are used for manufacturing and domestic purposes.

A Steamship Race of Eleven Thousand Miles.

For many years the Cunard Steamship Company enjoyed the reputation of running the fastest steamers that crossed the Atlantic, the Scotia being the fastest of a very fast fleet. Mr. Inman challenged the Scotia with the City of Paris at last. Then came the Cunard boat Russia, rivaled by the Inman steamer City of Brussels. There was not much to choose between those vessels as regarded speed. Last year, says a correspondent of the *Engineer*, the White Star line came into existence, and raced with the Inman boats between New York and Liverpool, starting on the same days; but the Inman fleet always won with one ship at least, the City of Brussels beating the Republic, a new ship of the White Star fleet, on her last trip. The Republic is now on her voyage from Liverpool to Callao in Peru, and she is racing the Tacora, one of the Pacific Company's fleet. It is 11,000 miles to Callao, quite enough in all conscience to settle the merits of the two ships.

The Republic was built in the early part of 1872 by Messrs. Harland, Wolf, and Co., of Belfast, and furnished with engines and boilers by Messrs. G. Forrester and Co., of Liverpool. The former are of the inverted cylinder direct-acting type, on the compound system. The high pressure cylinder has a diameter of 41 inches, and the low pressure one 78 inches. The stroke is 5 feet. The engines are furnished with surface condensers, the water for which is supplied by means of two of Gwynne's centrifugal pumps, each worked by an independent engine. The screw is a four-bladed common screw, with feathering blades, 22 feet in diameter, and having a pitch of 31 feet 6 inches. The engines are remarkably easy to start, stop, and reverse, the chief engineer, with two assistants, handling them as if they were toys. They work with great ease and quietness; in fact the total absence of vibration on board the Republic is most remarkable, it being frequently impossible to tell whether the engines are in motion or not. This is due not only to the excellent workmanship which has been bestowed upon the engines, but also to the immense strength of the vessel herself. The maximum number of revolutions per minute at which these engines are usually worked is fifty. The steam is supplied to the engines by means of twelve main boilers, and one boiler is devoted to supply steam to the various donkey engines. The boilers are all tubular wagon boilers, semicircular at top and bottom, with flat sides. They are placed on each side of the vessel, with a passage 10 feet wide down the center, from which they are fired. Each boiler has two furnace tubes, 3 feet 2 inches in diameter, and the grates are 6 feet in length. The whole of the furnaces are fitted with Mr. Symes Prideaux's patent furnace doors, and the smoke box doors are all furnished with the shields invented by the same gentleman.

Three objects are expected to be attained by the introduction of these inventions, namely, the entire consumption of smoke, economy in the consumption of fuel, and the reduction of the temperature of the stokehole. These three items are all of the most vital importance to all steamships, but more especially to those, like the Republic, which have to undertake extremely long voyages in very hot climates. The principle upon which the doors are constructed is that, in order to insure the total absence of smoke and the proper combustion of fuel, a very much larger quantity of air is required to be admitted to the furnace, above the fuel, immediately after firing than at any other time, and as the green fuel becomes coked the supply of air should be gradually diminished.

Spontaneous Ignition of Oiled Cotton.

Mr. John Gellatly has published some very interesting observations on these so-called spontaneous combustions. He took a handful of cotton waste, soaked it in the oil to be experimented upon, wrung out the excess of oil, and then put it into a box along with some dry cotton. The box with contents was then heated to 170° Fah., and in 75 minutes the cotton saturated with boiled linseed oil was found to be on fire. Boiled linseed oil and seal oil (sp. gr, 0·928) were found to be the most combustible. Next in order came lard oil (sp. gr. 9·16) which took four hours. Raw linseed oil took four to five hours. Rape oil and gallipoli olive oil appear to take a little longer than the last. It is interesting to note that all the oils just enumerated are ethers of glycerin. Castor oil, which is not an ether of glycerin, takes two days to ignite spontaneously. Sperm oil, too, does not ignite; and the petroleums actually stop the spontaneous combustion of the oils above mentioned. Chemists are in the habit of keeping potassium and sodium in petroleum, which excludes the atmosphere from these metals. It is curious that dangerous cotton should be preserved in a similar manner.

A NEW invention has been adopted this year at the Prince Consort's farm and the Norfolk farm at Windsor, England, for the preservation of hay ricks from the heating occasioned by confined air and moisture. A long perforated tube, fixed in short lengths which fit into each other, is built into the body of the rick as it is carried up, and surmounted by a cowl, which turns with the wind and provides a constant down current; an upward current is also arranged for in an inner tube, which is solid, opens at the bottom, and so completes the circulation. This invention is also adapted to granaries and ships in transit, but in these cases several arms are provided, running out from the central shaft at right angles, so as to distribute the air through the body of the grain. The use of perforated tubes for preserving grain, meal, etc, in storehouses, granaries, and in barrels, is an American invention and has long been in use in the United States.

ACTION OF ACTIVE OXYGEN UPON PYROGALLIC ACID.—H. Struve in an essay treats on the action of peroxides and other oxidizing substances upon pyrogallic acid alone or in the presence of gum, blood, saliva, malt extract, etc. It appears that pyrogallic acid yields several colored products of oxidation, among which purpurogallin is one of the most prominent.

THE Marquis of Bute is preparing for the Philadelphia Centennial Exhibition of 1873 a complete assortment of metals and ores from Wales, the county of Durham, and the entire basin of South Wales, including Monmouthshire.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

Transmission of Motion.

To the Editor of the Scientific American:

In your issue of No. 16, present volume, page 243, is a lecture delivered by Coleman Sellers on the above subject Speaking of shafting being enlarged at the ends to receive couplings, which is the English practice, he says: "Shafts so enlarged at the ends cannot be made to receive carefully bored pulleys unless the pulleys be made in halves and then bolted together upon the shaft." For the information of your readers, allow me to throw a little light on this matter. To my knowledge, 15 years ago, pulleys were bored out taper, large enough to pass the enlarged part or "coupling end." Suitable bushes were cast with three slots of three eighths inch width, equidistant, and three fourths inch shorter at each end than the bush, the bush itself being about one inch longer than the hub of the pulley was. Through these bushes holes were bored to suit shafts, and their outsides turned to same bore and taper of pulleys. When complete, a chisel was inserted in each slot, and the bushes burst in three parts. One chipping on any one of the parts that hold the bush together is sufficient to allow of the three pieces impinging the shaft when driven in the hub of the pulley with a hand hammer. This method makes a neat finish, and with it pulleys can be moved at pleasure. An advantage claimed for this method is that there is no set screw head whirling around while in motion, which is dangerous, especially when persons have to approach the pulleys fastened on shafting in that way.

There is another thing I would mention for the benefit of your readers; that is, a method of using a loose pulley, so that, when the machine is stopped, the driving belt is stopped also. This is accomplished by suspending the loose pulley (at the driving end) on a sleeve, through which the shaft runs; the fast pulley, running up against the loose, will keep the loose pulley on the sleeve. A collar on the sleeve on the opposite side will keep the loose pulley in its place. The bearings of a hanger would suffice for the sleeve, if they were extended long enough on the required side to receive the loose pulley, the loose pulley being bored and the outside of the bearings being turned to suit each other, and the fast pulley of course being bored to suit shaft. It is said that the extra work is soon paid for in the saving of belts and countershafts, which are stopped with the machine, to say nothing of the oil used on the ordinary loose pulleys and their constant racket and noise, all the time calling to be re-bushed. J. W.

Sheet Lightning.

To the Editor of the Scientific American:

Sheet lightning does not differ from zigzag lightning, except that sheet lightning, so called, is confined wholly to the clouds, and is not generally accompanied by rain. Sheet lighting is most frequently noticed in the evening, and on the horizon, but it occurs, perhaps, quite as frequently in the day time and overhead, though, owing to change of circumstances and position, it is not recognized as sheet lightning. Here are two notable instances:

Some 30 years ago, when the writer was a boy, the father called up the family at midnight, and, laying a feather bed upon the floor, directed the children to get upon it for security. A fearful thunderstorm was approaching, and if every stroke of lightning, he said, should fall to the earth, not a building, tree or fence stake would escape. And so it seemed. For more than half an hour the thunder was continuous, while the dazzling flashes of lightning were almost as frequent as the tickings of the clock. But no rain fell, no lightning descended to the earth, and no loud peals of thunder were heard, but only a subdued, yet variable and continuous rumbling. The same phenomenon was witnessed by another member of the family who was then 60 miles west of this.

A similar but less fearful and equally harmless storm occurred here in the past summer and at midday. For more than 25 minutes the thunder was incessant, and the lightning flashes fearfully frequent and vivid. Yet only a few drops of rain fell, and only one or two loud peals of thunder were heard, indicating a descent of the lightning to the earth. Both of these are instances of sheet lightning occurring overhead. The form of the lightning in these, as in every other similar instance, was zigzag, yet confined wholly to the clouds.

Franklin, N. Y. JAS. H. PARSONS.

The Temperature of the Moon.

To the Editor of the Scientific American:

I was recently interested in reading the article entitled the Latest News About the Moon" (on pages 247 and 248 of your current volume). In this article, it is stated that the temperature of the moon is undoubtedly below 70° below zero, Fahrenheit, and possibly reaches even 460° below that point. The moon reflects light and heat rays upon the earth. These rays are obtained from the sun. Part of the heat rays must necessarily be absorbed by the moon. The moon receives, proportionately, the same amount of heat rays that are received by the earth. Now, the question is, how can the moon, receiving the same proportion of heat rays received by the earth, be destitute of all heat, when it is otherwise with the earth? I confess I cannot comprehend how it can be.

A case is supposed, in the article referred to, of a mountain on the earth's surface, 240,000 miles high, and it is stated that there would evidently be no more heat on the surface of the moon than on the summit of that mountain. I hold that this is not a parallel case, for the reason that, on the peak of a high mountain, the rays of the sun are reflected off its precipitous sides into the surrounding atmosphere, and do not serve to heat its surface. There are many plateaus, 10,000 and 12,000 feet above the sea, where tropical vegetation flourishes; but notwithstanding that, there are many single peaks of that hight whose summits are far above the snow line.

The article above referred to further asserts that there are evidences of volcanic action in the moon. Plainly, there must be a considerable amount of heat accompanying such action. This fact also tends to show that it is probably not so cold that there is an "entire absence of heat." J. H. R.

Rochester, N. Y.

Mr. J. M. Jaeger's Propeller.

To the Editor of the Scientific American:

On page 246 in your issue of October 19, I noticed Mr. James M. Jaeger's claims for his new method of propelling canal boats, and in several points the invention seems to me to be defective.

1st. There is no power either to back the boat, or to stop it when making a landing, the want of which would prove a serious disadvantage in practice.

2d. The point of contact with the water is so far below the point of support that there would be a constant strain sidewise on both the guide rods and the piston rod, wearing not only these but also the cylinder, and making constant repairs necessary, beside detracting much from the effective power of the engine by unnecessary friction.

3d. Mr. Jaeger states, "that it utilizes a large amount of power." Let us look at this. When the propeller is drawn toward the boat, and ready to start back, a part of the stroke must be made before the floats are closed, making this part of the stroke of little effect. If the floats are raised at nearly right angles with the "supports," then the loss must be considerable; if they are not raised so far, then the resistance on the return stroke must be considerably increased. We must consider two facts: 1st, that the return stroke through the water must be at twice the speed of the boat; and, 2d, that the resistance is increased as the square of the velocity.

4th. He states that "it wastes no power by slipping." This, in regard to any form of propeller, is simply absurd.

Westerly, R. I. C. B. MAXSON.

How Trees are Killed by Lightning.

To the Editor of the Scientific American:

On page 229 of your current volume is an article from the *Building News*, under the above head, which conveys the idea that the way in which the lightning splits trees is by changing the sap to steam, the expansive force of which does the work. This I think is an error. Whatever may be the action of the electric fluid in killing trees, I think the splitting is due to another cause. It is well known that substances similarly electrified repel each other, and different parts of the same substance repel each other in the same way. It seems a self-evident fact that if this force is stronger than cohesion, the substance must be thrown asunder. Earth and stones are sometimes lifted; I suppose this is owing to the repellent force being stronger than gravity.

As far as I have observed, dry and half dead trees are shattered where green ones are unharmed or torn out by the roots by the lifting of stones, without fracturing the bodies of the trees.

Charlotte, Me. HENRY A. SPRAGUE.

Fireproof Gunpowder Magazines.

Some experiments as to the storage of gunpowder have been recently tried at the Practice Range, Plumstead Marshes, at the instance of the Home Secretary and by permission of the Secretary of State for War. With a view to guard against the danger of explosion, Messrs. Milner & Co., of Liverpool, have designed a fireproof safe, to hold small quantities of gunpowder, and the experiments were made to determine how far these miniature magazines will preserve their contents from explosion when exposed to the action of fire.

Four magazines were put to the proof. In form, says the *Mechanics' Magazine*, they differ in no respect from any ordinary fireproof safe. There is no intricate combination of bar and lock, for they need not, of course, be thief-proof, and a burglar would, if he knew it, be hardly likely to break into such a strong box. On the other hand, the walls are of unusual strength. They are formed of four inch chambers, between each of which is a stuffing of alum and sawdust. The action of heat dissolves the alum, which contains 52 per cent of water, and the liquid portion finds its way through small holes in the safe, wetting any loose powder, while that contained in canisters is so protected as to be non-explosive. This, at least, was the theory of the manufacturers. The value of the theory was now to be tested.

In the open air, several hundred yards apart, four furnaces had been erected, each seven feet in internal diameter, and each heaped up with wood, shavings, coal, and a dash of petroleum to assist ignition. All the magazines were of the same size, and made to hold 100 pounds of powder loose or in canisters, as it is generally kept by retail dealers and sportsmen; but for the purpose of experiment, only a small quantity of powder was placed in each, put up in different ways, some in paper, some in canisters, some in barrels, headed up and open. In each magazine, there were placed two of Negretti and Zambra's self registering thermometers, with 21 little sticks of alloy (tin and lead,) so made under Professor Abel's directions as to melt, according to the varying proportions of the alloy, at varying degrees of temperature from 340° to 558° Fahr. Gunpowder explodes at a temperature of 560°; but long before this degree of heat was reached, it was expected that the sulphur would be volatilized, when the remaining constituents would be robbed of their chief powers for mischief.

By 11.30 A. M, all four furnaces were in a blaze, and there could be no doubt as to the rough reality of the ordeal which the magazines were undergoing. The superintendents of the principal fire brigades in the United Kingdom had been previously asked what length of time a magazine, to be really safe, should be able to resist such a fire as might occur in an ordinary dwelling house. The longest time assigned by any of these officers in their replies was six hours. Captain Shaw, and the more experienced men on the ground were of opinion that this length of time was excessive. However, three of the magazines were constructed on the assumption that, if they could resist fire for six hours, they would afford all the protection which was actually necessary. The fourth was of stouter construction than its fellows; it had 6 inch instead of 4 inch chambers, and was made to resist fire from eight to nine hours. As the wall of coal gradually burnt through and the flames rose high above the buried magazines, there seemed to be no wish among any visitors to disobey the earnest request addressed to them: not to approach the furnaces during the progress of the experiments. There was little, indeed, to tempt visitors from cover. The rain poured down incessantly during the greater part of the day, and Plumstead Marshes, at no time very lively, became a dismal swamp indeed. Meanwhile the fires burned furiously, nursed by the wind and quite unchecked by the rain. It was admitted by most people present that, if the test was severe as to time, the exposure of the magazines to a heat so intense and continuous during that time was a test severer still. At last the end came, amid general impatience. At four o'clock, there had been no explosion anywhere. A few minutes afterwards, magazine No. 5 was disengaged—no easy task—from the glowing mass around and over it. It was then opened, and its contents were inspected by Major Majendie. One of the thermometers was broken. The other marked 210°. Of course none of the rods of alloy were fused. The "pinches" of loose powder were thoroughly wetted, and the paper containing them was pulp. The powder in the canisters came forth unharmed, and its properties were unchanged, portions taken from each canister exploding readily when a spark was applied. The magazine had been sorely tried. In two places the flames had eaten holes through the exterior plate of iron into the first chamber. The outer plate of the door had also slightly bulged, partly, perhaps, from expansion, partly owing to pressure from within—the generated vapor seeking an outlet. But all admitted that the magazine has passed successfully through the fire, and had fulfilled the promise of its makers that it would not merely, during the stipulated time, resist fire but preserve its contents from explosion. The other furnaces were left to burn out, to be examined the following day.

The Whitworth Breech-Loading Gun.

Sir Joseph Whitworth has advanced the claims of his system of ordnance to meritorious recognition another step, by the results of the recent practice made with his 9 pounder homogeneous steel field gun on the sands at Southport. The weapon, says *Engineering*, was made from a solid ingot of Whitworth metal, and is mounted on a carriage constructed of the same material. The gun is 6 feet 2 inches long, weighs 8¾ cwt., its carriage weighing 10 cwt., and its ordinary charge being 2¼ lbs. of R. L. G. powder. It is constructed with an enlarged powder chamber 6·8 inches long by 3·4 inches diameter, beyond which is a shot chamber $\frac{3}{16}$ of an inch larger than the hexagonal bore of the piece, which measures 2·72 inches in the major, and 2·47 inches in the minor axis. The gun is 4½ inches in diameter externally at the muzzle, and 10½ inches at the breech. The rifling has a twist of 1 in 55 calibers, and the ordinary projectiles are 3½ diameters in length, and are fired as cast, without being trimmed up. The breech end of the piece is slotted longitudinally, leaving an upper and under jaw. The opposite surfaces of these jaws are grooved diagonally by fine ridges 1 inch in width, and having ¼ of an inch rise. The breech block is a mass of metal 9 inches wide by 4½ inches high and 6 inches deep, is similarly grooved, and is moved along the grooves in the jaws from side to side by a handle actuating a pinion working on a rack behind the grooves; and by this means the breech chamber is opened and closed. The gun carriage is fitted with Madras wheels 4 feet 6 inches in diameter, with two ammunition boxes for three rounds, each fitted over the axle, and serving as seats for gunners. The trail is formed of two solid deep plates of Whitworth steel, tapering, from 9 inches deep and ⅝ inches near the axle, to 4 inches deep and ½ inch thick at the ground end. At the upper end is a strong hollow cylindrical stay, and at the lower end the cheeks are riveted to the iron shoe. There are two similar hollow stays at intermediate distances, the first of which affords the bearing for the elevating screw which passes through it. The support of the gun is midway of the lever, and the fulcrum immediately under the axle. There are also several pivot holes, to permit the shifting of the fulcrum, for high elevations.

With the weapon thus mounted and equipped, some remarkable practice was recently made with results as follows:

In the first series of experiments, ten rounds were fired, elevation 40°, solid shot, R. L. G. powder 2¼ lbs. mean range 10,225 yards, mean deflection to right 44 feet, the shot 4 diameters in length, with taper rear; wind strong and blowing down against flight, and slightly across range.

In the second series, with same elevation, same number of rounds, same charge of powder and a common 9 lb. shell, the mean range was 4,359 yards, deflection to right 3·7 yards.

In the third series 5 rounds were fired: elevation 3°, common 9 lbs. shell, same charge, mean range 1,931 yards, deflection 1 foot to right.

The fourth and last series for the day consisted of three rounds fired at a 3 inch armor plate made by Cammell, and inclined at angle of 45°. The range was 100 yards, the projectile a 15 lb. 14 oz. Whitworth metal shot, 5 diameters long, and the powder charge 2¼ lbs. R. L. G. The first shot struck close by the bull's eye, and broke up, the flat end nearly penetrating through the plate. The second shot missed the plate, was recovered and fired again, going clean through the plate.

By way of testing the Whitworth metal, a cylinder, 21 inches long and 10 inches external diameter, having a bore of 2·722 inches, representing the chamber portion of a 9 pounder field gun, was charged with 1½ lbs. of R. L. G. powder. One end of the bore was closed by the shot being screwed in, and the other by a steel plug, also screwed in. The vent was of steel, the touch hole being only one tenth of an inch in diameter. This charge thus enclosed was fired, and the whole discharge escaped with a loud hissing report through the touch hole, which was enlarged to double its original diameter. The steel cylinder, weighing over 3½ cwt., was driven forward like a rocket for 32 inches by the outrush of the gas against the air. The cylinder was not injured, nor even distended, and the plugs were easily unscrewed after the discharge.

The second day was mainly devoted to practice for rapidity. The first trials were with shrapnel shells of 3½ inches diameter, fuzed with special Pettman concussion fuzes; weight of shells, 9 lbs.; gun charges, 2¼ lbs.; powder, R. L. G.; bullets, 40 in number, gage 20 to the pound; bursting charge, 9 drams. Practice was made at a target at 2,000 yards, but the strength of the wind and its gusty nature prevented any remarkable attainments. The shooting, however, was fair. The gun was served by Mr. Leece and some assistants from the works, and they made good practice in the rapidity trials. The first series of five rounds with common shells were fired in 50 seconds. The second series of twenty rounds occupied 3 minutes, 37 seconds, including replacement of three faulty friction tubes. The third series of ten rounds was fired in 1 minute 44 seconds. A series of trials with case shot followed; ten rounds were fired with a result of 22·6 throughs per round, there being 83 bullets in each case. The concluding rounds—two in number—were with 5 diameter shells, weighing 12 lbs. The first was fired, empty, with 1 oz. of powder as in mortar practice, and with 42° elevation, the shell falling 500 yards away. The second was fired as a live shell with a Pettman special concussion fuze, and burst on graze at 2,000 yards range, the elevation being 4°. The experiments, which were highly satisfactory, were witnessed by Colonel Campbell, R. A., Major Alderson on the part of the Director of Artillery, and a number of other English and foreign officers and engineers.

New Process for Bleaching Salts.

Tessié de Motay has now succeeded, by operating on the whole mass or a part of the muriatic acid employed, in producing pure chlorine in a separate form, which combines with the alkalies and alkaline earths into the so-called bleaching salts without any loss.

The inventor describes the method employed by him for this purpose in the following manner:

I. I conduct a stream of muriatic gas into a retort containing peroxide of manganese, or a mixture of peroxide and lime heated to a dark red glow. In this way chlorine gas and steam are liberated, while oxide of manganese and chloride of calcium remain behind in the retort. The chlorine is seized by the water, or conducted into a chamber for the preparation of dry hypochlorites.

I allow a stream of atmospheric air, at the same temperature as before, to pass over the mass remaining in the retort; this liberates the chlorine contained in the chloride of calcium and the resulting chloride of manganese. This chlorine, mixed with air or with nitrogen and oxygen, is conducted into stoneware receivers containing a quantity of lime and oxide of manganese (previously prepared by the decomposition of chloride of manganese with excess of caustic lime), while the resulting solution of chloride of calcium is poured off from the manganese.

In presence of atmospheric oxygen and chlorine, a quantity of oxide of manganese and hypochlorous acid is formed, the latter of which combines with the lime, and remains behind as hypochlorite of lime. The mixture of peroxide of manganese, chloride of calcium, and hypochlorite of lime, I treat in the usual way with liquid muriatic acid; chlorine gas is evolved in consequence of the action of this acid, on the one hand upon the permanganate, on the other upon the hypochlorite of lime, which is conducted into chambers for the recovery of the chloride of lime. A mixture of chloride of manganese and chloride of calcium remains behind in the receivers. I treat this again with excess of lime, and obtain once more the above named mixture of manganese, chloride of calcium, and lime.

The dissolved chloride of calcium is drained off, and a mixture of manganese and hydrate of lime remains behind, which is preserved for future operations of the same kind, as it is converted by the action of chlorine and atmospheric air into peroxide of manganese, chloride of calcium, and liquid hypochlorite of lime.

It follows from this;—

1. That first of all, by the action of gaseous muriatic acid, air or oxygen in the retorts containing peroxide of manganese or a mixture of it with lime heated to a red glow, a quantity of pure chlorine is produced, which passes into the chambers fitted for the preparation of the dry hypochlorites.

2. That the mixture of pure chloride of manganese and chloride of calcium left behind in the retorts being decomposed by means of atmospheric air (oxygen), mixtures of gas are generated, containing chlorine and oxygen. These mixed gases, on their way through the receivers containing the mixture of manganese and excess of lime, convert this mixture into peroxide of manganese and liquid hypochlorite of lime, which, on being treated with liquid muriatic acid, yield up chlorine; the latter is also conducted to the chloride of lime chambers. Instead of treating the mixture or manganese and excess of lime, as before said, with the chlorine mixed with air, as it comes from the retorts, milk of lime may be simply used, which is then converted into hypochlorite of lime. The latter yields pure chlorine just as the mixture of permanganate and hypochlorite of lime, when treated with liquid muriatic acid, which is then conducted to chambers used for preparing dry chloride of lime. The chloride of calcium left behind as a solution at these different stages is heated in receivers with carbonate of magnesia, or with magnesia and carbonic acid gas, by which carbonate of lime and chloride of magnesium is produced. The latter yields, on distillation, muriatic acid, which is utilized for the production of a further quantity of chlorine. The distillation products of magnesia are employed for a fresh decomposition of chloride of calcium solution. The whole of these reactions leads consequently to the following results:

a. The oxides of manganese employed for the recovery of chlorine are continually renewed.

b. The muriatic acid is entirely utilized for the production of chlorine.

c. All the chlorine evolved is pure, consequently quite fitted for the preparation of dry hypochlorites.

II. The second method differs from the one previously described only in this, that I employ magnesia directly in place of lime, since the resulting chloride of magnesium remains unchanged, and can supply again, by simple distillation, the muriatic acid required.

Patent Decisions of the Courts.---United States Circuit Court, Southern District of New York.

The Wet Tan Furnace Patent.

BLACK *et al. vs.* THORNE *et al.*

A suit in equity, brought by Charles N. Black, as administrator of the estate of Moses Thompson, deceased, and Eliza W. Fitzgerald, as administratrix of the estate of Wm. P. N. Fitzgerald, deceased, against Samuel Thorne, James McFarlane, and Jonathan Thorne, Jr., engaged in business under the firm name of Thorne, McFarlane & Co.

This suit was brought on two patents of Moses Thompson, the original patent having been granted to him April 10, 1855, and extended April 8, 1869, for seven years from April 10, 1869. The second patent was granted December 15, 1857, and extended for seven years from December 15, 1871.

The contest between the parties has been very severe. The suit was brought after the extension of the 1855 patent and before the extension of the 1857 patent. The extension of the 1857 patent was strenuously opposed by the same parties who have conducted the defense of this suit, and on substantially the same evidence, on the question of the novelty of the inventions covered by that patent, which is adduced on the same question in this suit. It appears from a paper in evidence that seventeen different persons and firms, including the defendants, representing thirty-eight tanneries, including the three tanneries involved in this suit, have joined together to resist the claim of the plaintiffs under the said patents, agreeing to share *pro rata* all legal expenses incurred in defending against said patents. The defense of this suit has been conducted under that arrangement.

The answer sets up that the 1857 reissue of the 1855 patent was obtained by Thompson for the purpose of further including therein, and did include therein, more than Thompson originally contemplated, specified or showed to be his alleged invention on the application for his original patent, and matter which he had no right to include and claim therein, and that such reissue is not for the same invention as the original patent of 1855, but is for inventions and things substantially and materially different. It also sets up that the first claim of such reissue is invalid, because it is indefinite and equivocal, and does not refer to the process specified and described in the language preceding such claim. It avers that the extension of the 1855 patent was obtained by misrepresentation and fraud, and denies any infringement of either patent. It sets up want of novelty in regard to both patents, and specifies, in respect to each, prior knowledge by nineteen persons, and prior description in eight printed publications, fourteen English patents, and two United States patents. Twenty-six witnesses have been examined on the part of the defendants and twenty-one on the part of the plaintiffs. Of these, two on each side are chemical experts—Benj. Silliman and Wm. H. Plumb for the plaintiffs, and Chas. F. Chandler and Adolph Faber du Faur for the defendants. The printed case on the part of the plaintiffs covers over six hundred pages; that on the part of the defendants covers nearly one thousand printed pages. The direct examination of the plaintiffs' experts occupied six days, and covers sixty-five printed pages, embracing seventy-six interrogatories. The cross-examination of those experts occupied twenty-five days, and covers two hundred and seventy-two printed pages, embracing six hundred and five interrogatories. The direct examination of the defendants' expert, du Faur, occupied six days, and covers fifty-six printed pages, embracing one hundred and fifteen interrogatories. The cross examination of the same expert occupied seven days, and covers sixty-seven printed pages, embracing three hundred and thirty-one interrogatories. The direct examination of the defendants' expert, Chandler, covers fifteen printed pages, embracing thirty-two interrogatories. He was not cross-examined. These observations are made for the purpose of showing how thorough has been the investigation of the question at issue.

Judge Blatchford fully sustains both patents, and closes his decision as follows:

It is satisfactorily shown that the wet tan furnaces of the defendants, in their tanneries at Albion, Laporte, and Thorndale, which are the three proceeded against, infringe each of the patents. All of the claims of each patent are infringed by the furnaces at Albion and Laporte, and all, except, perhaps, the second claim of the reissue of 1857, are infringed by the furnace at Thorndale.

The claims of the Thompson patents are none of them successfully attacked on the ground of a want of novelty. There is nothing in the Crockett furnace, or the Morrison furnace, or the Woodstock, Sparrowbush, or Newark furnaces, or any of the other American furnaces adduced in evidence, so far as such furnaces are shown to have existed, in construction or in description or drawings, before the dates of Thompson's inventions, which destroys the novelty of those inventions. So far as such furnaces burned wet fuel successfully before Thompson's inventions, to what extent they did, they did so on different principles from those developed by him, and in structures arranged and operated in a manner not embraced in his claims. In regard to all the foreign patents and publications put in evidence, it is sufficient to say that none of them anticipate Thompson's inventions. It is not an unimportant consideration that both of his patents have been extended by the Patent Office after, as there is every reason to believe, a full consideration of substantially everything on the question of novelty that is brought up in defense in this suit.

It is apparent from the evidence that Thompson was the first to discover and put in practice the true method of economically burning wet fuels and obtaining from them better results than from equal quantities of dry fuels. In respect to the tanning business, tanners can by his inventions certainly obtain all the heat they need by the use of no other fuel than their spent tan, wet from the leaches. The combined resistance by them to his patents is a tribute to the merits of his inventions.

I have examined with care all the evidence taken in this case, and considered the views advanced by the counsel for the defendants, but I am unable to resist the conclusion that the plaintiffs have fully established their case.

As to the point that the cause of action respecting the furnace at Albion arose in the Northern District of New York, where that furnace is situated, the objection is one which may be voluntarily waived. The defendants in this case have waived it by not raising it in their answer.

There must be a decree for the plaintiffs for a perpetual injunction and an account, with costs.

Chas. N. Black, for Complainants.

A. J. Todd and *C. A. Seward*, for Defendants.

Fire Arm Patent.

RENWICK *et al. vs.* POND.

This was a suit in equity, brought by E. S. Renwick, W C. Hicks, H. Smith, and D. B. Wesson against Chas. H. Pond for the alleged infringement of letters patent for an improvement in fire arms, granted W. C. Hicks, March 10, 1857, and reissued a second time January 18, 1870.

The answer of the defendant sets up a prior description of the invention in the said patent to Smith and Wesson of the 14th of February, 1854, and in a patent granted by the United States to George W. Morse, October 28, 1856; and also prior knowledge and use of the invention by various persons named. It also sets up that the invention had been, with the knowledge and consent of Hicks, in public use and on sale more than two years prior to the application by him for a patent therefor. It also sets up that the reissue of March 1, 1870, was obtained by Hicks for the fraudulent purpose of enabling him to include therein matters of which he was not the original and first inventor, and that it includes such matters, and that they, on the face of the patent, (especially in connection with the state of the art as it existed at the date of the original patent and subsequently), clearly appear to be different from the invention described and claimed in the original patent, and that the reissue is, therefore, void.

It is insisted by the plantiff that the defendant has infringed the first three claims of the patent by selling fire arms manufactured by the Winchester Repeating Arms Company, of New Haven, Connecticut, containing the inventions covered by those claims.

Judge Blatchford, in his decision, sustains the patent and says:

There can be no doubt, on the evidence, that Hicks was the first person who devised a practical mechanism for certainly withdrawing a loaded cartridge from its chamber in a breech loading fire arm under all conditions, as well when its rim or flange has not been expanded by the blow of a striking instrument as when it has been so expanded, by effecting such withdrawal through the engagement, within the periphery of such chamber, of a hook, actuated automatically, with a metallic flange forming part of the cartridge. In devising such mechanism, he made an important invention. Sometimes it is desired to withdraw the loaded cartridge without attempting to fire it. Before the invention of Hicks, the only certain means of doing so was to insert a rammer in the muzzle of the barrel of the fire arm and push the cartridge out through the breech end. This was dangerous, because liable to cause the cartridge to explode by striking its fulminate against the breech-closing piece.

No such combination and arrangement as that described in the patent to Hicks, and covered by his first three claims, to effect the result of withdrawing an unexpanded loaded cartridge, existed before his invention. The same combination and arrangement, operating in substantially the same way, to effect the same result, is found in the defendant's fire arm.

There is nothing to impeach the validity of the plaintiffs' patent, and it is established that the defendant's arm in fringes the first three claims. There must be a decree for the plaintiffs for an account in respect of such infringement, with costs.

E. W. Stoughton and *Geo. Gifford* for Complainants.

J. S. Beach and *Keller & Blake* for Defendant.

METEORIC IRON FROM GREENLAND.—The iron had the appearance of gray pig iron, its fracture being partly leafy and partly granular; it had no action on a copper solution unless in contact with ordinary iron, when it became quickly covered with copper. The specific gravity was 5·82 at 20°C. Heated to redness, it evolved about one hundred times its volume of gas. The oxygen in it, determined by loss on heating in a current of dry hydrogen, was found to form 11·09 per cent of its weight. An analysis showed: iron, 80·64; nickel, 1·19; cobalt, 0·47; phosphorus, 0·15; sulphur, 2·82; carbon, 3·69; oxygen 11·09; total, 100·05.

STABILITY OF DYES.—Professor Chevreul has made an extended series of experiments on the stability of dyes imparted to silk, more particularly damasks and fabrics used in furnishing. The blue colors produced by indigo are fast and stable; Prussian blue resists moderately the action of air and light, but not of soap; scarlets and carmines produced by cochineal and lac dye are fast; the fastest yellows on silks are produced by weld.

THE newly discovered Colorado silver ledge is reported to be sixty-three feet in width and five miles long, and produces $5,000 to the tun, more or less.

IMPROVED GRATE BARS AND BEARER.

Our engravings illustrate a new form of grate which, it is claimed, is not only of unusual durability, but it also offers the advantage of a considerable saving in the cost of fuel. Fig. 1 shows a perspective view of the bars, of which a suitable number are joined together to form convenient sized sections.

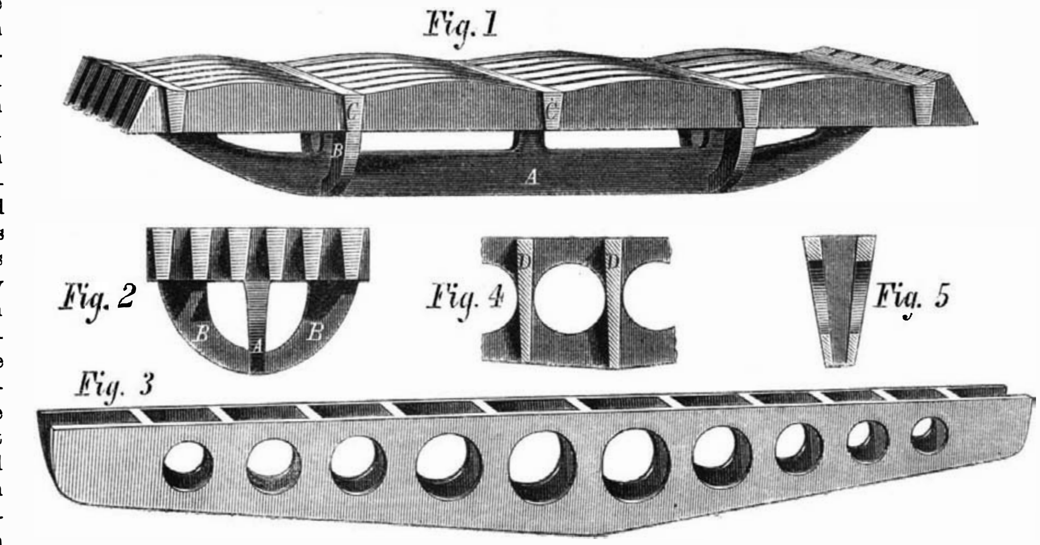
A is a longitudinal brace, to which are attached the transverse bridges, B B, of one of which an end view is shown in Fig. 2. The same illustration represents an end section of the bars, and the manner in which the latter are connected by the transverse blocks, C. It also will be noticed that the interstices or slots between the bars are widest at the bottom. The upper surface of the grate is corrugated, the object being to give an equal amount of metal at every point, and thus obviate the warping due to unequal contraction and expansion. There is also another and important advantage gained by this mode of construction. On the perfectly flat surface which would be afforded were the bars even on top, a thick layer of coal would easily pack, and, forming clinker, would make an air-tight covering, and thus effectually hinder the draft. This difficulty, it is claimed, is entirely avoided by the corrugations, which admit of a free circulation of air under the fuel, from the fact that there will always be portions of the bars—generally the lowest points of the curves—on which the coal will not directly rest, so that open spaces will be formed, through which air can pass. Moreover, the irregular surface serves as a guide to the fireman to inform him, in cleaning the fire, when his slice bar has reached the grate. The shape of the interstices between the bars, to which attention was directed above, is favorable to the ready passage of the ashes, while it aids in preventing clogging by clinker or otherwise.

The ends of the bars are open and beveled as shown, the points of the extremities of two contiguous sections meeting on the upper surface of the bearer. This construction, as will be more clearly apprehended when considered in connection with the form of the bearer, by affording open ends, admits of a free circulation, and also prevents the bars from warping, and thus becoming useless before they are half worn out.

Fig. 3 represents a side view of a bearer on which the sections of grate rest. Figs. 4 and 5 are respectively longitudinal and vertical sections of the same. The bearer consists of two parallel bars pierced with a number of circular openings and connected together by transverse pieces, D D. The appliance is, therefore, in fact, a frame which, from the small amount of metal it contains, opposes but slight resistance to the passage of the draft. It is evident that a prominent merit of this invention is the ingenious combination of the hollow bearer and open ends of the sections of bars, so that the part of the grate which, in ordinary use, is the most liable to become packed and difficult to keep clean, is here as free and as clear as any other portion. A uniform circulation of air is consequently afforded through the entire length of the grate, and also a transverse current through the open supports on the under side.

The device, we are informed, has been thoroughly tested for a considerable period of time, during which a continuous fire has been maintained. The result of a year's experiment at the Jersey City water works, at Belleville, N. J., was a direct saving of ten per cent in cost of both fuel and grates. Other testimonials appear to substantiate fully the claims advanced.

Three patents (two dated Aug. 2 and Nov. 1, 1870) have been granted on this invention: one for the bearer and two for the bars. Further information may be obtained, by letter or otherwise, of the inventor, Mr. William Kearney, engineer, Jersey City water works, Belleville, N. J.



KEARNEY'S GRATE BARS AND BEARER.

Railroad Accidents.

During the month of September last, there were seventy railway accidents in this country, from causes as follows: Unexplained, 16; by cattle, 5; by misplaced switches, 3; by spreading of rails, 3; by broken axles, 2; by open draw, 1; by broken beam, 1; by defective rail, 1; by fallen rock, 1; by rail removed for repairs, 1; by running through switch, 1; by breaking train in two, 1; by broken tire, 1. Collisions; Head collisions, 13; rear collisions, 11; unexplained, 3; crossing collision, 1; boiler explosions, 2; broken bridge, 1; fire, 1; broken car wheel, 1; total, 70.

These seventy train accidents caused the death of 22 and more or less severe injury of 100 persons. By the collisions 19 were killed and 69 injured by the head collisions alone. In the 37 derailments, one person was killed and 28 injured, and in 24 out of the 37 of these accidents, no one was hurt. The other two persons killed lost their lives by the breaking of a bridge, by which also two of the other three wounded persons were hurt, the other suffering from a boiler explosion.

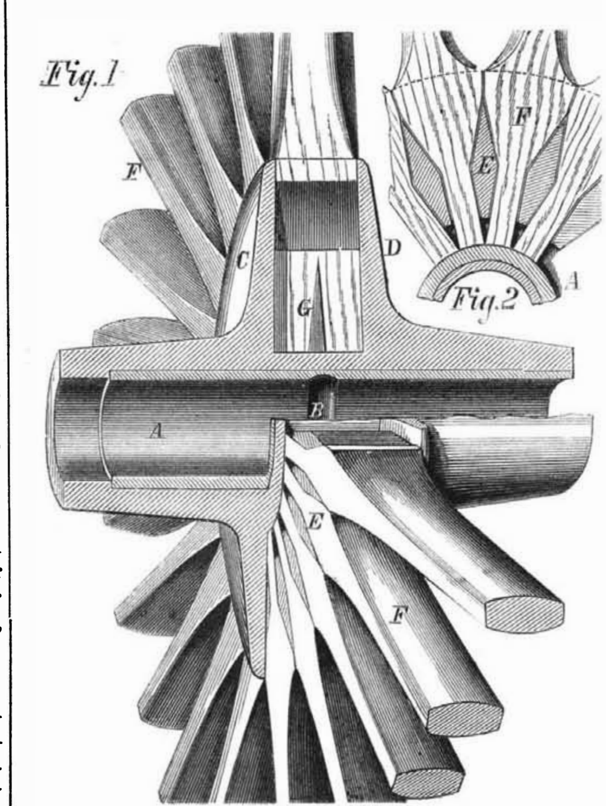
Salt Production in Portugal.

The sea salt works of Portugal are very extensive, and produce annually 250,000 tuns of a salt which is in great request. The centers of the manufacture are Setubal, Lisbon, Aveiro, and Algarve. The arrangement of the salines at Setubal is very simple. They form a vast reservoir 2½ to 5 acres in extent, divided into squares of 400 to 650 feet in surface, and 8 inches deep, separated from each other by roads 3½ feet wide, and all communicating with a main reservoir destined to store up the sea water. The water is admitted directly into these square tanks, where it evaporates and deposits its salt without any previous concentration or purification. In autumn, the water is allowed to flow in so as to cover the entire salt marsh to the depth of 20 inches. In spring the water evaporates, and in the month of June the separation roads appear above the surface. The tanks are then cleaned out and are then left to themselves, and recharged from time to time with new supplies of water.

Under the influence of the northeast winds which prevail at this season, the evaporation is very rapid, and after about twenty days each tank is covered with a layer of salt nearly two inches thick and almost dry. This is the first crop. The salt is collected, sea water is introduced anew into the reservoirs, and twenty days afterwards a second crop of from a half to one inch in thickness is gathered. But this is not evaporated to dryness, and the salt is covered with nearly an inch of mother liquor, which is left behind on gathering the salt. If the season is favorable a third crop is attempted, and in September the marsh is flooded over for the winter. This process is repeated each year without any modification.

FETTA'S IMPROVED WAGON WHEEL.

The invention illustrated herewith consists in a new method of constructing wheels for vehicles, by which greater strength



and a more secure fastening together of parts is obtained. The hub is a single piece of cast metal recessed to receive the lining, of Babbitt metal or other non-frictional material, which forms a bearing for the axle. In Fig. 1, a sectional and perspective view of the general arrangements is represented. A is the axle bearing, grooved as shown at B, in order to furnish a reservoir for the lubricating substance. On the hub are two circumferential flanges, C and D, which are connected by a series of ribs, E, made in double wedge shape, as shown in Fig. 2. The tenons of the spokes, F F, having their sides tapered radially, fit in the divisions made by the ribs, E, and reach nearly to the metal at the bottom of the mortises, where they come in close contact with each other, forming the arch around the hub.

In Fig. 1, it will be noticed that the space at the bottom of the mortise, measured in the direction of the axis of the hub, is greater than at the top. This permits the tenon to be firmly wedged in place by slitting its lower end and inserting a wedge, G. The spoke is then driven, and the butt end of the wedge, coming in contact with the bottom of the mortise, is forced in, causing the tenon to spread and fit tightly, so that all danger of the spoke becoming loosened, through shrinkage of the wood or other cause, is prevented. Patented Aug. 27, 1872. For information relative to the furnishing of castings, sale of rights, etc., address the inventor, Mr. H. H. Fetta, Richmond Malleable Iron Works, Richmond, Ind.

Alcohol from Sawdust.

Into an ordinary steam boiler, heated by means of steam, were introduced 9 cwts. of very wet sawdust, 10·7 cwts. of hydrochloric acid (sp. gr.=1·18), and 30 cwts. of water; after eleven hours' boiling, there was formed 19·67 per cent of grape sugar. The acid was next saturated with chalk, so as to leave in the liquid only a small quantity (¼ degree by Ludersdorf's acid areometer); when the saccharine liquid was cooled down to 30°, yeast was added, and the fermentation finished in twenty-four hours. By distillation there were obtained 26·5 liters of alcohol of 50 per cent at 15°, quite free from any smell of turpentine, and of excellent taste. It appears that the preparation of alcohol from sawdust may be successfully carried on industrially when it is precisely ascertained what degree of dilution of acid is required, and how long the liquid has to be boiled. When all the cellulose present in sawdust might be converted into sugar, 50 kilogrammes of the former substance would yield, after fermentation, 12 liters of alcohol at 50 per cent.—*M. Zetterlund.*

Action of Salts of Lime upon a Decoction of Cochineal.

A black colored carminate of lime is obtained by treating carminic acid or a decoction of cochineal with a solution of bicarbonate of lime, whereby an abundant precipitate is formed, which is insoluble in water and alcohol, and yields with lime water a violet-colored basic carminate of lime; while, when the black carminate is heated along with a solution of neutral acetate of lead, there is formed a bluish violet-colored carminate of lead. It is necessary to employ, in these reactions, lime salts quite free from iron, because the decoction of cochineal is precipitated by the salts of that metal, yielding with it black colored compounds. It appears that the action of salts of lime upon cochineal is so characteristic that it may be used as a test for lime; the author states that several commercially sold products, such as glue and starch, for instance, which have been prepared with water, containing lime salts are colored black by a decoction of cochineal.

Fine Wire Cloth.

Would any ordinary person conceive it possible that brass and copper wire could be woven of so fine a mesh that the number of perforations, or *holes* as they are technically called, exceeds 19,000 in a square inch of surface? Such, however, is proved to be possible; and, moreover, these perforations are so regular and uniform that they may be readily counted by a magnifier of small power. Fine meshes such as these are seldom used by paper manufacturers, but chemists occasionally sift their impalpable powders through them; indeed, they are exhibited more as curiosities, to show the extremely fine threads of wire which may be woven, rather than for the use to which they are put by ordinary manufacturers.

The chief meshes of woven wire used in the manufacture of paper are comprised between those of 2,300 and 6,400 holes to the square inch. Brass webs of these meshes are woven in lengths of 30 or 40 feet, ranging between 4 and 10 feet wide; they are finished by joining their ends together so as to make endless bands, and are then ready for use on the paper machine as a band of "paper machine wire." Several of these paper wires are exhibited by Mr. Potter of Barbican, London, at the International Exhibition; some suitable for machines on which coarse browns are made, others for making fine writing paper, and the rest of fine mesh adapted to meet the requirements of thin tissue and cigarette paper makers. Mr. Potter also exhibits paper molds watermarked for the hand made process, millboard molds of a new and improved kind, specimens illustrative of the methods adopted for making watermarks, and various models of larger machines connected with paper manufacture.—*Chemical Review.*

FIREPROOF PAINT FOR WOODWORK.—Owing to the fact that waterglass is gradually dissolved out of the wood, while chloride of zinc is volatile at the temperature where wood ignites, the author, F. Sieburger, proposes the following: Two coats of a hot saturated solution of 3 parts alum and 1 part ferrous sulphate are first applied and allowed to dry. The third coat is a dilute solution of ferrous sulphate into which white potter's clay is stirred until it has the consistency of good water colors. Another method is to apply hot glue water as long as it is absorbed into the pores of the wood. A thick coat of boiled glue is then applied, and, while fresh, is dusted over with a powder composed of 1 part sulphur, 1 part ocher of clay, and 6 parts ferrous sulphate.

A CORRESPONDENT of the *Philadelphia Photographer* strongly recommends the following as the best retouching varnish he has ever seen: Spirits of turpentine, 1 ounce; balsam of fir, 4 drops. With a small tuft of clean cotton, just moisten the surface of any previously varnished negative, and, when dry, it is ready for any grade of pencil. Try it, and you will be pleased with the result.

Scientific American.

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Contents:

(Illustrated articles are marked with an asterisk.)

THE MOLECULAR PHENOMENA OF EVAPORATION.

A correspondent writes from Tennessee to ask us : "Why is not all the water in a steam boiler converted into steam at once ? Might it not be possible for such an event to occur under certain circumstances ?" Our readers, if desirous of obtaining a solution of the question, will find all the information required in back volumes of the SCIENTIFIC AMERICAN, under the head of "Mechanical Equivalent of Heat and Evaporation;" but it may be useful to make here a *resumé* that will give satisfaction to our correspondent and will afford information to those who are unable to look it up for themselves.

The labors of scientific men, in the field of experimental investigation, have shown, as we have often had occasion to state, that heat and mechanical energy can both be measured by similar effects, can be converted, the one into the other, and that they have definite and well known quantitative relations to each other. One pound of water requires an amount of heat to be communicated to it, for each degree Fahrenheit that its temperature is raised, which is equivalent in energy to the mechanical action required to raise 772 pounds one foot high. In other words, as usually expressed, a thermal unit has a mechanical equivalent of 772 foot pounds. The combustion of a pound of coal liberates an amount of heat which, although variable, may be taken, with good fuel, as equal to about 13,000 thermal units.* The evaporation of a pound of water from, say, 60° Fahrenheit and at 75 pounds pressure, requires the expenditure of 260 units of heat to raise it to the temperature of 320° Fahrenheit, which is its boiling point; and then, before it can be compelled to expand into steam of 75 pounds pressure, an amount of work must be done which demands the expenditure of 891 additional thermal units, equivalent to the enormous quantity in mechanical work of 697,852 foot pounds, enough to raise over three tuns to the hight of 100 feet. We then have a pound of steam at a pressure, as indicated by the steam gage, of 75 pounds per square inch and occupying a volume measuring a trifle over five cubic feet. The evaporation of steam of 150 pounds pressure would require about one per centum more heat than has just been estimated, and a pound of it would occupy about three cubic feet. A moment's calculation will show that a pound of our fuel is capable of developing heat enough to evaporate about 11 pounds of water from 60° Fahrenheit, but, in practice, a considerable proportion is invariably wasted, and an evaporation of 8 pounds into dry steam is an unusually good result.

If, then, a pound of fuel is burned under an ordinary steam boiler, not more than about 8 pounds of water can be vaporized, for the simple reason that the fuel only supplies just heat enough to evaporate that amount; and if the fuel occupies one minute in combustion, the boiler can only deliver eight pounds of steam per minute. If the supply of heat is cut off, the evaporation of the water ceases at once; if the heat is supplied rapidly, steam is made rapidly, and is always at a rate precisely proportioned to the rate at which heat is applied. We can conceive of no circumstances under which the fuel can supply sufficient heat to evaporate all the water in a steam boiler in any very short space of time.

*Report of Committee on Steam Boiler Trials; American Institute, 1871.

INDUSTRIAL PROGRESS IN RUSSIA.

Next to our own country, there is no nation in the world that gives evidence of such rapid progress in industrial matters as Russia. Her mechanical and metallurgical interests are almost daily developing, and new means of utilizing her great resources are constantly coming into existence. The correspondence of the Brussels *Chronique de l'Industrie* informs us of a gigantic establishment recently founded by MM. Struve Brothers, situated near the city of Kolom, which, it is stated, rivals in magnitude the finest workshops of England or Belgium. It has been in operation but five years, and is at present engaged in the manufacture of iron bridges and railroad freight cars, though recently locomotives and passenger coaches have also been produced. At times during the year just past, the works employed 4,000 hands, at wages of from one rouble (78 cents) and one rouble and a half per day for ordinary operatives to three roubles for foremen. The fuel used is Torbane mineral, the anthracite of the country and coke; the blasting and melting apparatus was obtained from England. To give an idea of the importance of the establishment we may add that since its foundation it has completed 3,000 cars; and since it has begun the manufacture, 79 locomotives have left its shops.

THE AURORA BOREALIS.

On the evening of the 14th of October, a magnificent display of the aurora borealis was visible in many parts of the United States. In New York city, the suffusion of the sky began with the coming of darkness, and at eight o'clock the north threw out a brilliant belt of rose light that mounted to the zenith and deepened in color till over the city a belt of richest crimson seemed suspended. For hours this tint, varying in intensity from the faintest blush to the most brilliant carnation, and moving from north to east by gradual pulsations, rested in the heavens. At eleven o'clock the northwestern horizon sent forth shafts of a steel blue light and of a white light, sheeny like quicksilver, that tremulously darted directly overhead, while the intermediate space between these shafts and the ruddy eastern section of the sky seemed shut out from us by a pale green curtain, that rose and fell at intervals, and that had for its floor a horizontal line of dun colored cloud edged with gold.

At one period, the glare that lit up the heavens was so brilliant that one of our local fire companies became convinced that an extensive conflagration was in progress, and consequently rushed tumultuously to put it out. The only result of this enthusiastic performance was, we learn, the demolishing of a horse car, with which the heavy hose cart collided.

A correspondent in Westville, N. J., informs us that, at the time the phenomenon first appeared in that locality, about half past six, P. M., the sky was over two thirds clouded, and the auroras, which at times were very brilliant, appeared to be at least two hundred feet lower than the clouds.

The enterprising scientist who writes up auroras for the *Herald* will now doubtless propound a new theory. He has already advanced two ideas, as striking as they are ingeniously novel. The first is that the zodiacal lights are due to the reflection of the rays of the sun on minute ice crystals in the upper strata of the atmosphere; and the second, that the light is caused by a similar reflection of the above mentioned luminary on the ice fields of Labrador. Our witty contemporary, the *Commercial Advertiser*, sarcastically dissents from the "*Herald's* Aurora Borealist," as it terms the philosopher, and proposes for his consideration the theory that the aurora is not due to the causes he suggests, but to the phosphorescent glare of the immense heaps of decaying mackerel situated somewhere in Upper Canada.

STEAM ON THE CANALS.

Another new canal boat, a candidate for the $100,000 prize, named the William Baxter, has recently made some successful trips on the Erie Canal. This boat exhibits no special peculiarities of construction or propulsion. She is fitted with a pair of ordinary screw propellers, which are operated by Mr. Baxter's new steam engine. It is upon the economy resulting from the use of this engine that the inventor relies to obtain that advantage, over horse power in the propulsion of canal boats, which alone is what the prize law calls for. The boat has made trips from Buffalo to New York and back, carrying some 200 tuns of freight on 10 tuns of coal for the round trip. Total steam expenses, 12½ cents per mile. Towage by horse power costs 35 cents per mile.

The parties interested in the Baxter are reported to be so well satisfied with the success of the present boat that they intend to put a fleet of fifteen or twenty of them on the Erie Canal, on the opening of navigation in 1873.

A FEARFUL HORSE EPIDEMIC.

A virulent epidemic disease has broken out among the horses, which within the past few days has spread with such alarming rapidity as to create a well-founded apprehension lest it prove a formidable pestilence throughout the entire country. The disorder first appeared in Toronto, Canada, where it reached such a hight as to necessitate the stoppage of all business depending upon drayage and the running of the public conveyances. From that city, the infection spread to Montreal and Ottawa on one side, and to Western New York on the other, appearing at Buffalo and Niagara Falls, and within three days breaking out in Rochester. Thence its march can be distinctly traced to the eastward to Albany and Troy, and thence southward along the banks of the Hudson, until, at the time of writing, it is causing terrible havoc among the horses of New York city.

The disease is termed by veterinary surgeons "Epizootic influenza;" but no cause has been assigned for its sudden appearance. The early symptoms are a light hacking cough and general dullness, with an indisposition to move, cold ears and legs, with a watery discharge from the nostrils. At first, the nasal membrane is pale; but, as the disease advances, it becomes highly colored, and the mucous flow changes to a greenish or yellow color, the pulse becoming more rapid. The malady is common to horses of every class, those carefully attended in private stables becoming affected as quickly as the animals in the street cars and stages.

There seems to be little difference of opinion as to the proper course of treatment to be pursued. We select the following prescriptions as vouched for by the best veterinary authorities. As soon as the disease appears, place the animal in a well ventilated stall, blanket him thoroughly and give warm mashes, allowing perfect rest. Wash the entire stable with a solution of carbolic acid or with carbolic or cresylic soap, and sprinkle chloride of lime freely around every morning. The food should be laxative and mingled with water. Bran, with a little oats and a moderate quantity of hay, may be given. Administer the following prescription: Nitrate of potash, 1½ oz.; tartarized antimony, 1½ oz.; digitalis, ½ oz. Pulverize all together and make 12 powders—give one every morning and evening. Should the disease be light, omit the digitalis. If the throat seems very sore, rub upon it a liniment composed of a mixture of 1½ oz. linseed oil; 1½ oz. turpentine; 1 oz. liquor ammoniæ fort. Tar, dissolved in fluid extract of belladonna, is in some cases used as a substitute for the first mentioned remedy. So long as the disease is confined to the larynx there is little danger; but should it descend to the lungs—which will be indicated by the continued standing up of the animal, cold extremities, and labored breathing—a half pound of mustard should be mixed with two ounces of turpentine and water to the consistency of thick cream, and the mixture rubbed well in behind the fore legs and over the region of the lungs. The legs should be bandaged, if cold. If the pulse should be over fifty-five per minute, 15 drops of Flemming's tincture of aconite should be given every two hours; and if the breathing still continues labored and the pulse grows more rapid, apply the mustard again and give 1½ drams of calomel for two mornings.

This treatment is, in substance, that practiced in nearly all the large stables of the city. Tar seems in many cases to be a favorite remedy, and is given in different forms. Taylor's compound, manufactured by the Manhattan Feed Mill Company, is used by some, and is regarded as an excellent preventive. It looks like meal, and has a salty taste; not being posted as to its ingredients, we are unable to vouch for its value.

We advise all in whose sections of the country the pestilence has not yet appeared to lose no time in preparing for it, by cleansing and disinfecting their stables as above stated, and by exposing their animals as little as possible to the inclemency of the weather. The seed of disease once planted, it spreads with astonishing rapidity. No less than seven thousand horses were stricken in this city within twenty-four hours. Happily, but few cases have been fatal; nor is it believed that the malady will be productive of great mortality if promptly met. Still, its attacks are very injurious, incapacitating the animal for work for a considerable period of time, and, in many instances, rendering him permanently useless.

THEOLOGY VS. SCIENCE.

The observations recently given by us under the above heading have so far served the purpose intended, namely, to direct general attention to this most important subject, and to elicit responses both of assent and dissent, specimens of which we have published.

As we expected and hoped, the religious press is now taking the matter up; and in the different organs of the many conflicting orthodox sects, into which, alas! this Christian community is divided, we are overhauled more or less severely, according to the degree of importance which the individual editors accord to common sense and reason. The *Lutheran Standard*, published in Columbus, Ohio, in a lengthy article entitled "Oppositions of Science, So-called," bewails the fact that "times have changed and Science has become haughty and arrogant," and that "reason usurps the place of faith," and further, that "the abuse of Science has brought it into contempt, and men of superior abilities, which believe in the Lord, decline to labor in a field which is largely occupied by self-sufficient scoffers at Divine revelation. Thus the domain of physical science is in danger of being entirely given over into the hands of infidels," etc. And then the editor uses the following remarkable sentence: "In a late number of the SCIENTIFIC AMERICAN, the editor, mistaking *a certain species of theology which admits of sense and reason* as a criterion in matters of faith for Christian theology proper, exultingly alleges that whenever science and theology have occupied antagonistic ground, the former has triumphed, while theologians had to give in, and acknowledge, however reluctantly, these triumphs." (The italics are ours.)

We are here informed that we were mistaken if we supposed that Christian theology proper recognizes the authority of sense and reason as a criterion in matters of faith, that it is only *a certain species of theology* which is guilty of such a criminal theory, and that thus the primary cause of our erroneous conclusions is that we recognize the claims of common sense and reason as a criterion of what we have to believe. Now we take the liberty to ask our theological critic: How are we to know which are the genuine Divine revelations which we must believe, if we are forbidden the use of sense and reason? How are we to decide in our choice between the Bible, Talmud, Mormon Bible, Koran, Sendavesta or the writings of Confucius or Zoroaster, which all claim to be direct Divine revelation? How are we to decide which version of the Bible must be our guide? How are we to decide between Romanism and orthodox Lutheranism, which both reject sense and reason? What will guide us in the intricate labyrinth of mutually conflicting Christian sects, so as to find the truth?

The very same page, on which science and its advocates are overhauled by our ultra orthodox Lutheran critic, contains a remarkable revelation of another kind, namely, that the Lutheran church is now split up into two sects, at war with one another. Dr. Seiss, one of the warmest supporters of council circles, calls the members of the Lutheran synod of Missouri, Ohio, Wisconsin, Illinois, Minnesota, etc., "poor impotent imbeciles, fascinated by the wiles of crafty and politic men, who only seek the extension of the filthy and polluted worship of themselves." The editor of the *Lutheran Standard* (our critic), who belongs to the thus abused Synod, does not relish a treatment of this sort; and by way of a revenge, among other counter accusations, he answers thus: "Dr. Seiss for years has been poisoning the flock of Christ with General Synod heresies. Has he ever publicly atoned for the sins thus publicly committed? His old General Synod liturgy is still published as before. . . . His attention has been called to the Calvinistic heresies in his book called *Holy Types*; but has he ever seen fit to inform the church that those heresies shall be expunged in future editions of the book?" etc., etc. In the same article, we are informed that the Lutheran pastor Stephan induced 707 persons to follow him from Germany to our western wilds, which they did, husbands forsaking their wives, parents their children and *vice versa*; that they trusted him with all their property, which he squandered in debauchery, leaving them to perish; and then they deposed and banished him.

If scientists are accused of arrogance in believing that common sense and reason are Divine gifts which it is sinful to despise, and that the wonders of Nature are an unquestionable Divine revelation of the power and wisdom of the Creator, what is the word which we must apply in censure of the class of men who, having such records of their own, deny the value of the greatest gifts of God to man, his sense and reason, by which alone he is above the brute: a class of men who, after all, try to use this same sense and reason to prove the necessity of adopting a written revelation for our guide in faith, despising the created revelation of the glorious Universe?

EXTENSION OF PATENTS--THE ACCOUNTS.

Applications for the extension of patents often fail from mere ignorance or inadvertence as to what is required in the accounts of receipts and disbursements. Every one is aware that the patentee must furnish a statement of what he has received by means of the invention, and what he has expended upon it, in order to satisfy the Commissioner that he has not been sufficiently remunerated. He must embrace what he has obtained for royalties, if he has given licenses; what his profits have been, if he has manufactured under the patent; and what he has collected for damages on account of infringements. All the profits which he has derived from the invention, from whatever source, should be included, even though obtained in foreign countries. On the other hand, he may charge the expenses attendant upon experimenting and on perfecting the invention, on obtaining his patent, and upon introducing into public use.

This is apparently plain, but it sometimes happens that the same mistake is fallen into as in ascertaining the value of an invention. Instead of furnishing the Commissioner with data from which he can form an independent opinion of his own as to what has been realized, the petitioner presents mere estimates as to what has been expended, and what has been obtained in return, and makes oath in general terms to correctness of the estimate.

If he has been engaged, for instance, in manufacturing and selling his productions, he frequently designates a certain proportion of his gains as being "manufacturer's profits," and the rest as profits due to the invention. He supplies no means of determining whether the sum set down as "manufacturer's profits," is a just proportion or not. It is true that this is a difficult thing to ascertain; so difficult that in England, the Board which grants extensions have declined to enter into the calculation, and have charged the inventor with all he has made over the expense of manufacturing. The practice of our Patent Office has not been entirely uniform on this point. Where the patentee had given no license, but had kept the manufacture under his patent entirely in his own hands, a pretty decided intimation was dropped that he ought to be charged with all his profits as due to the invention. In other cases, an applicant has been allowed to deduct something for manufacturer's profits, where no such refusal to license appeared. Where the patentee has not only manufactured himself but has allowed others to do so on paying him a royalty, the royalty has been considered as a fair measure of what he has realized from the invention on a corresponding amount of business transacted by himself. More frequently, no such standard can well be obtained. However difficult it becomes to divide the gains in such cases, it cannot be expected that the patentee should be permitted to determine the question, or that the Commissioner should adopt his opinion, without having any information from other sources. The applicant may be able, for instance, to show how much other manufacturers of similar articles have been in the way of making from their business. This way constitutes a fair criterion by which to ascertain how much should be deducted from the entire gains as the regular profits of carrying on such an art, leaving the remainder to be set down as derived from the invention. This will afford some idea of the preparation which should be made under such circumstances. Other methods of arriving at the result will frequently be found.

It is quite common that the patentee has made several inventions relating to the same machine, and that they have all been patented and carried on by him together. It becomes necessary then to divide the profits which have been made between the several patents, in order to decide whether the one for which an extension was asked, has been adequately remunerated. But it is quite unusual to send in any evidence as to the comparative importance and value of the several inventions, so that the fair proportion of profits to be credited to the one in question can be ascertained. Sometimes the petitioner divides their profits equally among all of them, without assigning any reason for so doing, or so much as giving an assurance that the invention under consideration would only average in value with the rest. In one instance, where the inventions covered by three patents were all used in the construction of an article, only one fourth of the net gains was credited to the patent for which an extension was asked. In view of the difficulty which frequently exists, of arriving at any such apportionment in a way that shall inspire confidence in its accuracy, very great indulgence has been shown to the suitors on this point. But the applicant, who shall show that he has endeavored to supply all the information in his power, and all the means he has of forming an intelligent estimate, may justly expect to meet with a more favorable consideration than one who manifests no such disposition to aid the Office in its inquiries.

Those who deal in similar articles are frequently able to tell, to some extent, how much each improvement on a machine adds to the expense of producing it, and how much more it will bring in market in consequence, or, on the other hand, how much it diminishes the cost of manufacturing it. From these and other like circumstances, some conclusions can be formed as to the comparative worth of each. The testimony of such witnesses might be obtained and laid before the Commissioner. It should embrace not merely their estimates, but the circumstances on which their estimates are founded. This is suggested as an illustration of the course to be pursued.

For it must be understood that there is no rule which requires such evidence, or restricts the applicant to any particular proof on these points. All that is asked by the Office is that there should be some testimony from which it can frame an intelligent opinion of its own, one which has been formed in view of what is shown to exist, without relying upon the mere naked opinions of those who are under no responsibility for them. The Commissioner is responsible; the public trust to his judgment, and has a right to the best exercise of that judgment, founded on the facts, and not on the views of others. HETH.

SCIENTIFIC AND PRACTICAL INFORMATION.

RESONANT FLAMES.

M. Planeth, says *Les Mondes*, has found that if a flame burning in the open air be approached to a vibratory tuning fork, the sound of the latter is considerably increased, as if it were placed in contact with the box of a stringed instrument. The sound acquires its greatest intensity when the flame is placed between the two branches of the fork. This phenomenon is believed to be analogous to the singing flame, only, in such case, it is the flame that excites the vibratory movement of the tube in order to place itself in similar synchronous vibrations; while, in the above mentioned instance, it is the fork that gives the tone and the flame takes up vibration in unison.

ANTISEPTIC PROPERTIES AND PHYSIOLOGICAL ACTION OF SILICATE OF SODA (WATER GLASS).

MM. Rabuteau and Papillon have called the attention of the French Academy to the influence of the silicate of soda on alcoholic fermentation, that of urine, milk, and the action which gives rise to the essence of bitter almonds. Silicate of soda, like borax, in a certain quantity hinders all manifestation of the agents which produce putrefaction; while, being much more energetic than borax, a smaller amount is required to produce the desired effect. On the superior animals, the silicate exercises a poisonous action much more pronounced than that of borax. Two grammes of borax will not kill a dog; one gramme of silicate carries sure death. The substance, in brief, from its nature is of peculiar value in suppressing the development of the infectious or virulent germs to which a large number of diseases may be traced.

SOLAR EXPLOSIONS AND MAGNETIC TEMPESTS.

The Astronomer Royal of the Greenwich Observatory in England communicates to *Les Mondes* the following: "In a recent number of the *Comptes Rendus*, I find a paper by Father Secchi regarding a remarkable explosion on the limb of the sun, visible in Rome for about three hours on the afternoon of July 7. Now a magnetic tempest manifested itself at Greenwich at five o'clock on precisely the same day. The indications commenced suddenly and with extraordinary force, acting upon the magnetic instruments in a direction of nearly northeast and southwest. The perturbations continued, diminishing by degrees, until the evening of July 9, and, during a part of the time, were accompanied by an aurora.

Though not wishing to commit myself on the question as to the connection which may exist between the solar explosion and the terrestrial magnetic storm, I have noticed that if there be such connection, the transmission of influence from the sun to the earth ought to occupy about 2 hours and 20 minutes, or somewhat longer, in case Father Secchi did not see the explosion at the precise moment of its commencement. If this point is established, it will be an important cosmic fact. In any case, the notification of this apparent retardation may direct the attention of observers of similar phenomena in the future toward a new element for interpretation."

THE ACTION OF CHARCOAL AND OF IRON AT A RED HEAT ON CARBONIC ACID.

M. Dumas, in a note of experiments communicated to the Academy of Sciences, draws the following conclusions: That carbonic acid absolutely dry, passing over charcoal entirely free from hydrogen, is converted, at a bright red heat, into carbonic oxide; that if the charcoal is in excess, the carbonic acid disappears entirely, and is replaced by perfectly pure carbonic oxide. Charcoal, to whatever degree it be heated, retains either hydrogen or water, from which it can only be freed by the prolonged action of chlorine at a red heat. Charcoal which has not been submitted to the treatment by chlorine, when used to convert carbonic acid into carbonic oxide, always yields a gas accompanied by traces of hydrogen. A slow current of dry carbonic acid is partially converted by iron, heated to a bright red heat, into carbonic oxide, a considerable proportion of carbonic acid, however, remaining unaltered or undergoing regeneration.

A DREDGING SHIP VOYAGE.

A dredging vessel, built in England for the government of the Argentine Republic, has safely crossed the ocean and arrived in Buenos Ayres from London after a 45 days passage, by way of Madeira. This is the first instance of a ship of this kind accomplishing so long a journey by her own motive power. The vessel has twin screws, is 157 feet long, and is what is termed in this country a "double ender," that is, she will sail equally well ahead or astern. She is at present engaged in dredging the harbor of Buenos Ayres.

THE STRONGEST DERRICK IN THE WORLD.

A great floating derrick has been built for the Department of Docks of this city by Mr. Isaac Newton, assistant to General McClellan, the engineer of the department. It is constructed for the purpose of transporting and laying under water the huge blocks of artificial stone or *béton* which form the lower part of the river wall which is to surround the water front of the city. The dimensions of the machine are as follows: float, 77 feet long, 66 feet wide, by 13 feet deep. Length of hoisting boom, 63 feet, 3 inches. Length of back boom, 50 feet 3 inches. Length from end to end of booms, 110 feet and 6 inches, and hight from bottom of float to top of king post, 127 feet three inches. Lifting power, 100 tuns.

There are several excellent points in its construction, among which may be mentioned a novel arrangement of the wire grip on the back boom, spreading the strain over a large section of the traversing circle. All the machinery is placed on the float under the tower, the operating levers being brought to the platform thirty-five feet above the deck, so that the engineer has full view of the load that is being handled.

HINTS FOR USING THE CALLAUD BATTERY.

In using the Callaud battery for telegraphic purposes, it often happens that the connecting wires are eaten off by its energetic action. The remedy, says the *Telegrapher*, is to attach the wire at the bottom of the copper plate, and have gutta percha to protect it all the way down to its lowest point. When oil is used on the surface of this battery to prevent evaporation, the zincs may be readily cleaned, of the deposit of black oxide with which the oil combines, by dipping them in a solution of caustic soda and water and scrubbing with a common battery brush. It is a good plan in telegraph offices to place the Callaud locals in a case with shelves and glass doors, on the walls of the room some four or five feet from the floor, in order that they may always be in plain sight.

GERMAN TELEGRAPH STATISTICS.

At the end of last year, there were in Prussia alone 3,385 German miles of telegraphs, with 11,396 miles of wire, 1,130 stations belonging to the State, and 1,485 belonging to railways. 4,956 officials are employed. In 1871, 5,213,837 domestic, 2,846,176 foreign, and 32,641 official messages were forwarded. The receipts were 2,500,007 thalers, showing a profit over expenditures of 80,469 thalers. The *Telegrapher* adds that the Prussian telegraphs, like those of all other States of Germany, are now all amalgamated and worked for account of the empire, forming a separate branch of the Chancellor's Department.

CADMIUM, TIN, AND LEAD.

A remarkable coincidence, between cadmium, tin, and lead, has been noticed by Dr. Schenck, in that the same total quantity of caloric is required to bring an equivalent of either body from a temperature of —273° C., which is assumed as that of absolute absence of heat, to a state of fusion.

UTILIZATION OF TIN SCRAPS.

A corporation known as the Manhattan Metal and Chemical Company has recently been formed in this city for the working of a chemical process for the recovery of valuable material from tin clippings. The process, which has been lately patented, is as follows: The tin scraps are first treated with hydrochloric acid of 20° Baumé until the bath is exhausted; two or three per cent of nitric acid and about one and a half per cent (of the amount of hydrochloric acid) of chlorate of potash is then added, which in a measure regenerates the bath, so that 500 pounds of hydrochloric acid is found sufficient to treat one tun of scraps. About 1,200 lbs. of clippings are placed in a drum which revolves successively in several vats or tanks charged with the liquors used in the process, being transported from one to the other on an elevated tramway. The first vat contains hydrochloric acid. The tin being dissolved, the drum is inserted in the second vat, which is filled with water, and then allowed to rotate for a few minutes. A second washing in water follows in order that the iron scraps may be completely freed from acid, and finally the drum is plunged in a weak solution of silicate of soda, which forms a coating over the scrap iron and prevents its rusting. The time required to treat one charge averages about one hour and fifteen minutes. The tin is precipitated by spelter in a metallic form ready for melting, while there remains in solution chloride of zinc and chloride of iron, which are valuable for the preparation of paint, as disinfectants, or for the preservation of timber. The estimates of the company show a gain as follows:—From one tun of 2,000 pounds tin scrap, there will be obtained 1,800 pounds best refined scrap iron, $36.00, 100 pounds pure metallic tin, $35.00, 50 gallons chloride of zinc and iron, 29° Baumé, $12.50. Total, $83.50. The total cost of chemicals, labor, fuel, etc., $29.05, leaves a net profit of $54.45 per tun.

PROTECTING PLANTS FROM FROST.

Gardeners in this country have for a long time practiced the art of protecting plants in autumn from the withering effects of frost, by building fires at night in the vicinity and to the windward of the flower beds. The smoke and rarefied air is found to be a pretty sure protection against the destruction by cold weather. At a recent congress of vinegrowers in the south of France, discussion was had on the subject of protecting vines from frost, and several practical experiments were made, the result of which was the recommendation of the smoke process as producing the most satisfactory effect. The mode of producing the smoke was as follows: Iron vessels, containing a preparation principally of tar, having been disposed at intervals over the vineyards, were set fire to, and produced thick clouds, which hovered over the land and spread for miles around.

RESULTS OF VIBRATIONS IN LIQUIDS.

The resistance of liquids destroys with great rapidity any movement of vibration which submerged bodies may possess. A cord thus placed gives a subdued sound of short duration, of which the musical tone is difficult to appreciate.

The precise determination of the nodal points is a matter of considerable difficulty when the cord is covered by the liquid, especially if observed by the naked eye. In order to render the nodes clearly visible, M. Gripon, in *Les Mondes*, says: "I cause an electric current to pass through the cord so that hydrogen is generated from the decomposition of the surrounding water. A platinum wire placed in the fluid serves as a positive electrode. By causing the cord to vibrate, bubbles of hydrogen detach themselves therefrom and describe in the liquid small ellipses, of which the axes diminish in size according as a node is approached. These bubbles form two contiguous spindles, of which the common summit marks the nodal point. The general result of these experiments is that the distance of the consecutive nodes, or the length of a cord or of a rod which makes a determinate number of vibrations, is less in liquids than in air."

WATER NOT AN ELECTROLYTE.

Bourgoin has investigated this subject experimentally, and has proved that water is not itself an electrolyte. His apparatus consists of a cell divided into two equal compartments by an impermeable septum, which septum is pierced with an opening so minute as to prevent any mixing of the liquids on its two sides, while yet it allows the passage of the current. The cell is so arranged that the gases evolved from the electrodes may be collected and measured. Both compartments are filled with water acidulated with sulphuric acid, and the current is passed for a given time, the hydrogen being collected. By analysis after the experiment is concluded, it is found that in the positive compartment the acid has increased in amount by a certain quantity, *x*, while in the negative, it is diminished by the same amount. But this quantity of acid can furnish only a third of the hydrogen obtained. It is therefore certain that it is not $H_2 SO_4$ which is decomposed, but $H_2 SO_4 + (H_2O)_2$ or $H_6 SO_6$. The current therefore decomposes a definite compound, $H_6 SO_6$; and $H_6 SO_6 = (SO_3 + O_3) + H_6$.

This hypothesis is proved by experiment, as it is found that the ratio of the acid decomposed to the hydrogen evolved is always that above given, which would not in all probability be the case were the acid and water separately electrolyzed. Moreover, an acid of the constitution $H_6 SO_6$ has been rendered probable by the maximum contraction observed when one molecule of $H_2 SO_4$ and two of water are mixed. In the case of nitric acid, the action of the current appears to be upon the group $N_2O_5 (H_2O)_4$, a body conceded to exist. Crystallized oxalic acid, when in solution, is electrolyzed alone, water taking no part. The hydrogen disengaged corresponds to the equation $C_2H_2O_4 (H_2O)_2 = (C_2O_4 + O_2) + (H_2)_3$. As only carbonic dioxide is set free at the positive electrode, it must be that the oxygen evolved reacts upon and destroys another portion of the acid. The quantity of the acid destroyed, therefore, should be much greater at the positive than the negative electrode, for the

acid destroyed is (1) at N electrode. By current 1 molecule.
(2) at P electrode. By current 1 "; By oxygen 2 "

Experimentally this is supported; the loss of acid at the positive electrode is exactly three times greater than at the negative.

Again, in electrolyzing formic acid, only carbonic dioxide is disengaged at the positive electrode. The current acts on the acid only thus;

$$\underset{\text{Positive electrode.}}{(CH_2O_2)_2 = (C_2H_2O_3 + O)} \quad + \quad \underset{\text{Negative electrode.}}{H_2},$$

and then at the positive the further reactions occur, $C_2H_2O_3 + O = CO_2 + CH_2O_2$. On this hypothesis, if a represent the amount of acid electrolyzed, the loss will be nothing at the positive and equal to $\frac{a}{2}$ at the negative electrode. Now experiment shows that there is no loss of acid at the positive electrode, and hence the hypothesis is true. The same general results were obtained in the electrolysis of alkalies and salts. Bourgoin concludes that "water is *not* decomposed by the electric current, which plays the part of a solvent only."

POCKET SPECTROSCOPE.—M. Hofmann has perfected a very convenient form of spectroscope that can be carried in the waistcoat pocket, and is yet capable of really wonderful effects, considering its diminutive size, producing a large and brilliant spectrum, the violet rays of which extend far beyond the line G. It has a lens of rock crystal, with perfectly flat parallel faces at each end to keep out all particles of dust, etc. The organ of dispersion and analysis is a compound prismoid formed of three alternating prisms, one, of the most powerfully dispersive flint glass that can be procured, between two reversed prisms of crown, the angles being specially and skilfully arranged. The combination is completed by an ordinary compound doublet lens, of suitable focal length.

THE Rev. M. J. Berkeley describes, in the *Gardener's Chronicle*, a very remarkable instance of luminosity in fungi. It occurred in the mycelium of an unknown species growing on a trunk of spruce or larch, and was so powerful as to make a perfect blaze of white light in the track where the trunk had been dragged, and vividly illuminating everything in contact with it. It gave almost light enough to read the time on the face of a watch, and continued for three days.

THE Brighton aquarium has lately received two pairs of beautiful specimens of the Paradise or Peacock fish. These fish came first from China, and have been acclimatized by M. Carbonnier, the great pisciculturist of Paris; they are very lovely little creatures. Some of their habits are singular; thus M. Carbonnier states that "as the eggs are laid, the male carries them away in his mouth, and deposits them in a nest which he builds for them. He will not allow the female to come anywhere near the nest, and if she ventures to approach, he swings himself round and drives her away."

ON the 15th of April, a very violent volcanic eruption took place from the volcano Merapi in Java, which had been quiet since 1863. Great destruction of lives and property occurred, many villages being totally destroyed. The outburst was entirely unexpected, and the showers of stones and ashes and the streams of lava were very destructive. At Solo and other places, the showers of ashes lasted for three days, and it became so dark that the lamps had to be lit. By the last accounts, some 200 dead bodies had been found on one side of the volcano.

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Notes & Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.

1.—VALVE JOINTS.—What will make a good joint under a false valve seat of a steam engine?—Z. A. C.

2.—PRESERVING SHINGLES.—I have about 17,500 square feet of cedar shingle on a roof of a building which is a hollow square, of which two sides never see the sun. They never had anything on them. What is the best lasting and cheapest wash, paint, or mixture to preserve the shingles?—W. E. F.

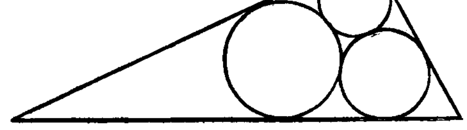
3.—WATERPROOF PASTE.—How can I make a paste that will be suitable for pasting directions for use to a painted board, and not be effected by moisture?—L. B.

4.—RESTORING LOOKING GLASSES.—I would like to know if a looking glass plate of which the amalgam is damaged can be restored. The mercury seems to be separated from the tin foil, and lays between the foil and the plate like dust. Is there any solution that can be put on the back side, or how can it be done?—H. B., of Wis.

5.—SAWING STOCK LUMBER.—What power will it take to drive sixteen 30 inch 12 gang circular saws through six inch stock at the rate of 36 feet per minute. There are 18 teeth in each saw. The saws run at 900 revolutions per minute. What size and how wide a belt is required?—W. B. N.

6.—A SPRING OF WATER AS A BAROMETER.—What is the cause of water turning blue whenever there is a prospect of rain, and becoming clear again as soon as the weather is clear? The water is the best I ever drank in my life. I have used it for three months at one time and two months at another time for drinking, cooking, and washing, and it is excellent for all these purposes.—T. C. H.

7.—GEOMETRICAL PROBLEM.—Will some one send a solution of the following problem? Within any triangle, to draw three circles, the circumference of each of which shall touch two of the sides of the triangle and also the circumference of each of the other two circles.—J. S. E.



Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries however, when paid for as advertisements at $1·00 a line, under the head of "Business and Personal."

ALL reference to back numbers must be by volume and page.

To C. F., of O.—The casting of platinum is a very trouble some process, requiring much chemical knowledge. The method was discovered by Wollaston, and is described in Miller's "Elements of Inorganic Chemistry."

To C. F., of O.—The specific gravity of copper is about 8·93; nickel, 8·82; platinum, 21·5; freestone, 2·14. For tables, refer to any cyclopædia.

Are the different shades of bronze on builders' hardware produced by a battery or by dipping? Answer: It is generally done by the application of a species of paint or varnish, containing bronze powder, to the iron.

J. T., of Colorado, asks:—Which is the cheapest process for making oxygen gas? Also the amount of chloride of lime and of protoxide of cobalt, required to make 100 cubic feet of oxygen? Answer: The cheapest process at present in vogue for producing oxygen is that of Tessie du Motay, now carried on in New York city at the works of the New York Oxygen Gas Company. It consists in subjecting manganese to heat in combination with steam, whereby the oxygen is liberated. The manganates are then regenerated by directing air upon them, and are thus used over and over. The process of Mallet, which is supposed to be still cheaper, consisting in the separation of the oxygen from the nitrogen of the atmosphere by passing air through water, has not as yet come into practical use. An easy, comparatively cheap, and very commonly used mode of producing oxygen on a small scale is to heat in a retort chlorate of potash, mixed with a little black oxide of manganese. You will require about 12 lbs. of cobalt and the same amount of lime salts to make 100 cubic feet of oxygen.

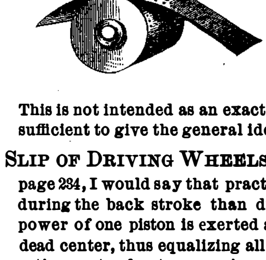
H. J. P., says:—Can you inform me if the manufacture of illuminating gas from paraffin is a success? Does it give as good a light as that made from coal? Is it more expensive than coal gas? Do you know of any objections in using or manufacturing it? The interests of a smart western town are involved in the above questions. Answer: Good illuminating gas can be made from paraffin. The light is as good as that from coal. The only objection to the use of paraffin for gas purposes is its cost. In most places it is dearer than coal.

C T. S. says:—In a conversation a few days ago, a gentleman remarked that any person can use a patented article or machine in his business, provided he constructs the machine himself. In doing so, does he not infringe on the rights of the patentee? Answer: He does.—And cannot the patentee prevent any party using his invention without compensation? Answer: He can. No person has the right to make, or use, or sell a patented article, whether for private purposes or otherwise, without the consent of the patentee.

B. F. H., says:—To settle a disputed point I wish to ask if, in the application of springs or clock work to the running of a sewing machine, there is as much actual power expended in the winding up of the springs as would be expended in running the same machine in the ordinary way by foot. It is understood that in the winding of the springs advantage may be taken of the lever or any other mechanical power. Answer: The same amount of power would be expended in winding the springs to drive the sewing machine, as in operating the machine by the foot and treadle in the usual way. The use of a lever would not diminish the expenditure of power. Levers, springs, etc., in such cases, are simply tools or conveniences for the application of the power.

THE BREAKING STRAIN OF CYLINDRICAL BOILERS.—R. C., in commenting on Mr. Bakewell's letter on page 244, current volume, suggests that a strong casing be made, semicircular in shape on one side and flat on the other, and as the pressure would be much greater on the curved than on the flat side, such a vessel could be used as a motor. The proposition is not more absurd than many that we have received; but R. C. must surely be aware that Mr. Bakewell's statement is that the bursting strain of the whole boiler is as the semi-circumference and not as the diameter, and not that there is more pressure on one part of a boiler than on another. R. C. also errs in calling his motor a perpetual motion. Whence does he propose to get his steam?

PERFORATION OF POSTAGE STAMPS.—A reader asks: "How was it done? To understand this process, the reader must imagine two cylinders placed horizontally above each other," SCIENTIFIC AMERICAN, Oct. 12, 1872. Well, I have tried my imagination to the utmost, turned my brains over and over, stood on my feet and on my head, and still I cannot imagine the "two cylinders" into such a position; and consequently I cannot "understand the process." Will the writer furnish a diagram of this curious relative position of the cylinders, and Messrs Editors, will you print it, for the use of the world? Answer: To assist our correspondent and others who, like him, may have "turned their brains," we here give a sketch of the perforating cylinders and sheet of stamps passing through them. This is not intended as an exact representation of the machine; but it is sufficient to give the general idea.



SLIP OF DRIVING WHEELS.—In answer to C. T., query 11, page 234, I would say that practically there is no more liability to slip during the back stroke than during the fore stroke, as the maximum power of one piston is exerted at the point at which the other is at the dead center, thus equalizing all the variations through which the reciprocating parts of a steam engine pass.—J. T. N., of N. Y.

GRINDING LENSES.—To G. A. B., query 3, page 249.—Lenses, after being nipped to the circular form with a pair of pliers, are rough ground within a cast iron shell (the wooden pattern of which has been turned to the curve desired) with sand and water; they are then ground under a brass tool of the correct form with the various sizes of emery and polished with putty powder on a woolen cloth stretched over the same tool.—A. H. N., of N. Y.

POLISHING STEEL.—To E., query 4, page 249.—Steel is polished with fine emery, and finished with crocus. If the work is small, you may polish with washed crocus on a piece of pewter.—A. H. N., of N. Y.

DEXTRIN PASTE.—To H. A. H. G., query 5, page 249.—Put a drop of carbolic acid or a few drops of alcohol in your dextrin, and you will have no more trouble.—A. H. N., of N. Y.

KILLING INSECTS.—To P., query 10, page 249.—Put your insects in a box with a hole, through which you can introduce smoke or the fumes of burning sulphur.—A. H. N., of N. Y.

PRESERVING INSECTS.—To P., query 9, page 249.—Try glycerin.—A. H. N., of N. Y.

REVOLUTION OF THE EARTH.—To A. F. M., query 8, page 202.—The effect of moving matter from the equator to the poles would be to render the earth of a more cylindrical shape, with a diameter less than the present one. Hence, in order to overcome the attraction of the sun (which remains the same), it must retain its present centrifugal force, which can be done only by an increased number of revolutions. Example: Of two tops, of the same weight, that which is of the greatest equatorial diameter will retain its perpendicular with fewer revolutions per minute.—A. W. L., of Ohio.

KILLING INSECTS.—To P., query 10, page 249.—The best way to kill the small insects is to use sulphuric ether; but you can kill the beetles better by dipping them in boiling water.—H. W. U., of Wis.

DEXTRIN PASTE.—H. A. H. G., query 5, page 249, may add to his paste fifteen grains of carbolic acid, and five drops oil of cloves to each half pint, and so prevent its fermenting.—E. H. H., of Mass.

CURING BLADDERS.—J. H. T., query 7, page 249, may paint his putty bladders with a dilute solution of corrosive sublimate and carbolic acid, thickened with a little flour. This will require care, as it is poisonous.—E. H. H., of Mass.

PRESERVING INSECTS.—P., query 9, page 249, may use either of the following solutions, all of which are used for preserving various objects of entomology for the microscope: Glycerin one part, water two parts; one part wood naphtha to eight water: one part alum to sixteen water; a saturated solution of sulphate of zinc; twenty-five drops creosote in a wine glass of water: bay salt 4 ounces, alum 2 ounces, corrosive sublimate 4 grains, water 2 quarts.—E. H. H., of Mass.

KILLING INSECTS.—Query 10, page 249.—Place in chloroform, or bisulphide of carbon; neither will injure the colors.—E. H. H., of Mass.

TROUBLE WITH TOMATOES.—To P., query 13, page 249.—They have doubtless fermented.—E. H. H., of Mass.

QUARTZ GLASS.—To P., query 14, page 249.—The quartz may be so insensible to heat; but when lime, soda, or oxide of lead are added, the mixture will fuse and form another chemical compound, namely, glass.—E. H. H., of Mass.

KILLING INSECTS.—To P., query 10, page 249.—Put the insects for five seconds in common benzine; they will be killed and not be spoiled at all.—F. G. V., of Mo.

CHEAP MICROSCOPES.—I do not agree with S., of Mass., in his answer on page 250, wherein he says that nothing less than fifty dollars will buy a microscope worth having. For ten or twelve dollars a compound achromatic microscope, that performs well, can be purchased. J. W. W. can buy an achromatic object glass, French make, for five or six dollars, that gives three powers by separating the combinations, and with an eye piece, costing three and one half dollars, an instrument can be constructed giving magnifying powers all the way from about 40 to 150 diameters. I have several of the French object glasses, costing from five to ten dollars, and they are of excellent quality.—A. F. K., of R. I.

BOILER SCALE.—To E., query 10, page 217.—It is well known by engineers, and it ought to be by steam users, that the patent anti-incrustators, although very effective in some cases, are not always adapted to the peculiar character of the water used, or rather of the chemicals held in solution therein. Potatoes, bran, sal soda, tan bark, slippery elm, and various other substances are used with more or less success in different localities, and many engine men make it a point to experiment with everything they can hear of until they find some one or more articles which answer their purpose. But in the generality of cases, there is a far better and more scientific method of avoiding scale, namely: By removing its chemical constituents from the water before it is fed to the boiler. This is accomplished by passing the feed water through a lime extracting or purifying heater, in which it is raised to the boiling point and the deposit made upon removable shelves which are readily cleaned. There are several of these apparatus in the market, and I have no doubt that E.'s difficulty will entirely disappear with their use.—C. H. F., of N. Y.

MECHANICAL DRAWING.—To S. J. L., query 6, page 202.—From some years experience and observation, I can say that a first class draftsman and designer will need a good English education, including algebra and geometry, and as much knowledge of the natural sciences and laws of physics as he can acquire. His mind ought to be trained to think accurately and quickly, and this discipline is obtained partly by careful habits of study and thought, and partly by actual practice in the art. Unless one has had unusual facilities for observation and the study of machinery in the course of construction, a regular apprenticeship in some good shop is absolutely essential. A course of engineering in a polytechnic school never made a good designer, and it is an acknowledged fact that our best engineers are, or have been, practical mechanics. In this way and in no other, can they acquire an intimate knowledge of all the processes of construction and the little practical details that make perfection of design. An "artistic" draftsman does not amount to much in this matter-of-fact age, unless he adds to fineness of execution, careful and thorough working up of details. Last, but not least, he must have an unmistakable taste for his profession.—C. H. F., of N. Y.

FREAKS OF BOILERS.—Query 5, page 217.—This query cannot be answered from the data given. If the sheets mentioned were exposed directly to the fire in the furnace, either a deposit collected rapidly from the water, or the fireman did not understand his business; or perhaps the sheets were too thick. Uneven firing will often "bay" sheets directly over the hottest part of the fire. There is obviously some good reason for such a rapid destruction of the metal, which an expert ought readily to detect upon an examination.—C. H. F., of N. Y.

SAW MILL QUERIES.—To P. P. S., query 4, page 185.—In answer to your first question: 270 inches water will be required. To the second: 70 revolutions. To the third: There is a feed derrick which is what you need. Four changes of feed can be made almost instantaneously, and "gigging" back can be done without stopping the saw. All this is done by friction. But you cannot drive, successfully, a 5½ feet saw 900 or 1,000 revolutions per minute. If you could, and had power to back it, you would be able to saw about 50,000 feet lumber in 12 hours. A 5½ feet saw run properly, should saw some 10,000 or 12,000 feet of lumber per 12 hours. You had better change the proportion of the proposed wheel. If you do not know how much water you need, you can hardly be expected to know what proportions are best.—R. B. O., of N. Y.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

TOLL TAKER.—Wm. W. McCauley, Fancy Farm, Ky.—The invention consists in combining with the ordinary wheel attachment, provided with as many buckets as there are fractions, of which the desired toll section forms one, an intermediate ratchet that is carried by the wheel and operates the feed spout.

PILE SAWING ATTACHMENT FOR BOATS.—Henry Vogler, Baltimore, Md.—The invention consists in providing a pile saw shaft with one removable bearing and a detachable cap on the other so that it can be speedily reversed to cut off pile either at top or bottom, also in a new mode of giving adjustment to the saw shaft by means of a bearing threaded on the outside and working in a suitable female screw; and also in placing the saw between two springs that enable it to play on the shaft with the motions of the boat.

FIREPROOF FLOORS.—George H. Johnson and William Freeborn, Chicago, Ill.—The end aimed at in this case seems to be attained, namely, the maximum of strength, durability, and compactness, consistent or possible with a like degree of economy of material and labor employed in construction. The floor or ceiling is formed of hollow tiles or blocks of burnt clay, or other analogous or suitable material, which are so shaped as to fill the space between girders, of whatever width it may be. Both the top and under surfaces are flat, and hence the floor above may be laid with little difficulty, and white finish may be applied to the under side with no intermediate or primary coat. These and numerous other advantageous qualities commend, inno small degree, the invention to builders.

CHURN.—Charles Hutchins, Baldwin City, Kansas, assignor to himself and Rynear Morgan, of same place.—This invention has for its object to furnish an improved churn. The churn body is revolved, the milk is thrown by paddles and by centrifugal force against the sides of the churn body, where it encounters the perforated arms of the stationary dasher. Part of the milk passes through the holes of the arms, the form of said holes increasing the friction. The rest of the milk is thrown back into the middle part of the churn body, to be again projected against its sides. When the butter is formed the stationary dasher is removed, and a few turns of the crank back and forth will gather the butter into a solid mass. The perforated plate is then raised, taking all the butter with it, the milk flowing through the holes in the said plate into the lower part of the churn.

HEAD REST.—Felice Fabrici, New York city.—The object of this invention is to provide an adjustable head rest to be applied to the backs of railroad car seats for promoting the comfort of the passengers. The invention consists in the combination of notched standards, which are applied by spring jaws to the seat backs, with a head rest having projecting pins that are supported in the notches of the standards.

PUMP.—Robert White, Mott Haven, and David Moritz, New York city.—This invention relates to a new arrangement of valve chamber, frame, and piston rod guide for a reciprocating pump, and more particularly to such mode of fastening the valve chamber that it can be freely turned to convert the pump into a vertical or horizontal one as may be desired. The invention consists, first, in so arranging the ports, in and to a cylindrical valve chamber, that the same will operate equally well when turned in either direction on the face plate of the pump cylinder. This enables the same to connect at the bottom or at the side with the suction pipe, and on the top or side with the discharge pipe, and thus to convert the pump into one drawing and discharging water in vertical or horizontal direction, as may be desired. The invention consists, also, in fastening the pump cylinder to its frame by means of the suction pipe and a nut thereon; also, in the arrangement of concave guides for the cross head on the piston rod; and in swiveling the guide frame to the end of the cylinder, so that the operating handle or lever can be turned to either side or into any desired position.

PRUNING SHEARS.—Owen L. Samson and James R. Dill, Crawfordsville, Iowa.—This invention belongs to the class of shears for pruning purposes, wherein a double edged cutter is arranged to operate in conjunction with a fixed cutter on either side; and it consists, mainly, in the arrangement of a guide and brace bar with an oscillating or movable cutter.

REMEDY FOR HOG CHOLERA.—Robt. A. Gettings, Marion, Ky.—This invention has for its object to furnish a compound which shall be an infallible remedy for the cure of hog cholera, and it consists in the combination of various ingredients in proportions which are detailed in the specification.

BEE HIVE.—Solomon Rogers and Albert J. Mason, Butler, Ind.—The invention consists in constructing and arranging relatively to each other the bee box, comb frames, and means of detachably applying the latter within the former, whereby the comb frames can be more conveniently examined, removed, or exchanged, without disturbing the bees. It is proposed to have a dividing board in the place of one of the comb frames, by which the hive may be separated into two compartments, or cut off a portion to limit the size of the hive when required to adapt it to the capacity of the swarm of bees, the passages to the part cut off being closed so they cannot enter it.

DEVICE FOR FASTENING NUTS.—Daniel Sawyer, Topeka, Kansas.—This invention consists of a flange on the nut with a series of holes and a spring paw', with a pin in the free end to enter said holes of the flange, and lock the nut against turning, the pawl being pivoted to another washer fastened to the timber, or to the timber and to a metal plate fastener thereon.

CURTAIN FIXTURE.—Isaac B. Werner, Rossville, Ill.—This invention has for its object to furnish an improved apparatus for rolling up a window shade and lowering it from the top of a window. To the upper end of the shade is attached a roller in the ordinary manner. The ends of the roller are pivoted to blocks of some material; the winding or rolling cord passes down through a guide eye attached to the block, and its lower end is connected with a reel. A cord, the ends of which are attached to the ends of the blocks, passes up along the inner sides of the window casing, and then over knobs or pulleys attached to the corners of the casing, one of the cords passing across the top of the casing. Both cords pass down together along one side of the casing, and are connected with a single cord and serve to support the shade horizontally. The single cord, to which both are attached, extends down along the side of the window casing and is attached to the reel. The reel consists of two spools moving on a shaft. The adjacent ends of the spools are formed to receive a clutch, so that by moving the shaft longitudinally the clutch may be thrown into gear with either of said spools, so as to revolve it, while the other spool stands still. Two diagonal spring bars, the outer ends of which are secured to the case that supports the reel, and the inner ends of which rest upon the outer or ratchet flanges of the spools, hold said spools securely in place. By raising either of said spring bar from its spool, the latter is allowed to run back. To the outer end of the shaft in the reel is attached a crank, for convenience in operating it.

SCUFFLE HOE.—Thomas R. Peck, Waterloo, N.Y.—This invention has for its object to improve the construction of scuffle hoes. The hoe plate is made in two parts, the inner end of each part being turned upward at right angles to form upwardly projecting wings. The forward edges are made with a salient angle. By loosening a screw, the parts of the hoe plate may be adjusted at any desired distance apart, so that the said parts may work, one upon each side of the row of plants, to clean both sides of the said row at the same time, the wings enabling the hoe to work close up to the plants, the ends of said wings projecting above the surface of the ground, so that the operator can see exactly where the inner ends of the parts of the plate may be.

CAR COUPLING.—James Pearson, Sacramento, Cal.—The invention relates to the class of automatic car couplings. When two cars, provided with this improved coupling, come together, the link will enter the drawheads and raise the heads of the coupling bars and then drop into a position so as to couple the cars. To release the coupling link the locking pin is first withdrawn, and then a hooked bar is elevated at its front end, which causes a stirrup to raise the end of the link, when it may be readily drawn out.

RATCHET DRILL.—Francis Stein, New York city, assignor to himself and Frederick Breivogel, of same place.—This invention has for its object to furnish an improved ratchet drill, which shall be so constructed as to drive the drill always in the same direction by the reciprocating movement of the handle. A drill socket shaft works in holes in the frame, and upon it, within said frame, is placed a ratchet wheel. The ratchet wheel is keyed or otherwise secured to a second shaft, so as to carry the said shaft with it in its revolution. A block is placed within the frame, and upon the forward end of it is formed a segmental ratchet wheel, the teeth of which are similar to the teeth of the ratchet wheel into which they mesh. By this construction, as the handle is moved in one direction, the teeth of the ratchet block take hold of the teeth of the ratchet wheel and turn it. As the handle reaches the end of its sweep, a projection of the ratchet block strikes against a projection formed upon the frame and throws the teeth of the ratchet block out of the teeth of the ratchet wheel, allowing the handle to easily begin its return movement. As the handle moves in the other direction, the teeth of a pawl take hold of the teeth of the ratchet wheel and turn it in the same direction as it was turned by the ratchet pawl. As the teeth of either pawl are working, the teeth of the other pawl are sliding over the teeth of the said ratchet wheel. To the frame is attached a second handle, by which the said frame is held stationary while the handle is being operated.

SAW GUMMER.—Robert W. Thompson, Pittsburgh, Pa., assignor to J. Fulton Thompson, of same place.—This invention relates to a new sawgumming apparatus for circular saws; and it consists in the combination of a rotary cutting tool with a tubular feed screw in such manner that by means of the screw the tool can be let down more or less to cut through the entire blades, even as its points become shorter. By the screw the pressure of the cutting tool upon the saw blade can also be increased at will.

SKATE.—John Simeon Armstrong, St. John, Canada.—This invention relates to improvements in that class of skates which are constructed to be fastened to the shoe by stationary and movable heel clamps and movable clamps at the ball of the foot, the latter and the movable heel clamp being operated by a screw rod extending from the ball plate to the heel plate and connected to them.

FLY TRAP.—William De Puy, Polk Station, Pa.—This invention consists of a shallow vessel, preferably round, in which the bait is to be placed for attracting the flies, which said vessel has several entrance holes through the side a little above the bottom, so as to make it more difficult for the flies to find the way out than if placed at the bottom. Ear-shaped pieces are attached to the outside of the vessel converging at the entrance holes to guide the flies to the holes. An oval cover, partly made of wire gauze with several large holes to allow the flies to escape through it, is fitted on the pan, and over this cover is a dome of wire gauze, affording a large ligh space into which the flies will naturally find their way from below after feeding, and from which they cannot escape.

SHEET METAL VESSEL.—Charles B. Cooper, of Nashville, Tenn.—The object of this invention is to provide means for preventing the wear of sheet metal vessels, especially the common tin pail; and it consists in a wooden hoop or rim attached to the bottom of the pail in an ingenious manner.

PRUNING SHEAR.—Samuel J. Beigh and Eli F. Beard, of Republic, Ohio.—This invention relates to a new and useful improvement in shears for pruning trees, shrubbery, etc. The cutting is effected by pulling on a knob, thereby sliding the shank in the staff and operating the shears. By a combination of levers, great power is brought to bear upon the cutting blades, which makes it a very effective implement. The blade has a compound motion, and gives a drawing stroke when applied to the limb or twig to be cut.

HOOP LOCK CUTTER.—Walter Tripp and Henry A. Tripp, of Williamson, N. Y.—This invention is an improvement on the hoop lock cutter for which letters patent were granted to Theodore Conklin, April 5, 1870, No. 101,436. To the bed plate is pivoted a lever, carrying a V cutter at one and a handle at the other end. Another lever, pivoted to the plate, is provided with a slotted arm, through the slot of which a pin projects from the lever first mentioned. The free end of the second lever carries a knife, the first lever carries the two knives toward a small elevated platform, which is rigidly connected with the plate, and on which the hoop to be cut is supported. The upright blade of the knife first enters the hoop and cuts the transverse shoulder. The horizontal blade of the same knife meanwhile cuts the bevel on the under side, the knife being set inclined and swinging on an inclined pivot, in order to produce this bevel. The V knife cuts the curved inner and outer bevels until it reaches the shoulder. The hoop while being cut rests against a gage or back, which can be set in or out to accommodate wider or narrower hoops. The knives are also slotted for the same purpose, and to enable the wear to be taken up.

STEAM WASH BOILER.—George S. Wright, of Racine, Wis., and Elias W. Harrington, of Geneva, N. Y.—This invention has for its object to furnish an improved machine for washing and bleaching clothes and other cloths by steam, which shall be simple in construction, convenient in use, and effective in operation, washing the clothes quickly and thoroughly, and without injuring even the most delicate fabric. It consists in the corrugated false bottom, provided with a downwardly projecting rim and one or more upwardly projecting steam conductors; in the steam conductors, made with their upper ends in the form of inverted cones; in the top steamer; and in the combination of a steam escape valve with the cover.

ELEVATOR.—Patrick Byrne, of Nashville, Tenn.—This invention has for its object to furnish an improved elevator for warehouses and other places. The hoistingrope passes over a pulley, pivoted to cross bars attached to the upper parts of the posts or frame. From the pulley the rope passes around another pulley pivoted to a post beside the well and makes two or more turns around the drum. It then returns, passes around another pulley pivoted to a post at the other side of the well, and to its end is attached a balance weight. The inner end of the drum is geared to the journal of the large wheel. The face of the wheel has a groove formed in it near one edge to receive the endless rope so as to leave a smooth part of said face for the brake shoe to operate upon. The rope passes down to and around a large wheel, pivoted to a frame-work near the bottom of the well or hoistway. The wheel is attached to a short shaft, upon which are placed two loose pulleys and a fast pulley, the fast pulley being placed between the loose pulleys. The loose pulleys are designed to receive, the one a straight and the other a crossed belt, so that the platform may be raised or lowered by shipping one or the other of said belts upon the fast pulley. By means of a belt shipper one of said belts may be slipped from and the other upon the fast pulley to reverse the motion of the elevator. To the belt shipper is attached the end of the cord, which passes through an eye attached to the platform frame and has knots or other stops, formed upon it in proper position above and below the eye, against which the said eye strikes at or near the limit of its movement to reverse the direction of motion of the elevator automatically. The direction of motion may be changed at any part of ascent or descent by operating the cord by hand. The brake shoe is so formed as to drop away from the wheel by its own weight. A screw passes through a stationary nut so that, when the screw is turned forward, its forward end may strike against a downwardly projecting arm of the brake and force the brake shoe against the wheel. To the outer end of the screw is attached a small grooved pulley, around which passes an endless cord, so that the brake may be applied to or removed from the brake shoe by operating the rope. The rope or cord is kept taut by a weight, suspended from a pulley around which passes the said endless cord. By this construction, by slipping both belts upon the loose pulleys, the elevator may be operated by hand by means of the rope.

COOKING RANGE.—Henry Martin, of Duncan, Penn.—This invention relates to a new construction of cooking range, and has for its object to reduce the combustion of fuel to the greatest practicable extent without impairing the heating capacity of the range. The invention consists in arranging the fire-place between the oven and boiler, in making the oven removable, and in the arrangement of a judicious draft system in connection therewith.

[OFFICIAL.]

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FOR THE WEEK ENDING OCTOBER 8, 1872, AND EACH BEARING THAT DATE.

SCHEDULE OF PATENT FEES:

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On each Trade-Mark	$25
On filing each application for a Patent, (seventeen years)	$15
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On granting the Extension	$50
On filing a Disclaimer	$10
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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:

22,489.—COOKING RANGE.—G. Chilson. December 18, 1872.
22,491.—BILLIARD CUE TIP.—H. W. Collender. December 18, 1872.
22,532.—CORSETS AND BUSTLES.—D. Lamoureux. December 18, 1872.
22,572.—SPECTACLE FRAME.—T. Noel. December 26, 1872.
22,606.—EMERY WHEELS AND STICKS.—T. J. Mayall. December 26, 1872.
22,631.—RAILROAD CHAIRS.—W. M. C. Cushman. January 2, 1873.
22,664.—LAMP HOLDER.—C. Monson. January 2, 1873.
22,668.—CURING TOBACCO.—B. Payne. January 2, 1873.
22,674.—TRUSS SPRINGS.—J. W. Riggs. January 2, 1873.
22,539.—WRINGING MACHINE.—J. Allender. December 26, 1872.

EXTENSIONS GRANTED.

22,734.—WATER CLOSET.—F. H. Bartholomew.
21,745.—SEWING MACHINE.—C. O. Crosby.
21,749.—SEAMING SHEET METAL.—L. Fay.
21,756.—CENTRIFUGAL PUMP.—W. C. Hibbard.

21,793.—SPELLING BLOCKS.—S. L. Hill,
21,762.—KNITTING MACHINE.—J. K. and E. E. Kilbourn.
21,846.—PLOW.—W. Reaney.
21,864.—SCREW CUTTING LATHE.—G. W. Daniels.
21,782.—PLANING CUTTER.—J. Sperry.
21,856.—STAVE CUTTING MACHINE.—W. Steele.

DISCLAIMER.

21,784.—WATER CLOSET.—F. H. Bartholomew.
1,782.—PLANING CUTTER.—J. Sperry.

DESIGNS PATENTED.

6,158.—MUCILAGE BOTTLE.—H. S. Adams, B. Fay, Cleveland, O.
6,159.—BOTTLE.—J. L. Dawes, Pittsburgh, Pa.
6,160.—BARREL BOLT.—O. F. Fogelstrand, Hartford, Conn.
6.161 & 6,162.—DRAWER PULL.—A. Wunder, New Haven, Conn.
6,163.—COAT AND HAT HOOK.—O. F. Fogelstrand, Kensington, Conn.
6,164 to 6,169.—CARPETS.—O. Heinigke, New York city.
6,170 to 6,175.—CARPETS.—H. Horan, Newark, N. J.
6,176 & 6,177.—CARPETS.—A. M. King, Kidderminster, England.
6,178 to 6,181.—CARPETS.—L. G. Malkin, New York city.
6,182 to 6,189.—CARPETS.—E. J. Ney, New York city.
6,190.—CARPET.—J. H. Smith, Enfield, Conn.
6,171.—BOX PLAITED RUFFLES.—E. W. Taylor, Jr., Brooklyn, N. Y.
6,192.—PENCIL POINT PROTECTOR.—E. Faber, New York city.
6,193.—SHOVEL AND TONGS STAND.—O. F. Fogelstrand, Kensington, Conn.
6,194.—BLOWER STAND.—O. F. Fogelstrand, Kensington, Conn.
6,195.—COMB AND BRUSH POCKET.—A. H. Forstner, Newport, Ky.
6,196.—BADGE.—W. B. Hamm, Philadelphia, Pa.
6,197.—HEAD REST.—J. J. Hayes, Green Point, N. Y.
6,198.—MATCH RECEIVER.—W. F. Müller, New York city.
6,199.—TOY BANK.—D. A. Stiles, Durham, Conn.
6,200.—LETTER CLIP.—A. Wunder, New Haven, Conn.

TRADE MARKS REGISTERED.

1,010.—TONIC BEER.—B. Bates, Baltimore, Md.
1,011.—LABELS, ETC.—S. Crump, New York city.
1,012.—WHISKY.—Fechheimer & Workum, Detroit, Mich.
1,013.—MEDICINE.—G. H. Fish & Son, Saratoga Springs, N. Y.
1,014.—AGUE MIXTURE.—D. M. Myer, Baltimore, Md.
1,015.—STEAM PUMP.—Norwalk Iron Works, South Norwalk, Conn.
1,016.—CIGARS.—T. Russell, Washington city, D. C.
1,017.—AGRICULTURAL IMPLEMENTS.—Soule, Kretzinger & Co., Fort Madison, Iowa.
1,018.—BAKING POWDER.—Trentman, Manning & Son, Fort Wayne, Ind.
1,019.—SEWING MACHINE.—Grover & Baker Co., Boston, Mass.
1,020 & 1,021.—CHEWING TOBACCO.—Myers & Drummond, Alton, Ill.
1,022.—WHISKY.—E. H. Taylor, Jr., Frankfort, Ky.
1,023 & 1,024.—SPECTACLES, ETC.—Spencer Manufacturing Co., New Haven, Conn.
1,025 & 1,026.—PERFUMERY, ETC.—Thomson, Langdon & Co., New York city.
1,027.—SEALING WAX.—G. Watterson & Son, Edinburgh, Scotland.

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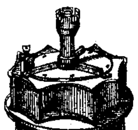

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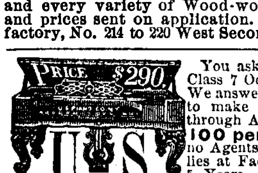

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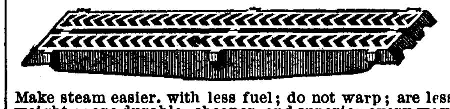

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1 Cash Gift,........	9,000	25 Cash Gifts,...	700 each
1 Cash Gift,........	8,000	35 Cash Gifts,...	600 each
1 Cash Gift,........	7,000	45 Cash Gifts,...	500 each
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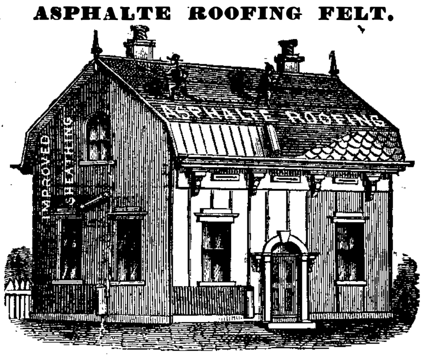

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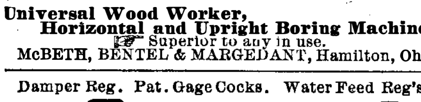

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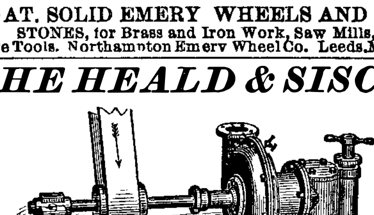

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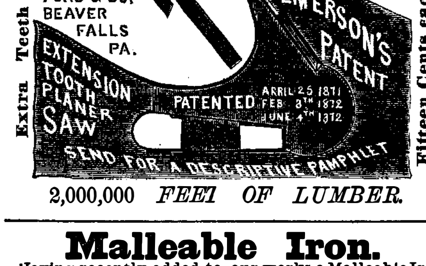

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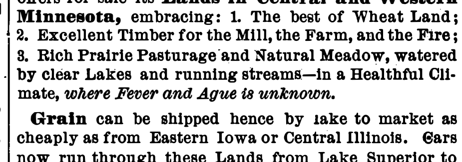

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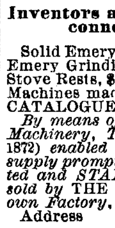

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